2008–2009

USP Pharmacists' Pharmacopeia

3 SUPPLEMENT

Pharmacists' Pharmacopeia

Official May 1, 2009 – August 1, 2009

SECOND EDITION

U.S. PHARMACOPEIA
*The Standard of Quality*SM

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USP Pharmacists' Pharmacopeia

Introduction

Background

The history of the *United States Pharmacopeia* dates back to 1817 when Lyman Spalding, a physician, recognized the need for standardization to eliminate regional differences among names and formulations of medicines. He and ten fellow physicians held the first United States Pharmacopeial Convention (USPC) in the U.S. Capitol building in January 1820. That meeting resulted in the formation of a committee that compiled the first *Pharmacopeia of the United States of America (USP)*. The equivalent of that committee still exists today as the USP Council of Experts, and the USPC still works to ensure good pharmaceutical care for all.

In 1975, USPC combined the *USP* and another compendium, the *National Formulary (NF)*, in a single volume, the *USP–NF*. In general, the *USP* contains standards for active drug substances and dietary ingredients, while the *NF* contains standards for excipients.

Standards in the *USP–NF* apply to compounded preparations as well as to manufactured products. They are enforceable under the Federal Food, Drug, and Cosmetic Act, and may be enforceable to practitioners under state and local laws, as well.

The *USP Pharmacists' Pharmacopeia*

The *USP Pharmacists' Pharmacopeia* contains two types of text: *official text* and *authorized text*.

Official text is text that is reproduced from the *USP–NF*. Each page of the book that contains *official text* is designated with a footer explaining its official status and the *USP–NF* revision from which it is reprinted. This text is derived from the standards-setting activities of the Council of Experts and is presented here in an easy-to-use abridged form. Official text that is reprinted in this volume maintains the same legal status as it does when published in the *USP–NF*.

Authorized text has been developed and approved by the Council of Experts, but has not been published as official text in the *USP–NF*. Authorized text in this publication includes monographs published in the *Food Chemicals Codex (FCC)*, *Sixth edition*; veterinary information monographs discussing the use of medications and specific preparations for animals; proposed monographs for compounded preparations that are still available for comment and that may be included in the *USP–NF* in the future; authored text previously published in the *Pharmacopeial Forum* and other USPC publications; copyrighted text reprinted with permission; and text that is in the public domain, including laws and regulations. This text is provided for reference purposes only, to aid in the practices of pharmacy and medicine.

The *USP–NF* and the *FCC* are modified through continuing revision, and the corresponding text in this volume will be updated accordingly. Because of varying publication schedules, changes to the *USP–NF* and *FCC* may not immediately appear as changes to the *USP Pharmacists' Pharmacopeia*. The text as it appears in the *USP–NF* and *FCC* is determinative and should be referred to when specific questions arise.

Second Edition

This Second Edition of the *USP Pharmacists' Pharmacopeia* is significantly revised from the 2005 publication. Section 3 has been enhanced to include new compounding monographs that are relevant to today's contemporary practicing pharmacist. The addition of content related to veterinary practice in Section 6, including the information on compounds for veterinary use, should increase the utility of this volume for veterinary pharmacists. The addition of quality standards for food-grade substances from the *FCC* in Section 4 also should be useful to compounding professionals seeking ingredients of appropriate quality when a *USP–NF* standard does not exist. The compounding support information in Section 9 has been expanded,

and the laws and regulations in Section 11 have been updated to reflect the most recent changes by Congress and by the Drug Enforcement Administration.

Acknowledgements

The staff at USP would like to express their sincere gratitude to the members of all expert committees, especially the Compounding Pharmacy Expert Committee and the Sterile Compounding Expert Committee for their diligent and untiring efforts in the preparation of this book.

Compounding Pharmacy Expert Committee

Loyd V. Allen, Jr., Ph.D., Chair
Judith E. Thompson, R.Ph., M.S., Vice Chair
Lisa D. Ashworth, B.S., R.Ph.
Robin H. Bogner, Ph.D.
Gigi S. Davidson, R.Ph.
Mary Ann F. Kirkpatrick, Ph.D.
Mark G. Klang, R.Ph., M.S.
Lawson G. Kloesel, R.Ph.
Linda McElhiney, Pharm.D.
Lawrence A. Trissel, B.S., R.Ph.

Sterile Compounding Expert Committee

David W. Newton, Ph.D., Chair
Lawrence A. Trissel, B.S., R.Ph., Vice Chair
Samuel C. Augustine, Pharm.D.
Mary B. Baker, Pharm.D.
James F. Cooper, Pharm.D.
Donald J. Filibeck, Pharm.D.
Larry W. Griffin, B.S.
Kenneth L. Hughes, B.S.
Eric S. Kastango, M.B.A.
Keith H. St. John, M.S.
Laura A. Thoma, Pharm.D.
James Wagner

Admissions

New Articles Appearing in This Supplement

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Erythorbic Acid
Alfuzosin Hydrochloride
Bicalutamide Tablets
Cabergoline
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Fenofibrate Capsules
Flavoxate Hydrochloride
Flavoxate Hydrochloride Tablets
Formoterol Fumarate
Foscarnet Sodium
Granisetron Hydrochloride
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Piperazine Phosphate
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Sodium Bromide Injection, Veterinary
Sodium Bromide Oral Solution, Veterinary
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No Longer Appearing in Section 6

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Sodium Bromide Injection, Veterinary
Sodium Bromide Oral Solution, Veterinary

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Arginine Tablets
Curcuminoids
Curcuminoids Capsules
Curcuminoids Tablets
Powdered Soy Isoflavones Extract
Soy Isoflavones Capsules
Soy Isoflavones Tablets
Turmeric
Powdered Turmeric
Powdered Turmeric Extract

Changes in Official Titles

The following title changes are official May 1, 2009

New Title	Former Title
⟨61⟩ Microbiological Examination of Nonsterile Products: Microbial Enumeration Tests	⟨61⟩ Microbial Limit Tests
⟨62⟩ Microbiological Examination of Nonsterile Products: Tests for Specified Microorganisms	
⟨1111⟩ Microbiological Examination of Nonsterile Products: Acceptance Criteria for Pharmaceutical Preparations and Substances for Pharmaceutical Use	⟨1111⟩ Microbiological Attributes of Nonsterile Pharmaceutical Products

Annotated List

General Notices, Monographs, General Chapters, Reagents, and Tables Affected by Changes Appearing in This Supplement

Note—In the material below, if a section is new or if a subsection is added to or deleted from an existing section, it is labeled as such in parentheses after the section or subsection name. Items on this list that appear without the designation "new," "added," or "deleted," are items in which changes have been made to existing official text.

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General Tests and Assays

Other Tests and Assays

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- Test Procedures

Physical Tests and Determinations

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⟨1121⟩ *Nomenclature*
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- USP Reference standards

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- Chemical information

Betadex
- Chemical information
- Packaging and storage
- USP Reference standards
- pH (added)

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- Definition
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- Viscosity

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- Definition
- Packaging and storage
- Viscosity

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- Title change
- Definition
- Packaging and storage
- Viscosity

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- Definition
- Labeling
- Viscosity

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Section 1

Mission and Preface

The Mission and Preface to the *USP-NF* provides general information about the compendia and about USP's standards-setting processes. In addition, this section includes information about USP and its role in setting standards for compounded preparations.

Section Contents

Mission and Preface *USP 32–NF 27*

This section provides background information on the United States Pharmacopeial Convention (USP), as well as general information about the 32nd revision of the *United States Pharmacopeia (USP 32)* and the 27th edition of the *National Formulary (NF 27)*. Additional official information about the specific uses of these texts is provided in the *General Notices and Requirements* section, which has been significantly revised (see www.usp.org/USPNF/GeneralNotices for a summary of revisions).

Mission Statement

USP–NF is published in continuing pursuit of the mission of USP: *To improve the health of people around the world through public standards and related programs that help ensure the quality and safety of medicines and foods.*

History

On January 1, 1820, 11 physicians met in the Senate Chamber of the U.S. Capitol building to establish a pharmacopeia for the United States. These practitioners sought to create a compendium of the best therapeutic products, give them useful names, and provide recipes for their preparation. Nearly a year later, on December 15, 1820, the first edition of *The Pharmacopoeia of the United States* was published. Over time, the nature of the *United States Pharmacopeia (USP)* changed from being a compendium of recipes to a compendium of documentary standards that increasingly are allied with reference materials, which together establish the identity of an article through tests for strength, quality, and purity. The publishing schedule of the *USP* also changed over time. From 1820 to 1942, the USP was published at 10-year intervals; from 1942 to 2000, at 5-year intervals; and beginning in 2002, annually.

In 1888, the American Pharmaceutical Association published the first national formulary under the title *The National Formulary of Unoficinal* [sic] *Preparations (NF)*. Both the *USP* and the *NF* were recognized in the Federal Food and Drugs Act of 1906 and again in the Federal Food, Drug, and Cosmetic Act 1938. In 1975, USP acquired the *National Formulary (NF), which now contains excipients standards with references to allied reference materials*. Today, USP continues to develop *USP* and *NF* through the work of the Council of Experts into compendia that provide standards for articles based on advances in analytical and metrological science. As these and allied sciences evolve, so do *USP* and *NF*.

USP 32–NF 27

USP 32–NF 27 text is official May 1, 2009, unless otherwise noted. *USP–NF* contains official substance and preparation (product) monographs. The terms *official substance* and *official preparation* are defined in the *General Notices* of this *Pharmacopeia*. With few exceptions, all articles for which monographs are provided in *USP 32–NF 27* are legally marketed in the United States or are contained in legally marketed articles.

A *USP–NF* monograph for an official substance or preparation includes the article's definition; packaging, storage, and other requirements; and a specification. The specification consists of a series of universal (description, identification, impurities, assay) and specific tests, one or more analytical procedures for each test, and acceptance criteria. Ingredients are defined as either drug substances or excipients. An excipient is any component, other than the active substance(s), intentionally added to the formulation of a dosage form. Excipients are not necessarily inert. Drug substances and excipients may be synthetic, semisynthetic, drawn from nature (natural source), or manufactured using recombinant technology. Larger molecules and mixtures requiring a potency test are usually referred to as biologicals or biotechnological articles.

USP 32–NF 27 contains approximately 4,303 monographs and more than 220 *General Tests and Assays* (General Chapters numbered 1,000 and below) and USP *General Information Chapters* (numbered above 1,000). General Chapters provide frequently cited procedures, sometimes with acceptance criteria, in order to compile into one location repetitive information that appears in many monographs. New and revised monographs and General Chapters and obsolete matter deleted from this edition are indicated in the *Admissions* section.

***USP 32–NF 27* Organization**—*USP 32–NF 27* is printed as a three-volume set. *Volume 1* includes front matter (Mission and Preface, People, Governance pages and websites, Admissions/Annotations, and Commentary). It also includes *USP General Notices,* General Chapters, Dietary Supplement chapters, Reagents, Reference Tables, Dietary Supplement monographs, *NF Admissions,* Excipients, and *NF* monographs. *Volume 2* includes *USP* monographs A–L, and *Volume 3* includes *USP* monographs M–Z. Volumes 2 and 3 also include the *USP General Notices* and the *Guide to General Chapters,* and all three volumes include the full index. General Chapters specific to dietary supplements are included in numerical order with the rest of the General Chapters in *USP.* Excipient monographs usually are presented in *NF* but also may appear in *USP* with suitable cross-referencing when they are also drug substances. The *Excipients* section (*Volume 1*) presents a tabulation of excipients by functional category.

USP 32–NF 27 Spanish Edition—In 2006, USP began providing an official Spanish edition of *USP–NF*. Maintenance of this edition follows the same revision approaches as the English edition.

Revisions—*USP–NF* is continuously revised. Revisions are presented annually, in twice-yearly *Supplements,* in *Interim Revision Announcements (IRAs),* and in *Revision Bulletins* (on the USP website).

Supplements—The *First Supplement* to *USP 32–NF 27* will be published in February 2009 and will become official in August 2009. The *Second Supplement* will be published in June 2009 and will become official in December 2009. Users of USP print products must retain *Supplements* and subscriptions to *Pharmacopeial Forum (PF)* in order to have up-to-date information. The *USP–NF* online version is updated with each *Supplement* or annual revision. Each time a new edition or *Supplement* is released during the subscription period, a new CD-ROM will be issued. The Index in each *Supplement* is cumulative and includes citations to the annual revision and, for the *Second Supplement,* citations to the *First Supplement*. The contents of the two *Supplements* are integrated into the annual edition of the following year, along with new official revisions that have been adopted since the *Second Supplement* to the previous compendia.

Interim Revision Announcements (IRAs)—*IRAs* contain revisions that become official in the interval between publication of the annual revision and *Supplements,* and thus provide an expedited mechanism for making revisions official. They appear in USP's bimonthly journal, *Pharmacopeial Forum (PF),* with the official date noted in the publication. They are subsequently incorporated into the next published *Supplement* or annual revision, although their official dates may precede the official date of that publication.

Revision Bulletins—If the circumstances require immediate publication of official text, a proposal or postponement may be published through a *Revision Bulletin*. *Revision Bulletins* are posted on the USP website and published in the next *USP–NF* or *Supplement*, as applicable. *Revision Bulletin* official dates are specified in the individual *Revision Bulletin*.

Pharmacopeial Forum (PF)—Each *PF* contains several sections. The *Policies and Announcements* section provides information about publication and comment deadlines, USP news, and summaries of issues discussed by the Council of Experts and its Expert Committees. Proposals for revision are presented as *In-Process Revisions* and represent draft revisions that are expected to advance to official status pending final review and approval by the relevant Expert Committee.

PF also includes *Pending and Canceled Proposals* and a *Harmonization* section. The *Stimuli to the Revision Process* section presents reports or statements of authoritative bodies, scientific articles relevant to compendial issues, general commentaries by interested parties, and summaries of comments received in response to policy initiatives. *PF* concludes with sections containing *Nomenclature, Index,* and *Chromatographic Reagents* used in *USP–NF* and *PF*. Each issue of *PF* also provides a cumulative index for the given calendar year.

Symbols Indicating Change to Official Text—Symbols identify the beginning and end of each revision. The following table summarizes the types of symbols and the associated subscripts used in USP publications:

Revision Type	Symbol	Subscript
Interim Revision Announcement	•new text$_{•1}$	1–6
Revision Bulletin	•new text$_{•1}$	(RB 1-Jan-2009)
Text deletion	$_{•1}^{•}$ or $_{■1S\ (USP31)}^{■}$ or $_{▲USP31}^{▲}$	
Adopted in *Supplement*	■new text$_{■1S\ (USP31)}$	1 or 2S (USP annual edition)
Adopted in *USP–NF*	▲new text$_{▲USP31}$	USP annual edition

Interim revisions are shown with new text (if any) enclosed in circles, •new text$_{•1}$. New text revised in Revision Bulletins is enclosed in circles, •new text$_{•1}$. Text enclosed in squares, ■new text$_{■1S\ (USP31)}$, has already been adopted in a *Supplement*. Text that has been adopted in the *USP–NF* is enclosed in triangles, ▲new text$_{▲USP32}$. Where the symbols appear together with no enclosed text, such as $_{•1}^{•}$ or $_{■1S\ (USP31)}^{■}$, it means that text has been deleted and no new text has been proposed to replace it.

In all revisions, the closing symbol is accompanied by a subscript number or date that indicates the *Interim Revision Announcement (IRA), Revision Bulletin,* or *Supplement* in which the revision first appeared. An example of a revision that was officially adopted in the *Second Interim Revision Announcement* would be $_{•2}$; an example of a revision that was officially adopted in the *Revision Bulletin* on June 18, 2008, would be $_{•1}$. An example of revision that was officially adopted in the *Second Supplement to USP 31* would be $_{■2S\ (USP31)}$. Last, an example of a revision that was officially adopted in *USP 32–NF 27* would be $_{▲USP32}$. The following table shows symbols and official dates for *Interim Revision Announcements* and *Supplements* to *USP 32–NF 27*:

USP 32–NF 27 **Revision Document**			
Supplement	**Interim Revision Announcement**	**Official Date**	**Symbols**
	35(1)	Feb. 1, 2009	•and$_{•1}$
	35(2)	Apr. 1, 2009	•and$_{•2}$
	35(3)	June 1, 2009	•and$_{•3}$
1		Aug. 1, 2009	■and$_{■1S\ (USP32)}$
	35(4)	Aug. 1, 2009	•and$_{•4}$
	35(5)	Oct. 1, 2009	•and$_{•5}$
2		Dec. 1, 2009	■and$_{■2S\ (USP32)}$
	35(6)	Dec. 1, 2009	•and$_{•6}$

Chemical Names and CAS Registry Numbers—Chemical subtitles given in the monographs are index names used by the Chemical Abstracts Service (CAS) of the American Chemical Society. They are provided only in monographs in which the titles specify substances that are definable chemical entities. The first subtitle is the inverted form of the systematic chemical name developed by CAS. This is presented in accordance with the rules established over the years by the International Union of Pure and Applied Chemistry (IUPAC) and the International Union of Biochemistry, and this form is employed in the current issues of *Chemical Abstracts (CA)*. The second subtitle, given in uninverted form, is of a systematic type formerly used in *CA*. It is identical with, or closely resembles, the chemical name sanctioned and employed by IUPAC and by the World Health Organization (WHO). IUPAC names make generous use of nonsystematic and semisystematic (often referred to as "trivial") names and qualifying terms, all of which impede electronic manipulation. In contrast, CAS names are fully systematic for most substances and are amenable to search and retrieval. The two subtitles referred to above are frequently identical, and a CAS synonym is occasionally supplied as a third subtitle. Monographs with chemical subtitles generally also carry CAS registry numbers. These italicized, bracketed numbers function independently of nomenclature as invariant numerical designators of unique, unambiguous chemical substances in the CAS registry and thus are convenient and widely used.

Print and Electronic Presentations—All *USP–NF* publications are available in print form. In addition, *USP–NF* and its two annual *Supplements* are available in compact disc (CD) and online versions. The CD version makes *USP–NF* accessible to users on their computer hard drives. The online format allows individual registered users to access the online format through the Internet. Both electronic formats provide access to official *USP–NF* content, along with extensive search options. The electronic formats are cumulatively updated to integrate the content of *Supplements*. Searchable electronic versions of *PF* and of the *USP Dictionary* also are available.

USP Governance, Standards-Setting, and Advisory Bodies

USP's governing, standards-setting, and advisory bodies include the USP Convention, the Board of Trustees, the Council of Experts and its Expert Committees, Advisory Panels, and staff. Additional volunteer bodies include Stakeholder Forums, Project Teams, and Advisory Groups, which act in an advisory capacity to provide input to USP's governing, standards-setting, and management bodies.

USP Convention—USP's direction and priorities are determined by more than 400 Convention members divided into nine categories (see the *People* section). Eligible organizations within each membership category are invited to appoint a representative. Convention composition is determined to ensure suitable representation of those sections of the health care system that are influenced by, and in turn influence, USP's activities. Convention members elect USP's President, Treasurer,

and other members of the Board of Trustees as well as the Council of Experts. They also vote on resolutions to guide USP's scientific policy and public health initiatives and update, as needed, USP's Constitution and By-Laws. The next meeting of the USP Convention is scheduled for April 2010 in Washington, DC.

Board of Trustees—USP's Board of Trustees is entrusted with management of the business affairs, finances, and property of USP. During its five-year term, the Board defines USP's strategic direction through its key policy and operational decisions. A listing of the members of the 2005–2010 Board of Trustees appears in the *People* section.

Council of Experts—The Council of Experts is the standards-setting body of USP. It is composed of 57 Expert Committee Chairs elected to five-year terms by USP's Convention members. A Nominating Committee, consisting of the Chair of the Council of Experts, the Convention President, and the Vice Chair of the Nominating Committee for the Council of Experts, nominates individuals who are subsequently elected by the members of the Council of Experts to serve as Expert Committee members. Collectively, the Expert Committee Chairs and members comprise more than 500 volunteers drawn from 50 countries. The 41 Standards Expert Committees are responsible for the content of *USP–NF*, the *Food Chemicals Codex*, and associated publications (see *Figure 1)* and organized in Collaborative Groups for topics of common interest. The Information Expert Committees focus on development of Model Guidelines for the Medicare Modernization Act and other information activities. The Executive Committee of the Council of Experts (see the *People* section) provides overall direction, is an appeals body, and performs other functions that support the Council's operations.

Advisory Panels to the Council of Experts—The Chair of the Council of Experts may appoint Advisory Panels to assist the Council of Experts in reaching scientific decisions and implementing new USP directives relating to *USP–NF*. A listing of Advisory Panels is provided in the *People* section. This list changes frequently as the work of Advisory Panels concludes and new ones start their deliberations. There are more than 350 Advisory Panel members who contribute to the standards-setting activities of the Council of Experts.

Stakeholder Forums and Project Teams—USP has formed several domestic and international Stakeholder Forums and Project Teams in the 2005–2010 cycle to exchange information and receive comment on USP's standards-setting activities. Depending on the topic, a stakeholder forum may form project teams to work on selected topics. USP has also formed country and regional Stakeholder Forums. The following are lists of Stakeholder Forums for the 2005–2010 cycle.

Domestic Stakeholder Forums (United States and Canada)

- Prescription/Nonprescription
- Biologics and Biotechnology
- Compounding
- Dietary Supplements
- Food Ingredients
- Patient Safety

International Stakeholder Forums

- Europe
- India
- Latin America

USP also conducts Annual Scientific Meetings in the United States, India, China, Latin America, and the Middle East/North Africa.

Staff—USP maintains a staff of over 500 scientists, professionals, and administrative personnel at its Rockville, Maryland, headquarters. Additional staff members are located at the account management office in Basel, Switzerland, and laboratory complexes in Hyderabad, India; Shanghai, China; and São Paolo, Brazil.

Rules and Procedures

Governing Documents—*USP–NF* standards are recognized widely because they are authoritative and science-based and are established by a transparent and credible process. See the *Articles of Incorporation* section in this book; the Constitution and Bylaws and the Rules and Procedures of the 2005–2010 Council of Experts are available on

Figure 1. Organization of the 2005–2010 USP Council of Experts

USP's website (www.usp.org). Collectively, these documents serve USP volunteers and staff as the governing principles for USP's standards-setting activities.

Conflicts of Interest—USP's Conflict of Interest provisions require all members of the Council of Experts, its Expert Committees, Advisory Panels, Board of Trustees, and key staff to disclose significant financial interests in companies or other entities that are subject to *USP–NF* standards or that may be affected by *USP–NF* information. Members of the Board of Trustees, Council of Experts, and related bodies are not allowed to vote on any matter in which they have a conflict of interest or the appearance of a conflict of interest.

Confidentiality and Document Disclosure—Members of the Council of Experts, Expert Committees, and Advisory Panels sign confidentiality agreements, in keeping with the confidentiality provisions of the Rules and Procedures of the Council of Experts. The USP Document Disclosure Policy, available on USP's website, contributes to the transparency of the standards-setting process by making information available to the public, yet provides protection to manufacturers and others who submit confidential information to USP.

Authority for Publication—*USP–NF* is published in accordance with Chapter VI, Section 8, of the USP Bylaws, which states, "The Board of Trustees shall authorize the revision and release of text to the *United States Pharmacopeia* and the *National Formulary*. Upon approval of the content by the Council of Experts, in accordance with the rules and procedures adopted under Section 9, the Board of Trustees shall then act upon releasing the text and upon designating the date when it is to become official, said date to be reasonably distant from the date of its release. The Executive Vice President–CEO shall, annually or more frequently, upon specific request of the Board of Trustees, certify that the information contained in the *United States Pharmacopeia, National Formulary,* or other authorized publications has been prepared in accordance with the rules and procedures under Section 9."

USP–NF Revision Process

Public Participation—Although USP's Council of Experts is the ultimate decision-making body for *USP–NF* standards, these standards are developed by an exceptional process of public involvement and substantial interaction between USP and its stakeholders, both domestically and internationally. Participation in the revision process results from the support of many individuals and groups and also from scientific, technical, and trade organizations.

Requests for revision of monographs, either new monographs or those needing updating, contain information submitted voluntarily by manufacturers and other interested parties. At times USP staff may develop information to support a monograph *Request for Revision*. USP has prepared a document titled *Guideline for Submitting Requests for Revision to USP–NF* (available at www.usp.org, click on *USP–NF*). Via *PF*, USP solicits and encourages public comment on these monographs, General Chapters, and other draft documents. USP scientific liaisons to Expert Committees review these responses and create draft proposals that are provided to the Council of Experts. These drafts become official when Expert Committees ballot to make them official in *USP–NF*. Thus, the USP standards-setting process gives those who manufacture, regulate, and use therapeutic products the opportunity to comment on the development and revision of *USP–NF* standards. Because of the voting process and its special link to the U.S. government in law, USP is not considered a voluntary, consensus standards-setting body. *Figure 2* shows the public review and comment process and its relationship to standards development.

Working with the Food and Drug Administration (FDA)—As specified in U.S. law, USP works with the Secretary of the Department of Health and Human Services in many ways. Principal agencies in the Department for this work are the Food and Drug Administration and the Centers for Medicare and Medicaid Services. The FDA Liaison Program allows FDA representatives to participate in Expert Committee meetings, enabling continuing interactions between FDA scientific staff and Expert Committee activities. Staff in the FDA Centers who are responsible for review of compendial activities provide specific links and opportunities for exchange of comments. Mr. Larry A. Ouderkirk in the Center for Drug Evaluation and Research provides a primary compendial link between FDA and USP.

Legal Recognition

Recognition of *USP–NF*—*USP–NF* is recognized by law and custom in many countries throughout the world. In the United States, the federal Food, Drug, and Cosmetic Act (FD&C Act) defines the term "official compendium" as the official *USP,* the official *NF,* the official *Homeopathic Pharmacopeia of the United States,* or any supplement to them. FDA may enforce compliance with official standards in *USP–NF* under the adulteration and misbranding provisions of the FD&C Act. These provisions extend broad authority to FDA to prevent entry to or remove designated products from the United States market on the basis of standards in the *USP–NF.*

The identity of an official article, as expressed by its name, is established if it conforms in all respects to the requirements of its monograph and other relevant portions of the compendia. The FD&C Act stipulates that an article may differ in strength, quality, or purity and still have the same name if the difference is stated on the article's label. FDA requires that names for articles that are not official must be clearly distinguishing and differentiating from any name recognized in an official compendium. Official preparations (a drug product, a dietary supplement including nutritional supplements, or a finished device) may contain additional suitable ingredients. (See *General Notices*.)

Drugs—USP's goal is to have substance and preparation (product) monographs in *USP–NF* for all FDA-approved drugs, including biologics, and their ingredients. USP also develops monographs for therapeutic products not approved by FDA, e.g., pre-1938 drugs, dietary supplements, and compounded preparations. Although submission of information needed to develop a monograph by the Council of Experts is voluntary, compliance with a *USP–NF* monograph, if available, is mandatory.

Biologics—In the United States, although some biologics are regulated under the provisions of the Public Health Service Act (PHSA), provisions of the FD&C Act also apply to these products. For this reason, products approved under the PHSA should comply with the adulteration and misbranding provisions of the FD&C Act at Section 501(b) and 502(g) and, thus, should conform to applicable official monographs in *USP–NF*.

Medical Devices—Section 201(h) of the FD&C Act defines a device as an instrument, apparatus, similar article, or component thereof recognized in *USP–NF.* Section 502(e) of the FD&C Act defines the established name of a device in the absence of an FDA designation of the official name as the official title in an official compendium. Despite these statutory provisions, there is no comparable recognition of USP's standards-setting authority and ability to define a medical device as exists for other FDA-regulated therapeutic products. Under authority granted by the Food and Drug Administration Modernization Act of 1997, the Center for Devices and Radiological Health recognizes national and international standards, including some *USP* tests and assays, for medical devices.

Dietary Supplements—The Dietary Supplement Health and Education Act of 1994 amendments to the FD&C Act name *USP* and *NF* as the official compendia for dietary supplements. The amendments also provide that a dietary supplement may be deemed misbranded if it is cov-

Public Review and Comment Process for *USP-NF* Standards Development

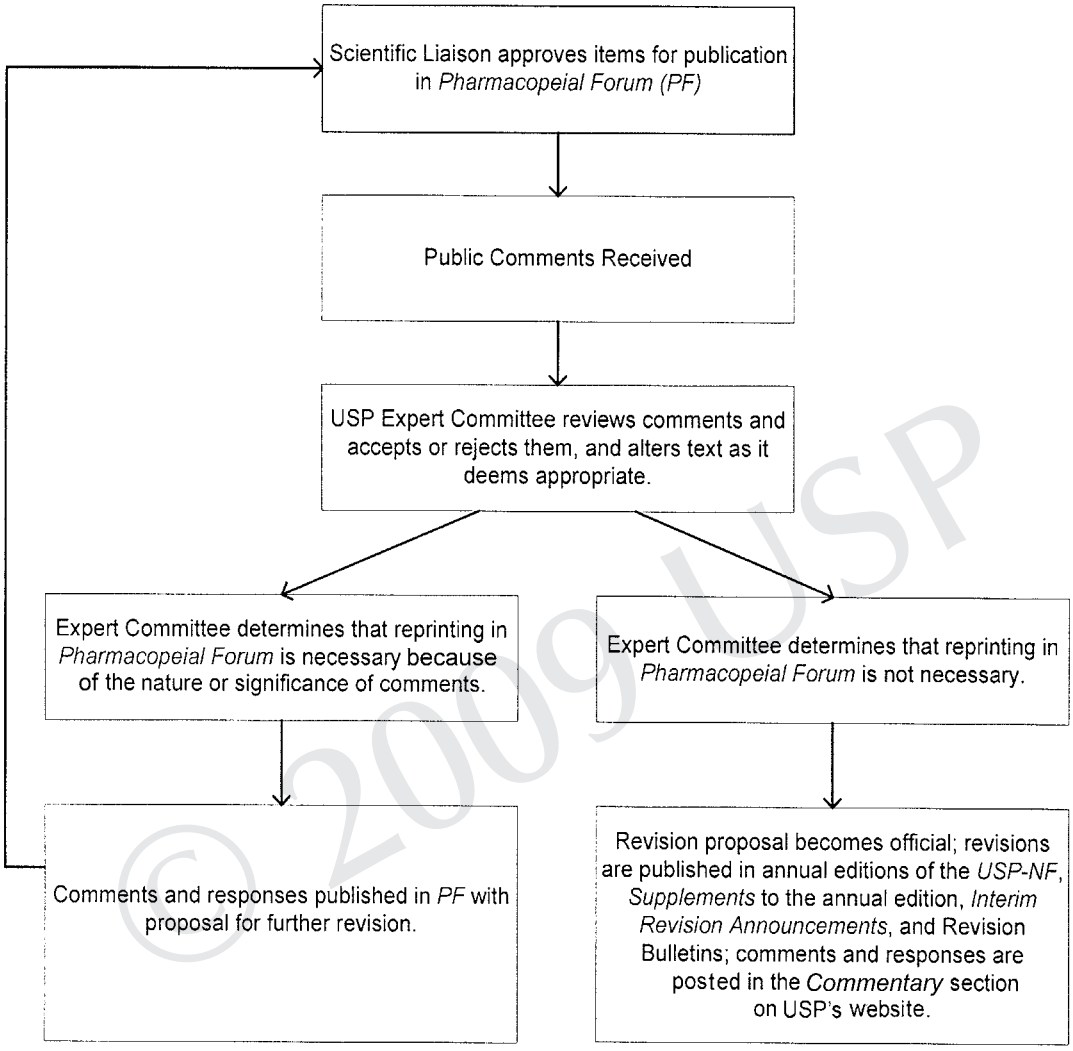


Figure 2. Public Review Process

ered by a monograph in an official compendium, is represented as conforming to this monograph, but fails to conform. The dietary supplement must be represented as conforming to a *USP–NF* dietary supplement monograph in order for the compendial standards to apply. This contrasts with pharmaceutical products, wherein conformance to the monograph is mandatory whether or not the product claims to conform.

Compounded Preparations—Preparation monographs provide information or standards applicable in compounding. Compounding means the preparation, mixing, assembling, packaging, or labeling of a drug or device or other article, as the result of a practitioner's order or in anticipation of such an order based on routine, regularly observed prescribing patterns. Standards in *USP–NF* for compounded preparations may be enforced at both the state and federal levels, e.g., if a practitioner writes a prescription for a compounded preparation that is named in a *USP–NF* monograph, the preparation, when tested, must conform to the stipulations of the monograph so named.

Nomenclature—In the United States, FDA has authority to establish names for drug products and ingredients and to determine proper names for biologics. In most cases, however, FDA works with the United States Adopted Names (USAN) Council to determine names for drug and biological substances and with USP to determine drug product names. Oversight of proprietary names and proper names is the responsibility of FDA, working with applicants.

The USAN Council's program began in 1961 by providing ingredient names for drugs prior to their marketing. USP participates in this activity, together with the American Medical Association, the American Pharmacists Association, and FDA. The Council's output is incorporated, along with other names for drugs (including generic, proprietary, and chemical names and code designations), in the *USP Dictionary of USAN and International Drug Names*. Since 1988 this publication has been recognized by federal regulation as the source of established names for drug substances in the United States.

Drug product names can be established by FDA, but more often are developed cooperatively by FDA and the USP Council of Experts' Nomenclature Expert Committee. The names developed by this Expert Committee are used as the titles of the relevant monographs, and as such are recognized as the "established names" for drug products under section 502(e)(3) of the FD&C Act. The USP Drug Nomenclature Committee was formed in 1986 to supplement the Executive Committees of the Drug Standards Division and the Information Division and to prevent any inconsistency regarding nomenclature. Following the 2000 meeting of the USP Convention, the responsibilities for devising and, when necessary, revising labeling requirements were delegated to this Expert Committee, which is now named the Nomenclature Expert Committee. The Expert Committee's work does not overlap that of the USAN Council. Rather, it is complementary and is concerned with standardization of compendial names, particularly dosage form names, and names for combination drug products.

Harmonization Activities

Pharmacopeial Discussion Group—USP harmonizes pharmacopeial excipient monographs and General Chapters through the Pharmacopeial Discussion Group (PDG), which includes representatives from the European, Japanese, and United States pharmacopeias, and WHO (as an observer). According to the PDG definition, "a pharmacopeial general chapter or other pharmacopeial document is harmonized when a pharmaceutical substance or product tested by the document's harmonized procedure yields the same results, and the same accept/reject decision is reached." General Information Chapter ⟨1196⟩, *Pharmacopeial Harmonization,* provides (1) the PDG Policy Statement, (2) the PDG Working Procedures and a definition of each stage of harmonization, (3) a discussion, (4) a status report, and (5) a glossary.

Other *USP–NF* Related Publications

Chromatographic Reagents—This comprehensive reference provides detailed information needed to conduct chromatographic procedures found in *USP–NF*. *Chromatographic Reagents* lists the brand names of the column reagents cited in every proposal for new or revised gas- or liquid-chromatographic analytical procedures that have been published in *PF* since 1980. *Chromatographic Reagents* also helps to track which column reagents were used to validate analytical procedures that have become official. The branded column reagents list is updated bimonthly in *PF*.

USP Pharmacists' Pharmacopeia—*USP–NF* is directed primarily to pharmaceutical and dietary supplement manufacturers, although it contains many monographs and allied text useful for compounding practitioners. To better accommodate the needs of these practitioners and more generally the needs of the pharmacy community, USP has made available the *USP Pharmacists' Pharmacopeia*. This text provides pharmacy-relevant abridged official text from the *USP–NF* as well as authorized information. The former refers to standards for official articles; the latter is more general information designed to be useful to practitioners. Both types of text are developed under the Rules and Procedures of the Council of Experts. The *USP Pharmacists' Pharmacopeia* is available both in print and in a web-based version.

USP Dictionary—*The USP Dictionary of USAN and International Drug Names* provides in a single volume the most up-to-date United States Adopted Names of drugs; official *USP–NF* names; nonproprietary, brand, and chemical names; graphic formulas; molecular formulas and weights; CAS registry numbers and code designations; drug manufacturers; and pharmacologic and therapeutic categories. The *Dictionary* helps to ensure the accuracy of the following: product labeling; reports, articles, and correspondence; FDA regulatory filings; and pharmaceutical package inserts. It is published annually (latest edition April 2008) and is recognized by FDA as the official source for established drug names (See *Nomenclature* section.)

USP Catalog—When referenced in a compendial procedure, use of official *USP–NF* Reference Standards promotes uniform quality of drugs and supports first-, second-, and third-party testing of all manufactured and compounded articles. The publication listing the collection of official *USP–NF* Reference Standards can be accessed on the USP website at www.usp.org and is available in print form by contacting USP Sales and Marketing staff at 301-816-8237. The listing identifies new items, replacement lots, lots of a single item that are simultaneously official, lots deleted from official status, and a preview of items eventually to be adopted. Purchase order information is included, and the names of distributors who can facilitate international availability of these items are suggested. This program benefits from the widespread voluntary contribution of suitable materials and test data from pharmaceutical manufacturers. USP advances this unofficial material to official status via careful characterization studies and collaborative testing, followed by review and, if appropriate, approval by the Reference Standards Committee of the Council of Experts.

Section 2

General Notices and Requirements

The *General Notices and Requirements* of *USP* provide guidelines for the interpretation and application of the monographs and general chapters in the *USP*. To assist the pharmacy practitioner, the *USP Pharmacists' Pharmacopeia* provides an unofficial summation of key parts of the *General Notices and Requirements* in the following section. This summation is explanatory only and is not considered to be official text. Following this summation, the official *General Notices and Requirements* are provided verbatim from the *USP*.

Section Contents

General Notices and Requirements

The *General Notices and Requirements* section (the *General Notices*) presents the basic assumptions, definitions, and default conditions for the interpretation and application of the *United States Pharmacopeia* (*USP*) and the *National Formulary* (*NF*).

Requirements stated in these *General Notices* apply to all articles recognized in the *USP* and *NF* (the "compendia") and to all general chapters unless specifically stated otherwise. Where the requirements of an individual monograph differ from the *General Notices* or a general chapter, the monograph requirements apply and supersede the requirements of the *General Notices* or the general chapter, whether or not the monograph explicitly states the difference.

1. Title and Revision

The full title of this publication (consisting of three volumes and including its *Supplements*), is *The Pharmacopeia of the United States of America*, Thirty-Second Revision and the *National Formulary,* Twenty-Seventh Edition. These titles may be abbreviated to *United States Pharmacopeia,* Thirty-Second Revision (or to *USP 32*), to *NF 27,* and to *USP 32–NF 27*. The *United States Pharmacopeia,* Thirty-Second Revision, and the *National Formulary,* Twenty-Seventh Edition, supersede all earlier revisions. Where the terms "*USP*," "*NF*," or "*USP–NF*" are used without further qualification during the period in which these compendia are official, they refer only to *USP 32, NF 27,* and any *Supplement(s)* thereto. The same titles, with no further distinction, apply equally to print or electronic presentation of these contents. Although *USP* and *NF* are published under one cover and share these *General Notices,* they are separate compendia.

This revision is official beginning May 1, 2009, unless otherwise indicated in specific text.

Supplements to *USP* and *NF* are published periodically.

Interim Revision Announcements are revisions to *USP* and *NF* that are published in *Pharmacopeial Forum*. *Interim Revision Announcements* contain official revisions and their effective dates, announcements of the availability of new USP Reference Standards, and announcements of tests or procedures that are held in abeyance pending availability of required USP Reference Standards.

Revision Bulletins are revisions to official text or postponements that require expedited publication. They are published on the USP website and generally are official immediately unless otherwise specified in the *Revision Bulletin*.

Errata are corrections to items erroneously published that have not received the approval of the Council of Experts and that do not reflect the official requirements. *Errata* are effective upon publication.

2. Official Status and Legal Recognition

2.10. Official Text

Official text is text contained in *USP* and *NF,* including monographs, general chapters, and these *General Notices*. Revisions to official text are provided in *Supplements, Interim Revision Announcements*, and *Revision Bulletins*. General chapters numbered from 1000 to 1999 are considered interpretive and are intended to provide information on, give definition to, or describe a particular subject. They contain no mandatory requirements applicable to any official article unless specifically referenced in these *General Notices*, a monograph, or a general chapter numbered below 1000. General chapters numbered above 2000 apply only to articles that are intended for use as dietary ingredients and dietary supplements.

2.20. Official Articles

An *official article* is an article that is recognized in *USP* or *NF*. An article is deemed to be recognized and included in a compendium when a monograph for the article is published in the compendium and an official date is generally or specifically assigned to the monograph.

The title specified in a monograph is the *official title* for such article. Other names considered to be synonyms of the official titles may not be used as substitutes for official titles.

Official articles include both *official substances* and *official products*. An *official substance* is a drug substance, excipient, dietary ingredient, other ingredient, or component of a finished device for which the monograph title includes no indication of the nature of the finished form.

An *official product* is a drug product, dietary supplement, compounded preparation, or finished device for which a monograph is provided.

2.30. Legal Recognition

The *USP* and *NF* are recognized in the laws and regulations of many countries throughout the world. Regulatory authorities may enforce the standards presented in the *USP* and *NF,* but because recognition of the *USP* and *NF* may vary by country, users should understand applicable laws and regulations. More information about the legal status of the *USP* and *NF* is provided in the *Mission and Preface*.

3. Conformance to Standards

3.10. Applicability of Standards

Standards for an article recognized in a USP compendium are expressed in the article's monograph, applicable general chapters, and these *General Notices*. Unless specifically exempted elsewhere in a compendium, the identity, strength, quality, and purity of an article are determined by the official tests, procedures, and acceptance criteria, whether incorporated in the monograph itself, in the *General Notices*, or in the applicable general chapters.

The standards in the relevant monograph, general chapter(s), and *General Notices* apply at any time in the life of the article from production to expiration. The manufacturer's specifications, and good manufacturing practices generally, are developed and followed to ensure that the article will comply with compendial standards until its expiration date, when stored as directed. Thus, any official article tested as directed in the relevant monograph shall comply.

At times, compendial standards take on the character of statistical procedures, with multiple units involved and perhaps a sequential procedural design to allow the user to determine that the tested article meets or does not meet the standard. The similarity to statistical procedures may seem to suggest an intent to make inference to some larger group of units, but in all cases, statements about whether the compendial standard is met apply only to the units tested. Repeats, replicates, statistical rejection of outliers, or extrapolations of results to larger populations, as well as the necessity and appropriate frequency of batch testing, are neither specified nor proscribed by the compendia. First-party (manufacturer), second-party (buyer), or third-party (regulator) compliance testing may or may not require examination of additional specimens, in accordance with predetermined guidelines or sampling strategies.

Official products other than dietary supplements are prepared from ingredients that meet *USP* or *NF* standards, where standards for such ingredients exist.

Official substances are prepared according to recognized principles of good manufacturing practice and from ingredients complying with specifications designed to ensure that the resultant substances meet the requirements of the compendial monographs.

3.10.10. Applicability of Standards to Drug Products, Drug Substances, and Excipients

The applicable *USP* or *NF* standard applies to any article marketed in the United States that (1) is recognized in the compendium and (2) is intended or labeled for use as a drug or as an ingredient in a drug. The applicable standard applies to such articles whether or not the added designation "USP" or "NF" is used. The standards apply equally to articles bearing the official titles or names derived by transposition of the definitive words of official titles or transposition in the order of the names of two or more active ingredients in official titles.

3.10.20. Applicability of Standards to Medical Devices, Dietary Supplements, and Their Components and Ingredients

An article recognized in *USP* or *NF* shall comply with the compendial standards if the article is a medical device, component intended for a medical device, dietary supplement, dietary ingredient, or other ingredient that is intended for incorporation into a dietary supplement, and is labeled as conforming to the *USP* or *NF*.

Generally, dietary supplements are prepared from ingredients that meet *USP, NF,* or *Food Chemicals Codex* standards. Where such standards do not exist, substances may be used in dietary supplements if they have been shown to be of acceptable food grade quality using other suitable procedures.

3.20. Indicating Conformance

A drug product, drug substance, or excipient may use the designation "USP" or "NF" in conjunction with its official title or elsewhere on the label only when (1) a monograph is provided in the specified compendium and (2) the article complies with the identity prescribed in the specified compendium.

When a drug product, drug substance, or excipient differs from the relevant *USP* or *NF* standard of strength, quality, or purity, as determined by the application of the tests, procedures, and acceptance criteria set forth in the relevant compendium, its difference shall be plainly stated on its label.

When a drug product, drug substance, or excipient fails to comply with the identity prescribed in *USP* or *NF* or contains an added substance that interferes with the prescribed tests and procedures, the article shall be designated by a name that is clearly distinguishing and differentiating from any name recognized in *USP* or *NF*.

A medical device, dietary supplement, or ingredient or component of a medical device or dietary supplement may use the designation "USP" or "NF" in conjunction with its official title or elsewhere on the label only when (1) a monograph is provided in the specified compendium and (2) the article complies with the monograph standards and other applicable standards in the compendium.

The designation "USP" or "NF" on the label may not and does not constitute an endorsement by USP and does not represent assurance by USP that the article is known to comply with the relevant standards. USP may seek legal redress if an article purports to be or is represented as an official article in one of USP's compendia and such claim is determined by USP not to be made in good faith.

The designation "*USP–NF*" may be used on the label of an article provided that the label also bears a statement such as "Meets *NF* standards as published by USP," indicating the particular compendium to which the article purports to apply.

When the letters "USP," "NF," or "USP–NF" are used on the label of an article to indicate compliance with compendial standards, the letters shall appear in conjunction with the official title of the article. The letters are not to be enclosed in any symbol such as a circle, square, etc., and shall appear in capital letters.

If a dietary supplement does not comply with all applicable compendial requirements but contains one or more dietary ingredients or other ingredients that are recognized in *USP* or *NF,* the individual ingredient(s) may be designated as complying with *USP* or *NF* standards or being of *USP* or *NF* quality provided that the designation is limited to the individual ingredient(s) and does not suggest that the dietary supplement complies with *USP* standards.

4. Monographs and General Chapters

4.10. Monographs

Monographs set forth the article's name, definition, specification, and other requirements related to packaging, storage, and labeling. The specification consists of tests, procedures, and acceptance criteria that help ensure the identity, strength, quality, and purity of the article. For general requirements relating to specific monograph sections, see section 5, *Monograph Components*.

Because monographs may not provide standards for all relevant characteristics, some official substances may conform to the *USP* or *NF* standard but differ with regard to nonstandardized properties that are relevant to their use in specific preparations. To assure interchangeability in such instances, users may wish to ascertain functional equivalence or determine such characteristics before use.

4.10.10. Applicability of Test Procedures

A single monograph may include several different tests, procedures, and/or acceptance criteria that reflect attributes of different manufacturers' articles. Such alternatives may be presented for different polymorphic forms, impurities, hydrates, and dissolution cases. Monographs indicate the tests, procedures, and/or acceptance criteria to be used and the required labeling.

4.10.20. Acceptance Criteria

The acceptance criteria allow for analytical error, for unavoidable variations in manufacturing and compounding, and for deterioration to an extent considered acceptable under practical conditions. The existence of compendial acceptance criteria does not constitute a basis for a claim that an official substance that more nearly approaches 100 percent purity "exceeds" compendial quality. Similarly, the fact that an article has been prepared to tighter criteria than those specified in the monograph does not constitute a basis for a claim that the article "exceeds" the compendial requirements.

An official product shall be formulated with the intent to provide 100 percent of the quantity of each ingredient declared on the label. Where the minimum amount of a substance present in a dietary supplement is required by law to be higher than the lower acceptance criterion allowed for in the monograph, the upper acceptance criterion contained in the monograph may be increased by a corresponding amount.

The acceptance criteria specified in individual monographs and in the general chapters for compounded preparations are based on such attributes of quality as might be expected to characterize an article compounded from suitable bulk drug substances and ingredients, using the procedures provided or recognized principles of good compounding practice, as described in these compendia.

4.20. General Chapters

Each general chapter is assigned a number that appears in angle brackets adjacent to the chapter name (e.g., *Chromatography* ⟨621⟩). General chapters may contain the following:

- Descriptions of tests and procedures for application through individual monographs,

- Descriptions and specifications of conditions and practices for pharmaceutical compounding,
- General information for the interpretation of the compendial requirements,
- Descriptions of general pharmaceutical storage, dispensing, and packaging practices, or
- General guidance to manufacturers of official substances or official products.

When a general chapter is referenced in a monograph, acceptance criteria may be presented after a colon.

Some chapters may serve as introductory overviews of a test or of analytical techniques. They may reference other general chapters that contain techniques, details of the procedures, and, at times, acceptance criteria.

5. Monograph Components

5.10. Molecular Formula

The use of the molecular formula for the active ingredient(s) named in defining the required strength of a compendial article is intended to designate the chemical entity or entities, as given in the complete chemical name of the article, having absolute (100 percent) purity.

5.20. Added Substances, Excipients, and Ingredients

Substances are regarded as unsuitable for inclusion in an official article and therefore prohibited unless: (1) they do not exceed the minimum quantity required for providing their intended effect; (2) their presence does not impair the bioavailability, therapeutic efficacy, or safety of the official article; and (3) they do not interfere with the assays and tests prescribed for determining compliance with the compendial standards.

The air in a container of an official article may, where appropriate, be evacuated or be replaced by carbon dioxide, helium, argon, or nitrogen, or by a mixture of these gases. The use of such gas need not be declared in the labeling.

5.20.10. Added Substances, Excipients, and Ingredients in Official Substances

Official substances may contain only the specific added substances that are permitted by the individual monograph. Where such addition is permitted, the label shall indicate the name(s) and amount(s) of any added substance(s).

5.20.20. Added Substances, Excipients, and Ingredients in Official Products

Suitable substances and excipients such as antimicrobial agents, pharmaceutical bases, carriers, coatings, flavors, preservatives, stabilizers, and vehicles may be added to an official product to enhance its stability, usefulness, or elegance, or to facilitate its preparation, unless otherwise specified in the individual monograph.

Added substances and excipients employed solely to impart color may be incorporated into official products other than those intended for parenteral or ophthalmic use, in accordance with the regulations pertaining to the use of colors issued by the U.S. Food and Drug Administration (FDA), provided such added substances or excipients are otherwise appropriate in all respects. (See also *Added Substances* under *Injections* ⟨1⟩.)

The proportions of the substances constituting the base in ointment and suppository products and preparations may be varied to maintain a suitable consistency under different climatic conditions, provided that the concentrations of active ingredients are not varied and provided that the bioavailability, therapeutic efficacy, and safety of the preparation are not impaired.

5.20.20.1. In Compounded Preparations

Compounded preparations for which a complete composition is given shall contain only the ingredients named in the formulas unless specifically exempted herein or in the individual monograph. Deviation from the specified processes or methods of compounding, although not from the ingredients or proportions thereof, may occur provided that the finished preparation conforms to the relevant standards and to preparations produced by following the specified process.

Where a monograph for a compounded preparation calls for an ingredient in an amount expressed on the dried basis, the ingredient need not be dried before use if due allowance is made for the water or other volatile substances present in the quantity taken.

Specially denatured alcohol formulas are available for use in accordance with federal statutes and regulations of the Internal Revenue Service. A suitable formula of specially denatured alcohol may be substituted for Alcohol in the manufacture of official preparations intended for internal or topical use, provided that the denaturant is volatile and does not remain in the finished product. A preparation that is intended for topical application to the skin may contain specially denatured alcohol, provided that the denaturant is either a usual ingredient in the preparation or a permissible added substance; in either case the denaturant shall be identified on the label of the topical preparation. Where a process is given in the individual monograph, any preparation compounded using denatured alcohol shall be identical to that prepared by the monograph process.

5.20.20.2. In Dietary Supplements

Additional ingredients may be added to dietary supplement products provided that the additional ingredients: (1) comply with applicable regulatory requirements; and (2) do not interfere with the assays and tests prescribed for determining compliance with compendial standards.

5.30. Description and Solubility

Only where a quantitative solubility test is given in a monograph and is designated as such is it a test for purity.

A monograph may include information regarding the article's description. Information about an article's "description and solubility" also is provided in the reference table *Description and Relative Solubility of USP and NF Articles*. The reference table merely denotes the properties of articles that comply with monograph standards. The reference table is intended primarily for those who use, prepare, and dispense drugs and/or related articles. Although the information provided in monographs and the information in the reference table may indirectly assist in the preliminary evaluation of an article, it is not intended to serve as a standard or test for purity.

The approximate solubility of a compendial substance is indicated by one of the following descriptive terms:

Descriptive Term	Parts of Solvent Required for 1 Part of Solute
Very soluble	Less than 1
Freely soluble	From 1 to 10
Soluble	From 10 to 30
Sparingly soluble	From 30 to 100
Slightly soluble	From 100 to 1,000
Very slightly soluble	From 1,000 to 10,000
Practically insoluble, or Insoluble	Greater than or equal to 10,000

5.40. Identification Test

The compendial test titled *Identification* is provided as an aid in verifying the identity of articles as they are purported to be, e.g., those taken from labeled containers. Tests presented in the *Identification* section shall be used to assist in establishing the identity of the substance but are not necessarily sufficient to establish proof of identity. Other tests

and specifications in the monograph often are necessary to establish or confirm the identity of an article. Failure of an article to meet the requirements of a prescribed *Identification* test may indicate that the article is mislabeled.

5.50. Assay

Assay tests for compounded preparations are not intended for evaluating a compounded preparation before dispensing, but instead are intended to serve as the official test in the event of a question or dispute regarding the preparation's conformance to official standards.

5.50.10. Units of Potency (Biological)

For substances that cannot be completely characterized by chemical and physical means, it may be necessary to express quantities of activity in biological units of potency, each defined by an authoritative, designated reference standard.

Units of biological potency defined by the World Health Organization (WHO) for International Biological Standards and International Biological Reference Preparations are termed International Units (IU). Monographs refer to the units defined by USP Reference Standards as "USP Units." For biological products, units of potency are defined by the corresponding U.S. Standard established by FDA, whether or not International Units or USP Units have been defined (see *Biologics* ⟨1041⟩).

5.60. Impurities and Foreign Substances

Tests for the presence of impurities and foreign substances are provided to limit such substances to amounts that are unobjectionable under conditions in which the article is customarily employed (see also *Impurities in Official Articles* ⟨1086⟩).

Nonmonograph tests and acceptance criteria suitable for detecting and controlling impurities that may result from a change in the processing methods or that may be introduced from external sources should be employed in addition to the tests provided in the individual monograph, where the presence of the impurity is inconsistent with applicable good manufacturing practices or good pharmaceutical practice.

5.60.10. Other Impurities in *USP* and *NF* Articles

If a *USP* or *NF* monograph includes an assay or organic impurity test based on chromatography, other than a test for residual solvents, and that monograph procedure does not detect an impurity present in the substance, the amount and identity of the impurity, where both are known, shall be stated in the labeling (certificate of analysis) of the official substance, under the heading *Other Impurity(ies)*.

The presence of any unlabeled other impurity in an official substance is a variance from the standard if the content is 0.1% or greater. The sum of all *Other Impurities* combined with the monograph-detected impurities may not exceed 2.0% (see *Ordinary Impurities* ⟨466⟩), unless otherwise stated in the monograph.

The following categories of drug substances are excluded from *Other Impurities* requirements:

- fermentation products and semi-synthetics derived therefrom,
- radiopharmaceuticals,
- biologics,
- biotechnology-derived products,
- peptides,
- herbals, and
- crude products of animal or plant origin.

Any substance known to be toxic shall not be listed under *Other Impurities*.

5.60.20. Residual Solvents in *USP* and *NF* Articles

All *USP* and *NF* articles are subject to relevant control of residual solvents, even when no test is specified in the individual monograph. If solvents are used during production, they must be of suitable quality. In addition, the toxicity and residual level of each solvent shall be taken into consideration, and the solvents limited according to the principles defined and the requirements specified in *Residual Solvents* ⟨467⟩, using the general methods presented therein or other suitable methods.

5.70. Performance Tests

Where content uniformity determinations have been made using the same analytical methodology specified in the *Assay,* with appropriate allowances made for differences in sample preparation, the average of all of the individual content uniformity determinations may be used as the *Assay* value.

5.80. USP Reference Standards

USP Reference Standards are authentic specimens that have been approved by the USP Reference Standards Expert Committee as suitable for use as comparison standards in *USP* or *NF* tests and assays. (See *USP Reference Standards* ⟨11⟩.) Current official lots of USP Reference Standards are published in the *USP Reference Standards Catalog*. Where a procedure calls for the use of a compendial article rather than for a USP Reference Standard as a material standard of reference, a substance meeting all of the compendial monograph requirements for that article shall be used. No new *USP* or *NF* standard or procedure requiring the use of a new USP Reference Standard shall be official until the specified USP Reference Standard is available.

Unless a reference standard label bears a specific potency or content, assume the reference standard is 100.0% pure in the official application. Unless otherwise directed in the procedure in the individual monograph or in a general chapter, USP Reference Standards are to be used in accordance with the instructions on the label of the Reference Standard.

6. Testing Practices and Procedures

6.10. Safe Laboratory Practices

In performing compendial procedures, safe laboratory practices shall be followed, including precautionary measures, protective equipment, and work practices consistent with the chemicals and procedures used. Before undertaking any procedure described in the compendia, the analyst should be aware of the hazards associated with the chemicals and the techniques and means of protecting against them. These compendia are not designed to describe such hazards or protective measures.

6.20. Automated Procedures

Automated and manual procedures employing the same basic chemistry are considered equivalent.

6.30. Alternative and Harmonized Methods and Procedures

Alternative methods and/or procedures may be used if they provide advantages in terms of accuracy, sensitivity, precision, selectivity, or adaptability to automation or computerized data reduction, or in other special circumstances. Such alternative procedures and methods shall be validated as described in the general chapter *Validation of Compendial Procedures* ⟨1225⟩ and must be shown to give equivalent or better results. Only those results obtained by the methods and procedures given in the compendium are conclusive.

Alternative procedures should be submitted to USP for evaluation as a potential replacement or addition to the standard (see section 4.10, *Monographs*).

Certain general chapters contain a statement that the text in question is harmonized with the corresponding text of the *European Pharmacopoeia* and/or the *Japanese Pharmacopoeia* and that these texts are interchangeable. Therefore, if a substance or preparation is found to comply with a requirement using an interchangeable method or procedure from one of these pharmacopeias, it should comply with the requirements of the *USP*. When a difference appears, or in the event of dispute, only the result obtained by the method and/or procedure given in the *USP* is conclusive.

6.40. Dried, Anhydrous, Ignited, or Solvent-Free Basis

All calculations in the compendia assume an "as-is" basis unless otherwise specified.

Test procedures may be performed on the undried or unignited substance and the results calculated on the dried, anhydrous, or ignited basis, provided a test for *Loss on drying,* or *Water,* or *Loss on ignition,* respectively, is given in the monograph. Where the presence of moisture or other volatile material may interfere with the procedure, previous drying of the substance is specified in the individual monograph and is obligatory.

The term "solvent-free" signifies that the calculation shall be corrected for the presence of known solvents as determined using the methods described in *Residual Solvents* ⟨467⟩ unless a test for limit of organic solvents is provided in the monograph.

The term "previously dried" without qualification signifies that the substance shall be dried as directed under *Loss on Drying* ⟨731⟩ or *Water Determination* ⟨921⟩ (gravimetric determination).

Where drying in vacuum over a desiccant is directed, a vacuum desiccator, a vacuum drying pistol, or other suitable vacuum drying apparatus shall be used.

6.40.10. Ignite to Constant Weight

"Ignite to constant weight" means that ignition shall be continued at 800 ± 25°, unless otherwise indicated, until two consecutive weighings, the second of which is taken after an additional period appropriate to the nature and quantity of the residue, do not differ by more than 0.50 mg per g of substance taken.

6.40.20. Dried to Constant Weight

"Dried to constant weight" means that drying shall be continued until two consecutive weighings, the second of which is taken after an additional drying period appropriate to the nature and quantity of the residue, do not differ by more than 0.50 mg per g of substance taken.

6.50. Preparation of Solutions

6.50.10. Filtration

Where a procedure gives direction to "filter" without further qualification, the liquid shall be passed through suitable filter paper or equivalent device until the filtrate is clear. Due to the possibility of filter effects, the initial volumes of a filtrate may be discarded.

6.50.20. Solutions

Unless otherwise specified, all solutions shall be prepared with Purified Water. Solutions for quantitative measures shall be prepared using accurately weighed or accurately measured analytes (see section 8.20, *About*).

An expression such as "(1 in 10)" means that 1 part *by volume* of a liquid shall be diluted with, or 1 part *by weight* of a solid shall be dissolved in, a sufficient quantity of the diluent or solvent to make the volume of the finished solution 10 parts *by volume*. An expression such as "(20:5:2)" means that the respective numbers of parts, by volume, of the designated liquids shall be mixed, unless otherwise indicated.

6.50.20.1. Adjustments to Solutions

When a specified concentration is called for in a procedure, a solution of other normality or molarity may be used, provided that allowance is made for the difference in concentration and that the change does not increase the error of measurement.

Unless otherwise indicated, analyte concentrations shall be prepared to within ten percent (10%) of the indicated value. In the special case in which a procedure is adapted to the working range of an instrument, solution concentrations may differ from the indicated value by more than ten percent (10%), with appropriate changes in associated calculations. Any changes shall fall within the validated range of the instrument.

When adjustment of pH is indicated with either an acid or base and the concentration is not indicated, appropriate concentrations of that acid or base may be used.

6.50.20.2. Test Solutions

Information on Test Solutions (TS) is provided in the *Test Solutions* portion of the *Reagents, Indicators, and Solutions* section of the *USP–NF*. Use of an alternative Test Solution or a change in the Test Solution used may require validation.

6.50.20.3. Indicator Solutions

Where a procedure specifies the use of an indicator TS, approximately 0.2 mL, or 3 drops, of the solution shall be added unless otherwise directed.

6.60. Units Necessary to Complete a Test

Unless otherwise specified, a sufficient number of units to ensure a suitable analytical result shall be taken.

6.60.10. Tablets

Where the procedure of a Tablet monograph directs to weigh and finely powder not fewer than a given number of Tablets, a counted number of Tablets shall be weighed and reduced to a powder. The portion of the powdered Tablets taken shall be representative of the whole Tablets and shall, in turn, be weighed accurately.

6.60.20. Capsules

Where the procedure of a Capsule monograph gives direction to remove, as completely as possible, the contents of not fewer than a given number of the Capsules, a counted number of Capsules shall be carefully opened and the contents quantitatively removed, combined, mixed, and weighed accurately. The portion of mixed Capsules contents taken shall be representative of the contents of the Capsules and shall, in turn, be weighed accurately.

6.70. Reagents

The proper conduct of the compendial procedures and the reliability of the results depend, in part, upon the quality of the reagents used in the performance of the procedures. Unless otherwise specified, reagents conforming to the specifications set forth in the current edition of *Reagent Chemicals* published by the American Chemical Society (ACS) shall be used. Where such ACS reagent specifications are not available or where the required purity differs, compendial specifications for reagents of acceptable quality are provided (see the *Reagents, Indicators, and Solutions* section of the *USP–NF*). Reagents not covered by any of these specifications should be of a grade suitable to the proper performance of the method of assay or test involved.

Listing of these reagents, including the indicators and solutions employed as reagents, in no way implies that they have therapeutic utility; furthermore, any reference to *USP* or *NF* in their labeling shall include also the term "reagent" or "reagent grade." USP may supply reagents if they otherwise may not be generally commercially available.

6.80. Equipment

Unless otherwise specified, a specification for a definite size or type of container or apparatus in a procedure is given solely as a recommendation. Other dimensions or types may be used if they are suitable for the intended use.

6.80.10. Apparatus for Measurement

Where volumetric flasks or other exact measuring, weighing, or sorting devices are specified, this or other equipment of at least equivalent accuracy shall be employed.

6.80.10.1. Pipet

Where a pipet is specified, a suitable buret may be substituted. Where a "to contain" pipet is specified, a suitable volumetric flask may be substituted.

6.80.10.2. Light Protection

Where low-actinic or light-resistant containers are specified, either containers specially treated to protect contents from light or clear containers that have been rendered opaque by application of a suitable coating or wrapping may be used.

6.80.20. Instrumental Apparatus

An instrument may be substituted for the specified instrument if the substitute uses the same fundamental principles of operation and is of equivalent or greater sensitivity and accuracy. These characteristics shall be qualified as appropriate. Where a particular brand or source of a material, instrument, or piece of equipment, or the name and address of a manufacturer or distributor, is mentioned (ordinarily in a footnote), this identification is furnished solely for informational purposes as a matter of convenience, without implication of approval, endorsement, or certification.

6.80.20.1. Chromatographic Tubes and Columns

The term "diameter" refers to internal diameter (ID).

6.80.20.2. Tubing

The term "diameter" refers to outside diameter (OD).

6.80.20.3. Steam Bath

Where use of a steam bath is directed, use actively flowing steam or another regulated heat source controlled at an equivalent temperature.

6.80.20.4. Water Bath

A water bath requires vigorously boiling water unless otherwise specified.

7. Test Results

7.10. Interpretation of Requirements

Analytical results observed in the laboratory (or calculated from experimental measurements) are compared with stated acceptance criteria to determine whether the article conforms to compendial requirements.

The reportable value, which often is a summary value for several individual determinations, is compared with the acceptance criteria. The reportable value is the end result of a completed measurement procedure, as documented.

Where acceptance criteria are expressed numerically herein through specification of an upper and/or lower limit, permitted values include the specified values themselves, but no values outside the limit(s). Acceptance criteria are considered significant to the last digit shown.

7.10.10. Equivalence Statements in Titrimetric Procedures

The directions for titrimetric procedures conclude with a statement of the weight of the analyte that is equivalent to each mL of the standardized titrant. In such an equivalence statement, the number of significant figures in the concentration of the titrant should be understood to correspond to the number of significant figures in the weight of the analyte. Corrections to calculations based on the blank determination are to be made for all titrimetric assays where appropriate (see *Titrimetry* ⟨541⟩).

7.20. Rounding Rules

The observed or calculated values shall be rounded off to the number of decimal places that is in agreement with the limit expression. Numbers should not be rounded until the final calculations for the reportable value have been completed. Intermediate calculations (e.g., slope for linearity) may be rounded for reporting purposes, but the original (not rounded) value should be used for any additional required calculations. Acceptance criteria are fixed numbers and are not rounded.

When rounding is required, consider only one digit in the decimal place to the right of the last place in the limit expression. If this digit is smaller than 5, it is eliminated and the preceding digit is unchanged. If this digit is equal to or greater than 5, it is eliminated and the preceding digit is increased by 1.

Illustration of Rounding Numerical Values for Comparison with Requirements

Compendial Requirement	Unrounded Value	Rounded Result	Conforms
Assay limit ≥98.0%	97.96%	98.0%	Yes
	97.92%	97.9%	No
	97.95%	98.0%	Yes
Assay limit ≤101.5%	101.55%	101.6%	No
	101.46%	101.5%	Yes
	101.45%	101.5%	Yes
Limit test ≤0.02%	0.025%	0.03%	No
	0.015%	0.02%	Yes
	0.027%	0.03%	No
Limit test ≤3 ppm	3.5 ppm	4 ppm	No
	3.4 ppm	3 ppm	Yes
	2.5 ppm	3 ppm	Yes

8. Terms and Definitions

8.10. Abbreviations

- RS refers to a USP Reference Standard.
- CS refers to a Colorimetric Solution.
- TS refers to a Test Solution.
- VS refers to a Volumetric Solution that is standardized in accordance with directions given in the individual monograph or in the *Reagents, Indicators, and Solutions* section of *USP–NF*.

8.20. About

"About" indicates a quantity within 10%.

If the measurement is stated to be "accurately measured" or "accurately weighed," follow the statements in the general chapters *Volumetric Apparatus* ⟨31⟩ and *Weights and Balances* ⟨41⟩, respectively.

8.30. Alcohol Content

Percentages of alcohol, such as those under the heading *Alcohol content,* refer to percentage by volume of C_2H_5OH at 15.56°. Where a formula, test, or assay calls for alcohol, ethyl alcohol, or ethanol, the *USP* monograph article Alcohol shall be used. Where reference is made to "C_2H_5OH," absolute (100 percent) ethanol is intended. Where a procedure calls for dehydrated alcohol, alcohol absolute, or anhydrous alcohol, the *USP* monograph article Dehydrated Alcohol shall be used.

8.40. Atomic Weights

Atomic weights used in computing molecular weights and the factors in the assays and elsewhere are those established by the IUPAC Commission on Atomic Weights and Isotopic Abundances.

8.50. Blank Determinations

Where it is directed that "any necessary correction" be made by a blank determination, the determination shall be conducted using the same quantities of the same reagents treated in the same manner as the solution or mixture containing the portion of the substance under assay or test, but with the substance itself omitted.

8.60. Concomitantly

"Concomitantly" denotes that the determinations or measurements are to be performed in immediate succession.

8.70. Desiccator

The instruction "in a desiccator" indicates use of a tightly closed container of suitable size and design that maintains an atmosphere of low moisture content by means of a suitable desiccant such as anhydrous calcium chloride, magnesium perchlorate, phosphorus pentoxide, or silica gel. See also section 8.220, *Vacuum Desiccator*.

8.80. Logarithms

Logarithms are to the base 10.

8.90. Microbial Strain

A microbial strain cited and identified by its ATCC catalog number shall be used directly or, if subcultured, shall be used not more than five passages removed from the original strain.

8.100. Negligible

"Negligible" indicates a quantity not exceeding 0.50 mg.

8.110. NLT/NMT

"NLT" means "not less than." "NMT" means "not more than."

8.120. Odor

"Odorless," "practically odorless," "a faint characteristic odor," and variations thereof indicate evaluation of a suitable quantity of freshly opened material after exposure to the air for 15 minutes. An odor designation is descriptive only and should not be regarded as a standard of purity for a particular lot of an article.

8.130. Percent

"Percent" used without qualification means:

- For mixtures of solids and semisolids, percent weight in weight;
- For solutions or suspensions of solids in liquids, percent weight in volume;
- For solutions of liquids in liquids, percent volume in volume;
- For solutions of gases in liquids, percent weight in volume.

For example, a 1 percent solution is prepared by dissolving 1 g of a solid or semisolid, or 1 mL of a liquid, in sufficient solvent to make 100 mL of the solution.

8.140. Percentage Concentrations

Percentage concentrations are expressed as follows:

- *Percent Weight in Weight* (w/w) is defined as the number of g of a solute in 100 g of solution.
- *Percent Weight in Volume* (w/v) is defined as number of g of a solute in 100 mL of solution.
- *Percent Volume in Volume* (v/v) is defined as the number of mL of a solute in 100 mL of solution.

8.150. Pressure

Pressure is determined by use of a suitable manometer or barometer calibrated in terms of the pressure exerted by a column of mercury of the stated height.

8.160. Reaction Time

Reaction time is 5 minutes unless otherwise specified.

8.170. Specific Gravity

Specific gravity is the weight of a substance in air at 25° divided by the weight of an equal volume of water at the same temperature.

8.180. Temperatures

Temperatures are expressed in centigrade (Celsius) degrees, and all measurements are made at 25° unless otherwise indicated. Where moderate heat is specified, any temperature not higher than 45°(113°F) is indicated.

8.190. Time

Unless otherwise specified, rounding rules, as described in section 7.20, *Rounding Rules*, apply to any time specified.

8.200. Transfer

"Transfer" indicates a quantitative manipulation.

8.210. Vacuum

"Vacuum" denotes exposure to a pressure of less than 20 mm of mercury (2.67 kPas), unless otherwise indicated.

8.220. Vacuum Desiccator

"Vacuum desiccator" indicates a desiccator that maintains a low-moisture atmosphere at a reduced pressure of not more than 20 mm of mercury (2.67 kPas) or at the pressure designated in the individual monograph.

8.230. Water

8.230.10. Water as an Ingredient in an Official Product

As an ingredient in an official product, water meets the requirements of the appropriate water monograph in *USP* or *NF*.

8.230.20. Water in the Manufacture of Official Substances

When used in the manufacture of official substances, water may meet the requirements for drinking water as set forth in the regulations of the U.S. Environmental Protection Agency (potable water).

8.230.30. Water in a Compendial Procedure

When water is called for in a compendial procedure, the *USP* article Purified Water shall be used unless otherwise specified. Definitions for *High-Purity Water* and *Carbon Dioxide–Free Water* are provided in *Containers—Glass* ⟨660⟩. Definitions of other types of water are provided in *Water for Pharmaceutical Purposes* ⟨1231⟩.

8.240. Weights and Measures

In general, weights and measures are expressed in the International System of Units (SI) as established and revised by the *Conférence générale des poids et mesures*. For compendial purposes, the term "weight" is considered to be synonymous with "mass."

Molality is designated by the symbol *m* preceded by a number that represents the number of moles of the designated solute contained in 1 kilogram of the designated solvent.

Molarity is designated by the symbol M preceded by a number that represents the number of moles of the designated solute contained in an amount of the designated solvent that is sufficient to prepare 1 liter of solution.

Normality is designated by the symbol N preceded by a number that represents the number of equivalents of the designated solute contained in an amount of the designated solvent that is sufficient to prepare 1 liter of solution.

Symbols commonly employed for SI metric units and other units are as follows:

Bq = becquerel	dL = deciliter
kBq = kilobecquerel	L = liter
MBq = megabecquerel	mL = milliliter[c]
GBq = gigabecquerel	µL = microliter
Ci = curie	Eq = gram-equivalent weight
mCi = millicurie	mEq = milliequivalent
µCi = microcurie	mol = gram-molecular weight (mole)
nCi = nanocurie	Da = dalton (relative molecular mass)
Gy = gray	mmol = millimole
mGy = milligray	Osmol = osmole
m = meter	mOsmol = milliosmole
dm = decimeter	Hz = hertz
cm = centimeter	kHz = kilohertz
mm = millimeter	MHz = megahertz
µm = micrometer (0.001mm)	V = volts
nm = nanometer[a]	MeV = million electron volts
kg = kilogram	keV = kilo-electron volt
g = gram	mV = millivolt
mg = milligram	psi = pounds per square inch
µg; mcg = microgram[b]	Pa = pascal
ng = nanogram	kPa = kilopascal
pg = pictogram	g = gravity (in centrifugation)
fg = femtogram	

[a]Previously the symbol mµ (for millimicron) was used.

[b]One milliliter (mL) is used herein as the equivalent of one cubic centimeter (cc).

[c]The symbol µg is used in the *USP* and *NF* to represent micrograms, but micrograms may be represented as "mcg" for labeling and prescribing purposes. The term "gamma," symbolized by γ, frequently is used to represent micrograms in biochemical literature.

9. Prescribing and Dispensing

9.10 Use of Metric Units

Prescriptions for compendial articles shall be written to state the quantity and/or strength desired in metric units unless otherwise indicated in the individual monograph (see also *Units of Potency,* section 5.50.10 above). If an amount is prescribed by any other system of measurement, only an amount that is the metric equivalent of the prescribed amount shall be dispensed. Apothecary unit designations on labels and labeling shall not be used.

9.20 Changes in Volume

In the dispensing of prescription medications, slight changes in volume owing to variations in room temperatures may be disregarded.

10. Preservation, Packaging, Storage, and Labeling

10.10. Storage Under Nonspecific Conditions

If no specific directions or limitations are provided in the *Packaging and Storage* section of an individual *USP* monograph or in the labeling of an article recognized in *USP,* the conditions of storage shall include storage at controlled room temperature, protection from moisture, and, where necessary, protection from light. Such articles shall be protected from moisture, freezing, and excessive heat, and, where necessary, from light during shipping and distribution. Drug substances are exempt from the requirements in this paragraph.

Regardless of quantity, where no specific storage directions or limitations are provided in an individual *NF* monograph or stated in the labeling of an article recognized in *NF,* the conditions of storage and distribution shall include protection from moisture, freezing, excessive heat, and, where necessary, from light.

10.20. Containers

The container is that which holds the article and is or may be in direct contact with the article. The immediate container is that which is in direct contact with the article at all times. The closure is a part of the container.

Before being filled, the container should be clean. Special precautions and cleaning procedures may be necessary to ensure that each container is clean and that extraneous matter is not introduced into or onto the article.

The container does not interact physically or chemically with the article placed in it so as to alter the strength, quality, or purity of the article beyond the official requirements.

The compendial requirements for the use of specified containers apply also to articles as packaged by the pharmacist or other dispenser, unless otherwise indicated in the individual monograph.

10.20.10. Tamper-Evident Packaging

The container or individual carton of a sterile article intended for ophthalmic or otic use, except where extemporaneously compounded for immediate dispensing on prescription, shall be so sealed that the contents cannot be used without obvious destruction of the seal.

Articles intended for sale without prescription are also required to comply with the tamper-evident packaging and labeling requirements of the FDA where applicable.

Preferably, the immediate container and/or the outer container or protective packaging used by a manufacturer or distributor for all dosage forms that are not specifically exempt is designed so as to show evidence of any tampering with the contents.

10.20.20. Light-Resistant Container

A light-resistant container (see *Light Transmission Test* under *Containers—Performance Testing* ⟨671⟩) protects the contents from the effects of light by virtue of the specific properties of the material of which it is composed, including any coating applied to it. Alternatively, a clear and colorless or a translucent container may be made light-resistant by means of an opaque covering, in which case the label of the container bears a statement that the opaque covering is needed until the contents are to be used or administered. Where it is directed to "protect from light" in an individual monograph, preservation in a light-resistant container is intended.

Where an article is required to be packaged in a light-resistant container, and if the container is made light-resistant by means of an opaque covering, a single-use, unit-dose container or mnemonic pack for dispensing may not be removed from the outer opaque covering before dispensing.

10.20.30. Well-Closed Container

A well-closed container protects the contents from extraneous solids and from loss of the article under the ordinary or customary conditions of handling, shipment, storage, and distribution.

10.20.40. Tight Container

A tight container protects the contents from contamination by extraneous liquids, solids, or vapors; from loss of the article; and from efflorescence, deliquescence, or evaporation under the ordinary or customary conditions of handling, shipment, storage, and distribution; and is capable of tight reclosure. Where a tight container is specified, it may be replaced by a hermetic container for a single dose of an article.

A gas cylinder is a metallic container designed to hold a gas under pressure. As a safety measure, for carbon dioxide, cyclopropane, helium, nitrous oxide, and oxygen, the Pin-Index Safety System of matched fittings is recommended for cylinders of Size E or smaller.

[NOTE—Where packaging and storage in a *tight container* or a *well-closed container* is specified in the individual monograph, the container used for an article when dispensed on prescription meets the requirements under *Containers—Performance Testing* ⟨671⟩.]

10.20.50. Hermetic Container

A hermetic container is impervious to air or any other gas under the ordinary or customary conditions of handling, shipment, storage, and distribution.

10.20.60. Single-Unit Container

A single-unit container is one that is designed to hold a quantity of drug product intended for administration as a single dose or a single finished device intended for use promptly after the container is opened. Preferably, the immediate container and/or the outer container or protective packaging shall be so designed as to show evidence of any tampering with the contents. Each single-unit container shall be labeled to indicate the identity, quantity and/or strength, name of the manufacturer, lot number, and expiration date of the article.

10.20.70. Single-Dose Container

A single-dose container is a single-unit container for articles intended for parenteral administration only. A single-dose container is labeled as such. Examples of single-dose containers include prefilled syringes, cartridges, fusion-sealed containers, and closure-sealed containers when so labeled. (See also *Containers for Injections* under *Injections* ⟨1⟩.)

10.20.80. Unit-Dose Container

A unit-dose container is a single-unit container for articles intended for administration by other than the parenteral route as a single dose, direct from the container.

10.20.90. Unit-of-Use Container

A unit-of-use container is one that contains a specific quantity of a drug product and that is intended to be dispensed as such without further modification except for the addition of appropriate labeling. A unit-of-use container is labeled as such.

10.20.100. Multiple-Unit Container

A multiple-unit container is a container that permits withdrawal of successive portions of the contents without changing the strength, quality, or purity of the remaining portion.

10.20.110. Multiple-Dose Container

A multiple-dose container is a multiple-unit container for articles intended for parenteral administration only. (See also *Containers for Injections* under *Injections* ⟨1⟩).

10.20.120. Requirements under the Poison Prevention Packaging Act (PPPA)

This act (see the website, www.cpsc.gov/businfo/pppa.html) requires special packaging of most human oral prescription drugs, oral controlled drugs, certain non-oral prescription drugs, certain dietary supplements, and many over-the-counter (OTC) drug preparations in order to protect the public from personal injury or illness from misuse of these preparations (16 CFR § 1700.14).

The immediate packaging of substances regulated under the PPPA shall comply with the special packaging standards (16 CFR § 1700.15 and 16 CFR § 1700.20). The PPPA regulations for special packaging apply to all packaging types including reclosable, nonclosable, and unit-dose types.

Special packaging is not required for drugs dispensed within a hospital setting for inpatient administration. Manufacturers and packagers of bulk-packaged prescription drugs do not have to use special packaging if the drug will be repackaged by the pharmacist. PPPA-regulated prescription drugs may be dispensed in non–child-resistant packaging upon the request of the purchaser or when directed in a legitimate prescription (15 U.S.C. § 1473).

Manufacturers or packagers of PPPA-regulated OTC preparations are allowed to package one size in non–child-resistant packaging as long as popular-size, special packages are also supplied. The non–child-resistant package requires special labeling (16 CFR § 1700.5).

Various types of child-resistant packages are covered in ASTM International Standard D-3475, Standard Classification of Child-Resistant Packaging. Examples are included as an aid in the understanding and comprehension of each type of classification.

10.30. Storage Temperature and Humidity

Specific directions are stated in some monographs with respect to the temperatures and humidity at which official articles shall be stored and distributed (including the shipment of articles to the consumer) when stability data indicate that storage and distribution at a lower or a higher temperature and a higher humidity produce undesirable results. Such directions apply except where the label on an article states a different storage temperature on the basis of stability studies of that particular formulation. Where no specific storage directions or limitations are provided in the individual monograph, but the label of an article states a storage temperature that is based on stability studies of that particular formulation, such labeled storage directions apply. (See also *Pharmaceutical Stability* ⟨1150⟩.) The conditions are defined by the following terms.

10.30.10. Freezer

"Freezer" indicates a place in which the temperature is maintained thermostatically between –25° and –10° (–13° and 14°F).

10.30.20. Cold

Any temperature not exceeding 8° (46°F) is "cold." A "refrigerator" is a cold place in which the temperature is maintained thermostatically between 2° and 8° (36° and 46°F).

10.30.30. Cool

Any temperature between 8° and 15° (46° and 59°F) is "cool." An article for which storage in a *cool place* is directed may, alternatively, be stored and distributed in a *refrigerator,* unless otherwise specified by the individual monograph.

10.30.40. Controlled Cold Temperature

"Controlled cold temperature" is defined as temperature maintained thermostatically between 2° and 8° (36° and 46°F), that allows for excursions in temperature between 0° and 15° (32° and 59°F) that may be experienced during storage, shipping, and distribution such that the allowable calculated mean kinetic temperature is not more than 8° (46°F). Transient spikes up to 25° (77°F) may be permitted if the manufacturer so instructs and provided that such spikes do not exceed 24 hours unless supported by stability data or the manufacturer instructs otherwise.

10.30.50. Room Temperature

"Room temperature" indicates the temperature prevailing in a working area.

10.30.60. Controlled Room Temperature

"Controlled room temperature" indicates a temperature maintained thermostatically that encompasses the usual and customary working environment of 20° to 25° (68° to 77°F); that results in a mean kinetic temperature calculated to be not more than 25°; and that allows for excursions between 15° and 30° (59° and 86°F) that are experienced in pharmacies, hospitals, and warehouses. Provided the mean kinetic temperature remains in the allowed range, transient spikes up to 40° are permitted as long as they do not exceed 24 hours. Spikes above 40° may be permitted if the manufacturer so instructs. Articles may be labeled for storage at "controlled room temperature" or at "up to 25°", or

other wording based on the same mean kinetic temperature. The mean kinetic temperature is a calculated value that may be used as an isothermal storage temperature that simulates the nonisothermal effects of storage temperature variations. (See also *Pharmaceutical Stability* ⟨1150⟩.)

An article for which storage at *controlled room temperature* is directed may, alternatively, be stored and distributed in a *cool place,* unless otherwise specified in the individual monograph or on the label.

10.30.70. Warm

Any temperature between 30° and 40° (86° and 104°F) is "warm."

10.30.80. Excessive Heat

"Excessive heat" means any temperature above 40° (104°F).

10.30.90. Protection From Freezing

Where, in addition to the risk of breakage of the container, freezing subjects an article to loss of strength or potency, or to destructive alteration of its characteristics, the container label bears an appropriate instruction to protect the article from freezing.

10.30.100. Dry Place

The term "dry place" denotes a place that does not exceed 40% average relative humidity at *Controlled Room Temperature* or the equivalent water vapor pressure at other temperatures. The determination may be made by direct measurement at the place or may be based on reported climatic conditions. Determination is based on not less than 12 equally spaced measurements that encompass either a season, a year, or, where recorded data demonstrate, the storage period of the article. There may be values of up to 45% relative humidity provided that the average value is 40% relative humidity.

Storage in a container validated to protect the article from moisture vapor, including storage in bulk, is considered storage in a dry place.

10.40. Labeling

The term "labeling" designates all labels and other written, printed, or graphic matter upon an immediate container of an article or upon, or in, any package or wrapper in which it is enclosed, except any outer shipping container. The term "label" designates that part of the labeling upon the immediate container.

A shipping container containing a single article, unless such container is also essentially the immediate container or the outside of the consumer package, is labeled with a minimum of product identification (except for controlled articles), lot number, expiration date, and conditions for storage and distribution.

Articles in these compendia are subject to compliance with such labeling requirements as may be promulgated by governmental bodies in addition to the compendial requirements set forth for the articles.

10.40.10. Amount of Ingredient Per Dosage Unit

The strength of a drug product is expressed on the container label in terms of micrograms or milligrams or grams or percentage of the therapeutically active moiety or drug substance, whichever form is used in the title, unless otherwise indicated in an individual monograph. Both the active moiety and drug substance names and their equivalent amounts are then provided in the labeling.

Official articles in capsule, tablet, or other unit dosage form shall be labeled to express the quantity of each active ingredient or recognized nutrient contained in each such unit; except that, in the case of unit-dose oral solutions or suspensions, whether supplied as liquid preparations or as liquid preparations that are constituted from solids upon addition of a designated volume of a specific diluent, the label shall express the quantity of each active ingredient or recognized nutrient delivered under the conditions prescribed in *Deliverable Volume* ⟨698⟩. Official drug products not in unit dosage form shall be labeled to express the quantity of each active ingredient in each milliliter or in each gram, or to express the percentage of each such ingredient (see 8.140., *Percentage Concentrations*), except that oral liquids or solids intended to be constituted to yield oral liquids may, alternatively, be labeled in terms of each 5-mL portion of the liquid or resulting liquid. Unless otherwise indicated in a monograph or chapter, such declarations of strength or quantity shall be stated only in metric units. See also 5.50.10., *Units of Potency (Biological)*.

10.40.20. Use of Leading and Terminal Zeros

To help minimize the possibility of errors in the dispensing and administration of drugs, the quantity of active ingredient when expressed in whole numbers shall be shown without a decimal point that is followed by a terminal zero (e.g., express as 4 mg [not 4.0 mg]). The quantity of active ingredient when expressed as a decimal number smaller than 1 shall be shown with a zero preceding the decimal point (e.g., express as 0.2 mg [not .2 mg]).

10.40.30. Labeling of Salts of Drugs

It is an established principle that official articles shall have only one official title. For purposes of saving space on labels, and because chemical symbols for the most common inorganic salts of drugs are well known to practitioners as synonymous with the written forms, the following alternatives are permitted in labeling official articles that are salts: HCl for hydrochloride; HBr for hydrobromide; Na for sodium; and K for potassium. The symbols Na and K are intended for use in abbreviating names of the salts of organic acids, but these symbols are not used where the word Sodium or Potassium appears at the beginning of an official title (e.g., Phenobarbital Na is acceptable, but Na Salicylate is not to be written).

10.40.40. Labeling Vitamin-Containing Products

The vitamin content of an official drug product shall be stated on the label in metric units per dosage unit. The amounts of vitamins A, D, and E may be stated also in USP Units. Quantities of vitamin A declared in metric units refer to the equivalent amounts of retinol (vitamin A alcohol). The label of a nutritional supplement shall bear an identifying lot number, control number, or batch number.

10.40.50. Labeling Botanical-Containing Products

The label of an herb or other botanical intended for use as a dietary supplement bears the statement, "If you are pregnant or nursing a baby, seek the advice of a health professional before using this product."

10.40.60. Labeling Parenteral and Topical Preparations

The label of a preparation intended for parenteral or topical use states the names of all added substances (see 5.20., *Added Substances, Excipients, and Ingredients* and see *Labeling* under *Injections* ⟨1⟩), and, in the case of parenteral preparations, also their amounts or proportions, except that for substances added for adjustment of pH or to achieve isotonicity, the label may indicate only their presence and the reason for their addition.

10.40.70. Labeling Electrolytes

The concentration and dosage of electrolytes for replacement therapy (e.g., sodium chloride or potassium chloride) shall be stated on the label in milliequivalents (mEq). The label of the product shall indicate also the quantity of ingredient(s) in terms of weight or percentage concentration.

10.40.80. Labeling Alcohol

The content of alcohol in a liquid preparation shall be stated on the label as a percentage (v/v) of C_2H_5OH.

10.40.90. Special Capsules and Tablets

The label of any form of Capsule or Tablet intended for administration other than by swallowing intact bears a prominent indication of the manner in which it shall be used.

10.40.100. Expiration Date and Beyond-Use Date

The label of an official drug product or nutritional or dietary supplement product shall bear an expiration date. All articles shall display the expiration date so that it can be read by an ordinary individual under customary conditions of purchase and use. The expiration date shall be prominently displayed in high contrast to the background or sharply embossed, and easily understood (e.g., "EXP 6/08," "Exp. June 08," or "Expires 6/08"). [NOTE—For additional information and guidance, refer to the Consumer Healthcare Products Association's *Voluntary Codes and Guidelines of the Self-Medication Industry.*]

The monographs for some preparations state how the expiration date that shall appear on the label shall be determined. In the absence of a specific requirement in the individual monograph for a drug product or nutritional supplement, the label shall bear an expiration date assigned for the particular formulation and package of the article, with the following exception: the label need not show an expiration date in the case of a drug product or nutritional supplement packaged in a container that is intended for sale without prescription and the labeling of which states no dosage limitations, and which is stable for not less than 3 years when stored under the prescribed conditions.

Where an official article is required to bear an expiration date, such article shall be dispensed solely in, or from, a container labeled with an expiration date, and the date on which the article is dispensed shall be within the labeled expiry period. The expiration date identifies the time during which the article may be expected to meet the requirements of the compendial monograph, provided it is kept under the prescribed storage conditions. The expiration date limits the time during which the article may be dispensed or used. Where an expiration date is stated only in terms of the month and the year, it is a representation that the intended expiration date is the last day of the stated month. The beyond-use date is the date after which an article shall not be used. The dispenser shall place on the label of the prescription container a suitable beyond-use date to limit the patient's use of the article based on any information supplied by the manufacturer and the *General Notices*. The beyond-use date placed on the label shall not be later than the expiration date on the manufacturer's container.

For articles requiring constitution before use, a suitable beyond-use date for the constituted product shall be identified in the labeling.

For all other dosage forms, in determining an appropriate period of time during which a prescription drug may be retained by a patient after its dispensing, the dispenser shall take into account, in addition to any other relevant factors, the nature of the drug; the container in which it was packaged by the manufacturer and the expiration date thereon; the characteristics of the patient's container, if the article is repackaged for dispensing; the expected storage conditions to which the article may be exposed; any unusual storage conditions to which the article may be exposed; and the expected length of time of the course of therapy. The dispenser shall, on taking into account the foregoing, place on the label of a multiple-unit container a suitable beyond-use date to limit the patient's use of the article. Unless otherwise specified in the individual monograph, or in the absence of stability data to the contrary, such beyond-use date shall be not later than (a) the expiration date on the manufacturer's container, or (b) 1 year from the date the drug is dispensed, whichever is earlier. For nonsterile solid and liquid dosage forms that are packaged in single-unit and unit-dose containers, the beyond-use date shall be 1 year from the date the drug is packaged into the single-unit or unit-dose container or the expiration date on the manufacturer's container, whichever is earlier, unless stability data or the manufacturer's labeling indicates otherwise.

The dispenser shall maintain the facility where the dosage forms are packaged and stored, at a temperature such that the mean kinetic temperature is not greater than 25°. The plastic material used in packaging the dosage forms shall afford better protection than polyvinyl chloride, which does not provide adequate protection against moisture permeation. Records shall be kept of the temperature of the facility where the dosage forms are stored, and of the plastic materials used in packaging.

10.40.100.1. Compounded Preparations

The label on the container or package of an official compounded preparation shall bear a beyond-use date. The beyond-use date is the date after which a compounded preparation is not to be used. Because compounded preparations are intended for administration immediately or following short-term storage, their beyond-use dates may be assigned based on criteria different from those applied to assigning expiration dates to manufactured drug products.

The monograph for an official compounded preparation typically includes a beyond-use requirement that states the time period following the date of compounding during which the preparation, properly stored, may be used. In the absence of stability information that is applicable to a specific drug and preparation, recommendations for maximum beyond-use dates have been devised for nonsterile compounded drug preparations that are packaged in tight, light-resistant containers and stored at controlled room temperature unless otherwise indicated (see *Stability Criteria and Beyond-Use Dating* under *Stability of Compounded Preparations* in the general test chapter *Pharmaceutical Compounding—Nonsterile Preparations* ⟨795⟩).

10.50. Guidelines for Packaging and Storage Statements in *USP–NF* Monographs

In order to provide users of the *USP* and *NF* with proper guidance on how to package and store official articles, every monograph in the *USP* and *NF* shall have a packaging and storage specification.

For the packaging portion of the statement, the choice of containers is given in this section 10, *Preservation, Packaging, Storage, and Labeling,* and includes *Light-Resistant Container, Well-Closed Container, Tight Container, Hermetic Container, Single-Unit Container, Single-Dose Container, Unit-Dose Container,* and *Unit-of-Use Container.* For most preparations, the choice is determined by the container in which it shall be dispensed (e.g., tight, well-closed, hermetic, unit-of-use, etc.). For drug substances, the choice would appear to be tight, well-closed, or, where needed, a light-resistant container. For excipients, given their typical nature as large-volume commodity items, with containers ranging from drums to tank cars, a well-closed container is an appropriate default. Therefore, in the absence of data indicating a need for a more protective class of container, the phrase "Preserve in well-closed containers" should be used as a default for excipients.

Section 3

Drug Substance and Compounded Preparation Monographs

The *USP Pharmacists' Pharmacopeia* contains two types of official *USP–NF* monographs: compounded preparation monographs and monographs for drug substances and ingredients.

Monographs for 127 compounded preparations are provided to help pharmacists ensure that a patient consistently receives a preparation that meets USP standards. For the most part, these monographs have been tested to meet USP standards of strength, quality, and purity until the stated beyond-use date (BUD). In some instances, data from articles published in peer-reviewed scientific journals have been used for this purpose. (For additional information on BUD, see general chapter *Pharmaceutical Compounding—Nonsterile Preparations* ⟨795⟩.)

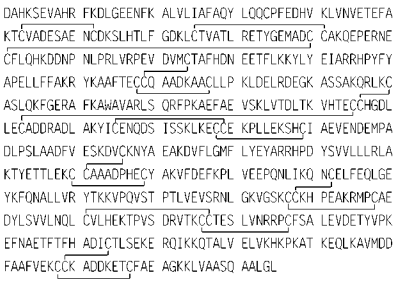
As outlined in the Federal Food, Drug, and Cosmetic Act (see section 11) any compounded drug must meet compendial (*USP–NF*) standards, if it uses the compendial name. Pharmacists must be aware that if they prepare medications that are named in the official *USP–NF* (and provided here in the *USP Pharmacists' Pharmacopeia*), those products must meet the *USP–NF* standards for strength, quality and purity.

This section also includes abridged versions of the official *USP* and *NF* monographs for drug substances and ingredients that may be used in compounding. While it is not expected that all compounding pharmacists will be able to perform the procedures found herein, the standards in these monographs are useful for evaluating Certificates of Analysis. A list of functional categories for excipients also is provided at the end of this section.

Section Contents

rAlbumin Human

SOURCE: NF



$C_{2936}H_{4624}N_{786}O_{889}S_{41}$ 66,438 Da

» Recombinant Albumin Human (rHA) is produced by recombinant DNA expression in *Saccharomyces cerevisiae*. Structural equivalence (primary, secondary, and tertiary) between rHA and human serum albumin (HSA) has been demonstrated. It consists of 3 domains composed of 585 amino acids containing a single tryptophan (Trp_{214}), one free thiol (Cys_{34}), and 17 disulfide bridges. It is presented as a sterile and nonpyrogenic aqueous liquid consisting of a 10 percent (w/v) or 20 percent (w/v) solution in Water for Injection. No human- or animal-derived raw material is involved in its manufacture. Not less than 99 percent of its total protein is albumin. It contains not less than 95 percent and not more than 105 percent of the labeled amount. It contains no added antimicrobial agents, but it may contain appropriate stabilizing agents.

The presence of process-related impurities, host cell DNA, and host cell proteins is process specific; suitable limits should be determined by appropriately validated methods. However, the limit for host cell proteins should be not more than 0.15 ppm (0.15 μg per g).

Packaging and storage—Preserve in tight glass containers, and store between 2° and 8°. Do not freeze.

Labeling—Label it to indicate that the material is of recombinant DNA origin.

USP Reference standards ⟨11⟩—*USP rAlbumin Human RS. USP Endotoxin RS.*

Bacterial endotoxins ⟨85⟩—It contains not more than 0.5 USP Endotoxin Unit RS per mL.

Sterility ⟨71⟩: meets the requirements.

pH ⟨791⟩: between 6.4 and 7.4 when diluted with 0.9% (w/v) sodium chloride to obtain a solution containing 1% (w/v) protein.

Alendronate Sodium Tablets

SOURCE: USP

» Alendronate Sodium Tablets contain an amount of Alendronate Sodium equivalent to not less than 90.0 percent and not more than 110.0 percent of the labeled amount of alendronic acid ($C_4H_{13}NO_7P_2$).

Packaging and storage—Preserve in tight containers. Store between 15° and 30°.

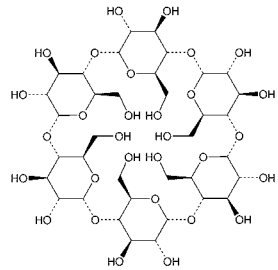
Labeling—The labeling indicates weekly dosing where appropriate. When more than one *Dissolution* test is given, the labeling states the test used only if *Test 1* is not used.

USP Reference standards ⟨11⟩—*USP Alendronate Sodium RS.*

Uniformity of dosage units ⟨905⟩: meet the requirements.

Alfadex

SOURCE: NF



$(C_6H_{10}O_5)_6$ 972.84

Alpha cyclodextrin [*10016-20-3*].

» Alfadex is composed of six alpha-(1-4) linked D-glucopyranosyl units. It contains not less than 98.0 percent and not more than 101.0 percent of $(C_6H_{10}O_5)_6$, calculated on the anhydrous basis.

Packaging and storage—Preserve in tight containers. No storage requirements specified.

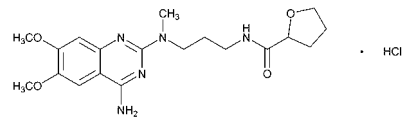
USP Reference standards ⟨11⟩—*USP Alpha Cyclodextrin RS. USP Beta Cyclodextrin RS. USP Gamma Cyclodextrin RS. USP Dextrose RS.*

pH ⟨791⟩—The pH of the mixture of 30 mL of its aqueous solution (1 in 100) and 1 mL of *Potassium chloride solution* is 5.0 to 8.0.

Potassium chloride solution—Transfer 22.4 g of potassium chloride into a 100-mL volumetric flask, and dilute with water to volume.

Alfuzosin Hydrochloride

SOURCE: USP



$C_{19}H_{27}N_5O_4 \cdot HCl$ 425.91

2-Furancarboxamide, *N*-[3-[(4-amino-6,7-dimethoxy-2-quinazolinyl)-methylamino]propyl]tetrahydro-, monohydrochloride (±).

(±)-*N*-[3-[(4-Amino-6,7-dimethoxy-2-quinazolinyl)methylamino]propyl]-tetrahydro-2-furamide monohydrochloride [*81403- 68-1*].

» Alfuzosin Hydrochloride contains not less than 99.0 percent and not more than 101.0 percent of $C_{19}H_{27}N_5O_4 \cdot HCl$, calculated on the anhydrous basis.

Packaging and storage—Preserve in tight, well-closed containers, protected from light and humidity. Store at room temperature.

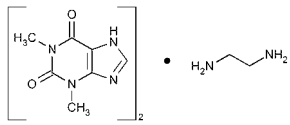
USP Reference standards ⟨11⟩—*USP Alfuzosin Hydrochloride RS. USP Alfuzosin System Suitability Mixture RS.*

pH ⟨791⟩: between 4.0 and 5.5

Test solution: 20 mg per mL, in carbon dioxide-free water.

Aminophylline

SOURCE: USP



$C_{16}H_{24}N_{10}O_4$ (anhydrous) 420.43

1*H*-Purine-2,6-dione, 3,7-dihydro-1,3-dimethyl-, compd. with 1,2-ethanediamine (2:1).

Theophylline compound with ethylenediamine (2:1) [*317-34-0*].

Dihydrate 456.46 [*5897-66-5*].

» Aminophylline is anhydrous or contains not more than two molecules of water of hydration. It contains not less than 84.0 percent and not more than 87.4 percent of anhydrous theophylline ($C_7H_8N_4O_2$), calculated on the anhydrous basis.

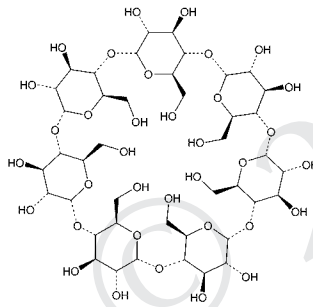
Packaging and storage—Preserve in tight containers.

Labeling—Label it to indicate whether it is anhydrous or hydrous and also to state the content of anhydrous theophylline.

USP Reference standards ⟨11⟩—*USP Theophylline RS.*

Betadex

SOURCE: NF



$(C_6H_{10}O_5)_7$ 1134.98

Beta Cyclodextrin [*7585-39-9*].

» Betadex is a nonreducing cyclic compound composed of seven alpha-(1-4) linked D-glucopyranosyl units. It contains not less than 98.0 percent and not more than 102.0 percent of $(C_6H_{10}O_5)_7$, calculated on the anhydrous basis.

Packaging and storage—Preserve in tight containers. No storage requirements specified.

USP Reference standards ⟨11⟩—*USP Alpha Cyclodextrin RS. USP Beta Cyclodextrin RS. USP Gamma Cyclodextrin RS. USP Dextrose RS.*

pH ⟨791⟩—Add 0.1 mL of a saturated solution of potassium chloride to 10 mL of Betadex aqueous solution (1 in 100). The pH of the solution is between 5.0 and 8.0.

Bicalutamide Tablets

SOURCE: USP

» Bicalutamide Tablets contain not less than 90.0 percent and not more than 110.0 percent of the labeled amount of bicalutamide ($C_{18}H_{14}F_4N_2O_4S$).

Packaging and storage—Preserve in tight containers. Store at controlled room temperature.

USP Reference standards ⟨11⟩—*USP Bicalutamide RS. USP Bicalutamide Related Compound B RS.*

Uniformity of dosage units ⟨905⟩: meet the requirements.

PROCEDURE FOR CONTENT UNIFORMITY—

1% Sodium lauryl sulfate solution—Dissolve 15 g of sodium lauryl sulfate in 1.5 L of water.

Standard solution—Dissolve an accurately weighed quantity of USP Bicalutamide RS in a minimum amount of tetrahydrofuran, and dilute quantitatively with *1% Sodium lauryl sulfate solution* to obtain a solution having a known concentration of about 0.05 mg per ml.

Test solution—Transfer 1 Tablet to a 100-mL volumetric flask, add about 10 mL of water, and sonicate for approximately 30 minutes. Add about 80 mL of tetrahydrofuran, and sonicate for 30 minutes to complete dissolution of the bicalutamide. Allow to cool to room temperature, and dilute with tetrahydrofuran to volume. Pass this solution through a 0.45-µm suitable filter unit, transfer 10.0 mL of filtrate to a 100-mL volumetric flask, and dilute with *1% Sodium lauryl sulfate solution* to volume.

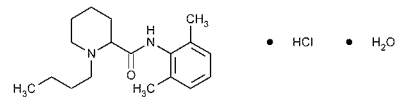
Procedure—Concomitantly determine the UV absorbances of the *Standard solution* and the *Test solution* with a suitable spectrophotometer at 270 nm, using *1% Sodium lauryl sulfate solution* as the blank. Calculate the quantity, in mg, of bicalutamide ($C_{18}H_{14}F_4N_2O_4S$) in the Tablet taken by the formula:

$$1000C(A_U/A_S)$$

in which C is the concentration, in mg per mL, of USP Bicalutamide RS in the *Standard solution*; and A_U and A_S are the absorbances obtained from the *Test solution* and the *Standard solution*, respectively.

Bupivacaine Hydrochloride

SOURCE: USP



$C_{18}H_{28}N_2O{\cdot}HCl{\cdot}H_2O$ 342.90

2-Piperidinecarboxamide, 1-butyl-*N*-(2,6-dimethylphenyl)-, monohydrochloride, monohydrate, (±)-.

(±)-1-Butyl-2',6'-pipecoloxylidide monohydrochloride, monohydrate [*73360-54-0*].

Anhydrous 324.90 [*18010-40-7*].

» Bupivacaine Hydrochloride contains not less than 98.5 percent and not more than 101.5 percent of $C_{18}H_{28}N_2O{\cdot}HCl$, calculated on the anhydrous basis.

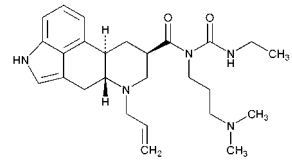
Packaging and storage—Preserve in well-closed containers.

USP Reference standards ⟨11⟩—*USP Bupivacaine Hydrochloride RS.*

pH ⟨791⟩: between 4.5 and 6.0, in a solution (1 in 100).

Cabergoline

SOURCE: USP



$C_{26}H_{37}N_5O_2$ 451.60

Ergoline-8β-carboxamide, *N*-[3-(dimethylamino)propyl]-*N*-[(ethylamino)carbonyl]-6-(2-propenyl)-.

1-[(6-Allylergolin-8β-yl)carbonyl]-1-[3-(dimethylamino)propyl]-3-ethylurea [*81409-90-7*].

» Cabergoline contains not less than 98.0 percent and not more than 102.0 percent of $C_{26}H_{37}N_5O_2$, calculated on the anhydrous basis.

Packaging and storage—Store in tight containers, protected from light.

USP Reference standards ⟨11⟩—*USP Cabergoline RS.*

Carbomer 934

(Any article currently titled Carbomer 934 that is manufactured without the use of benzene will be officially titled Carbomer Homopolymer after January 1, 2011, and will meet the requirements of the new Carbomer Homopolymer monograph after January 1, 2007.)

SOURCE: NF

» Carbomer 934 is a high molecular weight polymer of acrylic acid cross-linked with allyl ethers of sucrose. Carbomer 934, previously dried in vacuum at 80° for 1 hour, contains not less than 56.0 percent and not more than 68.0 percent of carboxylic acid (–COOH) groups. The viscosity of a neutralized 0.5 percent aqueous dispersion of Carbomer 934 is between 30,500 and 39,400 mPa·s.

[NOTE—Effective January 1, 2011, the heading of this monograph will no longer constitute the official title for Carbomer 934 manufactured without the use of benzene. When benzene is not used in the manufacturing process, the name of the article will be Carbomer Homopolymer and will meet the requirements of the Carbomer Homopolymer monograph.]

Packaging and storage—Preserve in tight containers. No storage requirements specified.

Labeling—Label it to indicate that it is not intended for internal use. A carbomer homopolymer manufactured using benzene and complying with the unique requirements of this monograph will be officially titled Carbomer 934 and will not be referred to as *Carbomer Homopolymer*.

Viscosity—Proceed as directed in the test for *Viscosity* under *Carbomer 934P*. It is between 30,500 and 39,400 mPa·s.

Carbomer 934P

(Any article currently titled Carbomer 934P that is manufactured without the use of benzene will be officially titled Carbomer Homopolymer after January 1, 2011, and will meet the requirements of the new Carbomer Homopolymer monograph after January 1, 2007.)

SOURCE: NF

» Carbomer 934P is a high molecular weight polymer of acrylic acid cross-linked with allyl ethers of sucrose or pentaerythritol. Carbomer 934P, previously dried in vacuum at 80° for 1 hour, contains not less than 56.0 percent and not more than 68.0 percent of carboxylic acid (–COOH) groups. The viscosity of a neutralized 0.5 percent aqueous dispersion of Carbomer 934P is between 29,400 and 39,400 mPa·s.

[NOTE—Effective January 1, 2011, the heading of this monograph will no longer constitute the official title for Carbomer 934P manufactured without the use of benzene. When benzene is not used in the manufacturing process, the name of the article will be Carbomer Homopolymer and will meet the requirements of the Carbomer Homopolymer monograph.]

Packaging and storage—Preserve in tight containers. No storage requirements specified.

Labeling—A carbomer homopolymer manufactured using benzene and complying with the unique requirements of this monograph will be officially titled Carbomer 934P and will not be referred to as *Carbomer Homopolymer*.

Viscosity ⟨911⟩—Carefully add 2.50 g, previously dried in a vacuum at 80° for 1 hour, to 500 mL of water in a 1000-mL beaker, while stirring continuously at 1000 ± 10 rpm, with the stirrer shaft set at an angle of 60° and to one side of the beaker, with the propeller positioned near the bottom of the beaker. Allow 45 to 90 seconds for addition of the test preparation at a uniform rate, being sure that loose aggregates of powder are broken up, and continue stirring at 1000 ± 10 rpm for 15 minutes. Remove the stirrer, and place the beaker containing the dispersion in a 25 ± 0.1° water bath for 30 minutes. Insert the stirrer to a depth necessary to ensure that air is not drawn into the dispersion, and, while stirring at 300 ± 10 rpm, titrate (see *Titrimetry* ⟨541⟩) with a calomel-glass electrode system to a pH of between 7.3 and 7.8 by adding sodium hydroxide solution (18 in 100) below the surface, determining the endpoint potentiometrically. Stir for 2 to 3 minutes until neutralization is complete. Then determine the final pH. [NOTE—If the pH is below 7.3, raise it with additional sodium hydroxide. If it is above 7.8, discard the mucilage, and prepare another using a smaller amount of sodium hydroxide for titration.] Return the neutralized mucilage to the 25° water bath for 1 hour. Measure the pH again and make certain that the mucilage pH is between 7.3 and 7.8. Perform the viscosity determination without delay to avoid slight viscosity changes that occur 75 minutes after neutralization. Equip a suitable rotational viscometer with a spindle having a cylinder 1.5 cm in diameter and 0.2 cm high attached to a shaft 0.3 cm in diameter, the distance from the top of the cylinder to the lower tip of the shaft being 3.0 cm. The spindle rotates at 20 rpm at an immersion depth of 4.9 cm. Follow the instrument manufacturer's directions to measure the apparent viscosity: the viscosity is between 29,400 and 39,400 mPa·s.

Carbomer 940

(Any article currently titled Carbomer 940 that is manufactured without the use of benzene will be officially titled Carbomer Homopolymer after January 1, 2011, and will meet the requirements of the new Carbomer Homopolymer monograph after January 1, 2007.)

SOURCE: NF

» Carbomer 940 is a high molecular weight polymer of acrylic acid cross-linked with allyl ethers of pentaerythritol. Carbomer 940, previously dried in vacuum at 80° for 1 hour, contains not less than 56.0 percent and not more than 68.0 percent of carboxylic acid (–COOH) groups. The viscosity of a neutralized 0.5 percent aqueous dispersion of Carbomer 940 is between 40,000 and 60,000 mPa·s.

[NOTE—Effective January 1, 2011, the heading of this monograph will no longer constitute the official title for Carbomer 940 manufactured without the use of benzene. When benzene is not used in the manufacturing process, the name of the article will be Carbomer Homopolymer and will meet the requirements of the Carbomer Homopolymer monograph.]

Packaging and storage—Preserve in tight containers. No storage requirements specified.

Labeling—Label it to indicate that it is not intended for internal use. A carbomer homopolymer manufactured using benzene and complying with the unique requirements of this monograph will be officially titled Carbomer 940 and will not be referred to as *Carbomer Homopolymer*.

Viscosity—Proceed as directed in the test for *Viscosity* under *Carbomer 934P*, except to use a spindle having a shaft about 0.3 cm in diameter, the distance from the top of the shaft to the lower tip of the shaft being 5.0 cm, and the immersion depth being 5.5 cm.[1] The viscosity is between 40,000 and 60,000 mPa·s.

[1]Available as an RV7 spindle from Brookfield, or the equivalent.

Carbomer 941

(Any article currently titled Carbomer 941 that is manufactured without the use of benzene will be officially titled Carbomer Homopolymer after January 1, 2011, and will meet the requirements of the new Carbomer Homopolymer monograph after January 1, 2007.)

SOURCE: NF

» Carbomer 941 is a high molecular weight polymer of acrylic acid cross-linked with allyl ethers of pentaerythritol. Carbomer 941, previously dried in vacuum at 80° for 1 hour, contains not less than 56.0 percent and not more than 68.0 percent of carboxylic acid (–COOH) groups. The viscosity of a neutralized 0.5 percent aqueous dispersion of Carbomer 941 is between 4000 and 11,000 mPa·s.

[NOTE—Effective January 1, 2011, the heading of this monograph will no longer constitute the official title for Carbomer 941 manufactured without the use of benzene. When benzene is not used in the manufacturing process, the name of the article will be Carbomer Homopolymer and will meet the requirements of the Carbomer Homopolymer monograph.]

Packaging and storage—Preserve in tight containers. No storage requirements specified.

Labeling—Label it to indicate that it is not intended for internal use. A carbomer homopolymer manufactured using benzene and complying with the unique requirements of this monograph will be officially titled Carbomer 941 and will not be referred to as *Carbomer Homopolymer*.

Viscosity—Proceed as directed in the test for *Viscosity* under *Carbomer 934P*, except to use a spindle having a disk about 2.1 cm in diameter and 0.2 cm high, attached to a shaft 0.3 cm in diameter, the distance from the top of the disk to the lower tip of the shaft being 2.7 cm, and the immersion depth being 4.9 cm[1]. The viscosity is between 4000 and 11,000 mPa·s.

Carbomer Copolymer

SOURCE: NF

» Carbomer Copolymer is a high molecular weight copolymer of acrylic acid and a long chain alkyl methacrylate cross-linked with allyl ethers of polyalcohols.

[NOTE—The heading of this monograph does not constitute the official title for a *Carbomer Copolymer* manufactured with the use of benzene. When benzene is used in the manufacturing process, the name will be *Carbomer 1342,* provided it complies with the existing requirements in the *Carbomer 1342* monograph.]

Packaging and storage—Preserve in tight containers, at a temperature not exceeding 45°.

Labeling—If benzene has been used in the manufacturing process, the name of the article will be *Carbomer 1342,* provided it complies with and is labeled in accordance with the requirements set forth in that monograph. If benzene is not used in the manufacturing process, label it to indicate whether it is Type A, B, or C; and label it to state the measured viscosity, giving the viscosity measurement parameters, concentration of the solution and the type of equipment used, the solvent or solvents used in the polymerization process, and the nominal and residual solvent levels for each solvent.

Viscosity ⟨911⟩—Carefully add 5.00 g of Carbomer Copolymer, previously dried in vacuum at 80° for 1 hour, to 500 mL of water in a 1000-mL beaker, while stirring continuously at 1000 ± 50 rpm, with the stirrer shaft set to one side of the beaker at an angle of 60° and the propeller positioned near the bottom of the beaker. The stirrer used is a three-blade, 2-inch diameter marine impeller. Add the Carbomer Copolymer at a uniform rate over a period of 45 to 90 seconds, being sure that loose aggregates of powder are broken up, and continue stirring at 1000 ± 50 rpm for 15 minutes. Remove the stirrer, and place the beaker containing the dispersion in a 25 ± 0.1° water bath for 30 minutes. Insert a paddle stirrer to a depth necessary to ensure that air is not drawn into the dispersion, and while stirring at 300 ± 25 rpm, titrate potentiometrically (see *Titrimetry* ⟨541⟩) with a calomel–glass electrode system to a pH between 7.3 and 7.8 by adding sodium hydroxide solution (18 in 100) below the surface. Stir 2 to 3 minutes until neutralization is complete. Then determine the final pH. [NOTE—If the pH is below 7.3, raise the pH with additional sodium hydroxide. If it is above 7.8, discard the mucilage, and prepare another batch, using a smaller amount of sodium hydroxide for titration.] Return the beaker containing the neutralized mucilage to the 25 ± 0.1° water bath for 1 hour. Measure the pH again, making certain that the mucilage pH is between 7.3 and 7.8. Using a rotational viscometer equipped with a suitable spindle at a spindle immersion depth as defined in *Table 1* (where A is the cylinder diameter, in cm; B is the cylinder height, in cm; C is the shaft diameter, in cm; D is the distance, in cm, from the top of the cylinder to the lower tip of the shaft; and E is the spindle immersion depth, in cm), perform the viscosity determination without delay to avoid the slight viscosity changes that occur 75 minutes after neutralization.

With the spindle rotating at 20 rpm, observe and record the scale reading. Calculate the viscosity, in millipascal seconds, by multiplying the scale reading by the constant for the spindle used at 20 rpm. The viscosity value so obtained is within the limits specified in *Table 2*.

Table 2

Carbomer Copolymer	1% Viscosity Specification (mPa·s)
A	4500–13,500
B	10,000–29,000
C	25,000–45,000

Carbomer Homopolymer

(Title for this new monograph—to become official January 1, 2011) (Prior to January 1, 2011, the current practice of labeling the article of commerce with the name Carbomer 934, Carbomer 934P, Carbomer 940, or Carbomer 941, whichever is appropriate, may be continued.)

SOURCE: NF

» Carbomer Homopolymer is a high molecular weight polymer of acrylic acid cross-linked with allyl ethers of polyalcohols. Carbomer Homopolymer, previously dried, contains not less than 56.0 percent and not more than 68.0 percent of carboxylic acid (–COOH) groups.

[1]Available as an RV5 spindle from Brookfield, or the equivalent.

Table 1

Viscosity Ranges (mPa·s)	Spindle No.	A	B	C	D	E	Multiplier
100–400	1	5.6	2.2	0.3	2.7	6.1	5
400–1600	2	4.7	0.2	0.3	2.7	4.9	20
1000–4000	3	3.5	0.2	0.3	2.7	4.9	50
2000–8000	4	2.7	0.2	0.3	2.7	4.9	100
4000–16,000	5	2.1	0.2	0.3	2.7	4.9	200
10,000–40,000	6	1.5	0.2	0.3	3.0	4.9	500
40,000–160,000	7	—	—	0.3	—	5.5	2,000

[NOTE—This monograph applies to, but is not limited to, Carbomer 934, Carbomer 934P, Carbomer 940, and Carbomer 941 manufactured without benzene. The heading of this monograph does not constitute the official title for a Carbomer Homopolymer manufactured with the use of benzene. When benzene is used in the manufacturing process, the name of the article will be Carbomer 934, Carbomer 934P, Carbomer 940, or Carbomer 941, whichever is appropriate.]

Packaging and storage—Preserve in tight containers, at a temperature not exceeding 45°.

Labeling—Label it to indicate whether it is Type A, B, or C; and also to state the measured viscosity, giving the viscosity measurement parameters, the concentration of the solution, and the type of equipment used; the solvent or solvents used in the polymerization process; and the nominal and residual solvent levels for each solvent.

Viscosity ⟨911⟩—Carefully add 2.50 g of the resin, which has been previously dried, to 500 mL of water in a 800-mL beaker, while stirring continuously at 1000 ± 50 rpm. The stirrer shaft is set at an angle of 60° and positioned at one side of the beaker, and the propeller is positioned near the bottom of the beaker. The stirrer used should be a three-blade, 2-inch marine impeller. Add Carbomer Homopolymer at a uniform rate over a period of 45 to 60 seconds, being sure that loose aggregates of powder are broken up, and continue stirring at 1000 ± 50 rpm for 15 minutes. [NOTE—Proper dispersion of the Carbomer Homopolymer resin is imperative for accurate viscosity readings.] Remove the stirrer, and allow the beaker containing the dispersion to stand at controlled room temperature for 30 minutes. Insert a paddle stirrer to a depth necessary to ensure that the air is not drawn into the dispersion, and while stirring at 300 ± 25 rpm, titrate potentiometrically (see *Titrimetry* ⟨541⟩) with sodium hydroxide solution (18 in 100) to a pH of between 7.3 and 7.8. After adding the sodium hydroxide solution, stir with a paddle mixer at 300 ± 25 rpm for 2 to 3 minutes. [NOTE—After neutralization, care must be taken to avoid excessively high shearing, as aggressive mixing will break the polymer chains and reduce the viscosity reading.] Take the final pH reading with a pH meter to make sure it is between 7.3 and 7.8. [NOTE—If the pH is below 7.3, raise the pH with additional sodium hydroxide. If the pH is above 7.8, discard the mucilage, and prepare another using a smaller amount of sodium hydroxide for titration.] Place the neutralized mucilage into a water bath maintained at 25° ± 0.1° for 1 hour. Measure the pH again, and make certain the mucilage pH is between 7.3 and 7.8. Perform the viscosity determination without delay to avoid slight viscosity changes occurring after 75 minutes of neutralization.

Equip a suitable rotational viscometer[1] with a suitable spindle, as defined in the chart below. For spindle dimensions, consult the table under *Carbomer Copolymer*.

Expected Viscosity (mPa·s)	Spindle Number	Multiplier
100–400	1	5
400–1600	2	20
1000–4000	3	50
2000–8000	4	100
4000–16,000	5	200
10,000–40,000	6	500
40,000–160,000	7	2000

The spindle rotates at 20 rpm. Follow the instrument manufacturer's directions to measure the apparent viscosity. The viscosity values, determined by the conditions specified herein, are within the limits specified in the accompanying table.

Carbomer Homopolymer	Viscosity Specified (mPa·s)
A	4,000–11,000
B	25,000–45,000
C	40,000–60,000

[1]Available as a Brookfield RV viscometer, or the equivalent.

Carbomer Interpolymer

SOURCE: NF

» Carbomer Interpolymer is a carbomer homopolymer or copolymer that contains a block copolymer of polyethylene glycol and a long chain alkyl acid ester.

Packaging and storage—Preserve in tight containers, at a temperature not exceeding 45°.

Labeling—Label it to indicate whether it is Type A, B, or C. Also label it to state the measured viscosity, giving the viscosity measurement parameters, the concentration of the solution, and the type of equipment used; the solvent or solvents used in the polymerization process; and the nominal and measured residual solvent levels for each solvent.

Viscosity ⟨911⟩—

Carbomer Interpolymer A—Proceed as directed for *Viscosity* under *Carbomer Copolymer,* except to perform the test on a 0.5% aqueous dispersion prepared by using 2.50 g instead of 5.00 g of copolymer.

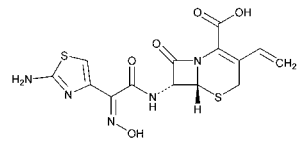
Carbomer Interpolymer B—Proceed as directed for *Viscosity* under *Carbomer Copolymer,* except to adjust the pH of the dispersion to a range of 5.8 to 6.3 instead of 7.3 to 7.8.

Carbomer Interpolymer C—Proceed as directed for *Viscosity* under *Carbomer Copolymer,* except to perform the test on a 0.5% aqueous dispersion prepared by using 2.50 g instead of 5.00 g of copolymer and to adjust the pH of the dispersion to a range of 5.8 to 6.3 instead of 7.3 to 7.8. The viscosity values, determined by the conditions specified herein, are within the limits specified in the accompanying table.

Carbomer Interpolymer	Viscosity Specifications (mPa·s)
A	45,000–65,000
B	47,000–77,000
C	8,500–16,500

Cefdinir

SOURCE: USP



$C_{14}H_{13}N_5O_5S_2$ 395.41

5-Thia-1-azabicyclo[4.2.0]oct-2-ene-2-carboxylic acid, 7-[[(2-amino-4-thiazolyl)(hydroxyimino)acetyl]amino]-3-ethenyl-8-oxo-, [6*R*-[6α,7β(*Z*)]]-.

(-)-(6*R*,7*R*)-7-[2-(2-Amino-4-thiazolyl)glyoxylamido]-8-oxo-3-vinyl-5-thia-1-azabicyclo[4.2.0]oct-2-ene-2-carboxylic acid, 7²-(*Z*)-oxime [*91832-40-5*].

» Cefdinir contains not less than 960 μg per mg and not more than 1020 μg per mg of $C_{14}H_{13}N_5O_5S_2$, calculated on the anhydrous basis.

Packaging and storage—Preserve in tight, light-resistant containers.

USP Reference standards ⟨11⟩—*USP Cefdinir RS. USP Cefdinir Related Compound A RS.*

Cefdinir Capsules

SOURCE: USP

» Cefdinir Capsules contain not less than 90.0 percent and not more than 110.0 percent of the labeled amount of$C_{14}H_{13}N_5O_5S_2$.

Packaging and storage—Preserve in tight, light-resistant containers, and store at controlled room temperature.

USP Reference standards ⟨11⟩—*USP Cefdinir RS. USP Cefdinir Related Compound A RS. USP Cefdinir Related Compound B RS.*

Uniformity of dosage units ⟨905⟩: meet the requirements.

Cefdinir for Oral Suspension

SOURCE: USP

» Cefdinir for Oral Suspension contains not less than 90.0 percent and not more than 110.0 percent of the labeled amount of $C_{14}H_{13}N_5O_5S_2$. It may contain one or more suitable buffers, flavors, preservatives, stabilizing agents, sweeteners, and suspending agents.

Packaging and storage—Preserve in tight, light-resistant containers, and store at controlled room temperature.

Labeling—The label specifies the directions for the constitution of the powder and states the equivalent amount of $C_{14}H_{13}N_5O_5S_2$ in a given volume of Oral Suspension after constitution.

USP Reference standards ⟨11⟩—*USP Cefdinir RS. USP Cefdinir Related Compound A RS. USP Cefdinir Related Compound B RS.*

Uniformity of dosage units ⟨905⟩—For Oral Suspension packaged in single-unit containers: meets the requirements.

pH ⟨791⟩: between 3.5 and 4.5.

Corn Syrup

SOURCE: NF

[8029-43-4].

» Corn Syrup is an aqueous solution of saccharides obtained by partial hydrolysis of edible corn starch by food grade acids and/or enzymes. It contains not less than 20.0 percent reducing sugar content (dextrose equivalent) expressed as D-glucose, calculated on the dried basis.

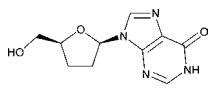
Packaging and storage—Preserve in tightly closed containers. No storage requirements are specified.

Labeling—Label it to indicate its nominal dextrose equivalent. Label it also to indicate the presence of sulfur dioxide if the residual concentration is greater than 10 µg per g.

USP Reference standards ⟨11⟩—*USP Dextrose RS.*

Didanosine

SOURCE: USP



$C_{10}H_{12}N_4O_3$ 236.23

Inosine, 2',3'-dideoxy-.

2',3'-Dideoxyinosine [*69655-05-6*].

» Didanosine contains not less than 98.0 percent and not more than 102.0 percent of $C_{10}H_{12}N_4O_3$, calculated on the anhydrous basis.

Packaging and storage—Preserve in well-closed containers, and store at controlled room temperature.

USP Reference standards ⟨11⟩—*USP Didanosine RS. USP Didanosine Related Compound A RS. USP Didanosine Related Compound B RS. USP Didanosine System Suitability Mixture RS.*

Dimethyl Sulfoxide

SOURCE: USP

C_2H_6OS 78.13

Methane, sulfinylbis-.

Methyl sulfoxide [*67-68-5*].

» Dimethyl Sulfoxide contains not less than 99.9 percent of C_2H_6OS, calculated on the anhydrous basis.

Packaging and storage—Preserve in tight, light-resistant containers.

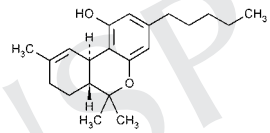
USP Reference standards ⟨11⟩—*USP Dimethyl Sulfoxide RS.*

Specific gravity ⟨841⟩: between 1.095 and 1.101.

Refractive index ⟨831⟩: between 1.4755 and 1.4775.

Dronabinol

SOURCE: USP



$C_{21}H_{30}O_2$ 314.46

6*H*-Dibenzo[*b*,*d*]pyran-1-ol, 6a,7,8,10a-tetrahydro-6,6,9-trimethyl-3-pentyl-, (6a*R*-*trans*)-.

(6a*R*,10a*R*)-6a,7,8,10a-Tetrahydro-6,6,9-trimethyl-3-pentyl-6*H*-dibenzo[*b*,*d*]-pyran-1-ol [*1972-08-3*].

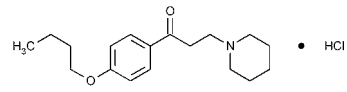
» Dronabinol is Δ^9-tetrahydrocannabinol. It contains not less than 95.0 percent of $C_{21}H_{30}O_2$.

Packaging and storage—Preserve in tight, light-resistant glass containers in inert atmosphere. Store as per labeling instructions.

USP Reference standards ⟨11⟩—*USP Exo-tetrahydrocannabinol RS. USP* Δ^9*-Tetrahydrocannabinol RS.*

Dyclonine Hydrochloride

SOURCE: USP



$C_{18}H_{27}NO_2 \cdot HCl$ 325.87

1-Propanone, 1-(4-butoxyphenyl)-3-(1-piperidinyl)-hydrochloride.

4'-Butoxy-3-piperidinopropiophenone hydrochloride [*536-43-6*].

» Dyclonine Hydrochloride contains not less than 98.0 percent and not more than 102.0 percent of $C_{18}H_{27}NO_2 \cdot HCl$, calculated on the dried basis.

Packaging and storage—Preserve in tight, light-resistant containers.

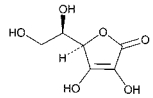
USP Reference standards ⟨11⟩—*USP Dyclonine Hydrochloride RS.*

Melting range ⟨741⟩: between 173° and 178°.

pH ⟨791⟩: between 4.0 and 7.0, in a solution (1 in 100).

Erythorbic Acid

SOURCE: NF



$C_6H_8O_6$ 176.13

o-Araboascorbic acid.

D-Erythro-hex-2-enoic acid delta-lactone.

Isoascorbic acid, D-isoascorbic acid. [*89-65-6*].

» Erythorbic Acid contains not less than 99.0 percent and not more than the equivalent of 100.5 percent of $C_6H_8O_6$, calculated on the dried basis.

Packaging and storage—Preserve in tight, light-resistant containers.

USP Reference standards ⟨11⟩—*USP Erythorbic Acid RS*.

Fenofibrate Capsules

SOURCE: USP

» Fenofibrate Capsules contain not less than 90.0 percent and not more than 110.0 percent of the labeled amount of fenofibrate ($C_{20}H_{21}ClO_4$).

Packaging and storage—Preserve in well-closed containers, and store at controlled room temperature.

Labeling—When more than one *Dissolution* test is given, the labeling states the test used only if *Test 1* is not used.

USP Reference standards ⟨11⟩—*USP Fenofibrate RS*. *USP Fenofibrate Related Compound B RS*.

Uniformity of dosage units ⟨905⟩: meet the requirements.

PROCEDURE FOR CONTENT UNIFORMITY—

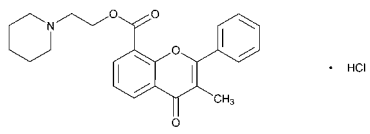
Buffer solution pH 2.9, *Mobile phase*, *Standard preparation*, and *Chromatographic system*—Proceed as directed In the *Assay*.

Test solution—Place 1 Capsule in a suitable volumetric flask, add *Buffer solution pH 2.9* to 10% to 20% of the final volume, and stir for 20 minutes to disintegrate the Capsule. Fill the flask to about 80% with methanol, sonicate for 10 minutes, stir for 15 minutes, and dilute with methanol to volume to obtain a solution having a known concentration of about 0.4 to 0.7 mg of fenofibrate per mL, based on the label claim. Quantitatively dilute an aliquot with *Mobile phase*, to obtain a solution having a known concentration of about 0.06 to 0.07 mg per mL, and pass it through a 0.45-um PVDF filter, discarding the first 5 mL.

Procedure—Proceed as directed in the *Assay*, except to inject the *Test solution* instead of the *Assay preparation*.

Flavoxate Hydrochloride

SOURCE: USP



$C_{24}H_{25}NO_4 \cdot HCl$ 427.92

4*H*-1-Benzopyran-8-carboxylic acid, 3-methyl-4-oxo-2-phenyl-, 2-(1-piperidinyl)ethyl ester, hydrochloride.

2-Piperidinoethyl 3-methyl-4-oxo-2-phenyl-4*H*-1-benzopyran-8-carboxylate hydrochloride [*3717-88-2*].

» Flavoxate Hydrochloride contains not less than 98.0 percent and not more than 102.0 percent of $C_{24}H_{25}NO_4 \cdot HCl$, calculated on the dried basis.

Packaging and storage—Preserve in well-closed containers, protected from light, and store at room temperature.

USP Reference standards ⟨11⟩—*USP Flavoxate Hydrochloride RS*. *USP Flavoxate Related Compound A RS*.

Flavoxate Hydrochloride Tablets

SOURCE: USP

» Flavoxate Hydrochloride Tablets contain not less than 90.0 percent and not more than 110.0 percent of $C_{24}H_{25}NO_4 \cdot HCl$, based on the label claim.

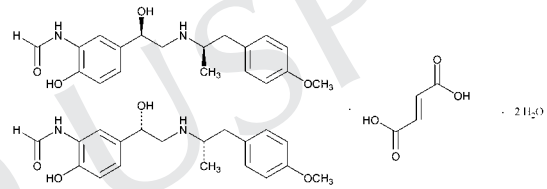
Packaging and storage—Preserve in well-closed containers, protected from light.

USP Reference standards ⟨11⟩—*USP Flavoxate Hydrochloride RS*. *USP Flavoxate Related Compound A RS*.

Uniformity of dosage units ⟨905⟩: meet the requirements.

Formoterol Fumarate

SOURCE: USP



$(C_{19}H_{24}N_2O_4)_2 \cdot C_4H_4O_4 \cdot 2H_2O$ 840.91

(±)-2'-Hydroxy-5'-[(*R**)-1-hydroxy-2-[[(*R**)-*p*-methoxy-α-methylphenethyl]amino]ethyl]formanilide fumarate (2:1) (salt), dihydrate [*43229-80-7*].

» Formoterol Fumarate contains not less than 98.5 percent and not more than 101.5 percent of $(C_{19}H_{24}N_2O_4)_2 \cdot C_4H_4O_4$, calculated on the anhydrous basis.

Packaging and storage—Preserve in well-closed, light-resistant containers.

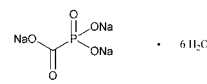
Labeling—The labeling states with which *Content of related compound I* the test article complies if a test other than *Content of related compound I*, *Test 1* is used.

USP Reference standards ⟨11⟩—*USP Formoterol Fumarate RS*. *USP Formoterol Fumarate System Suitability Mixture RS*. *USP Formoterol Fumarate Resolution Mixture RS*.

pH ⟨791⟩: between 5.5 and 6.5, in a solution in water containing 1 mg per mL.

Foscarnet Sodium

SOURCE: USP



$CNa_3O_5P \cdot 6H_2O$ 300.04

Phosphinecarboxylic acid, dihydroxy-, oxide, trisodium salt, hexahydrate.

Phosphonoformic acid, trisodium salt, hexahydrate [*34156-56-4*].

» Foscarnet Sodium contains not less than 98.5 percent and not more than 101.0 percent of CNa_3O_5P, calculated on the dried basis.

Packaging and storage—Preserve in tight, light-resistant containers. Store at room temperature.

USP Reference standards ⟨11⟩—*USP Foscarnet Sodium RS. USP Foscarnet Related Compound B RS. USP Foscarnet Related Compound D RS.*

pH ⟨791⟩: between 9.0 and 11.0, in a carbon dioxide-free aqueous solution containing 20 mg of Foscarnet Sodium per mL.

Liquid Glucose

SOURCE: NF

[8027-56-3].

» Liquid Glucose is a product obtained by the incomplete hydrolysis of starch. It consists chiefly of dextrose, dextrins, maltose, and water.

Packaging and storage—Preserve in tightly closed containers. No storage requirements specified.

Labeling—Label it to indicate the natural source of starch. Label it to indicate its nominal dextrose equivalent.

USP Reference standards ⟨11⟩—*USP Dextrose RS.*

Glyceryl Monooleate

SOURCE: NF

Oleic acid, 2,3-dihydroxypropyl ester, (±).

(*RS*)-1-Glyceryl oleate 356.54 [*25496-72-4*].

» Glyceryl Monooleate is a mixture of monoglycerides, mainly glyceryl monooleate, together with variable quantities of diglycerides and triglycerides. It is obtained by partial glycerolysis of vegetable oil that consists mainly of triglycerides of oleic acid, or by esterification of glycerol with oleic acid of vegetable or animal origin. It is defined by the nominal content of monoglycerides, and the assay requirements differ as set forth in the accompanying table. A suitable antioxidant may be added.

	Nominal Content of Monoglycerides (%)		
	40	60	90
Monoglycerides	32.0–52.0	55.0–65.0	90.0–101.0
Diglycerides	30.0–50.0	15.0–35.0	<10.0
Triglycerides	5.0–20.0	2.0–10.0	<2.0

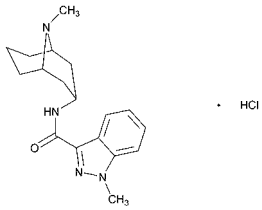
Packaging and storage—Preserve in tight containers. No storage requirements specified.

Labeling—The labeling indicates the nominal content of monoglycerides and the name and the concentration of any added antioxidant.

USP Reference standards ⟨11⟩—*USP Glyceryl Monooleate 40% RS. USP Glyceryl Monooleate 90% RS.*

Granisetron Hydrochloride

SOURCE: USP



$C_{18}H_{24}N_4O \cdot HCl$ 348.87

1*H*-Indazole-3-carboxamide, 1-methyl-*N*-(9-methyl-9-azabicyclo[3.3.1]non-3-yl)-, monohydrochloride, *endo*-.

1-Methyl-*N*-(9-methyl-*endo*-9-azabicyclo[3.3.1]non-3-yl)-1*H*-indazole-3-carboxamide monohydrochloride [*107007-99-8*].

» Granisetron Hydrochloride contains not less than 97.0 percent and not more than 102.0 percent of $C_{18}H_{24}N_4O \cdot HCl$, calculated on the dried basis.

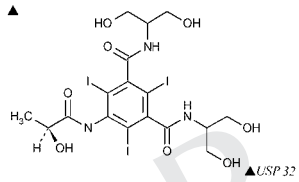
Packaging and storage—Preserve in well-closed containers, protected from light. Store at room temperature.

USP Reference standards ⟨11⟩—*USP Granisetron Hydrochloride RS. USP Granisetron Related Compound A RS. USP Granisetron Related Compound B RS. USP Granisetron Related Compound E RS.*

pH ⟨791⟩: between 4.0 and 6.5, in a solution in carbon dioxide-free water, containing 10 mg per mL.

Iopamidol

SOURCE: USP



$C_{17}H_{22}I_3N_3O_8$ 777.09

1,3-Benzenedicarboxamide, *N*,*N*′-bis[2-hydroxy-1-(hydroxymethyl)-ethyl]-5-[(2-hydroxy-1-oxopropyl)amino]-2,4,6-triiodo-, (*S*)-.

(*S*)-*N*,*N*′-Bis[2-hydroxy-1-(hydroxymethyl)ethyl]-2,4,6-triiodo-5-lactamidoisophthalamide [*60166-93-0*].

» Iopamidol contains not less than 98.0 percent and not more than 101.0 percent of iopamidol, calculated on the dried basis.

Packaging and storage—Preserve in well-closed, light-resistant containers. Store at 25°, excursions permitted between 15° and 30°.

USP Reference standards ⟨11⟩—*USP Iopamidol RS. USP Iopamidol Related Compound A RS. USP Iopamidol Related Compound C RS.*

Isopropyl Alcohol

SOURCE: USP

C_3H_8O 60.10

2-Propanol.

Isopropyl alcohol [*67-63-0*].

» Isopropyl Alcohol contains not less than 99.0 percent of C_3H_8O.

Packaging and storage—Preserve in tight containers, remote from heat.

USP Reference standards ⟨11⟩—*USP 2-Propanol RS.*

Specific gravity ⟨841⟩: between 0.783 and 0.787.

Refractive index ⟨831⟩: between 1.376 and 1.378 at 20°.

Lecithin

SOURCE: NF

[8002-43-5].

» Lecithin is a complex mixture of acetone-insoluble phosphatides, which consist chiefly of phosphatidyl choline, phosphatidyl ethanolamine, phosphatidyl serine, and phosphatidyl inositol, combined with various amounts of other substances such as triglycerides, fatty acids, and carbohydrates, as separated from the crude vegetable oil source. It contains not less than 50.0 percent of acetone-insoluble matter.

Packaging and storage—Preserve in well-closed, light-resistant containers. Store at the temperature indicated on the label. Protect from excess heat and moisture.

Labeling—Label it to indicate the storage conditions.

USP Reference standards ⟨11⟩—*USP Choline Chloride RS*.

Lisinopril and Hydrochlorothiazide Tablets

SOURCE: USP

» Lisinopril and Hydrochlorothiazide Tablets contain not less than 90.0 percent and not more than 110.0 percent of the labeled amount of lisinopril ($C_{21}H_{31}N_3O_5$) and hydrochlorothiazide ($C_7H_8ClN_3O_4S_2$).

Packaging and storage—Preserve in well-closed containers, and store at controlled room temperature.

USP Reference standards ⟨11⟩—*USP Lisinopril RS*. *USP Hydrochlorothiazide RS*. *USP Benzothiadiazine Related Compound A RS*. *USP Lisinopril Related Compound A RS*.

Uniformity of dosage units ⟨905⟩: meet the requirements.

Mirtazapine Orally Disintegrating Tablets

SOURCE: USP

» Mirtazapine Orally Disintegrating Tablets contain not less than 90.0 percent and not more than 110.0 percent of the labeled amount of Mirtazapine ($C_{17}H_{19}N_3$), calculated on the anhydrous basis.

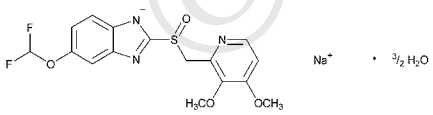
Packaging and storage—Store at controlled room temperature. Protect from light and moisture.

USP Reference standards ⟨11⟩—*USP Mirtazapine RS*.

Uniformity of dosage units ⟨905⟩: meet the requirements.

Pantoprazole Sodium

SOURCE: USP



$C_{16}H_{14}F_2N_3NaO_4S \cdot 1.5H_2O$ 432.37

1*H*-Benzimidazole, 5-(difluoromethoxy)-2-[[(3,4-dimethoxy-2-pyridyl)methyl]sulfinyl]-, sodium salt, hydrate (2:3).

5-(Difluoromethoxy)-2-[[(3,4-dimethoxy-2-pyridyl)methyl]sulfinyl]-benzimidazole, sodium salt, sesquihydrate [*164579-32-2*].

» Pantoprazole Sodium contains not less than 98.0 percent and not more than 102.0 percent of $C_{16}H_{14}F_2N_3NaO_4S$, calculated on the anhydrous basis.

Packaging and storage—Preserve in well-closed, light-resistant containers. Store at room temperature.

Labeling—If a test for *Related compounds* other than *Test 1* is used, then the labeling states the test with which the article complies.

USP Reference standards ⟨11⟩—*USP Pantoprazole Sodium RS*. *USP Pantoprazole Related Compound A RS*. *USP Pantoprazole Related Compound B RS*. *USP Pantoprazole Related Compound C RS*. *USP Pantoprazole Related Compound D and F Mixture RS*. *USP Pantoprazole Related Compound E RS*.

Pantoprazole Sodium Delayed-Release Tablets

SOURCE: USP

» Pantoprazole Sodium Delayed-Release Tablets contain an amount of Pantoprazole Sodium equivalent to not less than 90.0 percent and not more than 110.0 percent of the labeled amount of pantoprazole ($C_{16}H_{15}F_2N_3O_4S$).

Packaging and storage—Preserve in well-closed containers. Store at controlled room temperature.

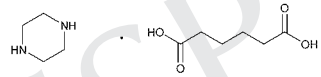
Labeling—Label Tablets to indicate that they must not be split, chewed, or crushed before administration. When more than one *Dissolution* test is given, the labeling states the test used only if *Test 1* is not used.

USP Reference standards ⟨11⟩—*USP Pantoprazole Sodium RS*. *USP Pantoprazole Related Compound A RS*. *USP Pantoprazole Related Compound B RS*.

Uniformity of dosage units ⟨905⟩: meet the requirements.

Piperazine Adipate

SOURCE: USP



$C_4H_{10}N_2 \cdot C_6H_{10}O_4$ 232.3

Piperazine, compound with 1,4-butanediacarboxylic acid (1:1).

Piperazine, compound with hexanedioic acid (1:1) [*142-88-1*].

» Piperazine Adipate contains not less than 98.0 percent and not more than 101.0 percent of $C_4H_{10}N_2 \cdot C_6H_{10}O_4$, calculated on the anhydrous basis.

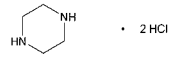
Packaging and storage—Preserve in well-closed containers, and store at room temperature.

Labeling—Label it to indicate that it is for veterinary use only.

USP Reference standards ⟨11⟩—*USP Piperazine Adipate RS*.

Piperazine Dihydrochloride

SOURCE: USP



$C_4H_{10}N_2 \cdot 2HCl \cdot xH_2O$ (anhydrous) 159.02

Piperazine dihydrochloride hydrate [*142-64-3*].

» Piperazine Dihydrochloride contains not less than 98.5 percent and not more than 100.5 percent of $C_4H_{10}N_2 \cdot 2HCl$, calculated on the anhydrous basis.

Packaging and storage—Preserve in well-closed containers, and store at room temperature.

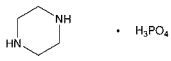
Labeling—Label it to indicate that it is for veterinary use only.

USP Reference standards ⟨11⟩—*USP Piperazine Dihydrochloride RS*.

pH ⟨791⟩: between 3.0 and 3.4, in a solution (1 in 20).

Piperazine Phosphate

SOURCE: USP



$C_4H_{10}N_2 \cdot H_3PO_4 \cdot H_2O$ 202.15

Piperazine phosphate (1:1), monohydrate.

Piperazine phosphate (1:1), monohydrate [*18534-18-4*].

Anhydrous 184.13 [*14538-56-8*].

» Piperazine Phosphate contains not less than 98.5 percent and not more than 100.5 percent of $C_4H_{10}N_2 \cdot H_3PO_4$, calculated on the anhydrous basis.

Packaging and storage—Preserve in tight containers, and store at room temperature.

Labeling—Label it to indicate that it is for veterinary use only.

USP Reference standards ⟨11⟩—*USP Piperazine Phosphate RS*.

pH ⟨791⟩: between 6.0 and 6.5, in a solution (1 in 100).

Polyvinyl Alcohol

SOURCE: USP

$(C_2H_4O)_n$

Ethenol, homopolymer.

Vinyl alcohol polymer [*9002-89-5*].

» Polyvinyl Alcohol is a water-soluble synthetic resin, represented by the formula:

$$(C_2H_4O)_n$$

in which the average value of *n* lies between 500 and 5000. It is prepared by 85 percent to 89 percent hydrolysis of polyvinyl acetate. The apparent viscosity, in mPa·s, at 20°, of a 4% (w/w) aqueous solution is not less than 85.0 percent and not more than 115.0 percent of that stated on the label.

Packaging and storage—Preserve in well-closed containers, and store at room temperature in a dry place.

Labeling—Label it to indicate the viscosity, giving the viscosity measurement parameters, the concentration of the solution, and the type of equipment used.

USP Reference standards ⟨11⟩—*USP Acetone RS*. *USP Methyl Acetate RS*. *USP Methyl Alcohol RS*. *USP Polyvinyl Alcohol RS*.

Viscosity ⟨911⟩—After determining the *Loss on drying*, weigh a quantity of undried Polyvinyl Alcohol, equivalent to 6.00 g on the dried basis. Over a period of seconds, transfer the test specimen with continuous slow stirring to about 140 mL of water contained in a suitable tared flask. When the specimen is well-wetted, increase the rate of stirring, avoiding mixing in excess air. Heat the mixture to 90°, and maintain the temperature at 90° for about 5 minutes. Discontinue heating, and continue stirring for 1 hour. Add water to make the mixture weigh 150 g. Resume stirring to obtain a homogenous solution. Filter the solution through a tared 100-mesh screen into a 250-mL conical flask, cool the filtrate to about 15°, and mix. Determine its viscosity at 20 ± 0.1°, using an appropriate viscometer: the apparent viscosity is between 85.0% and 115.0% of the value stated on the label.

pH ⟨791⟩: between 5.0 and 8.0, in a solution (1 in 25).

Potassium Bromide Oral Solution, Veterinary

SOURCE: USP

» Potassium Bromide Oral Solution, Veterinary contains an amount of Potassium Bromide equivalent to not less than 151 mg and not more than 185 mg of bromide (Br^-) per mL (see *Pharmaceutical Compounding—Nonsterile Preparations* ⟨795⟩):

Potassium Bromide	25 g
Purified Water	60 mL
Corn Syrup, *FCC*, a sufficient quantity to make	100 mL

Dissolve an accurately weighed quantity of Potassium Bromide in water. Add Corn Syrup to volume with mixing.

Packaging and storage—Package in a tight container, and store in a refrigerator.

Labeling—Label it to indicate that it is to be discarded after 180 days, to state that it is to be kept out of the reach of children, to indicate the nominal content of potassium bromide in the Oral Solution, Veterinary and to state that it is for veterinary use only.

USP Reference standards ⟨11⟩—*USP Sodium Bromide RS*.

Prednisolone Sodium Phosphate

SOURCE: USP

$C_{21}H_{27}Na_2O_8P$ 484.39

Pregna-1,4-diene-3,20-dione, 11,17-dihydroxy-21-(phosphono oxy)-, disodium salt, (11β)-.

11β,17,21-Trihydroxypregna-1,4-diene-3,20-dione 21-(disodium phosphate) [*125-02-0*].

» Prednisolone Sodium Phosphate contains not less than 96.0 percent and not more than 102.0 percent of $C_{21}H_{27}Na_2O_8P$, calculated on the anhydrous basis.

Packaging and storage—Preserve in tight containers.

USP Reference standards ⟨11⟩—*USP Prednisolone RS*. *USP Prednisolone Sodium Phosphate RS*.

pH ⟨791⟩: between 7.5 and 10.5, in a solution (1 in 100).

Propofol Injectable Emulsion

SOURCE: USP

» Propofol Injectable Emulsion contains Propofol in a 10 percent (w/v) oil-in-water sterile emulsion. The aqueous component contains glycerol, a suitable antimicrobial agent, and Water for Injection. It contains not less than 90.0 percent and not more than 110.0 percent of the labeled amount of propofol ($C_{12}H_{18}O$). It contains a suitable emulsifying agent.

Packaging and storage—Preserve under an inert atmosphere of nitrogen. Store at controlled room temperature. Do not freeze.

Labeling—Label it to include the following: Shake well before use. Do not use if there is evidence of excessive creaming or aggregation, if large droplets are visible, or if there are other forms of phase separation indicating that the stability of the product has been compromised. Slight creaming, which should disappear after shaking, may be visible upon prolonged standing.

USP Reference standards ⟨11⟩—*USP Endotoxin RS*. *USP Propofol RS*. *USP Propofol Related Compound A RS*. *USP Propofol Related Compound B RS*.

Bacterial endotoxins ⟨85⟩—It contains not more than 0.33 USP Endotoxin Units per mg of propofol.

Sterility ⟨71⟩: meets the requirements.

pH ⟨791⟩: between 7.0 and 8.5.

Propylene Glycol Monolaurate

SOURCE: NF

Dodecanoic acid, monoester with 1,2-propanediol.

Lauric acid, monoester with propane-1,2-diol.

» Propylene Glycol Monolaurate is a mixture of the propylene glycol mono- and di-esters of lauric acid. The requirements for monoester and diester content differ for the two types of Propylene Glycol Monolaurate, as set forth in the accompanying table.

	Content of monoesters (%)		Content of diesters (%)	
	Min.	Max.	Min.	Max.
Type I	45.0	70.0	30.0	55.0
Type II	90.0	—	—	10.0

Packaging and storage—Preserve in well-closed containers, and protect from moisture. No storage requirements specified.

Labeling—Label it to indicate the type (Type I or Type II).

USP Reference standards ⟨11⟩—*USP Propylene Glycol RS. USP Propylene Glycol Monolaurate Type I RS. USP Propylene Glycol Monolaurate Type II RS.*

Sodium Bromide Injection, Veterinary

SOURCE: USP

» Sodium Bromide Injection, Veterinary contains an amount of Sodium Bromide equivalent to not less than 21.0 mg and not more than 25.6 mg of bromide (Br^-) per mL (see *Pharmaceutical Compounding—Sterile Preparations* ⟨797⟩):

Sodium Bromide	3.0 g
Sterile Water for Injection, USP, a sufficient quantity to make	100 mL

Dissolve an accurately weighed quantity of Sodium Bromide in Sterile Water for Injection to volume with mixing. Sterilize by a suitable means such as sterile filtration or autoclaving.

Packaging and storage—Preserve in single-dose containers, preferably of Type I glass, and store in a refrigerator.

Labeling—Label it to indicate that it is to be discarded after 180 days, to state that it is to be kept out of the reach of children, and to indicate the nominal content of sodium bromide in the Injection. Label it to indicate that it is for infusion only at a rate not to exceed 150 mg of sodium bromide per kg body weight per hour. Label it to indicate that it is for veterinary use only.

USP Reference standards ⟨11⟩—*USP Endotoxin RS. USP Sodium Bromide RS.*

Bacterial endotoxins ⟨85⟩—It contains not more than 0.03 USP Endotoxin Unit per mg of sodium bromide.

Sterility ⟨71⟩: meets the requirements.

Sodium Bromide Oral Solution, Veterinary

SOURCE: USP

» Sodium Bromide Oral Solution, Veterinary contains an amount of Sodium Bromide equivalent to not less than 151 mg and not more than 185 mg of bromide (Br^-) per mL (see *Pharmaceutical Compounding—Nonsterile Preparations* ⟨795⟩):

Sodium Bromide	21.6 g
Purified Water	60 mL
Corn Syrup, *FCC*, a sufficient quantity to make	100 mL

Dissolve an accurately weighed quantity of Sodium Bromide in water. Add Corn Syrup to volume with mixing.

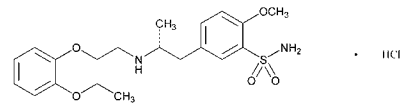
Packaging and storage—Package in a tight container, and store in a refrigerator.

Labeling—Label it to indicate that it is to be discarded after 180 days, to state that it is to be kept out of the reach of children, to indicate the nominal content of sodium bromide in the Oral Solution, Veterinary and to state that it is for veterinary use only.

USP Reference standards ⟨11⟩—*USP Sodium Bromide*.

Tamsulosin Hydrochloride

SOURCE: USP



$C_{20}H_{28}N_2O_5S{\cdot}HCl$ 444.97

Benzenesulfonamide, 5-[2-[[2-(2-ethoxyphenoxy)ethyl]amino]propyl]-2-methoxy-, monohydrochloride, (*R*)-.

(-)-(*R*)-5-[2-[[2-(*o*-Ethoxyphenoxy)ethyl]amino]propyl]-2-methoxybenzenesulfonamide monohydrochloride. [*106463-17-6*].

» Tamsulosin Hydrochloride contains not less than 98.5 percent and not more than 101.0 percent of $C_{20}H_{28}N_2O_5S{\cdot}HCl$, calculated on the dried basis.

Packaging and storage—Preserve in tight containers. Store at controlled room temperature.

USP Reference standards ⟨11⟩—*USP Tamsulosin Hydrochloride RS. USP Racemic Tamsulosin Hydrochloride RS.*

USP and NF Excipients, Listed by Category

In the following reference table, the grouping of excipients by functional category is intended to summarize the most typically identified purpose that these excipients serve in drug product formulations. The list of substances included in each category is not comprehensive. The statement of category is intended neither to limit in any way the choice or use of the substance nor to indicate that it has no other utility.

Acidifying Agent
- Acetic Acid
- Acetic Acid, Glacial
- Citric Acid, Anhydrous
- Citric Acid Monohydrate
- Fumaric Acid
- Hydrochloric Acid
- Hydrochloric Acid, Diluted
- Malic Acid
- Nitric Acid
- Phosphoric Acid
- Phosphoric Acid, Diluted
- Propionic Acid
- Sulfuric Acid
- Tartaric Acid

Aerosol Propellant
- Butane
- Dichlorodifluoromethane
- Dichlorotetrafluoroethane
- Isobutane
- Propane
- Trichloromonofluoromethane

Air Displacement
- Carbon Dioxide
- Nitrogen

Alcohol Denaturant
- Denatonium Benzoate
- Methyl Isobutyl Ketone
- Sucrose Octaacetate

Alkalizing Agent
- Ammonia Solution, Strong
- Ammonium Carbonate
- Diethanolamine
- Potassium Hydroxide
- Sodium Bicarbonate
- Sodium Borate
- Sodium Carbonate
- Sodium Hydroxide
- Trolamine

Anticaking Agent (See *Glidant*)

Antifoaming Agent
- Dimethicone
- Myristic Acid
- Palmitic Acid
- Simethicone

Antimicrobial Preservative
- Benzalkonium Chloride
- Benzalkonium Chloride Solution
- Benzethonium Chloride
- Benzoic Acid
- Benzyl Alcohol
- Butylparaben
- Cetrimonium Bromide
- Cetylpyridinium Chloride
- Chlorobutanol
- Chlorocresol
- Cresol
- Dehydroacetic Acid
- Erythorbic Acid
- Ethylparaben
- Methylparaben
- Methylparaben Sodium
- Phenol
- Phenoxyethanol
- Phenylethyl Alcohol
- Phenylmercuric Acetate
- Phenylmercuric Nitrate
- Potassium Benzoate
- Potassium Sorbate
- Propylparaben
- Propylparaben Sodium
- Sodium Benzoate
- Sodium Dehydroacetate
- Sodium Propionate
- Sorbic Acid
- Thimerosal
- Thymol

Antioxidant
- Ascorbic Acid
- Ascorbyl Palmitate
- Butylated Hydroxyanisole
- Butylated Hydroxytoluene
- Stannous Chloride
- Erythorbic Acid
- Hypophosphorous Acid
- Monothioglycerol
- Potassium Metabisulfite
- Propyl Gallate
- Sodium Bisulfite
- Sodium Formaldehyde Sulfoxylate
- Sodium Metabisulfite
- Sodium Sulfite
- Sodium Thiosulfate
- Sulfur Dioxide
- Tocopherol
- Tocopherols Excipient

Buffering Agent
- Acetic Acid
- Adipic Acid
- Ammonium Carbonate
- Ammonium Phosphate
- Boric Acid
- Citric Acid, Anhydrous
- Citric Acid Monohydrate
- Lactic Acid
- Phosphoric Acid
- Potassium Citrate
- Potassium Metaphosphate
- Potassium Phosphate, Dibasic
- Potassium Phosphate, Monobasic
- Sodium Acetate
- Sodium Citrate
- Sodium Lactate Solution
- Sodium Phosphate, Dibasic
- Sodium Phosphate, Monobasic
- Succinic Acid

Bulking Agent for Freeze-Drying
- Creatinine
- Mannitol
- Polydextrose
- Pullulan

Capsule Lubricant (See *Tablet and/or Capsule Lubricant*)

Chelating Agent
- Edetate Calcium Disodium
- Edetate Disodium
- Edetic Acid

Coating Agent
- Amino Methacrylate Copolymer
- Ammonio Methacrylate Copolymer
- Ammonio Methacrylate Copolymer Dispersion
- Carboxymethylcellulose, Sodium
- Cellaburate
- Cellacefate (formerly Cellulose Acetate Phthalate)
- Cellulose Acetate
- Cellulose Acetate Phthalate (see Cellacefate)
- Coconut Oil
- Copovidone
- Corn Syrup Solids
- Ethyl Acrylate and Methyl Methacrylate Copolymer Dispersion
- Ethylcellulose
- Ethylcellulose Aqueous Dispersion
- Gelatin
- Glaze, Pharmaceutical
- Hydroxypropyl Cellulose
- Hydroxypropyl Methylcellulose (see Hypromellose)
- Hydroxypropyl Methylcellulose Phthalate (see Hypromellose Phthalate)
- Hypromellose (formerly Hydroxypropyl Methylcellulose)
- Hypromellose Acetate Succinate
- Hypromellose Phthalate (formerly Hydroxypropyl Methylcellulose Phthalate)
- Maltodextrin
- Methacrylic Acid Copolymer
- Methacrylic Acid Copolymer Dispersion
- Methylcellulose
- Palm Kernel Oil
- Polyethylene Glycol
- Polyvinyl Acetate Phthalate
- Pullulan
- Fully Hydrogenated Rapeseed Oil
- Superglycerinated Fully Hydrogenated Rapeseed Oil
- Shellac
- Starch, Pregelatinized Modified
- Sucrose
- Titanium Dioxide
- Wax, Carnauba
- Wax, Microcrystalline
- Zein

Color
- Caramel
- Ferric Oxide, red, yellow, or blends

Complexing Agent
- Edetate Calcium Disodium
- Edetate Disodium
- Edetic Acid
- Oxyquinoline Sulfate

Desiccant
- Calcium Chloride
- Calcium Sulfate
- Silicon Dioxide

Emollient
- Alkyl (C12-15) Benzoate
- Hydrogenated Soybean Oil
- Hydrogenated Polydecene
- Oleyl Oleate

Emulsifying and/or Solubilizing Agent
- Acacia
- Carbomer Copolymer
- Carbomer Interpolymer
- Cholesterol
- Stannous Chloride
- Coconut Oil
- Diethanolamine (Adjunct)
- Diethylene Glycol Stearates
- Ethylene Glycol Stearates
- Gamma Cyclodextrin
- Glyceryl Distearate
- Glyceryl Monolinoleate
- Glyceryl Monooleate
- Glyceryl Monostearate
- Lanolin Alcohols
- Lecithin
- Mono- and Di-glycerides
- Monoethanolamine (Adjunct)
- Oleic Acid (Adjunct)
- Oleyl Alcohol (Stabilizer)
- Oleyl Oleate
- Palm Kernel Oil
- Poloxamer
- Polyoxyethylene 50 Stearate
- Polyoxyl 10 Oleyl Ether
- Polyoxyl 20 Cetostearyl Ether
- Polyoxyl 35 Castor Oil
- Polyoxyl 40 Hydrogenated Castor Oil
- Polyoxyl 40 Stearate
- Polyoxyl Lauryl Ether
- Polyoxyl Stearyl Ether
- Polysorbate 20
- Polysorbate 40
- Polysorbate 60
- Polysorbate 80
- Propylene Glycol Dicaprylate/Dicaprate
- Propylene Glycol Monocaprylate
- Propylene Glycol Monostearate
- Superglycerinated Fully Hydrogenated Rapeseed Oil
- Sodium Cetostearyl Sulfate
- Sodium Lauryl Sulfate
- Sodium Stearate
- Sorbitan Monolaurate
- Sorbitan Monooleate
- Sorbitan Monopalmitate
- Sorbitan Monostearate
- Sorbitan Sesquioleate
- Sorbitan Trioleate
- Stearic Acid
- Trolamine
- Wax, Emulsifying

Filtering Aid
- Cellulose, Powdered
- Siliceous Earth, Purified

Flavors and Perfumes
- Almond Oil
- Anethole
- Benzaldehyde
- Ethyl Acetate
- Ethyl Vanillin

Lactitol
Maltol
Menthol
Methyl Salicylate
Monosodium Glutamate
Peppermint
Peppermint Oil
Peppermint Spirit
Rose Oil
Rose Water, Stronger
Thymol
Vanillin

Glidant and/or Anticaking Agent
Calcium Silicate
Magnesium Silicate
Hydrophobic Colloidal Silica
Silicon Dioxide, Colloidal
Talc

Humectant
Corn Syrup Solids
Erythritol
Glycerin
Hexylene Glycol
Inositol
Maltitol
Polydextrose
Propylene Glycol
Sorbitol
Sorbitol Sorbitan Solution
Tagatose

Ointment Base
Caprylocaproyl Polyoxylglycerides
Diethylene Glycol Monoethyl Ether
Hydrogenated Polydecene
Lanolin
Lauroyl Polyoxylglycerides
Linoleoyl Polyoxylglycerides
Ointment, Hydrophilic
Ointment, White
Ointment, Yellow
Oleoyl Polyoxylglycerides
Polyethylene Glycol Monomethyl Ether
Petrolatum
Petrolatum, Hydrophilic
Petrolatum, White
Rose Water Ointment
Squalane
Stearoyl Polyoxylglycerides
Vegetable Oil, Hydrogenated, Type II

Plasticizer
Acetyltributyl Citrate
Acetyltriethyl Citrate
Castor Oil
Diacetylated Monoglycerides
Dibutyl Sebacate
Diethyl Phthalate
Glycerin
Polyethylene Glycol
Polyethylene Glycol Monomethyl Ether
Propylene Glycol
Pullulan
Sorbitol Sorbitan Solution
Triacetin
Tributyl Citrate
Triethyl Citrate

Polymer Membrane
Amino Methacrylate Copolymer
Ammonio Methacrylate Copolymer
Ammonio Methacrylate Copolymer Dispersion
Cellaburate
Cellulose Acetate
Ethyl Acrylate and Methyl Methacrylate Copolymer Dispersion
Pullulan

Sequestering Agent
Beta Cyclodextrin (see Betadex)
Betadex (formerly Beta Cyclodextrin)
Hydroxypropyl Betadex
Gamma Cyclodextrin
Pullulan
Sodium Tartrate

Solvent
Acetone
Alcohol
Alcohol, Diluted
Amylene Hydrate
Benzyl Benzoate
Butyl Alcohol
Canola Oil
Caprylocaproyl Polyoxylglycerides
Corn Oil
Cottonseed Oil
Diethylene Glycol Monoethyl Ether
Ethyl Acetate
Glycerin
Hexylene Glycol
Hydrogenated Polydecene
Isopropyl Alcohol
Lauroyl Polyoxylglycerides
Linoleoyl Polyoxylglycerides
Methyl Alcohol
Methylene Chloride
Methyl Isobutyl Ketone
Mineral Oil
Oleoyl Polyoxylglycerides
Peanut Oil
Polyethylene Glycol
Polyethylene Glycol Monomethyl Ether
Propylene Glycol
Sesame Oil
Stearoyl Polyoxylglycerides
Water for Injection
Water for Injection, Sterile
Water for Irrigation, Sterile
Water, Purified

Sorbent
Cellulose, Powdered
Charcoal, Activated
Siliceous Earth, Purified

Sorbent, Carbon Dioxide
Barium Hydroxide Lime
Soda Lime

Stiffening Agent
Castor Oil, Hydrogenated
Cetostearyl Alcohol
Cetyl Alcohol
Cetyl Esters Wax
Cetyl Palmitate
Hard Fat
Paraffin

Synthetic Paraffin
Fully Hydrogenated Rapeseed Oil
Superglycerinated Fully Hydrogenated Rapeseed Oil
Stearyl Alcohol
Wax, Emulsifying
Wax, White
Wax, Yellow

Suppository Base
Cocoa Butter
Hard Fat
Polyethylene Glycol

Suspending and/or Viscosity-Increasing Agent
Acacia
Agar
Alamic Acid
Alginic Acid
Aluminum Monostearate
Attapulgite, Activated
Attapulgite, Colloidal Activated
Bentonite
Bentonite, Purified
Bentonite Magma
Carbomer 910
Carbomer 934
Carbomer 934P
Carbomer 940
Carbomer 941
Carbomer 1342
Carbomer Copolymer
Carbomer Homopolymer
Carbomer Interpolymer
Carboxymethylcellulose Calcium
Carboxymethylcellulose Sodium
Carboxymethylcellulose Sodium 12
Carrageenan
Cellulose, Microcrystalline, and Carboxymethylcellulose Sodium
Corn Syrup
Corn Syrup Solids
Dextrin
Gelatin
Gellan Gum
Guar Gum
Hydroxyethyl Cellulose
Hydroxypropyl Cellulose
Hydroxypropyl Methylcellulose (see Hypromellose)
Hypromellose (formerly Hydroxypropyl Methylcellulose)
Magnesium Aluminum Silicate
Maltodextrin
Methylcellulose
Pectin
Polyethylene Oxide
Polyvinyl Alcohol
Povidone
Propylene Glycol Alginate
Pullulan
Hydrophobic Colloidal Silica
Silicon Dioxide
Silicon Dioxide, Colloidal
Sodium Alginate
Starch, Corn
Starch, Potato
Starch, Tapioca
Starch, Wheat
Tragacanth
Xanthan Gum

Sweetening Agent
Acesulfame Potassium
Aspartame
Aspartame Acesulfame
Corn Syrup
Corn Syrup Solids
High Fructose Corn Syrup
Dextrates
Dextrose
Dextrose Excipient
Erythritol
Fructose
Galactose
Maltitol
Maltose
Mannitol
Saccharin
Saccharin Calcium
Saccharin Sodium
Sorbitol
Sorbitol Solution
Sucralose
Sucrose
Sugar, Compressible
Sugar, Confectioner's
Syrup
Tagatose

Tablet Binder
Acacia
Alginic Acid
Amino Methacrylate Copolymer
Ammonio Methacrylate Copolymer
Ammonio Methacrylate Copolymer Dispersion
Carbomer Copolymer
Carbomer Homopolymer
Carbomer Interpolymer
Carboxymethylcellulose Sodium
Cellulose, Microcrystalline
Copovidone
Corn Syrup
Corn Syrup Solids
Dextrin
Ethyl Acrylate and Methyl Methacrylate Copolymer Dispersion
Ethylcellulose
Gelatin
Glucose, Liquid
Guar Gum
Low-Substituted Hydroxypropyl Cellulose
Hydroxypropyl Methylcellulose (see Hypromellose)
Hypromellose (formerly Hydroxypropyl Methylcellulose)
Hypromellose Acetate Succinate
Maltodextrin
Maltose
Methylcellulose
Polyethylene Oxide
Povidone
Pullulan
Starch, Corn
Starch, Potato
Starch, Pregelatinized
Starch, Pregelatinized Modified
Starch, Tapioca
Starch, Wheat
Syrup

Tablet and/or Capsule Diluent
Calcium Carbonate
Calcium Phosphate, Dibasic
Calcium Phosphate, Tribasic
Calcium Sulfate
Cellulose, Microcrystalline
Cellulose, Powdered
Corn Syrup

Corn Syrup Solids
Dextrates
Dextrin
Dextrose Excipient
Fructose
Kaolin
Lactitol
Lactose, Anhydrous
Lactose, Monohydrate
Maltitol
Maltodextrin
Maltose
Mannitol
Propylene Glycol Monocaprylate
Pullulan
Sorbitol
Starch
Starch, Corn
Starch, Potato
Starch, Pregelatinized
Starch, Pregelatinized Modified
Starch, Tapioca
Starch, Wheat
Sucrose
Sugar, Compressible
Sugar, Confectioner's

Tablet Disintegrant
Alginic Acid
Cellulose, Microcrystalline
Croscarmellose Sodium
Crospovidone
Low-Substituted Hydroxypropyl Cellulose
Maltose
Polacrilin Potassium
Pullulan
Sodium Starch Glycolate
Starch
Starch, Corn
Starch, Potato
Starch, Pregelatinized
Starch, Pregelatinized Modified
Starch, Tapioca
Starch, Wheat

Tablet and/or Capsule Lubricant
Calcium Stearate
Glyceryl Behenate
Magnesium Stearate
Mineral Oil, Light
Polyethylene Glycol
Polyoxyl 10 Oleyl Ether
Polyoxyl 20 Cetostearyl Ether
Polyoxyl 35 Castor Oil
Polyoxyl 40 Hydrogenated Castor Oil
Polyoxyl 40 Stearate
Polysorbate 20
Polysorbate 40
Polysorbate 60
Polysorbate 80
Sodium Lauryl Sulfate
Sodium Stearyl Fumarate
Sorbitan Monolaurate
Sorbitan Monooleate
Sorbitan Monopalmitate
Sorbitan Monostearate
Sorbitan Sesquioleate
Sorbitan Trioleate
Starch
Stearic Acid
Stearic Acid, Purified
Talc
Vegetable Oil, Hydrogenated, Type I
Zinc Stearate

Tonicity Agent
Corn Syrup
Corn Syrup Solids
Dextrose
Glycerin
Mannitol
Potassium Chloride
Sodium Chloride

Vehicle
FLAVORED AND/OR SWEETENED
Aromatic Elixir
Benzaldehyde Elixir, Compound
Corn Syrup Solids
Dextrose
Peppermint Water
Sorbitol Solution
Syrup
OLEAGINOUS
Alkyl (C12-15) Benzoate
Almond Oil
Canola Oil
Corn Oil
Cottonseed Oil
Ethyl Oleate
Hydrogenated Polydecene
Isopropyl Myristate
Isopropyl Palmitate
Mineral Oil
Mineral Oil, Light
Octyldodecanol
Olive Oil
Peanut Oil
Safflower Oil
Sesame Oil
Soybean Oil
Squalane
SOLID CARRIER
Corn Syrup Solids
Propylene Glycol Dicaprylate/Dicaprate
Propylene Glycol Monocaprylate
Sugar Spheres
STERILE
rAlbumin Human
Sodium Chloride Injection, Bacteriostatic
Water for Injection, Bacteriostatic

Viscosity-Increasing (See *Suspending Agent*)

Water Repelling Agent
Cyclomethicone
Dimethicone
Simethicone

Wetting and/or Solubilizing Agent
Benzalkonium Chloride
Benzethonium Chloride
Cetylpyridinium Chloride
Docusate Sodium
Nonoxynol 9
Octoxynol 9
Poloxamer
Polyoxyl 10 Oleyl Ether
Polyoxyl 20 Cetostearyl Ether
Polyoxyl 35 Castor Oil

Polyoxyl 40 Hydrogenated Castor Oil
Polyoxyl 40 Stearate
Polysorbate 20
Polysorbate 40
Polysorbate 60
Polysorbate 80
Pullulan
Sodium Lauryl Sulfate
Sorbitan Monolaurate
Sorbitan Monooleate
Sorbitan Monopalmitate
Sorbitan Monostearate
Sorbitan Sesquioleate
Sorbitan Trioleate
Tyloxapol

Section 7

Pharmacy-Related General Chapters

These pharmacy-related general chapters may be needed regularly in the daily pharmacy practice. The mandatory chapters, numbered below 1000, may have test requirements specified. The informational chapters, numbered above 1000, are used as a guide to the practitioner.

Section Contents

⟨61⟩ Microbiological Examination of Nonsterile Products: Microbial Enumeration Tests

Introduction

The tests described hereafter will allow quantitative enumeration of mesophilic bacteria and fungi that may grow under aerobic conditions.

The tests are designed primarily to determine whether a substance or preparation complies with an established specification for microbiological quality. When used for such purposes, follow the instructions given below, including the number of samples to be taken, and interpret the results as stated below.

The methods are not applicable to products containing viable microorganisms as active ingredients.

Alternative microbiological procedures, including automated methods, may be used, provided that their equivalence to the Pharmacopeial method has been demonstrated.

General Procedures

Carry out the determination under conditions designed to avoid extrinsic microbial contamination of the product to be examined. The precautions taken to avoid contamination must be such that they do not affect any microorganisms that are to be revealed in the test.

If the product to be examined has antimicrobial activity, this is, insofar as possible, removed or neutralized. If inactivators are used for this purpose, their efficacy and their absence of toxicity for microorganisms must be demonstrated.

If surface-active substances are used for sample preparation, their absence of toxicity for microorganisms and their compatibility with any inactivators used must be demonstrated.

Enumeration Methods

Use the *Membrane Filtration* method or one of the *Plate-Count Methods*, as directed. The *Most-Probable-Number (MPN) Method* is generally the least accurate method for microbial counts; however, for certain product groups with very low bioburden, it may be the most appropriate method.

The choice of a method is based on factors such as the nature of the product and the required limit of microorganisms. The method chosen must allow testing of a sufficient sample size to judge compliance with the specification. The suitability of the chosen method must be established.

Growth Promotion Test and Suitability of the Counting Method

General Considerations

The ability of the test to detect microorganisms in the presence of product to be tested must be established.

Suitability must be confirmed if a change in testing performance or a change in the product that may affect the outcome of the test, is introduced.

Preparation of Test Strains

Use standardized stable suspensions of test strains or prepare as stated below. Seed-lot culture maintenance techniques (seed-lot systems) are used so that the viable microorganisms used for inoculation are not more than 5 passages removed from the original master seed-lot. Grow each of the bacterial and fungal test strains separately as described in *Table 1*.

Table 1. Preparation and Use of Test Microorganisms

		Growth Promotion		Suitability of Counting Method in the Presence of Product	
Microorganism	**Preparation of Test Strain**	**Total Aerobic Microbial Count**	**Total Yeasts and Molds Count**	**Total Aerobic Microbial Count**	**Total Yeasts and Molds Count**
Staphylococcus aureus such as ATCC 6538, NCIMB 9518, CIP 4.83, or NBRC 13276	Soybean–Casein Digest Agar or Soybean–Casein Digest Broth 30°–35° 18–24 hours	Soybean–Casein Digest Agar and Soybean–Casein Digest Broth ≤ 100 cfu 30°–35° ≤ 3 days		Soybean–Casein Digest Agar/MPN Soybean–Casein Digest Broth ≤ 100 cfu 30°–35° ≤ 3 days	
Pseudomonas aeruginosa such as ATCC 9027, NCIMB 8626, CIP 82.118, or NBRC 13275	Soybean–Casein Digest Agar or Soybean–Casein Digest Broth 30°–35° 18–24 hours	Soybean–Casein Digest Agar and Soybean–Casein Digest Broth ≤ 100 cfu 30°–35° ≤ 3 days		Soybean–Casein Digest Agar/MPN Soybean–Casein Digest Broth ≤ 100 cfu 30°–35° ≤ 3 days	
Bacillus subtilis such as ATCC 6633, NCIMB 8054, CIP 52.62, or NBRC 3134	Soybean–Casein Digest Agar or Soybean–Casein Digest Broth 30°–35° 18–24 hours	Soybean–Casein Digest Agar and Soybean–Casein Digest Broth ≤ 100 cfu 30°–35° ≤ 3 days		Soybean–Casein Digest Agar/MPN Soybean–Casein Digest Broth ≤ 100 cfu 30°–35° ≤ 3 days	
Candida albicans such as ATCC 10231, NCPF 3179, IP 48.72, or NBRC 1594	Sabouraud Dextrose Agar or Sabouraud Dextrose Broth 20°–25° 2–3 days	Soybean–Casein Digest Agar ≤ 100 cfu 30°–35° ≤ 5 days	Sabouraud Dextrose Agar ≤ 100 cfu 20°–25° ≤ 5 days	Soybean–Casein Digest Agar ≤ 100 cfu 30°–35° ≤ 5 days MPN: not applicable	Sabouraud Dextrose Agar ≤ 100 cfu 20°–25° ≤ 5 days
Aspergillus niger such as ATCC 16404, IMI 149007, IP 1431.83, or NBRC 9455	Sabouraud Dextrose Agar or Potato–Dextrose Agar 20°–25° 5–7 days, or until good sporulation is achieved	Soybean–Casein Digest Agar ≤ 100 cfu 30°–35° ≤ 5 days	Sabouraud Dextrose Agar ≤ 100 cfu 20°–25° ≤ 5 days	Soybean–Casein Digest Agar ≤ 100 cfu 30°–35° ≤ 5 days MPN: not applicable	Sabouraud Dextrose Agar ≤ 100 cfu 20°–25° ≤ 5 days

Use *Buffered Sodium Chloride–Peptone Solution pH 7.0* or *Phosphate Buffer Solution pH 7.2* to make test suspensions; to suspend *A. niger* spores, 0.05% of polysorbate 80 may be added to the buffer. Use the suspensions within 2 hours, or within 24 hours if stored between 2° and 8°. As an alternative to preparing and then diluting a fresh suspension of vegetative cells of *A. niger* or *B. subtilis*, a stable spore suspension is prepared and then an appropriate volume of the spore suspension is used for test inoculation. The stable spore suspension may be maintained at 2° to 8° for a validated period of time.

Negative Control

To verify testing conditions, a negative control is performed using the chosen diluent in place of the test preparation. There must be no growth of microorganisms.

Growth Promotion of the Media

Test each batch of ready-prepared medium and each batch of medium prepared either from dehydrated medium or from the ingredients described.

Inoculate portions/plates of *Soybean–Casein Digest Broth* and *Soybean–Casein Digest Agar* with a small number (not more than 100 cfu) of the microorganisms indicated in *Table 1*, using a separate portion/plate of medium for each. Inoculate plates of *Sabouraud Dextrose Agar* with a small number (not more than 100 cfu) of the microorganisms indicated in *Table 1*, using a separate plate of medium for each. Incubate according to the conditions described in *Table 1*.

For solid media, growth obtained must not differ by a factor greater than 2 from the calculated value for a standardized inoculum. For a freshly prepared inoculum, growth of the microorganisms comparable to that previously obtained with a previously tested and approved batch of medium occurs. Liquid media are suitable if clearly visible growth of the microorganisms comparable to that previously obtained with a previously tested and approved batch of medium occurs.

Suitability of the Counting Method in the Presence of Product

Preparation of the Sample

The method for sample preparation depends on the physical characteristics of the product to be tested. If none of the procedures described below can be demonstrated to be satisfactory, a suitable alternative procedure must be developed.

Water-Soluble Products—Dissolve or dilute (usually a 1 in 10 dilution is prepared) the product to be examined in *Buffered Sodium Chloride–Peptone Solution pH 7.0, Phosphate Buffer Solution pH 7.2,* or *Soybean–Casein Digest Broth*. If necessary, adjust to a pH of 6 to 8. Further dilutions, where necessary, are prepared with the same diluent.

Nonfatty Products Insoluble in Water—Suspend the product to be examined (usually a 1 in 10 dilution is prepared) in *Buffered Sodium Chloride–Peptone Solution pH 7.0, Phosphate Buffer Solution pH 7.2,* or *Soybean–Casein Digest Broth*. A surface-active agent such as 1 g per L of polysorbate 80 may be added to assist the suspension of poorly wettable substances. If necessary, adjust to a pH of 6 to 8. Further dilutions, where necessary, are prepared with the same diluent.

Fatty Products—Dissolve in isopropyl myristate sterilized by filtration, or mix the product to be examined with the minimum necessary quantity of sterile polysorbate 80 or another noninhibitory sterile surface-active reagent heated, if necessary, to not more than 40° or, in exceptional cases, to not more than 45°. Mix carefully and if necessary maintain the temperature in a water bath. Add a sufficient quantity of the prewarmed chosen diluent to make a 1 in 10 dilution of the original product. Mix carefully, while maintaining the temperature for the shortest time necessary for the formation of an emulsion. Further serial 10-fold dilutions may be prepared using the chosen diluent containing a suitable concentration of sterile polysorbate 80 or another noninhibitory sterile surface-active reagent.

Fluids or Solids in Aerosol Form—Aseptically transfer the product into a membrane filter apparatus or a sterile container for further sampling. Use either the total contents or a defined number of metered doses from each of the containers tested.

Transdermal Patches—Remove the protective cover sheets ("release liners") of the transdermal patches and place them, adhesive side upwards, on sterile glass or plastic trays. Cover the adhesive surface with a suitable sterile porous material (e.g., sterile gauze) to prevent the patches from sticking together, and transfer the patches to a suitable volume of the chosen diluent containing inactivators such as polysorbate 80 and/or lecithin. Shake the preparation vigorously for at least 30 minutes.

Inoculation and Dilution

Add to the sample prepared as directed above and to a control (with no test material included) a sufficient volume of the microbial suspension to obtain an inoculum of not more than than 100 cfu. The volume of the suspension of the inoculum should not exceed 1% of the volume of diluted product.

To demonstrate acceptable microbial recovery from the product, the lowest possible dilution factor of the prepared sample must be used for the test. Where this is not possible due to antimicrobial activity or poor solubility, further appropriate protocols must be developed. If inhibition of growth by the sample cannot otherwise be avoided, the aliquot of the microbial suspension may be added after neutralization, dilution, or filtration.

Neutralization/Removal of Antimicrobial Activity

The number of microorganisms recovered from the prepared sample diluted as described in *Inoculation and Dilution* and incubated following the procedure described in *Recovery of Microorganisms in the Presence of Product,* is compared to the number of microorganisms recovered from the control preparation.

If growth is inhibited (reduction by a factor greater than 2), then modify the procedure for the particular enumeration test to ensure the validity of the results. Modification of the procedure may include, for example,

(1) An increase in the volume of the diluent or culture medium;

(2) Incorporation of a specific or general neutralizing agents into the diluent;

(3) Membrane filtration; or

(4) A combination of the above measures.

Neutralizing Agents—Neutralizing agents may be used to neutralize the activity of antimicrobial agents (see *Table 2*). They may be added to the chosen diluent or the medium preferably before sterilization. If used, their efficacy and their absence of toxicity for microorganisms must be demonstrated by carrying out a blank with neutralizer and without product.

Table 2. Common Neutralizing Agents/Methods for Interfering Substances

Interfering Substance	Potential Neutralizing Agents/ Method
Glutaraldehyde, mercurials	Sodium hydrogen sulfite (Sodium bisulfite)
Phenolics, alcohol, aldehydes, sorbate	Dilution
Aldehydes	Glycine
Quaternary ammonium compounds (QACs), parahydroxybenzoates (parabens), bis-biguanides	Lecithin
QACs, iodine, parabens	Polysorbate
Mercurials	Thioglycollate
Mercurials, halogens, aldehydes	Thiosulfate
EDTA (edetate)	Mg or Ca ions

If no suitable neutralizing method can be found, it can be assumed that the failure to isolate the inoculated organism is attributable to the microbicidal activity of the product. This information serves to indicate that the article is not likely to be contaminated with the given species of the microorganism. However, it is possible that the product inhibits only some of the microorganisms specified herein, but does not inhibit others not included among the test strains or those for which the latter are not representative. Then, perform the test with the highest dilution factor compatible with microbial growth and the specific acceptance criterion.

Recovery of Microorganisms in the Presence of Product

For each of the microorganisms listed, separate tests are performed. Only microorganisms of the added test strain are counted.

Membrane Filtration—Use membrane filters having a nominal pore size not greater than 0.45 µm. The type of filter material is chosen in such a way that the bacteria-retaining efficiency is not affected by the components of the sample to be investigated. For each of the microorganisms listed, one membrane filter is used.

Transfer a suitable quantity of the sample prepared as described under *Preparation of the Sample, Inoculation and Dilution,* and *Neutralization/Removal of Antimicrobial Activity* (preferably representing 1 g of the product, or less if large numbers of cfu are expected) to the membrane filter, filter immediately, and rinse the membrane filter with an appropriate volume of diluent.

For the determination of total aerobic microbial count (TAMC), transfer the membrane filter to the surface of the *Soybean–Casein Digest Agar*. For the determination of total combined yeasts and molds count (TYMC), transfer the membrane to the surface of the *Sabouraud Dextrose Agar.* Incubate the plates as indicated in *Table 1*. Perform the counting.

Plate-Count Methods—Perform plate-count methods at least in duplicate for each medium, and use the mean count of the result.

Pour-Plate Method—For Petri dishes 9 cm in diameter, add to the dish 1 mL of the sample prepared as described under *Preparation of the Sample, Inoculation and Dilution,* and *Neutralization/Removal of Antimicrobial Activity* and 15 to 20 mL of *Soybean–Casein Digest Agar* or *Sabouraud Dextrose Agar,* both media maintained at not more than 45°. If larger Petri dishes are used, the amount of agar medium is increased accordingly. For each of the microorganisms listed in *Table 1*, at least two Petri dishes are used.

Incubate the plates as indicated in *Table 1*. Take the arithmetic mean of the counts per medium, and calculate the number of cfu in the original inoculum.

Surface-Spread Method—For Petri dishes 9 cm in diameter, add 15 to 20 mL of *Soybean–Casein Digest Agar* or *Sabouraud Dextrose Agar* at about 45° to each Petri dish, and allow to solidify. If larger Petri dishes are used, the volume of the agar is increased accordingly. Dry the plates, for example, in a laminar-airflow cabinet or in an incubator. For each of the microorganisms listed in *Table 1*, at least two Petri dishes are used. Spread a measured volume of not less than 0.1 mL of the sample, prepared as directed under *Preparation of the Sample, Inoculation and Dilution,* and *Neutralization/Removal of Antimicrobial Activity* over the surface of the medium. Incubate and count as directed for *Pour-Plate Method*.

Most-Probable-Number (MPN) Method—The precision and accuracy of the *MPN Method* is less than that of the *Membrane Filtration* method or the *Plate-Count Method*. Unreliable results are obtained particularly for the enumeration of molds. For these reasons, the *MPN Method* is reserved for the enumeration of TAMC in situations where no other method is available. If the use of the method is justified, proceed as follows.

Prepare a series of at least three serial 10-fold dilutions of the product as described for *Preparation of the Sample, Inoculation and Dilution,* and *Neutralization/Removal of Antimicrobial Activity*. From each level of dilution, three aliquots of 1 g or 1 mL are used to inoculate three tubes with 9 to 10 mL of *Soybean–Casein Digest Broth*. If necessary a surface-active agent such as polysorbate 80, or an inactivator of antimicrobial agents may be added to the medium. Thus, if three levels of dilution are prepared, nine tubes are inoculated.

Incubate all tubes at 30° to 35° for not more than 3 days. If reading of the results is difficult or uncertain owing to the nature of the product to be examined, subculture in the same broth or in *Soybean–Casein Digest Agar* for 1 to 2 days at the same temperature, and use these results. From *Table 3,* determine the most probable number of microorganisms per g or mL of the product to be examined.

Table 3. Most-Probable-Number Values of Microorganisms

Observed Combinations of Numbers of Tubes Showing Growth in Each Set			MPN per g or per mL of Product	95% Confidence Limits
Number of g or mL of Product per Tube				
0.1	0.01	0.001		
0	0	0	<3	0–9.4
0	0	1	3	0.1–9.5
0	1	0	3	0.1–10
0	1	1	6.1	1.2–17
0	2	0	6.2	1.2–17
0	3	0	9.4	3.5–35
1	0	0	3.6	0.2–17
1	0	1	7.2	1.2–17
1	0	2	11	4–35
1	1	0	7.4	1.3–20
1	1	1	11	4–35
1	2	0	11	4–35
1	2	1	15	5–38
1	3	0	16	5–38
2	0	0	9.2	1.5–35
2	0	1	14	4–35
2	0	2	20	5–38
2	1	0	15	4–38
2	1	1	20	5–38
2	1	2	27	9–94
2	2	0	21	5–40
2	2	1	28	9–94
2	2	2	35	9–94
2	3	0	29	9–94
2	3	1	36	9–94
3	0	0	23	5–94
3	0	1	38	9–104
3	0	2	64	16–181

(continued)

Table 3. Most-Probable-Number Values of Microorganisms *(continued)*

Observed Combinations of Numbers of Tubes Showing Growth in Each Set			MPN per g or per mL of Product	95% Confidence Limits
Number of g or mL of Product per Tube				
0.1	0.01	0.001		
3	1	0	43	9–181
3	1	1	75	17–199
3	1	2	120	30–360
3	1	3	160	30–380
3	2	0	93	18–360
3	2	1	150	30–380
3	2	2	210	30–400
3	2	3	290	90–990
3	3	0	240	40–990
3	3	1	460	90–1980
3	3	2	1100	200–4000
3	3	3	>1100	

Results and Interpretation

When verifying the suitability of the *Membrane Filtration* method or the *Plate-Count Method,* a mean count of any of the test organisms not differing by a factor greater than 2 from the value of the control defined in *Inoculation and Dilution* in the absence of product must be obtained. When verifying the suitability of the *MPN Method,* the calculated value from the inoculum must be within 95% confidence limits of the results obtained with the control.

If the above criteria cannot be met for one of more of the organisms tested with any of the described methods, the method and test conditions that come closest to the criteria are used to test the product.

Testing of Products

Amount Used for the Test

Unless otherwise directed, use 10 g or 10 mL of the product to be examined taken with the precautions referred to above. For fluids or solids in aerosol form, sample 10 containers. For transdermal patches, sample 10 patches.

The amount to be tested may be reduced for active substances that will be formulated in the following conditions: the amount per dosage unit (e.g., tablet, capsule, injection) is less than or equal to 1 mg, or the amount per g or mL (for preparations not presented in dose units) is less than 1 mg. In these cases, the amount of sample to be tested is not less than the amount present in 10 dosage units or 10 g or 10 mL of the product.

For materials used as active substances where the sample quantity is limited or batch size is extremely small (i.e., less than 1000 mL or 1000 g), the amount tested shall be 1% of the batch unless a lesser amount is prescribed or justified and authorized.

For products where the total number of entities in a batch is less than 200 (e.g., samples used in clinical trials), the sample size may be reduced to two units, or one unit if the size is less than 100.

Select the sample(s) at random from the bulk material or from the available containers of the preparation. To obtain the required quantity, mix the contents of a sufficient number of containers to provide the sample.

Examination of the Product

Membrane Filtration

Use a filtration apparatus designed to allow the transfer of the filter to the medium. Prepare the sample using a method that has been shown to be suitable as described in *Growth Promotion Test and Suitability of the Counting Method,* transfer the appropriate amount to each of two membrane filters, and filter immediately. Wash each filter following the procedure shown to be suitable.

For the determination of TAMC, transfer one of the membrane filters to the surface of *Soybean–Casein Digest Agar*. For the determination of TYMC, transfer the other membrane to the surface of *Sabouraud Dextrose Agar*. Incubate the plate of *Soybean–Casein Digest Agar* at 30° to 35° for 3 to 5 days and the plate of *Sabouraud Dextrose Agar* at 20° to 25° for 5 to 7 days. Calculate the number of cfu per g or per mL of product.

When examining transdermal patches, separately filter 10% of the volume of the preparation described for *Preparation of the Sample* through each of two sterile filter membranes. Transfer one membrane to *Soybean–Casein Digest Agar* for TAMC and the other membrane to *Sabouraud Dextrose Agar* for TYMC.

Plate-Count Methods

Pour-Plate Method—Prepare the sample using a method that has been shown to be suitable as described in *Growth Promotion Test and Suitability of the Counting Method*. Prepare for each medium at least two Petri dishes for each level of dilution. Incubate the plates of *Soybean–Casein Digest Agar* at 30° to 35° for 3 to 5 days and the plates of *Sabouraud Dextrose Agar* at 20° to 25° for 5 to 7 days. Select the plates corresponding to a given dilution and showing the highest number of colonies less than 250 for TAMC and 50 for TYMC. Take the arithmetic mean per culture medium of the counts, and calculate the number of cfu per g or per mL of product.

Surface-Spread Method—Prepare the sample using a method that has been shown to be suitable as described in *Growth Promotion Test and Suitability of the Counting Method*. Prepare at least two Petri dishes for each medium and each level of dilution. For incubation and calculation of the number of cfu, proceed as directed for the *Pour-Plate Method*.

Most-Probable-Number Method

Prepare and dilute the sample using a method that has been shown to be suitable as decribed in *Growth Promotion Test and Suitability of the Counting Method*. Incubate all tubes for 3 to 5 days at 30° to 35°. Subculture if necessary, using the procedure shown to be suitable. Record for each level of dilution the number of tubes showing microbial growth. Determine the most probable number of microorganisms per g or mL of the product to be examined from *Table 3*.

Interpretation of the Results

The total aerobic microbial count (TAMC) is considered to be equal to the number of cfu found using *Soybean–Casein Digest Agar;* if colonies of fungi are detected on this medium, they are counted as part of TAMC. The total combined yeasts and molds count (TYMC) is considered to be equal to the number of cfu found using *Sabouraud Dextrose Agar;* if colonies of bacteria are detected on this medium, they are counted as part of TYMC. When the TYMC is expected to exceed the acceptance criterion due to the bacterial growth, *Sabouraud Dextrose Agar* containing antibiotics may be used. If the count is carried out by the *MPN Method,* the calculated value is TAMC.

When an acceptance criterion for microbiological quality is prescribed, it is interpreted as follows:

— 10^1 cfu: maximum acceptable count = 20;
— 10^2 cfu: maximum acceptable count = 200;
— 10^3 cfu: maximum acceptable count = 2000; and so forth.

The recommended solutions and media are described in *Tests for Specified Microorganisms* ⟨62⟩

(Official May 1, 2009)

⟨62⟩ Microbiological Examination of Nonsterile Products: Tests for Specified Microorganisms

Introduction

The tests described hereafter will allow determination of the absence of, or limited occurrence of, specified microorganisms that may be detected under the conditions described.

The tests are designed primarily to determine whether a substance or preparation complies with an established specification for microbiological quality. When used for such purposes, follow the instructions given below, including the number of samples to be taken, and interpret the results as stated below.

Alternative microbiological procedures, including automated methods, may be used, provided that their equivalence to the Pharmacopeial method has been demonstrated.

General Procedures

The preparation of samples is carried out as described in *Microbiological Examination of Nonsterile Products: Microbial Enumeration Tests* ⟨61⟩.

If the product to be examined has antimicrobial activity, this is insofar as possible removed or neutralized as described in *Microbiological Examination of Nonsterile Products: Microbial Enumeration Tests* ⟨61⟩.

If surface-active substances are used for sample preparation, their absence of toxicity for microorganisms and their compatibility with any inactivators used must be demonstrated as described in *Microbiological Examination of Nonsterile Products: Microbial Enumeration Tests* ⟨61⟩.

Growth-Promoting and Inhibitory Properties of the Media and Suitability of the Test

The ability of the test to detect microorganisms in the presence of the product to be tested must be established. Suitability must be confirmed if a change in testing performance or a change in the product that may affect the outcome of the test is introduced.

Preparation of Test Strains

Use standardized stable suspensions of test strains as stated below. Seed-lot culture maintenance techniques (seed-lot systems) are used so that the viable microorganisms used for inoculation are not more than five passages removed from the original master seed-lot.

Aerobic Microorganisms

Grow each of the bacterial test strains separately in containers containing *Soybean–Casein Digest Broth* or on *Soybean–Casein Digest Agar* at 30° to 35° for 18 to 24 hours. Grow the test strain for *Candida albicans* separately on *Sabouraud Dextrose Agar* or in *Sabouraud Dextrose Broth* at 20° to 25° for 2 to 3 days.

Staphylococcus aureus	such as ATCC 6538, NCIMB 9518, CIP 4.83, or NBRC 13276
Pseudomonas aeruginosa	such as ATCC 9027, NCIMB 8626, CIP 82.118, or NBRC 13275
Escherichia coli	such as ATCC 8739, NCIMB 8545, CIP 53.126, or NBRC 3972
Salmonella enterica ssp. *enterica* serotype typhimurium or, as an alternative,	such as ATCC 14028
Salmonella enterica ssp. *enterica* serotype *abony*	such as NBRC 100797, NCTC 6017, or CIP 80.39
Candida albicans	such as ATCC 10231, NCPF 3179, IP 48.72, or NBRC 1594

Use *Buffered Sodium Chloride–Peptone Solution pH 7.0* or *Phosphate Buffer Solution pH 7.2* to make test suspensions. Use the suspensions within 2 hours or within 24 hours if stored at 2° to 8°.

Clostridia

Use *Clostridium sporogenes* such as ATCC 11437 (NBRC 14293, NCIMB 12343, CIP 100651) or ATCC 19404 (NCTC 532 or CIP 79.3). Grow the clostridial test strain under anaerobic conditions in *Reinforced Medium for Clostridia* at 30° to 35° for 24 to 48 hours. As an alternative to preparing and then diluting down a fresh suspension of vegetative cells of *Cl. sporogenes,* a stable spore suspension is used for test inoculation. The stable spore suspension may be maintained at 2° to 8° for a validated period.

Negative Control

To verify testing conditions, a negative control is performed using the chosen diluent in place of the test preparation. There must be no growth of microorganisms.

Growth Promotion and Inhibitory Properties of the Media

Test each batch of ready-prepared medium and each batch of medium prepared either from dehydrated medium or from ingredients. Verify suitable properties of relevant media as described in *Table 1*.

Table 1. Growth Promoting, Inhibitory, and Indicative Properties of Media

Test/Medium	Property	Test Strains
Test for bile-tolerant Gram-negative bacteria		
Enterobacteria Enrichment Broth Mossel	Growth promoting	*E. coli* *P. aeruginosa*
	Inhibitory	*S. aureus*
Violet Red Bile Glucose Agar	Growth promoting + Indicative	*E. coli* *P. aeruginosa*
Test for Escherichia coli		
MacConkey Broth	Growth promoting	*E. coli*
	Inhibitory	*S. aureus*
MacConkey Agar	Growth promoting + Indicative	*E. coli*
Test for Salmonella		
Rappaport Vassiliadis Salmonella Enrichment Broth	Growth promoting	*Salmonella enterica* ssp. *enterica* serotype *typhimurium* or *Salmonella enterica* ssp. *enterica* serotype *abony*
	Inhibitory	*S. aureus*
Xylose Lysine Deoxycholate Agar	Growth promoting + Indicative	*Salmonella enterica* ssp. *enterica* serotype *typhimurium* or *Salmonella enterica* ssp. *enterica* serotype *abony*
	Indicative	*E. coli*
Test for Pseudomonas aeruginosa		
Cetrimide Agar	Growth promoting	*P. aeruginosa*
	Inhibitory	*E. coli*
Test for Staphylococcus aureus		
Mannitol Salt Agar	Growth promoting + Indicative	*S. aureus*
	Inhibitory	*E. coli*
Test for Clostridia		
Reinforced Medium for Clostridia	Growth promoting	*Cl. sporogenes*
Columbia Agar	Growth promoting	*Cl. sporogenes*
Test for Candida albicans		
Sabouraud Dextrose Broth	Growth promoting	*C. albicans*
Sabouraud Dextrose Agar	Growth promoting + Indicative	*C. albicans*

Test for Growth-Promoting Properties, Liquid Media—Inoculate a portion of the appropriate medium with a small number (not more than 100 cfu) of the appropriate microorganism. Incubate at the specified temperature for not more than the shortest period of time specified in the test. Clearly visible growth of the microorganism comparable to that previously obtained with a previously tested and approved batch of medium occurs.

Test for Growth-Promoting Properties, Solid Media—Perform *Surface-Spread Method* (see *Plate-Count Methods* under *Microbiological Examination of Nonsterile Products: Microbial Enumeration Tests* ⟨61⟩), inoculating each plate with a small number (not more than 100 cfu) of the appropriate microorganism. Incubate at the specified temperature for not more than the shortest period of time specified in the test. Growth of the microorganism comparable to that previously obtained with a previously tested and approved batch of medium occurs.

Test for Inhibitory Properties, Liquid or Solid Media—Inoculate the appropriate medium with at least 100 cfu of the appropriate microorganism. Incubate at the specified temperature for not less than the longest period of time specified in the test. No growth of the test microorganism occurs.

Test for Indicative Properties—Perform *Surface-Spread Method* (see *Plate-Count Methods* under *Microbiological Examination of Nonsterile Products: Microbial Enumeration Tests* ⟨61⟩), inoculating each plate with a small number (not more than 100 cfu) of the appropriate microorganism. Incubate at the specified temperature for a period of time within the range specified in the test. Colonies are comparable in appearance and indication reactions to those previously obtained with a previously tested and approved batch of medium.

Suitability of the Test Method

For each new product to be tested perform sample preparation as described in the relevant paragraph under *Testing of Products*. At the time of mixing, add each test strain in the prescribed growth medium. Inoculate the test strains individually. Use a number of microorganisms equivalent to not more than 100 cfu in the inoculated test preparation.

Perform the test as described in the relevant paragraph under *Testing of Products* using the shortest incubation period prescribed.

The specified microorganisms must be detected with the indication reactions as described under *Testing of Products*.

Any antimicrobial activity of the product necessitates a modification of the test procedure (see *Neutralization/Removal of Antimicrobial Activity* under *Microbiological Examination of Nonsterile Products: Microbial Enumeration Tests* ⟨61⟩).

For a given product, if the antimicrobial activity with respect to a microorganism for which testing is prescribed cannot be neutralized, then it is to be assumed that the inhibited microorganism will not be present in the product.

Testing of Products

Bile-Tolerant Gram-Negative Bacteria

Sample Preparation and Pre-Incubation—Prepare a sample using a 1 in 10 dilution of not less than 1 g of the product to be examined as described in *Microbiological Examination of Nonsterile Products: Microbial Enumeration Tests* ⟨61⟩, but using *Soybean–Casein Digest Broth* as the chosen diluent, mix, and incubate at 20° to 25° for a time sufficient to resuscitate the bacteria but not sufficient to encourage multiplication of the organisms (usually 2 hours but not more than 5 hours).

Test for Absence—Unless otherwise prescribed, use the volume corresponding to 1 g of the product, as prepared in *Sample Preparation and Pre-Incubation,* to inoculate *Enterobacteria Enrichment Broth Mossel*. Incubate at 30° to 35° for 24 to 48 hours. Subculture on plates of *Violet Red Bile Glucose Agar*. Incubate at 30° to 35° for 18 to 24 hours.

The product complies with the test if there is no growth of colonies.

Quantitative Test—

Selection and Subculture—Inoculate suitable quantities of *Enterobacteria Enrichment Broth Mossel* with the preparation as directed under *Sample Preparation and Pre-Incubation* and/or dilutions of it containing respectively 0.1 g, 0.01 g, and 0.001 g (or 0.1 mL, 0.01 mL, and 0.001 mL) of the product to be examined. Incubate at 30° to 35° for 24 to 48 hours. Subculture each of the cultures on a plate of *Violet Red Bile Glucose Agar*. Incubate at 30° to 35° for 18 to 24 hours.

Interpretation—Growth of colonies constitutes a positive result. Note the smallest quantity of the product that gives a positive result and the largest quantity that gives a negative result. Determine from *Table 2* the probable number of bacteria.

Table 2. Interpretation of Results

Results for Each Quantity of Product			
0.1 g or 0.1 mL	0.01 g or 0.01 mL	0.001 g or 0.001 mL	Probable Number of Bacteria per g or mL of Product
+	+	+	more than 10^3
+	+	–	less than 10^3 and more than 10^2
+	–	–	less than 10^2 and more than 10
–	–	–	less than 10

Escherichia coli

Sample Preparation and Pre-Incubation—Prepare a sample using a 1 in 10 dilution of not less than 1 g of the product to be examined as described in *Microbiological Examination of Nonsterile Products: Microbial Enumeration Tests* ⟨61⟩, and use 10 mL or the quantity corresponding to 1 g or 1 mL, to inoculate a suitable amount (determined as described under *Suitability of the Test Method*) of *Soybean–Casein Digest Broth,* mix, and incubate at 30° to 35° for 18 to 24 hours.

Selection and Subculture—Shake the container, transfer 1 mL of *Soybean–Casein Digest Broth* to 100 mL of *MacConkey Broth*, and incubate at 42° to 44° for 24 to 48 hours. Subculture on a plate of *MacConkey Agar* at 30° to 35° for 18 to 72 hours.

Interpretation—Growth of colonies indicates the possible presence of *E. coli*. This is confirmed by identification tests.

The product complies with the test if no colonies are present or if the identification tests are negative.

Salmonella

Sample Preparation and Pre-Incubation—Prepare the product to be examined as described in *Microbiological Examination of Nonsterile Products: Microbial Enumeration Tests* ⟨61⟩, and use the quantity corresponding to not less than 10 g or 10 mL to inoculate a suitable amount (determined as described under *Suitability of the Test Method*) of *Soybean–Casein Digest Broth,* mix, and incubate at 30° to 35° for 18 to 24 hours.

Selection and Subculture—Transfer 0.1 mL of *Soybean–Casein Digest Broth* to 10 mL of *Rappaport Vassiliadis Salmonella Enrichment Broth*, and incubate at 30° to 35° for 18 to 24 hours. Subculture on plates of *Xylose Lysine Deoxycholate Agar*. Incubate at 30° to 35° for 18 to 48 hours.

Interpretation—The possible presence of *Salmonella* is indicated by the growth of well-developed, red colonies, with or without black centers. This is confirmed by identification tests.

The product complies with the test if colonies of the types described are not present or if the confirmatory identification tests are negative.

Pseudomonas aeruginosa

Sample Preparation and Pre-Incubation—Prepare a sample using a 1 in 10 dilution of not less than 1 g of the product to be examined as described in *Microbiological Examination of Nonsterile Products: Microbial Enumeration Tests* ⟨61⟩, and use 10 mL or the quantity corresponding to 1 g or 1 mL to inoculate a suitable amount (determined as described under *Suitability of the Test Method*) of *Soybean–Casein Digest Broth,* and mix. When testing transdermal patches, filter the volume of sample corresponding to one patch of the preparation (see *Transdermal Patches* under *Preparation of the Sample* in *Microbiological Examination of Nonsterile Products: Microbial Enumeration Tests* ⟨61⟩) through a sterile filter membrane, and place in 100 mL of *Soybean–Casein Digest Broth*. Incubate at 30° to 35° for 18 to 24 hours.

Selection and Subculture—Subculture on a plate of *Cetrimide Agar,* and incubate at 30° to 35° for 18 to 72 hours.

Interpretation—Growth of colonies indicates the possible presence of *P. aeruginosa*. This is confirmed by identification tests.

The product complies with the test if colonies are not present or if the confirmatory identification tests are negative.

Staphylococcus aureus

Sample Preparation and Pre-Incubation—Prepare a sample using a 1 in 10 dilution of not less than 1 g of the product to be examined as described in *Microbiological Examination of Nonsterile Products: Microbial Enumeration Tests* ⟨61⟩, and use 10 mL or the quantity corresponding to 1 g or 1 mL to inoculate a suitable amount (determined as described under *Suitability of the Test Method*) of *Soybean–Casein Digest Broth*, and homogenize. When testing transdermal patches, filter the volume of sample corresponding to one patch of the preparation (see *Transdermal Patches* under *Preparation of the Sample* in *Microbiological Examination of Nonsterile Products: Microbial Enumeration Tests* ⟨61⟩) through a sterile filter membrane, and place in 100 mL of *Soybean–Casein Digest Broth*. Incubate at 30° to 35° for 18 to 24 hours.

Selection and Subculture—Subculture on a plate of *Mannitol Salt Agar*, and incubate at 30° to 35° for 18 to 72 hours.

Interpretation—The possible presence of *S. aureus* is indicated by the growth of yellow or white colonies surrounded by a yellow zone. This is confirmed by identification tests.

The product complies with the test if colonies of the types described are not present or if the confirmatory identification tests are negative.

Clostridia

Sample Preparation and Heat Treatment—Prepare the product to be examined as described in *Microbiological Examination of Nonsterile Products: Microbial Enumeration Tests* ⟨61⟩. Take two equal portions corresponding to not less than 1 g or 1 mL of the product to be examined. Heat one portion at 80° for 10 minutes, and cool rapidly. Do not heat the other portion.

Selection and Subculture—Transfer 10 mL of each of the mixed portions to two containers (38 mm × 200 mm) or other containers contain-

ing 100 mL of *Reinforced Medium for Clostridia*. Incubate under anaerobic conditions at 30° to 35° for 48 hours. After incubation, make subcultures from each tube on *Columbia Agar*, and incubate under anaerobic conditions at 30° to 35° for 48 hours.

Interpretation—The occurrence of anaerobic growth of rods (with or without endospores) giving a negative catalase reaction indicates the presence of *Clostridia*.

If no anaerobic growth of microorganisms is detected on *Columbia Agar* or the catalase test is positive, the product complies with the test.

Candida albicans

Sample Preparation and Pre-Incubation—Prepare the product to be examined as described in *Microbiological Examination of Nonsterile Products: Microbial Enumeration Tests* ⟨61⟩, and use 10 mL or the quantity corresponding to not less than 1 g or 1 mL, to inoculate 100 mL of *Sabouraud Dextrose Broth*, and mix. Incubate at 30° to 35° for 3 to 5 days.

Selection and Subculture—Subculture on a plate of *Sabouraud Dextrose Agar*, and incubate at 30° to 35° for 24 to 48 hours.

Interpretation—Growth of white colonies may indicate the presence of *C. albicans*. This is confirmed by identification tests.

The product complies with the test if such colonies are not present or if the confirmatory identification tests are negative.

Recommended Solutions and Culture Media

[NOTE—This section is given for information.]

The following solutions and culture media have been found satisfactory for the purposes for which they are prescribed in the test for microbial contamination in the Pharmacopeia. Other media may be used if they have similar growth-promoting and inhibitory properties.

Stock Buffer Solution—Transfer 34 g of potassium dihydrogen phosphate to a 1000-mL volumetric flask, dissolve in 500 mL of *Purified Water*, adjust with sodium hydroxide to a pH of 7.2 ± 0.2, add *Purified Water* to volume, and mix. Dispense in containers, and sterilize. Store at a temperature of 2° to 8°.

Phosphate Buffer Solution pH 7.2—Prepare a mixture of *Purified Water* and *Stock Buffer Solution* (800:1 v/v), and sterilize.

Buffered Sodium Chloride–Peptone Solution pH 7.0	
Potassium Dihydrogen Phosphate	3.6 g
Disodium Hydrogen Phosphate Dihydrate	7.2 g (equivalent to 0.067 M phosphate)
Sodium Chloride	4.3 g
Peptone (meat or casein)	1.0 g
Purified Water	1000 mL

Sterilize in an autoclave using a validated cycle.

Soybean–Casein Digest Broth	
Pancreatic Digest of Casein	17.0 g
Papaic Digest of Soybean	3.0 g
Sodium Chloride	5.0 g
Dibasic Hydrogen Phosphate	2.5 g
Glucose Monohydrate	2.5 g
Purified Water	1000 mL

Adjust the pH so that after sterilization it is 7.3 ± 0.2 at 25°. Sterilize in an autoclave using a validated cycle.

Soybean–Casein Digest Agar	
Pancreatic Digest of Casein	15.0 g
Papaic Digest of Soybean	5.0 g
Sodium Chloride	5.0 g
Agar	15.0 g
Purified Water	1000 mL

Adjust the pH so that after sterilization it is 7.3 ± 0.2 at 25°. Sterilize in an autoclave using a validated cycle.

Sabouraud Dextrose Agar	
Dextrose	40.0 g
Mixture of Peptic Digest of Animal Tissue and Pancreatic Digest of Casein (1:1)	10.0 g
Agar	15.0 g
Purified Water	1000 mL

Adjust the pH so that after sterilization it is 5.6 ± 0.2 at 25°. Sterilize in an autoclave using a validated cycle.

Potato Dextrose Agar	
Infusion from potatoes	200 g
Dextrose	20.0 g
Agar	15.0 g
Purified Water	1000 mL

Adjust the pH so that after sterilization it is 5.6 ± 0.2 at 25°. Sterilize in an autoclave using a validated cycle.

Sabouraud Dextrose Broth	
Dextrose	20.0 g
Mixture of Peptic Digest of Animal Tissue and Pancreatic Digest of Casein (1:1)	10.0 g
Purified Water	1000 mL

Adjust the pH so that after sterilization it is 5.6 ± 0.2 at 25°. Sterilize in an autoclave using a validated cycle.

Enterobacteria Enrichment Broth Mossel	
Pancreatic Digest of Gelatin	10.0 g
Glucose Monohydrate	5.0 g
Dehydrated Ox Bile	20.0 g
Potassium Dihydrogen Phosphate	2.0 g
Disodium Hydrogen Phosphate Dihydrate	8.0 g
Brilliant Green	15 mg
Purified Water	1000 mL

Adjust the pH so that after heating it is 7.2 ± 0.2 at 25°. Heat at 100° for 30 minutes, and cool immediately.

Violet Red Bile Glucose Agar	
Yeast Extract	3.0 g
Pancreatic Digest of Gelatin	7.0 g
Bile Salts	1.5 g
Sodium Chloride	5.0 g
Glucose Monohydrate	10.0 g
Agar	15.0 g
Neutral Red	30 mg
Crystal Violet	2 mg
Purified Water	1000 mL

Adjust the pH so that after heating it is 7.4 ± 0.2 at 25°. Heat to boiling; do not heat in an autoclave.

MacConkey Broth	
Pancreatic Digest of Gelatin	20.0 g
Lactose Monohydrate	10.0 g
Dehydrated Ox Bile	5.0 g
Bromocresol Purple	10 mg
Purified Water	1000 mL

Adjust the pH so that after sterilization it is 7.3 ± 0.2 at 25°. Sterilize in an autoclave using a validated cycle.

MacConkey Agar	
Pancreatic Digest of Gelatin	17.0 g
Peptones (meat and casein)	3.0 g
Lactose Monohydrate	10.0 g
Sodium Chloride	5.0 g
Bile Salts	1.5 g
Agar	13.5 g
Neutral Red	30.0 mg
Crystal Violet	1 mg
Purified Water	1000 mL

Adjust the pH so that after sterilization it is 7.1 ± 0.2 at 25°. Boil for 1 minute with constant shaking, then sterilize in an autoclave using a validated cycle.

Rappaport Vassiliadis Salmonella Enrichment Broth	
Soya Peptone	4.5 g
Magnesium Chloride Hexahydrate	29.0 g
Sodium Chloride	8.0 g
Dipotassium Phosphate	0.4 g
Potassium Dihydrogen Phosphate	0.6 g
Malachite Green	0.036 g
Purified Water	1000 mL

Dissolve, warming slightly. Sterilize in an autoclave using a validated cycle, at a temperature not exceeding 115°. The pH is to be 5.2 ± 0.2 at 25° after heating and autoclaving.

Xylose Lysine Deoxycholate Agar	
Xylose	3.5 g
L-Lysine	5.0 g
Lactose Monohydrate	7.5 g
Sucrose	7.5 g
Sodium Chloride	5.0 g
Yeast Extract	3.0 g
Phenol Red	80 mg
Agar	13.5 g
Sodium Deoxycholate	2.5 g
Sodium Thiosulfate	6.8 g
Ferric Ammonium Citrate	0.8 g
Purified Water	1000 mL

Adjust the pH so that after heating it is 7.4 ± 0.2 at 25°. Heat to boiling, cool to 50°, and pour into Petri dishes. Do not heat in an autoclave.

Cetrimide Agar	
Pancreatic Digest of Gelatin	20.0 g
Magnesium Chloride	1.4 g
Dipotassium Sulfate	10.0 g
Cetrimide	0.3 g
Agar	13.6 g
Purified Water	1000 mL
Glycerol	10.0 mL

Heat to boiling for 1 minute with shaking. Adjust the pH so that after sterilization it is 7.2 ± 0.2 at 25°. Sterilize in an autoclave using a validated cycle.

Mannitol Salt Agar	
Pancreatic Digest of Casein	5.0 g
Peptic Digest of Animal Tissue	5.0 g
Beef Extract	1.0 g
D-Mannitol	10.0 g
Sodium Chloride	75.0 g
Agar	15.0 g
Phenol Red	0.025 g
Purified Water	1000 mL

Heat to boiling for 1 minute with shaking. Adjust the pH so that after sterilization it is 7.4 ± 0.2 at 25°. Sterilize in an autoclave using a validated cycle.

Reinforced Medium for Clostridia	
Beef Extract	10.0 g
Peptone	10.0 g
Yeast Extract	3.0 g
Soluble Starch	1.0 g
Glucose Monohydrate	5.0 g
Cysteine Hydrochloride	0.5 g
Sodium Chloride	5.0 g
Sodium Acetate	3.0 g
Agar	0.5 g
Purified Water	1000 mL

Hydrate the agar, and dissolve by heating to boiling with continuous stirring. If necessary, adjust the pH so that after sterilization it is about 6.8 ± 0.2 at 25°. Sterilize in an autoclave using a validated cycle.

Columbia Agar	
Pancreatic Digest of Casein	10.0 g
Meat Peptic Digest	5.0 g
Heart Pancreatic Digest	3.0 g
Yeast Extract	5.0 g
Maize Starch	1.0 g
Sodium Chloride	5.0 g
Agar, according to gelling power	10.0–15.0 g
Purified Water	1000 mL

Hydrate the agar, and dissolve by heating to boiling with continuous stirring. If necessary, adjust the pH so that after sterilization it is 7.3 ± 0.2 at 25°. Sterilize in an autoclave using a validated cycle. Allow to cool to 45° to 50°; add, where necessary, gentamicin sulfate corresponding to 20 mg of gentamicin base, and pour into Petri dishes.

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⟨381⟩ Elastomeric Closures for Injections

Introduction

Elastomeric closures for containers used in the types of preparations defined in the general test chapter *Injections* ⟨1⟩ are made of materials obtained by vulcanization (cross-linking) polymerization, polyaddition, or polycondensation of macromolecular organic substances (elastomers). Closure formulations contain natural or synthetic elastomers and inorganic and organic additives to aid or control vulcanization, impart physical and chemical properties or color, or stabilize the closure formulation.

This chapter applies to closures used for long-term storage of preparations defined in the general test chapter *Injections* ⟨1⟩. Such closures are typically used as part of a vial, bottle, or pre-fill syringe package system.

This chapter applies to closures formulated with natural or synthetic elastomeric substances. This chapter does not apply to closures made from silicone elastomer; however, it does apply to closures treated with silicone (e.g., Dimethicone, *NF*). When performing the tests in this chapter, it is not required that closures be treated with silicone, although there is no restriction prohibiting the use of siliconized closures.

This chapter also applies to closures coated with other lubricious materials (e.g., materials chemically or mechanically bonded to the closure) that are not intended to, and in fact do not provide, a barrier to the base elastomer. When performing the tests, closures with lubricious non-barrier coatings are to be tested in their coated state.

The following comments relate solely to closures laminated or coated with materials intended to provide, or in fact function as, a barrier to the base elastomer (e.g., PTFE or lacquer coatings). It is not permissible to use a barrier material in an attempt to change a closure that does not meet compendial requirements to one that does conform. Therefore, all *Physicochemical Tests* apply to the base formula of such closures, as well as to the coated or laminated closure. To obtain *Physicochemical Tests* results, the tests are to be performed on uncoated or non-laminated closures of the same elastomeric compound, as well as to the laminated or coated closure. The *Functionality Tests* apply to and are to be performed using the laminated or coated elastomeric closure. *Biological Tests* apply to the lamination or coating material, as well as to the base formula. *Biological Tests* may be performed on the laminated or coated closure, or they may be performed on the laminate/coating material and the uncoated or non-laminated closures of the same elastomeric compound. In the latter case, the results are to be reported separately. The base formula used for physicochemical or biological tests intended to support the compendial compliance of a barrier-coated closure should be similar to the corresponding coated closure in configuration and size.

For all *Elastomeric Closures for Injection* ⟨381⟩ tests performed on any closure type, it is important to document the closure being tested, including a full description of the elastomer, and any lubrication, coating, laminations, or treatments applied.

This chapter states test limits for Type I and Type II elastomeric closures. Type I closures are those used for aqueous preparations. Type II closures are typically intended for nonaqueous preparations and are those which, having properties optimized for special uses, may not meet all requirements listed for Type I closures because of physical configuration, material of construction, or both. If a closure fails to meet one or more of the Type I test requirements, but still meets the Type II requirements for the test(s), the closure is assigned a final classification of Type II.

This chapter is intended as an initial screen to identify elastomeric closures that might be appropriate for use with injectable preparations on the basis of their biological compatibility, their aqueous extract physicochemical properties, and their functionality. All elastomeric closures suitable for use with injectable preparations comply with either Type I or Type II test limits. However, this specification is not intended to serve as the sole evaluation criteria for the selection of such closures.

The following closure evaluation requirements are beyond the scope of this chapter:

- The establishment of closure identification tests and specifications
- The verification of closure–product physicochemical compatibility
- The identification and safety determination of closure leachables found in the packaged product
- The verification of packaged product closure functionality under actual storage and use conditions

The manufacturer of the injectable product (the end user) must obtain from the closure supplier an assurance that the composition of the closure does not vary and that it is the same as that of the closure used during compatibility testing. When the supplier informs the end user of changes in the composition, compatibility testing must be repeated, totally or partly, depending on the nature of the changes. Closures must be properly stored, cleaned for removal of environmental contaminants and endotoxins, and sterilized prior to use in packaging injectable products.

Characteristics

Elastomeric closures are translucent or opaque and have no characteristic color, the latter depending on the additives used. They are homogeneous and practically free from flash and adventitious materials (e.g., fibers, foreign particles, and waste rubber.)

Identification

Closures are made of a wide variety of elastomeric materials and optional polymeric coatings. For this reason, it is beyond the scope of this chapter to specify identification tests that encompass all possible closure presentations. However, it is the responsibility of the closure supplier and the injectable product manufacturer (the end user) to verify the closure elastomeric formulation and any coating or laminate materials used according to suitable identification tests. Examples of some of the analytical test methodologies that may be used include specific gravity, percentage of ash analysis, sulfur content determination, FTIR-ATR test, thin-layer chromatography of an extract, UV absorption spectrophotometry of an extract, or IR absorption spectrophotometry of a pyrolysate.

Test Procedures

Elastomeric closures shall conform to biological, physicochemical, and functionality requirements both as they are shipped by the closure supplier to the injectable product manufacturer (the end user), and in their final ready-to-use state by the end user.

For those elastomeric closures processed by the supplier prior to distribution to the end user, the supplier shall demonstrate compendial conformance of closures exposed to such processing and/or sterilization steps. Similarly, if elastomeric closures received by the end user are subsequently processed or sterilized, the end user is responsible for demonstrating the continued conformance of closures to compendial requirements subsequent to such processing and/or sterilization conditions (i.e., in their ready-to-use state). This is especially important if closures shall be exposed to processes or conditions that may significantly impact the biological, physicochemical, or functionality characteristics of the closure (e.g., gamma irradiation).

For closures that are normally lubricated with silicone prior to use, it is permissible to perform physicochemical testing on non-lubricated closures, in order to avoid potential method interference and/or difficulties in interpreting test results. For closures supplied with other lubricious non-barrier coatings, all tests are to be performed using the coated closure.

For closures coated or laminated with coatings intended to provide a barrier function (e.g., PTFE or lacquer coatings), physicochemical compendial tests apply to the uncoated base elastomer, as well as to the coated closure. In this case, suppliers are responsible for demonstrating physicochemical compendial compliance of the coated closure, as well as of the uncoated closure, processed or treated in a manner simulating conditions typically followed by the supplier for such coated closures prior to shipment to the end user. The uncoated closure subject to physicochemical tests should be similar to the corresponding coated closure in size and configuration. End users of

Table 1

Closure Types (As Supplied or Used)	Test Requirements		
	Physicochemical Tests	**Functionality Tests**	**Biological Tests**
Closure with or without Silicone Coating	• Tests are to be performed. • Silicone use is optional. • Responsibility: supplier and end user	• Tests are to be performed. • Silicone use is optional. • Responsibility: supplier and end user	• Tests are to be performed. • Silicone use is optional. • Responsibility: supplier and end user
Closures with Lubricious Coating (Non-Barrier Material; Not Silicone)	• Tests are to be performed on coated closures. • Responsibility: supplier and end user	• Tests are to be performed on coated closures. • Responsibility: supplier and end user	• Tests are to be performed on coated closures. • Responsibility: supplier and end user
Closures with Barrier Coating	• Tests are to be performed on coated closures. • Responsibility: supplier and end user AND: • Tests are to be performed on uncoated closures (base formula). • Responsibility: supplier	• Tests are to be performed on coated closures. • Responsibility: supplier and end user	• Tests are to be performed on coated closures. OR: • Tests are to be performed on uncoated closures (base formula) and the laminate/coating material (report results separately). • Responsibility: supplier and end user

coated closures are also responsible for demonstrating the continued physicochemical compendial conformance of the coated closure, processed or treated in a manner simulating conditions typically employed by the end user prior to use.

In all cases, it is appropriate to document all conditions of closure processing, pretreatment, sterilization or lubrication when reporting test results.

Table 1 summarizes the testing requirements of closures, and the responsibilities of the supplier and the end user.

Biological Tests

Two stages of testing are indicated. The first stage is the performance of an in vitro test procedure as described in general test chapter *Biological Reactivity Tests, In Vitro* ⟨87⟩. Materials that do not meet the requirements of the in vitro test are subjected to the second stage of testing, which is the performance of the in vivo tests, *Systemic Injection Test and Intracutaneous Test*, according to the procedures set forth in the general test chapter *Biological Reactivity Tests, In Vivo* ⟨88⟩. Materials that meet the requirements of the in vitro test are not required to undergo in vivo testing.

Type I and Type II closures must both conform to the requirements of either the in vitro or the in vivo biological reactivity tests. [NOTE—Also see the general information chapter *The Biocompatibility of Material Used in Drug Containers, Medical Devices, and Implants* ⟨1031⟩.]

Physicochemical Tests

Preparation of Solution S

Place whole, uncut closures corresponding to a surface area of 100 ± 10 cm^2 into a suitable glass container. Cover the closures with 200 mL of Purified Water or Water for Injection. If it is not possible to achieve the prescribed closure surface area (100 ± 10 cm^2) using uncut closures, select the number of closures that will most closely approximate 100 cm^2, and adjust the volume of water used to the equivalent of 2 mL per each 1 cm^2 of actual closure surface area used. Boil for 5 minutes, and rinse five times with cold Purified Water or Water for Injection

Place the washed closures into a Type I glass wide-necked flask (see *Containers—Glass* ⟨660⟩), add the same quantity of Purified Water or Water for Injection initially added to the closures, and weigh. Cover the mouth of the flask with a Type I glass beaker. Heat in an autoclave so that a temperature of 121 ± 2°C is reached within 20 to 30 minutes, and maintain this temperature for 30 minutes. Cool to room temperature over a period of about 30 minutes. Add Purified Water or Water for Injection to bring it up to the original mass. Shake, and immediately decant and collect the solution. [NOTE—This solution must be shaken before being used in each of the tests.]

Preparation of Blank

Prepare a blank solution similarly, using 200 mL of Purified Water or Water for Injection omitting the closures.

Appearance of Solution (Turbidity/ Opalescence and Color)

Determination of Turbidity (Opalescence)

NOTE—The determination of turbidity may be performed by visual comparison (*Procedure A*), or instrumentally using a suitable ratio turbidimeter (*Procedure B*). For a discussion of turbidimetry, see *Spectrophotometry and Light-Scattering* ⟨851⟩. Instrumental assessment of clarity provides a more discriminatory test that does not depend on the visual acuity of the analyst.

Hydrazine Sulfate Solution—Dissolve 1.0 g of hydrazine sulfate, in water and dilute with water to 100.0 mL. Allow to stand for 4 to 6 hours.

Hexamethylenetetramine Solution—Dissolve 2.5 g of hexmethylenetetramine in 25.0 mL of water in a 100 mL glass– stoppered flask.

Opalescence Stock Suspension—Add 25.0 mL of *Hydrazine Sulfate Solution* to the *Hexamethylenetetramine Solution* in the flask. Mix, and allow to stand for 24 hours. This suspension is stable for 2 months, provided it is stored in a glass container free from surface defects. The suspension must not adhere to the glass and must be well mixed before use.

Opalescence Standard Suspension—Prepare a suspension by diluting 15.0 mL of the *Opalescence Stock Suspension* with water to 1000.0 mL. *Opalescence Standard Suspension* is stable for about 24 hours after preparation.

Reference Suspensions—Prepare according to *Table 2*. Mix and shake before use. [NOTE—Stabilized formazin suspensions that can be used to prepare stable, diluted turbidity standards are available commercially and may be used after comparison with the standards prepared as described.]

Table 2

	Reference Suspension A	Reference Suspension B	Reference Suspension C	Reference Suspension D
Standard of Opalescence	5.0 mL	10.0 mL	30.0 mL	50.0 mL
Water	95.0 mL	90.0 mL	70.0 mL	50.0 mL
Nephelometric turbidity units	3 NTU	6 NTU	18 NTU	30 NTU

Table 3

	Comparison Method	
Opalescence Requirements	Procedure A (Visual)	Procedure B (Instrumental)
Type I closures	no more opalescent that Suspension B	no more than 6 NTU
Type II closures	no more opalescent than Suspension C	no more than 18 NTU

Procedure A: Visual Comparison—Use identical test tubes made of colorless, transparent, neutral glass with a flat base and an internal diameter of 15 to 25 mm. Fill one tube to a depth of 40 mm with *Solution S*, one tube to the same depth with water, and four others to the same depth with *Reference Suspensions A, B, C,* and *D*. Compare the solutions in diffuse daylight 5 minutes after preparation of the *Reference Suspensions*, viewing vertically against a black background. The light conditions shall be such that *Reference Suspension A* can be readily distinguished from water and that *Reference Suspension B* can be readily distinguished from *Reference Suspension A*.

REQUIREMENT—*Solution S* is not more opalescent than *Reference Suspension B* for Type I closures, and not more opalescent than *Reference Suspension C* for Type II closures. *Solution S* is considered clear if its clarity is the same as that of water when examined as described above, or if its opalescence is not more pronounced than that of *Reference Suspension A* (refer to *Table 3*).

Procedure B: Instrumental Comparison—Measure the turbidity of the *Reference Suspensions* in a suitable calibrated turbidimeter (see *Spectrophotometry and Light Scattering* ⟨851⟩). The blank should be run and the results corrected for the blank. *Reference Suspensions A, B, C,* and *D* represent 3, 6, 18 and 30 Nephelometric Turbidity Units (NTU), respectively. Measure the turbidity of *Solution S* using the calibrated turbidimeter.

REQUIREMENT—The turbidity of *Solution S* is not greater than that for *Reference Suspension B* (6 NTU FTU) for Type I closures, and is not greater than that for *Reference Suspension C* (18 NTU FTU) for Type II closures (refer to *Table 3*).

Determination of Color

Color Standard—Prepare a solution by diluting 3.0 mL of *Matching Fluid O* (see *Color and Achromicity* ⟨631⟩) with 97.0 mL of diluted hydrochloric acid.

Procedure—Use identical tubes made of colorless, transparent, neutral glass with a flat base and an internal diameter of 15 to 25 mm. Fill one tube to a depth of 40 mm with *Solution S*, and the second with *Color Standard*. Compare the liquids in diffuse daylight, viewing vertically against a white background.

Requirement—*Solution S* is not more intensely colored than the *Color Standard*.

Acidity or Alkalinity

Bromothymol Blue Solution—Dissolve 50 mg of bromothymol blue in a mixture of 4 mL of 0.02 M sodium hydroxide and 20 mL of alcohol. Dilute with water to 100 mL.

Procedure—To 20 ml of *Solution S* add 0.1 ml of *Bromothymol Blue Solution*. If the solution is yellow, titrate with 0.01 N sodium hydroxide until a blue endpoint is reached. If the solution is blue, titrate with 0.01 N hydrochloric acid until a yellow endpoint is reached. If the solution is green, it is neutral and no titration is required.

Blank Correction—Test 20 mL of *Blank* similarly. Correct the results obtained for *Solution S* by subtracting or adding the volume of titrant required for the *Blank*, as appropriate. (*Reference Titrimetry* ⟨541⟩.)

Requirement—Not more than 0.3 ml of 0.01 N sodium hydroxide produces a blue color, or not more than 0.8 ml of 0.01 N hydrochloric acid produces a yellow color, or no titration is required.

Absorbance

Procedure—[NOTE—Perform this test within 5 hours of preparing *Solution S*.] Filter *Solution S* through a 0.45-µm pore size filter, discarding the first few mL of filtrate. Measure the absorbance of the filtrate at wavelengths between 220 and 360 nm in a 1-cm cell using the blank in a matched cell in the reference beam. If dilution of the filtrate is required before measurement of the absorbance, correct the test results for the dilution.

Requirement—The absorbances at these wavelengths do not exceed 0.2 for Type I closures or 4.0 for Type II closures.

Reducing Substances

Procedure—[NOTE—Perform this test within 4 hours of preparing *Solution S*.] To 20.0 mL of *Solution S* add 1 mL of diluted sulfuric acid and 20.0 mL of 0.002 M potassium permanganate. Boil for 3 minutes. Cool, add 1 g of potassium iodide, and titrate immediately with 0.01 M sodium thiosulfate, using 0.25 mL of starch solution TS as the indicator. Perform a titration using 20.0 mL of blank and note the difference in volume of 0.01 M sodium thiosulfate required.

Requirement—The difference between the titration volumes is not greater than 3.0 mL for Type I closures and not greater than 7.0 mL for Type II closures.

Heavy Metals

Procedure—Proceed as directed for *Method 1* under *Heavy Metals* ⟨231⟩. Prepare the *Test Preparation* using 10.0 mL of *Solution S*.

Requirement—*Solution S* contains not more than 2 ppm of heavy metals as lead.

Extractable Zinc

Test Solution—Prepare a *Test Solution* by diluting 10.0 mL of *Solution S* to 100 mL with 0.1N hydrochloric acid. Prepare a test blank similarly, using the *Blank* for *Solution S*.

Zinc Standard Solution—Prepare a solution (10 ppm Zn) by dissolving zinc sulfate in 0.1 N hydrochloric acid.

Reference Solutions—Prepare not fewer than 3 *Reference Solutions* by diluting the *Zinc Standard Solution* with 0.1 N hydrochloric

acid. The concentrations of zinc in these *Reference Solutions* are to span the expected limit of the *Test Solution*.

Procedure—Use a suitable atomic absorption spectrophotometer (see *Spectrophotometry and Light Scattering* ⟨851⟩) equipped with a zinc hollow-cathode lamp and an air–acetylene flame. An alternative procedure such as an appropriately validated inductively coupled plasma analysis (ICP) may be used.

Test each of the *Reference Solutions* at the zinc emission line of 213.9 nm at least 3 times. Record the steady readings. Rinse the apparatus with the test blank solution each time, to ensure that the reading returns to initial blank value. Prepare a calibration curve from the mean of the readings obtained for each *Reference Solution*. Record the absorbance of the *Test Solution*. Determine the ppm zinc concentration of the *Test Solution* using the calibration curve.

Requirement—*Solution S* contains not more than 5 ppm of extractable zinc.

Ammonium

Alkaline Potassium Tetraiodomercurate Solution—Prepare a 100 mL solution containing 11 g of potassium iodide and 15 g of mercuric iodide in water. Immediately before use, mix 1 volume of this solution with an equal volume of a 250 g per L solution of sodium hydroxide.

Test Solution—Dilute 5 mL of *Solution S* to 14 mL with water. Make alkaline if necessary by adding 1 N sodium hydroxide, and dilute with water to 15 mL. Add 0.3 mL of *Alkaline Potassium Tetraiodomercurate Solution,* and close the container.

Ammonium Standard Solution—Prepare a solution of ammonium chloride in water (1 ppm NH_4). Mix 10 mL of the 1 ppm ammonium chloride solution with 5 mL water and 0.3 mL of *Alkaline Potassium Tetraiodomercurate Solution*. Close the container.

Requirement—After 5 minutes, any yellow color in the *Test Solution* is no darker than the *Ammonium Standard Solution* (no more than 2 ppm of NH_4 in *Solution S*).

Volatile Sulfides

Procedure—Place closures, cut if necessary, with a total surface area of 20 ± 2 cm^2 in a 100-mL flask, and add 50 mL of a 20 g per L citric acid solution. In the same manner and at the same time, prepare a control solution in a separate 100-mL flask by dissolving 0.154 mg of sodium sulfide in 50 mL of a 20 g per L citric acid solution. Place a piece of lead acetate paper over the mouth of each flask, and hold the paper in position by placing over it an inverted weighing bottle. Heat the flasks in an autoclave at 121 ± 2° for 30 minutes.

Requirement—Any black stain on the paper produced by *Solution S* is not more intense than that produced by the control solution.

Functionality Tests

NOTE—Samples treated as described for preparation of *Solution S* and air dried should be used for *Functionality Tests* of *Penetrability, Fragmentation,* and *Self-Sealing Capacity. Functionality Tests* are performed on closures intended to be pierced by a hypodermic needle. The *Self-Sealing Capacity* test is required only for closures intended for multiple-dose containers. The needle specified for each test is a lubricated long bevel (bevel angle 12 ± 2°) hypodermic needle[1].

[1]Refer to ISO 7864, Sterile hypodermic needles for single use with an external diameter of 0.8 mm (21 Gauge).

Penetrability

Procedure—Fill 10 suitable vials to the nominal volume with water, fit the closures to be examined, and secure with a cap. Using a new hypodermic needle as described above for each closure, pierce the closure with the needle perpendicular to the surface.

Requirement—The force for piercing is no greater than 10 N (1 kgf) for each closure, determined with an accuracy of ± 0.25 N (25 gf).

Fragmentation

Closures for Liquid Preparations—Fill 12 clean vials with water to 4 mL less than the nominal capacity. Fit the closures to be examined, secure with a cap, and allow to stand for 16 hours.

Closures for Dry Preparations—Fit closures to be examined into 12 clean vials, and secure each with a cap.

Procedure—Using a hypodermic needle as described above fitted to a clean syringe, inject into each vial 1 mL of water while removing 1 mL of air. Repeat this procedure 4 times for each closure, piercing each time at a different site. Use a new needle for each closure, checking that it is not blunted during the test. Filter the total volume of liquid in all the vials through a single filter with a nominal pore size no greater than 0.5 μm. Count the rubber fragments on the surface of the filter visible to the naked eye.

Requirement—There are no more than 5 fragments visible. This limit is based on the assumption that fragments with a diameter >50 μm are visible to the naked eye. In case of doubt or dispute, the particles are examined microscopically to verify their nature and size.

Self-Sealing Capacity

Procedure—Fill 10 suitable vials with water to the nominal volume. Fit the closures that are to be examined, and cap. Using a new hypodermic needle as described above for each closure, pierce each closure 10 times, piercing each time at a different site. Immerse the 10 vials in a solution of 0.1% (1 g per L) methylene blue, and reduce the external pressure by 27 kPa for 10 minutes. Restore to atmospheric pressure, and leave the vials immersed for 30 minutes. Rinse the outside of the vials.

Requirement—None of the vials contain any trace of blue solution.

⟨621⟩ Chromatography

Introduction

This chapter defines the terms and procedures used in chromatography and provides general information. Specific requirements for chromatographic procedures for drug substances and dosage forms, including adsorbent and developing solvents, are given in the individual monographs.

Chromatography is defined as a procedure by which solutes are separated by a dynamic differential migration process in a system consisting of two or more phases, one of which moves continuously in a given direction and in which the individual substances exhibit different mobilities by reason of differences in adsorption, partition, solubility, vapor pressure, molecular size, or ionic charge density. The individual substances thus separated can be identified or determined by analytical procedures.

The general chromatographic technique requires that a solute undergo distribution between two phases, one of them fixed (stationary phase), the other moving (mobile phase). It is the mobile phase

that transfers the solute through the medium until it eventually emerges separated from other solutes that are eluted earlier or later. Generally, the solute is transported through the separation medium by means of a flowing stream of a liquid or a gaseous solvent known as the "eluant." The stationary phase may act through adsorption, as in the case of adsorbents such as activated alumina and silica gel, or it may act by dissolving the solute, thus partitioning the latter between the stationary and mobile phases. In the latter process, a liquid coated onto an inert support, or chemically bonded onto silica gel, or directly onto the wall of a fused silica capillary, serves as the stationary phase. Partitioning is the predominant mechanism of separation in gas–liquid chromatography, paper chromatography, in forms of column chromatography, and in thin-layer chromatography designated as liquid-liquid chromatography. In practice, separations frequently result from a combination of adsorption and partitioning effects. Other separation principles include ion exchange, ion-pair formation, size exclusion, hydrophobic interaction, and chiral recognition.

The types of chromatography useful in qualitative and quantitative analysis that are employed in the *USP* procedures are column, gas, paper, thin-layer, (including high-performance thin-layer chromatography), and pressurized liquid chromatography (commonly called high-pressure or high-performance liquid chromatography). Paper and thin-layer chromatography are ordinarily more useful for purposes of identification, because of their convenience and simplicity. Column chromatography offers a wider choice of stationary phases and is useful for the separation of individual compounds, in quantity, from mixtures. Modern high-performance thin-layer chromatography, gas chromatography, and pressurized liquid chromatography require more elaborate apparatus but usually provide high resolution and identify and quantitate very small amounts of material.

Use of Reference Substances in Identity Tests—In paper and thin-layer chromatography, the ratio of the distance (this distance being measured to the point of maximum intensity of the spot or zone) traveled on the medium by a given compound to the distance traveled by the front of the mobile phase, from the point of application of the test substance, is designated as the R_F value of the compound. The ratio between the distances traveled by a given compound and a reference substance is the R_R value. R_F values vary with the experimental conditions, and thus identification is best accomplished where an authentic specimen of the compound in question is used as a reference substance on the same chromatogram.

For this purpose, chromatograms are prepared by applying on the thin-layer adsorbent or on the paper in a straight line, parallel to the edge of the chromatographic plate or paper, solutions of the substance to be identified, the authentic specimen, and a mixture of nearly equal amounts of the substance to be identified and the authentic specimen. Each sample application contains approximately the same quantity by weight of material to be chromatographed. If the substance to be identified and the authentic specimen are identical, all chromatograms agree in color and R_F value and the mixed chromatogram yields a single spot; i.e., R_R is 1.0.

Location and Identification of Components—The spots produced by paper or thin-layer chromatography may be located by: (1) direct inspection if the compounds are visible under white or either short-wavelength (254 nm) or long-wavelength (360 nm) UV light, (2) inspection in white or UV light after treatment with reagents that will make the spots visible (reagents are most conveniently applied with an atomizer), (3) use of a Geiger-Müller counter or autoradiographic techniques in the case of the presence of radioactive substances, or (4) evidence resulting from stimulation or inhibition of bacterial growth by the placing of removed portions of the adsorbent and substance on inoculated media.

In open-column chromatography, in pressurized liquid chromatography performed under conditions of constant flow rate, and in gas chromatography, the retention time, *t*, defined as the time elapsed between sample injection and appearance of the peak concentration of the eluted sample zone, may be used as a parameter of identification. Solutions of the substance to be identified or derivatives thereof, of the reference compound, and of a mixture of equal amounts of these two are chromatographed successively on the same column under the same chromatographic conditions. Only one peak should be observed for the mixture. The ratio of the retention times of the test substance, the reference compound, and a mixture of these, to the retention time of an internal standard is called the relative retention time R_R and is also used frequently as a parameter of identification.

The deviations of R_R, R_F, or t values measured for the test substance from the values obtained for the reference compound and mixture should not exceed the reliability estimates determined statistically from replicate assays of the reference compound.

Chromatographic identification by these methods under given conditions strongly indicates identity but does not constitute definitive identification. Coincidence of identity parameters under three to six different sets of chromatographic conditions (temperatures, column packings, adsorbents, eluants, developing solvents, various chemical derivatives, etc.) increases the probability that the test and reference substances are identical. However, many isomeric compounds cannot be separated. Specific and pertinent chemical, spectroscopic, or physicochemical identification of the eluted component combined with chromatographic identity is the most valid criterion of identification. For this purpose, the individual components separated by chromatography may be collected for further identification.

Paper Chromatography

In paper chromatography the adsorbent is a sheet of paper of suitable texture and thickness. Chromatographic separation may proceed through the action of a single liquid phase in a process analogous to adsorption chromatography in columns. Since the natural water content of the paper, or selective imbibition of a hydrophilic component of the liquid phase by the paper fibers, may be regarded as a stationary phase, a partitioning mechanism may contribute significantly to the separation.

Alternatively, a two-phase system may be used. The paper is impregnated with one of the phases, which then remains stationary (usually the more polar phase in the case of unmodified paper). The chromatogram is developed by slow passage of the other, mobile phase over the sheet. Development may be ascending, in which case the solvent is carried up the paper by capillary forces, or descending, in which case the solvent flow is also assisted by gravitational force.

Differences in the value of R_F have been reported where chromatograms developed in the direction of the paper grain (machine direction) are compared with others developed at right angles to the grain; therefore, the orientation of paper grain with respect to solvent flow should be maintained constant in a series of chromatograms. (The machine direction is usually designated by the manufacturer on packages of chromatography paper.)

Descending Chromatography

In descending chromatography, the mobile phase flows downward on the chromatographic sheet.

Apparatus—The essential equipment for descending chromatography consists of the following:

A *vapor-tight chamber* provided with inlets for addition of solvent or for releasing internal pressure. The chamber is constructed preferably of glass, stainless steel, or porcelain and is so designed as to permit observation of the progress of the chromatographic run without opening of the chamber. Tall glass cylinders are convenient if they are made vapor-tight with suitable covers and a sealing compound.

A *rack of corrosion-resistant material* about 5 cm shorter than the inside height of the chamber. The rack serves as a support for solvent troughs and for antisiphon rods which, in turn, hold up the chromatographic sheets.

One or more *glass troughs* capable of holding a volume of solvent greater than that needed for one chromatographic run. The troughs must also be longer than the width of the chromatographic sheets.

Heavy glass antisiphon rods to be supported by the rack and running outside of, parallel to, and slightly above the edge of the glass trough.

Chromatographic sheets of special filter paper at least 2.5 cm wide and not wider than the length of the troughs are cut to a length approximately equal to the height of the chamber. A fine pencil line is drawn horizontally across the filter paper at a distance from one end such that, when the sheet is suspended from the antisiphon rods with the upper end of the paper resting in the trough and the lower portion hanging free into the chamber, the line is located a few centimeters below the rods. Care is necessary to avoid contaminating the filter paper by excessive handling or by contact with dirty surfaces.

Procedure—The substance or substances to be analyzed are dissolved in a suitable solvent. Convenient volumes, delivered from suitable micropipets, of the resulting solution, normally containing 1 to 20 µg of the compound, are placed in 6- to 10-mm spots not less than 3 cm apart along the pencil line. If the total volume to be applied would produce spots of a diameter greater than 6 to 10 mm, it is applied in separate portions to the same spot, each portion being allowed to dry before the next is added.

The spotted chromatographic sheet is suspended in the chamber by use of the antisiphon rod, which holds the upper end of the sheet in the solvent trough. The bottom of the chamber is covered with the prescribed solvent system. Saturation of the chamber with solvent vapor is facilitated by lining the inside walls with paper that is wetted with the prescribed solvent system. It is important to ensure that the portion of the sheet hanging below the rods is freely suspended in the chamber without touching the rack or the chamber walls or the fluid in the chamber. The chamber is sealed to allow equilibration (saturation) of the chamber and the paper with the solvent vapor. Any excess pressure is released as necessary. For large chambers, equilibration overnight may be necessary.

A volume of the mobile phase in excess of the volume required for complete development of the chromatogram is saturated with the immobile phase by shaking. After equilibration of the chamber, the prepared mobile solvent is introduced into the trough through the inlet. The inlet is closed and the mobile solvent phase is allowed to travel the desired distance down the paper. Precautions must be taken against allowing the solvent to run down the sheet when opening the chamber and removing the chromatogram. The location of the solvent front is quickly marked, and the sheets are dried.

The chromatogram is observed and measured directly or after suitable development to reveal the location of the spots of the isolated drug or drugs. The paper section(s) predetermined to contain the isolated drug(s) may be cut out and eluted by an appropriate solvent, and the solutions may be made up to a known volume and quantitatively analyzed by appropriate chemical or instrumental techniques. Similar procedures should be conducted with various amounts of similarly spotted reference standard on the same paper in the concentration range appropriate to prepare a valid calibration curve.

Ascending Chromatography

In ascending chromatography, the lower edge of the sheet (or strip) is dipped into the mobile phase to permit the mobile phase to rise on the chromatographic sheet by capillary action.

Apparatus—The essential equipment for ascending chromatography is substantially the same as that described under *Descending Chromatography*.

Procedure—The test materials are applied to the chromatographic sheets as directed under *Descending Chromatography,* and above the level to which the paper is dipped into the developing solvent. The bottom of the developing chamber is covered with the developing solvent system. If a two-phase system is used, both phases are added. It is also desirable to line the walls of the chamber with paper and to saturate this lining with the solvent system. Empty solvent troughs are placed on the bottom of the chamber, and the chromatographic sheets are suspended so that the end on which the spots have been added hangs free inside the empty trough.

The chamber is sealed, and equilibration is allowed to proceed as described under *Descending Chromatography*. Then the developing solvent (mobile phase) is added through the inlet to the trough in excess of the solvent required for complete moistening of the chromatographic sheet. The chamber is resealed. When the solvent front has reached the desired height, the chamber is opened and the sheet is removed and dried.

Quantitative analyses of the spots may be conducted as described under *Descending Chromatography*.

Thin-Layer Chromatography

In thin-layer chromatography, the adsorbent is a relatively thin, uniform layer of dry, finely powdered material applied to a glass, plastic, or metal sheet or plate, glass plates being most commonly employed. The coated plate can be considered an "open chromatographic column" and the separations achieved may be based upon adsorption, partition, or a combination of both effects, depending on the particular type of stationary phase, its preparation, and its use with different solvents. Thin-layer chromatography on ion-exchange layers can be used for the fractionation of polar compounds. Presumptive identification can be effected by observation of spots or zones of identical R_F value and about equal magnitude obtained, respectively, with an unknown and a reference sample chromatographed on the same plate. A visual comparison of the size or intensity of the spots or zones may serve for semiquantitative estimation. Quantitative measurements are possible by means of densitometry (absorbance or fluorescence measurements), or the spots may be carefully removed from the plate, followed by elution with a suitable solvent and spectrophotometric measurement. For two-dimensional thin-layer chromatography, the chromatographed plate is turned at a right angle and again chromatographed, usually in another chamber equilibrated with a different solvent system.

Apparatus—Acceptable apparatus and materials for thin-layer chromatography consist of the following.

A *TLC or HPTLC plate*. The chromatography is generally carried out using *precoated plates* or *sheets* (on glass, aluminum, or polyester support) of suitable size. It may be necessary to clean the plates prior to separation. This can be done by migration of, or immersion in, an appropriate solvent. The plates may also be impregnated by procedures such as development, immersion, or spraying. At the time of use, the plates may be activated, if necessary, by heating in an oven at 120° for 20 minutes. The *stationary phase* of TLC plates has an average particle size of 10–15 µm, and that of HPTLC plates an average particle size of 5 µm. Commercial plates with a preadsorbant zone can be used if they

are specified in a monograph. Sample applied to the preabsorbant region develops into sharp, narrow bands at the preabsorbant-sorbent interface. Alternatively, flat *glass plates* of convenient size, typically 20 cm × 20 cm can be coated as described under *Preparation of Chromatographic Plates*.

A suitable *manual, semiautomatic, or automatic application device* can be used to ensure proper positioning of the plate and proper transfer of the sample, with respect to volume and position, onto the plate. Alternatively, a *template* can be used to guide in manually placing the test spots at definite intervals, to mark distances as needed, and to aid in labeling the plates. For the proper application of the solutions, *micropipets, microsyringes, or calibrated disposable capillaries* are recommended.

For ascending development, a *chromatographic chamber* made of inert, transparent material and having the following specifications is used: a flat bottom or twin trough, a tightly fitted lid, and a size suitable for the plates. For horizontal development, the chamber is provided with a reservoir for the mobile phase, and it also contains a device for directing the mobile phase to the stationary phase.

Devices for transfer of reagents onto the plate by spraying, immersion, or exposure to vapor and devices to facilitate any necessary heating for visualization of the separated spots or zones.

A *UV light source* suitable for observations under short (254 nm) and long (365 nm) wavelength UV light.

A suitable *device for documentation* of the visualized chromatographic result.

Procedure—Apply the prescribed volume of the test solution and the standard solution in sufficiently small portions to obtain circular spots of 2 to 5 mm in diameter (1 to 2 mm on HPTLC plates) or bands of 10 to 20 mm by 1 to 2 mm (5 to 10 mm by 0.5 to 1 mm on HPTLC plates) at an appropriate distance from the lower edge—during chromatography the application position must be at least 3 mm (HPTLC) or 5 mm (TLC) above the level of the developing solvent—and from the sides of the plate. Apply the solutions on a line parallel to the lower edge of the plate with an interval of at least 10 mm (5 mm on HPTLC plates) between the centers of spots or 4 mm (2 mm on HPTLC plates) between the edges of bands, and allow to dry.

Ascending Development—Line at least one wall of the chromatographic chamber with filter paper. Pour into the chromatographic chamber a quantity of the mobile phase sufficient for the size of the chamber to give, after impregnation of the filter paper, a level of depth appropriate to the dimension of the plate used. For saturation of the chromatographic chamber, close the lid, and allow the system to equilibrate. Unless otherwise indicated, the chromatographic separation is performed in a saturated chamber.

Place the plate in the chamber, ensuring that the plate is as vertical as possible and that the spots or bands are above the surface of the mobile phase, and close the chamber. The stationary phase faces the inside of the chamber. Remove the plate when the mobile phase has moved over the prescribed distance. Dry the plate, and visualize the chromatograms as prescribed. For two-dimensional chromatography, dry the plates after the first development, and carry out a second development in a direction perpendicular to that of the first development.

Horizontal Development—Introduce a sufficient quantity of the developing solvent into the reservoir of the chamber using a syringe or pipet. Place the plate horizontally in the chamber, connect the mobile phase direction device according to the manufacturer's instructions, and close the chamber. If prescribed, develop the plate starting simultaneously at both ends. Remove the plate when the mobile phase has moved over the distance prescribed in the monograph. Dry the plate, and visualize the chromatograms as prescribed.

For two-dimensional chromatography, dry the plates after the first development, and carry out a second development in a direction perpendicular to that of the first development.

Detection—Observe the dry plate first under short-wavelength UV light (254 nm) and then under long-wavelength UV light (365 nm) or as stated in the monograph. If further directed, spray, immerse, or expose the plate to vapors of the specified reagent, heat the plate when required, observe, and compare the test chromatogram with the standard chromatogram. Document the plate after each observation. Measure and record the distance of each spot or zone from the point of origin, and indicate for each spot or zone the wavelength under which it was observed. Determine the R_f values for the principal spots or zones (see *Glossary of Symbols*).

Quantitative Measurement—Using appropriate instrumentation, substances separated by TLC and responding to ultraviolet-visible (UV-Vis) irradiation prior to or after derivatization can be determined directly on the plate. While moving the plate or the measuring device, the plate is examined by measuring the reflectance of the incident light. Similarly, fluorescence may be measured using an appropriate optical system. Substances containing radionuclides can be quantified in three ways: (1) directly by moving the plate alongside a suitable counter or vice versa; (2) by cutting the plates into strips and measuring the radioactivity on each individual strip using a suitable counter; or (3) by scraping off the stationary phase, dissolving it in a suitable scintillation cocktail, and measuring the radioactivity using a liquid scintillation counter (see *Radioactivity* ⟨821⟩).

The apparatus for direct quantitative measurement on the plate is a densitometer that is composed of a mechanical device to move the plate or the measuring device along the *x*-axis and the *y*-axis, a recorder, a suitable integrator or a computer; and, for substances responding to UV-Vis irradiation, a photometer with a source of light, an optical device capable of generating monochromatic light, and a photo cell of adequate sensitivity, all of which are used for the measurement of reflectance. In the case where fluorescence is measured, a suitable filter is also required to prevent the light used for excitation from reaching the photo cell while permitting the emitted light or specific portions thereof to pass. The linearity range of the counting device must be verified.

For quantitative tests, it is necessary to apply to the plate not fewer than three standard solutions of the substance to be examined, the concentrations of which span the expected value in the test solution (e.g., 80%, 100%, and 120%). Derivatize with the prescribed reagent, if necessary, and record the reflectance or fluorescence in the chromatograms obtained. Use the measured results for the calculation of the amount of substance in the test solution.

Preparation of Chromatographic Plates—

Apparatus—

Flat *glass plates* of convenient size, typically 20 cm × 20 cm.

An *aligning tray* or a flat surface upon which to align and rest the plates during the application of the adsorbent.

A *storage rack* to hold the prepared plates during drying and transportation. The rack holding the plates should be kept in a desiccator or be capable of being sealed in order to protect the plates from the environment after removal from the drying oven.

The *adsorbent* consists of finely divided adsorbent materials, normally 5 to 40 µm in diameter, suitable for chromatography. It can be applied directly to the glass plate or can be bonded to the plate by means of plaster of Paris [calcium sulfate hemihydrate (at a ratio of 5% to 15%)] or with starch paste or other binders. The plaster of Paris will not yield as hard a surface as will the starch, but it is not affected by strongly oxidizing spray reagents. The adsorbent may contain fluorescing material to aid in the visualization of spots that absorb UV light.

A *spreader,* which, when moved over the glass plate, will apply a uniform layer of adsorbent of desired thickness over the entire surface of the plate.

Procedure—[NOTE—In this procedure, use Purified Water that is obtained by distillation.] Clean the glass plates scrupulously, using an appropriate cleaning solution (see *Cleaning Glass Apparatus* ⟨1051⟩), rinsing them with copious quantities of water until the water runs off the plates without leaving any visible water or oily spots, then dry. It is important that the plates be completely free from lint and dust when the adsorbent is applied.

Arrange the plate or plates on the aligning tray, place a 5- × 20-cm plate adjacent to the front edge of the first square plate and another 5- × 20-cm plate adjacent to the rear edge of the last square, and secure all of the plates so that they will not slip during the application of the adsorbent. Position the spreader on the end plate opposite the raised end of the aligning tray. Mix 1 part of adsorbent with 2 parts of water (or in the ratio suggested by the supplier) by shaking vigorously for 30 seconds in a glass-stoppered conical flask, and transfer the slurry to the spreader. Usually 30 g of adsorbent and 60 mL of water are sufficient for five 20- × 20-cm plates. Complete the application of adsorbents using plaster of Paris binder within 2 minutes of the addition of the water, because thereafter the mixture begins to harden. Draw the spreader smoothly over the plates toward the raised end of the aligning tray, and remove the spreader when it is on the end plate next to the raised end of the aligning tray. (Wash away all traces of adsorbent from the spreader immediately after use.) Allow the plates to remain undisturbed for 5 minutes, then transfer the square plates, layer side up, to the storage rack, and dry at 105° for 30 minutes. Preferably place the rack at an angle in the drying oven to prevent the condensation of moisture on the back sides of plates in the rack. When the plates are dry, allow them to cool to room temperature, and inspect the uniformity of the distribution and the texture of the adsorbent layer; transmitted light will show uniformity of distribution, and reflected light will show uniformity of texture. Store the satisfactory plates over silica gel in a suitable chamber.

Column Chromatography

Apparatus—The apparatus required for column chromatographic procedures is simple, consisting only of the chromatographic tube itself and a tamping rod, which may be needed to pack a pledget of glass wool or cotton, if needed, in the base of the tube and compress the adsorbent or slurry uniformly within the tube. In some cases a porous glass disk is sealed at the base of the tube in order to support the contents. The tube is cylindrical and is made of glass, unless another material is specified in the individual monograph. A smaller-diameter delivery tube is fused or otherwise attached by a leakproof joint to the lower end of the main tube. Column dimensions are variable; the dimensions of those commonly used in pharmaceutical analysis range from 10 to 30 mm in uniform inside diameter and 150 to 400 mm in length, exclusive of the delivery tube. The delivery tube, usually 3 to 6 mm in inside diameter, may include a stopcock for accurate control of the flow rate of solvents through the column. The tamping rod, a cylindrical ram firmly attached to a shaft, may be constructed of plastic, glass, stainless steel, or aluminum, unless another material is specified in the individual monograph. The shaft of the rod is substantially smaller in diameter than the column and is not less than 5 cm longer than the effective length of the column. The ram has a diameter about 1 mm smaller than the inside diameter of the column.

Column Adsorption Chromatography

The adsorbent (such as activated alumina or silica gel, calcined diatomaceous silica, or chromatographic purified siliceous earth) as a dry solid or as a slurry is packed into a glass or quartz chromatographic tube. A solution of the drug in a small amount of solvent is added to the top of the column and allowed to flow into the adsorbent. The drug principles are quantitatively removed from the solution and are adsorbed in a narrow transverse band at the top of the column. As additional solvent is allowed to flow through the column, either by gravity or by application of air pressure, each substance progresses down the column at a characteristic rate resulting in a spatial separation to give what is known as the *chromatogram*. The rate of movement for a given substance is affected by several variables, including the adsorptive power of the adsorbent and its particle size and surface area; the nature and polarity of the solvent; the hydrostatic head or applied pressure; and the temperature of the chromatographic system.

If the separated compounds are colored or if they fluoresce under UV light, the adsorbent column may be extruded and, by transverse cuts, the appropriate segments may then be isolated. The desired compounds are then extracted from each segment with a suitable solvent. If the compounds are colorless, they may be located by means of painting or spraying the extruded column with color-forming reagents. Chromatographed radioactive substances may be located by means of Geiger-Müller detectors or similar sensing and recording instruments. Clear plastic tubing made of a material such as nylon, which is inert to most solvents and transparent to short-wavelength UV light, may be packed with adsorbent and used as a chromatographic column. Such a column may be sliced with a sharp knife without removing the packing from the tubing. If a fluorescent adsorbent is used, the column may be marked under UV light in preparation for slicing.

A "flowing" chromatogram, which is extensively used, is obtained by a procedure in which solvents are allowed to flow through the column until the separated drug appears in the effluent solution, known as the "eluate." The drug may be determined in the eluate by titration or by a spectrophotometric or colorimetric method, or the solvent may be evaporated, leaving the drug in more or less pure form. If a second drug principle is involved, it is eluted by continuing the first solvent or by passing a solvent of stronger eluting power through the column. The efficiency of the separation may be checked by obtaining a thin-layer chromatogram on the individual fractions.

A modified procedure for adding the mixture to the column is sometimes employed. The drug, in a solid form, and, as in the case of a powdered tablet, without separation from the excipients, is mixed with some of the adsorbent and added to the top of a column. The subsequent flow of solvent moves the drug down the column in the manner described.

Column Partition Chromatography

In partition chromatography the substances to be separated are partitioned between two immiscible liquids, one of which, the immobile phase, is adsorbed on a *Solid Support,* thereby presenting a very large surface area to the flowing solvent or mobile phase. The exceedingly high number of successive liquid-liquid contacts allows an efficiency of separation not achieved in ordinary liquid-liquid extraction.

The *Solid Support* is usually polar, and the adsorbed immobile phase more polar than the mobile phase. The *Solid Support* that is most widely used is chromatographic siliceous earth having a particle size suitable to permit proper flow of eluant.[1] In reverse-phase partition chromatography the adsorbed immobile phase is less polar than the mobile phase and the solid adsorbent is rendered nonpolar by treatment with a silanizing agent, such as dichlorodimethylsilane, to give silanized chromatographic siliceous earth.

[1] A suitable grade is acid-washed Celite 545, available from Johns-Manville Corp., 22 East 40th St., New York, NY 10016.

The sample to be chromatographed is usually introduced into the chromatographic system in one of two ways: (a) a solution of the sample in a small volume of the mobile phase is added to the top of the column; or, (b) a solution of the sample in a small volume of the immobile phase is mixed with the *Solid Support* and transferred to the column as a layer above a bed of a mixture of immobile phase with adsorbent.

Development and elution are accomplished with flowing solvent as before. The mobile solvent usually is saturated with the immobile solvent before use.

In conventional liquid-liquid partition chromatography, the degree of partition of a given compound between the two liquid phases is expressed by its partition or distribution coefficient. In the case of compounds that dissociate, distribution can be controlled by modifying the pH, dielectric constant, ionic strength, and other properties of the two phases. Selective elution of the components of a mixture can be achieved by successively changing the mobile phase to one that provides a more favorable partition coefficient, or by changing the pH of the immobile phase *in situ* with a mobile phase consisting of a solution of an appropriate acid or base in an organic solvent.

Unless otherwise specified in the individual monograph, assays and tests that employ column partition chromatography are performed according to the following general methods.

Solid Support—Use purified siliceous earth. Use silanized chromatographic siliceous earth for reverse-phase partition chromatography.

Stationary Phase—Use the solvent or solution specified in the individual monograph. If a mixture of liquids is to be used as the *Stationary Phase,* mix them prior to the introduction of the *Solid Support*.

Mobile Phase—Use the solvent or solution specified in the individual monograph. Equilibrate it with water if the *Stationary Phase* is an aqueous solution; if the *Stationary Phase* is a polar organic fluid, equilibrate with that fluid.

Preparation of Chromatographic Column—Unless otherwise specified in the individual monograph, the chromatographic tube is about 22 mm in inside diameter and 200 to 300 mm in length, without porous glass disk, to which is attached a delivery tube, without stopcock, about 4 mm in inside diameter and about 50 mm in length. Pack a pledget of fine glass wool in the base of the tube. Place the specified volume of *Stationary Phase* in a 100- to 250-mL beaker, add the specified amount of *Solid Support,* and mix to produce a homogeneous, fluffy mixture. Transfer this mixture to the chromatographic tube, and tamp, using gentle pressure, to obtain a uniform mass. If the specified amount of *Solid Support* is more than 3 g, transfer the mixture to the column in portions of approximately 2 g, and tamp each portion. If the assay or test requires a multisegment column, with a different *Stationary Phase* specified for each segment, tamp after the addition of each segment, and add each succeeding segment directly to the previous one.

If a solution of the analyte is incorporated in the *Stationary Phase,* complete the quantitative transfer to the chromatographic tube by scrubbing the beaker used for the preparation of the test mixture with a mixture of about 1 g of *Solid Support* and several drops of the solvent used to prepare the test solution.

Pack a pledget of fine glass wool above the completed column packing. The *Mobile Phase* flows through a properly packed column as a moderate stream or, if reverse-phase chromatography is applied, as a slow trickle.

Procedure—Transfer the *Mobile Phase* to the column space above the column packing, and allow it to flow through the column under the influence of gravity. Rinse the tip of the chromatographic column with about 1 mL of *Mobile Phase* before each change in composition of *Mobile Phase* and after completion of the elution. If the analyte is introduced into the column as a solution in the *Mobile Phase,* allow it to pass completely into the column packing, then add *Mobile Phase* in several small portions, allowing each to drain completely, before adding the bulk of the *Mobile Phase*. Where the assay or test requires the use of multiple chromatographic columns mounted in series and the addition of *Mobile Phase* in divided portions is specified, allow each portion to drain completely through each column, and rinse the tip of each with *Mobile Phase* prior to the addition of each succeeding portion.

Gas Chromatography

The distinguishing features of gas chromatography are a gaseous mobile phase and a solid or immobilized liquid stationary phase. Liquid stationary phases are available in packed or capillary columns. In the packed columns, the liquid phase is deposited on a finely divided, inert solid support, such as diatomaceous earth, porous polymer, or graphitized carbon, which is packed into a column that is typically 2 to 4 mm in internal diameter and 1 to 3 m in length. In capillary columns, which contain no packing, the liquid phase is deposited on the inner surface of the column and may be chemically bonded to it. In gas-solid chromatography, the solid phase is an active adsorbent, such as alumina, silica, or carbon, packed into a column. Polyaromatic porous resins, which are sometimes used in packed columns, are not coated with a liquid phase.

When a vaporized compound is introduced into the carrier gas and carried into the column, it is partitioned between the gas and stationary phases by a dynamic countercurrent distribution process. The compound is carried down the column by the carrier gas, retarded to a greater or lesser extent by sorption and desorption on the stationary phase. The elution of the compound is characterized by the partition ratio, *k′,* a dimensionless quantity also called the capacity factor (see *Glossary of Symbols* for the definition of symbols). It is equivalent to the ratio of the time required for the compound to flow through the column (the retention time) to the elution time of an unretained compound. The value of the capacity factor depends on the chemical nature of the compound, the nature, amount, and surface area of the liquid phase, the column temperature, and the gas flow rate. Under a specified set of experimental conditions, a characteristic capacity factor exists for every compound. Separation by gas chromatography occurs only if the compounds concerned have different capacity factors.

Apparatus—A gas chromatograph consists of a carrier gas source, an injection port, column, detector, and recording device. The injection port, column, and detector are temperature-controlled. The typical carrier gas is helium, nitrogen, or hydrogen, depending on the column and detector in use. The gas is supplied from a high-pressure cylinder or high-purity gas generator and passes through suitable pressure-reducing valves and a flow meter to the injection port and column. Compounds to be chromatographed, either in solution or as gases, are injected into the gas stream at the injection port. Depending upon the configuration of the apparatus, the test mixture may be injected directly into the column or be vaporized in the injection port and mixed into the flowing carrier gas prior to entering the column.

Once in the column, compounds in the test mixture are separated by virtue of differences in their capacity factors, which in turn depend upon vapor pressure and degree of interaction with the stationary phase. The capacity factor, which governs resolution, retention times, and column efficiencies of components of the test mixture, is also temperature-dependent. The use of temperature-programmable column ovens takes advantage of this dependence to achieve efficient separation of compounds differing widely in vapor pressure.

As resolved compounds emerge separately from the column, they pass through a differential detector, which responds to the amount of each compound present. The type of detector to be used depends

upon the nature of the compounds to be analyzed and is specified in the individual monograph. Detectors are heated to prevent condensation of the eluting compounds.

Detector output is recorded as a function of time, producing a chromatogram, which consists of a series of peaks on a time axis. Each peak represents a compound in the vaporized test mixture, although some peaks may overlap. The elution time is a characteristic of an individual compound; and the instrument response, measured as peak area or peak height, is a function of the amount present.

Injectors—Sample injection devices range from simple syringes to fully programmable automatic injectors. The amount of sample that can be injected into a capillary column without overloading is small compared to the amount that can be injected into packed columns, and may be less than the smallest amount that can be manipulated satisfactorily by syringe. Capillary columns, therefore, often are used with injectors able to split samples into two fractions, a small one that enters the column and a large one that goes to waste. Such injectors may be used in a *splitless mode* for analyses of trace or minor components.

Purge and trap injectors are equipped with a sparging device by which volatile compounds in solution are carried into a low-temperature trap. When sparging is complete, trapped compounds are desorbed into the carrier gas by rapid heating of the temperature-programmable trap.

Headspace injectors are equipped with a thermostatically controlled sample heating chamber. Solid or liquid samples in tightly closed containers are heated in the chamber for a fixed period of time, allowing the volatile components in the sample to reach an equilibrium between the nongaseous phase and the gaseous or headspace phase.

After this equilibrium has been established, the injector automatically introduces a fixed amount of the headspace in the sample container into the gas chromatograph.

Columns—Capillary columns, which are usually made of fused silica, are typically 0.2 to 0.53 mm in internal diameter and 5 to 60 m in length. The liquid or stationary phase, which is sometimes chemically bonded to the inner surface, is 0.1 to 1.0 μm thick, although nonpolar stationary phases may be up to 5 μm thick. A list of liquid phases in current use is given in the section *Chromatographic Reagents*.

Packed columns, made of glass or metal, are 1 to 3 m in length with internal diameters of 2 to 4 mm. Those used for analysis typically are porous polymers or solid supports with liquid phase loadings of about 5% (w/w). High-capacity columns, with liquid phase loadings of about 20% (w/w), are used for large test specimens and for the determination of low molecular weight compounds such as water. The capacity required influences the choice of solid support.

Supports for analysis of polar compounds on low-capacity, low-polarity liquid phase columns must be inert to avoid peak tailing. The reactivity of support materials can be reduced by silanizing prior to coating with liquid phase. Acid-washed, flux-calcined diatomaceous earth is often used for drug analysis. Support materials are available in various mesh sizes, with 80- to 100-mesh and 100- to 120-mesh being most commonly used with 2- to 4-mm columns. Supports and liquid phases are listed in the section *Chromatographic Reagents*.

Retention time and the peak efficiency depend on the carrier gas flow rate; retention time is also directly proportional to column length, while resolution is proportional to the square root of the column length. For packed columns, the carrier gas flow rate is usually expressed in mL per minute at atmospheric pressure and room temperature. It is measured at the detector outlet with a flowmeter while the column is at operating temperature. The linear flow rate through a packed column is inversely proportional to the square of the column diameter for a given flow volume. Flow rates of 60 mL per minute in a 4-mm column and 15 mL per minute in a 2-mm column give identical linear flow rates and thus similar retention times. Unless otherwise specified in the individual monograph, flow rates for packed columns are about 30 to 60 mL per minute. For capillary columns, linear flow velocity is often used instead of flow rate. This is conveniently determined from the length of the column and the retention time of a dilute methane sample, provided a flame-ionization detector is in use. At high operating temperatures there is sufficient vapor pressure to result in a gradual loss of liquid phase, a process called bleeding.

Detectors—Flame-ionization detectors are used for most pharmaceutical analyses, with lesser use made of thermal conductivity, electron-capture, nitrogen-phosphorus, and mass spectrometric detectors. For quantitative analyses, detectors must have a wide linear dynamic range: the response must be directly proportional to the amount of compound present in the detector over a wide range of concentrations. Flame-ionization detectors have a wide linear range and are sensitive to most organic compounds. Detector response depends on the structure and concentration of the compound and on the flow rates of the combustion, air, makeup, and carrier gases. Unless otherwise specified in individual monographs, flame-ionization detectors with either helium or nitrogen carrier gas are to be used for packed columns, and helium or hydrogen is used for capillary columns.

The thermal conductivity detector employs a heated wire placed in the carrier gas stream. When an analyte enters the detector with the carrier gas, the difference in thermal conductivity of the gas stream (carrier and sample components) relative to that of a reference flow of carrier gas alone is measured. In general, the thermal conductivity detector responds uniformly to volatile compounds regardless of structure; however, it is considerably less sensitive than the flame-ionization detector.

The alkali flame-ionization detector, sometimes called an NP or nitrogen-phosphorus detector, contains a thermionic source, such as an alkali-metal salt or a glass element containing rubidium or other metal, that results in the efficient ionization of organic nitrogen and phosphorus compounds. It is a selective detector that shows little response to hydrocarbons.

The electron-capture detector contains a radioactive source of ionizing radiation. It exhibits an extremely high response to compounds containing halogens and nitro groups but little response to hydrocarbons. The sensitivity increases with the number and atomic weight of the halogen atoms.

Data Collection Devices—Modern data stations receive the detector output, calculate peak areas and peak heights, and print chromatograms, complete with run parameters and peak data. Chromatographic data may be stored and reprocessed, with integration and other calculation variables being changed as required. Data stations are used also to program the chromatograph, controlling most operational variables and providing for long periods of unattended operation.

Data can also be collected for manual measurement on simple recorders or on integrators whose capabilities range from those providing a printout of peak areas to those providing chromatograms with peak areas and peak heights calculated and data stored for possible reprocessing.

Procedure—Packed and capillary columns must be conditioned before use until the baseline and other characteristics are stable. This may be done by operation at a temperature above that called for by the method or by repeated injections of the compound or mixture to be chromatographed. The column or packing material supplier provides instructions for the recommended conditioning procedure. In the case of thermally stable methyl- and phenyl-substituted polysiloxanes, a special sequence increases inertness and efficiency; maintain the column at a temperature of 250° for 1 hour, with helium flowing, to remove oxygen and solvents. Stop the flow of helium, heat at about 340°

for 4 hours, then reduce the heating to a temperature of 250°, and condition with helium flowing until stable.

Most drugs are reactive polar molecules. Successful chromatography may require conversion of the drug to a less polar and more volatile derivative by treatment of reactive groups with appropriate reagents. Silylating agents are widely used for this purpose and are readily available.

Assays require quantitative comparison of one chromatogram with another. A major source of error is irreproducibility in the amount of sample injected, notably when manual injections are made with a syringe. The effects of variability can be minimized by addition of an internal standard, a noninterfering compound present at the same concentration in test and standard solutions. The ratio of peak response of the analyte to that of the internal standard is compared from one chromatogram to another. Where the internal standard is chemically similar to the substance being determined, there is also compensation for minor variations in column and detector characteristics. In some cases, the internal standard may be carried through the sample preparation procedure prior to gas chromatography to control other quantitative aspects of the assay. Automatic injectors greatly improve the reproducibility of sample injections and reduce the need for internal standards.

Many monographs require that system suitability requirements be met before samples are analyzed (see *System Suitability* and *Interpretation of Chromatograms*).

High-Pressure Liquid Chromatography

High-pressure liquid chromatography (HPLC), sometimes called high-performance liquid chromatography, is a separation technique based on a solid stationary phase and a liquid mobile phase. Separations are achieved by partition, adsorption, or ion-exchange processes, depending upon the type of stationary phase used. HPLC has distinct advantages over gas chromatography for the analysis of organic compounds. Compounds to be analyzed are dissolved in a suitable solvent, and most separations take place at room temperature. Thus, most drugs, being nonvolatile or thermally unstable compounds, can be chromatographed without decomposition or the necessity of making volatile derivatives. Most pharmaceutical analyses are based on partition chromatography and are completed within 30 minutes.

As in gas chromatography, the elution time of a compound can be described by the capacity factor, k' (see *Glossary of Symbols*), which depends on the chemical nature of the analyte, the composition and flow rate of the mobile phase, and the composition and surface area of the stationary phase. Column length is an important determinant of resolution. Only compounds having different capacity factors can be separated by HPLC.

Apparatus—A liquid chromatograph consists of a reservoir containing the mobile phase, a pump to force the mobile phase through the system at high pressure, an injector to introduce the sample into the mobile phase, a chromatographic column, a detector, and a data collection device such as a computer, integrator, or recorder. Short, small-bore columns containing densely packed particles of stationary phase provide for the rapid exchange of compounds between the mobile and stationary phases. In addition to receiving and reporting detector output, computers are used to control chromatographic settings and operations, thus providing for long periods of unattended operation.

Pumping Systems—HPLC pumping systems deliver metered amounts of mobile phase from the solvent reservoirs to the column through high-pressure tubing and fittings. Modern systems consist of one or more computer-controlled metering pumps that can be programmed to vary the ratio of mobile phase components, as is required for gradient chromatography, or to mix isocratic mobile phases (i.e., mobile phases having a fixed ratio of solvents). However, the proportion of ingredients in premixed isocratic mobile phases can be more accurately controlled than in those delivered by most pumping systems. Operating pressures up to 5000 psi or higher, with delivery rates up to about 10 mL per minute are typical. Pumps used for quantitative analysis should be constructed of materials inert to corrosive mobile phase components and be capable of delivering the mobile phase at a constant rate with minimal fluctuations over extended periods of time.

Injectors—After dissolution in mobile phase or other suitable solution, compounds to be chromatographed are injected into the mobile phase, either manually by syringe or loop injectors, or automatically by autosamplers. The latter consist of a carousel or rack to hold sample vials with tops that have a pierceable septum or stopper and an injection device to transfer sample from the vials to a loop from which it is loaded into the chromatograph. Some autosamplers can be programmed to control sample volume, the number of injections and loop rinse cycles, the interval between injections, and other operating variables.

A syringe can be used for manual injection of samples through a septum when column head pressures are less than 70 atmospheres (about 1000 psi). At higher pressures an injection valve is essential. Some valve systems incorporate a calibrated loop that is filled with test solution for transfer to the column in the mobile phase. In other systems, the test solution is transferred to a cavity by syringe and then switched into the mobile phase.

Columns—For most pharmaceutical analyses, separation is achieved by partition of compounds in the test solution between the mobile and stationary phases. Systems consisting of polar stationary phases and nonpolar mobile phases are described as normal phase, while the opposite arrangement, polar mobile phases and nonpolar stationary phases, is called reverse-phase chromatography. Partition chromatography is almost always used for hydrocarbon-soluble compounds of molecular weight less than 1000. The affinity of a compound for the stationary phase, and thus its retention time on the column, is controlled by making the mobile phase more or less polar. Mobile phase polarity can be varied by the addition of a second, and sometimes a third or even a fourth, component.

Stationary phases for modern, reverse-phase liquid chromatography typically consist of an organic phase chemically bound to silica or other materials. Particles are usually 3 to 10 µm in diameter, but sizes may range up to 50 µm or more for preparative columns. Small particles thinly coated with organic phase provide for low mass transfer resistance and, hence, rapid transfer of compounds between the stationary and mobile phases. Column polarity depends on the polarity of the bound functional groups, which range from relatively nonpolar octadecyl silane to very polar nitrile groups. Liquid, nonbound stationary phases must be largely immiscible in the mobile phase. Even so, it is usually necessary to presaturate the mobile phase with stationary phase to prevent stripping of the stationary phase from the column. Polymeric stationary phases coated on the support are more durable.

Columns used for analytical separations usually have internal diameters of 2 to 5 mm; larger diameter columns are used for preparative chromatography. Columns may be heated to give more efficient separations, but only rarely are they used at temperatures above 60° because of potential stationary phase degradation or mobile phase volatility. Unless otherwise specified in the individual monograph, columns are used at ambient temperature.

Ion-exchange chromatography is used to separate water-soluble, ionizable compounds of molecular weight less than 1500. The stationary phases are usually synthetic organic resins; cation-exchange resins contain negatively charged active sites and are used to separate basic substances such as amines, while anion-exchange resins have positively charged active sites for separation of compounds with negatively charged groups, such as phosphate, sulfonate, or carboxylate groups.

Water-soluble ionic or ionizable compounds are attracted to the resins, and differences in affinity bring about the chromatographic separation. The pH of the mobile phase, temperature, ion type, ionic concentration, and organic modifiers affect the equilibrium, and these variables can be adjusted to obtain the desired degree of separation.

In size-exclusion chromatography, columns are packed with a porous stationary phase. Molecules of the compounds being chromatographed are filtered according to size. Those too large to enter the pores pass unretained through the column. Smaller molecules enter the pores and are increasingly retained as molecular size decreases. These columns are typically used to measure aggregation and degradation of large molecules (see *Size-Exclusion Chromatography* section).

Detectors—Many compendial HPLC methods require the use of spectrophotometric detectors. Such a detector consists of a flow-through cell mounted at the end of the column. A beam of UV radiation passes through the flow cell and into the detector. As compounds elute from the column, they pass through the cell and absorb the radiation, resulting in measurable energy level changes.

Fixed, variable, and multi-wavelength detectors are widely available. Fixed wavelength detectors operate at a single wavelength, typically 254 nm, emitted by a low-pressure mercury lamp. Variable wavelength detectors contain a continuous source, such as a deuterium or high-pressure xenon lamp, and a monochromator or an interference filter to generate monochromatic radiation at a wavelength selected by the operator. The wavelength accuracy of a variable-wavelength detector equipped with a monochromator should be checked by the procedure recommended by its manufacturer; if the observed wavelengths differ by more than 3 nm from the correct values, recalibration of the instrument is indicated. Modern variable wavelength detectors can be programmed to change wavelength while an analysis is in progress. Multi-wavelength detectors measure absorbance at two or more wavelengths simultaneously. In diode array multi-wavelength detectors, continuous radiation is passed through the sample cell, then resolved into its constituent wavelengths, which are individually detected by the photodiode array. These detectors acquire absorbance data over the entire UV-visible range, thus providing the analyst with chromatograms at multiple, selectable wavelengths and spectra of the eluting peaks. Diode array detectors usually have lower signal-to-noise ratios than fixed or variable wavelength detectors, and thus are less suitable for analysis of compounds present at low concentrations.

Differential refractometer detectors measure the difference between the refractive index of the mobile phase alone and that of the mobile phase containing chromatographed compounds as it emerges from the column. Refractive index detectors are used to detect non-UV absorbing compounds, but they are less sensitive than UV detectors. They are sensitive to small changes in solvent composition, flow rate, and temperature, so that a reference column may be required to obtain a satisfactory baseline.

Fluorometric detectors are sensitive to compounds that are inherently fluorescent or that can be converted to fluorescent derivatives either by chemical transformation of the compound or by coupling with fluorescent reagents at specific functional groups. If derivatization is required, it can be done prior to chromatographic separation or, alternatively, the reagent can be introduced into the mobile phase just prior to its entering the detector.

Potentiometric, voltametric, or polarographic electrochemical detectors are useful for the quantitation of species that can be oxidized or reduced at a working electrode. These detectors are selective, sensitive, and reliable, but require conducting mobile phases free of dissolved oxygen and reducible metal ions. A pulseless pump must be used, and care must be taken to ensure that the pH, ionic strength, and temperature of the mobile phase remain constant. Working electrodes are prone to contamination by reaction products with consequent variable responses.

Electrochemical detectors with carbon-paste electrodes may be used advantageously to measure nanogram quantities of easily oxidized compounds, notably phenols and catechols.

New detectors continue to be developed in attempts to overcome the deficiencies of those being used.

Data Collection Devices—Modern data stations receive and store detector output and print out chromatograms complete with peak heights, peak areas, sample identification, and method variables. They are also used to program the liquid chromatograph, controlling most variables and providing for long periods of unattended operation.

Data also may be collected on simple recorders for manual measurement or on stand-alone integrators, which range in complexity from those providing a printout of peak areas to those providing chromatograms with peak areas and peak heights calculated and data stored for possible subsequent reprocessing.

Procedure—The mobile phase composition significantly influences chromatographic performance and the resolution of compounds in the mixture being chromatographed. For accurate quantitative work, high-purity reagents and "HPLC grade" organic solvents must be used. Water of suitable quality should have low conductivity and low UV absorption, appropriate to the intended use.

Reagents used with special types of detectors (e.g., electrochemical, mass spectrometer) may require the establishment of additional tolerances for potential interfering species. Composition has a much greater effect than temperature on the capacity factor, *k′*.

In partition chromatography, the partition coefficient, and hence the separation, can be changed by addition of another component to the mobile phase. In ion-exchange chromatography, pH and ionic strength, as well as changes in the composition of the mobile phase, affect capacity factors. The technique of continuously changing the solvent composition during the chromatographic run is called gradient elution or solvent programming. It is sometimes used to chromatograph complex mixtures of components differing greatly in their capacity factors. Detectors that are sensitive to change in solvent composition, such as the differential refractometer, are more difficult to use with the gradient elution technique.

The detector must have a broad linear dynamic range, and compounds to be measured must be resolved from any interfering substances. The linear dynamic range of a compound is the range over which the detector signal response is directly proportional to the amount of the compound. For maximum flexibility in quantitative work, this range should be about three orders of magnitude. HPLC systems are calibrated by plotting peak responses in comparison with known concentrations of a reference standard, using either an external or an internal standardization procedure.

Reliable quantitative results are obtained by external calibration if automatic injectors or autosamplers are used. This method involves direct comparison of the peak responses obtained by separately chromatographing the test and reference standard solutions. If syringe injection, which is irreproducible at the high pressures involved, must be used, better quantitative results are obtained by the internal calibration procedure where a known amount of a noninterfering compound, the internal standard, is added to the test and reference standard solutions, and the ratios of peak responses of drug and internal standard are compared.

Because of normal variations in equipment, supplies, and techniques, a system suitability test is required to ensure that a given operating system may be generally applicable. The main features of system suitability tests are described below.

For information on the interpretation of results, see the section *Interpretation of Chromatograms*.

Size-Exclusion Chromatography

Size-exclusion chromatography is a high-pressure liquid chromatographic technique that separates molecules in solution according to their size. Methods for size-exclusion chromatography are divided into gel permeation chromatographic methods, which utilize nonpolar organic mobile phases and hydrophilic packings, and gel filtration chromatographic methods, which utilize aqueous mobile phases and hydrophobic packings. The sample is introduced into a column, which is filled with a gel or a porous particle packing material and is carried by the mobile phase through the column. The size separation takes place by repeated exchange of the solute molecules between the solvent of the mobile phase and the same solvent in the stationary liquid phase within the pores of the packing material. The pore-size range of the packing material determines the molecular-size range within which separation can occur.

Molecules small enough to penetrate all the pore spaces elute at the total permeation volume, V_T. On the other hand, molecules apparently larger than the maximum pore size of the packing material migrate along the column only through the spaces between the particles of the packing material without being retained and elute at the exclusion volume, V_O (void volume). Separation according to molecular size occurs between the exclusion volume and the total permeation volume, useful separation usually occurring in the first two-thirds of this range.

Apparatus—The components of the chromatograph are described under *High-Pressure Liquid Chromatography*.

Column—If necessary, the column is temperature-controlled. It is packed with a separation material that is capable of fractionation in the appropriate range of molecular sizes and through which the eluant is passed at a constant rate. One end of the column is usually fitted with a suitable device for applying the sample, such as a flow adaptor, a syringe through a septum or an injection valve, and it may also be connected to a suitable pump for controlling the flow of the eluant. Alternatively, the sample may be applied directly to the drained bed surface, or, where the sample is denser than the eluant, it may be layered beneath the eluant. The packing material may be a soft support such as a swollen gel or a rigid support composed of a material such as glass, silica, or a solvent-compatible, cross-linked organic polymer. Rigid supports usually require pressurized systems giving faster separations. The mobile phase is chosen according to sample type, separation medium, and method of detection.

Detector—The outlet of the column is usually connected to a suitable detector fitted with an automatic recorder that enables the monitoring of the relative concentrations of separated components of the sample. Detectors are usually based on photometric, refractometric, or luminescent properties (see *Detectors* under *High-Pressure Liquid Chromatography*). An automatic fraction collector may be attached, if necessary.

Procedure—Before carrying out the separation, the packing material is treated and the column is packed, as described in the individual monograph or according to the manufacturer's instructions. Where necessary, procedures for verifying the suitability of the system are described in the individual monograph. The column efficiency may be evaluated from the number of theoretical plates, *N* (see the section *Interpretation of Chromatograms*). The elution characteristics of a compound in a particular column may be described by the distribution coefficient, K_D, which is calculated by the formula:

$$(V_I - V_O) / (V_T - V_O)$$

in which V_O, V_T, and V_I are the retention volumes for the nonretained component, the component that has full access to all the pores in the support, and the compound under test, respectively. Each retention volume is measured from the time of application to the time of the peak maximum.

Determination of Relative Component Composition of Mixture—Carry out the separation as directed in the individual monograph. Monitor the elution of the components continuously, and measure the corresponding peak areas. If all the components under test exhibit equivalent responses to the physicochemical property being monitored (for example, if they exhibit corresponding absorptivities), calculate the relative amount of each component by dividing the respective peak area by the sum of the peak areas of all the components under test. If the responses to the property used for detection of the components under test are not equivalent, calculate the content using calibration curves obtained from the calibration procedure specified in the individual monograph.

Determination of Molecular Weights—Size-exclusion chromatography is used to determine molecular weights of components under test by comparison to calibration standards specified in the individual monograph. Plot the retention volumes of the calibration standards versus the logarithm of their molecular weights. Draw the line that best fits the plotted points within the exclusion and total permeation limits for the particular separation medium. From the calibration curve, molecular weights of components under test are estimated. This calibration is valid only for the particular macromolecular solute-solvent system used under the specified experimental conditions.

Determination of Molecular Weight Distribution of Polymers—The material used for calibration and the methods for determination of the distribution of molecular weights of polymers are specified in the individual monograph. However, sample comparison is valid only for results obtained under identical experimental conditions.

Interpretation of Chromatograms

Figure 1 represents a typical chromatographic separation of two substances, 1 and 2, where t_1 and t_2 are the respective retention times; and h, $h/2$, and $W_{h/2}$ are the height, the half-height, and the width at half-height, respectively, for peak 1. W_1 and W_2 are the respective widths of peaks 1 and 2 at the baseline. Air peaks are a feature of gas chromatograms and correspond to the solvent front in liquid chromatography. The retention time of these unretained components is designated as t_M.

Chromatographic retention times are characteristic of the compounds they represent but are not unique. Coincidence of retention times of a test and a reference substance can be used as a feature in construction of an identity profile but is insufficient on its own to establish identity. Absolute retention times of a given compound vary from one chromatogram to the next.

Because in most procedures there is no need to identify an unretained peak, comparisons are normally made in terms of relative retention times, R_r:

$$R_r = \frac{t_2}{t_1}$$

where t_2 and t_1 are the retention times, measured from the point of injection, of the test and the reference substances, respectively, determined under identical experimental conditions on the same column.

Other procedures may identify the peak position using the relative retention, *r*:

$$r = \frac{t_2 - t_M}{t_1 - t_M}$$

where t_M is the retention time of a non-retained marker, which needs to be defined in the procedure.

The number of theoretical plates, *N*, is a measure of column efficiency. For Gaussian peaks, it is calculated by the equation:

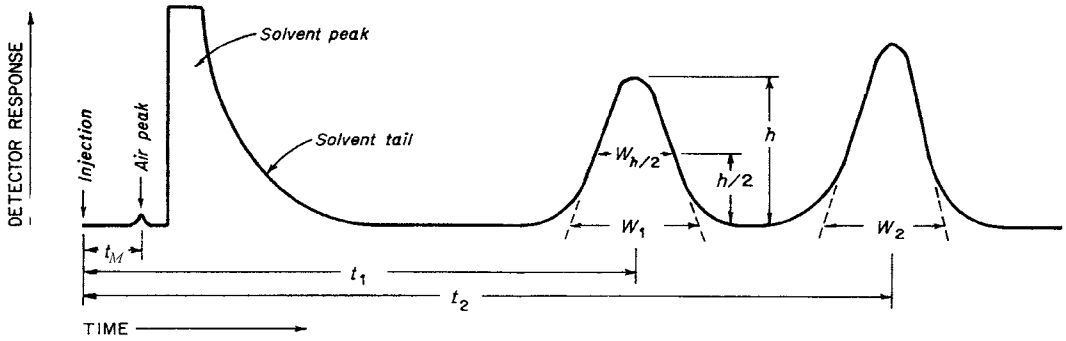


Figure 1. Chromatographic separation of two substances

$$N = 16\left(\frac{t}{W}\right)^2$$

where t is the retention time of the substance and W is the width of the peak at its base, obtained by extrapolating the relatively straight sides of the peak to the baseline. The value of N depends upon the substance being chromatographed as well as the operating conditions such as mobile phase or carrier gas flow rates and temperature, the quality of the packing, the uniformity of the packing within the column and, for capillary columns, the thickness of the stationary phase film, and the internal diameter and length of the column.

The separation of two components in a mixture, the resolution, R, is determined by the equation:

$$R = \frac{2(t_2 - t_1)}{W_2 + W_1}$$

in which t_2 and t_1 are the retention times of the two components, and W_2 and W_1 are the corresponding widths at the bases of the peaks obtained by extrapolating the relatively straight sides of the peaks to the baseline.

Where electronic integrators are used, it may be convenient to determine the resolution, R, by the equation:

$$R = \frac{2(t_2 - t_1)}{1.70(W_{1,h/2} + W_{2,h/2})}$$

and to determine the number of theoretical plates, N, by the equation:

$$N = 5.54(t/W_{h/2})^2$$

where $W_{h/2}$ is the peak width at half-height, obtained directly by electronic integrators. However, in the event of dispute, only equations based on peak width at baseline are to be used.

Peak areas and peak heights are usually proportional to the quantity of compound eluting. These are commonly measured by electronic integrators but may be determined by more classical approaches. Peak areas are generally used but may be less accurate if peak interference occurs. For manual measurements, the chart should be run faster than usual, or a comparator should be used to measure the width at half-height and the width at the base of the peak, to minimize error in these measurements. For accurate quantitative work, the components to be measured should be separated from any interfering components. Peak tailing and fronting and the measurement of peaks on solvent tails are to be avoided.

Chromatographic purity tests for drug raw materials are sometimes based on the determination of peaks due to impurities, expressed as a percentage of the area due to the drug peak. It is preferable, however, to compare impurity peaks with those in the chromatogram of a standard at a similar concentration. The standard may be the drug itself at a level corresponding to, for example, 0.5% impurity, or in the case of toxic or signal impurities, a standard of the impurity itself.

System Suitability

System suitability tests are an integral part of gas and liquid chromatographic methods. They are used to verify that the resolution and reproducibility of the chromatographic system are adequate for the analysis to be done. The tests are based on the concept that the equipment, electronics, analytical operations, and samples to be analyzed constitute an integral system that can be evaluated as such.

The resolution, R, [NOTE—All terms and symbols are defined in the *Glossary of Symbols*] is a function of column efficiency, N, and is specified to ensure that closely eluting compounds are resolved from each other, to establish the general resolving power of the system, and to ensure that internal standards are resolved from the drug. Column efficiency may be specified also as a system suitability requirement, especially if there is only one peak of interest in the chromatogram; however, it is a less reliable means to ensure resolution than direct measurement. Column efficiency is a measure of peak sharpness, which is important for the detection of trace components.

Replicate injections of a standard preparation used in the assay or other standard solution are compared to ascertain whether requirements for precision are met. Unless otherwise specified in the individual monograph, data from five replicate injections of the analyte are used to calculate the relative standard deviation, S_R, if the requirement is 2.0% or less; data from six replicate injections are used if the relative standard deviation requirement is more than 2.0%.

The tailing factor, T, a measure of peak symmetry, is unity for perfectly symmetrical peaks and its value increases as tailing becomes more pronounced (see *Figure 2*). In some cases, values less than unity may be observed. As peak asymmetry increases, integration, and hence precision, becomes less reliable.

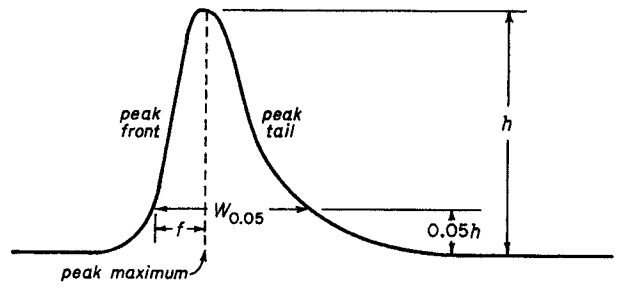


Figure 2. Asymmetrical chromatographic peak

These tests are performed by collecting data from replicate injections of standard or other solutions as specified in the individual monograph. The specification of definitive parameters in a monograph does not preclude the use of other suitable operating conditions (see *Procedures* under *Tests and Assays* in the *General Notices*). If adjustments of operating conditions to meet system suitability requirements are necessary, each of the following is the maximum variation that can be considered, unless otherwise directed in the monograph. Adjustments are permitted only when suitable standards (including Reference Standards) are available for all compounds used in the suitability test and only when those standards are used to show that the adjustments have improved the quality of the chromatography in meeting system suitability requirements. Adjustments to chromatographic systems performed in order to comply with system suitability requirements are not to be made to compensate for column failure or system malfunction. The changes described below may require additional validation data. The user should verify the suitability of the method under the new conditions by assessing the relevant analytical performance characteristics potentially affected by the change. Multiple adjustments can have a cumulative effect in the performance of the system and should be considered carefully before implementation.

pH of Mobile Phase (HPLC)—The pH of the aqueous buffer used in the preparation of the mobile phase can be adjusted to within ±0.2 units of the value or range specified.

Concentration of Salts in Buffer (HPLC)—The concentration of the salts used in the preparation of the aqueous buffer used in the mobile phase can be adjusted to within ±10%, provided the permitted pH variation (see above) is met.

Ratio of Components in Mobile Phase (HPLC)—The following adjustment limits apply to minor components of the mobile phase (specified at 50% or less). The amount(s) of these component(s) can be adjusted by ±30% relative. However, the change in any component cannot exceed ±10% absolute (i.e., in relation to the total mobile phase). Adjustment can be made to one minor component in a ternary mixture. Examples of adjustments for binary and ternary mixtures are given below.

Binary Mixtures—

SPECIFIED RATIO OF 50:50—Thirty percent of 50 is 15% absolute, but this exceeds the maximum permitted change of ±10% absolute in either component. Therefore, the mobile phase ratio may be adjusted only within the range of 40:60 to 60:40.

SPECIFIED RATIO OF 2:98—Thirty percent of 2 is 0.6% absolute. Therefore the maximum allowed adjustment is within the range of 1.4:98.6 to 2.6:97.4.

Ternary Mixtures—

SPECIFIED RATIO OF 60:35:5—For the second component, 30% of 35 is 10.5% absolute, which exceeds the maximum permitted change of ±10% absolute in any component. Therefore the second component may be adjusted only within the range of 25% to 45% absolute. For the third component, 30% of 5 is 1.5% absolute. In all cases, a sufficient quantity of the first component is used to give a total of 100%. Therefore, mixture ranges of 50:45:5 to 70:25:5 or 58.5:35:6.5 to 61.5:35:3.5 would meet the requirement.

Wavelength of UV-Visible Detector (HPLC)—Deviations from the wavelengths specified in the method are not permitted. The procedure specified by the detector manufacturer, or another validated procedure, is to be used to verify that error in the detector wavelength is, at most, ±3 nm.

Column Length (GC, HPLC): can be adjusted by as much as ±70%.

Column Inner Diameter (GC, HPLC): can be adjusted by as much as ±25% for HPLC and ±50% for GC.

Film Thickness (Capillary GC): can be adjusted by as much as –50% to 100%.

Particle Size (HPLC): can be reduced by as much as 50%.

Particle Size (GC): going from a larger to a smaller or a smaller to a larger (if it is the same "Range Ratio", which is the diameter of the largest particle divided by the diameter of the smallest particle) particle size GC mesh support is acceptable, provided the chromatography meets the requirements of the system suitability.

Flow Rate (GC, HPLC): can be adjusted by as much as ±50%.

Injection Volume (GC, HPLC): can be reduced as far as is consistent with accepted precision and detection limits.

Column Temperature (HPLC): can be adjusted by as much as ±10°. Column thermostating is recommended to improve control and reproducibility of retention time.

Oven Temperature (GC): can be adjusted by as much as ±10%.

Oven Temperature Program (GC)—Adjustment of temperatures is permitted as stated above. For the times specified for the temperature to be maintained or for the temperature to be changed from one value to another, an adjustment of up to ±20% is permitted.

Unless otherwise directed in the monograph, system suitability parameters are determined from the analyte peak.

Relative retention times may be provided in monographs for informational purposes only, to aid in peak identification. There are no acceptance criteria applied to relative retention times.

To ascertain the effectiveness of the final operating system, it should be subjected to suitability testing. Replicate injections of the standard preparation required to demonstrate adequate system precision may be made before the injection of samples or may be interspersed among sample injections. System suitability must be demonstrated throughout the run by injection of an appropriate control preparation at appropriate intervals, including at the end of the analysis. The control preparation can be a standard preparation or a solution containing a known amount of analyte and any additional materials useful in the control of the analytical system, such as excipients or impurities. Whenever there is a significant change in equipment or in a critical reagent, suitability testing should be performed before the injection of samples. No sample analysis is acceptable unless the requirements of system suitability have been met. Sample analyses obtained while the system fails system suitability requirements are unacceptable.

Glossary of Symbols

To promote uniformity of interpretation, the following symbols and definitions are employed where applicable in presenting formulas in the individual monographs. Where a different symbol or definition is used in an individual monograph, the monograph text takes precedence (see *General Notices*). [NOTE—Where the terms W and t both appear in the same equation they must be expressed in the same units.]

f distance from the peak maximum to the leading edge of the peak, the distance being measured at a point 5% of the peak height from the baseline.

k' capacity factor,[2]

$$k' = \frac{\text{amount of substance in stationary phase}}{\text{amount of substance in mobile phase}}$$

$$k' = \frac{\text{time spent by substance in stationary phase}}{\text{time spent by substance in mobile phase}} = \frac{t}{t_M} - 1$$

N number of theoretical plates in a chromatographic column,[2]

$$N = 16\left(\frac{t}{W}\right)^2 \text{ or } N = 5.54\left(\frac{t}{W_{h/2}}\right)^2$$

r relative retention,[2]

$$r = \frac{t_2 - t_M}{t_1 - t_M}$$

r_i peak response of an impurity obtained from a chromatogram.
r_{IS} peak response of the internal standard obtained from a chromatogram.
r_S peak response of the Reference Standard obtained from a chromatogram.
r_U peak response of the analyte obtained from a chromatogram.
R resolution between two chromatographic peaks,

$$R = \frac{2(t_2 - t_1)}{W_1 + W_2}$$

$$\text{or} \quad R = \frac{2(t_2 - t_1)}{1.70(W_{1,h/2} + W_{2,h/2})}$$

R_F chromatographic retardation factor equal to the ratio of the distance from the origin to the center of a zone divided by the distance from the origin to the solvent front.

R_r relative retention time,[2]

$$R_r = \frac{t_2}{t_1}$$

R_{rel} relative retardation

$$R_{rel} = \frac{\text{distance traveled by test substance}}{\text{distance traveled by standard}}$$

R_S peak response ratio for a Standard preparation containing Reference Standard and internal standard,

$$R_S = \frac{r_S}{r_{IS}}$$

R_U peak response ratio for *Assay preparation* containing the analyte and internal standard,

$$R_U = \frac{r_U}{r_{IS}}$$

%RSD percent relative standard deviation,

▲
$$\%RSD = \frac{100}{\bar{X}}\left[\frac{\sum_{i=1}^{N}(X_i - \bar{X})^2}{N-1}\right]^{1/2}$$
▲*USP32*

where X_i is an individual measurement in a set of N measurements and $\bar{X}$ is the arithmetic mean of the set.

T tailing factor,[3]

$$T = \frac{W_{0.05}}{2f}$$

t retention time measured from time of injection to time of elution of peak maximum.
t_M retention time of nonretarded component, air with thermal conductivity detection.
W width of peak measured by extrapolating the relatively straight sides to the baseline.
$W_{h/2}$ width of peak at half height.
$W_{0.05}$ width of peak at 5% height.

Chromatographic Reagents

A complete list of *Packings* (L), *Phases* (G), and *Supports* (S) used in *USP–NF* tests and assays is located under *Chromatographic Reagents* in the *Reagents, Indicators, and Solutions* section. This list is intended to be a convenient reference for the chromatographer to identify the pertinent chromatographic reagent specified in the individual monograph.

[NOTE—Particle sizes given in the listing are those generally provided. Where other, usually finer, sizes are required, the individual monograph specifies the desired particle size. Within any category of packings or phases listed there may be a wide range of columns available. Where it is necessary to define more specifically the chromatographic conditions, the individual monograph so indicates.]

⟨1111⟩ Microbiological Examination of Nonsterile Products: Acceptance Criteria for Pharmaceutical Preparations and Substances for Pharmaceutical Use

The presence of certain microorganisms in nonsterile preparations may have the potential to reduce or even inactivate the therapeutic activity of the product and has a potential to adversely affect the health of the patient. Manufacturers have therefore to ensure a low bioburden of finished dosage forms by implementing current guidelines on Good Manufacturing Practice during the manufacture, storage, and distribution of pharmaceutical preparations.

Microbial examination of nonsterile products is performed according to the methods given in the texts on *Microbial Enumeration Tests* ⟨61⟩ and *Tests for Specified Microorganisms* ⟨62⟩. Acceptance criteria for nonsterile pharmaceutical products based upon the total aerobic microbial count (TAMC) and the total combined yeasts and molds count (TYMC) are given in *Tables 1* and *2*. Acceptance criteria are based on individual results or on the average of replicate counts when replicate counts are performed (e.g., direct plating methods).

[2]The parameters *k′, N, r,* and R_r were developed for isothermal GC separations and isocratic HPLC separations. Because these terms are thermodynamic parameters, they are valid only for separations made at constant temperature, mobile phase composition, and flow rate. However, for separations made with a temperature program or solvent gradient, these parameters may be used simply as comparative means to ensure that adequate chromatographic conditions exist to perform the methods as intended in the monographs.

[3]It is also a common practice to measure the *Asymmetry factor* as the ratio of the distance between the vertical line connecting the peak apex with the interpolated baseline and the peak front, and the distance between that line and the peak back measured at 10% of the peak height (in *Figure 2*), it would be $(W_{0.10} - f_{0.10})/f_{0.10}$. However, for the purposes of USP, only the formula presented in the *Glossary of Symbols* is valid.

Table 1. Acceptance Criteria for Microbiological Quality of Nonsterile Dosage Forms

Route of Administration	Total Aerobic Microbial Count (cfu/g or cfu/mL)	Total Combined Yeasts/Molds Count (cfu/g or cfu/mL)	Specified Microorganism(s)
Nonaqueous preparations for oral use	10^3	10^2	Absence of *Escherichia coli* (1 g or 1 mL)
Aqueous preparations for oral use	10^2	10^1	Absence of *Escherichia coli* (1 g or 1 mL)
Rectal use	10^3	10^2	—
Oromucosal use	10^2	10^1	Absence of *Staphylococcus aureus* (1 g or 1 mL) Absence of *Pseudomonas aeruginosa* (1 g or 1 mL)
Gingival use	10^2	10^1	Absence of *Staphylococcus aureus* (1 g or 1 mL) Absence of *Pseudomonas aeruginosa* (1 g or 1 mL)
Cutaneous use	10^2	10^1	Absence of *Staphylococcus aureus* (1 g or 1 mL) Absence of *Pseudomonas aeruginosa* (1 g or 1 mL)
Nasal use	10^2	10^1	Absence of *Staphylococcus aureus* (1 g or 1 mL) Absence of *Pseudomonas aeruginosa* (1 g or 1 mL)
Auricular use	10^2	10^1	Absence of *Staphylococcus aureus* (1 g or 1 mL) Absence of *Pseudomonas aeruginosa* (1 g or 1 mL)
Vaginal use	10^2	10^1	Absence of *Pseudomonas aeruginosa* (1 g or 1 mL) Absence of *Staphylococcus aureus* (1 g or 1 mL) Absence of *Candida albicans* (1 g or 1 mL)
Transdermal patches (limits for one patch including adhesive layer and backing)	10^2	10^1	Absence of *Staphylococcus aureus* (1 patch) Absence of *Pseudomonas aeruginosa* (1 patch)
Inhalation use (special requirements apply to liquid preparations for nebulization)	10^2	10^1	Absence of *Staphylococcus aureus* (1 g or 1 mL) Absence of *Pseudomonas aeruginosa* (1 g or 1 mL) Absence of bile-tolerant Gram-negative bacteria (1 g or 1 mL)

When an acceptance criterion for microbiological quality is prescribed, it is interpreted as follows:

- — 10^1 cfu: maximum acceptable count = 20;
- — 10^2 cfu: maximum acceptable count = 200;
- — 10^3 cfu: maximum acceptable count = 2000; and so forth.

Table 1 includes a list of specified microorganisms for which acceptance criteria are set. The list is not necessarily exhaustive, and for a given preparation it may be necessary to test for other microorganisms depending on the nature of the starting materials and the manufacturing process.

If it has been shown that none of the prescribed tests will allow valid enumeration of microorganisms at the level prescribed, a validated method with a limit of detection as close as possible to the indicated acceptance criterion is used.

Table 2. Acceptance Criteria for Microbiological Quality of Nonsterile Substances for Pharmaceutical Use

	Total Aerobic Microbial Count (cfu/g or cfu/mL)	Total Combined Yeasts/Molds Count (cfu/g or cfu/mL)
Substances for pharmaceutical use	10^3	10^2

In addition to the microorganisms listed in *Table 1*, the significance of other microorganisms recovered should be evaluated in terms of the following:

- The use of the product: hazard varies according to the route of administration (eye, nose, respiratory tract).
- The nature of the product: does the product support growth? does it have adequate antimicrobial preservation?
- The method of application.
- The intended recipient: risk may differ for neonates, infants, the debilitated.
- Use of immunosuppressive agents, corticosteroids.
- The presence of disease, wounds, organ damage.

Where warranted, a risk-based assessment of the relevant factors is conducted by personnel with specialized training in microbiology and in the interpretation of microbiological data. For raw materials, the assessment takes account of the processing to which the product is subjected, the current technology of testing, and the availability of materials of the desired quality.

(Official May 1, 2009)

⟨1121⟩ Nomenclature

The *USP* (or *NF*) titles for monograph articles are legally recognized under the Federal Food, Drug, and Cosmetic Act as the designations for use in labeling the articles to which they apply.

The value of designating each drug by one and only one nonproprietary[1] name is important in terms of achieving simplicity and uniformity in drug nomenclature. In support of the U.S. Adopted Names program (see *Mission and Preface* in *USP–NF*), of which the U.S. Pharmacopeial Convention is a cosponsor, the USP Council of Experts gives consideration to the adoption of the U.S. Adopted Name, if any, as the official title for any compound that attains compendial recognition.

A compilation of the U.S. Adopted Names (USAN) published from the start of the USAN program in 1961, as well as other names for drugs, both current and retrospective, is provided in the *USP Dictionary of USAN and International Drug Names*. This publication serves as a book of names useful for identifying and distinguishing all kinds of names for drugs, whether public, proprietary, chemical, or code-designated names.[2]

A nonproprietary name of a drug serves numerous and varied purposes, its principal function being to identify the substance to which it applies by means of a designation that may be used by the professional and lay public free from the restrictions associated with registered trademarks. Teaching in the health sciences requires a common designation, especially for a drug that is available from several sources or is incorporated into a combination drug product; nonpro-

[1] The term "generic" has been widely used in place of the more accurate and descriptive term "nonproprietary" with reference to drug nomenclature.

[2] *USP Dictionary of USAN and International Drug Names* is obtainable on order from U.S. Pharmacopeia, Customer Service Department, 12601 Twinbrook Parkway, Rockville, MD 20852.

prietary names facilitate communication among healthcare providers; nonproprietary names must be used as the titles of the articles recognized by official drug compendia; a nonproprietary name is essential to the pharmaceutical manufacturer as a means of protecting trademark rights in the brand name for the article concerned; and, finally, the manufacturer is obligated by federal law to include the established nonproprietary name in advertising and labeling.

Under the terms of the Drug Amendments of 1962 to the Federal Food, Drug, and Cosmetic Act, which became law October 10, 1962, the Secretary of Health and Human Services is authorized to designate an official name for any drug wherever deemed "necessary or desirable in the interest of usefulness and simplicity."[3]

The Commissioner of Food and Drugs and the Secretary of Health and Human Services published in the *Federal Register* regulations effective November 26, 1984, which state, in part:

"Sec. 299.4 Established names of drugs."

"(e) The Food and Drug Administration will not routinely designate official names under section 508 of the act. As a result, the established name under section 502(e) of the act will ordinarily be either the compendial name of the drug or, if there is no compendial name, the common and usual name of the drug. Interested persons, in the absence of the designation by the Food and Drug Administration of an official name, may rely on as the established name for any drug the current compendial name or the USAN adopted name listed in *USAN and the USP Dictionary of Drug Names*."[4]

It will be noted that the monographs on the biologics, which are produced under licenses issued by the Secretary of the U.S. Department of Health and Human Services, represent a special case. Although efforts continue toward achieving uniformity, there may be a difference between the respective title required by federal law and the USP title. Such differences are fewer than in past revisions of the Pharmacopeia. The USP title, where different from the FDA Center for Biologics Evaluation and Research title, does not necessarily constitute a synonym for labeling purposes; the conditions of licensing the biologic concerned require that each such article be designated by the name appearing in the product license issued to the manufacturer. Where a USP title differs from the title in the federal regulations, the former has been adopted with a view to usefulness, simplicity, and conformity with the principles governing the selection of monograph titles generally.

General Nomenclature Forms

Some monograph titles existing in the *USP–NF* do not conform to the formats outlined in this general information chapter. Typically, these monograph titles were adopted before the establishment of the title formats and nomenclature policies presented in this general information chapter. Such monograph titles may be subject to subsequent revision and should not be interpreted as precedents for other monograph titles.

Standardized forms of nomenclature have been devised in the interest of achieving uniformity for naming compendial articles. The general nomenclature forms that follow illustrate the terminology used throughout the official compendia for consistency in establishing titles of monographs on official pharmaceutical dosage forms and preparations. Examples are shown for the more frequently encountered categories of dosage forms.

For a variety of dosage forms, titles are in the following general form: [DRUG] [ROUTE OF ADMINISTRATION] [DOSAGE FORM].

Examples:
Calcium Carbonate Oral Suspension
Cetylpyridinium Chloride Topical Solution
Dexamethasone Ophthalmic Suspension
Epinephrine Bitartrate Ophthalmic Solution
Isosorbide Dinitrate Sublingual Tablets
Miconazole Nitrate Topical Powder
Triple Sulfa Vaginal Cream

The term "Vaginal Inserts", rather than "Vaginal Tablets", "Vaginal Capsules", or "Vaginal Suppositories" is used in the title of this type of vaginal preparation to avoid the potential for misuse of these products if the term "Tablets" or "Capsules" or "Suppositories" were to appear in the title.

Example:
Clotrimazole Vaginal Inserts

The term for route of administration is omitted for those dosage forms for which the route of administration is understood. The general form then becomes simply [DRUG] [DOSAGE FORM]. Thus, capsules, tablets, and lozenges are administered via the oral route unless otherwise indicated by the title.

Examples:
Acetaminophen Capsules
Aminophylline Delayed-Release Tablets
Aspirin Extended-Release Tablets
Hexylresorcinol Lozenges
Meperidine Hydrochloride Tablets

Drugs that are injected may be administered via the intravenous, intramuscular, subcutaneous, etc., route; the route being specified in the labeling rather than in the name.

Examples:
Aurothioglucose Injectable Suspension
Epinephrine Injection
Fluorouracil Injection
Hydrocortisone Acetate Injectable Suspension
Phytonadione Injectable Emulsion

Creams, ointments, lotions, and pastes are applied topically, unless otherwise indicated by the name.

Examples:
Benzoyl Peroxide Lotion
Betamethasone Dipropionate Cream
Estradiol Vaginal Cream
Nystatin Ointment
Zinc Oxide Paste

The term "Suppositories" is used in the titles of preparations that are intended for rectal administration.

Example:
Aspirin Suppositories

The term "for" is included in names, as appropriate, of preparations for which a solid drug substance must be dissolved or suspended in a suitable liquid to obtain a dosage form, and the general form becomes [DRUG] for [ROUTE OF ADMINISTRATION] [DOSAGE FORM].

Examples:
Ampicillin for Oral Suspension
Epinephrine Bitartrate for Ophthalmic Solution
Nafcillin for Injection
Spectinomycin for Injectable Suspension

In some instances, the drug is supplied in one dosage form for the preparation of the intended dosage form.

[3] F.D.&C. Act, Sec. 508 [358].

[4] 53 Fed. Reg. 5369 (1988) amending 21 CFR § 299.4.

Examples:
Aspirin Effervescent Tablets for Oral Solution
Methadone Hydrochloride Tablets for Oral Suspension
Papain Tablets for Topical Solution

Systems are preparations of drugs in carrier devices that are applied topically or inserted into body cavities, from which drugs are released gradually over extended times, after which the carrier device is removed. The general form for a system is [DRUG] [ROUTE] [SYSTEM].

Examples:
Nicotine Transdermal System
Progesterone Intrauterine Contraceptive System

Some drugs are available as concentrated solutions that are not intended for direct administration to humans or animals, but are to be diluted with suitable liquid vehicles to obtain the intended preparation. The general form for these preparations, which are not dosage forms, is [DRUG] [CONCENTRATE].

Examples:
Isosorbide Concentrate (used to prepare Isosorbide Oral Solution)
Glutaral Concentrate (used to prepare Glutaral Disinfectant Solution)

For products intended for parenteral administration, the use of the word "Concentrate" in the monograph title is restricted to one specific monograph, Potassium Chloride for Injection Concentrate. The word "Concentrate" should not appear in the monograph title for any other parenteral product; rather, this issue is to be addressed in the product labeling.

Some drugs are supplied as preparations that may be intermediates used for convenience in formulating finished dosage forms. The general form for such preparations, which are not finished dosage forms, is [DRUG] [PREPARATION].

Examples:
Vitamin E Preparation
Cranberry Liquid Preparation

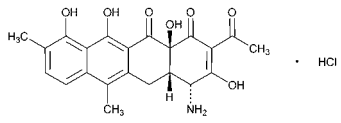
Monograph Naming Policy for Salt Drug Substances in Drug Products and Compounded Preparations

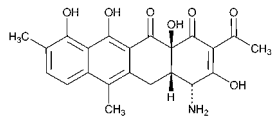
The titles of USP monographs for drug products and compounded preparations formulated with a salt of an acid or base use the name of the active moiety, as defined below. The strength of the product or preparation also is expressed in terms of the active moiety.

An active moiety is the molecule or ion, excluding those appended portions of the molecule that cause the drug to be an ester, salt (including a salt with hydrogen or coordination bonds), or other noncovalent derivative (such as a complex, chelate, or clathrate) of the molecule, responsible for the physiological or pharmacological action of the drug substance, without regard to the actual charged state of the molecule in-vivo.

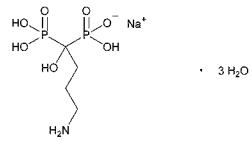
For example, the active moiety of a hydrochloride salt of a base will be the free base and not the protonated form of the base. The active moiety of a metal acid salt will be the free acid.

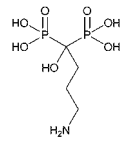
i. Example: Chelocardin Hydrochloride active moiety is Chelocardin





ii. Example: Alendronate Sodium active moiety is Alendronic Acid





This Policy is followed by USP in naming drug products and compounded preparations that are newly recognized in the USP. Revising existing monographs to conform to this Policy is not intended, except where the USP Council of Experts determines that, for reasons such as safety, a nomenclature change is warranted.

Related Issues

Labeling—The labeling clearly states the specific salt form of the active moiety that is present in the product/preparation, as this information may be useful to practitioners and patients. The names and strengths of both the active moiety and specific salt form (where applicable) are provided in the labeling.

Exceptions—In those rare cases in which the use of the specific salt form of the active moiety in the title provides vital information from a clinical perspective, an exception to this Policy may be considered. In such cases, where the monograph title contains the specific salt form of the active moiety, the strength of the product or preparation also is expressed in terms of the specific salt form.

Policy for Postponement Schedules

It is the practice of USP to postpone the official dates of nomenclature and labeling revisions for a reasonable time primarily to allow for product label changes to be made and to allow health practitioners and consumers time to become familiar with the new terminology. A postponement period of 18 months is usually applied when only one or a small number of products is affected. A postponement period of 30 months is usually applied when names or labeling of multisource products or multiproduct lines of a firm's preparations are being changed. A postponement period of 60 months is usually applied for title and labeling changes that affect excipients, because such changes would require relabeling of very large numbers of prescription-only and OTC preparations.

There may be exceptions to this postponement schedule where a shorter time is needed in order to specify nomenclature and labeling changes in cases where public health and safety are a concern.

The assignment of a postponement schedule is handled by the USP Expert Committee on Nomenclature. The postponement schedules are presented below. USP's implementation of a postponement schedule is automatic, unless an exception is sought. Exceptions to the postponement schedule are rarely made, and must have suitable justi-

fication as well as the approval of the Expert Committee on Nomenclature. Any questions or concerns regarding this postponement schedule may be addressed to the USP staff liaison assigned to the Expert Committee on Nomenclature.

18 months—Schedule for title and labeling changes for a drug product. One or few companies are involved. *Example:* Sterile [Drug] change to [Drug] for Injection.

30 months—Schedule for title and labeling changes for prescription-only and OTC products.

1. Extensive product line for a company. *Examples:* syrups and elixirs.
2. Several companies are involved. *Examples:* syrups and elixirs; lotions; sunscreens.

60 months—Schedule for title and labeling changes for excipient monographs. Ingredient names in numerous multisource products are affected.

Section 8

Dietary Supplement Monographs and General Chapters

This section provides abridged versions of monographs for dietary supplement ingredients and products. These monographs are followed by selected dietary supplement general chapters related to the practice of pharmacy.

In 1994, the U.S. Congress enacted the Dietary Supplement Health and Education Act (DSHEA). Its importance to the profession of pharmacy has been acknowledged by the National Association of Boards of Pharmacy (NABP), which added a competency statement related to dietary supplements to the updated North American Pharmacist Licensure Examination (NAPLEX) blueprint. NABP has noted that the *USP* is the official compendia for dietary supplement standards. Although USP standards are referenced in DSHEA and by NABP, manufacturer conformance is optional.

Section Contents

Arginine Capsules

» Arginine Capsules contain not less than 90.0 percent and not more than 110.0 percent of the labeled amount of arginine or arginine hydrochloride in an amount equivalent to $C_6H_{14}N_4O_2$.

Packaging and storage—Preserve in tight, light-resistant containers.

Labeling—The label states the form of arginine that is used and the equivalent amount of $C_6H_{14}N_4O_2$.

Arginine Tablets

» Arginine Tablets contain not less than 90.0 percent and not more than 110.0 percent of the labeled amount of arginine or arginine hydrochloride in an amount equivalent to $C_6H_{14}N_4O_2$.

Packaging and storage—Preserve in tight, light-resistant containers.

Labeling—The label states the form of the arginine that is used and the equivalent amount of $C_6H_{14}N_4O_2$.

Curcuminoids

» Curcuminoids is a partially purified natural complex of diaryl heptanoid derivatives isolated from turmeric, *Curcuma longa* L. It contains not less than 95.0 percent of curcuminoids, calculated on the dried basis, as the sum of curcumin, desmethoxycurcumin, and bisdesmethoxycurcumin. It contains not less than 70.0 percent and not more than 80.0 percent of curcumin, not less than 15.0 percent and not more than 25.0 percent of desmethoxycurcumin, and not less than 2.5 percent and not more than 6.5 percent of bisdesmethoxycurcumin.

Packaging and storage—Preserve in well-closed containers, protected from light and moisture, and store at room temperature.

Labeling—The label states the content of curcuminoids and the content of individual curcuminoids, on the dried basis; the Latin binominal; and the part of the plant used to prepare the article.

Loss on drying ⟨731⟩—Dry 1.0 g at 105° for 2 hours: it loses not more than 2.0% of its weight.

Curcuminoids Capsules

» Curcuminoids Capsules are prepared from Curcuminoids and contain not less than 90.0 percent and not more than 110.0 percent of the labeled amount of curcuminoids, calculated as the sum of curcumin, desmethoxycurcumin, and bisdesmethoxycurcumin.

Packaging and storage—Preserve in well-closed containers, protected from light and moisture, and store at room temperature.

Labeling—The label indicates the content of curcuminoids in mg per Capsule.

Curcuminoids Tablets

» Curcuminoids Tablets are prepared from Curcuminoids and contain not less than 90.0 percent and not more than 110.0 percent of the labeled amount of curcuminoids, calculated as the sum of curcumin, desmethoxycurcumin, and bisdesmethoxycurcumin.

Packaging and storage—Preserve in well-closed containers, protected from light and moisture, and store at room temperature.

Labeling—The label indicates the content of curcuminoids in mg per Tablet.

Powdered Soy Isoflavones Extract

» Powdered Soy Isoflavones Extract is prepared from the seeds of *Glycine max* Merr. (Fam. Fabaceae) by extraction with water or hydroalcoholic mixtures. It contains not less than 90.0 percent and not more than 110.0 percent of the labeled amount of isoflavones, calculated on the dried basis as the sum of daidzin, glycitin, genistin, and one or more of the following isoflavones: malonyl daidzin, malonyl glycitin, malonyl genistin, acetyl daidzin, acetyl glycitin, acetyl genistin, daidzein, glycitein, and genistein.

Packaging and storage—Preserve in tight, light-resistant containers, and store at controlled room temperature.

Labeling—The label states the Latin binomial and, following the official name, the part of the plant from which the article was prepared. The label also indicates the content of isoflavones. It meets other requirements for labeling under *Botanical Extracts* ⟨565⟩.

Loss on drying ⟨731⟩—Dry about 1.0 g of the Powdered Soy Isoflavones Extract, accurately weighed, at 130° for 2 hours: it loses not more than 7.0% of its weight.

Soy Isoflavones Capsules

» Soy Isoflavones Capsules contain Powdered Soy Isoflavones Extract. Capsules contain not less than 90.0 percent and not more than 110.0 percent of the labeled amount of the Extract, represented by the sum of the content of the isoflavones daidzin, glycitin, genistin and one or more of the following isoflavones: malonyl daidzin, malonyl glycitin, malonyl genistin, acetyl daidzin, acetyl glycitin, acetyl genistin, daidzein, glycitein, and genistein.

Packaging and storage—Preserve in tight, light-resistant containers, and store at room temperature.

Labeling—The label states the Latin binomial and, following the official name, the article from which the Capsules were prepared. Label it to indicate the amount of Extract, in mg, per Capsule. Label it to indicate the content, in percentage, of the isoflavones in the Extract used to prepare the Capsules.

Soy Isoflavones Tablets

» Soy Isoflavones Tablets contain Powdered Soy Isoflavones Extract. Tablets contain not less than 90.0 percent and not more than 110.0 percent of the labeled amount of the Extract, represented by the sum of the content of the isoflavones daidzin, glycitin, genistin, and one or more of the following isoflavones: malonyl daidzin, malonyl glycitin, malonyl genistin, acetyl daidzin, acetyl glycitin, acetyl genistin, daidzein, glycitein, and genistein.

Packaging and storage—Preserve in tight, light-resistant containers, and store at room temperature.

Labeling—The label states the Latin binomial and, following the official name, the article from which the Tablets were prepared. Label it to indicate the amount of Extract, in mg, per Tablet. Label it to indicate the content, in percentage, of the isoflavones in the Extract used to prepare the Tablets.

Turmeric

» Turmeric is the dried rhizome of *Curcuma longa* L., also known as *C. domestica* Val., (Fam. Zingiberaceae). It is commonly known as Curcuma, Curcum, Haridra, and Indian Saffron. It contains not less than 3.0 percent of curcuminoids, calculated on the dried basis.

Packaging and storage—Preserve in well-closed containers, protected from light and moisture, and store at room temperature.

Labeling—The label states the Latin binominal and, following the official name, the part of the plant contained in the article.

Powdered Turmeric

» Powdered Turmeric is Turmeric reduced to a fine or very fine powder.

Packaging and storage—Preserve in well-closed containers, protected from light and moisture, and store at room temperature.

Labeling—The label states the Latin binominal and, following the official name, the part of the plant contained in the article.

Powdered Turmeric Extract

» Powdered Turmeric Extract is prepared from the pulverized rhizomes of *Curcuma longa* L. (Fam. Zingiberaceae), using acetone, methanol, or other suitable solvents. It contains not less than 20 percent of total curcuminoids, calculated on the dried basis. It may contain other added substances.

Packaging and storage—Preserve in well-closed containers, protected from light and moisture, and store at controlled room temperature.

Labeling—The label states the Latin binominal and, following the official name, the part of the plant contained in the article. It meets other labeling requirements under *Botanical Extracts* ⟨565⟩.

Loss on drying ⟨731⟩—Dry 1.0 g at 105° for 2 hours: it loses not more than 7.0% of its weight.

Section 13

Reference Tables of *USP–NF*

The following material discusses the description and relative solubilities of articles in *USP–NF,* describes standard buffer solutions, and provides atomic weights of the elements and relative atomic masses and half-lives of certain radionuclides. An alcoholometric table, intrinsic viscosity table, and table of thermometric equivalents also are included. This material, extracted from the *USP–NF,* is intended as a valuable resource for practicing pharmacists.

Section Contents

Description and Solubility

Description and Relative Solubility of USP and NF Articles

The "description" and "solubility" statements pertaining to an article (formerly included in the individual monograph) are general in nature. The information is provided for those who use, prepare, and dispense drugs, solely to indicate descriptive and solubility properties of an article complying with monograph standards. The properties are not in themselves standards or tests for purity even though they may indirectly assist in the preliminary evaluation of the integrity of an article.

Taste and Odor

Organoleptic characteristics are indicated in many instances because they may be useful and descriptive properties of substances. However, they are not meant to be applied as tests for identifying materials.

The inclusion of odor or taste among other descriptive properties may aid in identifying the causative agent following accidental exposure to or contact with a substance. This information is provided as a warning or to make an individual aware of sensations that may be encountered. The use of odor or taste as a test for identification or content is strongly discouraged.

The characteristic odor of a volatile substance becomes apparent immediately on opening a container of it. The odor may be agreeable (e.g., Peppermint Oil), unpleasant (e.g., Sulfur Dioxide), or potentially hazardous on prolonged exposure (e.g., Coal Tar). Moreover, an unexpected odor may be encountered if the characteristics of a substance are not known or if a container is incorrectly labeled. Consequently, containers of such substances should be opened cautiously, preferably in a well-ventilated fume hood. A characteristic taste or sensation produced in the oral cavity likewise is apparent if traces of residue materials on fingers are inadvertently brought into contact with the tongue or adjacent mucosal tissues.

Solubility

Only where a special, quantitative solubility test is given in the individual monograph, and is designated by a test heading, is it a test for purity.

The approximate solubilities of Pharmacopeial and National Formulary substances are indicated by the descriptive terms in the accompanying table. The term "miscible" as used in this Pharmacopeia pertains to a substance that yields a homogeneous mixture when mixed in any proportion with the designated solvent.

Descriptive Term	Parts of Solvent Required for 1 Part of Solute
Very soluble	Less than 1
Freely soluble	From 1 to 10
Soluble	From 10 to 30
Sparingly soluble	From 30 to 100
Slightly soluble	From 100 to 1000
Very slightly soluble	From 1000 to 10,000
Practically insoluble, or Insoluble	10,000 and over

Soluble Pharmacopeial and National Formulary articles, when brought into solution, may show traces of physical impurities, such as minute fragments of filter paper, fibers, and other particulate matter, unless limited or excluded by definite tests or other specifications in the individual monographs.

Acacia: Is practically odorless and produces a mucilaginous sensation on the tongue. Insoluble in alcohol. Optical rotation varies depending on the source of Acacia. For example, specific rotation values, calculated on the anhydrous basis and determined on a 1.0% (w/v) solution, usually are between –25° and –35° for *Acacia senegal* and between +35° and +60° for *Acacia seyal*. *NF category:* Emulsifying and/or solubilizing agent; suspending and/or viscosity-increasing agent; tablet binder.

Acebutolol Hydrochloride: White or almost white, crystalline powder. Soluble in alcohol and in water; very slightly soluble in acetone and in methylene chloride; practically insoluble in ether. Melts at about 141° to 144°.

Acesulfame Potassium: A white, crystalline powder or colorless crystals. Soluble in water; very slightly soluble in acetone and in alcohol. *NF category:* Sweetening agent.

Acetaminophen: White, odorless, crystalline powder, having a slightly bitter taste. Freely soluble in alcohol; soluble in boiling water and in 1 N sodium hydroxide.

Acetazolamide: White to faintly yellowish-white, crystalline, odorless powder. Sparingly soluble in practically boiling water; slightly soluble in alcohol; very slightly soluble in water.

Acetic Acid: Clear, colorless liquid, having a strong, characteristic odor, and a sharply acid taste. Specific gravity is about 1.045. Miscible with water, with alcohol, and with glycerin. *NF category:* Acidifying agent; buffering agent.

Glacial Acetic Acid: Clear, colorless liquid, having a pungent, characteristic odor and, when well diluted with water, an acid taste. Boils at about 118°. Specific gravity is about 1.05. Miscible with water, with alcohol, and with glycerin. *NF category:* Acidifying agent.

Acetohexamide: White, crystalline, practically odorless powder. Soluble in pyridine and in dilute solutions of alkali hydroxides; slightly soluble in alcohol and in chloroform; practically insoluble in water and in ether.

Acetohydroxamic Acid: White, slightly hygroscopic, crystalline powder. Melts, after drying at about 80° for 2 to 4 hours, at about 88°. Freely soluble in water and in alcohol; very slightly soluble in chloroform.

Acetone: Transparent, colorless, mobile, volatile liquid, having a characteristic odor. A solution (1 in 2) is neutral to litmus. Miscible with water, with alcohol, with ether, with chloroform, and with most volatile oils. *NF category:* Solvent.

Acetylcholine Chloride: White or off-white crystals or crystalline powder. Very soluble in water; freely soluble in alcohol; insoluble in ether. Is decomposed by hot water and by alkalies.

Acetylcysteine: White, crystalline powder, having a slight acetic odor. Freely soluble in water and in alcohol; practically insoluble in chloroform and in ether.

Acetyltributyl Citrate: Clear, practically colorless, oily liquid. Freely soluble in alcohol, in isopropyl alcohol, in acetone, and in toluene; insoluble in water. *NF category:* Plasticizer.

Acetyltriethyl Citrate: Clear, practically colorless, oily liquid. Freely soluble in alcohol, in isopropyl alcohol, in acetone, and in toluene; insoluble in water. *NF category:* Plasticizer.

Acitretin: Yellow or greenish, crystalline powder. Sparingly soluble in tetrahydrofuran; slightly soluble in acetone and in alcohol; very slightly soluble in cyclohexane; practically insoluble in water.

Acyclovir: White to off-white, crystalline powder. Melts at temperatures higher than 250°, with decomposition. Soluble in diluted hydrochloric acid; slightly soluble in water; insoluble in alcohol.

Ademetionine Disulfate Tosylate: White powder. Freely soluble in water.

Adenine: White crystals or crystalline powder. Is odorless and tasteless. Sparingly soluble in boiling water; slightly soluble in alcohol; very slightly soluble in water; practically insoluble in ether and in chloroform.

Adenosine: White, odorless, crystalline powder. Slightly soluble in water; practically insoluble in alcohol. Melts at about 235°.

Adipic Acid: A white, crystalline powder. Freely soluble in alcohol and in methanol; soluble in boiling water and in acetone; slightly soluble in water. *NF category:* Buffering agent.

Agar: Odorless or has a slight odor, and produces a mucilaginous sensation on the tongue. Soluble in boiling water; insoluble in cold water. *NF category:* Suspending and/or viscosity-increasing agent.

Alamic Acid: *NF category:* Suspending and/or viscosity-increasing agent.

Alanine: White, odorless crystals or crystalline powder, having a slightly sweet taste. Freely soluble in water; slightly soluble in 80% alcohol; insoluble in ether.

Albendazole: White to faintly yellowish powder. Freely soluble in anhydrous formic acid; very slightly soluble in ether and in methylene chloride; practically insoluble in alcohol and in water.

Albumin Human: Practically odorless, moderately viscous, clear, brownish fluid.

rAlbumin Human: Clear, slightly viscous, and colorless to yellow amber in color. *NF category:* Vehicle (sterile).

Albuterol: White, crystalline powder. Soluble in alcohol; sparingly soluble in water. Melts at about 156°.

Albuterol Sulfate: White or practically white powder. Freely soluble in water; slightly soluble in alcohol, in chloroform, and in ether.

Alcohol: Clear, colorless, mobile, volatile liquid. Has a characteristic odor and produces a burning sensation on the tongue. Is readily volatilized even at low temperatures, and boils at about 78°. Is flammable. Miscible with water and with practically all organic solvents. *NF category:* Solvent.

Dehydrated Alcohol: Clear, colorless, mobile, volatile liquid. Has a characteristic odor and produces a burning sensation on the tongue. Is readily volatilized even at low temperatures, and boils at about 78°. Is flammable. Miscible with water and with practically all organic solvents.

Diluted Alcohol: Clear, colorless, mobile liquid, having a characteristic odor and producing a burning sensation on the tongue. *NF category:* Solvent.

Rubbing Alcohol: Transparent, colorless, or colored as desired, mobile, volatile liquid. Has an extremely bitter taste and, in the absence of added odorous constituents, a characteristic odor. Is flammable.

Alendronate Sodium: White, free-flowing powder. Soluble in water; very slightly soluble in dimethyl sulfoxide, in methyl alcohol, and in propylene glycol; practically insoluble in acetone, in acetonitrile, in alcohol, in chloroform, and in isopropyl alcohol.

Alfadex: A white or almost white, amorphous or crystalline powder. Freely soluble in water and in propylene glycol; practically insoluble in ethanol and in methylene chloride.

Alfentanil Hydrochloride: White to almost white powder. Freely soluble in methanol, in alcohol, and in chloroform; soluble in water; sparingly soluble in acetone. Melting point range, crystals from acetone: 136° – 143° (anhydrous) and reported as crystals from aqueous hydrochloric acid: 116° – 126° (monohydrate).

Alfentanil Injection: Clear, colorless solution.

Alfuzosin Hydrochloride: White to almost white powder, slightly hygroscopic. Freely soluble in water; sparingly soluble in alcohol; practically insoluble in methylene chloride.

Alginic Acid: White to yellowish white, fibrous powder. Is odorless, or practically odorless, and is tasteless. Insoluble in water and in organic solvents; soluble in alkaline solutions. *NF category:* Suspending and/or viscosity-increasing agent; tablet binder; tablet disintegrant.

Alkyl (C12-15) Benzoate: Clear, practically colorless, oily liquid. Soluble in acetone, in alcohol, in isopropyl alcohol, in ethyl acetate, in isopropyl myristate, in isopropyl palmitate, in lanolin, in mineral oil, in vegetable oils, and in volatile silicones; insoluble in water, in glycerin, and in propylene glycol. *NF category:* Vehicle (oleaginous); emollient.

Allantoin: White, crystalline powder. Slightly soluble in water; very slightly soluble in alcohol. Melts at about 225°, with decomposition.

Allopurinol: Fluffy white to off-white powder, having only a slight odor. Soluble in solutions of potassium and sodium hydroxides; very slightly soluble in water and in alcohol; practically insoluble in chloroform and in ether.

Allyl Isothiocyanate: Colorless to pale yellow, very refractive, liquid. Pungent irritating odor, acrid taste. [*Caution: Lachrymator.*] Miscible with alcohol, with carbon disulfide, and with ether. Slightly soluble in water.

Almond Oil: Clear, pale straw-colored or colorless, oily liquid, having a bland taste. Remains clear at –10°, and does not congeal until cooled to almost –20°. Slightly soluble in alcohol; miscible with ether, with chloroform, with benzene, and with solvent hexane. *NF category:* Flavors and perfumes; vehicle (oleaginous).

Aloe: Has a characteristic, somewhat sour and disagreeable, odor.

Alprazolam: A white to off-white, crystalline powder. Melts at about 225°. Freely soluble in chloroform; soluble in alcohol; sparingly soluble in acetone; slightly soluble in ethyl acetate; insoluble in water.

Alprostadil: A white to off-white, crystalline powder. Melts at about 110°. Freely soluble in alcohol; soluble in water and in acetone; slightly soluble in ethyl acetate; very slightly soluble in chloroform and in ether.

Altretamine: White, crystalline powder. Soluble in chloroform; insoluble in water.

Ammonium Alum: Large, colorless crystals, crystalline fragments, or white powder. Is odorless, and has a sweetish, strongly astringent taste. Its solutions are acid to litmus. Very soluble in boiling water; freely soluble in water; freely but slowly soluble in glycerin; insoluble in alcohol.

Potassium Alum: Large, colorless crystals, crystalline fragments, or white powder. Is odorless, and has a sweetish, strongly astringent taste. Its solutions are acid to litmus. Very soluble in boiling water; freely soluble in water; freely but slowly soluble in glycerin; insoluble in alcohol.

Aluminum Acetate Topical Solution: Clear, colorless liquid having a faint odor of acetic acid, and a sweetish, astringent taste. Specific gravity is about 1.02.

Aluminum Chloride: White, or yellowish-white, deliquescent, crystalline powder. Is practically odorless, and has a sweet, very astringent taste. Its solutions are acid to litmus. Very soluble in water; freely soluble in alcohol; soluble in glycerin.

Aluminum Hydroxide Gel: White, viscous suspension, from which small amounts of clear liquid may separate on standing.

Dried Aluminum Hydroxide Gel: White, odorless, tasteless, amorphous powder. Soluble in dilute mineral acids and in solutions of fixed alkali hydroxides; insoluble in water and in alcohol.

Aluminum Monostearate: Fine, white to yellowish-white, bulky powder, having a faint, characteristic odor. Insoluble in water, in alcohol, and in ether. *NF category:* Suspending and/or viscosity-increasing agent.

Aluminum Phosphate Gel: White, viscous suspension from which small amounts of water separate on standing.

Aluminum Subacetate Topical Solution: Clear, colorless or faintly yellow liquid, having an odor of acetic acid and an acid reaction to litmus. Gradually becomes turbid on standing, through separation of a more basic salt.

Aluminum Sulfate: White, crystalline powder, shining plates, or crystalline fragments. Is stable in air. Is odorless, and has a sweet taste, becoming mildly astringent. Freely soluble in water; insoluble in alcohol.

Amantadine Hydrochloride: White or practically white, crystalline powder, having a bitter taste. Freely soluble in water; soluble in alcohol and in chloroform.

Amifostine: White, crystalline powder. Freely soluble in water.

Amikacin: White, crystalline powder. Sparingly soluble in water.

Amikacin Sulfate: White, crystalline powder. Freely soluble in water.

Amiloride Hydrochloride: Yellow to greenish-yellow, odorless or practically odorless powder. Freely soluble in dimethyl sulfoxide; slightly soluble in water; sparingly soluble in methanol; insoluble in ether, in ethyl acetate, in acetone, and in chloroform.

Amino Methacrylate Copolymer: Colorless to yellowish granules. Soluble in acetone, in isopropyl alcohol, and in diluted acids; practically insoluble in water. The solutions are clear to slightly cloudy. *NF category:* Coating agent; polymer membrane; tablet binder.

Aminobenzoate Potassium: White, crystalline powder. The pH of a 1 in 100 solution in water is about 7. Very soluble in water; soluble in alcohol; practically insoluble in ether.

Aminobenzoic Acid: White or slightly yellow, odorless crystals or crystalline powder. Discolors on exposure to air or light. Slightly soluble in water and in chloroform; freely soluble in alcohol and in solutions of alkali hydroxides and carbonates; sparingly soluble in ether.

Aminobenzoic Acid Topical Solution: Straw-colored solution having the odor of alcohol.

Aminocaproic Acid: Fine, white, crystalline powder. Is odorless, or practically odorless. Its solutions are neutral to litmus. Melts at about 205°. Freely soluble in water, in acids, and in alkalies; slightly soluble in methanol and in alcohol; practically insoluble in chloroform and in ether.

Aminoglutethimide: Fine, white, or creamy white, crystalline powder. Very slightly soluble in water; readily soluble in most organic solvents. Forms water-soluble salts with strong acids.

Aminohippuric Acid: White, crystalline powder. Discolors on exposure to light. Melts at about 195°, with decomposition. Sparingly soluble in water and in alcohol; freely soluble in alkaline solutions, with some decomposition, and in diluted hydrochloric acid; very slightly soluble in benzene, in carbon tetrachloride, in chloroform, and in ether.

Aminopentamide Sulfate: White, crystalline powder. Freely soluble in water and in alcohol; very slightly soluble in chloroform; practically insoluble in ether.

Aminophylline: White or slightly yellowish granules or powder, having a slight ammoniacal odor and a bitter taste. Upon exposure to air, it gradually loses ethylenediamine and absorbs carbon dioxide with the liberation of free theophylline. Its solutions are alkaline to litmus. One g dissolves in 25 mL of water to give a clear solution; 1 g dissolved in 5 mL of water crystallizes upon standing, but redissolves when a small amount of ethylenediamine is added. Insoluble in alcohol and in ether.

Aminophylline Tablets: May have a faint ammoniacal odor.

Aminosalicylate Sodium: White to cream-colored, crystalline powder. Is practically odorless, and has a sweet, saline taste. Its solutions decompose slowly and darken in color. Freely soluble in water; sparingly soluble in alcohol; very slightly soluble in ether and in chloroform.

Aminosalicylic Acid: White or practically white, bulky powder, that darkens on exposure to light and air. Is odorless, or has a slight acetous odor. Slightly soluble in water and in ether; soluble in alcohol; practically insoluble in benzene.

Amitriptyline Hydrochloride: White or practically white, odorless or practically odorless, crystalline powder or small crystals. Freely soluble in water, in alcohol, in chloroform, and in methanol; insoluble in ether.

Amlodipine Besylate: A white or almost white powder. Freely soluble in methanol; sparingly soluble in alcohol; slightly soluble in 2-propanol and in water.

Strong Ammonia Solution: Clear, colorless liquid, having an exceedingly pungent, characteristic odor. Specific gravity is about 0.90. *NF category:* Alkalizing agent.

Aromatic Ammonia Spirit: Practically colorless liquid when recently prepared, but gradually acquiring a yellow color on standing. Has the taste of ammonia, has an aromatic and pungent odor, and is affected by light. Specific gravity is about 0.90.

Ammonio Methacrylate Copolymer: Colorless, clear to white-opaque granules or a white powder, both with a faint amine-like odor. Soluble to freely soluble in methanol, in alcohol, and in isopropyl alcohol, each of which contains small amounts of water; soluble to freely soluble in acetone, in ethyl acetate, and in methylene chloride. The solutions are clear to slightly cloudy. Insoluble in petroleum ether and in water. *NF category:* Coating agent; tablet binder; polymer membrane.

Ammonio Methacrylate Copolymer Dispersion: Milky-white liquids of low viscosity with a faint characteristic odor. Miscible with water in any proportion, the milky-white appearance being retained. A clear or slightly cloudy solution is obtained on mixing one part with five parts of acetone, alcohol, or isopropyl alcohol. When mixed with methanol in a ratio of 1:5, Ammonio Methacrylate Copolymer Dispersion Type A dissolves completely, and Ammonio Methacrylate Copolymer Dispersion Type B dissolves only partially. *NF category:* Coating agent; polymer membrane; tablet binder.

Ammonium Carbonate: White powder, or hard, white or translucent masses, having a strong odor of ammonia, without empyreuma, and a sharp, ammoniacal taste. Its solutions are alkaline to litmus. On exposure to air, it loses ammonia and carbon dioxide, becoming opaque, and is finally converted into friable porous lumps or a white powder of ammonium bicarbonate. Freely soluble in water, but is decomposed by hot water. *NF category:* Alkalizing agent; buffering agent.

Ammonium Chloride: Colorless crystals or white, fine or coarse, crystalline powder. Has a cool, saline taste, and is somewhat hygroscopic. Freely soluble in water and in glycerin, and even more so in boiling water; sparingly soluble in alcohol.

Ammonium Molybdate: Colorless or slightly greenish or yellowish crystals. Soluble in water; practically insoluble in alcohol.

Ammonium Phosphate: Colorless or white granules or powder, having a saline taste. Freely soluble in water; practically insoluble in acetone and in alcohol. *NF category:* Buffering agent.

Ammonium Sulfate: Colorless or white crystals or granules that decompose at temperatures above 280°. One g is soluble in about 1.5 mL of water. It is insoluble in alcohol. The pH of a 0.1 M solution is between 4.5 and 6.0.

Amobarbital Sodium: White, friable, granular powder. Is odorless, has a bitter taste, and is hygroscopic. Its solutions decompose on standing, heat accelerating the decomposition. Very soluble in water; soluble in alcohol; practically insoluble in ether and in chloroform.

Amodiaquine: Very pale yellow to light tan-yellow, odorless powder. Practically insoluble in water; sparingly soluble in 1.0 N hydrochloric acid; slightly soluble in alcohol.

Amodiaquine Hydrochloride: Yellow, crystalline powder. Is odorless and has a bitter taste. Soluble in water; sparingly soluble in alcohol; very slightly soluble in benzene, in chloroform, and in ether.

Amoxapine: White to yellowish crystalline powder. Freely soluble in chloroform; soluble in tetrahydrofuran; sparingly soluble in methanol and in toluene; slightly soluble in acetone; practically insoluble in water.

Amoxicillin: White, practically odorless, crystalline powder. Slightly soluble in water and in methanol; insoluble in benzene, in carbon tetrachloride, and in chloroform.

Amphetamine Sulfate: White, odorless, crystalline powder, having a slightly bitter taste. Its solutions are acid to litmus, having a pH of 5 to 6. Freely soluble in water; slightly soluble in alcohol; practically insoluble in ether.

Amphotericin B: Yellow to orange powder; odorless or practically so. Insoluble in water, in anhydrous alcohol, in ether, in benzene, and in toluene; soluble in dimethylformamide, in dimethyl sulfoxide, and in propylene glycol; slightly soluble in methanol.

Amphotericin B for Injection: It yields a colloidal dispersion in water.

Ampicillin: White, practically odorless, crystalline powder. Slightly soluble in water and in methanol; insoluble in benzene, in carbon tetrachloride, and in chloroform.

Ampicillin Sodium: White to off-white, odorless or practically odorless, crystalline powder. Is hygroscopic. Very soluble in water and in isotonic sodium chloride and dextrose solutions.

Amprolium ($C_{14}H_{19}ClN_4 \cdot HCl$): White to light yellow powder. Freely soluble in water, in methanol, in alcohol, and in dimethylformamide; sparingly soluble in dehydrated alcohol; practically insoluble in isopropyl alcohol, in butyl alcohol, and in acetone.

Amyl Nitrite: Clear, yellowish liquid, having a peculiar, ethereal, fruity odor. Is volatile even at low temperatures, and is flammable. Boils at about 96°. Practically insoluble in water. Miscible with alcohol and with ether.

Amylene Hydrate: Clear, colorless liquid, having a camphoraceous odor. Its solutions are neutral to litmus. Freely soluble in water. Miscible with alcohol, with chloroform, with ether, and with glycerin. *NF category:* Solvent.

Anethole: Colorless or faintly yellow liquid at or above 23°. Has a sweet taste and the aromatic odor of anise. Is affected by light. Very slightly soluble in water; freely soluble in alcohol. Readily miscible with ether and with chloroform. *NF category:* Flavors and perfumes.

Anileridine: White to yellowish-white, odorless to practically odorless, crystalline powder. Is oxidized on exposure to air and light, becoming darker in color. It exhibits polymorphism, and of two crystalline forms observed, one melts at about 80° and the other at about 89°. Very slightly soluble in water; freely soluble in alcohol and in chloroform; soluble in ether, although it may show turbidity.

Anileridine Hydrochloride: White or nearly white, odorless, crystalline powder. Is stable in air. Melts at about 270°, with decomposition. Freely soluble in water; sparingly soluble in alcohol; practically insoluble in ether, and in chloroform.

Antazoline Phosphate: White to off-white, crystalline powder, having a bitter taste. Soluble in water; sparingly soluble in methanol; practically insoluble in benzene and in ether.

Anthralin: Yellowish-brown, crystalline powder. Is odorless and tasteless. Insoluble in water; soluble in chloroform, in acetone, in benzene, and in solutions of alkali hydroxides; slightly soluble in alcohol, in ether, and in glacial acetic acid.

Anticoagulant Citrate Dextrose Solution: Clear, colorless, odorless liquid. Is dextrorotatory.

Anticoagulant Citrate Phosphate Dextrose Solution: Clear, colorless to slightly yellow, odorless liquid. Is dextrorotatory.

Anticoagulant Sodium Citrate Solution: Clear and colorless liquid.

Antihemophilic Factor: White or yellowish powder. On constitution is opalescent with a slight blue tinge or is a yellowish liquid.

Cryoprecipitated Antihemophilic Factor: Yellowish, frozen solid. On thawing becomes a very viscous, yellow, gummy liquid.

Antimony Potassium Tartrate: Colorless, odorless, transparent crystals, or white powder. The crystals effloresce upon exposure to air and do not readily rehydrate even on exposure to high humidity. Its solutions are acid to litmus. Freely soluble in boiling water; soluble in water and in glycerin; insoluble in alcohol.

Antimony Sodium Tartrate: Colorless, odorless, transparent crystals, or white powder. The crystals effloresce upon exposure to air. Freely soluble in water; insoluble in alcohol.

Antipyrine: Colorless crystals, or white, crystalline powder. Is odorless and has a slightly bitter taste. Its solutions are neutral to litmus. Very soluble in water; freely soluble in alcohol and in chloroform; sparingly soluble in ether.

Antivenin (Crotalidae) Polyvalent: Solid exhibiting the characteristic structure of a freeze-dried solid; light cream in color.

Antivenin (Micrurus Fulvius): Solid exhibiting the characteristic structure of a freeze-dried solid; light cream in color.

Apomorphine Hydrochloride: Minute, white or grayish-white, glistening crystals or white powder. Is odorless. It gradually acquires a green color on exposure to light and air. Its solutions are neutral to litmus. Sparingly soluble in water and in alcohol; soluble in water at 80°; very slightly soluble in chloroform and in ether.

Apraclonidine Hydrochloride: White to off-white, odorless to practically odorless powder. Soluble in methanol; sparingly soluble in water and in alcohol; insoluble in chloroform, in ethyl acetate, and in hexanes.

Arginine: White, practically odorless crystals. Freely soluble in water; sparingly soluble in alcohol; insoluble in ether.

Arginine Hydrochloride: White crystals or crystalline powder, practically odorless. Freely soluble in water.

Aromatic Elixir: *NF category:* Vehicle (flavored and/or sweetened).

Arsanilic Acid: White to off-white, crystalline powder. Melts at about 232°. Soluble in hot water, in amyl alcohol, and in solutions of alkali carbonates; sparingly soluble in concentrated mineral acids; slightly soluble in cold water, in alcohol, and in acetic acid; insoluble in acetone, in benzene, in chloroform, in ether, and in dilute mineral acids.

Ascorbic Acid: White or slightly yellow crystals or powder. On exposure to light it gradually darkens. In the dry state, is reasonably stable in air, but in solution rapidly oxidizes. Melts at about 190°. Freely soluble in water; sparingly soluble in alcohol; insoluble in chloroform, in ether, and in benzene. *NF category:* Antioxidant.

Ascorbyl Palmitate: White to yellowish white powder, having a characteristic odor. Very slightly soluble in water and in vegetable oils; soluble in alcohol. *NF category:* Antioxidant.

Asparagine: White crystals or a crystalline powder. Soluble in water; practically insoluble in alcohol and in ether. Its solutions are acid to litmus. It melts at about 234°.

Aspartame: White, odorless, crystalline powder, having a sweet taste. Sparingly soluble in water; slightly soluble in alcohol. Melts at about 246°. The pH of an 8 in 1000 solution is about 5. *NF category:* Sweetening agent.

Aspartame Acesulfame: White, odorless, crystalline powder. Slightly soluble in water and in ethanol. *NF category:* Sweetening agent.

Aspartic Acid: White or almost white, crystalline powder, or colorless crystals. Soluble in dilute solutions of alkali hydroxides and in dilute mineral acids; slightly soluble in water; practically insoluble in alcohol and in ether.

Aspirin: White crystals, commonly tabular or needle-like, or white, crystalline powder. Is odorless or has a faint odor. Is stable in dry air; in moist air it gradually hydrolyzes to salicylic and acetic acids. Slightly soluble in water; freely soluble in alcohol; soluble in chloroform and in ether; sparingly soluble in absolute ether.

Atenolol: White or practically white, odorless powder. Melting point 146° – 148° (crystals from ethyl acetate). Freely soluble in methanol; sparingly soluble in alcohol; slightly soluble in water and in isopropanol.

Atovaquone: Yellow powder. Freely soluble in *N*-methyl-2-pyrrolidone and in tetrahydrofuran; soluble in chloroform; sparingly soluble in acetone, in di-*n*-butyl adipate, in dimethyl sulfoxide, and in polyethylene glycol 400; slightly soluble in alcohol, in 1,3-butanediol, in ethyl acetate, in glycerin, in octanol, and in polyethylene glycol 200; very slightly soluble in 0.1 N sodium hydroxide; insoluble in water.

Atracurium Besylate: White to off-white solid.

Atropine: White crystals, usually needle-like, or white, crystalline powder. Its saturated solution is alkaline to phenolphthalein TS. Is optically inactive, but usually contains some levorotatory hyoscyamine. Slightly soluble in water, and sparingly soluble in water at 80°; freely soluble in alcohol and in chloroform; soluble in glycerin and in ether.

Atropine Sulfate: Colorless crystals, or white, crystalline powder. Odorless; effloresces in dry air; is slowly affected by light. Very soluble in water; freely soluble in alcohol and even more so in boiling alcohol; freely soluble in glycerin.

Activated Attapulgite: Cream-colored, micronized, nonswelling powder, free from gritty particles. The high heat treatment used in its preparation causes it to yield only moderately viscous aqueous suspensions, its dispersion consisting mainly of particle groups. Insoluble in water. *NF category:* Suspending and/or viscosity-increasing agent.

Colloidal Activated Attapulgite: Cream-colored, micronized, nonswelling powder, free from gritty particles. Yields viscous aqueous suspensions, as a result of dispersion into its constituent ultimate particles. Insoluble in water. *NF category:* Suspending and/or viscosity-increasing agent.

Aurothioglucose: Yellow, odorless or practically odorless powder. Is stable in air. An aqueous solution is unstable on long standing. The pH of its 1 in 100 solution is about 6.3. Freely soluble in water; practically insoluble in acetone, in alcohol, in chloroform, and in ether.

Azatadine Maleate: White to light cream-colored, odorless powder. Melts at about 153°. Freely soluble in water, in alcohol, in chloroform, and in methanol; practically insoluble in benzene and in ether.

Azathioprine: Pale yellow, odorless powder. Insoluble in water; soluble in dilute solutions of alkali hydroxides; sparingly soluble in dilute mineral acids; very slightly soluble in alcohol and in chloroform.

Azathioprine Sodium for Injection: Bright yellow, hygroscopic, amorphous mass or cake.

Aztreonam: White, odorless, crystalline powder. Soluble in dimethylformamide and in dimethyl sulfoxide; slightly soluble in methanol; very slightly soluble in dehydrated alcohol; practically insoluble in ethyl acetate, in chloroform, and in toluene.

Bacampicillin Hydrochloride: White or practically white powder. Is hygroscopic. Soluble in methylene chloride and in water; freely soluble in alcohol and in chloroform; very slightly soluble in ether.

Bacitracin: White to pale buff powder, odorless or having a slight odor. Is hygroscopic. Its solutions deteriorate rapidly at room temperature. Is precipitated from its solutions and is inactivated by salts of many of the heavy metals. Freely soluble in water; soluble in alcohol, in methanol, and in glacial acetic acid, the solution in the organic solvents usually showing some insoluble residue; insoluble in acetone, in chloroform, and in ether.

Bacitracin Zinc: White to pale tan powder, odorless or having a slight odor. Is hygroscopic. Sparingly soluble in water.

Baclofen: White to off-white, crystalline powder. Is odorless or practically so. Slightly soluble in water; very slightly soluble in methanol; insoluble in chloroform.

Adhesive Bandage: The compress of Adhesive Bandage is substantially free from loose threads or ravelings. The adhesive strip may be perforated, and the back may be coated with a water-repellent film.

Gauze Bandage: One continuous piece, tightly rolled, in various widths and lengths and substantially free from loose threads and ravelings.

Barium Hydroxide Lime: White or grayish-white granules. May have a color if an indicator has been added. *NF category:* Sorbent, carbon dioxide.

Barium Sulfate: Fine, white, odorless, tasteless, bulky powder, free from grittiness. Practically insoluble in water, in organic solvents, and in solutions of acids and of alkalies.

Barium Sulfate for Suspension: White or colored, bulky or granular powder.

BCG Vaccine: White to creamy white, dried mass, having the characteristic texture of material dried in the frozen state.

Beclomethasone Dipropionate: White to cream white, odorless powder. Very slightly soluble in water; very soluble in chloroform; freely soluble in acetone and in alcohol.

Belladonna Leaf: When moistened, its odor is slight, somewhat tobacco-like. Its taste is somewhat bitter and acrid.

Benazepril Hydrochloride: White to off-white, crystalline powder. Soluble in water, in methanol, and in alcohol.

Bendroflumethiazide: White to cream-colored, finely divided, crystalline powder. Is odorless, or has a slight odor. Melts at about 220°. Practically insoluble in water; freely soluble in alcohol and in acetone.

Benoxinate Hydrochloride: White, or slightly off-white, crystals or crystalline powder. Is odorless, or has a slight characteristic odor, has a salty taste, and exhibits local anesthetic properties when placed upon the tongue. Its solutions are neutral to litmus, and it melts at about 158°. Very soluble in water; freely soluble in chloroform and in alcohol; insoluble in ether.

Bentonite: Very fine, odorless, pale buff or cream-colored to grayish powder, free from grit. Has a slightly earthy taste. Is hygroscopic. Insoluble in water, but swells to approximately twelve times its volume when added to water; insoluble in, and does not swell in, organic solvents. *NF category:* Suspending and/or viscosity-increasing agent.

Purified Bentonite: Odorless, tasteless, fine (micronized) powder or small flakes that are creamy when viewed on their flat surfaces and tan to brown when viewed on their edges. Insoluble in water and in alcohol. Swells when added to water or glycerin. *NF category:* Suspending and/or viscosity-increasing agent.

Bentonite Magma: *NF category:* Suspending and/or viscosity-increasing agent.

Benzaldehyde: Colorless, strongly refractive liquid, having an odor resembling that of bitter almond oil, and having a burning, aromatic taste. Is affected by light. Slightly soluble in water. Miscible with alcohol, with ether, and with fixed and volatile oils. *NF category:* Flavors and perfumes.

Benzaldehyde Elixir, Compound: *NF category:* Flavored and/or sweetened vehicle.

Benzalkonium Chloride: White or yellowish-white, thick gel or gelatinous pieces. Usually has a mild, aromatic odor. Its aqueous solution has a bitter taste, foams strongly when shaken, and usually is slightly alkaline. Very soluble in water and in alcohol. Anhydrous form freely soluble in benzene, and slightly soluble in ether. *NF category:* Antimicrobial preservative; wetting and/or solubilizing agent.

Benzalkonium Chloride Solution: Clear liquid; colorless or slightly yellow unless a color has been added. Has an aromatic odor and a bitter taste. *NF category:* Antimicrobial preservative.

Benzethonium Chloride: White crystals, having a mild odor. Its solution (1 in 100) is slightly alkaline to litmus. Soluble in water, in alcohol, and in chloroform; slightly soluble in ether. *NF category:* Antimicrobial preservative; wetting and/or solubilizing agent.

Benzethonium Chloride Solution: Odorless, clear liquid, slightly alkaline to litmus.

Benzethonium Chloride Tincture: Clear liquid, having the characteristic odor of acetone and of alcohol.

Benzocaine: Small, white crystals or white, crystalline powder. Is odorless, is stable in air, and exhibits local anesthetic properties when placed upon the tongue. Very slightly soluble in water; freely soluble in alcohol, in chloroform, and in ether; sparingly soluble in almond oil and in olive oil. Dissolves in dilute acids.

Benzoic Acid: White crystals, scales, or needles. Has a slight odor, usually suggesting benzaldehyde or benzoin. Somewhat volatile at moderately warm temperatures. Freely volatile in steam. Slightly soluble in water; freely soluble in alcohol, in chloroform, and in ether. *NF category:* Antimicrobial preservative.

Benzoin: Sumatra Benzoin has an aromatic and balsamic odor. When heated it does not emit a pinaceous odor. When Sumatra Benzoin is digested with boiling water, the odor suggests cinnamates or storax. Its taste is aromatic and slightly acrid. Siam Benzoin has an agreeable, balsamic, vanilla-like odor. Its taste is aromatic and slightly acrid.

Benzonatate: Clear, pale yellow, viscous liquid, having a faint, characteristic odor. Has a bitter taste, and exhibits local anesthetic properties when placed upon the tongue. Miscible with water in all proportions. Freely soluble in chloroform, in alcohol, and in benzene.

Hydrous Benzoyl Peroxide: White, granular powder, having a characteristic odor. Sparingly soluble in water and in alcohol; soluble in acetone, in chloroform, and in ether.

Benzoyl Peroxide Gel: A soft, white gel, having a characteristic odor.

Benzoyl Peroxide Lotion: White, viscous, creamy lotion, having a characteristic odor.

Benztropine Mesylate: White, slightly hygroscopic, crystalline powder. Very soluble in water; freely soluble in alcohol; very slightly soluble in ether.

Benzyl Alcohol: Clear, colorless, oily liquid. Boils at about 206°, without decomposition. Is neutral to litmus. Freely soluble in 50% alcohol; sparingly soluble in water. Miscible with alcohol, with ether, and with chloroform. The specific gravity is between 1.042 and 1.047. *NF category:* Antimicrobial preservative.

Benzyl Benzoate: Clear, colorless, oily liquid having a slight aromatic odor and producing a sharp, burning sensation on the tongue. Practically insoluble in water and in glycerin. Miscible with alcohol, with ether, and with chloroform. *NF category:* Solvent.

Beta Carotene: Red or reddish-brown to violet-brown crystals or crystalline powder. Insoluble in water and in acids and in alkalies; soluble in carbon disulfide, in benzene, and in chloroform; sparingly soluble in ether, in solvent hexane, and in vegetable oils; practically insoluble in methanol and in alcohol.

Betadex: White, practically odorless, fine crystalline powder having a slightly sweet taste. Sparingly soluble in water. *NF category:* Sequestering agent.

Betahistine Hydrochloride: White to almost yellow, crystalline powder. Very hygroscopic. Melts between 151° and 154°. Very soluble in water; freely soluble in alcohol; practically insoluble in isopropyl alcohol.

Betaine Hydrochloride: White, crystalline powder. Soluble in water and in alcohol; practically insoluble in chloroform and in ether.

Betamethasone: White to practically white, odorless, crystalline powder. Melts at about 240°, with some decomposition. Insoluble in water; sparingly soluble in acetone, in alcohol, in dioxane, and in methanol; very slightly soluble in chloroform and in ether.

Betamethasone Acetate: White to creamy white, odorless powder. Sinters and resolidifies at about 165°, and remelts at about 200° or 220°, with decomposition (see *Melting Range or Temperature* ⟨741⟩). Practically insoluble in water; freely soluble in acetone; soluble in alcohol and in chloroform.

Betamethasone Benzoate: White to practically white, practically odorless powder. Melts at about 220°, with decomposition. Insoluble in water; soluble in alcohol, in methanol, and in chloroform.

Betamethasone Dipropionate: White to cream-white, odorless powder. Insoluble in water; freely soluble in acetone and in chloroform; sparingly soluble in alcohol.

Betamethasone Sodium Phosphate: White to practically white, odorless powder. Is hygroscopic. Freely soluble in water and in methanol; practically insoluble in acetone and in chloroform.

Betamethasone Valerate: White to practically white, odorless powder. Melts at about 190°, with decomposition. Practically insoluble in water; freely soluble in acetone and in chloroform; soluble in alcohol; slightly soluble in benzene and in ether.

Betaxolol Hydrochloride: White, crystalline powder. Freely soluble in water, in alcohol, in chloroform, and in methanol.

Bethanechol Chloride: Colorless or white crystals or white, crystalline powder, usually having a slight, amine-like odor. Is hygroscopic. Exhibits polymorphism, and of two crystalline forms observed, one melts at about 211° and the other melts at about 219°. Freely soluble in water and in alcohol; insoluble in chloroform and in ether.

Bicalutamide: Fine, white to off-white powder. Freely soluble in tetrahydrofuran and in acetone; soluble in acetonitrile; sparingly soluble in methanol; slightly soluble in alcohol.

Biotin: Practically white, crystalline powder. Very slightly soluble in water and in alcohol; insoluble in other common organic solvents.

Biperiden: White, practically odorless, crystalline powder. Practically insoluble in water; freely soluble in chloroform; sparingly soluble in alcohol.

Biperiden Hydrochloride: White, practically odorless, crystalline powder. Melts at about 275°, with decomposition. Is optically inactive. Slightly soluble in water, in ether, in alcohol, and in chloroform; sparingly soluble in methanol.

Bisacodyl: White to off-white, crystalline powder, in which the number of particles having a longest diameter smaller than 50 µm predominate. Practically insoluble in water; soluble in chloroform and in benzene; sparingly soluble in alcohol and in methanol; slightly soluble in ether.

Milk of Bismuth: Thick, white, opaque suspension that separates on standing. Is odorless and practically tasteless. Miscible with water and with alcohol.

Bismuth Citrate: White, amorphous or crystalline powder. Stable in air. Melts at about 300°, with decomposition. Soluble in ammonia TS and in solutions of alkali citrates; insoluble in water and in alcohol.

Bismuth Subcarbonate: White or almost white powder. Practically insoluble in water, in alcohol, and in ether. Dissolves in dilute acids with effervescence.

Bismuth Subgallate: Amorphous, bright yellow powder. Is odorless and tasteless. Is stable in air, but is affected by light. Dissolves readily with decomposition in warm, moderately dilute hydrochloric, nitric, or sulfuric acid; readily dissolved by solutions of alkali hydroxides, forming a clear, yellow liquid that rapidly assumes a deep red color. Practically insoluble in water, in alcohol, in chloroform, and in ether; insoluble in very dilute mineral acids.

Bismuth Subnitrate: White, slightly hygroscopic powder. Practically insoluble in water and in alcohol; readily dissolved by hydrochloric acid or by nitric acid.

Bismuth Subsalicylate: Fine to off-white, microcrystalline, odorless, tasteless powder. Practically insoluble in water, in alcohol, and in ether. Reacts with alkalies and mineral acids.

Bisoprolol Fumarate: White, crystalline powder. Very soluble in water and in methanol; freely soluble in chloroform, in glacial acetic acid, and in alcohol; slightly soluble in acetone and in ethyl acetate.

Bleomycin Sulfate: Cream-colored, amorphous powder. Very soluble in water.

Anti-A Blood Grouping Serum: Liquid Serum is a clear or slightly opalescent fluid unless artificially colored blue. Dried Serum is light yellow to deep cream color, unless artificially colored as indicated for liquid Serum. The liquid Serum may develop slight turbidity on storage. The dried Serum may show slight turbidity upon reconstitution for use.

Anti-B Blood Grouping Serum: Liquid Serum is a clear or slightly opalescent fluid unless artificially colored yellow. Dried Serum is light yellow to deep cream color, unless artificially colored as indicated for liquid Serum. The liquid Serum may develop a slight turbidity on storage. The dried Serum may show slight turbidity upon reconstitution for use.

Blood Grouping Serums Anti-D, Anti-C, Anti-E, Anti-c, Anti-e: The liquid Serums are clear, slightly yellowish fluids, that may develop slight turbidity on storage. The dried Serums are light yellow to deep cream color.

Blood Group Specific Substances A, B, and AB: Clear solution that may have a slight odor because of the preservative.

Red Blood Cells: Dark red in color when packed. May show a slight creamy layer on the surface and a small supernatant layer of yellow or opalescent plasma. Also supplied in deep-frozen form with added cryophylactic substance to extend storage time.

Whole Blood: Deep red, opaque liquid from which the corpuscles readily settle upon standing for 24 to 48 hours, leaving a clear, yellowish or pinkish supernatant layer of plasma.

Boric Acid: Colorless, odorless scales of a somewhat pearly luster, or crystals, or white powder that is slightly unctuous to the touch. Is stable in air. Soluble in water and in alcohol; freely soluble in glycerin, in boiling water, and in boiling alcohol. *NF category:* Buffering agent.

Botulism Antitoxin: Transparent or slightly opalescent liquid, practically colorless, and practically odorless or having an odor because of the antimicrobial agent.

Bretylium Tosylate: White, crystalline powder. Is hygroscopic. Freely soluble in water, in methanol, and in alcohol; practically insoluble in ether, in ethyl acetate, and in hexane.

Brinzolamide: White or almost white powder. Insoluble in water; slightly soluble in alcohol and in methanol.

Bromocriptine Mesylate: White or slightly colored, fine crystalline powder, odorless or having a weak, characteristic odor.

Bromodiphenhydramine Hydrochloride: White to pale buff, crystalline powder, having no more than a faint odor. Freely soluble in water and in alcohol; soluble in isopropyl alcohol; insoluble in ether and in solvent hexane.

Brompheniramine Maleate: White, odorless, crystalline powder. Freely soluble in water; soluble in alcohol and in chloroform; slightly soluble in ether and in benzene.

Budesonide: White to off-white, odorless, crystalline powder. Freely soluble in chloroform; sparingly soluble in alcohol; practically insoluble in water and in heptane.

Bumetanide: Practically white powder. Slightly soluble in water; soluble in alkaline solutions.

Bupivacaine Hydrochloride: White, odorless, crystalline powder. Melts at about 248°, with decomposition. Freely soluble in water and in alcohol; slightly soluble in chloroform and in acetone.

Bupivacaine Hydrochloride Injection: Clear, colorless solution.

Bupivacaine Hydrochloride and Epinephrine Injection: Clear, colorless solution.

Bupropion Hydrochloride: White powder. Soluble in water, in 0.1 N hydrochloric acid, and in alcohol.

Busulfan: White, crystalline powder. Very slightly soluble in water; sparingly soluble in acetone; slightly soluble in alcohol.

Buspirone Hydrochloride: White crystalline powder. Very soluble in water; freely soluble in methanol and in methylene chloride; sparingly soluble in ethanol and in acetonitrile; very slightly soluble in ethyl acetate; practically insoluble in hexanes.

Butabarbital: White, odorless, crystalline powder. Very slightly soluble in water; soluble in alcohol, in chloroform, in ether, and in solutions of alkali hydroxides and carbonates.

Butabarbital Sodium: White powder, having a bitter taste. Freely soluble in water and in alcohol; practically insoluble in absolute ether.

Butalbital: White, crystalline, odorless powder, having a slightly bitter taste. Is stable in air. Its saturated solution is acid to litmus. Freely soluble in alcohol, in ether, and in chloroform; slightly soluble in cold water; soluble in boiling water, and in solutions of fixed alkalies and alkali carbonates.

Butamben: White, crystalline powder. Is odorless and tasteless. Very slightly soluble in water; soluble in dilute acids, in alcohol, in chloroform, in ether, and in fixed oils. Is slowly hydrolyzed when boiled with water.

Butane: Colorless, flammable gas (boiling temperature is about –0.5°). One volume of water dissolves 0.15 volume, and 1 volume of alcohol dissolves 18 volumes at 17° and 770 mm; 1 volume of ether or chloroform at 17° dissolves 25 or 30 volumes, respectively. Vapor pressure at 21° is about 1620 mm of mercury (17 psig). *NF category:* Aerosol propellant.

Butoconazole Nitrate: White to off-white, crystalline powder. Melts at about 160°. Practically insoluble in water; very slightly soluble in ethyl acetate; slightly soluble in acetonitrile, in acetone, in dichloromethane, and in tetrahydrofuran; sparingly soluble in methanol.

Butorphanol Tartrate: White powder. Its solutions are slightly acidic. Melts between 217° and 219°, with decomposition. Sparingly soluble in water; slightly soluble in methanol; insoluble in alcohol, in chloroform, in ethyl acetate, in ethyl ether, and in hexane; soluble in dilute acids.

Butyl Alcohol: Clear, colorless, mobile liquid, having a characteristic, penetrating vinous odor. Soluble in water. Miscible with alcohol, with ether, and with many other organic solvents. *NF category:* Solvent.

Butylated Hydroxyanisole: White or slightly yellow, waxy solid, having a faint, characteristic odor. Insoluble in water; freely soluble in alcohol, in propylene glycol, in chloroform, and in ether. *NF category:* Antioxidant.

Butylated Hydroxytoluene: White, crystalline solid, having a faint, characteristic odor. Insoluble in water and in propylene glycol; freely soluble in alcohol, in chloroform, and in ether. *NF category:* Antioxidant.

Butylparaben: Small, colorless crystals or white powder. Very slightly soluble in water and in glycerin; freely soluble in acetone, in alcohol, in ether, and in propylene glycol. *NF category:* Antimicrobial preservative.

Cabergoline: White or almost white, crystalline powder. Freely soluble in alcohol (96%); slightly soluble in 0.1 M hydrochloric acid; very slightly soluble in hexane; practically insoluble in water.

Caffeine: White powder or white, glistening needles, usually matted together. Is odorless and has a bitter taste. Its solutions are neutral to litmus. The hydrate is efflorescent in air. Sparingly soluble in water and in alcohol; freely soluble in chloroform; slightly soluble in ether.

Calamine: Pink, odorless, practically tasteless, fine powder. Insoluble in water; practically completely soluble in mineral acids.

Calcitriol: White or almost white crystals. Freely soluble in alcohol; soluble in ether and in fatty oils; practically insoluble in water. It is sensitive to air, heat, and light.

Calcium Acetate: White, odorless or almost odorless, hygroscopic, crystalline powder. When heated to above 160°, it decomposes to calcium carbonate and acetone. Freely soluble in water; slightly soluble in methanol; practically insoluble in acetone, in dehydrated alcohol, and in benzene.

Calcium Ascorbate: White to slightly yellow, practically odorless powder. Freely soluble in water (approximately 50 g per 100 mL); slightly soluble in alcohol; insoluble in ether.

Calcium Carbonate: Fine, white, odorless, tasteless, microcrystalline powder. Is stable in air. Practically insoluble in water. Its solubility in water is increased by the presence of any ammonium salt or of carbon dioxide. The presence of any alkali hydroxide reduces its solubility. Insoluble in alcohol. Dissolves with effervescence in 1 N acetic acid, in 3 N hydrochloric acid, and in 2 N nitric acid. *NF category:* Tablet and/or capsule diluent.

Calcium Chloride: White, hard, odorless fragments or granules. Is deliquescent. Freely soluble in water, in alcohol, and in boiling alcohol; very soluble in boiling water. *NF category:* Desiccant.

Calcium Citrate: White, odorless, crystalline powder. Slightly soluble in water; freely soluble in diluted 3 N hydrochloric acid and in diluted 2 N nitric acid; insoluble in alcohol.

Calcium Gluceptate: White to faintly yellow, amorphous powder. Is stable in air, but the hydrous forms may lose part of their water of hydration on standing. Freely soluble in water; insoluble in alcohol and in many other organic solvents.

Calcium Gluconate: White, crystalline, odorless, tasteless granules or powder. Is stable in air. Its solutions are neutral to litmus. Sparingly (and slowly) soluble in water; freely soluble in boiling water; insoluble in alcohol.

Calcium Hydroxide: White powder. Has an alkaline, slightly bitter taste. Slightly soluble in water; soluble in glycerin and in syrup; very slightly soluble in boiling water; insoluble in alcohol.

Calcium Hydroxide Solution: Clear, colorless liquid having an alkaline taste. Is alkaline to litmus.

Calcium Lactate: White, practically odorless granules or powder. The pentahydrate is somewhat efflorescent and at 120° becomes anhydrous. The pentahydrate is soluble in water; it is practically insoluble in alcohol.

Calcium Levulinate: White, crystalline or amorphous, powder, having a faint odor suggestive of burnt sugar. Has a bitter, salty taste. Freely soluble in water; slightly soluble in alcohol; insoluble in ether and in chloroform.

Calcium Pantothenate: Slightly hygroscopic, white powder. Is odorless and has a bitter taste. Freely soluble in water; soluble in glycerin; practically insoluble in alcohol, in chloroform, and in ether.

Racemic Calcium Pantothenate: White, slightly hygroscopic powder, having a faint, characteristic odor, and a bitter taste. Is stable in air. Its solutions are neutral or alkaline to litmus. Is optically inactive. Freely soluble in water; soluble in glycerin; practically insoluble in alcohol, in chloroform, and in ether.

Dibasic Calcium Phosphate: White, odorless, tasteless powder. Is stable in air. Practically insoluble in water; soluble in 3 N hydrochloric acid and in 2 N nitric acid; insoluble in alcohol. *NF category:* Tablet and/or capsule diluent.

Tribasic Calcium Phosphate: White, odorless, tasteless powder. Is stable in air. Practically insoluble in water; readily soluble in 3 N hydrochloric acid and in 2 N nitric acid; insoluble in alcohol. *NF category:* Tablet and/or capsule diluent.

Calcium Polycarbophil: White to creamy white powder. Insoluble in water, in dilute acids, in dilute alkalies, and in common organic solvents.

Calcium Saccharate: White, odorless, tasteless, crystalline powder. Very slightly soluble in cold water; slightly soluble in boiling water; very slightly soluble in alcohol; practically insoluble in ether and in chloroform; soluble in dilute mineral acids and in solutions of calcium gluconate.

Calcium Silicate: White to off-white, free-flowing powder that remains so after absorbing relatively large amounts of water or other liquids. Insoluble in water. Forms a gel with mineral acids. *NF category:* Glidant and/or anticaking agent.

Calcium Stearate: Fine, white to yellowish-white, bulky powder having a slight, characteristic odor. Is unctuous, and is free from grittiness. Insoluble in water, in alcohol, and in ether. *NF category:* Tablet and/or capsule lubricant.

Calcium Sulfate: Fine, white to slightly yellow-white, odorless powder. Slightly soluble in water; soluble in 3 N hydrochloric acid. *NF category:* Desiccant; tablet and/or capsule diluent.

Calcium Undecylenate: Fine, white powder, having a characteristic odor and no grit. Practically insoluble in water, in ether, in chloroform, in acetone, and in cold alcohol; slightly soluble in hot alcohol.

Camphor: Colorless or white crystals, granules, or crystalline masses; or colorless to white, translucent, tough masses. Has a penetrating, characteristic odor and a pungent, aromatic taste. Specific gravity is about 0.99. Slowly volatilizes at ordinary temperatures. Slightly soluble in water; very soluble in alcohol, in chloroform, and in ether; freely soluble in carbon disulfide, in solvent hexane, and in fixed and volatile oils.

Candelilla Wax: A hard, yellowish-brown-opaque to translucent wax. Its specific gravity is about 0.983. Soluble in chloroform and in toluene; insoluble in water.

Canola Oil: Clear, pale yellow, slightly viscous liquid. Practically insoluble in water and in alcohol; miscible with light petroleum (bp: 40° to 60°). *NF category:* Solvent; vehicle (oleaginous).

Capecitabine: White to off-white crystalline powder. Freely soluble in methanol; soluble in acetonitrile and in alcohol; sparingly soluble in water.

Capreomycin Sulfate: White to practically white, amorphous powder. Freely soluble in water; practically insoluble in most organic solvents.

Caprylocaproyl Polyoxylglycerides: Pale yellow, oily liquids. Dispersible in hot water; freely soluble in methylene chloride. *NF category:* Ointment base; solvent.

Capsaicin: Off-white powder. Melts at about 65°. Soluble in alcohol, in benzene, in chloroform; slightly soluble in carbon disulfide; practically insoluble in cold water.

Capsicum Oleoresin: Dark red, oily liquid. Soluble in alcohol, in acetone, in ether, in chloroform, and in volatile oils; soluble with opalescence in fixed oils.

Captopril: White to off-white, crystalline powder, which may have a characteristic, sulfide-like odor. Melts in the range of 104° to 110°. Freely soluble in water, in methanol, in alcohol, and in chloroform.

Caramel: Thick, dark brown liquid having the characteristic odor of burnt sugar, and a pleasant, bitter taste. One part dissolved in 1000 parts of water yields a clear solution having a distinct yellowish-orange color. The color of this solution is not changed and no precipitate is formed after exposure to sunlight for 6 hours. When spread in a thin layer on a glass plate, it appears homogeneous, reddish-brown, and transparent. Miscible with water. Soluble in dilute alcohol up to 55% (v/v). Immiscible with ether, with chloroform, with acetone, with benzene, and with solvent hexane. *NF category:* Color.

Carbachol: White powder. Freely soluble in water; sparingly soluble in alcohol; practically insoluble in chloroform and in ether.

Carbamazepine: White to off-white powder. Practically insoluble in water; soluble in alcohol and in acetone.

Carbamide Peroxide Topical Solution: Clear, colorless, viscous liquid, having a characteristic odor and taste.

Carbenicillin Disodium: White to off-white, crystalline powder. Freely soluble in water; soluble in alcohol; practically insoluble in chloroform and in ether.

Carbenicillin Indanyl Sodium: White to off-white powder. Soluble in water and in alcohol.

Carbidopa: White to creamy white, odorless or practically odorless, powder. Slightly soluble in water; freely soluble in 3 N hydrochloric acid; slightly soluble in methanol; practically insoluble in alcohol, in acetone, in chloroform, and in ether.

Carbinoxamine Maleate: White, odorless, crystalline powder. Very soluble in water; freely soluble in alcohol and in chloroform; very slightly soluble in ether.

Carbol-Fuchsin Topical Solution: Dark purple liquid, which appears purplish red when spread in a thin film.

Carbomer 910: White, fluffy powder, having a slight, characteristic odor. Is hygroscopic. The pH of a 1 in 100 dispersion is about 3. When neutralized with alkali hydroxides or with amines, it dissolves in water, in alcohol, and in glycerin. *NF category:* Suspending and/or viscosity-increasing agent.

Carbomer 934: See *Carbomer 910*.

Carbomer 934P: See *Carbomer 910*.

Carbomer 940: See *Carbomer 910*.

Carbomer 941: See *Carbomer 910*.

Carbomer 1342: See *Carbomer 910*.

Carbomer Copolymer: White, hygroscopic powder. It swells in water when a dispersion of it is neutralized with sodium hydroxide to a pH within the range of 7.9 to 7.8. *NF category:* Emulsifying and/or solubilizing agent; suspending and/or viscosity increasing agent; tablet binder.

Carbomer Homopolymer: White, fluffy hygroscopic powder, having a slight, characteristic odor. The pH of a 1 in 100 dispersion in water is about 3. When neutralized with alkali hydroxides or with amines, it swells giving the appearance of dissolving in water; when neutralized with lower amines and alkanolamines, it swells giving the appearance of dissolving in methanol or glycerin; when neutralized with ethoxylated long-chain (C_{14}–C_{18}) amines, it swells giving the appearance of dissolving in ethanol. *NF category:* Tablet binder; suspending and/or viscosity-increasing agent.

Carbomer Interpolymer: White, hygroscopic powder. It swells in water when a dispersion of it is neutralized with sodium hydroxide to a pH within the range of 5.5 to 9. *NF category:* Emulsifying and/or solubilizing agent; suspending and/or viscosity increasing agent; tablet binder.

Urea C 13: See *Urea*.

Carbon Dioxide: Odorless, colorless gas. Its solutions are acid to litmus. One L at 0° and at a pressure of 760 mm of mercury weighs 1.977 g. One volume dissolves in about 1 volume of water. *NF category:* Air displacement.

Carboprost Tromethamine: White to off-white powder. Soluble in water.

Carboxymethylcellulose Calcium: White to yellowish-white powder. Is hygroscopic. Practically insoluble in alcohol, in acetone, in ether, in chloroform, and in benzene. It swells with water to form a suspension; the pH of the suspension, obtained by shaking 1 g with 100 mL of water, is between 4.5 and 6.0. *NF category:* Suspending and/or viscosity-increasing agent.

Carboxymethylcellulose Sodium: White to cream-colored powder or granules. The powder is hygroscopic. Is easily dispersed in water to form colloidal solutions. Insoluble in alcohol, in ether, and in most other organic solvents. *NF category:* Coating agent; suspending and/or viscosity-increasing agent; tablet binder.

Carboxymethylcellulose Sodium 12: Colorless or white to off-white powder or granules. Is odorless. Water solubility depends on degree of substitution (easily dispersed in water at all temperatures, forming a clear, colloidal solution). Insoluble in acetone, in alcohol, in ether, and in toluene. *NF category:* Suspending and/or viscosity-increasing agent.

Low-Substituted Carboxymethylcellulose Sodium: A white or almost white powder or short fibers. Practically insoluble in acetone, in alcohol, and in toluene. It swells in water to form a gel.

Carisoprodol: White, crystalline powder, having a mild, characteristic odor and a bitter taste. Very slightly soluble in water; freely soluble in alcohol, in chloroform, and in acetone.

Carprofen: White crystalline powder. Freely soluble in ether, in acetone, in ethyl acetate, and in sodium hydroxide TS or sodium carbonate TS; practically insoluble in water.

Carrageenan: Yellowish or tan to white, coarse to fine powder. Is practically odorless and has a mucilaginous taste. Soluble in water at a temperature of about 80°, forming a viscous, clear or slightly opalescent solution that flows readily. Disperses in water more readily if first moistened with alcohol, with glycerin, or with a saturated solution of sucrose in water. *NF category:* Suspending and/or viscosity-increasing agent.

Carvedilol: White or nearly white, crystalline powder. Slightly soluble in alcohol; practically insoluble in water and in dilute acids.

Casanthranol: Light tan to brown, amorphous, hygroscopic powder. Freely soluble in water, with some residue; partially soluble in methanol and in hot isopropyl alcohol; practically insoluble in acetone.

Cascara Sagrada: Has a distinct odor and a bitter and slightly acrid taste.

Castor Oil: Pale yellowish or almost colorless, transparent, viscid liquid. Has a faint, mild odor; is free from foreign and rancid odor; and has a bland, characteristic taste. Soluble in alcohol. Miscible with dehydrated alcohol, with glacial acetic acid, with chloroform, and with ether. *NF category:* Plasticizer.

Hydrogenated Castor Oil: White, crystalline wax. Insoluble in water and in most common organic solvents. *NF category:* Stiffening agent.

Cefaclor: White to off-white, crystalline powder. Slightly soluble in water; practically insoluble in methanol, in chloroform, and in benzene.

Cefadroxil: White to off-white, crystalline powder. Slightly soluble in water; practically insoluble in alcohol, in chloroform, and in ether.

Cefamandole Nafate: White, odorless, crystalline solid. Soluble in water and in methanol; practically insoluble in ether, in chloroform, in benzene, and in cyclohexane.

Cefazolin: White to slightly off-white, odorless, crystalline powder. Melts at about 198° to 200°, with decomposition. Soluble in dimethylformamide and in pyridine; sparingly soluble in acetone; slightly soluble in alcohol, in methanol, and in water; very slightly soluble in ethyl acetate, in isopropyl alcohol, and in methyl isobutyl ketone; practically insoluble in benzene, in chloroform, in ether, and in methylene chloride.

Cefazolin Sodium: White to off-white, practically odorless, crystalline powder, or white to off-white solid. Freely soluble in water, in saline TS, and in dextrose solutions; very slightly soluble in alcohol; practically insoluble in chloroform and in ether.

Cefdinir: White to light yellow crystalline powder. Soluble in 0.1 M phosphate buffer (pH 7) solution; practically insoluble in water, in alcohol, and in diethyl ether.

Cefepime Hydrochloride: White to off-white, crystalline, nonhygroscopic solid. Freely soluble in water.

Cefepime for Injection: White to pale yellow powder. Freely soluble in water.

Cefixime: White to light yellow, crystalline powder. Soluble in methanol and in propylene glycol; slightly soluble in alcohol, in acetone, and in glycerin; very slightly soluble in 70% sorbitol and in octanol; practically insoluble in ether, in ethyl acetate, in hexane, and in water.

Cefmenoxime Hydrochloride: White to light orange-yellow crystals or crystalline powder. Very slightly soluble in water; freely soluble in formamide; slightly soluble in methanol; practically insoluble in dehydrated alcohol and in ether.

Cefmetazole Sodium: White solid. Very soluble in water and in methanol; soluble in acetone; practically insoluble in chloroform.

Cefonicid Sodium: White to off-white solid. Freely soluble in water, in 0.9% sodium chloride solution, and in 5% dextrose solution; soluble in methanol; very slightly soluble in dehydrated alcohol.

Cefoperazone Sodium: White to pale buff crystalline powder. Freely soluble in water and in methanol; slightly soluble in dehydrated alcohol; insoluble in acetone, in ethyl acetate, and in ether.

Ceforanide: White to off-white powder. Practically insoluble in water, in methanol, in chloroform, and in ether; very soluble in 1 N sodium hydroxide.

Cefotaxime Sodium: Off-white to pale yellow crystalline powder. Freely soluble in water; practically insoluble in organic solvents.

Cefoxitin Sodium: White to off-white, granules or powder, having a slight characteristic odor. Is somewhat hygroscopic. Very soluble in water; soluble in methanol; sparingly soluble in dimethylformamide; slightly soluble in acetone; insoluble in ether and in chloroform.

Cefpodoxime Proxetil: White to light brownish-white powder. Odorless or having a faint odor, and has a bitter taste. Very slightly soluble in water; soluble in acetonitrile and in methanol; freely soluble in dehydrated alcohol; slightly soluble in ether.

Ceftazidime: White to cream-colored, crystalline powder. Soluble in alkali and in dimethyl sulfoxide; slightly soluble in dimethylformamide, in methanol, and in water; insoluble in acetone, in alcohol, in chloroform, in dioxane, in ether, in ethyl acetate, and in toluene.

Ceftizoxime Sodium: White to pale yellow crystalline powder. Freely soluble in water.

Ceftriaxone Sodium: White to yellowish-orange crystalline powder. Freely soluble in water; sparingly soluble in methanol; very slightly soluble in alcohol.

Cefuroxime Axetil: White to almost white powder. The amorphous form is freely soluble in acetone; soluble in chloroform, in ethyl acetate, and in methanol; slightly soluble in dehydrated alcohol; insoluble in ether and in water. The crystalline form is freely soluble in acetone; sparingly soluble in chloroform, in ethyl acetate, and in methanol; slightly soluble in dehydrated alcohol; insoluble in ether and in water.

Cefuroxime Sodium: White or faintly yellow powder. Freely soluble in water; soluble in methanol; very slightly soluble in alcohol, in ether, in ethyl acetate, and in chloroform.

Cellaburate: Fine white or almost white powder or granules. Available in a range of viscosities, acetyl and butyl contents. Slightly hygroscopic; soluble in acetone, in methylene chloride, in pyridine, and in dimethyl sulfoxide; practically insoluble in water and in alcohol. *NF category:* Coating agent; polymer membrane.

Cellacefate: Free-flowing, white powder. May have a slight odor of acetic acid. Insoluble in water and in alcohol; soluble in acetone and in dioxane. *NF category:* Coating agent.

Cellulose Acetate: Fine, white powder or free-flowing pellets. Available in a range of viscosities and acetyl contents. High viscosity, which reflects high molecular weight, decreases solubility slightly. High acetyl content cellulose acetates generally have more limited solubility in commonly used organic solvents than low acetyl content cellulose acetates, but are more soluble in methylene chloride. All acetyl content cellulose acetates are insoluble in alcohol and in water; soluble in dioxane and in dimethylformamide. *NF category:* Coating agent; polymer membrane.

Microcrystalline Cellulose: Fine, white or almost white powder. It consists of free-flowing, nonfibrous particles. Insoluble in water, in dilute acids, and in most organic solvents; practically insoluble in sodium hydroxide solution (1 in 20). *NF category:* Tablet binder; tablet disintegrant; tablet and/or capsule diluent.

Microcrystalline Cellulose and Carboxymethylcellulose Sodium: Tasteless, odorless, white to off-white, coarse to fine powder. Swells in water, producing, when dispersed, a white, opaque dispersion or gel. Insoluble in organic solvents and in dilute acids. *NF category:* Suspending and/or viscosity-increasing agent.

Oxidized Cellulose: In the form of gauze or lint. Is slightly off-white in color, is acidic to the taste, and has a slight, charred odor. Insoluble in water and in acids; soluble in dilute alkalies.

Oxidized Regenerated Cellulose: A knit fabric, usually in the form of sterile strips. Slightly off-white, having a slight odor. Insoluble in water and in dilute acids; soluble in dilute alkalies.

Powdered Cellulose: White or almost white powder. Exhibits degrees of fineness ranging from a free-flowing dense powder to a coarse, fluffy, nonflowing material. Insoluble in water, in dilute acids, and in nearly all organic solvents; slightly soluble in sodium hydroxide solution (1 in 20). *NF category:* Filtering aid; sorbent; tablet and/or capsule diluent.

Cellulose Sodium Phosphate: Free-flowing cream-colored, odorless, tasteless powder. Insoluble in water, in dilute acids, and in most organic solvents.

Cephalexin: White to off-white, crystalline powder. Slightly soluble in water; practically insoluble in alcohol, in chloroform, and in ether.

Cephalexin Hydrochloride: White to off-white, crystalline powder. Soluble to the extent of 10 mg per mL in water, in acetone, in acetonitrile, in alcohol, in dimethylformamide, and in methanol; practically insoluble in chloroform, in ether, in ethyl acetate, and in isopropyl alcohol.

Cephalothin Sodium: White to off-white, practically odorless, crystalline powder. Freely soluble in water, in saline TS, and in dextrose solutions; insoluble in most organic solvents.

Cephapirin Benzathine: White, crystalline powder. Practically insoluble in water, in ether, and in toluene; insoluble in alcohol; soluble in 0.1 N hydrochloric acid.

Cephapirin Sodium: White to off-white, crystalline powder, odorless or having a slight odor. Very soluble in water; insoluble in most organic solvents.

Cephradine: White to off-white, crystalline powder. Sparingly soluble in water; very slightly soluble in alcohol and in chloroform; practically insoluble in ether.

Cetostearyl Alcohol: Unctuous, white flakes or granules, having a faint, characteristic odor, and a bland, mild taste. Insoluble in water; soluble in alcohol and in ether. *NF category:* Stiffening agent.

Cetrimonium Bromide: A white to creamy white, voluminous, free-flowing powder, with a characteristic faint odor and bitter, soapy taste. Freely soluble in water and in alcohol; practically insoluble in ether. *NF category:* Antimicrobial preservative.

Cetyl Alcohol: Unctuous, white flakes, granules, cubes, or castings. Has a faint characteristic odor and a bland, mild taste. Usually melts in the range between 45° and 50°. Insoluble in water; soluble in alcohol and in ether, the solubility increasing with an increase in temperature. *NF category:* Stiffening agent.

Cetyl Esters Wax: White to off-white, somewhat translucent flakes, having a crystalline structure and a pearly luster when caked. Has a faint odor and a bland, mild taste, free from rancidity, and has a specific gravity of about 0.83 at 50°. Insoluble in water; soluble in boiling alcohol, in ether, in chloroform, and in fixed and volatile oils; slightly soluble in cold solvent hexane; practically insoluble in cold alcohol. *NF category:* Stiffening agent.

Cetyl Palmitate: White crystals or flakes. Freely soluble in alcohol and in ether; practically insoluble in water. *NF category:* Stiffening agent.

Cetylpyridinium Chloride: White powder, having a slight, characteristic odor. Very soluble in water, in alcohol, and in chloroform; slightly soluble in benzene and in ether. *NF category:* Antimicrobial preservative; wetting and/or solubilizing agent.

Cetylpyridinium Chloride Topical Solution: Clear liquid. Is colorless unless a color has been added; has an aromatic odor and a bitter taste.

Activated Charcoal: Fine, black, odorless, tasteless powder, free from gritty matter. *NF category:* Sorbent.

Chloral Hydrate: Colorless, transparent, or white crystals having an aromatic, penetrating, and slightly acrid odor, and a slightly bitter, caustic taste. Melts at about 55°, and slowly volatilizes when exposed to air. Very soluble in water and in olive oil; freely soluble in alcohol, in chloroform, and in ether.

Chlorambucil: Off-white, slightly granular powder. Very slightly soluble in water; freely soluble in acetone; soluble in dilute alkali.

Chloramphenicol: Fine, white to grayish-white or yellowish-white, needle-like crystals or elongated plates. Its solutions are practically neutral to litmus. Is reasonably stable in neutral or moderately acid solutions. Its alcohol solution is dextrorotatory and its ethyl acetate solution is levorotatory. Slightly soluble in water; freely soluble in alcohol, in propylene glycol, in acetone, and in ethyl acetate.

Chloramphenicol Palmitate: Fine, white, unctuous, crystalline powder, having a faint odor and a bland, mild taste. Insoluble in water; freely soluble in acetone and in chloroform; soluble in ether; sparingly soluble in alcohol; very slightly soluble in solvent hexane.

Chloramphenicol Sodium Succinate: Light yellow powder. Freely soluble in water and in alcohol.

Chlordiazepoxide: Yellow, practically odorless, crystalline powder. Is sensitive to sunlight. Melts at about 240°. Insoluble in water; sparingly soluble in chloroform and in alcohol.

Chlordiazepoxide Hydrochloride: White or practically white, odorless, crystalline powder. Is affected by sunlight. Soluble in water; sparingly soluble in alcohol; insoluble in solvent hexane.

Chlorhexidine Gluconate Solution: Almost colorless or pale yellow, clear liquid. Miscible with glacial acetic acid and with water; miscible with three times its volume of acetone and with five times its volume of dehydrated alcohol; further addition of acetone or dehydrated alcohol yields a white turbidity.

Chlorhexidine Hydrochloride: White or almost white, crystalline powder. Sparingly soluble in propylene glycol and in water; very slightly soluble in alcohol.

Chlorobutanol: Colorless to white crystals, having a characteristic, somewhat camphoraceous, odor and taste. Anhydrous form melts at about 95°, and hydrous form melts at about 76°. Slightly soluble in water; freely soluble in alcohol, in ether, in chloroform, and in volatile oils; soluble in glycerin. *NF category:* Antimicrobial preservative.

Chlorocresol: Colorless or practically colorless crystals or crystalline powder, having a characteristic, nontarry odor. Is volatile in steam. Slightly soluble in water and more soluble in hot water; very soluble in alcohol; soluble in ether, in terpenes, in fixed oils, and in solutions of alkali hydroxides. *NF category:* Antimicrobial preservative.

Chloroprocaine Hydrochloride: White, crystalline powder. Is odorless, and is stable in air. Its solutions are acid to litmus. Exhibits local anesthetic properties when placed upon the tongue. Soluble in water; slightly soluble in alcohol; very slightly soluble in chloroform; practically insoluble in ether.

Chloroquine: White or slightly yellow, crystalline powder. Is odorless, and has a bitter taste. Very slightly soluble in water; soluble in dilute acids, in chloroform, and in ether.

Chloroquine Hydrochloride Injection: Colorless liquid.

Chloroquine Phosphate: White, crystalline powder. Is odorless, has a bitter taste, and is discolored slowly on exposure to light. Its solutions have a pH of about 4.5. Exists in two polymorphic forms, one melting between 193° and 195° and the other between 210° and 215° (see *Melting Range or Temperature* ⟨741⟩); mixture of the forms melts between 193° and 215°. Freely soluble in water; practically insoluble in alcohol, in chloroform, and in ether.

Chlorothiazide: White or practically white, crystalline, odorless powder. Melts at about 340°, with decomposition. Very slightly soluble in water; freely soluble in dimethylformamide and in dimethyl sulfoxide; slightly soluble in methanol and in pyridine; practically insoluble in ether, in benzene, and in chloroform.

Chloroxylenol: White crystals or crystalline powder, having a characteristic odor. Is volatile in steam. Very slightly soluble in water; freely soluble in alcohol, in ether, in terpenes, in fixed oils, and in solutions of alkali hydroxides.

Chlorpheniramine Maleate: White, odorless, crystalline powder. Its solutions have a pH between 4 and 5. Freely soluble in water; soluble in alcohol and in chloroform; slightly soluble in ether and in benzene.

Chlorpromazine: White, crystalline solid, having an amine-like odor. Darkens on prolonged exposure to light. Melts at about 60°. Practically insoluble in water and in dilute alkali hydroxides; freely soluble in alcohol, in benzene, in chloroform, in ether, and in dilute mineral acids.

Chlorpromazine Hydrochloride: White or slightly creamy white, odorless, crystalline powder. Darkens on prolonged exposure to light. Very soluble in water; freely soluble in alcohol and in chloroform; insoluble in ether and in benzene.

Chlorpropamide: White, crystalline powder, having a slight odor. Practically insoluble in water; soluble in alcohol; sparingly soluble in chloroform.

Chlortetracycline Hydrochloride: Yellow, crystalline powder. Is odorless, and has a bitter taste. Is stable in air, but is slowly affected by light. Sparingly soluble in water; soluble in solutions of alkali hydroxides and carbonates; slightly soluble in alcohol; practically insoluble in acetone, in chloroform, in dioxane, and in ether.

Chlorthalidone: White to yellowish-white, crystalline powder. Melts at a temperature above 215°, with decomposition. Practically insoluble in water, in ether, and in chloroform; soluble in methanol; slightly soluble in alcohol.

Chlorzoxazone: White or practically white, practically odorless, crystalline powder. Slightly soluble in water; sparingly soluble in alcohol, in isopropyl alcohol, and in methanol; soluble in solutions of alkali hydroxides and ammonia.

Cholecalciferol: White, odorless crystals. Is affected by air and by light. Melts at about 85°. Insoluble in water; soluble in alcohol, in chloroform, and in fatty oils.

Cholesterol: White or faintly yellow, practically odorless, pearly leaflets, needles, powder, or granules. Acquires a yellow to pale tan color on prolonged exposure to light. Insoluble in water; soluble in acetone, in chloroform, in dioxane, in ether, in ethyl acetate, in solvent hexane, and in vegetable oils; sparingly soluble in dehydrated alcohol; slightly (and slowly) soluble in alcohol. *NF category:* Emulsifying and/or solubilizing agent.

Cholestyramine Resin: White to buff-colored, hygroscopic, fine powder. Is odorless or has not more than a slight amine-like odor. Insoluble in water, in alcohol, in chloroform, and in ether.

Choline Bitartrate: White, hygroscopic, crystalline powder. Clear, colorless liquid in solution. Melts between 148° and 153°. Is odorless, or may have a faint trimethylamine odor. Freely soluble in water; slightly soluble in alcohol; insoluble in ether and in chloroform.

Choline Chloride: Colorless or white crystals or crystalline powder, usually having a slight odor of trimethylamine. Clear and colorless in solution. Hygroscopic. Soluble in alcohol and in water.

Sodium Chromate Cr 51 Injection: Clear, slightly yellow solution.

Chromic Chloride: Dark green, odorless, slightly deliquescent crystals. Soluble in water and in alcohol; slightly soluble in acetone; practically insoluble in ether.

Chymotrypsin: White to yellowish-white, crystalline or amorphous, odorless, powder. An amount equivalent to 100,000 USP Units is soluble in 10 mL of water and in 10 mL of saline TS.

Ciclopirox: White to slightly yellowish-white, crystalline powder. Slightly soluble in water; freely soluble in ethanol and in methylene chloride; soluble in ether.

Ciclopirox Olamine: White to slightly yellowish-white, crystalline powder. Very soluble in alcohol and in methylene chloride; slightly soluble in water; practically insoluble in cyclohexane.

Cilastatin Sodium: White to tan-colored powder. Soluble in water and in methanol.

Cilostazol: White to off-white crystals. Freely soluble in chloroform; slightly soluble in methanol and in alcohol; practically insoluble in water.

Cimetidine: White to off-white, crystalline powder; odorless, or having a slight mercaptan odor. Soluble in alcohol and in polyethylene glycol 400; freely soluble in methanol; sparingly soluble in isopropyl alcohol; slightly soluble in water and in chloroform; practically insoluble in ether.

Cinoxacin: White to yellowish-white, crystalline solid. Is odorless, and has a bitter taste and a lingering aftertaste. Insoluble in water and in most common organic solvents; soluble in alkaline solution.

Ciprofloxacin Hydrochloride: Faintly yellowish to light yellow crystals. Sparingly soluble in water; slightly soluble in acetic acid and in methanol; very slightly soluble in dehydrated alcohol; practically insoluble in acetone, in acetonitrile, in ethyl acetate, in hexane, and in methylene chloride.

Citalopram Hydrobromide: White to almost white, crystalline powder. Freely soluble in water, in alcohol, and in chloroform.

Anhydrous Citric Acid: Colorless, translucent crystals, or white, granular to fine, crystalline powder. Melts at about 153°, with decomposition. Very soluble in water; freely soluble in alcohol; very slightly soluble in ether. *NF category:* Acidifying agent; buffering agent.

Citric Acid Monohydrate: Colorless, translucent crystals, or white, granular to fine, crystalline powder. Efflorescent in dry air. Very soluble in water; freely soluble in alcohol; very slightly soluble in ether. *NF category:* Acidifying agent; buffering agent.

Clarithromycin: White to off-white, crystalline powder. Soluble in acetone; slightly soluble in dehydrated alcohol, in methanol, and in acetonitrile; practically insoluble in water. Slightly soluble in phosphate buffer at pH values of 2 to 5.

Clavulanate Potassium: White to off-white powder. Is moisture-sensitive. Freely soluble in water, but stability in aqueous solution is not good, optimum stability at a pH of 6.0 to 6.3; soluble in methanol, with decomposition.

Clemastine Fumarate: White to off-white, odorless powder. Its solutions are acid to litmus. Very slightly soluble in water; slightly soluble in methanol; very slightly soluble in chloroform.

Clidinium Bromide: White to nearly white, practically odorless, crystalline powder. Is optically inactive. Melts at about 242°. Soluble in water and in alcohol; slightly soluble in benzene and in ether.

Clindamycin Hydrochloride: White or practically white, crystalline powder. Is odorless or has a faint mercaptan-like odor. Is stable in the presence of air and light. Its solutions are acidic and are dextrorotatory. Freely soluble in water, in dimethylformamide, and in methanol; soluble in alcohol; practically insoluble in acetone.

Clindamycin Palmitate Hydrochloride: White to off-white amorphous powder, having a characteristic odor. Very soluble in ethyl acetate and in dimethylformamide; freely soluble in water, in benzene, in ether, in chloroform, and in alcohol.

Clindamycin Phosphate: White to off-white, hygroscopic, crystalline powder. Is odorless or practically odorless, and has a bitter taste. Freely soluble in water; slightly soluble in dehydrated alcohol; very slightly soluble in acetone; practically insoluble in chloroform, in benzene, and in ether.

Clioquinol: Voluminous, spongy, yellowish-white to brownish-yellow powder, having a slight, characteristic odor. Darkens on exposure to light. Melts at about 180°, with decomposition. Practically insoluble in water and in alcohol; soluble in hot ethyl acetate and in hot glacial acetic acid.

Clobetasol Propionate: White to cream, crystalline powder. Practically insoluble in water; slightly soluble in benzene and in diethyl ether; sparingly soluble in ethanol; soluble in acetone, in dimethyl sulfoxide, in chloroform, in methanol, and in dioxane.

Clocortolone Pivalate: White to yellowish-white, odorless powder. Melts at about 230°, with decomposition. Freely soluble in chloroform and in dioxane; soluble in acetone; sparingly soluble in alcohol; slightly soluble in benzene and in ether.

Clofazimine: Dark red crystals. Melts at about 217°, with decomposition. Practically insoluble in water; soluble in chloroform and in benzene; sparingly soluble in alcohol, in acetone, and in ethyl acetate.

Clofibrate: Colorless to pale yellow liquid having a characteristic odor. Insoluble in water; soluble in acetone, in alcohol, in benzene, and in chloroform.

Clomiphene Citrate: White to pale yellow, essentially odorless powder. Slightly soluble in water and in chloroform; freely soluble in methanol; sparingly soluble in alcohol; insoluble in ether.

Clomipramine Hydrochloride: White to faintly yellow, crystalline powder. Very soluble in water.

Clonazepam: Light yellow powder, having a faint odor. Insoluble in water; sparingly soluble in acetone and in chloroform; slightly soluble in alcohol and in ether.

Clonidine: White to almost white, crystalline powder. Melting point is about 130°. Freely soluble in methanol and in alcohol.

Clopidogrel Bisulfate: White to off-white powder. Freely soluble in water and in methanol; practically insoluble in ether.

Clorazepate Dipotassium: Light yellow, crystalline powder. Darkens on exposure to light. Soluble in water but, upon standing, may precipitate from the solution; slightly soluble in alcohol and in isopropyl alcohol; practically insoluble in acetone, in benzene, in chloroform, in ether, and in methylene chloride.

Clorsulon: White to off-white powder. Slightly soluble in water; freely soluble in acetonitrile and in methanol; very slightly soluble in methylene chloride.

Clotrimazole: White to pale yellow, crystalline powder. Melts at about 142°, with decomposition. Practically insoluble in water; freely soluble in methanol, in acetone, in chloroform, and in alcohol.

Cloxacillin Benzathine: White or almost white, almost odorless, crystals or crystalline powder. Slightly soluble in water, in alcohol, and in isopropyl alcohol; soluble in chloroform and in methanol; sparingly soluble in acetone.

Cloxacillin Sodium: White, odorless, crystalline powder. Freely soluble in water; soluble in alcohol; slightly soluble in chloroform.

Clozapine: Yellow, crystalline powder. Soluble in chloroform, in acetone, and in alcohol; sparingly soluble in acetonitrile; insoluble in water.

Coal Tar: Nearly black, viscous liquid, heavier than water, having a characteristic, naphthalene-like odor, and producing a sharp, burning sensation on the tongue. Slightly soluble in water, to which it imparts its characteristic odor and taste and a faintly alkaline reaction; partially soluble in acetone, in alcohol, in carbon disulfide, in chloroform, in ether, in methanol, and in solvent hexane; is more soluble in benzene, only about 5% remaining undissolved, and is almost completely soluble in nitrobenzene, only a small amount of undissolved matter remaining suspended in the solution.

Cyanocobalamin Co 57 Capsules: May contain a small amount of solid or solids, or may appear empty.

Cyanocobalamin Co 57 Oral Solution: Clear, colorless to pink solution.

Cocaine: Colorless to white crystals or white, crystalline powder. Is levorotatory in 3 N hydrochloric acid solution. Its saturated solution is alkaline to litmus. Slightly soluble in water; very soluble in warm alcohol; freely soluble in alcohol, in chloroform, and in ether; soluble in olive oil; sparingly soluble in mineral oil.

Cocaine Hydrochloride: Colorless crystals or white, crystalline powder. Very soluble in water; freely soluble in alcohol; soluble in chloroform and in glycerin; insoluble in ether.

Coccidioidin: Clear, practically colorless or amber-colored liquid.

Cocoa Butter: Yellowish-white solid, having a faint, agreeable odor, and a bland, chocolate-like taste if the cocoa butter is obtained by pressing. If obtained by extraction, the taste is bland. Is usually brittle at temperatures below 25°. Freely soluble in ether and in chloroform; soluble in boiling dehydrated alcohol; slightly soluble in alcohol. *NF category:* Suppository base.

Coconut Oil: Clear, white to light yellow-tan, viscous liquid. Freely soluble in methylene chloride and in light petroleum (bp: 65° to 70°); very slightly soluble in alcohol; practically insoluble in water. *NF category:* Coating agent; emulsifying and/or solubilizing agent.

Cod Liver Oil: Thin, oily liquid, having a characteristic, slightly fishy but not rancid odor, and a fishy taste. Slightly soluble in alcohol; freely soluble in ether, in chloroform, in carbon disulfide, and in ethyl acetate.

Codeine: Colorless or white crystals or white, crystalline powder. It effloresces slowly in dry air, and is affected by light. In acid or alcohol solutions it is levorotatory. Its saturated solution is alkaline to litmus. Slightly soluble in water; very soluble in chloroform; freely soluble in alcohol; sparingly soluble in ether. When heated in an amount of water insufficient for complete solution, it melts to oily drops that crystallize on cooling.

Codeine Phosphate: Fine, white, needle-shaped crystals, or white, crystalline powder. Is odorless. Is affected by light. Its solutions are acid to litmus. Freely soluble in water; very soluble in hot water; slightly soluble in alcohol but more so in boiling alcohol.

Codeine Sulfate: White crystals, usually needle-like, or white, crystalline powder. Is affected by light. Soluble in water; freely soluble in water at 80°; very slightly soluble in alcohol; insoluble in chloroform and in ether.

Colchicine: Pale yellow to pale greenish-yellow, amorphous scales, or powder or crystalline powder. Is odorless or nearly so, and darkens on exposure to light. Soluble in water; freely soluble in alcohol and in chloroform; slightly soluble in ether.

Colestipol Hydrochloride: Yellow to orange beads. Swells but does not dissolve in water or dilute aqueous solutions of acid or alkali. Insoluble in the common organic solvents.

Colistimethate Sodium: White to slightly yellow, odorless, fine powder. Freely soluble in water; soluble in methanol; insoluble in acetone and in ether.

Colistin Sulfate: White to slightly yellow, odorless, fine powder. Freely soluble in water; slightly soluble in methanol; insoluble in acetone and in ether.

Collodion: Clear, or slightly opalescent, viscous liquid. Is colorless, or slightly yellowish, and has the odor of ether.

Flexible Collodion: Clear, or slightly opalescent, viscous liquid. Is colorless or slightly yellow, and has the odor of ether. The strong odor of camphor becomes noticeable as the ether evaporates.

Copovidone: White to yellowish-white powder or flakes. Is hygroscopic. Freely soluble in water, in alcohol, and in methylene chloride; practically insoluble in ether. *NF category:* Tablet binder; coating agent.

Corn Oil: Clear, light yellow, oily liquid, having a faint, characteristic odor and taste. Slightly soluble in alcohol. Miscible with ether, with chloroform, with benzene, and with solvent hexane. *NF category:* Solvent; vehicle (oleaginous).

Corn Syrup: Clear, white to light yellow, viscous liquid. Is miscible in all proportions with water. *NF category:* Suspending and/or viscosity-increasing agent; sweetening agent; tablet and/or capsule diluent; tablet binder; tonicity agent.

Corn Syrup Solids: Sweet, white to light yellow powder or granules. Soluble in water. *NF category:* Coating agent; flavored and/or sweetened vehicle; humectant; solid carrier; suspending and/or viscosity-increasing agent; sweetening agent; tablet and/or capsule diluent; tablet binder; tonicity agent.

Corticotropin Injection: Colorless or light straw-colored liquid.

Corticotropin for Injection: White or practically white, soluble, amorphous solid having the characteristic appearance of substances prepared by freeze-drying.

Repository Corticotropin Injection: Colorless or light straw-colored liquid, which may be quite viscid at room temperature. Is odorless or has an odor of an antimicrobial agent.

Corticotropin Zinc Hydroxide Injectable Suspension: Flocculent, white, aqueous suspension, free from large particles following moderate shaking.

Cortisone Acetate: White or practically white, odorless, crystalline powder. Is stable in air. Melts at about 240°, with some decomposition (see *Melting Range or Temperature* ⟨741⟩). Insoluble in water; freely soluble in chloroform; soluble in dioxane; sparingly soluble in acetone; slightly soluble in alcohol.

Purified Cotton: White, soft, fine filament-like hairs appearing under the microscope as hollow, flattened, and twisted bands, striate and slightly thickened at the edges. Is practically odorless and practically tasteless. Insoluble in ordinary solvents; soluble in ammoniated cupric oxide TS.

Cottonseed Oil: Pale yellow, oily liquid. Is odorless or nearly so, and has a bland taste. At temperatures below 10° particles of solid fat may separate from the Oil, and at about 0° to –5° the Oil becomes a solid or nearly so. Slightly soluble in alcohol. Miscible with ether, with chloroform, with solvent hexane, and with carbon disulfide. *NF category:* Solvent; vehicle (oleaginous).

Hydrogenated Cottonseed Oil: A white mass or powder that melts to a clear, pale yellow liquid when heated. Freely soluble in methylene

chloride and in toluene; very slightly soluble in alcohol; practically insoluble in water.

Creatinine: White crystals or crystalline powder; odorless. Soluble in water; slightly soluble in alcohol; practically insoluble in acetone, in ether, and in chloroform. *NF category:* Bulking agent for freeze-drying.

Cresol: Colorless, or yellowish to brownish-yellow, or pinkish, highly refractive liquid, becoming darker with age and on exposure to light. Has a phenol-like, sometimes empyreumatic odor. A saturated solution of it is neutral or only slightly acid to litmus. Sparingly soluble in water, usually forming a cloudy solution; dissolves in solutions of fixed alkali hydroxides. Miscible with alcohol, with ether, and with glycerin. *NF category:* Antimicrobial preservative.

Cromolyn Sodium: White, odorless, crystalline powder. Is tasteless at first, with a slightly bitter aftertaste. Is hygroscopic. Soluble in water; insoluble in alcohol and in chloroform.

Cromolyn Sodium for Inhalation: White to creamy white, odorless, hygroscopic, and very finely divided powder.

Croscarmellose Sodium: White, free-flowing powder. Partially soluble in water; insoluble in alcohol, in ether, and in other organic solvents. *NF category:* Tablet disintegrant.

Crospovidone: White to creamy-white, hygroscopic powder, having a faint odor. Insoluble in water and in ordinary organic solvents. *NF category:* Tablet disintegrant.

Crotamiton: Colorless to slightly yellowish oil, having a faint amine-like odor. Soluble in alcohol and in methanol.

Cupric Chloride: Bluish green, deliquescent crystals. Freely soluble in water; soluble in alcohol; slightly soluble in ether.

Cupric Sulfate: Deep blue, triclinic crystals or blue, crystalline granules or powder. It effloresces slowly in dry air. Its solutions are acid to litmus. Freely soluble in water and in glycerin; very soluble in boiling water; slightly soluble in alcohol.

Cyanocobalamin: Dark red crystals or amorphous or crystalline red powder. In the anhydrous form, it is very hygroscopic and when exposed to air it may absorb about 12% of water. Sparingly soluble in water; soluble in alcohol; insoluble in acetone, in chloroform, and in ether.

Cyclandelate: White, crystalline powder. Very soluble in acetonitrile, in alcohol, and in ether; practically insoluble in water. Melts at about 58°.

Cyclizine Hydrochloride: White, crystalline powder or small, colorless crystals. Is odorless or nearly so, and has a bitter taste. Melts indistinctly at about 285°, with decomposition. Slightly soluble in water and in alcohol; sparingly soluble in chloroform; insoluble in ether.

Cyclobenzaprine Hydrochloride: White to off-white, odorless, crystalline powder. Freely soluble in water, in alcohol, and in methanol; sparingly soluble in isopropanol; slightly soluble in chloroform and in methylene chloride; insoluble in hydrocarbons.

Cyclopentolate Hydrochloride: White, crystalline powder, which upon standing develops a characteristic odor. Its solutions are acid to litmus. Melts at about 138°, the melt appearing opaque. Very soluble in water; freely soluble in alcohol; insoluble in ether.

Cyclophosphamide: White, crystalline powder. Liquefies upon loss of its water of crystallization. Soluble in water and in alcohol.

Cyclopropane: Colorless gas having a characteristic odor. Has a pungent taste. One L at a pressure of 760 mm and a temperature of 0° weighs about 1.88 g. One volume dissolves in about 2.7 volumes of water at 15°. Freely soluble in alcohol; soluble in fixed oils.

Cycloserine: White to pale yellow, crystalline powder. Is odorless or has a faint odor. Is hygroscopic and deteriorates upon absorbing water. Its solutions are dextrorotatory. Freely soluble in water.

Cyclosporine: White to almost white powder. Soluble in acetone, in alcohol, in methanol, in ether, in chloroform, and in methylene chloride; slightly soluble in saturated hydrocarbons; practically insoluble in water.

Cyproheptadine Hydrochloride: White to slightly yellow, odorless or practically odorless, crystalline powder. Slightly soluble in water; freely soluble in methanol; soluble in chloroform; sparingly soluble in alcohol; practically insoluble in ether.

Cyromazine: White or off-white, odorless, crystalline powder. Slightly soluble in methanol and in water.

Cysteine Hydrochloride: White crystals or crystalline powder. Soluble in water, in alcohol, and in acetone.

Cytarabine: Odorless, white to off-white, crystalline powder. Freely soluble in water; slightly soluble in alcohol and in chloroform.

Dactinomycin: Bright red, crystalline powder. Is somewhat hygroscopic and is affected by light and by heat. Soluble in water at 10° and slightly soluble in water at 37°; freely soluble in alcohol; very slightly soluble in ether.

Danazol: White to pale yellow, crystalline powder. Melts at about 225°, with some decomposition. Practically insoluble or insoluble in water and in hexane; freely soluble in chloroform; soluble in acetone; sparingly soluble in alcohol and in benzene; slightly soluble in ether.

Dantrolene Sodium: Fine orange to orange-brown powder. Sparingly soluble in acetone, in dimethyformamide, and in glycerine.

Dapsone: White or creamy white, crystalline powder. Is odorless and has a slightly bitter taste. Very slightly soluble in water; freely soluble in alcohol; soluble in acetone and in dilute mineral acids.

Daunorubicin Hydrochloride: Orange-red, crystalline, hygroscopic powder. Freely soluble in water and in methanol; slightly soluble in alcohol; very slightly soluble in chloroform; practically insoluble in acetone.

Deferoxamine Mesylate: White to off-white powder. Freely soluble in water; slightly soluble in methanol.

Dehydrocholic Acid: White, fluffy, odorless powder, having a bitter taste. Practically insoluble in water; soluble in glacial acetic acid and in solutions of alkali hydroxides and carbonates; slightly soluble in alcohol and in ether; sparingly soluble in chloroform (the solutions in alcohol and in chloroform usually are slightly turbid).

Dehydroacetic Acid: White or nearly white, crystalline powder. Soluble in aqueous solutions of alkalies; very slightly soluble in water. One g of sample dissolves in about 35 mL of alcohol and in 5 mL of acetone. *NF category:* Antimicrobial preservative.

Demecarium Bromide: White or slightly yellow, slightly hygroscopic, crystalline powder. Freely soluble in water and in alcohol; soluble in ether; sparingly soluble in acetone.

Demeclocycline: Yellow, crystalline, odorless powder, having a bitter taste. Sparingly soluble in water; soluble in alcohol. Dissolves readily in 3 N hydrochloric acid and in alkaline solutions.

Demeclocycline Hydrochloride: Yellow, crystalline, odorless powder, having a bitter taste. Sparingly soluble in water and in solutions of alkali hydroxides and carbonates; slightly soluble in alcohol; practically insoluble in acetone and in chloroform.

Denatonium Benzoate: Freely soluble in water and in alcohol; very soluble in chloroform and in methanol; very slightly soluble in ether. *NF category:* Alcohol denaturant.

Desipramine Hydrochloride: White to off-white, crystalline powder. Melts at about 213°. Soluble in water and in alcohol; freely soluble in methanol and in chloroform; insoluble in ether.

Desmopressin Acetate: White, fluffy powder. Soluble in water, in alcohol, and in acetic acid.

Desoximetasone: White to practically white, odorless, crystalline powder. Insoluble in water; freely soluble in alcohol, in acetone, and in chloroform.

Desoxycorticosterone Acetate: White or creamy white, crystalline powder. Is odorless, and is stable in air. Practically insoluble in water; sparingly soluble in alcohol, in acetone, and in dioxane; slightly soluble in vegetable oils.

Dexamethasone: White to practically white, odorless, crystalline powder. Is stable in air. Melts at about 250°, with some decomposition. Practically insoluble in water; sparingly soluble in acetone, in alcohol, in dioxane, and in methanol; slightly soluble in chloroform; very slightly soluble in ether.

Dexamethasone Acetate: Clear, white to off-white, odorless powder. Practically insoluble in water; freely soluble in methanol, in acetone, and in dioxane.

Dexamethasone Sodium Phosphate: White or slightly yellow, crystalline powder. Is odorless or has a slight odor of alcohol, and is exceedingly hygroscopic. Freely soluble in water; slightly soluble in alcohol; very slightly soluble in dioxane; insoluble in chloroform and in ether.

Dexbrompheniramine Maleate: White, odorless, crystalline powder. Exists in two polymorphic forms, one melting between 106° and 107° and the other between 112° and 113°. Mixtures of the forms may melt between 105° and 113°. The pH of a solution (1 in 100) is about 5. Freely soluble in water; soluble in alcohol and in chloroform.

Dexchlorpheniramine Maleate: White, odorless, crystalline powder. Freely soluble in water; soluble in alcohol and in chloroform; slightly soluble in benzene and in ether.

Dexpanthenol: Clear, viscous, somewhat hygroscopic liquid, having a slight, characteristic odor. Some crystallization may occur on standing. Freely soluble in water, in alcohol, in methanol, and in propylene glycol; soluble in chloroform and in ether; slightly soluble in glycerin.

Dextran 1: A white to off-white powder. Is hygroscopic. Very soluble in water; sparingly soluble in alcohol.

Dextrates: Free-flowing, porous, white, odorless, spherical granules consisting of aggregates of microcrystals, having a sweet taste and producing a cooling sensation in the mouth. May be compressed directly into self-binding tablets. Freely soluble in water (heating increases its solubility in water); soluble in dilute acids and alkalies and in basic organic solvents such as pyridine; insoluble in the common organic solvents. *NF category:* Sweetening agent; tablet and/or capsule diluent.

Dextrin: Free-flowing, white, yellow, or brown powder. Its solubility in water varies; it is usually very soluble, but often contains an insoluble portion. *NF category:* Tablet binder; tablet and/or capsule diluent.

Dextroamphetamine Sulfate: White, odorless, crystalline powder. Soluble in water; slightly soluble in alcohol; insoluble in ether.

Dextromethorphan: Practically white to slightly yellow, odorless, crystalline powder. Eleven mg of Dextromethorphan is equivalent to 15 mg of dextromethorphan hydrobromide monohydrate. Practically insoluble in water; freely soluble in chloroform.

Dextromethorphan Hydrobromide: Practically white crystals or crystalline powder, having a faint odor. Melts at about 126°, with decomposition. Sparingly soluble in water; freely soluble in alcohol and in chloroform; insoluble in ether.

Dextrose: Colorless crystals or white, crystalline or granular powder. Is odorless, and has a sweet taste. Freely soluble in water; very soluble in boiling water; soluble in boiling alcohol; slightly soluble in alcohol. *NF category:* Sweetening agent; tonicity agent; vehicle (flavored and/or sweetened).

Dextrose Excipient: Colorless crystals or white, crystalline or granular powder. Is odorless and sweet-tasting. Freely soluble in water; very soluble in boiling water; sparingly soluble in boiling alcohol; slightly soluble in alcohol. *NF category:* Sweetening agent; tablet and/or capsule diluent.

Diacetylated Monoglycerides: Clear liquid. Very soluble in 80% (w/w) aqueous alcohol, in vegetable oils, and in mineral oils; sparingly soluble in 70% alcohol. *NF category:* Plasticizer.

Diatrizoate Meglumine: White, odorless powder. Freely soluble in water.

Diatrizoate Meglumine Injection: Clear, colorless to pale yellow, slightly viscous liquid.

Diatrizoate Meglumine and Diatrizoate Sodium Injection: Clear, colorless to pale yellow, slightly viscous liquid. May crystallize at room temperature or below.

Diatrizoate Sodium: White, odorless powder. Soluble in water; slightly soluble in alcohol; practically insoluble in acetone and in ether.

Diatrizoate Sodium Injection: Clear, colorless to pale yellow, slightly viscous liquid.

Diatrizoate Sodium Solution: Clear, pale yellow to light brown liquid.

Diatrizoic Acid: White, odorless powder. Very slightly soluble in water and in alcohol; soluble in dimethylformamide and in alkali hydroxide solutions.

Diazepam: Off-white to yellow, practically odorless, crystalline powder. Practically insoluble in water; freely soluble in chloroform; soluble in alcohol.

Diazoxide: White or cream-white crystals or crystalline powder. Practically insoluble to sparingly soluble in water and in most organic solvents; very soluble in strong alkaline solutions; freely soluble in dimethylformamide.

Dibucaine: White to off-white powder, having a slight, characteristic odor. Darkens on exposure to light. Slightly soluble in water; soluble in 1 N hydrochloric acid and in ether.

Dibucaine Hydrochloride: Colorless or white to off-white crystals or white to off-white, crystalline powder. Is odorless, is somewhat hygroscopic, and darkens on exposure to light. Its solutions have a pH of about 5.5. Freely soluble in water, in alcohol, in acetone, and in chloroform.

Dibutyl Phthalate: A clear, oily liquid, colorless or very slightly yellow. Practically insoluble in water; miscible with alcohol and with ether.

Dibutyl Sebacate: Colorless, oily liquid of very mild odor. Soluble in alcohol, in isopropyl alcohol, and in mineral oil; very slightly soluble in propylene glycol; practically insoluble in water and in glycerin. *NF category:* Plasticizer.

Dichloralphenazone: White, microcrystalline powder. Has a slight odor characteristic of chloral hydrate. Decomposed by dilute alkali, liberating chloroform. Freely soluble in water, in alcohol, and in chloroform; soluble in dilute acids.

Dichlorodifluoromethane: Clear, colorless gas, having a faint, ethereal odor. Its vapor pressure at 25° is about 4880 mm of mercury (80 psig). *NF category:* Aerosol propellant.

Dichlorotetrafluoroethane: Clear, colorless gas, having a faint, ethereal odor. Its vapor pressure at 25° is about 1620 mm of mercury (17 psig). Usually contains between 6% and 10% of its isomer, $CCl_2F\text{-}CF_3$. *NF category:* Aerosol propellant.

Diclofenac Sodium: White to off-white, hygroscopic, crystalline powder. Melts at about 284°. Freely soluble in methanol; soluble in ethanol; sparingly soluble in water; practically insoluble in chloroform and in ether.

Dicloxacillin Sodium: White to off-white, crystalline powder. Freely soluble in water.

Dicyclomine Hydrochloride: Fine, white, crystalline powder. Is practically odorless and has a very bitter taste. Soluble in water; freely soluble in alcohol and in chloroform; very slightly soluble in ether.

Dicyclomine Hydrochloride Injection: Colorless solution, which may have the odor of a preservative.

Didanosine: White to off-white, crystalline powder. Very soluble in dimethyl sulfoxide; practically insoluble or insoluble in acetone and in methanol.

Dienestrol: Colorless, white or practically white, needle-like crystals, or white or practically white, crystalline powder. Is odorless. Practically insoluble in water; soluble in alcohol, in acetone, in ether, in methanol, in propylene glycol, and in solutions of alkali hydroxides; slightly soluble in chloroform and in fatty oils.

Diethanolamine: White or clear, colorless crystals, deliquescing in moist air; or colorless liquid. Miscible with water, with alcohol, with acetone, with chloroform, and with glycerin. Slightly soluble to insoluble in benzene, in ether, and in petroleum ether. *NF category:* Alkalizing agent; emulsifying and/or solubilizing agent.

Diethylcarbamazine Citrate: White, crystalline powder. Melts at about 136°, with decomposition. Is odorless or has a slight odor; is slightly hygroscopic. Very soluble in water; sparingly soluble in alcohol; practically insoluble in acetone, in chloroform, and in ether.

Diethylene Glycol Monoethyl Ether: Clear, colorless liquid. Is hygroscopic. Miscible with water, with acetone, and with alcohol; partially miscible with vegetable oils; immiscible with mineral oils. Specific gravity about 0.991. *NF category:* Ointment base; solvent.

Diethylene Glycol Stearates: White or almost white, waxy solid. Soluble in acetone and in hot alcohol; practically insoluble in water. *NF category:* Emulsifying and/or solubilizing agent.

Diethyl Phthalate: Colorless, practically odorless, oily liquid. Insoluble in water. Miscible with alcohol, with ether, and with other usual organic solvents. *NF category:* Plasticizer.

Diethylpropion Hydrochloride: White to off-white, fine crystalline powder. Is odorless, or has a slight characteristic odor. It melts at about 175°, with decomposition. Freely soluble in water, in chloroform, and in alcohol; practically insoluble in ether.

Diethylstilbestrol: White, odorless, crystalline powder. Practically insoluble in water; soluble in alcohol, in chloroform, in ether, in fatty oils, and in dilute alkali hydroxides.

Diethylstilbestrol Diphosphate: Off-white, odorless, crystalline powder. Sparingly soluble in water; soluble in alcohol and in dilute alkali.

Diethylstilbestrol Diphosphate Injection: Colorless to light, straw-colored liquid.

Diethyltoluamide: Colorless liquid, having a faint, pleasant odor. Boils at about 111° under a pressure of 1 mm of mercury. Practically insoluble in water and in glycerin. Miscible with alcohol, with isopropyl alcohol, with ether, with chloroform, and with carbon disulfide.

Diflorasone Diacetate: White to pale yellow, crystalline powder. Insoluble in water; soluble in methanol and in acetone; sparingly soluble in ethyl acetate; slightly soluble in toluene; very slightly soluble in ether.

Diflunisal: White to off-white, practically odorless powder. Freely soluble in alcohol and in methanol; soluble in acetone and in ethyl acetate; slightly soluble in chloroform, in carbon tetrachloride, and in methylene chloride; insoluble in hexane and in water.

Digitoxin: White or pale buff, odorless, microcrystalline powder. Practically insoluble in water; sparingly soluble in chloroform; slightly soluble in alcohol; very slightly soluble in ether.

Digoxin: Clear to white, odorless crystals or white, odorless crystalline powder. Practically insoluble in water and in ether; freely soluble in pyridine; slightly soluble in diluted alcohol and in chloroform.

Dihydroergotamine Mesylate: White to slightly yellowish powder, or off-white to faintly red powder, having a faint odor. Slightly soluble in water and in chloroform; soluble in alcohol.

Dihydrostreptomycin Sulfate: White or almost white, amorphous or crystalline powder. Amorphous form is hygroscopic. Freely soluble in water; practically insoluble in acetone, in chloroform, and in methanol.

Dihydrotachysterol: Colorless or white, odorless crystals, or white, odorless, crystalline powder. Practically insoluble in water; soluble in alcohol; freely soluble in ether and in chloroform; sparingly soluble in vegetable oils.

Dihydroxyacetone: White to off-white crystalline powder. The monomeric form is freely soluble in water, in alcohol, and in ether. The dimeric form is freely soluble in water; soluble in alcohol; and sparingly soluble in ether.

Dihydroxyaluminum Aminoacetate: White, odorless powder having a faintly sweet taste. Insoluble in water and in organic solvents; soluble in dilute mineral acids and in solutions of fixed alkalies.

Dihydroxyaluminum Aminoacetate Magma: White, viscous suspension, from which small amounts of water may separate on standing.

Dihydroxyaluminum Sodium Carbonate: Fine, white, odorless powder. Practically insoluble in water and in organic solvents; soluble in dilute mineral acids with the evolution of carbon dioxide.

Diloxanide Furoate: White or almost white, crystalline powder. Freely soluble in chloroform; slightly soluble in alcohol and in ether; very slightly soluble in water.

Diltiazem Hydrochloride: White, odorless, crystalline powder or small crystals. Freely soluble in chloroform, in formic acid, in methanol, and in water; sparingly soluble in dehydrated alcohol; insoluble in ether. Melts at about 210°, with decomposition.

Dimenhydrinate: White, crystalline, odorless powder. Slightly soluble in water; freely soluble in alcohol and in chloroform; sparingly soluble in ether.

Dimercaprol: Colorless or practically colorless liquid, having a disagreeable, mercaptan-like odor. Soluble in water, in alcohol, in benzyl benzoate, and in methanol.

Dimercaprol Injection: Yellow, viscous solution having a pungent, disagreeable odor. Specific gravity is about 0.978.

Dimethicone: A clear, colorless, and odorless liquid. Soluble in chlorinated hydrocarbons, in benzene, in toluene, in xylene, in *n*-hexane, in petroleum spirits, in ether, and in amyl acetate; very slightly soluble in isopropyl alcohol; insoluble in water, in methanol, in alcohol, and in acetone. *NF category:* Antifoaming agent; water repelling agent.

Dimethyl Sulfoxide: Clear, colorless, odorless, hygroscopic liquid. Melts at about 18.4°. Boils at about 189°. Soluble in water; practically insoluble in acetone, in alcohol, in benzene, in chloroform, and in ether.

Dinoprostone: White to off-white, crystalline powder. Freely soluble in acetone, in alcohol, in ether, in ethyl acetate, in isopropyl alcohol, in methanol, and in methylene chloride; soluble in toluene and in diisopropyl ether; practically insoluble in hexanes.

Dinoprost Tromethamine: White to off-white, crystalline powder. Very soluble in water; freely soluble in dimethylformamide; soluble in methanol; slightly soluble in chloroform.

Dioxybenzone: Yellow powder. Practically insoluble in water; freely soluble in alcohol and in toluene.

Diphenhydramine Hydrochloride: White, odorless, crystalline powder. Slowly darkens on exposure to light. Its solutions are practically neutral to litmus. Freely soluble in water, in alcohol, and in chloroform; sparingly soluble in acetone; very slightly soluble in benzene and in ether.

Diphenoxylate Hydrochloride: White, odorless, crystalline powder. Its saturated solution has a pH of about 3.3. Slightly soluble in water and in isopropanol; freely soluble in chloroform; soluble in methanol; sparingly soluble in alcohol and in acetone; practically insoluble in ether and in solvent hexane.

Diphtheria and Tetanus Toxoids Adsorbed: Turbid, and white, slightly gray, or slightly pink suspension, free from evident clumps after shaking.

Dipivefrin Hydrochloride: White, crystalline powder or small crystals, having a faint odor. Very soluble in water.

Dipyridamole: Intensely yellow, crystalline powder or needles. Very soluble in methanol, in alcohol, and in chloroform; slightly soluble in water; very slightly soluble in acetone and in ethyl acetate.

Dirithromycin: White or practically white powder. Very slightly soluble in water; very soluble in methanol and in methylene chloride.

Disopyramide Phosphate: White or practically white, odorless powder. Melts at about 205°, with decomposition. Freely soluble in water; slightly soluble in alcohol; practically insoluble in chloroform and in ether.

Disulfiram: White to off-white, odorless, crystalline powder. Very slightly soluble in water; soluble in acetone, in alcohol, in carbon disulfide, and in chloroform.

Divalproex Sodium: White to off-white powder. Very soluble in chloroform; freely soluble in methanol and in ethyl ether; soluble in acetone; practically insoluble in acetonitrile.

Dobutamine Hydrochloride: White to practically white, crystalline powder. Sparingly soluble in water and in methanol; soluble in alcohol and in pyridine.

Docusate Calcium: White, amorphous solid, having the characteristic odor of octyl alcohol. It is free of the odor of other solvents. Very slightly soluble in water; very soluble in alcohol, in polyethylene glycol 400, and in corn oil.

Docusate Potassium: White, amorphous solid, having a characteristic odor suggestive of octyl alcohol. Sparingly soluble in water; very soluble in solvent hexane; soluble in alcohol and in glycerin.

Docusate Sodium: White, wax-like, plastic solid, having a characteristic odor suggestive of octyl alcohol, but no odor of other solvents. Sparingly soluble in water; very soluble in solvent hexane; freely soluble in alcohol and in glycerin. *NF category:* Wetting and/or solubilizing agent.

Dolasetron Mesylate: White to off-white powder. Freely soluble in water and in propylene glycol; slightly soluble in alcohol and in saline TS.

Dopamine Hydrochloride: White to off-white, crystalline powder. May have a slight odor of hydrochloric acid. Melts at about 240°, with decomposition. Freely soluble in water and in aqueous solutions of alkali hydroxides; soluble in methanol; insoluble in ether and in chloroform.

Dorzolamide Hydrochloride: White to off-white, crystalline powder. Soluble in water.

Doxapram Hydrochloride: White to off-white, odorless, crystalline powder. Melts at about 220°. Soluble in water and in chloroform; sparingly soluble in alcohol; practically insoluble in ether.

Doxazosin Mesylate: White to tan-colored powder. Freely soluble in formic acid. Very slightly soluble in methanol and in water.

Doxorubicin Hydrochloride: Red-orange, hygroscopic, crystalline or amorphous powder. Soluble in water, in isotonic sodium chloride solution, and in methanol; practically insoluble in chloroform, in ether, and in other organic solvents.

Doxycycline: Yellow, crystalline powder. Very slightly soluble in water; freely soluble in dilute acid and in alkali hydroxide solutions; sparingly soluble in alcohol; practically insoluble in chloroform and in ether.

Doxycycline Hyclate: Yellow, crystalline powder. Soluble in water and in solutions of alkali hydroxides and carbonates; slightly soluble in alcohol; practically insoluble in chloroform and in ether.

Doxylamine Succinate: White or creamy white powder, having a characteristic odor. Very soluble in water and in alcohol; freely soluble in chloroform; very slightly soluble in ether and in benzene.

Dronabinol: Light yellow resinous oil that is sticky at room temperature and hardens upon refrigeration. Insoluble in water.

Droperidol: White to light tan, amorphous or microcrystalline powder. Practically insoluble in water; freely soluble in chloroform; slightly soluble in alcohol and in ether. Melts at about 145°.

Drospirenone: White to off-white powder. Freely soluble in methylene chloride; soluble in acetone and in methanol; sparingly soluble in ethyl acetate and in alcohol; practically insoluble in hexane and in water.

Absorbable Dusting Powder: White, odorless powder.

Dyclonine Hydrochloride: White crystals or white crystalline powder, which may have a slight odor. Exhibits local anesthetic properties when placed upon the tongue. Soluble in water, in acetone, in alcohol, and in chloroform.

Dydrogesterone: White to pale yellow, crystalline powder. Practically insoluble in water; sparingly soluble in alcohol.

Dyphylline: White, odorless, extremely bitter, amorphous or crystalline solid. Freely soluble in water; sparingly soluble in alcohol and in chloroform; practically insoluble in ether.

Echothiophate Iodide: White, crystalline, hygroscopic solid having a slight mercaptan-like odor. Its solutions have a pH of about 4. Freely soluble in water and in methanol; soluble in dehydrated alcohol; practically insoluble in other organic solvents.

Echothiophate Iodide for Ophthalmic Solution: White, amorphous powder.

Econazole Nitrate: White or practically white, crystalline powder, having not more than a slight odor. Very slightly soluble in water and in ether; slightly soluble in alcohol; sparingly soluble in chloroform; soluble in methanol.

Edetate Calcium Disodium: White, crystalline granules or white, crystalline powder. Is odorless, is slightly hygroscopic, and has a faint, saline taste. Is stable in air. Freely soluble in water. *NF category:* Chelating agent; complexing agent.

Edetate Disodium: White, crystalline powder. Soluble in water. *NF category:* Chelating agent; complexing agent.

Edetic Acid: White, crystalline powder. Melts above 220°, with decomposition. Soluble in solutions of alkali hydroxides; very slightly soluble in water. *NF category:* Chelating agent; complexing agent.

Edrophonium Chloride: White, odorless, crystalline powder. Its solution (1 in 10) is practically colorless. Very soluble in water; freely soluble in alcohol; insoluble in chloroform and in ether.

Emedastine Fumarate: White to faintly yellow, crystalline powder. Soluble in water.

Emetine Hydrochloride: White or very slightly yellowish, odorless, crystalline powder. Is affected by light. Freely soluble in water and in alcohol.

Enalapril Maleate: Off-white, crystalline powder. Melts at about 144°. Practically insoluble in nonpolar organic solvents; slightly soluble in semipolar organic solvents; sparingly soluble in water; soluble in alcohol; freely soluble in methanol and in dimethylformamide.

Enalaprilat: White to nearly white, hygroscopic, crystalline powder. Sparingly soluble in methanol and in dimethylformamide; slightly soluble in water and in isopropyl alcohol; very slightly soluble in acetone, in alcohol, and in hexane; practically insoluble in acetonitrile and in chloroform.

Enflurane: Clear, colorless, stable, volatile liquid, having a mild, sweet odor. Is nonflammable. Slightly soluble in water. Miscible with organic solvents, with fats, and with oils.

Ephedrine: Unctuous, practically colorless solid or white crystals or granules. Gradually decomposes on exposure to light. Melts between 33° and 40°, the variability in the melting point being the result of differences in the moisture content, anhydrous Ephedrine having a lower melting point than the hemihydrate of Ephedrine. Its solutions are

alkaline to litmus. Soluble in water, in alcohol, in chloroform, and in ether; moderately and slowly soluble in mineral oil, the solution becoming turbid if the Ephedrine contains more than about 1% of water.

Ephedrine Hydrochloride: Fine, white, odorless crystals or powder. Is affected by light. Freely soluble in water; soluble in alcohol; insoluble in ether.

Ephedrine Sulfate: Fine, white, odorless crystals or powder. Darkens on exposure to light. Freely soluble in water; sparingly soluble in alcohol.

Ephedrine Sulfate Nasal Solution: Clear, colorless solution. Is neutral or slightly acid to litmus.

Epinephrine: White to practically white, odorless, microcrystalline powder or granules, gradually darkening on exposure to light and air. With acids, it forms salts that are readily soluble in water, and the base may be recovered by the addition of ammonia water or alkali carbonates. Its solutions are alkaline to litmus. Very slightly soluble in water and in alcohol; insoluble in ether, in chloroform, and in fixed and volatile oils.

Epinephrine Injection: Practically colorless, slightly acid liquid. Gradually turns dark on exposure to light and air.

Epinephrine Inhalation Solution: Practically colorless, slightly acid liquid. Gradually turns dark on exposure to light and air.

Epinephrine Nasal Solution: Nearly colorless, slightly acid liquid. Gradually turns dark on exposure to light and air.

Epinephrine Ophthalmic Solution: Colorless to faint yellow solution. Gradually turns dark on exposure to light and air.

Epinephrine Bitartrate: White, or grayish-white or light brownish-gray, odorless, crystalline powder. Slowly darkens on exposure to air and light. Its solutions are acid to litmus, having a pH of about 3.5. Freely soluble in water; slightly soluble in alcohol; practically insoluble in chloroform and in ether.

Epinephrine Bitartrate for Ophthalmic Solution: White to off-white solid.

Epinephryl Borate Ophthalmic Solution: Clear, pale yellow liquid, gradually darkening on exposure to light and air.

Eprinomectin: White to off-white powder. Insoluble in cold water.

Ergocalciferol: White, odorless crystals. Is affected by air and by light. Insoluble in water; soluble in alcohol, in chloroform, in ether, and in fatty oils.

Ergocalciferol Oral Solution: Clear liquid having the characteristics of the solvent used in preparing the Solution.

Ergoloid Mesylates: White to off-white, microcrystalline or amorphous, practically odorless powder. Slightly soluble in water; soluble in methanol and in alcohol; sparingly soluble in acetone.

Ergonovine Maleate: White to grayish-white or faintly yellow, odorless, microcrystalline powder. Darkens with age and on exposure to light. Sparingly soluble in water; slightly soluble in alcohol; insoluble in ether and in chloroform.

Ergotamine Tartrate: Colorless crystals or white to yellowish-white, crystalline powder. Is odorless. Melts at about 180°, with decomposition. One g dissolves in about 3200 mL of water; in the presence of a slight excess of tartaric acid 1 g dissolves in about 500 mL of water. Slightly soluble in alcohol.

Erythorbic Acid: White or slightly yellow crystals or powder. It gradually darkens when exposed to light. In the dry state, it is reasonably stable in air, but in solution, it rapidly deteriorates in the presence of air. It melts between 164° and 171° with decomposition. One g is soluble in about 2.5 mL of water and in about 20 mL of alcohol. Slightly soluble in glycerin. *NF category:* Antimicrobial preservative; antioxidant.

Erythritol: White or almost white, crystalline powder or free-flowing granules. It is stable to heat and is nonhygroscopic. Freely soluble in water; very slightly soluble in alcohol. *NF category:* Humectant; sweetening agent.

Erythromycin: White or slightly yellow, crystalline powder. Is odorless or practically odorless. Slightly soluble in water; soluble in alcohol, in chloroform, and in ether.

Erythromycin Estolate: White, crystalline powder. Is odorless or practically odorless, and is practically tasteless. Soluble in alcohol, in acetone, and in chloroform; practically insoluble in water.

Erythromycin Ethylsuccinate: White or slightly yellow crystalline powder. Is odorless or practically odorless, and is practically tasteless. Very slightly soluble in water; freely soluble in alcohol, in chloroform, and in polyethylene glycol 400.

Erythromycin Gluceptate: Colorless to white crystals. Slightly hygroscopic. Freely soluble in water, in alcohol, in methanol, in dioxane, and in propylene glycol; slightly soluble in acetone and in chloroform; practically insoluble in ether, in carbon tetrachloride, in benzene, and in toluene.

Erythromycin Lactobionate for Injection: White or slightly yellow crystals or powder, having a faint odor. Its solution (1 in 20) is neutral or slightly alkaline. Freely soluble in water, in alcohol, and in methanol; slightly soluble in acetone and in chloroform; practically insoluble in ether.

Erythromycin Stearate: White or slightly yellow crystals or powder. Is odorless or may have a slight, earthy odor, and has a slightly bitter taste. Practically insoluble in water; soluble in alcohol, in chloroform, in methanol, and in ether.

Esomeprazole Magnesium: White to slightly colored powder. Soluble in methanol; slightly soluble in water; practically insoluble in heptane.

Estradiol: White or creamy white, small crystals or crystalline powder. Is odorless, and is stable in air. Is hygroscopic. Practically insoluble in water; soluble in alcohol, in acetone, in dioxane, in chloroform, and in solutions of fixed alkali hydroxides; sparingly soluble in vegetable oils.

Estradiol Benzoate: White to off-white, crystalline powder. Soluble in alcohol and in acetone; slightly soluble in diethyl ether; insoluble in water.

Estradiol Cypionate: White to practically white, crystalline powder. Is odorless or has a slight odor. Insoluble in water; soluble in alcohol, in acetone, in chloroform, and in dioxane; sparingly soluble in vegetable oils.

Estradiol Valerate: White, crystalline powder. Is usually odorless but may have a faint, fatty odor. Practically insoluble in water; soluble in castor oil, in methanol, in benzyl benzoate, and in dioxane; sparingly soluble in sesame oil and in peanut oil.

Estriol: White to practically white, odorless, crystalline powder. Melts at about 280°. Insoluble in water; sparingly soluble in alcohol; soluble in acetone, in chloroform, in dioxane, in ether, and in vegetable oils.

Conjugated Estrogens: Conjugated Estrogens obtained from natural sources is a buff-colored, amorphous powder, odorless or having a slight, characteristic odor. The synthetic form is a white to light buff, crystalline or amorphous powder, odorless or having a slight odor.

Synthetic Conjugated Estrogens: A white to light buff, crystalline or amorphous powder that is odorless or has a slight odor.

Esterified Estrogens: White or buff-colored, amorphous powder, odorless or having a slight, characteristic odor.

Estrone: Small, white crystals or white to creamy white, crystalline powder. Is odorless, and is stable in air. Melts at about 260°. Practically insoluble in water; soluble in alcohol, in acetone, in dioxane, and in vegetable oils; slightly soluble in solutions of fixed alkali hydroxides.

Estropipate: White to yellowish-white, fine, crystalline powder. Is odorless, or may have a slight odor. Melts at about 190° to a light brown, viscous liquid, which solidifies on further heating and finally

melts at about 245°, with decomposition. Very slightly soluble in water, in alcohol, in chloroform, and in ether; soluble in warm water.

Ethacrynic Acid: White or practically white, odorless or practically odorless, crystalline powder. Very slightly soluble in water; freely soluble in alcohol, in chloroform, and in ether.

Ethambutol Hydrochloride: White, crystalline powder. Freely soluble in water; soluble in alcohol and in methanol; slightly soluble in ether and in chloroform.

Ethchlorvynol: Colorless to yellow, slightly viscous liquid, having a characteristic pungent odor. Darkens on exposure to light and air. Immiscible with water; miscible with most organic solvents.

Ether: Colorless, mobile, volatile liquid, having a characteristic sweet, pungent odor. Is slowly oxidized by the action of air and light, with the formation of peroxides. It boils at about 35°. Soluble in water and in hydrochloric acid. Miscible with alcohol, with benzene, with chloroform, with solvent hexane, with methylene chloride, and with fixed and volatile oils.

Ethinyl Estradiol: White to creamy white, odorless, crystalline powder. Insoluble in water; soluble in alcohol, in chloroform, in ether, in vegetable oils, and in solutions of fixed alkali hydroxides.

Ethiodized Oil Injection: Straw-colored to amber-colored, oily liquid. It may possess an alliaceous odor. Insoluble in water; soluble in acetone, in chloroform, in ether, and in solvent hexane.

Ethionamide: Bright yellow powder, having a faint to moderate sulfide-like odor. Slightly soluble in water, in chloroform, and in ether; soluble in methanol; sparingly soluble in alcohol and in propylene glycol.

Ethopabate: White to pinkish-white, odorless or practically odorless powder. Very slightly soluble in water; soluble in acetonitrile, in acetone, in dehydrated alcohol, and in methanol; sparingly soluble in isopropyl alcohol, in dioxane, in ethyl acetate, and in methylene chloride; slightly soluble in ether.

Ethosuximide: White to off-white, crystalline powder or waxy solid, having a characteristic odor. Freely soluble in water and in chloroform; very soluble in alcohol and in ether; very slightly soluble in solvent hexane.

Ethotoin: White, crystalline powder. Insoluble in water; freely soluble in dehydrated alcohol and in chloroform; soluble in ether.

Ethyl Acetate: Transparent, colorless liquid, having a fragrant, refreshing, slightly acetous odor, and a peculiar, acetous, burning taste. Soluble in water. Miscible with alcohol, with ether, with fixed oils, and with volatile oils. *NF category:* Flavors and perfumes; solvent.

Ethyl Acrylate and Methyl Methacrylate Copolymer Dispersion: Milky-white liquid of low viscosity with a faint, characteristic odor. It is miscible with water in any proportion; the milky-white appearance is retained. A clear or slightly opalescent, viscous solution is obtained on mixing one part with five parts of acetone, alcohol, or isopropyl alcohol; the polymer substance first precipitates, but then dissolves in the excess organic solvent. When mixed with 1 N sodium hydroxide in a ratio of 1:2, the dispersion does not dissolve; the milky-white appearance is retained. *NF category:* Coating agent; polymer membrane; tablet binder.

Ethyl Chloride: Colorless, mobile, very volatile liquid at low temperatures or under pressure, having a characteristic, ethereal odor. It boils between 12° and 13°, and its specific gravity at 0° is about 0.921. When liberated at room temperature from its sealed container, it vaporizes immediately. It burns with a smoky, greenish flame, producing hydrogen chloride. Slightly soluble in water; freely soluble in alcohol and in ether.

Ethyl Oleate: Mobile, practically colorless liquid, having an agreeable taste. Insoluble in water. Miscible with vegetable oils, with mineral oil, with alcohol, and with most organic solvents. *NF category:* Vehicle (oleaginous).

Ethyl Vanillin: Fine, white or slightly yellowish crystals. Its taste and odor are similar to the taste and odor of vanillin. Is affected by light. Its solutions are acid to litmus. Sparingly soluble in water at 50°; freely soluble in alcohol, in chloroform, in ether, and in solutions of alkali hydroxides. *NF category:* Flavors and perfumes.

Ethylcellulose: Free-flowing, white to light tan powder. It forms films that have a refractive index of about 1.47. Its aqueous suspensions are neutral to litmus. Insoluble in water, in glycerin, and in propylene glycol. Ethylcellulose containing less than 46.5% of ethoxy groups is freely soluble in tetrahydrofuran, in methyl acetate, in chloroform, and in mixtures of aromatic hydrocarbons with alcohol. Ethylcellulose containing not less than 46.5% of ethoxy groups is freely soluble in alcohol, in methanol, in toluene, in chloroform, and in ethyl acetate. *NF category:* Coating agent; tablet binder.

Ethylenediamine: Clear, colorless or only slightly yellow liquid, having an ammonia-like odor and a strong alkaline reaction. Miscible with water and with alcohol.

Ethylene Glycol Stearates: White or almost white, waxy solid. Soluble in acetone and in hot alcohol; practically insoluble in water. *NF category:* Emulsifying and/or solubilizing agent.

Ethylparaben: Small, colorless crystals or white powder. Slightly soluble in water and in glycerin; freely soluble in acetone, in alcohol, in ether, and in propylene glycol. *NF category:* Antimicrobial preservative.

Ethynodiol Diacetate: White, odorless, crystalline powder. Is stable in air. Insoluble in water; very soluble in chloroform; freely soluble in ether; soluble in alcohol; sparingly soluble in fixed oils.

Etidronate Disodium: White powder, which may contain lumps. Freely soluble in water; practically insoluble in alcohol.

Etoposide: Fine, white to off-white, crystalline powder. Very slightly soluble in water; slightly soluble in alcohol, in chloroform, in ethyl acetate, and in methylene chloride; sparingly soluble in methanol.

Eucatropine Hydrochloride: White, granular, odorless powder. Its solutions are neutral to litmus. Very soluble in water; freely soluble in alcohol and in chloroform; insoluble in ether.

Eugenol: Colorless or pale yellow liquid, having a strongly aromatic odor of clove and a pungent, spicy taste. Upon exposure to air, it darkens and thickens. Is optically inactive. Slightly soluble in water. Miscible with alcohol, with chloroform, with ether, and with fixed oils.

Famotidine: White to pale yellowish-white, crystalline powder. Is sensitive to light. Freely soluble in dimethylformamide and in glacial acetic acid; slightly soluble in methanol; very slightly soluble in water; practically insoluble in acetone, in alcohol, in chloroform, in ether, and in ethyl acetate.

Hard Fat: White mass; almost odorless and free from rancid odor; greasy to the touch. On warming, melts to give a colorless or slightly yellowish liquid. When the molten material is shaken with an equal quantity of hot water, a white emulsion is formed. Practically insoluble in water; freely soluble in ether; slightly soluble in alcohol. *NF category:* Stiffening agent; suppository base.

Felodipine: Light yellow to yellow, crystalline powder. Freely soluble in acetone and in methanol; very slightly soluble in heptane; insoluble in water.

Fenbendazole: White to off-white powder. Sparingly soluble in dimethylformamide; very slightly soluble in methanol; practically insoluble in water.

Fenofibrate: White or almost white, crystalline powder. Very soluble in methylene chloride; slightly soluble in alcohol; practically insoluble in water.

Fenoldopam Mesylate: White to off-white powder. Soluble in water.

Fenoprofen Calcium: White, crystalline powder. Slightly soluble in *n*-hexanol, in methanol, and in water; practically insoluble in chloroform.

Fentanyl Citrate: White, crystalline powder or white, glistening crystals. Melts at about 150°, with decomposition. Sparingly soluble in water; soluble in methanol; slightly soluble in chloroform.

Ferric Oxide: Powder exhibiting two basic colors (red and yellow), or other shades produced on blending the basic colors. Insoluble in water and in organic solvents; dissolves in hydrochloric acid upon warming, a small amount of insoluble residue usually remaining. *NF category:* Color.

Ferric Subsulfate Solution: Reddish-brown liquid, odorless or nearly so. Acid to litmus, and is affected by light. Specific gravity is about 1.548.

Ferric Sulfate: Grayish-white or yellowish powder or fawn-colored pearls. Hygroscopic. Rapidly soluble in the presence of a trace of ferrous sulfate; slowly soluble in water; sparingly soluble in alcohol; practically insoluble in acetone and in ethyl acetate. Hydrolyzes slowly in aqueous solution.

Ferrous Fumarate: Reddish-orange to red-brown, odorless powder. May contain soft lumps that produce a yellow streak when crushed. Slightly soluble in water; very slightly soluble in alcohol. Its solubility in dilute hydrochloric acid is limited by the separation of fumaric acid.

Ferrous Gluconate: Yellowish-gray or pale greenish-yellow, fine powder or granules, having a slight odor resembling that of burned sugar. Its solution (1 in 20) is acid to litmus. Soluble in water, with slight heating; practically insoluble in alcohol.

Ferrous Sulfate: Pale, bluish-green crystals or granules. Is odorless and is efflorescent in dry air. Oxidizes readily in moist air to form brownish yellow basic ferric sulfate. Its solution (1 in 10) is acid to litmus, having a pH of about 3.7. Freely soluble in water; very soluble in boiling water; insoluble in alcohol.

Dried Ferrous Sulfate: Grayish-white to buff-colored powder, consisting primarily of $FeSO_4 \cdot H_2O$ with varying amounts of $FeSO_4 \cdot 4H_2O$. Slowly soluble in water; insoluble in alcohol.

Ferumoxides Injection: Black to reddish-brown, aqueous colloid. It is stable for 24 hours after dilution.

Finasteride: White to off-white, crystalline solid. Melts at about 257°. Freely soluble in chloroform and in alcohol; very slightly soluble in water.

Fish Oil Containing Omega-3 Acids: Pale yellow liquid. Very soluble in acetone and in heptane; slightly soluble in anhydrous alcohol; practically insoluble in water.

Flavoxate Hydrochloride: White or almost white, crystalline powder. Slightly soluble in alcohol, in water, and in methylene chloride.

Flecainide Acetate: White to slightly off-white, crystalline powder. Freely soluble in alcohol; soluble in water. pK_a is 9.3.

Fluconazole: White or almost white, crystalline powder. Freely soluble in methanol; soluble in alcohol and in acetone; sparingly soluble in isopropanol and in chloroform; slightly soluble in water; very slightly soluble in toluene.

Flucytosine: White to off-white, crystalline powder. Is odorless or has a slight odor. Sparingly soluble in water; slightly soluble in alcohol; practically insoluble in chloroform and in ether.

Fludarabine Phosphate: White to off-white, crystalline, hygroscopic powder. Freely soluble in dimethylformamide; slightly soluble in water and in 0.1 M hydrochloric acid; practically insoluble in ethanol.

Fludrocortisone Acetate: White to pale yellow crystals or crystalline powder. Is odorless or practically odorless. Is hygroscopic. Insoluble in water; slightly soluble in ether; sparingly soluble in alcohol and in chloroform.

Flumazenil: White to off-white powder. Slightly soluble in acidic aqueous solutions; practically insoluble in water.

Flumethasone Pivalate: White to off-white, crystalline powder. Insoluble in water; slightly soluble in methanol; very slightly soluble in chloroform and in methylene chloride.

Flunisolide: White to creamy-white, crystalline powder. Melts at about 245°, with decomposition. Practically insoluble in water; soluble in acetone; sparingly soluble in chloroform; slightly soluble in methanol.

Flunixin Meglumine: White to off-white crystalline powder. Soluble in water, in alcohol, and in methanol; practically insoluble in ethyl acetate.

Fluocinolone Acetonide: White or practically white, odorless, crystalline powder. Is stable in air. Melts at about 270°, with decomposition. Insoluble in water; soluble in methanol; slightly soluble in ether and in chloroform.

Fluocinonide: White to cream-colored, crystalline powder, having not more than a slight odor. Practically insoluble in water; sparingly soluble in acetone and in chloroform; slightly soluble in alcohol, in methanol, and in dioxane; very slightly soluble in ether.

Fluorescein: Yellowish-red to red, odorless powder. Insoluble in water; soluble in dilute alkali hydroxides.

Fluorescein Sodium: Orange-red, hygroscopic, odorless powder. Freely soluble in water; sparingly soluble in alcohol.

Fluorescein Sodium Ophthalmic Strip: Each Strip is a dry, white piece of paper, one end of which is rounded and is uniformly orange-red in color because of the fluorescein sodium impregnated in the paper.

Fluorometholone: White to yellowish-white, odorless, crystalline powder. Melts at about 280°, with some decomposition. Practically insoluble in water; slightly soluble in alcohol; very slightly soluble in chloroform and in ether.

Fluorouracil: White to practically white, practically odorless, crystalline powder. Decomposes at about 282°. Sparingly soluble in water; slightly soluble in alcohol; practically insoluble in chloroform and in ether.

Fluoxetine Hydrochloride: White to off-white crystalline powder. Sparingly soluble in water and in dichloromethane; freely soluble in alcohol and in methanol; practically insoluble in ether.

Fluoxymesterone: White or practically white, odorless, crystalline powder. Melts at about 240°, with some decomposition. Practically insoluble in water; sparingly soluble in alcohol; slightly soluble in chloroform.

Fluphenazine Enanthate: Pale yellow to yellow-orange, clear to slightly turbid, viscous liquid, having a characteristic odor. Is unstable in strong light, but stable to air at room temperature. Insoluble in water; freely soluble in alcohol, in chloroform, and in ether.

Fluphenazine Hydrochloride: White or nearly white, odorless, crystalline powder. Melts, within a range of 5°, at a temperature above 225°. Freely soluble in water; slightly soluble in acetone, in alcohol, and in chloroform; practically insoluble in benzene and in ether.

Flurandrenolide: White to off-white, fluffy, crystalline powder. Is odorless. Practically insoluble in water and in ether; freely soluble in chloroform; soluble in methanol; sparingly soluble in alcohol.

Flurazepam Hydrochloride: Off-white to yellow, crystalline powder. Is odorless, or has a slight odor, and its solutions are acid to litmus. Melts at about 212°, with decomposition. Freely soluble in water and in alcohol; slightly soluble in isopropyl alcohol and in chloroform.

Flurbiprofen: White, crystalline powder. Freely soluble in acetone, in dehydrated alcohol, in ether, and in methanol; soluble in acetonitrile; practically insoluble in water. Optically inactive (1 in 50 solution in dehydrated alcohol).

Flutamide: Pale yellow, crystalline powder. Freely soluble in acetone, in ethyl acetate, and in methanol; soluble in chloroform and in ether; practically insoluble in mineral oil, in petroleum ether, and in water.

Fluticasone Propionate (micronized): Fine, white powder.

Fluvastatin Sodium: White to pale yellow, brownish-pale yellow, or reddish-pale yellow, hygroscopic powder. Soluble in alcohol, in methanol, and in water.

Fluvoxamine Maleate: White to off-white, crystalline powder. Freely soluble in alcohol and in chloroform; sparingly soluble in water; and practically insoluble in diethyl ether.

Folic Acid: Yellow, yellow-brownish, or yellowish-orange, odorless, crystalline powder. Very slightly soluble in water; insoluble in alcohol, in acetone, in chloroform, and in ether. It readily dissolves in dilute solutions of alkali hydroxides and carbonates, and is soluble in hot, 3 N hydrochloric acid and in hot, 2 N sulfuric acid. Soluble in hydrochloric acid and in sulfuric acid, yielding very pale yellow solutions.

Folic Acid Injection: Clear, yellow to orange-yellow, alkaline liquid.

Formaldehyde Solution: Clear, colorless or practically colorless liquid, having a pungent odor. The vapor from it irritates the mucous membrane of the throat and nose. On long standing, especially in the cold, it may become cloudy because of the separation of paraformaldehyde. This cloudiness disappears when the solution is warmed. Miscible with water and with alcohol.

Formoterol Fumarate Dihydrate: White or almost white or slightly yellow powder. Freely soluble in dimethyl sulfoxide and in acetic acid; soluble in methanol; slightly soluble in water and in 2-propanol; practically insoluble in acetonitrile and in diethyl ether.

Foscarnet Sodium: White to almost white, crystalline powder. Soluble in water; practically insoluble in alcohol.

Fosphenytoin Sodium: White to pale yellow solid. Freely soluble in water.

Fructose: Colorless crystals or as a white, crystalline powder. Is odorless, and has a sweet taste. Freely soluble in water; soluble in alcohol and in methanol. *NF category:* Sweetening agent; tablet and/or capsule diluent.

Basic Fuchsin: Dark green powder or greenish glistening crystalline fragments, having a bronze-like luster and not more than a faint odor. Soluble in water, in alcohol, and in amyl alcohol; insoluble in ether.

Fulvestrant: White powder. Freely soluble in alcohol.

Fumaric Acid: White, odorless granules or crystalline powder. Soluble in alcohol; slightly soluble in water and in ether; very slightly soluble in chloroform. *NF category:* Acidifying agent.

Furazolidone: Yellow, odorless, crystalline powder. Is tasteless at first, then a bitter aftertaste develops. Practically insoluble in water, in alcohol, and in carbon tetrachloride.

Furosemide: White to slightly yellow, odorless, crystalline powder. Practically insoluble in water; freely soluble in acetone, in dimethylformamide, and in solutions of alkali hydroxides; soluble in methanol; sparingly soluble in alcohol; slightly soluble in ether; very slightly soluble in chloroform.

Furosemide Injection: Clear, colorless solution.

Gabapentin: White to off-white, crystalline solid. Freely soluble in water and in alkaline and acidic solutions.

Gadodiamide: White, odorless powder. Freely soluble in water and in methanol; soluble in ethyl alcohol; slightly soluble in acetone and in chloroform.

Gadoteridol: White to off-white, crystalline, odorless powder. Freely soluble in water and in methyl alcohol. Soluble in isopropyl alcohol. Melts at about 300°.

Gadoversetamide: White, odorless powder. Freely soluble in water.

Galactose: A white, crystalline or finely granulated powder. Soluble in water; very slightly soluble in alcohol. *NF category:* Sweetening agent.

Galantamine Hydrobromide: White to almost white powder. Soluble in 0.1 N sodium hydroxide; sparingly soluble in water; very slightly soluble in alcohol; insoluble in *n*-propanol.

Gallamine Triethiodide: White, odorless, amorphous powder. Is hygroscopic. Very soluble in water; sparingly soluble in alcohol; very slightly soluble in chloroform.

Gamma Cyclodextrin: White or almost white, amorphous or crystalline powder. Freely soluble in water and in propylene glycol; very slightly soluble in alcohol. *NF category:* Sequestering agent; emulsifying and/or solubilizing agent.

Ganciclovir: White to off-white, crystalline powder.

Ganciclovir for Injection: White to off-white powder. Soluble in water.

Petrolatum Gauze: The petrolatum recovered by draining in the *Assay* is a white or faintly yellowish, unctuous mass, transparent in thin layers even after cooling to 0°.

Gelatin: Sheets, flakes, or shreds, or coarse to fine powder. Is faintly yellow or amber in color, the color varying in depth according to the particle size. Has a slight, characteristic bouillon-like odor in solution. Is stable in air when dry, but is subject to microbic decomposition when moist or in solution. Gelatin has any suitable strength that is designated by Bloom Gelometer number (see *Gel Strength of Gelatin* ⟨1081⟩). Type A Gelatin exhibits an isoelectric point between pH 7 and pH 9, and Type B Gelatin exhibits an isoelectric point between pH 4.7 and pH 5.2. Insoluble in cold water, but swells and softens when immersed in it, gradually absorbing from 5 to 10 times its own weight of water. Soluble in hot water, in 6 N acetic acid, and in a hot mixture of glycerin and water. Insoluble in alcohol, in chloroform, in ether, and in fixed and volatile oils. *NF category:* Coating agent; suspending and/or viscosity-increasing agent; tablet binder.

Absorbable Gelatin Film: Light amber, transparent, pliable film which becomes rubbery when moistened. Insoluble in water.

Absorbable Gelatin Sponge: Light, nearly white, nonelastic, tough, porous, hydrophilic solid. Insoluble in water.

Gellan Gum: Off-white powder. Soluble in hot or in cold deionized water. *NF category:* Suspending and/or viscosity-increasing agent.

Gemcitabine Hydrochloride: White to off-white solid. Soluble in water; slightly soluble in methanol; practically insoluble in alcohol and in polar organic solvents.

Gemfibrozil: White, waxy, crystalline solid. Practically insoluble in water; soluble in alcohol, in methanol, and in chloroform.

Gentamicin Sulfate: White to buff powder. Freely soluble in water; insoluble in alcohol, in acetone, in chloroform, in ether, and in benzene.

Gentamicin Injection: Clear, slightly yellow solution, having a faint odor.

Gentian Violet: Dark green powder or greenish, glistening pieces having a metallic luster, and having not more than a faint odor. Sparingly soluble in water; soluble in alcohol, in glycerin, and in chloroform; insoluble in ether.

Gentian Violet Cream: Dark purple, water-washable cream.

Gentian Violet Topical Solution: Purple liquid, having a slight odor of alcohol. A dilution (1 in 100), viewed downward through 1 cm of depth, is deep purple in color.

Powdered Asian Ginseng Extract: Pale yellow-brown, hygroscopic, powdery or easily pulverizable mass. Soluble in water, forming a slightly cloudy solution.

Glaze, Pharmaceutical: Denatured alcohol solution. *NF category:* Coating agent.

Glimepiride: White to almost white powder. Soluble in dimethylformamide; slightly soluble in methanol; sparingly soluble in methylene chloride; practically insoluble in water.

Glipizide: White to off-white powder. Freely soluble in dimethylformamide; soluble in 0.1 N sodium hydroxide; slightly soluble in methylene chloride.

Immune Globulin: Transparent or slightly opalescent liquid, either colorless or of a brownish color due to denatured hemoglobin. Is practically odorless. May develop a slight, granular deposit during storage.

Rh_0 (D) Immune Globulin: Transparent or slightly opalescent liquid. Is practically colorless and odorless. May develop a slight, granular deposit during storage.

Glucagon: Fine, white or faintly colored, crystalline powder. Is practically odorless and tasteless. Soluble in dilute alkali and acid solutions; insoluble in most organic solvents.

Glucagon for Injection: White, odorless powder.

Gluconolactone: Fine, white, practically odorless, crystalline powder. Melts at about 153°, with decomposition. Freely soluble in water; sparingly soluble in alcohol; insoluble in ether.

Liquid Glucose: Colorless or yellowish, thick, syrupy liquid. Odorless or nearly odorless, and has a sweet taste. Miscible with water; sparingly soluble in alcohol. *NF category:* Tablet binder.

Glutamine: White crystals or crystalline powder. Soluble in water; practically insoluble in alcohol and in ether.

Glutaral Concentrate: Clear, colorless or faintly yellow liquid, having a characteristic, irritating odor.

Glycerin: Clear, colorless, syrupy liquid, having a sweet taste. Has not more than a slight characteristic odor, which is neither harsh nor disagreeable. Is hygroscopic. Its solutions are neutral to litmus. Miscible with water and with alcohol. Insoluble in chloroform, in ether, and in fixed and volatile oils. *NF category:* Humectant; plasticizer; solvent; tonicity agent.

Glyceryl Behenate: Fine powder, having a faint odor. Melts at about 70°. Practically insoluble in water and in alcohol; soluble in chloroform.

Glyceryl Distearate: Hard, waxy mass or powder or white or almost white flakes. Soluble in methylene chloride and in tetrahydrofuran; partly soluble in hot alcohol; insoluble in water. *NF category:* Emulsifying and/or solubilizing agent.

Glyceryl Monolinoleate: Amber, oily liquids that may be partially solidified at room temperature. Practically insoluble in water; soluble in tetrahydrofuran; freely soluble in methylene chloride. *NF category:* Emulsifying and/or solubilizing agent.

Glyceryl Monooleate: Amber, oily liquids that may be partially solidified at room temperature. Practically insoluble in water; soluble in tetrahydrofuran; freely soluble in methylene chloride. *NF category:* Emulsifying and/or solubilizing agent.

Glyceryl Monostearate: White to yellowish wax-like solid; or white to yellowish wax-like beads, flakes, or powder. Slight, agreeable, fatty odor and taste. Is affected by light. Dissolves in hot organic solvents such as alcohol, minerals or fixed oils, benzene, ether, and acetone. Insoluble in water, but it may be dispersed in hot water with the aid of a small amount of soap or other suitable surface-active agent. *NF category:* Emulsifying and/or solubilizing agent.

Glycine: White, odorless, crystalline powder, having a sweetish taste. Its solutions are acid to litmus. Freely soluble in water; very slightly soluble in alcohol and in ether.

Glycopyrrolate: White, odorless, crystalline powder. Soluble in water and in alcohol; practically insoluble in chloroform and in ether.

Gonadorelin Acetate: White to slightly yellowish powder. Soluble in water; sparingly soluble in methanol.

Chorionic Gonadotropin: White or practically white, amorphous powder. Freely soluble in water.

Chorionic Gonadotropin for Injection: White or practically white, amorphous solid having the characteristic appearance of substances prepared by freeze-drying.

Gramicidin: White or practically white, odorless, crystalline powder. Insoluble in water; soluble in alcohol.

Granisetron Hydrochloride: White or almost white powder. Freely soluble in water; sparingly soluble in methylene chloride; slightly soluble in methanol.

Green Soap: Soft, unctuous, yellowish-white to brownish or greenish yellow, transparent to translucent mass. Has a slight, characteristic odor, often suggesting the oil from which it was prepared. Its solution (1 in 20) is alkaline to bromothymol blue TS.

Griseofulvin: White to creamy white, odorless powder, in which particles of the order of 4 µm in diameter predominate. Very slightly soluble in water; soluble in acetone, in dimethylformamide, and in chloroform; sparingly soluble in alcohol.

Guaifenesin: White to slightly gray, crystalline powder. May have a slight characteristic odor. Soluble in water, in alcohol, in chloroform, and in propylene glycol; sparingly soluble in glycerin.

Guanabenz Acetate: White or almost white powder having not more than a slight odor. Sparingly soluble in water and in 0.1 N hydrochloric acid; soluble in alcohol and in propylene glycol.

Guanadrel Sulfate: White to off-white, crystalline powder. Melts at about 235°, with decomposition. Soluble in water; sparingly soluble in methanol; slightly soluble in alcohol and in acetone.

Guanethidine Monosulfate: White to off-white, crystalline powder. Very soluble in water; sparingly soluble in alcohol; practically insoluble in chloroform.

Guar Gum: White to yellowish-white, practically odorless powder. Dispersible in hot or cold water, forming a colloidal solution. *NF category:* Suspending and/or viscosity-increasing agent; tablet binder.

Gutta Percha: Lumps or blocks of variable size; externally brown or grayish-brown to grayish-white in color; internally reddish yellow or reddish gray and having a laminated or fibrous appearance. Is flexible but only slightly elastic. Has a slight, characteristic odor and a slight taste. Insoluble in water; about 90% soluble in chloroform; partly soluble in benzene, in carbon disulfide, and in turpentine oil.

Halazone: White, crystalline powder, having a characteristic chlorine-like odor. Is affected by light. Melts at about 194°, with decomposition. Very slightly soluble in water and in chloroform; soluble in glacial acetic acid. Dissolves in solutions of alkali hydroxides and carbonates with the formation of a salt.

Halazone Tablets for Solution: Soluble in water.

Halcinonide: White to off-white, odorless, crystalline powder. Soluble in acetone and in chloroform; slightly soluble in alcohol and in ethyl ether; insoluble in water and in hexanes.

Haloperidol: White to faintly yellowish, amorphous or microcrystalline powder. Its saturated solution is neutral to litmus. Practically insoluble in water; soluble in chloroform; sparingly soluble in alcohol; slightly soluble in ether.

Halothane: Colorless, mobile, nonflammable, heavy liquid, having a characteristic odor resembling that of chloroform. Its taste is sweet and produces a burning sensation. Slightly soluble in water. Miscible with alcohol, with chloroform, with ether, and with fixed oils.

Helium: Colorless, odorless, tasteless gas, which is not combustible and does not support combustion. Very slightly soluble in water. At 0° and at a pressure of 760 mm of mercury, 1000 mL of the gas weighs about 180 mg.

Heparin Sodium: White or pale-colored, amorphous powder. Is odorless or practically so, and is hygroscopic. Soluble in water.

Hexachlorophene: White to light tan, crystalline powder. Is odorless or has only a slight, phenolic odor. Insoluble in water; freely soluble in acetone, in alcohol, and in ether; soluble in chloroform and in dilute solutions of fixed alkali hydroxides.

Hexachlorophene Liquid Soap: Clear, amber-colored liquid, having a slight, characteristic odor. Its solution (1 in 20) is clear and has an alkaline reaction.

Hexylene Glycol: Clear, colorless, viscous liquid. Absorbs moisture when exposed to moist air. Miscible with water and with many organic solvents, including alcohol, ether, chloroform, acetone, and hexanes. *NF category:* Humectant; solvent.

Histamine Phosphate: Colorless, odorless, long prismatic crystals. Is stable in air but is affected by light. Its solutions are acid to litmus. Freely soluble in water.

Histidine: White, odorless crystals, having a slightly bitter taste. Soluble in water; very slightly soluble in alcohol; insoluble in ether.

Histoplasmin: Clear, red liquid. Miscible with water.

Homatropine Hydrobromide: White crystals, or white, crystalline powder. Slowly darkens on exposure to light. Freely soluble in water; sparingly soluble in alcohol; slightly soluble in chloroform; insoluble in ether. Melts between 214° and 217°, with slight decomposition.

Homatropine Methylbromide: White, odorless powder. Slowly darkens on exposure to light. Melts at about 190°. Very soluble in water; freely soluble in alcohol and in acetone containing about 20% of water; practically insoluble in ether and in acetone.

Hydralazine Hydrochloride: White to off-white, odorless, crystalline powder. Melts at about 275°, with decomposition. Soluble in water; slightly soluble in alcohol; very slightly soluble in ether.

Hydrochloric Acid: Colorless, fuming liquid having a pungent odor. It ceases to fume when it is diluted with 2 volumes of water. Specific gravity is about 1.18. *NF category:* Acidifying agent.

Diluted Hydrochloric Acid: Colorless, odorless liquid. Specific gravity is about 1.05. *NF category:* Acidifying agent.

Hydrochlorothiazide: White, or practically white, practically odorless, crystalline powder. Slightly soluble in water; freely soluble in sodium hydroxide solution, in *n*-butylamine, and in dimethylformamide; sparingly soluble in methanol; insoluble in ether, in chloroform, and in dilute mineral acids.

Hydrocodone Bitartrate: Fine, white crystals or a crystalline powder. Is affected by light. Soluble in water; slightly soluble in alcohol; insoluble in ether and in chloroform.

Hydrocortisone: White to practically white, odorless, crystalline powder. Melts at about 215°, with decomposition. Very slightly soluble in water and in ether; sparingly soluble in acetone and in alcohol; slightly soluble in chloroform.

Hydrocortisone Acetate: White to practically white, odorless, crystalline powder. Melts at about 200°, with decomposition. Insoluble in water; slightly soluble in alcohol and in chloroform.

Hydrocortisone Butyrate: White to practically white, practically odorless, crystalline powder. Practically insoluble in water; slightly soluble in ether; soluble in methanol, in alcohol, and in acetone; freely soluble in chloroform.

Hydrocortisone Sodium Phosphate: White to light yellow, odorless or practically odorless, powder. Is exceedingly hygroscopic. Freely soluble in water; slightly soluble in alcohol; practically insoluble in chloroform, in dioxane, and in ether.

Hydrocortisone Sodium Succinate: White or nearly white, odorless, hygroscopic, amorphous solid. Very soluble in water and in alcohol; very slightly soluble in acetone; insoluble in chloroform.

Hydroflumethiazide: White to cream-colored, finely divided, odorless, crystalline powder. Very slightly soluble in water; freely soluble in acetone; soluble in alcohol.

Hydrogen Peroxide Concentrate: Clear, colorless liquid. Is acid to litmus. Slowly decomposes, and is affected by light.

Hydrogen Peroxide Solution: Clear, colorless liquid, odorless, or having an odor resembling that of ozone. Is acid to litmus and to the taste and produces a froth in the mouth. Rapidly decomposes when in contact with many oxidizing as well as reducing substances. When rapidly heated, it may decompose suddenly. Is affected by light. Specific gravity is about 1.01.

Hydromorphone Hydrochloride: Fine, white or practically white, odorless, crystalline powder. Is affected by light. Freely soluble in water; sparingly soluble in alcohol; practically insoluble in ether.

Hydroquinone: Fine white needles. Darkens upon exposure to light and air. Freely soluble in water, in alcohol, and in ether.

Hydroxocobalamin: Dark red crystals or red crystalline powder. Is odorless, or has not more than a slight acetone odor. The anhydrous form is very hygroscopic. Sparingly soluble in water, in alcohol, and in methanol; practically insoluble in acetone, in ether, in chloroform, and in benzene.

Hydroxyamphetamine Hydrobromide: White, crystalline powder. Its solutions are slightly acid to litmus, having a pH of about 5. Freely soluble in water and in alcohol; slightly soluble in chloroform; practically insoluble in ether.

Hydroxychloroquine Sulfate: White or practically white, crystalline powder. Is odorless, and has a bitter taste. Its solutions have a pH of about 4.5. Exists in two forms, the usual form melting at about 240° and the other form melting at about 198°. Freely soluble in water; practically insoluble in alcohol, in chloroform, and in ether.

Hydroxyethyl Cellulose: White to light tan, practically odorless and tasteless, hygroscopic powder. Soluble in hot water and in cold water, giving a colloidal solution; practically insoluble in alcohol and in most organic solvents. *NF category:* Suspending and/or viscosity-increasing agent.

Hydroxyprogesterone Caproate: White or creamy white, crystalline powder. Is odorless or has a slight odor. Insoluble in water; soluble in ether; slightly soluble in benzene.

Hydroxypropyl Betadex: White or almost white, amorphous or crystalline powder. Freely soluble in water and in propylene glycol. *NF category:* Sequestering agent.

Hydroxypropyl Cellulose: White to cream-colored, practically odorless and tasteless, granular solid or powder. Is hygroscopic after drying. Soluble in cold water, in alcohol, in chloroform, and in propylene glycol, giving a colloidal solution; insoluble in hot water. *NF category:* Coating agent; suspending and/or viscosity-increasing agent.

Low-Substituted Hydroxypropyl Cellulose: White to yellowish-white, practically odorless and tasteless, fibrous or granular powder. Is hygroscopic. Practically insoluble in alcohol and in ether. Dissolves in a solution of sodium hydroxide (1 in 10), and produces a viscous solution. Swells in water, in sodium carbonate TS, and in 2 N hydrochloric acid. The pH of the suspension, obtained by shaking 1.0 g with 100 mL of water, is between 5.0 and 7.5. *NF category:* Tablet binder; tablet disintegrant.

Hydroxyurea: White to off-white powder. Is somewhat hygroscopic, decomposing in the presence of moisture. Melts at a temperature exceeding 133°, with decomposition. Freely soluble in water and in hot alcohol.

Hydroxyzine Hydrochloride: White, odorless powder. Melts at about 200°, with decomposition. Very soluble in water; soluble in chloroform; slightly soluble in acetone; practically insoluble in ether.

Hydroxyzine Pamoate: Light yellow, practically odorless powder. Practically insoluble in water and in methanol; freely soluble in dimethylformamide.

Hymetellose: A white, yellowish-white or grayish-white powder or granules. Hygroscopic after drying. Dissolves in cold water, giving a colloidal solution; insoluble in hot water, in acetone, in alcohol, in ether, and in toluene.

Hyoscyamine: White, crystalline powder. Is affected by light. Its solutions are alkaline to litmus. Slightly soluble in water and in benzene; freely soluble in alcohol, in chloroform, and in dilute acids; sparingly soluble in ether.

Hyoscyamine Hydrobromide: White, odorless crystals or crystalline powder. The pH of a solution (1 in 20) is about 5.4. Is affected by light. Freely soluble in water, in alcohol, and in chloroform; very slightly soluble in ether.

Hyoscyamine Sulfate: White or almost white, crystalline powder or colorless needles. Is deliquescent and is affected by light. The pH of a solution (1 in 100) is about 5.3. Very soluble in water; freely soluble in alcohol; practically insoluble in ether. Melts at a temperature not less than 200°.

Hypophosphorous Acid: Colorless or slightly yellow, odorless liquid. Specific gravity is about 1.13. *NF category:* Antioxidant.

Hypromellose: White to slightly off-white, fibrous or granular powder. Swells in water and produces a clear to opalescent, viscous, colloidal mixture. Insoluble in dehydrated alcohol, in ether, and in chloroform. *NF category:* Coating agent; suspending and/or viscosity-increasing agent; tablet binder.

Hypromellose 2208: White to slightly off-white, fibrous or granular powder. Swells in water and produces a clear to opalescent, viscous, colloidal mixture. Insoluble in dehydrated alcohol, in ether, and in chloroform. *NF category:* Coating agent; suspending and/or viscosity-increasing agent; tablet binder.

Hypromellose 2906: White to slightly off-white, fibrous or granular powder. Swells in water and produces a clear to opalescent, viscous, colloidal mixture. Insoluble in dehydrated alcohol, in ether, and in chloroform. *NF category:* Coating agent; suspending and/or viscosity-increasing agent; tablet binder.

Hypromellose 2910: White to slightly off-white, fibrous or granular powder. Swells in water and produces a clear to opalescent, viscous, colloidal mixture. Insoluble in dehydrated alcohol, in ether, and in chloroform. *NF category:* Coating agent; suspending and/or viscosity-increasing agent; tablet binder.

Hypromellose Acetate Succinate: White to yellowish-white powder or pills. Odorless, or has a faint, acetic acid-like odor, and tasteless. Practically insoluble in water, in dehydrated alcohol, in xylene, and in hexane. On the addition of a mixture of dehydrated alcohol and dichloromethane (1:1) or acetone, a clear or turbid viscous liquid is produced. Dissolves in 1 N sodium hydroxide. Slightly hygroscopic. *NF category:* Coating agent; tablet binder.

Hypromellose Phthalate: White powder or granules. Is odorless and tasteless. Practically insoluble in water, in dehydrated alcohol, and in hexane. Produces a viscous solution in a mixture of methanol and dichloromethane (1:1), or in a mixture of dehydrated alcohol and acetone (1:1). Dissolves in 1 N sodium hydroxide. *NF category:* Coating agent.

Ibuprofen: White to off-white, crystalline powder, having a slight, characteristic odor. Practically insoluble in water; very soluble in alcohol, in methanol, in acetone, and in chloroform; slightly soluble in ethyl acetate.

Ichthammol: Reddish-brown to brownish-black, viscous fluid, having a strong, characteristic, empyreumatic odor. Miscible with water, with glycerin, and with fixed oils and fats. Partially soluble in alcohol and in ether.

Idarubicin Hydrochloride: Red-orange to red-brown powder. Soluble in methanol; slightly soluble in water; insoluble in acetone and in ethyl ether.

Idoxuridine: White, crystalline, practically odorless powder. Slightly soluble in water and in alcohol; practically insoluble in chloroform and in ether.

Ifosfamide: White, crystalline powder. Melts at about 40°. Freely soluble in water; very soluble in alcohol, in ethyl acetate, in isopropyl alcohol, in methanol, and in methylene chloride; very slightly soluble in hexanes.

Imidurea: White, odorless, tasteless powder. Soluble in water and in glycerin; sparingly soluble in propylene glycol; insoluble in most organic solvents.

Imipenem: White to tan-colored crystalline powder. Sparingly soluble in water; slightly soluble in methanol.

Imipramine Hydrochloride: White to off-white, odorless or practically odorless, crystalline powder. Freely soluble in water and in alcohol; soluble in acetone; insoluble in ether and in benzene.

Inamrinone: Pale yellow to tan powder. It is odorless or has a faint odor. Slightly soluble in methanol; practically insoluble or insoluble in chloroform and in water.

Indapamide: White to off-white, crystalline powder. Melts between 167° and 170°. Soluble in methanol, in alcohol, in acetonitrile, in glacial acetic acid, and in ethyl acetate; very slightly soluble in ether and in chloroform; practically insoluble in water.

Indigotindisulfonate Sodium: Dusky, purplish-blue powder, or blue granules having a coppery luster. Is affected by light. Its solutions have a blue or bluish purple color. Slightly soluble in water and in alcohol; practically insoluble in most other organic solvents.

Indocyanine Green: Olive-brown, dark green, blue-green, dark blue, or black powder. Is odorless or has a slight odor. Its solutions are deep emerald-green in color. The pH of a solution (1 in 200) is about 6. Its aqueous solutions are stable for about 8 hours. Soluble in water and in methanol; practically insoluble in most other organic solvents.

Indomethacin: Pale yellow to yellow-tan, crystalline powder, having not more than a slight odor. Is sensitive to light. Melts at about 162°. Exhibits polymorphism. Practically insoluble in water; sparingly soluble in alcohol, in chloroform, and in ether.

Influenza Virus Vaccine: Slightly turbid liquid or suspension, which may have a slight yellow or reddish tinge and may have an odor because of the preservative.

Inositol: White or almost white, crystalline powder. Very soluble in water; practically insoluble in alcohol absolute and in ether.

Insulin: White or practically white crystals. Soluble in solutions of dilute acids and alkalies.

Insulin Injection: The Injection containing, in each mL, not more than 100 USP Units is a clear, colorless or almost colorless liquid; the Injection containing, in each mL, 500 Units may be straw-colored. Contains between 0.1% and 0.25% (w/v) of either phenol or cresol. Contains between 1.4% and 1.8% (w/v) of glycerin.

Insulin Lispro: White or practically white crystals. Soluble in solutions of dilute acids and alkalies.

Insulin Zinc Suspension: Practically colorless suspension of a mixture of characteristic crystals predominantly between 10 and 40 µm in maximum dimension and many particles that have no uniform shape and do not exceed 2 µm in maximum dimension. Contains between 0.15% and 0.17% (w/v) of sodium acetate, between 0.65% and 0.75% (w/v) of sodium chloride, and between 0.09% and 0.11% (w/v) of methylparaben.

Isophane Insulin Suspension: White suspension of rod-shaped crystals, free from large aggregates of crystals following moderate agitation. Contains either (1) between 1.4% and 1.8% (w/v) of glycerin, between 0.15% and 0.17% (w/v) of metacresol, and between 0.06% and 0.07% (w/v) of phenol, or (2) between 1.4% and 1.8% (w/v) of glycerin and between 0.20% and 0.25% (w/v) of phenol. Contains between 0.15% and 0.25% (w/v) of dibasic sodium phosphate. When examined microscopically, the insoluble matter in the Suspension is crystalline, and contains not more than traces of amorphous material.

Extended Insulin Zinc Suspension: Practically colorless suspension of a mixture of characteristic crystals the maximum dimension of which is predominantly between 10 and 40 µm. Contains between 0.15% and 0.17% (w/v) of sodium acetate, between 0.65% and 0.75% (w/v) of sodium chloride, and between 0.09% and 0.11% (w/v) of methylparaben.

Prompt Insulin Zinc Suspension: Practically colorless suspension of particles that have no uniform shape and the maximum dimension of which does not exceed 2 µm. Contains between 0.15% and 0.17% (w/v) of sodium acetate, between 0.65% and 0.75% (w/v) of sodium chloride, and between 0.09% and 0.11% (w/v) of methylparaben.

Inulin: White, friable, chalk-like, amorphous, odorless, tasteless powder. Soluble in hot water; slightly soluble in cold water and in organic solvents.

Iodine: Heavy, grayish-black plates or granules, having a metallic luster and a characteristic odor. Very slightly soluble in water; freely soluble in carbon disulfide, in chloroform, in carbon tetrachloride, and in ether; soluble in alcohol and in solutions of iodides; sparingly soluble in glycerin.

Iodine Topical Solution: Transparent, reddish-brown liquid, having the odor of iodine.

Strong Iodine Solution: Transparent liquid having a deep brown color and having the odor of iodine.

Iodine Tincture: Transparent liquid having a reddish-brown color and the odor of iodine and of alcohol.

Sodium Iodide I 123 Capsules: Capsules may contain a small amount of solid or solids, or may appear empty.

Sodium Iodide I 123 Solution: Clear, colorless solution. Upon standing, both the Solution and the glass container may darken as a result of the effects of the radiation.

Iodinated I 125 Albumin Injection: Clear, colorless to slightly yellow solution. Upon standing, both the Albumin and the glass container may darken as a result of the effects of the radiation.

Iodinated I 131 Albumin Injection: Clear, colorless to slightly yellow solution. Upon standing, both the Albumin and the glass container may darken as a result of the effects of the radiation.

Iodinated I 131 Albumin Aggregated Injection: Dilute suspension of white to faintly yellow particles, which may settle on standing. The glass container may darken on standing, as a result of the effects of the radiation.

Sodium Rose Bengal I 131 Injection: Clear, deep-red solution.

Iodohippurate Sodium I 131 Injection: Clear, colorless solution. Upon standing, both the Injection and the glass container may darken as a result of the effects of the radiation.

Sodium Iodide I 131 Capsules: May contain a small amount of solid or solids, or may appear empty.

Sodium Iodide I 131 Solution: Clear, colorless solution. Upon standing, both the Solution and the glass container may darken as a result of the effects of the radiation.

Iodipamide: White, practically odorless, crystalline powder. Very slightly soluble in water, in chloroform, and in ether; slightly soluble in alcohol.

Iodipamide Meglumine Injection: Clear, colorless to pale yellow, slightly viscous liquid.

Iodixanol: White to off-white, amorphous, odorless, hygroscopic powder. Freely soluble in water.

Iodoform: Lustrous greenish yellow powder, or lustrous crystals. It is slightly volatile even at ordinary temperatures, and distills slowly with steam. Freely soluble in ether and in chloroform; soluble in boiling alcohol; sparingly soluble in alcohol, in glycerin, and in olive oil; practically insoluble in water. Melts to a brown liquid at about 115°, and decomposes at a higher temperature, emitting vapors of iodine.

Iodoquinol: Light yellowish to tan, microcrystalline powder not readily wetted by water. Is odorless or has a faint odor; is stable in air. Melts with decomposition. Practically insoluble in water; sparingly soluble in alcohol and in ether.

Iohexol: White to off-white, hygroscopic, odorless powder. Very soluble in water and in methanol; practically insoluble or insoluble in ether and in chloroform.

Iohexol Injection: Clear, colorless to pale yellow liquid.

Iopamidol: Practically odorless, white to off-white powder. Very soluble in water; sparingly soluble in methanol; practically insoluble in alcohol and in chloroform.

Iopanoic Acid: Cream-colored powder. Is tasteless or practically so, and has a faint, characteristic odor. Is affected by light. Insoluble in water; soluble in alcohol, in chloroform, and in ether; soluble in solutions of alkali hydroxides and carbonates.

Iophendylate: Colorless to pale yellow, viscous liquid, the color darkening on long exposure to air. Is odorless or has a faintly ethereal odor. Very slightly soluble in water; freely soluble in alcohol, in benzene, in chloroform, and in ether.

Iophendylate Injection: Colorless to pale yellow, viscous liquid, the color darkening on long exposure to air. Is odorless or has a faintly ethereal odor. Very slightly soluble in water; freely soluble in alcohol, in benzene, in chloroform, and in ether.

Iopromide: White to slightly yellow powder. Freely soluble in water and in dimethyl sulfoxide; practically insoluble in alcohol, in acetone, and in ether.

Iothalamate Meglumine Injection: Clear, colorless to pale yellow, slightly viscous liquid.

Iothalamate Meglumine and Iothalamate Sodium Injection: Clear, colorless to pale yellow, slightly viscous liquid.

Iothalamate Sodium Injection: Clear, colorless to pale yellow, slightly viscous liquid.

Iothalamic Acid: White, odorless powder. Slightly soluble in water and in alcohol; soluble in solutions of alkali hydroxides.

Ioxilan: White to off-white, practically odorless powder. Soluble in water and in methanol.

Ioxilan Injection: Clear, colorless to pale yellow liquid.

Powdered Ipecac: Pale brown, weak yellow, or light olive-gray powder.

Ipodate Sodium: White to off-white, odorless, fine, crystalline powder. Freely soluble in water, in alcohol, and in methanol; very slightly soluble in chloroform.

Ipratropium Bromide: White to off-white, crystalline powder. Soluble in water; freely soluble in methanol; slightly soluble in alcohol.

Irbesartan: White to off-white, crystalline powder. Slightly soluble in alcohol and in methylene chloride; practically insoluble in water.

Iron Dextran Injection: Dark brown, slightly viscous liquid.

Iron Sorbitex Injection: Clear liquid, having a dark brown color.

Isobutane: Colorless, flammable gas (boiling temperature is about –11°). Vapor pressure at 21° is about 2950 mm of mercury (31 psig). *NF category:* Aerosol propellant.

Isoetharine Inhalation Solution: Colorless or slightly yellow, slightly acid liquid, gradually turning dark on exposure to air and light.

Isoetharine Hydrochloride: White to off-white, odorless, crystalline solid. Melts between 196° and 208°, with decomposition. Soluble in water; sparingly soluble in alcohol; practically insoluble in ether.

Isoetharine Mesylate: White or practically white, odorless crystals having a salty, bitter taste. Freely soluble in water; soluble in alcohol; practically insoluble in acetone and in ether.

Isoflurane: Clear, colorless, volatile liquid, having a slight odor. Boils at about 49°. Insoluble in water. Miscible with common organic solvents and with fats and oils.

Isoflurophate: Clear, colorless or faintly yellow liquid. Its vapor is extremely irritating to the eye and mucous membranes. Is decomposed by moisture, with the formation of hydrogen fluoride. Specific gravity

is about 1.05. Sparingly soluble in water; soluble in alcohol and in vegetable oils.

Isoleucine: White, practically odorless crystals, having a slightly bitter taste. Soluble in water; slightly soluble in hot alcohol; insoluble in ether.

Isometheptene Mucate: White, crystalline powder. Freely soluble in water; soluble in alcohol; practically insoluble in chloroform and in ether.

Isoniazid: Colorless or white crystals or white, crystalline powder. Is odorless and is slowly affected by exposure to air and light. Freely soluble in water; sparingly soluble in alcohol; slightly soluble in chloroform; and very slightly soluble in ether.

Isoniazid Injection: Clear, colorless to faintly greenish-yellow liquid. Gradually darkens on exposure to air and light. Tends to crystallize at low temperatures.

Isopropamide Iodide: White to pale yellow, crystalline powder, having a bitter taste. Sparingly soluble in water; freely soluble in chloroform and in alcohol; very slightly soluble in benzene and in ether.

Isopropyl Alcohol: Transparent, colorless, mobile, volatile liquid, having a characteristic odor and a slightly bitter taste. Is flammable. Miscible with water, with alcohol, with ether, and with chloroform. *NF category:* Solvent.

Azeotropic Isopropyl Alcohol: Transparent, colorless, mobile, volatile liquid, having a characteristic odor and a slightly bitter taste. Is flammable. Miscible with water, with alcohol, with ether, and with chloroform.

Isopropyl Myristate: Clear, practically colorless, oily liquid. Is practically odorless, and congeals at about 5°. Insoluble in water, in glycerin, and in propylene glycol; freely soluble in 90% alcohol. Miscible with most organic solvents and with fixed oils. *NF category:* Vehicle (oleaginous).

Isopropyl Palmitate: Colorless, mobile liquid having a very slight odor. Soluble in acetone, in castor oil, in chloroform, in cottonseed oil, in ethyl acetate, in alcohol, and in mineral oil; insoluble in water, in glycerin, and in propylene glycol. *NF category:* Vehicle (oleaginous).

Isoproterenol Inhalation Solution: Colorless or practically colorless, slightly acid liquid, gradually turning dark on exposure to air and light.

Isoproterenol Hydrochloride: White to practically white, odorless, crystalline powder, having a slightly bitter taste. Gradually darkens on exposure to air and light. Its solutions become pink to brownish pink on standing exposed to air, doing so almost immediately when rendered alkaline. Its solution (1 in 100) has a pH of about 5. Freely soluble in water; sparingly soluble in alcohol and less soluble in dehydrated alcohol; insoluble in chloroform and in ether.

Isoproterenol Hydrochloride Injection: Colorless or practically colorless liquid, gradually turning dark on exposure to air and light.

Isoproterenol Sulfate: White to practically white, odorless, crystalline powder. It gradually darkens on exposure to air and light. Its solutions become pink to brownish pink on standing exposed to air, doing so almost immediately when rendered alkaline. A solution (1 in 100) has a pH of about 5. Freely soluble in water; very slightly soluble in alcohol, in benzene, and in ether.

Isosorbide Concentrate: Colorless to slightly yellow liquid. Soluble in water and in alcohol.

Diluted Isosorbide Dinitrate: Ivory-white, odorless powder. [NOTE—Undiluted isosorbide dinitrate occurs as white, crystalline rosettes.] Undiluted isosorbide dinitrate is very slightly soluble in water; very soluble in acetone; freely soluble in chloroform; sparingly soluble in alcohol.

Isotretinoin: Yellow crystals. Practically insoluble in water; soluble in chloroform; sparingly soluble in alcohol, in isopropyl alcohol, and in polyethylene glycol 400.

Isoxsuprine Hydrochloride: White, odorless, crystalline powder, having a bitter taste. Melts at about 200°, with decomposition. Slightly soluble in water; sparingly soluble in alcohol.

Isradipine: Yellow, fine crystalline powder.

Ivermectin: White to yellowish-white, crystalline powder. Slightly hygroscopic. Freely soluble in methanol and in methylene chloride; soluble in acetone and in acetonitrile; practically insoluble in hexane and in water.

Juniper Tar: Dark brown, clear, thick liquid, having a tarry odor and a faintly aromatic, bitter taste. Very slightly soluble in water; partially soluble in solvent hexane. One volume dissolves in 9 volumes of alcohol. Dissolves in 3 volumes of ether, leaving only a slight, flocculent residue. Miscible with amyl alcohol, with chloroform, and with glacial acetic acid.

Kanamycin Sulfate: White, odorless, crystalline powder. Freely soluble in water; insoluble in acetone, in ethyl acetate, and in benzene.

Kaolin: Soft, white or yellowish-white powder or lumps. Has an earthy or clay-like taste and, when moistened with water, assumes a darker color and develops a marked clay-like odor. Insoluble in water, in cold dilute acids, and in solutions of alkali hydroxides. *NF category:* Tablet and/or capsule diluent.

Ketamine Hydrochloride: White, crystalline powder, having a slight, characteristic odor. Freely soluble in water and in methanol; soluble in alcohol; sparingly soluble in chloroform.

Ketorolac Tromethamine: White to off-white, crystalline powder. Melts between 165° and 170°, with decomposition. Freely soluble in water and in methanol; slightly soluble in alcohol, in dehydrated alcohol, and in tetrahydrofuran; practically insoluble in acetone, in dichloromethane, in toluene, in ethyl acetate, in dioxane, in hexane, in butyl alcohol, and in acetonitrile.

Labetalol Hydrochloride: White to off-white powder. Melts at about 180°, with decomposition. Soluble in water and in alcohol; insoluble in ether and in chloroform.

Lactic Acid: Colorless or yellowish, practically odorless, syrupy liquid. Is hygroscopic. When it is concentrated by boiling, lactic acid lactate is formed. Specific gravity is about 1.20. Miscible with water, with alcohol, and with ether. Insoluble in chloroform. *NF category:* Buffering agent.

Lactitol: A white or light brown, odorless crystal. Has a mild, sweet taste, and no aftertaste. *NF category:* Flavors and perfumes; tablet and/or capsule diluent.

Anhydrous Lactose: White or almost white powder. Freely soluble in water; practically insoluble in alcohol. *NF category:* Tablet and/or capsule diluent.

Lactose Monohydrate: White, free-flowing powder. Freely but slowly soluble in water; practically insoluble in alcohol. *NF category:* Tablet and/or capsule diluent.

Lactulose Concentrate: Colorless to amber syrupy liquid, which may exhibit some precipitation and darkening upon standing. Miscible with water.

Lamivudine: White to off-white solid. Soluble in water. Melts at about 176°.

Lanolin: Yellow, tenacious, unctuous mass, having a slight, characteristic odor. Insoluble in water, but mixes without separation with about twice its weight of water. Sparingly soluble in cold alcohol; more soluble in hot alcohol; freely soluble in ether and in chloroform. *NF category:* Ointment base.

Lanolin Alcohols: Hard, waxy, amber solid, having a characteristic odor. Insoluble in water; slightly soluble in alcohol; freely soluble in chloroform, in ether, and in petroleum ether. *NF category:* Emulsifying and/or solubilizing agent.

Lansoprazole: White to brownish-white powder. Freely soluble in dimethylformamide; practically insoluble in water. Melts at about 166°, with decomposition.

Lauroyl Polyoxylglycerides: Pale yellow, waxy liquids. Freely soluble in methylene chloride; dispersible in hot water. *NF category:* Ointment base; solvent.

Lecithin: The consistency of both natural grades and refined grades of lecithin may vary from plastic to fluid, depending upon free fatty acid and oil content, and upon the presence or absence of other diluents. Its color varies from light yellow to brown, depending on the source, on crop variations, and on whether it is bleached or unbleached. It is odorless or has a characteristic, slight nut-like odor and a bland taste. Practically insoluble in water, but it readily hydrates to form emulsions. The oil-free phosphatides are soluble in fatty acids, but are practically insoluble in fixed oils. When all phosphatide fractions are present, lecithin is partially soluble in alcohol and practically insoluble in acetone. *NF category:* Emulsifying and/or solubilizing agent.

Leflunomide: White to almost white powder. Freely soluble in methanol, in alcohol, in 2-propanol, in ethyl acetate, in acetone, in acetonitrile, and in chloroform; practically insoluble in water.

Letrozole: White to yellowish, crystalline powder. Freely soluble in dichloromethane; slightly soluble in alcohol; practically insoluble in water.

Leucine: White, practically odorless, tasteless crystals. Sparingly soluble in water; insoluble in ether.

Leucovorin Calcium: Yellowish-white or yellow, odorless powder. Very soluble in water; practically insoluble in alcohol.

Leucovorin Calcium Injection: Clear, yellowish solution.

Levamisole Hydrochloride: White or almost white, crystalline powder. Freely soluble in water; soluble in alcohol; slightly soluble in methylene chloride; practically insoluble in ether.

Levmetamfetamine: Clear, practically colorless liquid.

Levobunolol Hydrochloride: White crystalline, odorless powder. Soluble in water and in methanol; slightly soluble in alcohol and in chloroform.

Levocarnitine: White crystals or crystalline powder. Hygroscopic. Freely soluble in water, and in hot alcohol. Practically insoluble in acetone, in ether, and in benzene.

Levodopa: White to off-white, odorless, crystalline powder. In the presence of moisture, is rapidly oxidized by atmospheric oxygen and darkens. Slightly soluble in water; freely soluble in 3 N hydrochloric acid; insoluble in alcohol.

Levonordefrin: White to buff-colored, odorless, crystalline solid. Melts at about 210°. Practically insoluble in water; freely soluble in aqueous solutions of mineral acids; slightly soluble in acetone, in chloroform, in alcohol, and in ether.

Levonorgestrel: White or practically white, odorless powder. Practically insoluble in water; soluble in chloroform; slightly soluble in alcohol.

Levorphanol Tartrate: Practically white, odorless, crystalline powder. Sparingly soluble in water; slightly soluble in alcohol; insoluble in chloroform and in ether. Melts, in a sealed tube, at about 110°, with decomposition.

Levothyroxine Sodium: Light yellow to buff-colored, odorless, tasteless, hygroscopic powder. Is stable in dry air but may assume a slight pink color upon exposure to light. The pH of a saturated solution is about 8.9. Very slightly soluble in water; soluble in solutions of alkali hydroxides and in hot solutions of alkali carbonates; slightly soluble in alcohol; insoluble in acetone, in chloroform, and in ether.

Lidocaine: White or slightly yellow, crystalline powder. Has a characteristic odor and is stable in air. Practically insoluble in water; very soluble in alcohol and in chloroform; freely soluble in benzene and in ether. Dissolves in oils.

Lidocaine Hydrochloride: White, odorless, crystalline powder, having a slightly bitter taste. Very soluble in water and in alcohol; soluble in chloroform; insoluble in ether.

Lime: Hard, white or grayish-white masses or granules, or white or grayish white powder. Is odorless. Slightly soluble in water; very slightly soluble in boiling water.

Lincomycin Hydrochloride: White or practically white, crystalline powder. Is odorless or has a faint odor. Is stable in the presence of air and light. Its solutions are acid and dextrorotatory. Freely soluble in water; soluble in dimethylformamide; very slightly soluble in acetone.

Lincomycin Hydrochloride Injection: Clear, colorless to slightly yellow solution, having a slight odor.

Lincomycin Hydrochloride Soluble Powder: White to off-white, or light tan free-flowing, fine powder.

Lindane: White, crystalline powder, having a slight, musty odor. Practically insoluble in water; freely soluble in chloroform; soluble in dehydrated alcohol; sparingly soluble in ether; slightly soluble in ethylene glycol.

Linoleoyl Polyoxylglycerides: Amber, oily liquids. May develop deposit after prolonged storage periods at 20°. Freely soluble in methylene chloride; practically insoluble but dispersible in water. *NF category:* Ointment base; solvent.

Liothyronine Sodium: Light tan, odorless, crystalline powder. Very slightly soluble in water; slightly soluble in alcohol; practically insoluble in most other organic solvents.

Lisinopril: White, crystalline powder. Melts at about 160°, with decomposition. Soluble in water; sparingly soluble in methanol; practically insoluble in alcohol, in acetone, in acetonitrile, and in chloroform.

Lithium Carbonate: White, granular, odorless powder. Sparingly soluble in water; very slightly soluble in alcohol. Dissolves, with effervescence, in dilute mineral acids.

Lithium Citrate: White, odorless, deliquescent powder or granules, having a cooling, faintly alkaline taste. Freely soluble in water; slightly soluble in alcohol.

Loperamide Hydrochloride: White to slightly yellow powder. Melts at about 225°, with some decomposition. Freely soluble in methanol and in chloroform; slightly soluble in water and in dilute acids; very slightly soluble in isopropyl alcohol.

Loratadine: White to off-white powder. Freely soluble in acetone, in chloroform, in methanol, and in toluene; insoluble in water.

Lorazepam: White or practically white, practically odorless powder. Insoluble in water; sparingly soluble in alcohol; slightly soluble in chloroform.

Losartan Potassium: White to off-white powder. Freely soluble in water; soluble in isopropyl alcohol; slightly soluble in acetonitrile.

Lovastatin: White to off-white, crystalline powder. Freely soluble in chloroform; soluble in acetone, in acetonitrile, and in methanol; sparingly soluble in alcohol; practically insoluble in hexane; insoluble in water.

Loxapine Succinate: White to yellowish, crystalline powder. Is odorless.

Lutein: Red, crystalline powder. Soluble in ethanol, in ethyl acetate, and in methylene chloride; partially soluble in hexane.

Lysine Acetate: White, odorless crystals or crystalline powder, having an acid taste. Freely soluble in water.

Lysine Hydrochloride: White, odorless powder. Freely soluble in water.

Mafenide Acetate: White to pale yellow, crystalline powder. Freely soluble in water.

Magaldrate: White, odorless, crystalline powder. Insoluble in water and in alcohol; soluble in dilute solutions of mineral acids.

Milk of Magnesia: White, opaque, more or less viscous suspension from which varying proportions of water usually separate on standing. pH is about 10.

Magnesium Aluminometasilicate: White powder or granules having an amorphous structure. Partially soluble in acids and in alkalies; practically insoluble in water and in alcohol.

Magnesium Aluminosilicate: White powder or granules having an amorphous structure. Partially soluble in acids and in alkalies; practically insoluble in water and in alcohol.

Magnesium Aluminum Silicate: Odorless, tasteless, fine (micronized) powder, small cream to tan granules, or small flakes that are creamy when viewed on their flat surfaces and tan to brown when viewed on their edges. Insoluble in water and in alcohol. Swells when added to water or glycerin. *NF category:* Suspending and/or viscosity-increasing agent.

Magnesium Carbonate: Light, white, friable masses or bulky, white powder. Is odorless, and is stable in air. Practically insoluble in water to which, however, it imparts a slightly alkaline reaction; insoluble in alcohol, but is dissolved by dilute acids with effervescence.

Magnesium Chloride: Colorless, odorless, deliquescent flakes or crystals, which lose water when heated to 100° and lose hydrochloric acid when heated to 110°. Very soluble in water; freely soluble in alcohol.

Magnesium Citrate Oral Solution: Colorless to slightly yellow, clear, effervescent liquid, having a sweet, acidulous taste and a lemon flavor.

Magnesium Gluconate: Colorless crystals or white powder or granules. Is odorless and tasteless. Freely soluble in water; very slightly soluble in alcohol; insoluble in ether.

Magnesium Hydroxide: Bulky, white powder. Practically insoluble in water and in alcohol; soluble in dilute acids.

Magnesium Oxide: Very bulky, white powder or relatively dense, white powder or granulated powder. Soluble in dilute acids; practically insoluble in water; insoluble in alcohol.

Magnesium Phosphate: White, odorless, tasteless powder. Almost insoluble in water; readily soluble in diluted mineral acids.

Magnesium Salicylate: White, odorless, efflorescent, crystalline powder. Freely soluble in methanol; soluble in alcohol and in water; slightly soluble in ether.

Magnesium Silicate: Fine, white, odorless, tasteless powder, free from grittiness. Insoluble in water and in alcohol. Is readily decomposed by mineral acids. *NF category:* Glidant and/or anticaking agent.

Magnesium Stearate: Very fine, light, white powder, slippery to touch. Insoluble in water, in alcohol, and in ether. *NF category:* Tablet and/or capsule lubricant.

Magnesium Sulfate: Small, colorless crystals, usually needle-like, with a cooling, saline, bitter taste. It effloresces in warm, dry air. Freely soluble in water; freely (and slowly) soluble in glycerin; very soluble in boiling water; sparingly soluble in alcohol.

Magnesium Trisilicate: Fine, white, odorless, tasteless powder, free from grittiness. Insoluble in water and in alcohol. Is readily decomposed by mineral acids.

Malathion: Clear, colorless, or slightly yellowish liquid, having a characteristic odor. Congeals at about 2.9°. Slightly soluble in water. Miscible with alcohols, with esters, with ketones, with ethers, with aromatic and alkylated aromatic hydrocarbons, and with vegetable oils.

Maleic Acid: White, crystalline powder. Freely soluble in water and in alcohol; sparingly soluble in ether.

Malic Acid: White or practically white, crystalline powder or granules, having a strongly acid taste. Melts at about 130°. Very soluble in water; freely soluble in alcohol. *NF category:* Acidifying agent.

Maltitol: White, crystalline powder. Very soluble in water; practically insoluble in ethanol. *NF category:* Humectant; sweetening agent; tablet and/or capsule diluent.

Maltodextrin: White, hygroscopic powder or granules. Freely soluble or readily dispersible in water; slightly soluble to insoluble in anhydrous alcohol. *NF category:* Coating agent; suspending and/or viscosity-increasing agent; tablet binder; tablet and/or capsule diluent.

Maltol: A white, crystalline powder having a characteristic caramel-butterscotch odor, suggestive of a fruity-strawberry aroma in dilute solution. One g dissolves in about 82 mL of water, in 21 mL of alcohol, in 80 mL of glycerin, and in 28 mL of propylene glycol. *NF category:* Flavors and perfumes.

Maltose: Maltose occurs in either the anhydrous state or as a monohydrate. It is a white, crystalline powder, odorless, and has a sweet taste. Freely soluble in water; slightly soluble in methanol; very soluble in ethanol; and practically insoluble in ether.

Mangafodipir Trisodium: Pale yellow crystals or crystalline powder. Freely soluble in water; sparingly soluble in methanol; slightly soluble in chloroform; very slightly soluble in alcohol and in acetone.

Manganese Chloride: Large, irregular, pink, odorless, translucent crystals. Soluble in water and in alcohol; insoluble in ether.

Manganese Chloride for Oral Solution: Off-white to tan-colored powder with a strawberry odor. Soluble in water.

Manganese Sulfate: Pale red, slightly efflorescent crystals, or purple, odorless powder. Soluble in water; insoluble in alcohol.

Mannitol: White, crystalline powder or free-flowing granules. Is odorless and has a sweet taste. Freely soluble in water; soluble in alkaline solutions; slightly soluble in pyridine; very slightly soluble in alcohol; practically insoluble in ether. *NF category:* Sweetening agent; tablet and/or capsule diluent; tonicity agent; bulking agent for freeze-drying.

Maprotiline Hydrochloride: Fine, white to off-white, crystalline powder. Is practically odorless. Freely soluble in methanol and in chloroform; slightly soluble in water; practically insoluble in isooctane.

Mazindol: White to off-white, crystalline powder, having not more than a faint odor. Insoluble in water; slightly soluble in methanol and in chloroform.

Measles Virus Vaccine Live: Solid having the characteristic appearance of substances dried from the frozen state. Undergoes loss of potency on exposure to sunlight. The Vaccine is to be constituted with a suitable diluent just prior to use.

Measles, Mumps, and Rubella Virus Vaccine Live: Solid having the characteristic appearance of substances dried from the frozen state. The Vaccine is to be constituted with a suitable diluent just prior to use. Constituted vaccine undergoes loss of potency on exposure to sunlight.

Measles and Rubella Virus Vaccine Live: Solid having the characteristic appearance of substances dried from the frozen state. The Vaccine is to be constituted with a suitable diluent just prior to use. Constituted vaccine undergoes loss of potency on exposure to sunlight.

Mebendazole: White to slightly yellow powder. Is almost odorless. Melts at about 290°. Practically insoluble in water, in dilute solutions of mineral acids, in alcohol, in ether, and in chloroform; freely soluble in formic acid.

Mechlorethamine Hydrochloride: White, crystalline powder. Is hygroscopic.

Meclizine Hydrochloride: White or slightly yellowish, crystalline powder. Has a slight odor and is tasteless. Practically insoluble in water and in ether; freely soluble in chloroform, in pyridine, and in acid-alcohol-water mixtures; slightly soluble in dilute acids and in alcohol.

Meclofenamate Sodium: A white to creamy white, odorless to almost odorless, crystalline powder. Soluble in methanol; slightly soluble in chloroform; practically insoluble in ether. Freely soluble in water, the solution sometimes being somewhat turbid due to partial hydrolysis and absorption of carbon dioxide; the solution is clear above pH 11.5.

Medroxyprogesterone Acetate: White to off-white, odorless, crystalline powder. Melts at about 205°. Is stable in air. Insoluble in water; freely soluble in chloroform; soluble in acetone and in dioxane; sparingly soluble in alcohol and in methanol; slightly soluble in ether.

Mefenamic Acid: White to off-white, crystalline powder. Melts at about 230°, with decomposition. Soluble in solutions of alkali hydroxides; sparingly soluble in chloroform; slightly soluble in alcohol and in methanol; practically insoluble in water.

Mefloquine Hydrochloride: White or slightly yellow, crystalline powder. It exhibits polymorphism. Freely soluble in methanol; soluble in alcohol; very slightly soluble in water.

Megestrol Acetate: White to creamy white, tasteless and essentially odorless, crystalline powder. Insoluble in water; sparingly soluble in alcohol; slightly soluble in ether and in fixed oils; soluble in acetone; very soluble in chloroform. Is unstable under aqueous conditions at pH 7 or above.

Meglumine: White to faintly yellowish-white, odorless crystals or powder. Freely soluble in water; sparingly soluble in alcohol.

Melengestrol Acetate: White to light yellow, crystalline powder. Freely soluble in chloroform and in ethyl acetate; slightly soluble in alcohol; insoluble in water.

Meloxicam: Pale yellow powder. Soluble in dimethylformamide; slightly soluble in acetone; very slightly soluble in methanol and in alcohol; practically insoluble in water.

Melphalan: Off-white to buff powder, having a faint odor. Melts at about 180°, with decomposition. Practically insoluble in water, in chloroform, and in ether; soluble in dilute mineral acids; slightly soluble in alcohol and in methanol.

Menadiol Sodium Diphosphate: White to pink powder, having a characteristic odor. Is hygroscopic. Its solutions are neutral or slightly alkaline to litmus, having a pH of about 8. Very soluble in water; insoluble in alcohol.

Menadione: Bright yellow, crystalline, practically odorless powder. Is affected by sunlight. Practically insoluble in water; soluble in vegetable oils; sparingly soluble in chloroform and in alcohol.

Menthol: Colorless, hexagonal crystals, usually needle-like, or in fused masses, or crystalline powder. Has a pleasant, peppermint-like odor. Slightly soluble in water; very soluble in alcohol, in chloroform, in ether, and in solvent hexane; freely soluble in glacial acetic acid, in mineral oil, and in fixed and volatile oils. *NF category:* Flavors and perfumes.

Meperidine Hydrochloride: Fine, white, crystalline, odorless powder. The pH of a solution (1 in 20) is about 5. Very soluble in water; soluble in alcohol; sparingly soluble in ether.

Mephobarbital: White, odorless, crystalline powder, having a bitter taste. Its saturated solution is acid to litmus. Slightly soluble in water, in alcohol, and in ether; soluble in chloroform and in solutions of fixed alkali hydroxides and carbonates.

Mepivacaine Hydrochloride: White, odorless, crystalline solid. The pH of a solution (1 in 50) is about 4.5. Freely soluble in water and in methanol; very slightly soluble in chloroform; practically insoluble in ether.

Meprobamate: White powder, having a characteristic odor and a bitter taste. Slightly soluble in water; freely soluble in acetone and in alcohol; practically insoluble or insoluble in ether.

Mercaptopurine: Yellow, odorless or practically odorless, crystalline powder. Melts at a temperature exceeding 308°, with decomposition. Insoluble in water, in acetone, and in ether; soluble in hot alcohol and in dilute alkali solutions; slightly soluble in 2 N sulfuric acid.

Ammoniated Mercury: White, pulverulent pieces or white, amorphous powder. Is odorless, and is stable in air, but darkens on exposure to light. Insoluble in water, and in alcohol; readily soluble in warm hydrochloric, nitric, and acetic acids.

Meropenem: Colorless to white crystals. Soluble in dimethylformamide and in 5% dibasic potassium phosphate solution; sparingly soluble in water and in 5% monobasic potassium phosphate solution; very slightly soluble in alcohol; practically insoluble in acetone and in ether.

Mesalamine: Light tan to pink colored, needle-shaped crystals. Color may darken on exposure to air. Is odorless or may have a slight characteristic odor. Slightly soluble in water; very slightly soluble in methanol, in dehydrated alcohol, and in acetone; practically insoluble in *n*-butyl alcohol, in chloroform, in ether, in ethyl acetate, in *n*-hexane, in methylene chloride, and in *n*-propyl alcohol; soluble in dilute hydrochloric acid and in dilute alkali hydroxides.

Mesoridazine Besylate: White to pale yellowish powder, having not more than a faint odor. Melts at about 178°, with decomposition. Freely soluble in water, in chloroform, and in methanol.

Mestranol: White to creamy white, odorless, crystalline powder. Insoluble in water; freely soluble in chloroform; soluble in dioxane; sparingly soluble in dehydrated alcohol; slightly soluble in methanol.

Metaproterenol Sulfate: White to off-white, crystalline powder. Freely soluble in water.

Metformin Hydrochloride: White, crystalline powder. Freely soluble in water; slightly soluble in alcohol; practically insoluble in acetone and in methylene chloride.

Methacholine Chloride: Colorless or white crystals, or white, crystalline powder. Is odorless or has a slight odor, and is very hygroscopic. Its solutions are neutral to litmus. Very soluble in water; freely soluble in alcohol and in chloroform.

Methacrylic Acid Copolymer: White powder having a faint, characteristic odor. The polymer is soluble in diluted alkali, in simulated intestinal fluid TS, and in buffer solutions of pH 7 and above. The solubility between pH 5.5 and pH 7 depends on the content of methacrylic acid units in the copolymer. The polymer is soluble to freely soluble in methanol, in alcohol, in isopropyl alcohol, and in acetone, each of which contains not less than 3% of water insoluble in water, in diluted acids, in simulated gastric fluid TS, and in buffer solutions of up to pH 5. *NF category:* Coating agent.

Methacrylic Acid Copolymer Dispersion: Milky-white liquid of low viscosity. It is miscible with water in any proportion; the milky-white appearance is retained. A clear or slightly opalescent, viscous solution is obtained on mixing one part with five parts of acetone, alcohol, or isopropyl alcohol; the polymer substance is first precipitated, but then dissolves in the excess organic solvent. A clear or slightly opalescent, viscous solution is obtained on mixing one part with two parts of 1 N sodium hydroxide.

Methacycline Hydrochloride: Yellow to dark yellow, crystalline powder. Soluble in water.

Methadone Hydrochloride: Colorless crystals or white, crystalline, odorless powder. Soluble in water; freely soluble in alcohol and in chloroform; practically insoluble in ether and in glycerin.

Methadone Hydrochloride Oral Concentrate: Clear to slightly hazy, syrupy liquid.

Methamphetamine Hydrochloride: White crystals or white, crystalline powder. Is odorless or practically so. Its solutions have a pH of about 6. Freely soluble in water, in alcohol, and in chloroform; very slightly soluble in absolute ether.

Methazolamide: White or faintly yellow, crystalline powder having a slight odor. Melts at about 213°. Very slightly soluble in water and in alcohol; soluble in dimethylformamide; slightly soluble in acetone.

Methdilazine Hydrochloride: Light tan, crystalline powder, having a slight, characteristic odor. Freely soluble in water, in alcohol, and in chloroform.

Methenamine: Colorless, lustrous crystals or white, crystalline powder. Is practically odorless. When brought into contact with fire, it readily ignites, burning with a smokeless flame. It sublimes at about 260°, without melting. Its solutions are alkaline to litmus. Freely soluble in water; soluble in alcohol and in chloroform.

Methenamine Mandelate: White, crystalline powder. Has a sour taste and is practically odorless. Its solutions have a pH of about 4. Melts at about 127°, with decomposition. Very soluble in water; soluble in alcohol and in chloroform; slightly soluble in ether.

Methimazole: White to pale buff, crystalline powder, having a faint, characteristic odor. Its solutions are practically neutral to litmus. Freely soluble in water, in alcohol, and in chloroform; slightly soluble in ether.

Methionine: White crystals, having a characteristic odor and taste. Soluble in water, in warm dilute alcohol, and in dilute mineral acids; insoluble in ether, in absolute alcohol, in benzene, and in acetone (L-form).

Methocarbamol: White powder, odorless, or having a slight characteristic odor. Melts at about 94°, or, if previously ground to a fine powder, melts at about 90°. Sparingly soluble in water and in chloroform; soluble in alcohol only with heating; insoluble in benzene and in *n*-hexane.

Methohexital: White to faintly yellowish-white, crystalline, odorless powder. Very slightly soluble in water; slightly soluble in alcohol, in chloroform, and in dilute alkalies.

Methohexital Sodium for Injection: White to off-white, hygroscopic powder. Is essentially odorless.

Methotrexate: Orange-brown, or yellow, crystalline powder. Practically insoluble in water, in alcohol, in chloroform, and in ether; freely soluble in dilute solutions of alkali hydroxides and carbonates; slightly soluble in 6 N hydrochloric acid.

Methotrimeprazine: Fine, white, practically odorless, crystalline powder. Melts at about 126°. Practically insoluble in water; freely soluble in chloroform and in ether; sparingly soluble in methanol. Is sparingly soluble in alcohol at 25°, but is freely soluble in boiling alcohol.

Methoxsalen: White to cream-colored, fluffy, needle-like crystals. Is odorless. Practically insoluble in water; freely soluble in chloroform; soluble in boiling alcohol, in acetone, in acetic acid, in propylene glycol, and in benzene; sparingly soluble in boiling water and in ether.

Methoxsalen Topical Solution: Clear, colorless liquid.

Methoxyflurane: Clear, practically colorless, mobile liquid, having a characteristic odor. Boils at about 105°. Miscible with alcohol, with acetone, with chloroform, with ether, and with fixed oils.

Methsuximide: White to grayish white, crystalline powder. Is odorless, or has not more than a slight odor. Slightly soluble in hot water; very soluble in chloroform; freely soluble in alcohol and in ether.

Methyclothiazide: White or practically white, crystalline powder. Is odorless, or has a slight odor. Very slightly soluble in water, in chloroform, and in benzene; freely soluble in acetone and in pyridine; sparingly soluble in methanol; slightly soluble in alcohol.

Methyl Alcohol: Clear, colorless liquid, having a characteristic odor. Is flammable. Miscible with water, with alcohol, with ether, with benzene, and with most other organic solvents. *NF category:* Solvent.

Methyl Benzylidene Camphor: A white, fine crystalline powder. Very soluble in chloroform; freely soluble in alcohol; practically insoluble in water.

Methyl Isobutyl Ketone: Transparent, colorless, mobile, volatile liquid, having a faint ketonic and camphoraceous odor. Slightly soluble in water; miscible with alcohol, with ether, and with benzene. *NF category:* Alcohol denaturant; solvent.

Methyl Salicylate: Colorless, yellowish, or reddish liquid, having the characteristic odor and taste of wintergreen. It boils between 219° and 224°, with some decomposition. Slightly soluble in water; soluble in alcohol and in glacial acetic acid. *NF category:* Flavors and perfumes.

Methylbenzethonium Chloride: White, hygroscopic crystals, having a mild odor. Its solutions are neutral or slightly alkaline to litmus. Very soluble in water, in alcohol, and in ether; practically insoluble in chloroform.

Methylcellulose: White, fibrous powder or granules. Its aqueous suspensions are neutral to litmus. It swells in water and produces a clear to opalescent, viscous, colloidal suspension. Insoluble in alcohol, in ether, and in chloroform; soluble in glacial acetic acid and in a mixture of equal volumes of alcohol and chloroform. *NF category:* Coating agent; suspending and/or viscosity-increasing agent; tablet binder.

Methyldopa: White to yellowish-white, odorless, fine powder, which may contain friable lumps. Sparingly soluble in water; very soluble in 3 N hydrochloric acid; slightly soluble in alcohol; practically insoluble in ether.

Methyldopate Hydrochloride: White or practically white, odorless or practically odorless, crystalline powder. Freely soluble in water, in alcohol, and in methanol; slightly soluble in chloroform; practically insoluble in ether.

Methylene Blue: Dark green crystals or crystalline powder having a bronze-like luster. Is odorless or practically so, and is stable in air. Its solutions in water and in alcohol are deep blue in color. Soluble in water and in chloroform; sparingly soluble in alcohol.

Methylene Chloride: Clear, colorless, mobile liquid, having an odor resembling that of chloroform. Miscible with alcohol, with ether, and with fixed and volatile oils. *NF category:* Solvent.

Methylergonovine Maleate: White to pinkish-tan, microcrystalline powder. Is odorless. Slightly soluble in water and in alcohol; very slightly soluble in chloroform and in ether.

Methylparaben: White, crystalline powder or colorless crystals. Slightly soluble in water; freely soluble in alcohol and in methanol. *NF category:* Antimicrobial preservative.

Methylparaben Sodium: White, hygroscopic powder. Freely soluble in water; sparingly soluble in alcohol; insoluble in fixed oils. *NF category:* Antimicrobial preservative.

Methylphenidate Hydrochloride: White, odorless, fine, crystalline powder. Its solutions are acid to litmus. Freely soluble in water and in methanol; soluble in alcohol; slightly soluble in chloroform and in acetone.

Methylprednisolone: White to practically white, odorless, crystalline powder. Melts at about 240°, with some decomposition (see *Melting Range or Temperature* ⟨741⟩). Practically insoluble in water; sparingly soluble in alcohol, in dioxane, and in methanol; slightly soluble in acetone and in chloroform; very slightly soluble in ether.

Methylprednisolone Acetate: White or practically white, odorless, crystalline powder. Melts at about 225°, with some decomposition (see *Melting Range or Temperature* ⟨741⟩). Practically insoluble in water; soluble in dioxane; sparingly soluble in acetone, in alcohol, in chloroform, and in methanol; slightly soluble in ether.

Methylprednisolone Hemisuccinate: White or nearly white, odorless or nearly odorless, hygroscopic solid. Very slightly soluble in water; freely soluble in alcohol; soluble in acetone.

Methylprednisolone Sodium Succinate: White or nearly white, odorless, hygroscopic, amorphous solid. Very soluble in water and in alcohol; very slightly soluble in acetone; insoluble in chloroform.

Methylsulfonylmethane: White powder or flake crystal. Melts at about 109°. Freely soluble in water, in methanol, in alcohol, and in acetone. Sparingly soluble in ether.

Methyltestosterone: White or creamy white crystals or crystalline powder. Is odorless and is stable in air, but is slightly hygroscopic. Is affected by light. Practically insoluble in water; soluble in alcohol, in

methanol, in ether, and in other organic solvents; sparingly soluble in vegetable oils.

Methysergide Maleate: White to yellowish-white or reddish-white, crystalline powder. Is odorless or has not more than a slight odor. Slightly soluble in water and in alcohol; very slightly soluble in chloroform; practically insoluble in ether.

Metoclopramide Hydrochloride: White or practically white, crystalline, odorless or practically odorless powder. Very soluble in water; freely soluble in alcohol; sparingly soluble in chloroform; practically insoluble in ether.

Metoprolol Succinate: White to off-white powder. Freely soluble in water; soluble in methanol; sparingly soluble in alcohol; slightly soluble in isopropyl alcohol.

Metoprolol Tartrate: White, crystalline powder. Very soluble in water; freely soluble in methylene chloride, in chloroform, and in alcohol; slightly soluble in acetone; insoluble in ether.

Metronidazole: White to pale yellow, odorless crystals or crystalline powder. Is stable in air, but darkens on exposure to light. Sparingly soluble in water and in alcohol; slightly soluble in ether and in chloroform.

Metronidazole Benzoate: White to slightly yellow, crystalline powder. Freely soluble in methylene chloride; soluble in acetone; slightly soluble in alcohol; very slightly soluble in ethyl ether; practically insoluble in water.

Metyrapone: White to light amber, fine, crystalline powder, having a characteristic odor. Darkens on exposure to light. Sparingly soluble in water; soluble in methanol and in chloroform. It forms water-soluble salts with acids.

Mexiletine Hydrochloride: White powder. Freely soluble in dehydrated alcohol and in water; slightly soluble in acetonitrile; practically insoluble in ether. Optically inactive (1 in 20 solution in water).

Mezlocillin Sodium: White to pale yellow, crystalline powder. Freely soluble in water.

Mibolerone: White to off-white powder. Slightly soluble in chloroform, in dioxane, and in methylene chloride; practically insoluble in water (0.0454 mg per mL at 37°).

Miconazole: White to pale cream powder. Melts in the range of 78° to 88°. May exhibit polymorphism. Insoluble in water; soluble in ether; freely soluble in alcohol, in methanol, in isopropyl alcohol, in acetone, in propylene glycol, in chloroform, and in dimethylformamide.

Miconazole Nitrate: White or practically white, crystalline powder, having not more than a slight odor. Melts in the range of 178° to 183°, with decomposition. Insoluble in ether; very slightly soluble in water and in isopropyl alcohol; slightly soluble in alcohol, in chloroform, and in propylene glycol; sparingly soluble in methanol; soluble in dimethylformamide; freely soluble in dimethyl sulfoxide.

Milrinone: White to tan, crystalline solid. Is hygroscopic. Freely soluble in dimethyl sulfoxide; very slightly soluble in methanol; practically insoluble in water and in chloroform.

Mineral Oil: Colorless, transparent, oily liquid, free or practically free from fluorescence. Is odorless and tasteless when cold, and develops not more than a faint odor of petroleum when heated. Insoluble in water and in alcohol; soluble in volatile oils. Miscible with most fixed oils but not with castor oil. *NF category:* Solvent; vehicle (oleaginous).

Light Mineral Oil: Colorless, transparent, oily liquid, free, or practically free, from fluorescence. Is odorless and tasteless when cold, and develops not more than a faint odor of petroleum when heated. Insoluble in water and in alcohol; soluble in volatile oils. Miscible with most fixed oils, but not with castor oil. *NF category:* Tablet and/or capsule lubricant; vehicle (oleaginous).

Minocycline Hydrochloride: Yellow, crystalline powder. Sparingly soluble in water; soluble in solutions of alkali hydroxides and carbonates; slightly soluble in alcohol; practically insoluble in chloroform and in ether.

Minoxidil: White to off-white, crystalline powder. Melts in the approximate range of between 248° and 268°, with decomposition. Soluble in alcohol and in propylene glycol; sparingly soluble in methanol; slightly soluble in water; practically insoluble in chloroform, in acetone, in ethyl acetate, and in hexane.

Mirtazapine: White to creamy white, crystalline powder. Freely soluble in methanol and in toluene; soluble in ethyl ether; sparingly soluble in *n*-hexane; practically insoluble in water.

Mitomycin: Blue-violet, crystalline powder. Slightly soluble in water; soluble in acetone, in methanol, in butyl acetate, and in cyclohexanone.

Mitotane: White, crystalline powder, having a slight, aromatic odor. Practically insoluble in water; soluble in alcohol, in ether, in solvent hexane, and in fixed oils and fats.

Mitoxantrone Hydrochloride: Dark blue powder. Sparingly soluble in water; slightly soluble in methanol; practically insoluble in acetone, in acetonitrile, and in chloroform.

Modafinil: White to off-white, crystalline powder. Slightly soluble in absolute alcohol; sparingly soluble in methanol; very slightly soluble in water.

Mometasone Furoate: White to off-white powder. Melts at about 220°, with decomposition. Soluble in acetone and in methylene chloride.

Monensin Sodium: Off-white to tan, crystalline powder. Slightly soluble in water; soluble in chloroform and in methanol; practically insoluble in solvent hexane.

Mono- and Di-glycerides: Vary in consistency from yellow liquids, through ivory-colored plastics, to ivory white-colored solids (bead or flake forms). Insoluble in water, but soluble in alcohol, in ethyl acetate, in chloroform, and in other chlorinated hydrocarbons. *NF category:* Emulsifying and/or solubilizing agent.

Monobenzone Ointment: Dispersible with, but not soluble in, water.

Monoethanolamine: Clear, colorless, moderately viscous liquid, having a distinctly ammoniacal odor. Miscible with water, with acetone, with alcohol, with glycerin, and with chloroform. Immiscible with ether, with solvent hexane, and with fixed oils, although it dissolves many essential oils. *NF category:* Emulsifying and/or solubilizing agent.

Monoglyceride Citrate: Soft white to ivory-colored, waxy solid with a lard-like consistency and bland odor. Dispersible in most common fat solvents and in alcohol; insoluble in water.

Monosodium Glutamate: White, practically odorless, free-flowing crystals or crystalline powder. Freely soluble in water; sparingly soluble in alcohol. May have either a slightly sweet or a slightly salty taste. *NF category:* Flavors and perfumes.

Monothioglycerol: Colorless or pale yellow, viscous liquid, having a slight sulfidic odor. Is hygroscopic. Miscible with alcohol. Freely soluble in water; insoluble in ether. *NF category:* Antioxidant.

Morantel Tartrate: A white or pale yellow, crystalline powder. Very soluble in water and in alcohol; practically insoluble in ethyl acetate.

Moricizine Hydrochloride: White to off-white, crystalline powder. Melts at about 189°, with decomposition. Soluble in water and in alcohol.

Morphine Sulfate: White, feathery, silky crystals, cubical masses of crystals, or white, crystalline powder. Is odorless, and when exposed to air it gradually loses water of hydration. Darkens on prolonged exposure to light. Soluble in water; freely soluble in hot water; slightly soluble in alcohol but more so in hot alcohol; insoluble in chloroform and in ether.

Mumps Skin Test Antigen: Slightly turbid liquid.

Mumps Virus Vaccine Live: Solid having the characteristic appearance of substances dried from the frozen state. The Vaccine is to be constituted with a suitable diluent just prior to use. Constituted vaccine undergoes loss of potency on exposure to sunlight.

Mupirocin: White to off-white, crystalline solid. Freely soluble in acetone, in chloroform, in dehydrated alcohol, and in methanol; slightly soluble in ether; very slightly soluble in water.

Mycophenolate Mofetil: White or almost white, crystalline powder. Freely soluble in acetone; soluble in methanol; sparingly soluble in ethanol; and slightly soluble in water.

Myristic Acid: Hard, white or faintly yellow, somewhat glossy, crystalline solid or white or yellow-white powder. Soluble in alcohol, in chloroform, and in ether; practically insoluble in water. *NF category:* Antifoaming agent.

Nabumetone: A white, or almost white, crystalline powder. Freely soluble in acetone; sparingly soluble in alcohol and in methanol; practically insoluble in water.

Nadolol: White to off-white, practically odorless, crystalline powder. Freely soluble in alcohol and in methanol; soluble in water at pH 2; slightly soluble in chloroform, in methylene chloride, in isopropyl alcohol, and in water (between pH 7 and pH 10); insoluble in acetone, in benzene, in ether, in hexane, and in trichloroethane.

Nafcillin Sodium: White to yellowish-white powder, having not more than a slight characteristic odor. Freely soluble in water and in chloroform; soluble in alcohol.

Nalidixic Acid: White to very pale yellow, odorless, crystalline powder. Soluble in chloroform, in methylene chloride, and in solutions of fixed alkali hydroxides and carbonates; slightly soluble in acetone, in alcohol, in methanol, and in toluene; very slightly soluble in ether and in water.

Naloxone Hydrochloride: White to slightly off-white powder. Its aqueous solution is acidic. Soluble in water, in dilute acids, and in strong alkali; slightly soluble in alcohol; practically insoluble in ether and in chloroform.

Naloxone Hydrochloride Injection: Clear, colorless liquid.

Nandrolone Decanoate: Fine, white to creamy white, crystalline powder. Is odorless, or may have a slight odor. Practically insoluble in water; soluble in chloroform, in alcohol, in acetone, and in vegetable oils.

Naphazoline Hydrochloride: White, crystalline powder. Is odorless and has a bitter taste. Melts at a temperature of about 255°, with decomposition. Freely soluble in water and in alcohol; very slightly soluble in chloroform; practically insoluble in ether.

Naproxen: White to off-white, practically odorless, crystalline powder. Soluble in chloroform, in dehydrated alcohol, and in alcohol; sparingly soluble in ether; practically insoluble in water.

Naproxen Sodium: White to creamy crystalline powder. Soluble in water and in methanol; sparingly soluble in alcohol; very slightly soluble in acetone; and practically insoluble in chloroform and in toluene. Melts at about 255°, with decomposition.

Narasin: White to off-white, crystalline powder. Melts at about 217°, with decomposition. Soluble in methanol and in water.

Naratriptan Hydrochloride: White to pale yellow solid. Soluble in water.

Natamycin: Off-white to cream-colored powder, which may contain up to 3 moles of water. Practically insoluble in water; slightly soluble in methanol; soluble in glacial acetic acid and in dimethylformamide.

Nefazodone Hydrochloride: Nonhygroscopic, white powder. Freely soluble in chloroform; soluble in propylene glycol; slightly soluble in polyethylene glycol and in water.

Neomycin Sulfate: White to slightly yellow powder, or cryodesiccated solid. Is odorless or practically so and is hygroscopic. Its solutions are dextrorotatory. Freely soluble in water; very slightly soluble in alcohol; insoluble in acetone, in chloroform, and in ether.

Netilmicin Sulfate: White to pale yellowish-white powder. Freely soluble in water; practically insoluble in dehydrated alcohol and in ether.

Nevirapine: White to off-white, odorless to nearly odorless, crystalline powder. Practically insoluble in water; slightly soluble in alcohol and in methanol. Hydrous form also slightly soluble in propylene glycol.

Niacin: White crystals or crystalline powder. Is odorless, or has a slight odor. Melts at about 235°. Sparingly soluble in water; freely soluble in boiling water, in boiling alcohol, and in solutions of alkali hydroxides and carbonates; practically insoluble in ether.

Niacinamide: White, crystalline powder. Is odorless or practically so, and has a bitter taste. Its solutions are neutral to litmus. Freely soluble in water and in alcohol; soluble in glycerin.

Nifedipine: Yellow powder. Is affected by exposure to light. Practically insoluble in water; freely soluble in acetone.

Nimodipine: Light yellow or yellow, crystalline powder, affected by light. Freely soluble in ethyl acetate; sparingly soluble in alcohol; practically insoluble in water. Exhibits polymorphism.

Nitric Acid: Highly corrosive fuming liquid, having a characteristic, highly irritating odor. Stains animal tissues yellow. Boils at about 120°. Specific gravity is about 1.41. *NF category:* Acidifying agent.

Nitrofurantoin: Lemon-yellow, odorless crystals or fine powder. Has a bitter aftertaste. Very slightly soluble in water and in alcohol; soluble in dimethylformamide.

Nitrofurazone: Lemon yellow, odorless, crystalline powder. Darkens slowly on exposure to light. Melts at about 236°, with decomposition. Very slightly soluble in alcohol and in water; soluble in dimethylformamide; slightly soluble in propylene glycol and in polyethylene glycol mixtures; practically insoluble in chloroform and in ether.

Nitrofurazone Ointment: Yellow, opaque, and water-miscible, and has ointment-like consistency.

Nitrofurazone Topical Solution: Light yellow, clear, somewhat viscous liquid, having a faint characteristic odor. Miscible with water.

Nitrogen: Colorless, odorless, tasteless gas. Is nonflammable and does not support combustion. One L at 0° and at a pressure of 760 mm of mercury weighs about 1.251 g. One volume dissolves in about 65 volumes of water and in about 9 volumes of alcohol at 20° and at a pressure of 760 mm of mercury. *NF category:* Air displacement.

Diluted Nitroglycerin: When diluted with lactose, it is a white, odorless powder. When diluted with propylene glycol or alcohol, it is a clear, colorless, or pale yellow liquid. [NOTE—Undiluted nitroglycerin occurs as a white to pale yellow, thick, flammable, explosive liquid.] Undiluted nitroglycerin is slightly soluble in water; soluble in methanol, in alcohol, in carbon disulfide, in acetone, in ethyl ether, in ethyl acetate, in glacial acetic acid, in benzene, in toluene, in nitrobenzene, in phenol, in chloroform, and in methylene chloride.

Nitromersol: Brownish yellow to yellow granules or brownish yellow to yellow powder. Is odorless and tasteless and is affected by light. Very slightly soluble in water, in alcohol, in acetone, and in ether; soluble in solutions of alkalies and of ammonia by opening of the anhydride ring and the formation of a salt.

Nitromersol Topical Solution: Clear, reddish-orange solution. Is affected by light.

Nitrous Oxide: Colorless gas, without appreciable odor or taste. One L at 0° and at a pressure of 760 mm of mercury weighs about 1.97 g. One volume dissolves in about 1.4 volumes of water at 20° and at a pressure of 760 mm of mercury. Freely soluble in alcohol; soluble in ether and in oils.

Nizatidine: Off-white to buff crystalline solid. Freely soluble in chloroform; soluble in methanol; sparingly soluble in water.

Nonoxynol 9: Clear, colorless to light yellow, viscous liquid. Soluble in water, in alcohol, and in corn oil. *NF category:* Wetting and/or solubilizing agent.

Norepinephrine Bitartrate: White or faintly gray, odorless, crystalline powder. Slowly darkens on exposure to air and light. Its solutions are acid to litmus, having a pH of about 3.5. Freely soluble in water; slightly soluble in alcohol; practically insoluble in chloroform and in ether. Melts between 98° and 104°, without previous drying of the specimen, the melt being turbid.

Norepinephrine Bitartrate Injection: Colorless or practically colorless liquid, gradually turning dark on exposure to air and light.

Norethindrone: White to creamy white, odorless, crystalline powder. Is stable in air. Practically insoluble in water; soluble in chloroform and in dioxane; sparingly soluble in alcohol; slightly soluble in ether.

Norethindrone Acetate: White to creamy white, odorless, crystalline powder. Practically insoluble in water; very soluble in chloroform; freely soluble in dioxane; soluble in ether and in alcohol.

Norethynodrel: White or practically white, odorless, crystalline powder. Melts at about 175°, over a range of about 3°. Is stable in air. Very slightly soluble in water and in solvent hexane; freely soluble in chloroform; soluble in acetone; sparingly soluble in alcohol.

Norfloxacin: White to pale yellow, crystalline powder. Sensitive to light and moisture. Slightly soluble in acetone, in water, and in alcohol; freely soluble in acetic acid; sparingly soluble in chloroform; very slightly soluble in methanol and in ethyl acetate; insoluble in ether.

Norgestimate: White to pale yellow powder. Freely to very soluble in methylene chloride; insoluble in water; sparingly soluble in acetonitrile.

Norgestrel: White or practically white, practically odorless, crystalline powder. Insoluble in water; freely soluble in chloroform; sparingly soluble in alcohol.

Nortriptyline Hydrochloride: White to off-white powder, having a slight, characteristic odor. Its solution (1 in 100) has a pH of about 5. Soluble in water and in chloroform; sparingly soluble in methanol; practically insoluble in ether, in benzene, and in most other organic solvents.

Noscapine: Fine, white or practically white, crystalline powder. Freely soluble in chloroform; soluble in acetone; slightly soluble in alcohol and in ether; practically insoluble in water.

Novobiocin Calcium: White or yellowish-white, odorless, crystalline powder. Slightly soluble in water and in ether; freely soluble in alcohol and in methanol; sparingly soluble in acetone and in butyl acetate; very slightly soluble in chloroform.

Novobiocin Sodium: White or yellowish-white, odorless, hygroscopic, crystalline powder. Freely soluble in water, in alcohol, in methanol, in glycerin, and in propylene glycol; slightly soluble in butyl acetate; practically insoluble in acetone, in chloroform, and in ether.

Nystatin: Yellow to light tan powder, having an odor suggestive of cereals. Is hygroscopic, and is affected by long exposure to light, heat, and air. Freely soluble in dimethylformamide and in dimethyl sulfoxide; slightly to sparingly soluble in methanol, in *n*-propyl alcohol, and in *n*-butyl alcohol; practically insoluble in water and in alcohol; insoluble in chloroform and in ether.

Octoxynol 9: Clear, pale yellow, viscous liquid, having a faint odor and a bitter taste. Miscible with water, with alcohol, and with acetone. Soluble in benzene and in toluene; practically insoluble in solvent hexane. *NF category:* Wetting and/or solubilizing agent.

Octyldodecanol: Clear water-white, free-flowing liquid. Soluble in alcohol and in ether; insoluble in water. *NF category:* Vehicle (oleaginous).

Octyl Methoxycinnamate: Pale yellow oil. Insoluble in water.

Ofloxacin: Pale yellowish-white to light yellowish-white crystals or crystalline powder. Slightly soluble in alcohol, in methanol, and in water; sparingly soluble in chloroform.

Hydrophilic Ointment: *NF category:* Ointment base.

White Ointment: *NF category:* Ointment base.

Yellow Ointment: *NF category:* Ointment base.

Oleic Acid: Colorless to pale yellow, oily liquid when freshly prepared, but on exposure to air it gradually absorbs oxygen and darkens. Has a characteristic, lard-like odor and taste. When strongly heated in air, it is decomposed with the production of acrid vapors. Practically insoluble in water. Miscible with alcohol, with chloroform, with ether, with benzene, and with fixed and volatile oils. *NF category:* Emulsifying and/or solubilizing agent.

Oleovitamin A and D: Yellow to red, oily liquid, practically odorless or having a fish-like odor, and having no rancid odor or taste. Is a clear liquid at temperatures exceeding 65°, and may crystallize on cooling. Is unstable in air and in light. Insoluble in water and in glycerin; very soluble in ether and in chloroform; soluble in dehydrated alcohol and in vegetable oils.

Oleovitamin A and D Capsules: The oil contained in Oleovitamin A and D Capsules is a yellow to red, oily liquid, practically odorless or having a fish-like odor, and having no rancid odor or taste. Is a clear liquid at temperatures exceeding 65°, and may crystallize on cooling. Is unstable in air and in light.

Oleoyl Polyoxylglycerides: Amber, oily liquids. May develop deposit after prolonged storage at 20°. Freely soluble in methylene chloride; practically insoluble but dispersible in water. *NF category:* Ointment base; solvent.

Oleyl Alcohol: Clear, colorless to light yellow, oily liquid. Has a faint characteristic odor and a bland taste. Insoluble in water; soluble in alcohol, in ether, in isopropyl alcohol, and in light mineral oil. *NF category:* Emulsifying and/or solubilizing agent.

Oleyl Oleate: Clear, colorless to light yellow liquid. Has a faint characteristic odor. Slightly soluble in alcohol; miscible with chloroform and with ether. *NF category:* Emollient; emulsifying and/or solubilizing agent.

Olive Oil: Pale yellow, or light greenish-yellow, oily liquid, having a slight, characteristic odor and taste, with a faintly acrid aftertaste. Slightly soluble in alcohol. Miscible with ether, with chloroform, and with carbon disulfide. *NF category:* Vehicle (oleaginous).

Omeprazole: White to off-white powder. Melts between 150° and 160°, with decomposition. Soluble in dichloromethane; sparingly soluble in methanol and in alcohol; very slightly soluble in water.

Omeprazole Magnesium: White to off-white powder. Sparingly soluble in methanol; slightly soluble in alcohol; very slightly soluble in water and in dichloromethane.

Ondansetron: White to off-white powder. Very soluble in acid solutions; sparingly soluble in water.

Ondansetron Hydrochloride: White to off-white powder. Sparingly soluble in water and in alcohol; soluble in methanol; slightly soluble in isopropyl alcohol and in dichloromethane; very slightly soluble in acetone, in chloroform, and in ethyl acetate.

Opium: Has a very characteristic odor and a very bitter taste.

Powdered Opium: Light brown or moderately yellowish-brown powder.

Orphenadrine Citrate: White, practically odorless, crystalline powder, having a bitter taste. Sparingly soluble in water; slightly soluble in alcohol; insoluble in chloroform, in benzene, and in ether.

Oxacillin Sodium: Fine, white, crystalline powder, odorless or having a slight odor. Freely soluble in water, in methanol, and in dimethyl sulfoxide; slightly soluble in absolute alcohol, in chloroform, in pyridine,

and in methyl acetate; insoluble in ethyl acetate, in ether, in benzene, and in ethylene chloride.

Oxacillin Sodium for Injection: Fine, white, crystalline powder, odorless or having a slight odor. Freely soluble in water, in methanol, and in dimethyl sulfoxide; slightly soluble in absolute alcohol, in chloroform, in pyridine, and in methyl acetate; insoluble in ethyl acetate, in ether, in benzene, and in ethylene chloride.

Oxandrolone: White, odorless, crystalline powder. Is stable in air, but darkens on exposure to light. Melts at about 225°. Practically insoluble in water; freely soluble in chloroform; sparingly soluble in alcohol and in acetone.

Oxaprozin: White to yellowish-white, crystalline powder.

Oxazepam: Creamy white to pale yellow powder. Is practically odorless. Practically insoluble in water; slightly soluble in alcohol and in chloroform; very slightly soluble in ether.

Oxfendazole: White or almost white powder. Slightly soluble in alcohol and in methylene chloride; practically insoluble in water.

Oxprenolol Hydrochloride: White, crystalline powder. Freely soluble in alcohol, in chloroform, and in water; sparingly soluble in acetone; practically insoluble in ether.

Oxtriphylline: White, crystalline powder, having an amine-like odor. A solution (1 in 100) has a pH of about 10.3. Freely soluble in water and in alcohol; very slightly soluble in chloroform.

Oxybenzone: Pale yellow powder. Practically insoluble in water; freely soluble in alcohol and in toluene.

Oxybutynin Chloride: White, crystalline, practically odorless powder. Freely soluble in water and in alcohol; very soluble in methanol and in chloroform; soluble in acetone; slightly soluble in ether; very slightly soluble in hexane.

Oxycodone Hydrochloride: White to off-white, hygroscopic crystals or powder. Is odorless. Soluble in water; slightly soluble in alcohol.

Oxygen: Colorless, odorless, tasteless gas, which supports combustion more energetically than does air. One L at 0° and at a pressure of 760 mm of mercury weighs about 1.429 g. One volume dissolves in about 32 volumes of water and in about 7 volumes of alcohol at 20° and at a pressure of 760 mm of mercury.

Oxymetazoline Hydrochloride: White to practically white, fine crystalline powder. Is hygroscopic. Melts at about 300°, with decomposition. Soluble in water and in alcohol; practically insoluble in benzene, in chloroform, and in ether.

Oxymetholone: White to creamy white, crystalline powder. Is odorless, and is stable in air. Practically insoluble in water; freely soluble in chloroform; soluble in dioxane; sparingly soluble in alcohol; slightly soluble in ether.

Oxymorphone Hydrochloride: White or slightly off-white, odorless powder. Darkens on exposure to light. Its aqueous solutions are slightly acidic. Freely soluble in water; sparingly soluble in alcohol and in ether.

Oxyquinoline Sulfate: Yellow powder. Melts at about 185°. Very soluble in water; freely soluble in methanol; slightly soluble in alcohol; practically insoluble in acetone and in ether. *NF category:* Complexing agent.

Oxytetracycline: Pale yellow to tan, odorless, crystalline powder. Is stable in air, but exposure to strong sunlight causes it to darken. It loses potency in solutions of pH below 2, and is rapidly destroyed by alkali hydroxide solutions. Very slightly soluble in water; freely soluble in 3 N hydrochloric acid and in alkaline solutions; sparingly soluble in alcohol.

Oxytetracycline Calcium: Yellow to light brown, crystalline powder. Insoluble in water.

Oxytetracycline Hydrochloride: Yellow, odorless, crystalline powder, having a bitter taste. Is hygroscopic. Decomposes at a temperature exceeding 180°, and exposure to strong sunlight or to temperatures exceeding 90° in moist air causes it to darken. Its potency is diminished in solutions having a pH below 2, and is rapidly destroyed by alkali hydroxide solutions. Freely soluble in water, but crystals of oxytetracycline base separate as a result of partial hydrolysis of the hydrochloride. Sparingly soluble in alcohol and in methanol, and even less soluble in dehydrated alcohol; insoluble in chloroform and in ether.

Paclitaxel: White to off-white powder. Insoluble in water; soluble in alcohol.

Padimate O: A light yellow, mobile liquid having a faint, aromatic odor. Practically insoluble in water; soluble in alcohol, in isopropyl alcohol, and in mineral oil; practically insoluble in glycerin and in propylene glycol.

Palm Kernel Oil: White to yellowish, fatty solid. Insoluble in water. *NF category:* Coating agent; emulsifying and/or solubilizing agent.

Palmitic Acid: Hard, white or faintly yellow, somewhat glossy crystalline solid, or white or yellowish-white powder. It has a slight characteristic odor and taste. Soluble in alcohol, in ether, and in chloroform; practically insoluble in water.

Pamidronate Disodium: White, crystalline powder. Soluble in water and in 2 N sodium hydroxide; sparingly soluble in 0.1 N hydrochloric acid and in 0.1 N acetic acid; practically insoluble in organic solvents.

Pancreatin: Cream-colored, amorphous powder, having a faint, characteristic, but not offensive odor. It hydrolyzes fats to glycerol and fatty acids, changes protein into proteoses and derived substances, and converts starch into dextrins and sugars. Its greatest activities are in neutral or faintly alkaline media; more than traces of mineral acids or large amounts of alkali hydroxides make it inert. An excess of alkali carbonate also inhibits its action.

Pancrelipase: Cream-colored, amorphous powder, having a faint, characteristic, but not offensive odor. Pancrelipase hydrolyzes fats to glycerol and fatty acids, changes protein into proteoses and derived substances, and converts starch into dextrins and sugars. Its greatest activities are in neutral or faintly alkaline media; more than traces of mineral acids or large amounts of alkali hydroxides make it inert. An excess of alkali carbonate also inhibits its action.

Pancrelipase Capsules: The contents of Capsules conform to the *Description* under *Pancrelipase*, except that the odor may vary with the flavoring agent used.

Pancuronium Bromide: White, yellowish-white, or slightly pink, crystalline powder. Is hygroscopic. Freely soluble in water, in methylene chloride, and in alcohol.

Panthenol: White to creamy white, crystalline powder having a slight, characteristic odor. Freely soluble in water, in alcohol, and in propylene glycol; soluble in chloroform and in ether; slightly soluble in glycerin.

Pantoprazole Sodium: White to off-white powder. Freely soluble in water, in methanol, and in dehydrated alcohol; practically insoluble in hexane and in dichloromethane.

Papain: White to light tan, amorphous powder. Soluble in water, the solution being colorless to light yellow and more or less opalescent; practically insoluble in alcohol, in chloroform, and in ether.

Papaverine Hydrochloride: White crystals or white, crystalline powder. Is odorless, and has a slightly bitter taste. Is optically inactive. Its solutions are acid to litmus. Melts at about 220°, with decomposition. Soluble in water and in chloroform; slightly soluble in alcohol; practically insoluble in ether.

Parachlorophenol: White or pink crystals having a characteristic phenolic odor. When undiluted, it whitens and cauterizes the skin and mucous membranes. Melts at about 42°. Sparingly soluble in water and in liquid petrolatum; very soluble in alcohol, in glycerin, in chloroform, in ether, and in fixed and volatile oils; soluble in petrolatum.

Paraffin: Colorless or white, more or less translucent mass showing a crystalline structure. Is odorless and tasteless, and is slightly greasy to the touch. Insoluble in water and in alcohol; freely soluble in chloroform, in ether, in volatile oils, and in most warm fixed oils; slightly soluble in dehydrated alcohol. *NF category:* Stiffening agent.

Synthetic Paraffin: Very hard, white, practically tasteless and odorless wax. Contains mostly long-chain, unbranched, saturated hydrocarbons, with a small amount of branched hydrocarbons. Is represented by the formula C_nH_{2n2}, in which *n* may range from 20 to about 100. The average molecular weight may range from 400 to 1400. Insoluble in water; very slightly soluble in aliphatic, oxygenated, and halogenated hydrocarbon solvents; slightly soluble in aromatic and normal paraffinic solvents. *NF category:* Stiffening agent.

Paraldehyde: Colorless, transparent liquid. Has a strong, characteristic but not unpleasant or pungent odor, and a disagreeable taste. Specific gravity is about 0.99. Soluble in water, but less soluble in boiling water. Miscible with alcohol, with chloroform, with ether, and with volatile oils.

Paramethasone Acetate: Fluffy, white to creamy white, odorless, crystalline powder. Melts at about 240°, with decomposition. Insoluble in water; soluble in chloroform, in ether, and in methanol.

Paricalcitol: White to almost white powder. Soluble in alcohol; insoluble in water.

Paromomycin Sulfate: Creamy white to light yellow powder. Is odorless or practically odorless, and is very hygroscopic. Very soluble in water; insoluble in alcohol, in chloroform, and in ether.

Paroxetine Hydrochloride: White to off-white solid. Slightly soluble in water; soluble in methanol and in alcohol.

Peanut Oil: Colorless or pale yellow, oily liquid with a bland taste. May have a characteristic, nutty odor. Very slightly soluble in alcohol. Miscible with ether, with chloroform, and with carbon disulfide. *NF category:* Solvent; vehicle (oleaginous).

Pectin: Coarse or fine powder, yellowish-white in color, almost odorless, and having a mucilaginous taste. Almost completely soluble in 20 parts of water, forming a viscous, opalescent, colloidal solution that flows readily and is acid to litmus; practically insoluble in alcohol or in diluted alcohol and in other organic solvents. Pectin dissolves in water more readily if first moistened with alcohol, glycerin, or simple syrup, or if first mixed with 3 or more parts of sucrose. *NF category:* Suspending and/or viscosity-increasing agent.

Penbutolol Sulfate: White to off-white, crystalline powder. Melts at about 217°, with decomposition. Soluble in water and in methanol.

Penicillamine: White or practically white, crystalline powder, having a slight, characteristic odor. Freely soluble in water; slightly soluble in alcohol; insoluble in chloroform and in ether.

Penicillin G Benzathine: White, odorless, crystalline powder. Very slightly soluble in water; sparingly soluble in alcohol.

Penicillin G Potassium: Colorless or white crystals, or white, crystalline powder. Is odorless or practically so, and is moderately hygroscopic. Its solutions are dextrorotatory. Its solutions retain substantially full potency for several days at temperatures below 15°, but are rapidly inactivated by acids, by alkali hydroxides, by glycerin, and by oxidizing agents. Very soluble in water, in saline TS, and in dextrose solutions; sparingly soluble in alcohol.

Penicillin G Procaine: White crystals or white, very fine, microcrystalline powder. Is odorless or practically odorless, and is relatively stable in air. Its solutions are dextrorotatory. Is rapidly inactivated by acids, by alkali hydroxides, and by oxidizing agents. Slightly soluble in water; soluble in alcohol and in chloroform.

Penicillin G Sodium: Colorless or white crystals or white to slightly yellow, crystalline powder. Is odorless or practically odorless, and is moderately hygroscopic. Its solutions are dextrorotatory. Is relatively stable in air, but is inactivated by prolonged heating at about 100°, especially in the presence of moisture. Its solutions lose potency fairly rapidly at room temperature, but retain substantially full potency for several days at temperatures below 15°. Its solutions are rapidly inactivated by acids, by alkali hydroxides, by oxidizing agents, and by penicillinase.

Penicillin V: White, odorless, crystalline powder. Very slightly soluble in water; freely soluble in alcohol and in acetone; insoluble in fixed oils.

Penicillin V Benzathine: Practically white powder, having a characteristic odor. Very slightly soluble in water; slightly soluble in alcohol and in ether; sparingly soluble in chloroform.

Penicillin V Potassium: White, odorless, crystalline powder. Very soluble in water; slightly soluble in alcohol; insoluble in acetone.

Pentazocine: White or very pale, tan-colored powder. Practically insoluble in water; freely soluble in chloroform; soluble in alcohol, in acetone, and in ether; sparingly soluble in benzene and in ethyl acetate.

Pentazocine Hydrochloride: White, crystalline powder. It exhibits polymorphism, one form melting at about 254° and the other at about 218°. Freely soluble in chloroform; soluble in alcohol; sparingly soluble in water; very slightly soluble in acetone and in ether; practically insoluble in benzene.

Pentetic Acid: White, odorless or almost odorless powder. Melts with foaming and degradation at 220°.

Pentobarbital: White to practically white, fine, practically odorless powder. May occur in a polymorphic form that melts at about 116°. This form gradually reverts to the more stable higher-melting form upon being heated at about 110°. Very slightly soluble in water and in carbon tetrachloride; very soluble in alcohol, in methanol, in ether, in chloroform, and in acetone; soluble in benzene.

Pentobarbital Sodium: White, crystalline granules or white powder. Is odorless or has a slight characteristic odor, and has a slightly bitter taste. Its solutions decompose on standing, heat accelerating the decomposition. Very soluble in water; freely soluble in alcohol; practically insoluble in ether.

Pentoxifylline: White to almost white crystalline powder. Freely soluble in chloroform and in methanol; soluble in water; sparingly soluble in alcohol; slightly soluble in ether.

Peppermint: Has an aromatic, characteristic odor and a pungent taste, and produces a cooling sensation in the mouth. *NF category:* Flavors and perfumes.

Peppermint Oil: Colorless or pale yellow liquid, having a strong, penetrating, characteristic odor and a pungent taste, followed by a sensation of cold when air is drawn into the mouth. *NF category:* Flavors and perfumes.

Peppermint Spirit: A clear, colorless liquid with a peppermint fragrance. Completely soluble in water; easily soluble in methanol and in diethyl ether. *NF category:* Flavors and perfumes.

Peppermint Water: *NF category:* Vehicle (flavored and/or sweetened).

Perflubron: Clear, colorless, practically odorless liquid.

Pergolide Mesylate: White to off-white powder. Sparingly soluble in methanol; slighly soluble in water, in dehydrated alcohol, and in chloroform; very slightly soluble in acetone; practically insoluble in ether.

Perphenazine: White to creamy white, odorless powder. Practically insoluble in water; freely soluble in alcohol and in chloroform; soluble in acetone.

Pertussis Immune Globulin: Transparent or slightly opalescent liquid, practically colorless, free from turbidity or particles, and practically odorless. May develop a slight, granular deposit during storage. Is standardized for agglutinating activity with the U.S. Standard Antipertussis Serum.

Petrolatum: Unctuous yellowish to light amber mass, having not more than a slight fluorescence even after being melted. Is transparent in thin layers. Is free or practically free from odor and taste. Insoluble in water; freely soluble in benzene, in carbon disulfide, in chloroform, and in turpentine oil; soluble in ether, in solvent hexane, and in most fixed and volatile oils; practically insoluble in cold and hot alcohol and in cold dehydrated alcohol. *NF category:* Ointment base.

Hydrophilic Petrolatum: *NF category:* Ointment base.

White Petrolatum: White or faintly yellowish, unctuous mass, transparent in thin layers even after cooling to 0°. Insoluble in water; slightly soluble in cold or hot alcohol, and in cold dehydrated alcohol; freely soluble in benzene, in carbon disulfide, and in chloroform; soluble in ether, in solvent hexane, and in most fixed and volatile oils. *NF category:* Ointment base.

Phenazopyridine Hydrochloride: Light or dark red to dark violet, crystalline powder. Is odorless, or has a slight odor. Melts at about 235°, with decomposition. Slightly soluble in water, in alcohol, and in chloroform.

Phendimetrazine Tartrate: White, odorless, crystalline powder. Freely soluble in water; sparingly soluble in warm alcohol; insoluble in chloroform, in acetone, in ether, and in benzene. Phendimetrazine base is extracted by organic solvents from alkaline solution.

Phenelzine Sulfate: White to yellowish white powder, having a characteristic odor. Freely soluble in water; practically insoluble in alcohol, in chloroform, and in ether.

Pheniramine Maleate: White, crystalline powder having a faint amine-like odor. Soluble in water and in alcohol.

Phenmetrazine Hydrochloride: White to off-white, crystalline powder. Very soluble in water; freely soluble in alcohol and in chloroform.

Phenobarbital: White, odorless, glistening, small crystals, or white, crystalline powder, which may exhibit polymorphism. Is stable in air. Its saturated solution has a pH of about 5. Very slightly soluble in water; soluble in alcohol, in ether, and in solutions of fixed alkali hydroxides and carbonates; sparingly soluble in chloroform.

Phenobarbital Sodium: Flaky crystals, or white, crystalline granules, or white powder. Is odorless, has a bitter taste, and is hygroscopic. Its solutions are alkaline to phenolphthalein TS, and decompose on standing. Very soluble in water; soluble in alcohol; practically insoluble in ether and in chloroform.

Phenol: Colorless to light pink, interlaced or separate, needle-shaped crystals, or white to light pink, crystalline mass. Has a characteristic odor. Is liquefied by warming and by the addition of 10% of water. Boils at about 182°, and its vapor is flammable. Gradually darkens on exposure to light and air. Soluble in water; very soluble in alcohol, in glycerin, in chloroform, in ether, and in fixed and volatile oils; sparingly soluble in mineral oil. *NF category:* Antimicrobial preservative.

Liquefied Phenol: Colorless to pink liquid, which may develop a red tint upon exposure to air or light. Has a characteristic, somewhat aromatic odor. It whitens and cauterizes the skin and mucous membranes. Specific gravity is about 1.065. Miscible with alcohol, with ether, and with glycerin. A mixture of equal volumes of Liquefied Phenol and glycerin is miscible with water.

Camphorated Phenol Topical Gel: Clear, colorless, oily gel.

Phenolsulfonphthalein: A bright-red to dark-red, crystalline powder. Very slightly soluble in water; slightly soluble in alcohol.

Phenoxyethanol: A colorless, slightly viscous liquid. Slightly soluble in water; miscible with acetone, with alcohol, and with glycerol; slightly soluble in peanut oil and in olive oil. *NF category:* Antimicrobial preservative.

Phensuximide: White to off-white, crystalline powder. Is odorless, or has not more than a slight odor. Slightly soluble in water; very soluble in chloroform; soluble in alcohol.

Phentermine Hydrochloride: White, odorless, hygroscopic, crystalline powder. Soluble in water and in the lower alcohols; slightly soluble in chloroform; insoluble in ether.

Phentolamine Mesylate: White or off-white, odorless, crystalline powder. Its solutions are acid to litmus, having a pH of about 5, and slowly deteriorate. Melts at about 178°. Freely soluble in water and in alcohol; slightly soluble in chloroform.

Phenylalanine: White, odorless crystals, having a slightly bitter taste. Sparingly soluble in water; very slightly soluble in methanol, in alcohol, and in dilute mineral acids.

Phenylbenzimidazole Sulfonic Acid: White to ivory-colored, odorless powder. Soluble in alcohol; practically insoluble in oily solvents and in water. Its salts are freely soluble in water.

Phenylbutazone: White to off-white, odorless, crystalline powder. Very slightly soluble in water; freely soluble in acetone and in ether; soluble in alcohol.

Phenylephrine Bitartrate: White or almost white powder or colorless crystals. Freely soluble in water.

Phenylephrine Hydrochloride: White or practically white, odorless crystals, having a bitter taste. Freely soluble in water and in alcohol.

Phenylephrine Hydrochloride Nasal Solution: Clear, colorless or slightly yellow, odorless liquid. Is neutral or acid to litmus.

Phenylephrine Hydrochloride Ophthalmic Solution: Clear, colorless or slightly yellow liquid, depending on the concentration.

Phenylethyl Alcohol: Colorless liquid, having a rose-like odor and a sharp, burning taste. Sparingly soluble in water; very soluble in alcohol, in fixed oils, in glycerin, and in propylene glycol; slightly soluble in mineral oil. *NF category:* Antimicrobial preservative.

Phenylmercuric Acetate: White to creamy white, crystalline powder, or small white prisms or leaflets. Is odorless. Slightly soluble in water; soluble in alcohol and in acetone. *NF category:* Antimicrobial preservative.

Phenylmercuric Nitrate: White, crystalline powder. Is affected by light. Its saturated solution is acid to litmus. Very slightly soluble in water; slightly soluble in alcohol and in glycerin. It is more soluble in the presence of either nitric acid or alkali hydroxides. *NF category:* Antimicrobial preservative.

Phenylpropanolamine Bitartrate: White, crystalline powder.

Phenylpropanolamine Hydrochloride: White, crystalline powder, having a slight aromatic odor. Is affected by light. Freely soluble in water and in alcohol; insoluble in ether.

Phenyltoloxamine Citrate: White, crystalline powder. Very soluble in boiling water; slightly soluble in cold water and in alcohol; practically insoluble in cold acetone, in ethyl ether, and in toluene.

Phenytoin: White, odorless powder. Melts at about 295°. Practically insoluble in water; soluble in hot alcohol; slightly soluble in cold alcohol, in chloroform, and in ether.

Phenytoin Sodium: White, odorless powder. Is somewhat hygroscopic and on exposure to air gradually absorbs carbon dioxide. Freely soluble in water, the solution usually being somewhat turbid due to partial hydrolysis and absorption of carbon dioxide; soluble in alcohol; practically insoluble in ether and in chloroform.

Sodium Phosphate P 32 Solution: Clear, colorless solution. Upon standing, both the Solution and the glass container may darken as a result of the effects of the radiation.

Phosphoric Acid: Colorless, odorless liquid of syrupy consistency. Specific gravity is about 1.71. Miscible with water and with alcohol. *NF category:* Acidifying agent; buffering agent.

Diluted Phosphoric Acid: Clear, colorless, odorless liquid. Specific gravity is about 1.057. *NF category:* Acidifying agent.

Physostigmine: White, odorless, microcrystalline powder. Acquires a red tint when exposed to heat, light, air, or contact with traces of metals. Melts at a temperature not lower than 103°. Slightly soluble in water; very soluble in chloroform and in dichloromethane; freely soluble in alcohol; soluble in benzene and in fixed oils.

Physostigmine Salicylate: White, shining, odorless crystals or white powder. Acquires a red tint when exposed to heat, light, air, or contact with traces of metals for long periods. Melts at about 184°. Sparingly soluble in water; freely soluble in chloroform; soluble in alcohol; slightly soluble in ether.

Physostigmine Sulfate: White, odorless, microcrystalline powder. Is deliquescent in moist air and acquires a red tint when exposed to heat, light, air, or contact with traces of metals for long periods. Melts at about 143°. Freely soluble in water; very soluble in alcohol; very slightly soluble in ether.

Phytonadione: Clear, yellow to amber, very viscous, odorless or practically odorless liquid, having a specific gravity of about 0.967. Is stable in air, but decomposes on exposure to sunlight. Insoluble in water; soluble in dehydrated alcohol, in benzene, in chloroform, in ether, and in vegetable oils; slightly soluble in alcohol.

Pilocarpine: A viscous, oily liquid, or crystals melting at about 34°. Exceedingly hygroscopic. Soluble in water, in alcohol, and in chloroform; practically insoluble in petroleum ether; sparingly soluble in ether and in benzene.

Pilocarpine Hydrochloride: Colorless, translucent, odorless, faintly bitter crystals. Is hygroscopic and is affected by light. Its solutions are acid to litmus. Very soluble in water; freely soluble in alcohol; slightly soluble in chloroform; insoluble in ether.

Pilocarpine Nitrate: Shining, white crystals. Is stable in air but is affected by light. Its solutions are acid to litmus. Freely soluble in water; sparingly soluble in alcohol; insoluble in chloroform and in ether.

Pimozide: White, crystalline powder. Insoluble in water; slightly soluble in ether and in alcohol; freely soluble in chloroform.

Pindolol: White to off-white, crystalline powder, having a faint odor. Practically insoluble in water; slightly soluble in methanol; very slightly soluble in chloroform.

Piperacillin: White to off-white, crystalline powder. Very slightly soluble in water; very soluble in methanol; sparingly soluble in isopropyl alcohol; slightly soluble in ethyl acetate.

Piperacillin Sodium: White to off-white solid. Freely soluble in water and in alcohol.

Piperazine: White to slightly off-white lumps or flakes, having an ammoniacal odor. Soluble in water and in alcohol; insoluble in ether.

Piperazine Adipate: White crystalline powder. Soluble in water; practically insoluble in alcohol.

Piperazine Citrate: White, crystalline powder, having not more than a slight odor. Its solution (1 in 10) has a pH of about 5. Soluble in water; insoluble in alcohol and in ether.

Piperazine Dihydrochloride: White crystalline powder. Soluble in water.

Piperazine Phosphate: White crystalline powder. Sparingly soluble in water; practically insoluble in alcohol.

Piroxicam: Off-white to light tan or light yellow, odorless powder. Forms a monohydrate that is yellow. Very slightly soluble in water, in dilute acids, and in most organic solvents; slightly soluble in alcohol and in aqueous alkaline solutions.

Plantago Seed: All varieties are practically odorless and have a bland, mucilaginous taste.

Plicamycin: Yellow, odorless, hygroscopic, crystalline powder. Slightly soluble in water and in methanol; very slightly soluble in alcohol; freely soluble in ethyl acetate.

Podophyllum: Has a slight odor and a disagreeably bitter and acrid taste.

Podophyllum Resin: Amorphous powder, varying in color from light brown to greenish yellow, turning darker when subjected to a temperature exceeding 25° or when exposed to light. Has a slight, peculiar, faintly bitter taste. Its alcohol solution is acid to moistened litmus paper. Soluble in alcohol with a slight opalescence; partially soluble in ether and in chloroform.

Polacrilin Potassium: White to off-white, free-flowing powder. Has a faint odor or is odorless. Insoluble in water and in most liquids. *NF category:* Tablet disintegrant.

Poliovirus Vaccine Inactivated: Clear, reddish-tinged or yellowish liquid, that may have a slight odor because of the preservative.

Poloxalene: Colorless or pale yellow liquid. Soluble in water, in chloroform, and in ethylene dichloride.

Poloxamer: *NF category:* Emulsifying and/or solubilizing agent; wetting and/or solubilizing agent.

Poloxamer 124: Colorless liquid, having a mild odor. When solidified, it melts at about 16°. Freely soluble in water, in alcohol, in isopropyl alcohol, in propylene glycol, and in xylene.

Poloxamer 188: White, prilled or cast solid. Is odorless, or has a very mild odor. Melts at about 52°. Freely soluble in water and in alcohol.

Poloxamer 237: White, prilled or cast solid. Is odorless, or has a very mild odor. Melts at about 49°. Freely soluble in water and in alcohol; sparingly soluble in isopropyl alcohol and in xylene.

Poloxamer 338: White, prilled or cast solid. Is odorless, or has a very mild odor. Melts at about 57°. Freely soluble in water and in alcohol; sparingly soluble in propylene glycol.

Poloxamer 407: White, prilled or cast solid. Is odorless, or has a very mild odor. Melts at about 56°. Freely soluble in water, in alcohol, and in isopropyl alcohol.

Polycarbophil: White to creamy white granules, having a characteristic, ester-like odor. Swells in water to a range of volumes, depending primarily on the pH. Insoluble in water, in dilute acids, in dilute alkalies, and in common organic solvents.

Hydrogenated Polydecene: Clear, colorless, odorless, tasteless liquid. Very slightly soluble in water. *NF category:* Emollient; ointment base; solvent; vehicle (oleaginous).

Polydextrose: Off-white to light tan-colored solid. Very soluble in water; slightly soluble in glycerin and in propylene glycol; insoluble in alcohol. *NF category:* Bulking agent; humectant.

Polyethylene Glycol: Polyethylene Glycol is usually designated by a number that corresponds approximately to its average molecular weight. As the average molecular weight increases, the water solubility, vapor pressure, hygroscopicity, and solubility in organic solvents decrease, while congealing temperature, specific gravity, flash point, and viscosity increase. Liquid grades occur as clear to slightly hazy, colorless or practically colorless, slightly hygroscopic, viscous liquids, having a slight, characteristic odor, and a specific gravity at 25° of about 1.12. Solid grades occur as practically odorless and tasteless, white, waxy, plastic material having a consistency similar to beeswax, or as creamy white flakes, beads, or powders. The accompanying table states the approximate congealing temperatures that are characteristic of commonly available grades. Liquid grades are miscible with water; solid grades are freely soluble in water; and all are soluble in acetone, in alcohol, in chloroform, in ethylene glycol monoethyl ether, in ethyl acetate, and in toluene; all are insoluble in ether and in hexane. *NF category:* Coating agent; plasticizer; solvent; suppository base; tablet and/or capsule lubricant.

Nominal Molecular Weight Polyethylene Glycol	Approximate Congealing Temperature (°)
300	–11
400	6
600	20
900	34
1000	38
1450	44
3350	56
4500	58
8000	60

Polyethylene Glycol Monomethyl Ether: Polyethylene Glycol Monomethyl Ether is usually designated by a number that corresponds approximately to its average molecular weight. As the average molecular weight increases, the water solubility, vapor pressure, hygroscopicity, and solubility in organic solvents decrease, while congealing temperature, specific gravity, flash point, and viscosity increase. Liquid grades occur as clear to slightly hazy, colorless or practically colorless, slightly hygroscopic, viscous liquids, having a slight, characteristic odor, and a specific gravity at 25° of about 1.09 – 1.10. Solid grades occur as practically odorless and tasteless, white, waxy, plastic material having a consistency similar to beeswax, or as creamy white flakes, beads, or powders. The accompanying table states the approximate congealing temperatures that are characteristic of commonly available grades. Liquid grades are miscible with water; solid grades are freely soluble in water; and all are soluble in acetone, in alcohol, in chloroform, in ethylene glycol monoethyl ether, in ethyl acetate, and in toluene; all are insoluble in ether and in hexane. *NF category:* Ointment base; solvent; plasticizer.

Nominal Molecular Weight Polyethylene Glycol Monomethyl Ether	Approximate Congealing Temperature (°)
350	–7
550	17
750	28
1000	35
2000	51
5000	59
8000	60
10000	61

Polyethylene Oxide: Polyethylene oxide resins are high molecular weight polymers having the common structure:

$$(–O–CH_2CH_2–)_n$$

in which *n*, the degree of polymerization, varies from about 2000 to over 100,000. Polyethylene oxide, being a polyether, strongly hydrogen, bonds with water. It is nonionic and undergoes salting-out effects associated with neutral molecules in solutions of high dielectric media. Salting-out effects manifest themselves in depressing the upper temperature limit of solubility, and in reducing the viscosity of both dilute and concentrated solutions of the polymers. All molecular weight grades are powdered or granular solids. They are soluble in water but, because of the high solution viscosities obtained (see *table*), solutions over 1% in water may be difficult to prepare. The water solubility, hygroscopicity, solubility in organic solvents, and melting point do not vary in the specified molecular weight range. At room temperature polyethylene oxide is miscible with water in all proportions. At concentrations of about 20% polymer in water, the solutions are nontacky, reversible, elastic gels. At higher concentrations, the solutions are tough, elastic materials with the water acting as a plasticizer. Polyethylene oxide is also freely soluble in acetonitrile, in ethylene dichloride, in trichloroethylene, and in methylene chloride. Heating may be required to obtain solutions in many other organic solvents. It is insoluble in aliphatic hydrocarbons, in ethylene glycol, in diethylene glycol, and in glycerol. *NF category:* Suspending and/or viscosity-increasing agent; tablet binder.

Approximate Molecular Weight	Typical Solution Viscosity (cps), 25°	
	5% Solution	1% Solution
100,000	40	
200,000	100	
300,000	800	
400,000	3000	
600,000	6000	
900,000	15000	
4,000,000		3500
5,000,000		5500

Polyethylene 50 Stearate: *NF category:* Emulsifying and/or solubilizing agent.

Polyisobutylene: Low molecular-weight grades are soft and gummy; high molecular-weight grades are tough and elastic. All grades are light in color, odorless, and tasteless. Soluble in diisobutylene, in toluene, and in chloroform; insoluble in water.

Polymyxin B Sulfate: White to buff-colored powder. Is odorless or has a faint odor. Freely soluble in water; slightly soluble in alcohol.

Polyoxyl Lauryl Ether: A material with 3–5 oxyethylene units per molecule is a colorless liquid. Soluble or dispersible in alcohol; practically insoluble in water and in hexane. A material with 9–23 oxyethylene units per molecule is a white, waxy mass. Soluble or dispersible in water; soluble in alcohol; practically insoluble in hexane. *NF category:* Emulsifying and/or solubilizing agent.

Polyoxyl Oleate: A slightly yellowish, viscous liquid. Dispersible in water and in oils; soluble in alcohol and in isopropyl alcohol; miscible with fatty oils and with waxes. Its refractive index is about 1.466.

Polyoxyl 10 Oleyl Ether: White, soft semisolid, or pale yellow liquid, having a bland odor. Soluble in water and in alcohol; dispersible in mineral oil and in propylene glycol, with possible separation on standing. *NF category:* Emulsifying and/or solubilizing agent; tablet and/or capsule lubricant; wetting and/or solubilizing agent.

Polyoxyl 20 Cetostearyl Ether: Cream-colored, waxy, unctuous mass, melting, when heated, to a clear brownish-yellow liquid. Soluble in water, in alcohol, and in acetone; insoluble in solvent hexane. *NF category:* Emulsifying and/or solubilizing agent; tablet and/or capsule lubricant; wetting and/or solubilizing agent.

Polyoxyl 35 Castor Oil: Yellow, oily liquid, having a faint, characteristic odor and a somewhat bitter taste. Very soluble in water, producing a practically odorless and colorless solution; soluble in alcohol and in ethyl acetate; insoluble in mineral oils. *NF category:* Emulsifying and/or solubilizing agent; tablet and/or capsule lubricant; wetting and/or solubilizing agent.

Polyoxyl 40 Hydrogenated Castor Oil: White to yellowish paste or pasty liquid, having a faint odor and a slight taste. Very soluble in water, producing a practically tasteless, odorless, and colorless solution; soluble in alcohol and in ethyl acetate; insoluble in mineral oils. *NF category:* Emulsifying and/or solubilizing agent; tablet and/or capsule lubricant; wetting and/or solubilizing agent.

Polyoxyl 40 Stearate: Waxy, white to light tan solid. Is odorless or has a faint, fat-like odor. Soluble in water, in alcohol, in ether, and in acetone; insoluble in mineral oil and in vegetable oils. *NF category:* Emulsifying and/or solubilizing agent; tablet and/or capsule lubricant; wetting and/or solubilizing agent.

Polyoxyl Stearyl Ether: A white to yellowish-white, waxy, unctuous mass, pellets, microbeads, or flakes. Polyoxyl Stearyl Ether with 2 oxyethylene units per molecule is practically insoluble in water; soluble in alcohol, with heating, and in methylene chloride. Polyoxyl Stearyl Ether with 10 oxyethylene units per molecule is soluble in water and in alcohol. Polyoxyl Stearyl Ether with 20 oxethylene units per molecule is soluble in water, in alcohol, and in methylene chloride. After melting, it solidifies at about 45°.

Polysorbate 20: Lemon to amber liquid having a faint characteristic odor. Soluble in water, in alcohol, in ethyl acetate, in methanol, and in dioxane; insoluble in mineral oil. *NF category:* Emulsifying and/or solubilizing agent; tablet and/or capsule lubricant; wetting and/or solubilizing agent.

Polysorbate 40: Yellow liquid having a faint, characteristic odor. Soluble in water and in alcohol; insoluble in mineral oil and in vegetable oils. *NF category:* Emulsifying and/or solubilizing agent; tablet and/or capsule lubricant; wetting and/or solubilizing agent.

Polysorbate 60: Lemon- to orange-colored, oily liquid or semi-gel having a faint, characteristic odor. Soluble in water, in ethyl acetate, and in toluene; insoluble in mineral oil and in vegetable oils. *NF category:* Emulsifying and/or solubilizing agent; tablet and/or capsule lubricant; wetting and/or solubilizing agent.

Polysorbate 80: Lemon- to amber-colored, oily liquid having a faint, characteristic odor and a warm, somewhat bitter taste. Very soluble in water, producing an odorless and practically colorless solution; soluble in alcohol and in ethyl acetate; insoluble in mineral oil. *NF category:* Emulsifying and/or solubilizing agent; tablet and/or capsule lubricant; wetting and/or solubilizing agent.

Polyvinyl Acetate Phthalate: Free-flowing white powder. May have a slight odor of acetic acid. Insoluble in water, in methylene chloride, and in chloroform; soluble in methanol and in alcohol. *NF category:* Coating agent.

Polyvinyl Alcohol: White to cream-colored granules, or white to cream-colored powder. Is odorless. Freely soluble in water at room temperature. Solution may be effected more rapidly at somewhat higher temperatures. *NF category:* Suspending and/or viscosity-increasing agent.

Sulfurated Potash: Irregular, liver-brown pieces when freshly made, changing to a greenish yellow. Has an odor of hydrogen sulfide and a bitter, acrid, and alkaline taste, and decomposes on exposure to air. A solution (1 in 10) is light brown in color and is alkaline to litmus. Freely soluble in water, usually leaving a slight residue. Alcohol dissolves only the sulfides.

Potassium Acetate: Colorless, monoclinic crystals or white, crystalline powder having a saline and slightly alkaline taste. Is odorless, or has a faint acetous odor. Deliquesces on exposure to moist air. Very soluble in water; freely soluble in alcohol.

Potassium Alginate: White to yellow, fibrous or granular powder. Dissolves in water to form a viscous, colloidal solution; insoluble in alcohol and in hydroalcoholic solutions in which the alcohol content is greater than 30% by weight; insoluble in chloroform, in ether, and in acids having a pH lower than about 3.

Potassium Benzoate: White, odorless, or practically odorless, granular or crystalline powder. Is stable in air. Freely soluble in water; sparingly soluble in alcohol and somewhat more soluble in 90% alcohol. *NF category:* Antimicrobial preservative.

Potassium Bicarbonate: Colorless, transparent, monoclinic prisms or as a white, granular powder. Is odorless, and is stable in air. Its solutions are neutral or alkaline to phenolphthalein TS. Freely soluble in water; practically insoluble in alcohol.

Potassium Bitartrate: Colorless or slightly opaque crystals, or white, crystalline powder. A saturated solution is acid to litmus. Soluble in boiling water; slightly soluble in water; very slightly soluble in alcohol.

Potassium Bromide: White, crystalline powder or colorless, cubical crystals. Freely soluble in water and in glycerol; slightly soluble in alcohol.

Potassium Chloride: Colorless, elongated, prismatic, or cubical crystals, or white, granular powder. Is odorless, has a saline taste, and is stable in air. Its solutions are neutral to litmus. Freely soluble in water and even more soluble in boiling water; insoluble in alcohol. *NF category:* Tonicity agent.

Potassium Citrate: Transparent crystals or white, granular powder. Is odorless, has a cooling, saline taste, and is deliquescent when exposed to moist air. Freely soluble in water; almost insoluble in alcohol. *NF category:* Buffering agent.

Potassium Gluconate: White to yellowish-white, crystalline powder or granules. Is odorless, has a slightly bitter taste, and is stable in air. Its solutions are slightly alkaline to litmus. Freely soluble in water; practically insoluble in dehydrated alcohol, in ether, in benzene, and in chloroform.

Potassium Hydroxide: White or practically white, fused masses, or small pellets, or flakes, or sticks, or other forms. Is hard and brittle and shows a crystalline fracture. Exposed to air, it rapidly absorbs carbon dioxide and moisture, and deliquesces. Freely soluble in water, in alcohol, and in glycerin; very soluble in boiling alcohol. *NF category:* Alkalizing agent.

Potassium Iodide: Hexahedral crystals, either transparent and colorless or somewhat opaque and white, or a white, granular powder. Is slightly hygroscopic. Its solutions are neutral or alkaline to litmus. Very soluble in water and even more soluble in boiling water; freely soluble in glycerin; soluble in alcohol.

Potassium Iodide Oral Solution: Clear, colorless, odorless liquid, having a characteristic, strongly salty taste. Is neutral or alkaline to litmus. Specific gravity is about 1.70.

Potassium Metabisulfite: White or colorless, free-flowing crystals, crystalline powder, or granules, usually having an odor of sulfur dioxide. Gradually oxidizes in air to the sulfate. Its solutions are acid to litmus. Soluble in water; insoluble in alcohol. *NF category:* Antioxidant.

Potassium Metaphosphate: White, odorless powder. Insoluble in water; soluble in dilute solutions of sodium salts. *NF category:* Buffering agent.

Potassium Nitrate: White, crystalline powder or colorless crystals. Freely soluble in water; very soluble in boiling water; soluble in glycerin; practically insoluble in alcohol.

Potassium Permanganate: Dark purple crystals, almost opaque by transmitted light and of a blue metallic luster by reflected light. Its color is sometimes modified by a dark bronze-like appearance. Is stable in air. Soluble in water; freely soluble in boiling water.

Dibasic Potassium Phosphate: Colorless or white, somewhat hygroscopic, granular powder. The pH of a solution (1 in 20) is about 8.5 to 9.6. Freely soluble in water; very slightly soluble in alcohol. *NF category:* Buffering agent.

Monobasic Potassium Phosphate: Colorless crystals or white, granular or crystalline powder. Is odorless, and is stable in air. The pH of a solution (1 in 100) is about 4.5. Freely soluble in water; practically insoluble in alcohol. *NF category:* Buffering agent.

Potassium Sodium Tartrate: Colorless crystals or white, crystalline powder, having a cooling, saline taste. As it effloresces slightly in warm, dry air, the crystals are often coated with a white powder. Freely soluble in water; practically insoluble in alcohol.

Potassium Sorbate: White crystals or powder, having a characteristic odor. Melts at about 270°, with decomposition. Freely soluble in water; soluble in alcohol. *NF category:* Antimicrobial preservative.

Povidone: White to slightly creamy white powder. Is hygroscopic. Freely soluble in water, in methanol, and in alcohol; slightly soluble in acetone; practically insoluble in ether. *NF category:* Suspending and/or viscosity-increasing agent; tablet binder.

Povidone-Iodine: Yellowish-brown to reddish-brown, amorphous powder, having a slight, characteristic odor. Its solution is acid to litmus. Soluble in water and in alcohol; practically insoluble in chloroform, in carbon tetrachloride, in ether, in solvent hexane, and in acetone.

Povidone-Iodine Topical Aerosol Solution: The liquid obtained from Povidone-Iodine Topical Aerosol Solution is transparent, having a reddish brown color.

Pralidoxime Chloride: White to pale-yellow, crystalline powder. Is odorless and is stable in air. Freely soluble in water.

Pramoxine Hydrochloride: White to practically white, crystalline powder, having a numbing taste. May have a slight aromatic odor. The pH of a solution (1 in 100) is about 4.5. Freely soluble in water and in alcohol; soluble in chloroform; very slightly soluble in ether.

Pravastatin Sodium: White to yellowish white, hygroscopic powder. Freely soluble in water and in methanol; soluble in alcohol; very slightly soluble in acetonitrile; practically insoluble in ether, in ethyl acetate, and in chloroform.

Praziquantel: White or practically white, crystalline powder; odorless or having a faint characteristic odor. Very slightly soluble in water; freely soluble in alcohol and in chloroform.

Prazosin Hydrochloride: White to tan powder. Slightly soluble in water, in methanol, in dimethylformamide, and in dimethylacetamide; very slightly soluble in alcohol; practically insoluble in chloroform and in acetone.

Prednicarbate: White to almost white, crystalline powder. Freely soluble in acetone and in alcohol; sparingly soluble in propylene glycol; practically insoluble in water.

Prednisolone: White to practically white, odorless, crystalline powder. Melts at about 235°, with some decomposition (see *Melting Range or Temperature* ⟨741⟩). Very slightly soluble in water; soluble in methanol and in dioxane; sparingly soluble in acetone and in alcohol; slightly soluble in chloroform.

Prednisolone Acetate: White to practically white, odorless, crystalline powder. Melts at about 235°, with some decomposition (see *Melting Range or Temperature* ⟨741⟩). Practically insoluble in water; slightly soluble in acetone, in alcohol, and in chloroform.

Prednisolone Hemisuccinate: Fine, creamy white powder with friable lumps; practically odorless. Melts at about 205°, with decomposition. Very slightly soluble in water; freely soluble in alcohol; soluble in acetone.

Prednisolone Sodium Phosphate: White or slightly yellow, friable granules or powder. Is odorless or has a slight odor. Is slightly hygroscopic. Freely soluble in water; soluble in methanol; slightly soluble in alcohol and in chloroform; very slightly soluble in acetone and in dioxane.

Prednisolone Sodium Succinate for Injection: Creamy white powder with friable lumps, having a slight odor.

Prednisolone Tebutate: White to slightly yellow, free-flowing powder, which may show some soft lumps. Is odorless or has not more than a moderate, characteristic odor. Is hygroscopic. Very slightly soluble in water; freely soluble in chloroform and in dioxane; soluble in acetone; sparingly soluble in alcohol and in methanol.

Prednisone: White to practically white, odorless, crystalline powder. Melts at about 230°, with some decomposition (see *Melting Range or Temperature* ⟨741⟩). Very slightly soluble in water; slightly soluble in alcohol, in chloroform, in dioxane, and in methanol.

Prilocaine: White or almost white powder or crystal aggregates. Very soluble in alcohol and in acetone; slightly soluble in water.

Prilocaine Hydrochloride: White, odorless, crystalline powder, having a bitter taste. Freely soluble in water and in alcohol; slightly soluble in chloroform; very slightly soluble in acetone; practically insoluble in ether.

Primaquine Phosphate: Orange-red, crystalline powder. Is odorless and has a bitter taste. Its solutions are acid to litmus. Melts at about 200°. Soluble in water; insoluble in chloroform and in ether.

Primidone: White, crystalline powder. Is odorless and has a slightly bitter taste. Very slightly soluble in water and in most organic solvents; slightly soluble in alcohol.

Probucol: White to off-white, crystalline powder. Insoluble in water; freely soluble in chloroform and in *n*-propyl alcohol; soluble in alcohol and in solvent hexane.

Probenecid: White or practically white, fine, crystalline powder. Is practically odorless. Practically insoluble in water and in dilute acids; soluble in dilute alkali, in chloroform, in alcohol, and in acetone.

Procainamide Hydrochloride: White to tan, crystalline powder. Is odorless. Its solution (1 in 10) has a pH between 5 and 6.5. Very soluble in water; soluble in alcohol; slightly soluble in chloroform; very slightly soluble in benzene and in ether.

Procainamide Hydrochloride Injection: Colorless, or having not more than a slight yellow color.

Procaine Hydrochloride: Small, white crystals or white, crystalline powder. Is odorless. Exhibits local anesthetic properties when placed on the tongue. Freely soluble in water; soluble in alcohol; slightly soluble in chloroform; practically insoluble in ether.

Procaine Hydrochloride Injection: Clear, colorless liquid.

Prochlorperazine: Clear, pale yellow, viscous liquid. Is sensitive to light. Very slightly soluble in water; freely soluble in alcohol, in chloroform, and in ether.

Prochlorperazine Edisylate: White to very light yellow, odorless, crystalline powder. Its solutions are acid to litmus. Freely soluble in water; very slightly soluble in alcohol; insoluble in ether and in chloroform.

Prochlorperazine Maleate: White or pale yellow, practically odorless, crystalline powder. Its saturated solution is acid to litmus. Practically insoluble in water and in alcohol; slightly soluble in warm chloroform.

Procyclidine Hydrochloride: White, crystalline powder, having a moderate, characteristic odor. Melts at about 225°, with decomposition. Soluble in water and in alcohol; insoluble in ether and in acetone.

Progesterone: White or creamy white, odorless, crystalline powder. Is stable in air. Practically insoluble in water; soluble in alcohol, in acetone, and in dioxane; sparingly soluble in vegetable oils.

Proline: White, odorless crystals, having a slightly sweet taste. Freely soluble in water and in absolute alcohol; insoluble in ether, in butanol, and in isopropanol.

Promazine Hydrochloride: White to slightly yellow, practically odorless, crystalline powder. It oxidizes upon prolonged exposure to air and acquires a blue or pink color. Freely soluble in water and in chloroform.

Promethazine Hydrochloride: White to faint yellow, practically odorless, crystalline powder. Slowly oxidizes, and acquires a blue color, on prolonged exposure to air. Freely soluble in water, in hot dehydrated alcohol, and in chloroform; practically insoluble in ether, in acetone, and in ethyl acetate.

Propafenone Hydrochloride: White powder. Soluble in methanol and in hot water; slightly soluble in alcohol and in chloroform; very slightly soluble in acetone; insoluble in diethyl ether and in toluene.

Propane: Colorless, flammable gas (boiling temperature is about –42°). One hundred volumes of water dissolves 6.5 volumes at 17.8° and 753 mm pressure; 100 volumes of anhydrous alcohol dissolves 790 volumes at 16.6° and 754 mm pressure; 100 volumes of ether dissolves 926 volumes at 16.6° and 757 mm pressure; 100 volumes of chloroform dissolves 1299 volumes at 21.6° and 757 mm pressure. Vapor pressure at 21° is about 10290 mm of mercury (108 psig). *NF category:* Aerosol propellant.

Propantheline Bromide: White or practically white crystals. Is odorless and has a bitter taste. Melts at about 160°, with decomposition. Very soluble in water, in alcohol, and in chloroform; practically insoluble in ether and in benzene.

Proparacaine Hydrochloride: White to off-white, or faintly buff-colored, odorless, crystalline powder. Its solutions are neutral to litmus. Soluble in water, in warm alcohol, and in methanol; insoluble in ether and in benzene.

Proparacaine Hydrochloride Ophthalmic Solution: Colorless or faint yellow solution.

Propionic Acid: Oily liquid having a slight pungent, rancid odor. Miscible with water and with alcohol and various other organic solvents. *NF category:* Acidifying agent.

Propofol: Clear, colorless to slightly yellowish liquid. Very soluble in methanol and in ethanol; slightly soluble in cyclohexane and in isopropyl alcohol; very slightly soluble in water.

Propoxycaine Hydrochloride: White, odorless, crystalline solid, which discolors on prolonged exposure to light and air. The pH of a solution (1 in 50) is about 5.4. Freely soluble in water; soluble in alcohol; sparingly soluble in ether; practically insoluble in acetone and in chloroform.

Propoxyphene Hydrochloride: White, crystalline powder. Is odorless, and has a bitter taste. Freely soluble in water; soluble in alcohol, in chloroform, and in acetone; practically insoluble in benzene and in ether.

Propoxyphene Napsylate: White powder, having essentially no odor, but having a bitter taste. Very slightly soluble in water; soluble in methanol, in alcohol, in chloroform, and in acetone.

Propranolol Hydrochloride: White to off-white, crystalline powder. Is odorless and has a bitter taste. Melts at about 164°. Soluble in water and in alcohol; slightly soluble in chloroform; practically insoluble in ether.

Propyl Gallate: White, crystalline powder having a very slight, characteristic odor. Slightly soluble in water; freely soluble in alcohol. *NF category:* Antioxidant.

Propylene Glycol: Clear, colorless, viscous liquid having a slight, characteristic taste. Is practically odorless. Absorbs moisture when exposed to moist air. Miscible with water, with acetone, and with chloroform. Soluble in ether and will dissolve many essential oils, but is immiscible with fixed oils. *NF category:* Humectant; plasticizer; solvent.

Propylene Glycol Alginate: White to yellowish fibrous or granular powder. Practically odorless and tasteless. Soluble in water, in solutions of dilute organic acids, and, depending on the degree of esterification, in hydroalcoholic mixture containing up to 60% by weight of alcohol to form stable, viscous colloidal solutions at a pH of 3. *NF category:* Suspending and/or viscosity-increasing agent.

Propylene Glycol Dicaprylate/Dicaprate: Clear, colorless or slightly yellow oily liquid at 20°. Soluble in fatty oils and in light petroleum; slightly soluble in dehydrated alcohol; practically insoluble in water. *NF category:* Emulsifying and/or solubilizing agent; vehicle.

Propylene Glycol Dilaurate: Clear, oily liquid at 20°. Colorless or slightly yellow. Very soluble in alcohol, in methanol, and in methylene chloride; practically insoluble in water.

Propylene Glycol Monocaprylate: Clear, colorless, or slightly yellow, oily liquid at 20°. Very soluble in alcohol, in chloroform, and in methylene chloride; practically insoluble in water. *NF category:* Emulsifying and/or solubilizing agent; tablet and/or capsule diluent; vehicle.

Propylene Glycol Monolaurate: Clear, oily liquid at 20°. Colorless or slightly yellow. Very soluble in alcohol, in methanol, and in methylene chloride; practically insoluble in water.

Propylene Glycol Monostearate: White, wax-like solid or as white, wax-like beads or flakes. Has a slight, agreeable, fatty odor and taste. Insoluble in water, but may be dispersed in hot water with the aid of a small amount of soap or other suitable surface-active agent; soluble in organic solvents such as alcohol, mineral or fixed oils, benzene, ether, and acetone. *NF category:* Emulsifying and/or solubilizing agent.

Propylhexedrine: Clear, colorless liquid, having a characteristic, amine-like odor. Volatilizes slowly at room temperature. Absorbs carbon dioxide from the air, and its solutions are alkaline to litmus. Boils at about 205°. Very slightly soluble in water. Miscible with alcohol, with chloroform, and with ether.

Propyliodone: White or almost white, crystalline powder. Is odorless or has a faint odor. Practically insoluble in water; soluble in acetone, in alcohol, and in ether.

Propylparaben: Small, colorless crystals or white powder. Very slightly soluble in water; freely soluble in alcohol and in ether; slightly soluble in boiling water. *NF category:* Antimicrobial preservative.

Propylparaben Sodium: White powder. Is odorless and hygroscopic. Freely soluble in water; sparingly soluble in alcohol; insoluble in fixed oils. *NF category:* Antimicrobial preservative.

Propylthiouracil: White, powdery, crystalline substance. Is starch-like in appearance and to the touch, and has a bitter taste. Slightly soluble in water; sparingly soluble in alcohol; slightly soluble in chloroform and in ether; soluble in ammonium hydroxide and in alkali hydroxides.

Protamine Sulfate Injection: Colorless solution, which may have the odor of a preservative.

Protamine Sulfate for Injection: White, odorless powder, having the characteristic appearance of solids dried from the frozen state.

Protein Hydrolysate Injection: Yellowish to reddish-amber, transparent liquid.

Protriptyline Hydrochloride: White to yellowish powder. Is odorless, or has not more than a slight odor. Melts at about 168°. Freely soluble in water, in alcohol, and in chloroform; practically insoluble in ether.

Pseudoephedrine Hydrochloride: Fine, white to off-white crystals or powder, having a faint characteristic odor. Very soluble in water; freely soluble in alcohol; slightly soluble in chloroform.

Pseudoephedrine Sulfate: White crystals or crystalline powder. Is odorless. Freely soluble in alcohol.

Pullulan: White powder. Freely soluble in water; practically insoluble in dehydrated alcohol. *NF category:* Bulking agent for freeze-drying; coating agent; plasticizer; polymer membrane; sequestering agent; suspending and/or viscosity-increasing agent; tablet binder; tablet and/or capsule diluent; tablet disintegrant; wetting and/or solubilizing agent.

Pumice: Very light, hard, rough, porous, grayish masses or gritty, grayish powder. Is odorless and tasteless, and is stable in air. Practically insoluble in water; is not attacked by acids.

Pyrantel Pamoate: Yellow to tan solid. Practically insoluble in water and in methanol; soluble in dimethyl sulfoxide; slightly soluble in dimethylformamide.

Pyrazinamide: White to practically white, odorless or practically odorless, crystalline powder. Sparingly soluble in water; slightly soluble in alcohol, in ether, and in chloroform.

Pyrethrum Extract: Pale yellow liquid having a bland, flowery odor. Insoluble in water; soluble in mineral oil and in most organic solvents. *Pyrethrins I* denotes the group containing pyrethrin 1, cinerin 1, and jasmolin 1; *Pyrethrins II* denotes the group containing pyrethrin 2, cinerin 2, and jasmolin 2.

Pyridostigmine Bromide: White or practically white, crystalline powder, having an agreeable, characteristic odor. Is hygroscopic. Freely soluble in water, in alcohol, and in chloroform; slightly soluble in solvent hexane; practically insoluble in ether.

Pyridoxine Hydrochloride: White to practically white crystals or crystalline powder. Is stable in air, and is slowly affected by sunlight. Its solutions have a pH of about 3. Freely soluble in water; slightly soluble in alcohol; insoluble in ether.

Pyrilamine Maleate: White, crystalline powder, usually having a faint odor. Its solutions are acid to litmus. Very soluble in water; freely soluble in alcohol and in chloroform; slightly soluble in ether and in benzene.

Pyrimethamine: White, odorless, crystalline powder. Practically insoluble in water; slightly soluble in acetone, in alcohol, and in chloroform.

Pyrvinium Pamoate: Bright orange or orange-red to practically black, crystalline powder. Practically insoluble in water and in ether; freely soluble in glacial acetic acid; slightly soluble in chloroform and in methoxyethanol; very slightly soluble in methanol.

Pyrvinium Pamoate Oral Suspension: Dark red, opaque suspension of essentially very fine, amorphous particles or aggregates, usually less than 10 µm in size. Larger particles, some of which may be crystals, up to 100 µm in size also may be present.

Quazepam: Off-white to yellowish powder.

Quinapril Hydrochloride: White to off-white powder, with a pink cast at times. Freely soluble in aqueous solvents.

Quinidine Gluconate: White powder. Is odorless and has a very bitter taste. Freely soluble in water; slightly soluble in alcohol.

Quinidine Sulfate: Fine, needle-like, white crystals, frequently cohering in masses, or fine, white powder. Is odorless, and darkens on exposure to light. Its solutions are neutral or alkaline to litmus. Slightly soluble in water; soluble in alcohol; sparingly soluble in chloroform; insoluble in ether.

Quinine Sulfate: White, fine, needle-like crystals, usually lusterless, making a light and readily compressible mass. Is odorless. It darkens on exposure to light. Its saturated solution is neutral or alkaline to litmus. Slightly soluble in water, in alcohol, and in chloroform; very slightly soluble in ether; freely soluble in alcohol at 80°, and in a mixture of 2 volumes of chloroform and 1 volume of dehydrated alcohol; sparingly soluble in water at 100°.

Rabies Immune Globulin: Transparent or slightly opalescent liquid, practically colorless and practically odorless. May develop a slight, granular deposit during storage.

Rabies Vaccine: White to straw-colored, amorphous pellet, which may or may not become fragmented when shaken.

Racepinephrine: White to nearly white, crystalline, odorless powder, gradually darkening on exposure to light and air. With acids, it forms salts that are readily soluble in water, and the base may be recovered by the addition of ammonium hydroxide. Very slightly soluble in water and in alcohol; insoluble in ether, in chloroform, and in fixed and volatile oils.

Racepinephrine Hydrochloride: Fine, white, odorless powder. Darkens on exposure to light and air. Its solutions are acid to litmus. Melts at about 157°. Freely soluble in water; sparingly soluble in alcohol.

Raloxifene Hydrochloride: Almost white to pale yellow powder. Freely soluble in dimethylsulfoxide; sparingly soluble in methanol; slightly soluble in alcohol; very slightly soluble in water, in isopropyl alcohol, and in octanol; practically insoluble in ether and in ethyl acetate.

Ramipril: White to almost white crystalline powder. Freely soluble in methanol; sparingly soluble in water.

Ranitidine Hydrochloride: White to pale yellow, crystalline, practically odorless powder. Is sensitive to light and moisture. Melts at about 140°, with decomposition. Very soluble in water; sparingly soluble in alcohol.

Fully Hydrogenated Rapeseed Oil: White, waxy solid. Insoluble in water and in alcohol. *NF category:* Coating agent; stiffening agent.

Superglycerinated Fully Hydrogenated Rapeseed Oil: White solid. Insoluble in water and in alcohol. *NF category:* Coating agent; emulsifying and/or solubilizing agent; stiffening agent.

Purified Rayon: White, lustrous or dull, fine, soft, filamentous fibers, appearing under the microscope as round, oval, or slightly flattened translucent rods, straight or crimped, striate and with serrate cross-sectional edges. Is practically odorless and practically tasteless. Very soluble in ammoniated cupric oxide TS and in dilute sulfuric acid (3 in 5); insoluble in ordinary solvents.

Repaglinide: White to off-white solid. Melts at about 132° to 136°. Soluble in methanol.

Reserpine: White or pale buff to slightly yellowish, odorless, crystalline powder. Darkens slowly on exposure to light, but more rapidly when in solution. Insoluble in water; freely soluble in acetic acid and in chloroform; slightly soluble in benzene; very slightly soluble in alcohol and in ether.

Resorcinol: White, or practically white, needle-shaped crystals or powder. Has a faint, characteristic odor and a sweetish, followed by a bitter, taste. Acquires a pink tint on exposure to light and air. Its solution (1 in 20) is neutral or acid to litmus. Freely soluble in water, in alcohol, in glycerin, and in ether; slightly soluble in chloroform.

Ribavirin: White, crystalline powder. Freely soluble in water; slightly soluble in dehydrated alcohol.

Riboflavin: Yellow to orange-yellow, crystalline powder having a slight odor. Melts at about 280°. Its saturated solution is neutral to litmus. When dry, it is not appreciably affected by diffused light, but when in solution, light induces quite rapid deterioration, especially in the presence of alkalies. Very slightly soluble in water, in alcohol, and in isotonic sodium chloride solution; soluble in dilute solutions of alkalies; insoluble in ether and in chloroform.

Riboflavin 5'-Phosphate Sodium: Fine, orange-yellow, crystalline powder, having a slight odor. Sparingly soluble in water. When dry, it is not affected by diffused light, but when in solution, light induces deterioration rapidly. Is hygroscopic.

Rifabutin: Amorphous red-violet powder. Soluble in chloroform and in methanol; sparingly soluble in alcohol; very slightly soluble in water.

Rifampin: Red-brown, crystalline powder. Very slightly soluble in water; freely soluble in chloroform; soluble in ethyl acetate and in methanol.

Rimexolone: White to off-white powder. Freely soluble in chloroform; sparingly soluble in methanol.

Risperidone: White or almost white powder. Soluble in methylene chloride; sparingly soluble in alcohol; practically insoluble in water.

Ritodrine Hydrochloride: White to nearly white, odorless or practically odorless, crystalline powder. Melts at about 200°. Freely soluble in water and in alcohol; soluble in *n*-propyl alcohol; practically insoluble in ether.

Ritonavir: Freely soluble in methanol and in methylene chloride; very slightly soluble in acetonitrile; practically insoluble in water.

Ropivacaine Hydrochloride: White, crystalline powder. Soluble in water.

Rose Oil: Colorless or yellow liquid, having the characteristic odor and taste of rose. At 25° is a viscous liquid. Upon gradual cooling, changes to a translucent, crystalline mass, easily liquefied by warming. *NF category:* Flavors and perfumes.

Rose Water Ointment: *NF category:* Ointment base.

Stronger Rose Water: Practically colorless and clear, having the pleasant odor and taste of fresh rose blossoms. Is free from empyreuma, mustiness, and fungal growths. *NF category:* Flavors and perfumes.

Roxarsone: Pale yellow, crystalline powder. Slightly soluble in cold water; soluble in boiling water; freely soluble in acetic acid, in acetone, in alkalies, in methanol, and in dehydrated alcohol; sparingly soluble in dilute mineral acids; insoluble in ether and in ethyl acetate. Puffs up and deflagrates on heating.

Rubella Virus Vaccine Live: Solid having the characteristic appearance of substances dried from the frozen state. Undergoes loss of potency on exposure to sunlight. The Vaccine is to be constituted with a suitable diluent just prior to use.

Saccharin: White crystals or white, crystalline powder. Is odorless or has a faint, aromatic odor. In dilute solution, it is intensely sweet. Its solutions are acid to litmus. Slightly soluble in water, in chloroform, and in ether; soluble in boiling water; sparingly soluble in alcohol. Is readily dissolved by dilute solutions of ammonia, by solutions of alkali hydroxides, and by solutions of alkali carbonates with the evolution of carbon dioxide. *NF category:* Sweetening agent.

Saccharin Calcium: White crystals or white, crystalline powder. Is odorless, or has a faint, aromatic odor, and has an intensely sweet taste even in dilute solutions. Its dilute solution is about 300 times as sweet as sucrose. Freely soluble in water. *NF category:* Sweetening agent.

Saccharin Sodium: White crystals or white, crystalline powder. Is odorless, or has a faint, aromatic odor, and has an intensely sweet taste even in dilute solutions. Its dilute solution is about 300 times as sweet as sucrose. When in powdered form, it usually contains about one-third the theoretical amount of water of hydration as a result of

efflorescence. Freely soluble in water; sparingly soluble in alcohol. *NF category:* Sweetening agent.

Saccharin Sodium Oral Solution: Clear, colorless, odorless liquid, having a sweet taste.

Safflower Oil: Light yellow oil. Thickens and becomes rancid on prolonged exposure to air. Insoluble in water. Miscible with ether and with chloroform. *NF category:* Vehicle (oleaginous).

Salicylamide: White, practically odorless, crystalline powder. Slightly soluble in water and in chloroform; soluble in alcohol and in propylene glycol; freely soluble in ether and in solutions of alkalies.

Salicylic Acid: White crystals, usually in fine needles, or fluffy, white, crystalline powder. Has a sweetish, followed by an acrid, taste and is stable in air. The synthetic form is white and odorless. When prepared from natural methyl salicylate, it may have a slightly yellow or pink tint, and a faint, mint-like odor. Slightly soluble in water and in benzene; freely soluble in alcohol and in ether; soluble in boiling water; sparingly soluble in chloroform.

Scopolamine Hydrobromide: Colorless or white crystals or white, granular powder. Melts at about 197°, with decomposition. Is odorless, and slightly efflorescent in dry air. Freely soluble in water; soluble in alcohol; slightly soluble in chloroform; insoluble in ether.

Secobarbital: White, amorphous or crystalline, odorless powder, having a slightly bitter taste. Its saturated solution has a pH of about 5.6. Very slightly soluble in water; freely soluble in alcohol, in ether, and in solutions of fixed alkali hydroxides and carbonates; soluble in chloroform.

Secobarbital Sodium: White powder. Is odorless, has a bitter taste, and is hygroscopic. Its solutions decompose on standing, heat accelerating the decomposition. Very soluble in water; soluble in alcohol; practically insoluble in ether.

Selegiline Hydrochloride: White, odorless, crystalline powder. Freely soluble in water, in chloroform, and in methanol.

Selenium Sulfide: Reddish-brown to bright orange powder, having not more than a faint odor. Practically insoluble in water and in organic solvents.

Sennosides: Brownish powder.

Serine: White, odorless crystals, having a sweet taste. Soluble in water; practically insoluble in absolute alcohol and in ether.

Sesame Oil: Pale yellow, oily liquid. Is practically odorless, and has a bland taste. Slightly soluble in alcohol. Miscible with ether, with chloroform, with solvent hexane, and with carbon disulfide. *NF category:* Solvent, vehicle (oleaginous).

Sevoflurane: Clear, colorless, volatile, nonflammable liquid. Slightly soluble in water. Miscible with alcohol, with chloroform, and with ether.

Shellac: *Orange Shellac*—Thin, hard, brittle, transparent, pale lemon-yellow to brownish orange flakes, having little or no odor; *Bleached Shellac*—Opaque, amorphous cream to yellow granules or coarse powder, having little or no odor. Insoluble in water; soluble (very slowly) in alcohol, 85% to 95% (w/w); in ether, 13% to 15%; in benzene, 10% to 20%; in petroleum ether, 2% to 6%; soluble in aqueous solutions of ethanolamines, alkalies, and borax; sparingly soluble in oil of turpentine. *NF category:* Coating agent.

Dental-Type Silica: Fine, white, hygroscopic, odorless, amorphous powder, in which the diameter of the average particles ranges between 0.5 and 40 µm. Insoluble in water, in alcohol, and in acid (except hydrofluoric acid); soluble in hot solutions of alkali hydroxides. *NF category:* Glidant and/or anticaking agent; suspending and/or viscosity-increasing agent.

Hydrophobic Colloidal Silica: Light, fine, white or almost white, amorphous powder, not wettable by water. Dissolves slowly in hot solutions of alkali hydroxides; practically insoluble in water and in mineral acids, except hydrofluoric acid. *NF category:* Glidant and/or anticaking agent; suspending and/or viscosity-increasing agent.

Purified Siliceous Earth: Very fine, white, light gray, or pale buff mixture of amorphous powder and lesser amounts of crystalline polymorphs, including quartz and cristobalite. Is gritty, readily absorbs moisture, and retains about four times its weight of water without becoming fluid. Insoluble in water, in acids, and in dilute solutions of the alkali hydroxides. *NF category:* Filtering aid; sorbent.

Silicon Dioxide: Fine, white, hygroscopic, odorless, amorphous powder, in which the diameter of the average particles ranges between 2 and 10 µm. Insoluble in water, in alcohol, and in other organic solvents; soluble in hot solutions of alkali hydroxides. *NF category:* Desiccant; suspending and/or viscosity-increasing agent.

Colloidal Silicon Dioxide: Light, white, nongritty powder of extremely fine particle size (about 15 nm). Insoluble in water and in acid (except hydrofluoric); soluble in hot solutions of alkali hydroxides. *NF category:* Glidant and/or anticaking agent; suspending and/or viscosity-increasing agent.

Silver Nitrate: Colorless or white crystals. The pH of its solutions is about 5.5. On exposure to light in the presence of organic matter, it becomes gray or grayish black. Very soluble in water and even more so in boiling water; sparingly soluble in alcohol; freely soluble in boiling alcohol; slightly soluble in ether.

Toughened Silver Nitrate: White, crystalline masses generally molded as pencils or cones. It breaks with a fibrous fracture. Its solutions are neutral to litmus. It becomes gray or grayish black upon exposure to light. Soluble in water to the extent of its nitrate content (there is always a residue of silver chloride). Partially soluble in alcohol; slightly soluble in ether.

Simethicone: Translucent, gray, viscous fluid. The liquid phase is soluble in chloroform, in ether, and in benzene, but silicon dioxide remains as a residue in these solvents. Insoluble in water and in alcohol. *NF category:* Antifoaming agent; water repelling agent.

Simvastatin: White to off-white powder. Practically insoluble in water; freely soluble in chloroform, in methanol, and in alcohol; sparingly soluble in propylene glycol; very slightly soluble in hexane.

Smallpox Vaccine: Liquid Vaccine is a turbid, whitish to greenish suspension, which may have a slight odor due to the antimicrobial agent. Dried Vaccine is a yellow to grayish pellet, which may or may not become fragmented when shaken.

Soda Lime: White or grayish-white granules. May have a color if an indicator has been added. *NF category:* Sorbent, carbon dioxide.

Sodium Acetate: Colorless, transparent crystals, or white, granular crystalline powder, or white flakes. Is odorless or has a faint acetous odor, and has a slightly bitter, saline taste. Is efflorescent in warm, dry air. Very soluble in water; soluble in alcohol. *NF category:* Buffering agent.

Sodium Alginate: Practically odorless and tasteless, coarse or fine powder, yellowish white in color. Soluble in water, forming a viscous, colloidal solution; insoluble in alcohol and in hydroalcoholic solutions in which the alcohol content is greater than about 30% by weight; insoluble in chloroform, in ether, and in acids when the pH of the resulting solution becomes lower than about 3. *NF category:* Suspending and/or viscosity-increasing agent.

Sodium Ascorbate: White or very faintly yellow crystals or crystalline powder. Is odorless or practically odorless. Is relatively stable in air. On exposure to light it gradually darkens. Freely soluble in water; very slightly soluble in alcohol; insoluble in chloroform and in ether.

Sodium Benzoate: White, odorless or practically odorless, granular or crystalline powder. Is stable in air. Freely soluble in water; sparingly soluble in alcohol and somewhat more soluble in 90% alcohol. *NF category:* Antimicrobial preservative.

Sodium Bicarbonate: White, crystalline powder. Is stable in dry air, but slowly decomposes in moist air. Its solutions, when freshly prepared with cold water, without shaking, are alkaline to litmus. The alkalinity increases as the solutions stand, as they are agitated, or as they are heated. Soluble in water; insoluble in alcohol. *NF category:* Alkalizing agent.

Sodium Bisulfite: White, crystalline powder. Freely soluble in cold water and in hot water; sparingly soluble in alcohol. *NF category:* Antioxidant.

Sodium Borate: Colorless, transparent crystals or white, crystalline powder. Is odorless. Its solutions are alkaline to phenolphthalein TS. As it effloresces in warm, dry air, the crystals are often coated with white powder. Soluble in water; freely soluble in boiling water and in glycerin; insoluble in alcohol. *NF category:* Alkalizing agent.

Sodium Bromide: White, crystalline powder or colorless, cubical crystals. Freely soluble in water; soluble in alcohol.

Sodium Butyrate: Clear, colorless, hygroscopic powder. Soluble in water and in methanol. Melting range is about 250° to 253°.

Sodium Caprylate: A white, crystalline powder. Very soluble or freely soluble in water; freely soluble in acetic acid; sparingly soluble in alcohol; practically insoluble in acetone.

Sodium Carbonate: Colorless crystals, or white, crystalline powder or granules. Is stable in air under ordinary conditions. When exposed to dry air above 50°, the hydrous salt effloresces and, at 100°, becomes anhydrous. Freely soluble in water, but still more soluble in boiling water. *NF category:* Alkalizing agent.

Sodium Cetostearyl Sulfate: A white or pale yellow, amorphous or crystalline powder. Soluble in hot water giving an opalescent solution; partly soluble in alcohol; practically insoluble in cold water.

Sodium Chloride: Colorless, cubic crystals or white crystalline powder. Has a saline taste. Freely soluble in water; and slightly more soluble in boiling water; soluble in glycerin; slightly soluble in alcohol. *NF category:* Tonicity agent.

Sodium Chloride Inhalation Solution: Clear, colorless solution.

Bacteriostatic Sodium Chloride Injection: Clear, colorless solution, odorless or having the odor of the bacteriostatic substance. *NF category:* Vehicle (sterile).

Sodium Chloride Irrigation: Clear, colorless solution.

Sodium Citrate: Colorless crystals, or white, crystalline powder. Hydrous form freely soluble in water and very soluble in boiling water. Insoluble in alcohol. *NF category:* Buffering agent.

Sodium Citrate and Citric Acid Oral Solution: Clear solution having the color of any added preservative or flavoring agents.

Sodium Dehydroacetate: White or practically white, odorless powder, having a slight characteristic taste. Freely soluble in water, in propylene glycol, and in glycerin. *NF category:* Antimicrobial preservative.

Sodium Fluoride: White, odorless powder. Soluble in water; insoluble in alcohol.

Sodium Formaldehyde Sulfoxylate: White crystals or hard, white masses, having the characteristic odor of garlic. Freely soluble in water; slightly soluble in alcohol, in ether, in chloroform, and in benzene. *NF category:* Antioxidant.

Sodium Hydroxide: White, or practically white, fused masses, in small pellets, in flakes, or sticks, and in other forms. Is hard and brittle and shows a crystalline fracture. Exposed to the air, it rapidly absorbs carbon dioxide and moisture. Freely soluble in water and in alcohol. *NF category:* Alkalizing agent.

Sodium Hypochlorite Solution: Clear, pale greenish-yellow liquid, having the odor of chlorine. Is affected by light.

Sodium Iodide: Colorless, odorless crystals, or white, crystalline powder. Is deliquescent in moist air, and develops a brown tint upon decomposition. Very soluble in water; freely soluble in alcohol and in glycerin.

Sodium Lactate Solution: Clear, colorless or practically colorless, slightly viscous liquid, odorless or having a slight, not unpleasant odor. Miscible with water. *NF category:* Buffering agent.

Sodium Lauryl Sulfate: Small, white or light yellow crystals having a slight, characteristic odor. Freely soluble in water, forming an opalescent solution. *NF category:* Emulsifying and/or solubilizing agent; tablet and/or capsule lubricant; wetting and/or solubilizing agent.

Sodium Metabisulfite: White crystals or white to yellowish, crystalline powder, having the odor of sulfur dioxide. Freely soluble in water and in glycerin; slightly soluble in alcohol. *NF category:* Antioxidant.

Sodium Monofluorophosphate: White to slightly gray, odorless powder. Freely soluble in water.

Sodium Nitrite: White to slightly yellow, granular powder, or white or practically white, opaque, fused masses or sticks. Has a mild, saline taste and is deliquescent in air. Its solutions are alkaline to litmus. Freely soluble in water; sparingly soluble in alcohol.

Sodium Nitrite Injection: Clear, colorless liquid.

Sodium Nitroprusside: Reddish-brown, practically odorless, crystals or powder. Freely soluble in water; slightly soluble in alcohol; very slightly soluble in chloroform; insoluble in benzene.

Dibasic Sodium Phosphate (*dried*)**:** White powder that readily absorbs moisture. Freely soluble in water; insoluble in alcohol. *NF category:* Buffering agent.

Dibasic Sodium Phosphate (*heptahydrate*)**:** Colorless or white, granular or caked salt. Effloresces in warm, dry air. Its solutions are alkaline to phenolphthalein TS, a 0.1 M solution having a pH of about 9. Freely soluble in water; very slightly soluble in alcohol. *NF category:* Buffering agent.

Monobasic Sodium Phosphate: Colorless crystals or white, crystalline powder. Is odorless and is slightly deliquescent. Its solutions are acid to litmus and effervesce with sodium carbonate. Freely soluble in water; practically insoluble in alcohol. *NF category:* Buffering agent.

Tribasic Sodium Phosphate: The formula for a crystalline material is approximately $4(Na_3PO_4 \cdot 12H_2O)NaOH$. It occurs as white, odorless crystals or granules or as a crystalline powder. It is freely soluble in water; insoluble in alcohol. The pH of a 1 in 100 solution is between 11.5 and 12.0.

Sodium Polystyrene Sulfonate: Golden brown, fine powder. Is odorless and has a characteristic taste. Insoluble in water.

Sodium Propionate: Colorless, transparent crystals or granular, crystalline powder. Is odorless, or has a faint acetic-butyric odor and is deliquescent in moist air. Very soluble in water; soluble in alcohol. *NF category:* Antimicrobial preservative.

Sodium Salicylate: Amorphous or microcrystalline powder or scales. Is colorless, or has not more than a faint, pink tinge. Is odorless, or has a faint, characteristic odor, and is affected by light. A freshly made solution (1 in 10) is neutral or acid to litmus. Freely (and slowly) soluble in water and in glycerin; very soluble in boiling water and in boiling alcohol; slowly soluble in alcohol.

Sodium Starch Glycolate: White, tasteless, odorless, relatively free-flowing powder; available in several different viscosity grades. A 2% (w/v) dispersion in cold water settles, on standing, in the form of a highly hydrated layer. *NF category:* Tablet disintegrant.

Sodium Stearate: Fine, white powder, soapy to the touch, usually having a slight, tallow-like odor. Is affected by light. Its solutions are alkaline to phenolphthalein TS. Slowly soluble in cold water and in cold alcohol; readily soluble in hot water and in hot alcohol. *NF category:* Emulsifying and/or solubilizing agent.

Sodium Stearyl Fumarate: Fine, white powder. Slightly soluble in methanol; practically insoluble in water. *NF category:* Tablet and/or capsule lubricant.

Sodium Sulfate: Large, colorless, odorless, transparent crystals, or a granular powder. Effloresces rapidly in air, liquefies in its water of hydration at about 33°, and loses all of its water of hydration at about 100°. Freely soluble in water; soluble in glycerin; insoluble in alcohol.

Sodium Sulfite: Colorless crystals. Freely soluble in water; very slightly soluble in alcohol. *NF category:* Antioxidant.

Sodium Tartrate: Transparent, colorless, odorless crystals. Freely soluble in water; insoluble in alcohol. *NF category:* Sequestering agent.

Sodium Thiosulfate: Large, colorless crystals or coarse, crystalline powder. Is deliquescent in moist air and effloresces in dry air at tem-

peratures exceeding 33°. Its solutions are neutral or faintly alkaline to litmus. Very soluble in water; insoluble in alcohol. *NF category:* Antioxidant.

Sorbic Acid: Free-flowing, white, crystalline powder, having a characteristic odor. Slightly soluble in water; soluble in alcohol and in ether. *NF category:* Antimicrobial preservative.

Sorbitan Monolaurate: Yellow to amber-colored, oily liquid, having a bland, characteristic odor. Soluble in mineral oil; slightly soluble in cottonseed oil and in ethyl acetate; insoluble in water. *NF category:* Emulsifying and/or solubilizing agent; tablet and/or capsule lubricant; wetting and/or solubilizing agent.

Sorbitan Monooleate: Viscous, yellow to amber-colored, oily liquid, having a bland, characteristic odor. Insoluble in water and in propylene glycol. Miscible with mineral and vegetable oils. *NF category:* Emulsifying and/or solubilizing agent; tablet and/or capsule lubricant; wetting and/or solubilizing agent.

Sorbitan Monopalmitate: Cream-colored, waxy solid having a faint fatty odor. Soluble in warm absolute alcohol; soluble, with haze, in warm peanut oil and in warm mineral oil; insoluble in water. *NF category:* Emulsifying and/or solubilizing agent; tablet and/or capsule lubricant; wetting and/or solubilizing agent.

Sorbitan Monostearate: Cream-colored to tan, hard, waxy solid, having a bland odor and taste. Soluble, with haze, above 50° in mineral oil and in ethyl acetate; dispersible in warm water; insoluble in cold water and in acetone. *NF category:* Emulsifying and/or solubilizing agent; tablet and/or capsule lubricant; wetting and/or solubilizing agent.

Sorbitan Sesquioleate: Viscous, yellow to amber-colored, oily liquid. Soluble in alcohol, in isopropyl alcohol, in cottonseed oil, and in mineral oil; insoluble in water and in propylene glycol. *NF category:* Emulsifying and/or solubilizing agent; tablet and/or capsule lubricant; wetting and/or solubilizing agent.

Sorbitan Trioleate: Yellow to amber-colored, oily liquid. Soluble in methyl alcohol, in alcohol, in isopropyl alcohol, in corn oil, in cottonseed oil, and in mineral oil; insoluble in water, in ethylene glycol, and in propylene glycol. *NF category:* Emulsifying and/or solubilizing agent; tablet and/or capsule lubricant; wetting and/or solubilizing agent.

Sorbitol: D-Sorbitol occurs as white granules, powder, or crystalline masses. Is odorless, and has a sweet taste with a cold sensation. Very soluble in water; sparingly soluble in alcohol; and practically insoluble in ethyl ether. Is hygroscopic. *NF category:* Humectant; sweetening agent; tablet and/or capsule diluent.

Sorbitol Solution: Clear, colorless, syrupy liquid. Is odorless and has a sweet taste. It sometimes separates into crystalline masses. Miscible with water, with alcohol, with glycerin, and with propylene glycol. Is neutral to litmus. *NF category:* Sweetening agent; vehicle (flavored and/or sweetened).

Sorbitol Sorbitan Solution: A clear, colorless to pale yellow, syrupy liquid. Is odorless and has a sweet taste. Miscible with water, with alcohol, with glycerin, and with propylene glycol; insoluble in mineral oil and in vegetable oil. *NF category:* Humectant; plasticizer.

Sotalol Hydrochloride: White to off-white powder. Freely soluble in water; soluble in alcohol; very slightly soluble in chloroform.

Soybean Oil: Clear, pale yellow, oily liquid having a characteristic odor and taste. Insoluble in water. Miscible with ether and with chloroform. *NF category:* Vehicle (oleaginous).

Hydrogenated Soybean Oil: A white mass or powder that melts to a clear, pale yellow liquid when heated. Freely soluble in methylene chloride, in hexane after heating, and in toluene; very slightly soluble in alcohol; practically insoluble in water. *NF category:* Emollient.

Spectinomycin Hydrochloride: White to pale-buff crystalline powder. Freely soluble in water; practically insoluble in alcohol, in chloroform, and in ether.

Spironolactone: Light cream-colored to light tan, crystalline powder. Has a faint to mild mercaptan-like odor; is stable in air. Practically insoluble in water; freely soluble in benzene and in chloroform; soluble in ethyl acetate and in alcohol; slightly soluble in methanol and in fixed oils.

Squalane: Colorless, practically odorless transparent oil. Insoluble in water; very slightly soluble in absolute alcohol; slightly soluble in acetone. Miscible with ether and with chloroform. *NF category:* Ointment base; vehicle (oleaginous).

Stannous Chloride: White, crystalline powder or colorless crystals, efflorescent in air. Freely soluble in water (the solution becomes cloudy after standing or on dilution) and in alcohol; dissolves in dilute hydrochloric acid. *NF category:* Emulsifying agent; antioxidant.

Stannous Fluoride: White, crystalline powder, having a bitter, salty taste. Melts at about 213°. Freely soluble in water; practically insoluble in alcohol, in ether, and in chloroform.

Stanozolol: Odorless, crystalline powder, occurring in two forms: as needles, melting at about 155°, and as prisms, melting at about 235°. Insoluble in water; soluble in dimethylformamide; sparingly soluble in alcohol and in chloroform; slightly soluble in ethyl acetate and in acetone; very slightly soluble in benzene.

Starch: Irregular, angular, white masses or fine powder. Is odorless, and has a slight, characteristic taste. Insoluble in cold water and in alcohol. *NF category:* Tablet and/or capsule diluent; tablet disintegrant; tablet and/or capsule lubricant.

Corn Starch: Irregular, angular, white masses or fine powder. Is odorless, and has a slight, characteristic taste. Insoluble in cold water and in alcohol. *NF category:* Tablet and/or capsule diluent; tablet disintegrant; tablet binder; suspending and/or viscosity-increasing agent.

Potato Starch: Irregular, angular, white masses or fine powder. Is odorless, and has a slight, characteristic taste. Insoluble in cold water and in alcohol. *NF category:* Tablet and/or capsule diluent; tablet disintegrant; tablet binder; suspending and/or viscosity-increasing agent.

Pregelatinized Starch: Moderately coarse to fine, white to off-white powder. Is odorless and has a slight, characteristic taste. Slightly soluble to soluble in cold water; insoluble in alcohol. *NF category:* Tablet binder; tablet and/or capsule diluent; tablet disintegrant.

Pregelatinized Modified Starch: Moderately coarse to fine, white to off-white powder. Is odorless and has a slight, characteristic taste. Slightly soluble to soluble in cold water; insoluble in alcohol. *NF category:* Tablet binder; tablet and/or capsule diluent; tablet disintegrant.

Tapioca Starch: Irregular, angular, white to pale yellow masses or fine powder. Insoluble in cold water and in alcohol. *NF category:* Suspending and/or viscosity-increasing agent; tablet binder; tablet and/or capsule diluent; tablet disintegrant.

Wheat Starch: Irregular, angular, white masses or fine powder. Is odorless and has a slight, characteristic taste. Insoluble in cold water and in alcohol. *NF category:* Tablet and/or capsule diluent; tablet disintegrant; tablet binder; suspending and/or viscosity-increasing agent.

Stavudine: White to off-white, crystalline powder. Soluble in water, in dimethylacetamide, and in dimethyl sulfoxide; sparingly soluble in methanol, in alcohol, and in acetonitrile; slightly soluble in dichloromethane; insoluble in hexane.

Stearic Acid: Hard, white or faintly yellowish, somewhat glossy and crystalline solid, or white or yellowish-white powder. Its odor and taste are slight, suggesting tallow. Practically insoluble in water; freely soluble in chloroform and in ether; soluble in alcohol. *NF category:* Emulsifying and/or solubilizing agent; tablet and/or capsule lubricant.

Purified Stearic Acid: Hard, white or faintly yellowish, somewhat glossy and crystalline solid, or white or yellowish-white powder. Its odor and taste are slight, suggesting tallow. Freely soluble in chloroform and in ether; soluble in alcohol; practically insoluble in water. *NF category:* Tablet and/or capsule lubricant.

Stearoyl Polyoxylglycerides: Pale yellow, waxy solids. Dispersible in warm water and in warm paraffin; freely soluble in methylene chloride; soluble in warm methanol. *NF category:* Ointment base; solvent.

Stearyl Alcohol: Unctuous, white flakes or granules. Has a faint, characteristic odor and a bland, mild taste. Insoluble in water; soluble in alcohol and in ether. *NF category:* Stiffening agent.

Storax: Semiliquid, grayish to grayish-brown, sticky, opaque mass depositing on standing a heavy dark brown layer (Levant Storax); or semisolid, sometimes a solid mass, softened by gently warming (American Storax). Is transparent in thin layers, has a characteristic odor and taste, and is more dense than water. Insoluble in water; soluble, usually incompletely, in an equal weight of warm alcohol; soluble in acetone, in carbon disulfide, and in ether, some insoluble residue usually remaining.

Streptomycin Sulfate: White or practically white powder. Is odorless or has not more than a faint odor. Is hygroscopic, but is stable in air and on exposure to light. Its solutions are acid to practically neutral to litmus. Freely soluble in water; very slightly soluble in alcohol; practically insoluble in chloroform.

Streptomycin Sulfate Injection: Clear, colorless to yellow, viscous liquid. Is odorless or has a slight odor.

Strontium Chloride: Colorless, odorless crystals or white granules. Effloresces in air; deliquesces in moist air. Very soluble in water; soluble in alcohol.

Succinic Acid: White, odorless crystals. Soluble in water, in alcohol, and in glycerin; freely soluble in boiling water. *NF category:* Buffering agent.

Succinylcholine Chloride: White, odorless, crystalline powder. Its solutions have a pH of about 4. The dihydrate form melts at about 160°; the anhydrous form melts at about 190°, and is hygroscopic. Freely soluble in water; slightly soluble in alcohol and in chloroform; practically insoluble in ether.

Sucralose: White to off-white, crystalline powder. Freely soluble in water, in methanol, and in alcohol; slightly soluble in ethyl acetate. *NF category:* Sweetening agent.

Sucrose: White, crystalline powder or lustrous, dry, colorless or white crystals. Very soluble in water; slightly soluble in alcohol; practically insoluble in dehydrated alcohol. *NF category:* Coating agent; sweetening agent; tablet and/or capsule diluent.

Sucrose Octaacetate: White, practically odorless powder, having an intensely bitter taste. Is hygroscopic. Very slightly soluble in water; very soluble in methanol and in chloroform; soluble in alcohol and in ether. *NF category:* Alcohol denaturant.

Sufentanil Citrate: White powder. Soluble in water; freely soluble in methanol; sparingly soluble in acetone, in alcohol, and in chloroform. Melts between 133° and 140°.

Compressible Sugar: Practically white, crystalline, odorless powder, having a sweet taste. Is stable in air. The sucrose portion of Compressible Sugar is very soluble in water. *NF category:* Sweetening agent; tablet and/or capsule diluent.

Confectioner's Sugar: Fine, white, odorless powder, having a sweet taste. Is stable in air. The sucrose portion of Confectioner's Sugar is soluble in cold water. Confectioner's Sugar is freely soluble in boiling water. *NF category:* Sweetening agent; tablet and/or capsule diluent.

Sugar Spheres: Hard, brittle, free-flowing, spherical masses ranging generally in size from 10- to 60-mesh. Usually white, but may be colored. Solubility in water varies according to the sugar-to-starch ratio. *NF category:* Vehicle (solid carrier).

Sulbactam Sodium: White to off-white, crystalline powder. Freely soluble in water and in dilute acid; sparingly soluble in acetone, in ethyl acetate, and in chloroform.

Sulconazole Nitrate: White to off-white, crystalline powder. Melts at about 130°, with decomposition. Very slightly soluble in water, in toluene, and in dioxane; slightly soluble in alcohol, in chloroform, in acetone, and in methylene chloride; sparingly soluble in methanol; freely soluble in pyridine.

Sulfabenzamide: Fine, white, practically odorless powder. Insoluble in water and in ether; soluble in alcohol, in acetone, and in sodium hydroxide TS.

Sulfacetamide: White, crystalline powder, odorless and having a characteristic sour taste. Its aqueous solutions are sensitive to light, and are unstable when acidic or strongly alkaline. Slightly soluble in water and in ether; freely soluble in dilute mineral acids and in solutions of potassium and sodium hydroxides; soluble in alcohol; very slightly soluble in chloroform; practically insoluble in benzene.

Sulfacetamide Sodium: White, crystalline powder. Is odorless and has a bitter taste. Freely soluble in water; sparingly soluble in alcohol; practically insoluble in chloroform and in ether.

Sulfadiazine: White or slightly yellow powder. Is odorless or nearly odorless and is stable in air, but slowly darkens on exposure to light. Practically insoluble in water; freely soluble in dilute mineral acids, in solutions of potassium and sodium hydroxides, and in ammonia TS; sparingly soluble in alcohol and in acetone; slightly soluble in human serum at 37°.

Silver Sulfadiazine: White to creamy-white, crystalline powder, odorless to having a slight odor. Is stable in air, but turns yellow on exposure to light. Slightly soluble in acetone; practically insoluble in alcohol, in chloroform, and in ether; freely soluble in 30% ammonium solution; decomposes in moderately strong mineral acids.

Sulfadiazine Sodium: White powder. On prolonged exposure to humid air it absorbs carbon dioxide with the liberation of sulfadiazine and becomes incompletely soluble in water. Its solutions are alkaline to phenolphthalein. Is affected by light. Freely soluble in water; slightly soluble in alcohol.

Sulfadimethoxine: Practically white, crystalline powder. Soluble in 2 N sodium hydroxide; sparingly soluble in 2 N hydrochloric acid; slightly soluble in alcohol, in ether, in chloroform, and in hexane; practically insoluble in water.

Sulfamethazine: White to yellowish-white powder, which may darken on exposure to light. Has a slightly bitter taste and is practically odorless. Very slightly soluble in water and in ether; soluble in acetone; slightly soluble in alcohol.

Sulfamethizole: White crystals or powder, having a slightly bitter taste. Is practically odorless, and has no odor of hydrogen sulfide. Very slightly soluble in water, in chloroform, and in ether; freely soluble in solutions of ammonium, potassium, and sodium hydroxides; soluble in dilute mineral acids and in acetone; sparingly soluble in alcohol; practically insoluble in benzene.

Sulfamethoxazole: White to off-white, practically odorless, crystalline powder. Practically insoluble in water, in ether, and in chloroform; freely soluble in acetone and in dilute solutions of sodium hydroxide; sparingly soluble in alcohol.

Sulfapyridine: White or faintly yellowish-white crystals, granules, or powder. Is odorless or practically odorless, and is stable in air, but slowly darkens on exposure to light. Very slightly soluble in water; freely soluble in dilute mineral acids and in solutions of potassium and sodium hydroxides; sparingly soluble in acetone; slightly soluble in alcohol.

Sulfasalazine: Bright yellow or brownish-yellow, odorless, fine powder. Melts at about 255°, with decomposition. Very slightly soluble in alcohol; practically insoluble in water, in ether, in chloroform, and in benzene; soluble in aqueous solutions of alkali hydroxides.

Sulfathiazole: Fine, white or faintly yellowish-white, practically odorless powder. Very slightly soluble in water; soluble in acetone, in dilute mineral acids, in solutions of alkali hydroxides, and in 6 N ammonium hydroxide; slightly soluble in alcohol.

Sulfinpyrazone: White to off-white powder. Practically insoluble in water and in solvent hexane; soluble in alcohol and in acetone; sparingly soluble in dilute alkali.

Sulfisoxazole: White to slightly yellowish, odorless, crystalline powder. Very slightly soluble in water; soluble in boiling alcohol and in 3 N hydrochloric acid.

Sulfisoxazole Acetyl: White or slightly yellow, crystalline powder. Practically insoluble in water; sparingly soluble in chloroform; slightly soluble in alcohol.

Precipitated Sulfur: Very fine, pale yellow, amorphous or microcrystalline powder. Is odorless and tasteless. Practically insoluble in water; very soluble in carbon disulfide; slightly soluble in olive oil; very slightly soluble in alcohol.

Sublimed Sulfur: Fine, yellow, crystalline powder, having a faint odor and taste. Practically insoluble in water; sparingly soluble in olive oil; practically insoluble in alcohol.

Sulfur Dioxide: Colorless, nonflammable gas, possessing a strong, suffocating odor characteristic of burning sulfur. Under pressure, it condenses readily to a colorless liquid that boils at –10° and has a density of approximately 1.5. At 20° and at standard pressure, approximately 36 volumes dissolve in 1 volume of water and approximately 114 volumes dissolve in 1 volume of alcohol. Soluble also in ether and in chloroform. *NF category:* Antioxidant.

Sulfuric Acid: Clear, colorless, oily liquid. Miscible with water and with alcohol with the generation of much heat. Is very caustic and corrosive. Specific gravity is about 1.84. *NF category:* Acidifying agent.

Sulindac: Yellow, crystalline powder, which is odorless or practically so. Slightly soluble in methanol, in alcohol, in acetone, and in chloroform; very slightly soluble in isopropanol and in ethyl acetate; practically insoluble in hexane and in water.

Sulisobenzone: Light tan powder, with a melting point of about 145°. Freely soluble in methanol, in alcohol, and in water; sparingly soluble in ethyl acetate.

Sumatriptan: White to pale yellow powder. Very slightly soluble in water.

Sumatriptan Succinate: White or almost white powder. Freely soluble in water; sparingly soluble in methanol; practically insoluble in methylene chloride.

Suprofen: White to off-white powder, odorless to having a slight odor. Sparingly soluble in water.

Syrup: *NF category:* Sweetening agent; tablet binder; vehicle (flavored and/or sweetened).

Tacrine Hydrochloride: White powder. Freely soluble in water, in 0.1 N hydrochloric acid, in pH 4.0 acetate buffer, in phosphate buffer (pH between 7.0 and 7.4), in methanol, in dimethylsulfoxide, in alcohol, and in propylene glycol; sparingly soluble in linoleic acid and in polyethylene glycol 400.

Tagatose: White or almost white crystals, having a sweet taste. Very soluble in water; very slightly soluble in alcohol. *NF category:* Sweetening agent; humectant.

Talc: Very fine, white or grayish-white, crystalline powder. Is unctuous, adheres readily to the skin, and is free from grittiness. *NF category:* Glidant and/or anticaking agent; tablet and/or capsule lubricant.

Tamoxifen Citrate: White, fine, crystalline powder. Very slightly soluble in water, in acetone, in chloroform, and in alcohol; soluble in methanol. Melts at about 142°, with decomposition.

Tamsulosin Hydrochloride: White or almost white crystalline powder. Melts with decomposition at approximately 230°. Freely soluble in formic acid; sparingly soluble in methanol; slightly soluble in water and in dehydrated alcohol; practically insoluble in ether.

Tannic Acid: Amorphous powder, glistening scales, or spongy masses, varying in color from yellowish-white to light brown. Is odorless or has a faint, characteristic odor, and has a strongly astringent taste. Very soluble in water, in acetone, and in alcohol; is freely soluble in diluted alcohol, and only slightly soluble in dehydrated alcohol; practically insoluble in benzene, in chloroform, in ether, and in solvent hexane; 1 g dissolves in about 1 mL of warm glycerin.

Tartaric Acid: Colorless or translucent crystals or white, fine to granular, crystalline powder. Is odorless, has an acid taste, and is stable in air. Very soluble in water; freely soluble in alcohol. *NF category:* Acidifying agent.

Taurine: White crystals or crystalline powder. Soluble in water.

Tazobactam: White to pale yellow, nonhygroscopic, crystalline powder. Soluble in dimethylformamide; slightly soluble in water, in methanol, in acetone, and in alcohol; very slightly soluble in ethyl acetate, in ethyl ether, and in chloroform; insoluble in hexane.

Technetium Tc 99m Aggregated Albumin Injection: Milky suspension, from which particles settle upon standing.

Technetium Tc 99m Pentetate Injection: Clear, colorless solution.

Sodium Pertechnetate Tc 99m Injection: Clear, colorless solution.

Technetium Tc 99m (Pyro- and trimeta-) Phosphates Injection: Clear solution.

Technetium Tc 99m Sulfur Colloid Injection: Colloidal dispersion. Slightly opalescent, colorless to light tan liquid.

Temazepam: White or nearly white, crystalline powder. Very slightly soluble in water; sparingly soluble in alcohol. Melts between 157° and 163°, within a 3° range.

Terazosin Hydrochloride: White to pale yellow, crystalline powder. Freely soluble in isotonic saline solution; soluble in methanol and in water; slightly soluble in alcohol and in 0.1 N hydrochloric acid; very slightly soluble in chloroform; practically insoluble in acetone and in hexanes.

Terbinafine Hydrochloride: White or off-white powder. Freely soluble in dehydrated alcohol and in methanol; slightly soluble in acetone; very slightly or slightly soluble in water.

Terbutaline Sulfate: White to gray-white, crystalline powder. Is odorless or has a faint odor of acetic acid. Soluble in water and in 0.1 N hydrochloric acid; slightly soluble in methanol; insoluble in chloroform.

Terpin Hydrate: Colorless, lustrous crystals or white powder. Has a slight odor, and effloresces in dry air. A hot solution (1 in 100) is neutral to litmus. When dried in vacuum at 60° for 2 hours, it melts at about 103°. Slightly soluble in water, in chloroform, and in ether; very soluble in boiling alcohol; soluble in alcohol; sparingly soluble in boiling water.

Testolactone: White to off-white, practically odorless, crystalline powder. Melts at about 218°. Slightly soluble in water and in benzyl alcohol; soluble in alcohol and in chloroform; insoluble in ether and in solvent hexane.

Testosterone: White or slightly creamy white crystals or crystalline powder. Is odorless, and is stable in air. Practically insoluble in water; freely soluble in dehydrated alcohol and in chloroform; soluble in dioxane and in vegetable oils; slightly soluble in ether.

Testosterone Cypionate: White or creamy white, crystalline powder. Is odorless or has a slight odor, and is stable in air. Insoluble in water; freely soluble in alcohol, in chloroform, in dioxane, and in ether; soluble in vegetable oils.

Testosterone Enanthate: White or creamy white, crystalline powder. Is odorless or has a faint odor characteristic of heptanoic acid. Insoluble in water; very soluble in ether; soluble in vegetable oils.

Testosterone Propionate: White or creamy white crystals or crystalline powder. Is odorless and is stable in air. Insoluble in water; freely soluble in alcohol, in dioxane, in ether, and in other organic solvents; soluble in vegetable oils.

Tetanus Immune Globulin: Transparent or slightly opalescent liquid, practically colorless and practically odorless. May develop a slight granular deposit during storage.

Tetanus Toxoid: Clear, colorless to brownish-yellow, or slightly turbid liquid, free from evident clumps or particles, having a characteristic odor or an odor of formaldehyde.

Tetanus Toxoid Adsorbed: Turbid, white, slightly gray, or slightly pink suspension, free from evident clumps after shaking.

Tetanus and Diphtheria Toxoids Adsorbed for Adult Use: Turbid, white, slightly gray, or cream-colored suspension, free from evident clumps after shaking.

Tetracaine: White or light yellow, waxy solid. Very slightly soluble in water; soluble in alcohol, in ether, in benzene, and in chloroform.

Tetracaine Hydrochloride: Fine, white, crystalline, odorless powder. Has a slightly bitter taste followed by a sense of numbness. Its solutions are neutral to litmus. Melts at about 148°, or may occur in either of two other polymorphic modifications that melt at about 134° and 139°, respectively. Mixtures of the forms may melt within the range of 134° to 147°. Is hygroscopic. Very soluble in water; soluble in alcohol; insoluble in ether and in benzene.

Tetracycline: Yellow, odorless, crystalline powder. Is stable in air, but exposure to strong sunlight causes it to darken. It loses potency in solutions of pH below 2, and is rapidly destroyed by alkali hydroxide solutions. Very slightly soluble in water; freely soluble in dilute acid and in alkali hydroxide solutions; sparingly soluble in alcohol; practically insoluble in chloroform and in ether.

Tetracycline Hydrochloride: Yellow, odorless, crystalline powder. Is moderately hygroscopic. Is stable in air, but exposure to strong sunlight in moist air causes it to darken. It loses potency in solution at a pH below 2, and is rapidly destroyed by alkali hydroxide solutions. Soluble in water and in solutions of alkali hydroxides and carbonates; slightly soluble in alcohol; practically insoluble in chloroform and in ether.

Tetrahydrozoline Hydrochloride: White, odorless solid. Melts at about 256°, with decomposition. Freely soluble in water and in alcohol; very slightly soluble in chloroform; practically insoluble in ether.

Thalidomide: White to off-white powder. Very soluble in dimethylformamide, in dioxane, and in pyridine; sparingly soluble in acetone, in butyl acetate, in ethanol, in ethyl acetate, in glacial acetic acid, in methanol, and in water; practically insoluble in benzene, in chloroform, and in ether.

Theophylline: White, odorless, crystalline powder, having a bitter taste. Is stable in air. Slightly soluble in water, but more soluble in hot water; freely soluble in solutions of alkali hydroxides and in ammonia; sparingly soluble in alcohol, in chloroform, and in ether.

Theophylline Sodium Glycinate: White, crystalline powder having a slight ammoniacal odor and a bitter taste. Freely soluble in water; very slightly soluble in alcohol; practically insoluble in chloroform.

Thiabendazole: White to practically white, odorless or practically odorless powder. Practically insoluble in water; slightly soluble in acetone and in alcohol; very slightly soluble in chloroform and in ether.

Thiacetarsamide: White to yellowish, crystalline powder. Sparingly soluble in cold dehydrated alcohol, in cold methanol, and in cold water; more soluble in water above 90°; soluble in warm dehydrated alcohol and in warm methanol; insoluble in warm isopropyl alcohol. pK_a is 4.

Thiamine Hydrochloride: White crystals or crystalline powder, usually having a slight, characteristic odor. When exposed to air, the anhydrous product rapidly absorbs about 4% of water. Melts at about 248°, with some decomposition. Freely soluble in water; soluble in glycerin; slightly soluble in alcohol; insoluble in ether and in benzene.

Thiamine Mononitrate: White crystals or crystalline powder, usually having a slight, characteristic odor. Sparingly soluble in water; slightly soluble in alcohol; very slightly soluble in chloroform.

Thiethylperazine Maleate: Yellowish, granular powder. Is odorless or has not more than a slight odor. Melts at about 183°, with decomposition. Practically insoluble in water; slightly soluble in methanol; practically insoluble in chloroform.

Thimerosal: Light cream-colored, crystalline powder, having a slight characteristic odor. Is affected by light. The pH of a solution (1 in 100) is about 6.7. Freely soluble in water; soluble in alcohol; practically insoluble in ether. *NF category:* Antimicrobial preservative.

Thimerosal Topical Solution: Clear liquid, having a slight characteristic odor. Is affected by light.

Thimerosal Tincture: Transparent, mobile liquid, having the characteristic odor of alcohol and acetone. Is affected by light.

Thioguanine: Pale yellow, odorless or practically odorless, crystalline powder. Insoluble in water, in alcohol, and in chloroform; freely soluble in dilute solutions of alkali hydroxides.

Thiopental Sodium: White to off-white, crystalline powder, or yellowish-white to pale greenish-yellow, hygroscopic powder. May have a disagreeable odor. Its solutions are alkaline to litmus. Its solutions decompose on standing, and on boiling precipitation occurs. Soluble in water and in alcohol; insoluble in benzene, in absolute ether, and in solvent hexane.

Thiopental Sodium for Injection: White to off-white, crystalline powder, or yellowish-white to pale greenish-yellow, hygroscopic powder. May have a disagreeable odor. Its solutions are alkaline to litmus. Its solutions decompose on standing, and on boiling precipitation occurs.

Thioridazine: White to slightly yellow, crystalline or micronized powder, odorless or having a faint odor. Practically insoluble in water; freely soluble in dehydrated alcohol and in ether; very soluble in chloroform.

Thioridazine Hydrochloride: White to slightly yellow, granular powder, having a faint odor and a very bitter taste. Freely soluble in water, in methanol, and in chloroform; insoluble in ether.

Thiostrepton: White to off-white, crystalline solid. Practically insoluble in water, in the lower alcohols, in nonpolar organic solvents, and in dilute aqueous acids or alkali; soluble in glacial acetic acid, in chloroform, in dimethylformamide, in dimethyl sulfoxide, in dioxane, and in pyridine.

Thiotepa: Fine, white, crystalline flakes, having a faint odor. Freely soluble in water, in alcohol, in chloroform, and in ether.

Thiotepa for Injection: White powder.

Thiothixene: White to tan, practically odorless crystals. Is affected by light. Practically insoluble in water; very soluble in chloroform; slightly soluble in methanol and in acetone.

Thiothixene Hydrochloride: White, or practically white, crystalline powder, having a slight odor. Is affected by light. Soluble in water; slightly soluble in chloroform; practically insoluble in benzene, in acetone, and in ether.

Threonine: White, odorless crystals, having a slightly sweet taste. Freely soluble in water; insoluble in absolute alcohol, in ether, and in chloroform.

Thrombin: White to grayish, amorphous substance dried from the frozen state.

Thymol: Colorless, often large, crystals, or white, crystalline powder, having an aromatic, thyme-like odor and a pungent taste. Is affected by light. Its alcohol solution is neutral to litmus. Very slightly soluble in water; freely soluble in alcohol, in chloroform, in ether, and in olive oil; soluble in glacial acetic acid and in fixed and volatile oils. *NF category:* Antimicrobial preservative; flavors and perfumes.

Thyroid: Yellowish to buff-colored, amorphous powder, having a slight, characteristic, meat-like odor and a saline taste.

Tiagabine Hydrochloride: White to off-white powder. Freely soluble in methanol and in alcohol; soluble in isopropanol; very slightly soluble in chloroform; sparingly soluble in water; practically insoluble in *n*-heptane.

Tiamulin: A sticky, translucent yellowish mass, slightly hygroscopic. Very soluble in dichloromethane; freely soluble in dehydrated alcohol; practically insoluble in water.

Ticarcillin Disodium: White to pale yellow powder, or white to pale yellow solid. Freely soluble in water.

Tiletamine Hydrochloride: White to off-white, crystalline powder. Freely soluble in water and in 0.1 N hydrochloric acid; soluble in methanol; slightly soluble in chloroform; practically insoluble in ether.

Tilmicosin: White to off-white, amorphous solid. Slightly soluble in water and in *n*-hexane.

Timolol Maleate: White to practically white, odorless or practically odorless powder. Soluble in water, in alcohol, and in methanol; sparingly soluble in chloroform and in propylene glycol; insoluble in ether and in cyclohexane.

Tinidazole: Almost white or pale yellow, crystalline powder. Soluble in acetone and in methylene chloride; sparingly soluble in methanol; practically insoluble in water.

Titanium Dioxide: White, odorless, tasteless powder. Its 1 in 10 suspension in water is neutral to litmus. Insoluble in water, in hydrochloric acid, in nitric acid, and in 2 N sulfuric acid. Dissolves in hydrofluoric acid and in hot sulfuric acid. Is rendered soluble by fusion with potassium bisulfate or with alkali carbonates or hydroxides. *NF category:* Coating agent.

Tizanidine Hydrochloride: Almost white to slightly yellow, crystalline powder. Slightly soluble in water and in methanol.

Tobramycin: White to off-white, hygroscopic powder. Freely soluble in water; very slightly soluble in alcohol; practically insoluble in chloroform and in ether.

Tobramycin Sulfate Injection: Clear, colorless solution.

Tocainide Hydrochloride: Fine, white, odorless powder. Freely soluble in water and in alcohol; practically insoluble in chloroform and in ether.

Tocopherol: Clear, colorless to yellow, yellowish-brown, or greenish-yellow, viscous oil. Is odorless. Soluble in oils, in fats, in acetone, in alcohol, in chloroform, in ether, and in alcohol; insoluble in water. *NF category:* Antioxidant.

Tocopherols Excipient: Brownish-red to red, clear, viscous oil, having a mild, characteristic odor and taste. May show a slight separation of waxlike constituents in microcrystalline form. Oxidizes and darkens slowly in air and on exposure to light, particularly in alkaline media. Insoluble in water; soluble in alcohol; miscible with acetone, with chloroform, with ether, and with vegetable oils. *NF category:* Antioxidant.

Tolazamide: White to off-white, crystalline powder, odorless or having a slight odor. Melts with decomposition in the approximate range of 161° to 173°. Very slightly soluble in water; freely soluble in chloroform; soluble in acetone; slightly soluble in alcohol.

Tolazoline Hydrochloride: White to off-white, crystalline powder. Its solutions are slightly acid to litmus. Freely soluble in water and in alcohol.

Tolbutamide: White, or practically white, crystalline powder. Is slightly bitter and practically odorless. Practically insoluble in water; soluble in alcohol and in chloroform.

Tolbutamide Sodium: White to off-white, practically odorless, crystalline powder, having a slightly bitter taste. Freely soluble in water; soluble in alcohol and in chloroform; very slightly soluble in ether.

Tolcapone: Yellow, fine powder or fine powder with lumps. Freely soluble in acetone and in tetrahydrofuran; soluble in methanol and in ethyl acetate; sparingly soluble in chloroform and in dichloromethane; insoluble in water and in *n*-hexane.

Tolmetin Sodium: Light yellow to light orange, crystalline powder. Freely soluble in water and in methanol; slightly soluble in alcohol; very slightly soluble in chloroform.

Tolnaftate: White to creamy white, fine powder, having a slight odor. Practically insoluble in water; freely soluble in acetone and in chloroform; sparingly soluble in ether; slightly soluble in alcohol.

Tolu Balsam: Brown or yellowish-brown, plastic solid, transparent in thin layers and brittle when old, dried, or exposed to cold temperatures. Has a pleasant, aromatic odor resembling that of vanilla, and a mild, aromatic taste. Practically insoluble in water and in solvent hexane; soluble in alcohol, in chloroform, and in ether, sometimes with slight residue or turbidity. *NF category:* Flavors and perfumes.

Topiramate: White to off-white powder. Freely soluble in dichloromethane.

Torsemide: White to off-white, crystalline powder. Slightly soluble in 0.1 N sodium hydroxide, in 0.1 N hydrochloric acid, in alcohol, and in methanol; very slightly soluble in acetone and in chloroform; practically insoluble in water and in ether.

Tragacanth: Is odorless, and has an insipid, mucilaginous taste. *NF category:* Suspending and/or viscosity-increasing agent.

Trazodone Hydrochloride: White to off-white, crystalline powder. Sparingly soluble in chloroform and in water. Melts between 231° and 234° when the melting point determination is carried out in an evacuated capillary tube; otherwise melts with decomposition over a broad range below 230°.

Tretinoin: Yellow to light-orange, crystalline powder. Insoluble in water; slightly soluble in alcohol and in chloroform.

Triacetin: Colorless, somewhat oily liquid having a slight, fatty odor and a bitter taste. Soluble in water; slightly soluble in carbon disulfide. Miscible with alcohol, with ether, and with chloroform. *NF category:* Plasticizer.

Triamcinolone: White or practically white, odorless, crystalline powder. Very slightly soluble in water, in chloroform, and in ether; slightly soluble in alcohol and in methanol.

Triamcinolone Acetonide: White to cream-colored, crystalline powder, having not more than a slight odor. Practically insoluble in water; sparingly soluble in dehydrated alcohol, in chloroform, and in methanol.

Triamcinolone Diacetate: Fine, white to off-white, crystalline powder, having not more than a slight odor. Practically insoluble in water; soluble in chloroform; sparingly soluble in alcohol and in methanol; slightly soluble in ether.

Triamcinolone Hexacetonide: White to cream-colored powder. Practically insoluble in water; soluble in chloroform; slightly soluble in methanol.

Triamterene: Yellow, odorless, crystalline powder. Practically insoluble in water, in benzene, in chloroform, in ether, and in dilute alkali hydroxides; soluble in formic acid; sparingly soluble in methoxyethanol;

very slightly soluble in acetic acid, in alcohol, and in dilute mineral acids.

Triazolam: White to off-white, practically odorless, crystalline powder. Soluble in chloroform; slightly soluble in alcohol; practically insoluble in ether and in water.

Tributyl Citrate: Clear, practically colorless, oily liquid. Insoluble in water; freely soluble in alcohol, in isopropyl alcohol, in acetone, and in toluene. *NF category:* Plasticizer.

Trichlorfon: White crystalline powder. Freely soluble in acetone, in alcohol, in benzene, in chloroform, in ether, and in water; very soluble in methylene chloride; very slightly soluble in hexane and in pentane. Decomposed by alkali. Melts at about 78° with decomposition.

Trichlormethiazide: White or practically white, crystalline powder. Is odorless, or has a slight characteristic odor. Melts at about 274°, with decomposition. Very slightly soluble in water, in ether, and in chloroform; freely soluble in acetone; soluble in methanol; sparingly soluble in alcohol.

Trichloromonofluoromethane: Clear, colorless gas, having a faint, ethereal odor. Its vapor pressure at 25° is about 796 mm of mercury (1 psig). *NF category:* Aerosol propellant.

Triclosan: Fine, whitish, crystalline powder. Melts at about 57°. Practically insoluble in water; soluble in methanol, in alcohol, and in acetone; slightly soluble in hexane.

Trientine Hydrochloride: White to pale yellow, crystalline powder. Melts at about 117°. Insoluble in chloroform and in ether; slightly soluble in alcohol; soluble in methanol; freely soluble in water.

Triethyl Citrate: Practically colorless, oily liquid. Soluble in water; miscible with alcohol and with ether. *NF category:* Plasticizer.

Trifluoperazine Hydrochloride: White to pale yellow, crystalline powder. Is practically odorless, and has a bitter taste. Melts at about 242°, with decomposition. Freely soluble in water; soluble in alcohol; sparingly soluble in chloroform; insoluble in ether and in benzene.

Triflupromazine: Viscous, light amber-colored, oily liquid, which crystallizes on prolonged standing into large, irregular crystals. Practically insoluble in water.

Triflupromazine Hydrochloride: White to pale tan, crystalline powder, having a slight, characteristic odor. Melts between 170° and 178°. Soluble in water, in alcohol, and in acetone; insoluble in ether.

Trifluridine: Odorless, white powder appearing under the microscope as rodlike crystals; melts at 175°, with sublimation.

Medium-Chain Triglycerides: Colorless or slightly yellowish, oily liquid. Practically insoluble in water; miscible with alcohol, with methylene chloride, with hexane, and with fatty oils.

Trihexyphenidyl Hydrochloride: White or slightly off-white, crystalline powder, having not more than a very faint odor. Melts at about 250°. Slightly soluble in water; soluble in alcohol and in chloroform.

Trimeprazine Tartrate: White to off-white, odorless, crystalline powder. Freely soluble in water and in chloroform; soluble in alcohol; very slightly soluble in ether and in benzene.

Trimethobenzamide Hydrochloride: White, crystalline powder having a slight phenolic odor. Soluble in water and in warm alcohol; insoluble in ether and in benzene.

Trimethoprim: White to cream-colored, odorless crystals, or crystalline powder. Very slightly soluble in water; soluble in benzyl alcohol; sparingly soluble in chloroform and in methanol; slightly soluble in alcohol and in acetone; practically insoluble in ether and in carbon tetrachloride.

Trimethoprim Sulfate: White to off-white, crystalline powder. Soluble in water, in alcohol, in dilute mineral acids, and in fixed alkalies.

Trimipramine Maleate: White to almost white crystalline powder. Slightly soluble in water and in alcohol.

Trioxsalen: White to off-white or grayish, odorless, crystalline solid. Melts at about 230°. Practically insoluble in water; sparingly soluble in chloroform; slightly soluble in alcohol.

Tripelennamine Hydrochloride: White, crystalline powder. Slowly darkens on exposure to light. Its solutions are practically neutral to litmus. Freely soluble in water, in alcohol, and in chloroform; slightly soluble in acetone; insoluble in benzene, in ether, and in ethyl acetate.

Triprolidine Hydrochloride: White, crystalline powder, having no more than a slight, but unpleasant, odor. Its solutions are alkaline to litmus, and it melts at about 115°. Soluble in water, in alcohol, and in chloroform; insoluble in ether.

Trolamine: Colorless to pale yellow, viscous, hygroscopic liquid having a slight, ammoniacal odor. Miscible with water and with alcohol. Soluble in chloroform. *NF category:* Alkalizing agent; emulsifying and/or solubilizing agent.

Troleandomycin: White, odorless, crystalline powder. Freely soluble in alcohol; soluble in chloroform; slightly soluble in ether and in water.

Tromethamine: White, crystalline powder, having a slight, characteristic odor. Freely soluble in water and in low molecular weight aliphatic alcohols; practically insoluble in chloroform, in benzene, and in carbon tetrachloride.

Tropicamide: White or practically white, crystalline powder, odorless or having not more than a slight odor. Slightly soluble in water; freely soluble in chloroform and in solutions of strong acids.

Crystallized Trypsin: White to yellowish white, odorless, crystalline or amorphous powder.

Tryptophan: White to slightly yellowish-white crystals or crystalline powder, having a slightly bitter taste. Soluble in hot alcohol and in dilute hydrochloric acid.

Tuberculin: Old Tuberculin is a clear, brownish liquid, which is readily miscible with water and has a characteristic odor. Purified Protein Derivative (PPD) of Tuberculin is a very slightly opalescent, colorless solution. Old Tuberculin and PPD concentrates contain 50% of glycerin for use with various application devices. Old Tuberculin and PPD are also dried on the tines of multiple-puncture devices.

Tubocurarine Chloride: White or yellowish-white to grayish-white, crystalline powder. Melts at about 270°, with decomposition. Soluble in water; sparingly soluble in alcohol.

Tylosin: White to buff-colored powder. Freely soluble in methanol; soluble in alcohol, in amyl acetate, in chloroform, and in dilute mineral acids; slightly soluble in water.

Tylosin Tartrate: Almost white or slightly yellow, hygroscopic powder. Freely soluble in water and in dichloromethane; slightly soluble in alcohol. It dissolves in dilute solutions of mineral acids.

Tyloxapol: Viscous, amber liquid, having a slight, aromatic odor. May exhibit a slight turbidity. Slowly but freely miscible with water. Soluble in glacial acetic acid, in benzene, in toluene, in carbon tetrachloride, in chloroform, and in carbon disulfide. *NF category:* Wetting and/or solubilizing agent.

Tyrosine: White, odorless, tasteless crystals or crystalline powder. Very slightly soluble in water; insoluble in alcohol and in ether.

Ubidecarenone: Yellow to orange, crystalline powder. Melts at about 48°. Soluble in ether; very slightly soluble in dehydrated alcohol; practically insoluble in water.

Undecylenic Acid: Clear, colorless to pale yellow liquid having a characteristic odor. Practically insoluble in water; miscible with alcohol, with chloroform, with ether, with benzene, and with fixed and volatile oils.

Urea: Colorless to white, prismatic crystals, or white, crystalline powder, or small white pellets. Is practically odorless, but may gradually develop a slight odor of ammonia upon long standing. Its solutions are neutral to litmus. Freely soluble in water and in boiling alcohol; practically insoluble in chloroform and in ether.

Ursodiol: White or almost white, crystalline powder. Practically insoluble in water; freely soluble in alcohol and in glacial acetic acid; sparingly soluble in chloroform; slightly soluble in ether.

Vaccinia Immune Globulin: Transparent or slightly opalescent liquid. Is practically colorless and practically odorless. May develop a slight, granular deposit during storage.

Powdered Valerian Extract: Brown, hygroscopic, powdery or easily pulverizable mass. Soluble in water to form a slightly cloudy solution; sparingly soluble in 70 percent alcohol; practically insoluble in alcohol.

Valganciclovir Hydrochloride: White to off-white powder. Very soluble in 2-propanol; freely soluble in alcohol; slightly soluble in hexane; practically insoluble in acetone or in ethyl acetate.

Valine: White, odorless, tasteless crystals. Soluble in water; practically insoluble in ether, in alcohol, and in acetone.

Valproic Acid: Colorless to pale yellow, slightly viscous, clear liquid, having a characteristic odor. Refractive index: about 1.423 at 20°. Slightly soluble in water; freely soluble in 1 N sodium hydroxide, in methanol, in alcohol, in acetone, in chloroform, in benzene, in ether, and in *n*-heptane; slightly soluble in 0.1 N hydrochloric acid.

Valrubicin: Orange to orange-red, crystalline powder. Soluble in methylene chloride, in dehydrated alcohol, in methanol, and in acetone; very slightly soluble in water, in hexane, and in petroleum ether.

Vancomycin Hydrochloride: White, almost white, or tan to brown, free-flowing powder, odorless, and having a bitter taste. Freely soluble in water; insoluble in ether and in chloroform.

Sterile Vancomycin Hydrochloride: Tan to brown, free-flowing powder, odorless and having a bitter taste. Freely soluble in water; insoluble in ether and in chloroform.

Vanillin: Fine, white to slightly yellow crystals, usually needle-like, having an odor and taste suggestive of vanilla. Is affected by light. Its solutions are acid to litmus. Slightly soluble in water; freely soluble in alcohol, in chloroform, in ether, and in solutions of the fixed alkali hydroxides; soluble in glycerin and in hot water. *NF category:* Flavors and perfumes.

Vasopressin Injection: Clear, colorless or practically colorless liquid, having a faint, characteristic odor.

Vecuronium Bromide: White or creamy white crystals, or a crystalline powder. Slightly soluble in water and in acetone; sparingly soluble in alcohol.

Hydrogenated Vegetable Oil: Type I Hydrogenated Vegetable Oil—Fine, white powder, beads, or small flakes. Type II Hydrogenated Vegetable Oil—Plastic (semi-solid) or flakes having a softer consistency than Type I. Insoluble in water; soluble in hot isopropyl alcohol, in hexane, and in chloroform. *NF category:* Type I Hydrogenated Vegetable Oil—Tablet and/or capsule lubricant; Type II Hydrogenated Vegetable Oil—Ointment base.

Verapamil Hydrochloride: White or practically white, crystalline powder. Is practically odorless and has a bitter taste. Soluble in water; freely soluble in chloroform; sparingly soluble in alcohol; practically insoluble in ether.

Vidarabine: White to off-white powder. Very slightly soluble in water; slightly soluble in dimethylformamide.

Vinblastine Sulfate: White or slightly yellow, odorless, amorphous or crystalline powder. Is hygroscopic. Freely soluble in water.

Vincristine Sulfate: White to slightly yellow, odorless, amorphous or crystalline powder. Is hygroscopic. Freely soluble in water; soluble in methanol; slightly soluble in alcohol.

Vincristine Sulfate for Injection: Yellowish-white solid, having the characteristic appearance of products prepared by freeze-drying.

Vinorelbine Tartrate: White to yellow or light brown, amorphous powder. Freely soluble in water.

Vitamin A: In liquid form, a light-yellow to red oil that may solidify upon refrigeration. In solid form, has the appearance of any diluent that has been added. May be practically odorless or may have a mild fishy odor, but has no rancid odor or taste. Is unstable to air and light. In liquid form, insoluble in water and in glycerin; very soluble in chloroform and in ether; soluble in absolute alcohol and in vegetable oils. In solid form, may be dispersible in water.

Vitamin E: Practically odorless and tasteless. The alpha tocopherols and alpha tocopheryl acetates occur as clear, yellow, or greenish yellow, viscous oils. *d*-Alpha tocopheryl acetate may solidify in the cold. Alpha tocopheryl acid succinate occurs as a white powder; the *d*-isomer melts at about 75°, and the *dl*-form melts at about 70°. The alpha tocopherols are unstable to air and light, particularly when in alkaline media. The esters are stable to air and light, but are unstable to alkali; the acid succinate is also unstable when held molten. Alpha tocopheryl acid succinate is insoluble in water; slightly soluble in alkaline solutions; soluble in alcohol, in ether, in acetone, and in vegetable oils; very soluble in chloroform. The other forms of Vitamin E are insoluble in water; soluble in alcohol; miscible with ether, with acetone, with vegetable oils, and with chloroform.

Vitamin E Preparation: The liquid forms are clear, yellow to brownish red, viscous oils. The solid forms are white to tan-white granular powders. The liquid forms are insoluble in water; soluble in alcohol; miscible with ether, with acetone, with vegetable oils, and with chloroform. The solid forms disperse in water to give cloudy suspensions.

Warfarin Sodium: White, odorless, amorphous or crystalline powder, having a slightly bitter taste. Is discolored by light. Very soluble in water; freely soluble in alcohol; very slightly soluble in chloroform and in ether.

Water for Injection: Clear, colorless, odorless liquid. *NF category:* Solvent.

Bacteriostatic Water for Injection: Clear, colorless liquid, odorless or having the odor of the antimicrobial substance. *NF category:* Vehicle (sterile).

Sterile Water for Inhalation: Clear, colorless solution.

Sterile Water for Injection: Clear, colorless, odorless liquid. *NF category:* Solvent.

Sterile Water for Irrigation: Clear, colorless, odorless liquid. *NF category:* Solvent.

Purified Water: Clear, colorless, odorless liquid. *NF category:* Solvent.

Carnauba Wax: Light brown to pale yellow, moderately coarse powder or flakes, possessing a characteristic bland odor, and free from rancidity. Specific gravity is about 0.99. Insoluble in water; freely soluble in warm benzene; soluble in warm chloroform and in warm toluene; slightly soluble in boiling alcohol. *NF category:* Coating agent.

Emulsifying Wax: Creamy white, wax-like solid, having a mild, characteristic odor. Insoluble in water; freely soluble in ether, in chloroform, in most hydrocarbon solvents, and in aerosol propellants; soluble in alcohol. *NF category:* Emulsifying and/or solubilizing agent; stiffening agent.

Microcrystalline Wax: White or cream-colored, odorless, waxy solid. Insoluble in water; sparingly soluble in dehydrated alcohol; soluble in chloroform, in ether, in volatile oils, and in most warm fixed oils. *NF category:* Coating agent.

White Wax: Yellowish-white solid, somewhat translucent in thin layers. Has a faint, characteristic odor, and is free from rancidity. Specific gravity is about 0.95. Insoluble in water; sparingly soluble in cold alcohol. Boiling alcohol dissolves the cerotic acid and a portion of the myricin, which are constituents of White Wax. Completely soluble in chloroform, in ether, and in fixed and volatile oils. Partly soluble in cold benzene and in cold carbon disulfide; completely soluble in these liquids at about 30°. *NF category:* Stiffening agent.

Yellow Wax: Solid varying in color from yellow to grayish brown. Has an agreeable, honey-like odor. Is somewhat brittle when cold, and presents a dull, granular, noncrystalline fracture when broken. It becomes pliable from the heat of the hand. Specific gravity is about 0.95. Insoluble in water; sparingly soluble in cold alcohol. Boiling alcohol dissolves the cerotic acid and a portion of the myricin, that are constituents of Yellow Wax. Completely soluble in chloroform, in ether, in fixed oils, and in volatile oils; partly soluble in cold benzene and in cold carbon disulfide; completely soluble in these liquids at about 30°. *NF category:* Stiffening agent.

Wheat Bran: Light tan powder having a characteristic aroma. Practically insoluble in cold water and in alcohol. Available in a variety of particle sizes depending upon the degree of milling to which it is subjected. Color and flavor development variable, depending on the extent to which it is heat-stabilized.

Xanthan Gum: Cream-colored powder. Its solutions in water are neutral to litmus. Soluble in hot or cold water. *NF category:* Suspending and/or viscosity-increasing agent.

Xenon Xe 127: Clear, colorless gas.

Xenon Xe 133 Injection: Clear, colorless solution.

Xylazine: Colorless to white crystals. Sparingly soluble in dilute acid, in acetone, and in chloroform; insoluble in dilute alkali.

Xylazine Hydrochloride: Colorless to white crystals. Sparingly soluble in dilute acid, in acetone, and in methanol; insoluble in dilute alkali.

Xylitol: White crystals or crystalline powder. It has a sweet taste and produces a cooling sensation in the mouth. One g dissolves in about 0.65 mL of water. Sparingly soluble in alcohol. Crystalline xylitol has a melting range between 92° and 96°.

Xylometazoline Hydrochloride: White to off-white, odorless, crystalline powder. Melts above 300°, with decomposition. Soluble in water; freely soluble in alcohol; sparingly soluble in chloroform; practically insoluble in benzene and in ether.

Xylose: Colorless needles or white, crystalline powder. Is odorless, and has a slightly sweet taste. Very soluble in water; slightly soluble in alcohol.

Yellow Fever Vaccine: Slightly dull, light-orange colored, flaky or crust-like, desiccated mass.

Yohimbine Hydrochloride: White to yellow powder. Melts at about 295°, with decomposition. Slightly soluble in water and in alcohol; soluble in boiling water.

Yttrium Chloride: Colorless, deliquescent crystals. Soluble in water and in alcohol.

Zalcitabine: White to off-white, crystalline powder. Soluble in water and in methanol; sparingly soluble in alcohol, in acetonitrile, in chloroform, and in methylene chloride; slightly soluble in cyclohexane.

Zein: White to yellow powder. Soluble in aqueous alcohols, in glycols, in ethylene glycol ethyl ether, in furfuryl alcohol, in tetrahydrofurfuryl alcohol, and in aqueous alkaline solutions of pH 11.5 or greater; readily soluble in acetone-water mixtures between the limits of 60% and 80% of acetone by volume; insoluble in water, in acetone, and in all anhydrous alcohols except methanol. *NF category:* Coating agent.

Zidovudine: White to yellowish powder. Melts at about 124°. Exhibits polymorphism. Sparingly soluble in water; soluble in alcohol.

Zileuton: White to off-white powder.

Zinc Acetate: White crystals or granules, having a slight acetous odor and an astringent taste. Is slightly efflorescent. Freely soluble in water and in boiling alcohol; slightly soluble in alcohol.

Zinc Chloride: White or practically white, odorless, crystalline powder, or white or practically white crystalline granules. May also be in porcelain-like masses or molded into cylinders. Is very deliquescent. A solution (1 in 10) is acid to litmus. Very soluble in water; freely soluble in alcohol and in glycerin. Its solution in water or in alcohol is usually slightly turbid, but the turbidity disappears when a small quantity of hydrochloric acid is added.

Zinc Gluconate: White or practically white powder or granules. Soluble in water; very slightly soluble in alcohol.

Zinc Oxide: Very fine, odorless, amorphous, white or yellowish white powder, free from gritty particles. It gradually absorbs carbon dioxide from air. Insoluble in water and in alcohol; soluble in dilute acids.

Zinc Stearate: Fine, white, bulky powder, free from grittiness. Has a faint, characteristic odor. Is neutral to moistened litmus paper. Insoluble in water, in alcohol, and in ether. *NF category:* Tablet and/or capsule lubricant.

Zinc Sulfate: Colorless, transparent prisms, or small needles. May occur as a white, granular, crystalline powder. Is odorless and is efflorescent in dry air. Its solutions are acid to litmus. Very soluble in water (heptahydrate); freely soluble in water (monohydrate); freely soluble in glycerin (heptahydrate); practically insoluble in alcohol (monohydrate); insoluble in alcohol (heptahydrate).

Zinc Undecylenate: Fine, white powder. Practically insoluble in water and in alcohol.

Zolazepam Hydrochloride: White to off-white, crystalline powder. Freely soluble in water and in 0.1 N hydrochloric acid; soluble in methanol; slightly soluble in chloroform; practically insoluble in ether.

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