HANDY BOOK
FOR
THE HOSPITAL CORPS
UNITED STATES NAVY

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CONTENTS.

Anatomy and Physiology 4
First Aid. 36
Emergency Surgery 42
Bandaging 51
Field Hygiene and Sanitation 56
On the March 61
Hygiene and Sanitation 63
Personal Hygiene. 73
Air and Ventilation 77
Prevention of Disease 84
Pharmacy 95
Medicines and Medicinal Agents of the U. S. Navy Supply Table 130
Chemistry. 152
Naval Hospitals 175
Hospital Duties and Ward Management 180
Nursing 187
The Operating Room and Surgical Technique 206
Clerical Duties 212

ANATOMY AND PHYSIOLOGY

(NOTE.—The study of the structure and function of a complex organism, such as the human body is, cannot be considered simple. Even when taken up in an elementary way; furthermore, the numerous technical terms that must be used in the descriptive work will soon entangle the student in a jungle of words, unless he is willing to refer frequently to medical dictionaries and books on anatomy and physiology for definitions and plates. As it is well known that descriptions, supplemented by a plate, form a much more lasting picture on the mind of a student, it is particularly recommended that the figures used in the works on anatomy be studied carefully in conjunction with this text, as a comprehensive idea of the subject can hardly be obtained without a clear mental picture of the part being studied.)

Define anatomy. Anatomy is the study of the construction of the body and the relation of the different organs and other structures to one another.

What is comparative anatomy? Comparative anatomy is the study of the construction of one species of animal in comparison to that of another species; for example, the muscles controlling the movement of the external ear in a horse are well developed, allowing free movement of the pinna, while in man these muscles, though present in a rudimentary state, allow no motion, except in rare instances.

What is visceral anatomy? Visceral anatomy is the study of organs having a special function, such as the liver, in contradistinction to the study of the bones, muscles and skin.

What is morbid anatomy? Morbid anatomy is the study of the diseased tissues as seen by the naked eye.

What is normal histology? Normal histology is the study of finely cut pieces of the normal tissues of the body, properly prepared and magnified, with the aid of a microscope, for the purpose of observing the minute construction of the tissues. When the tissues are diseased, this study is called pathological histology.

What is embryology? Embryology is the study of the development of the offspring, from the beginning of the germ cell in the uterus of the mother to the time of birth.

Into what divisions is the body divided for the purpose of description? Head and neck, trunk, upper and lower extremities. The trunk is divided into the chest or thorax, the abdomen, and pelvis; the upper extremities into the arms, forearms, wrists and hands; the lower extremities into the thighs, legs, ankles and feet.

What are the general types of tissues that go to make up the body? There are four types of tissues making up the entire body—1. Muscular; 2. Epithelial; 3. Connective; 4. Nerve tissues.

What different kinds of muscular tissues are there, and where may each type be found? 1. Voluntary striated muscles, found in all muscles that we move of our own volition, such as the biceps; 2. Involuntary striated muscle, found only in the muscular substance of the heart and not under the domination of the will; 3. Involuntary non-striated muscle; this type is widely distributed, being found in the digestive tract, the respiratory tract, the ducts of the larger glands, the arteries, the iris, the genito-urinary apparatus, the lymph and sweat glands. We have no control over the action of this type of muscle, and are entirely unconscious of its action.

What are the epithelial tissues? The epithelial tissues are formed of different types of epithelial cells, and make up the covering of the mucous membranes and the free surface of the skin. There are many different kinds of epithelial cells, depending on the work that is required of them. Those of the stomach that assist in

digestion are very different from those found in the trachea; some are found in a single layer as in certain parts of the kidney, others in several layers piled one on the other as in the intestine; some contain pigment, such as the deep layers of the skin, especially in the negro, and lastly there are certain specialized epithelial cells that are sensitive to the production of certain perceptive elements and are connected with sight, hearing, smell and taste.

What are the principle forms of connective tissue? They are areolar tissue, such as found immediately under the skin and between muscle fibers; dense fibrous tissue, found covering groups of muscle and forming tendons; cartilage; bone; dentine; the supporting tissue of the nervous system and the various other organs; and adipose tissue or fat.

Of what are the nervous tissues made up? Nerve cells and nerve fibers for transmitting the impulses of the nerve cells. These are all held together by a supportive connective tissue frame-work as mentioned above.

OSTEOLOGY AND SYNDESMOLOGY.

Define osteology. Osteology is the study of the bony framework of the body, including the study of individual bones.

Define syndesmology. Syndesmology is the study of the joints of the body, taking into consideration the parts forming the joints and the movements each joint is limited to in its action.

What is the skeleton? The skeleton is the bony framework of the body, its purpose being to maintain the body in its form and to protect certain vital organs from injury.

How many bones are there in the body? There are 206 bones in the body. This number includes the small bones of the ear and the patellae.

What is the structure of bone? Bone is a form of connective tissue made up of an outer hard, compact substance and an inner spongy substance. Bone contains certain lime salts and these salts increase in quantity as a person ages, making the

bones harder, but more brittle. Intimately covering all bones is a thin, highly vascular membrane called the periosteum. This membrane has the power of generating new bone, when for some reason or other the original bone has been destroyed.

How does bone receive its nourishment? Each bone has a blood supply, usually from a small artery that enters the bone by a small opening; bone is also nourished from the numerous little capillaries contained in the periosteum.

What are the different kinds of bones? Long bones, such as the femur and humerus; short bones, such as the bones of the wrist and ankle; flat bones, such as those of the skull, the scapula and the ribs; and irregular bones, such as the vertebra and sacrum.

How are the bones of the head divided? Into the bones of the cranium and bones of the face.

Give a short description of the cranium. The cranium is somewhat elliptical in shape, the bones forming the upper dome-shaped part being very hard in order to afford all necessary protection to the delicate brain tissue contained within its cavity; but those of the lower part or base of the cranium are thin and very irregular and are pierced by many openings called foramina, the largest of which is the foramen magnum for the passage of the spinal cord, its membranes, several of the cranial nerves and the vertebral arteries.

Name the bones forming the cranium. The bones of the cranium are occipital, two parietals, frontal, two temporals, sphenoid and ethmoid, eight bones in all.

What are the bones of the face? The bones of the face are fourteen in number, namely, two nasals, two maxillaries, two lacrimals, two malars, two palates, two turbinates, vomer and the mandible. The entire skull is therefore made up of twenty-two bones.

What three important cavities are formed by the bones of the face? The orbital, nasal and oral cavities.

What is the spinal column? The spinal column is a series of bones placed one on the other, extending from the base of the skull to the interval between the buttocks, and forms what is commonly called the back bone.

How many bones are there in the spinal column and what are they called? There are thirty-three bones in the spinal column, the individual bones being called vertebrae. They are divided into the cervical vertebrae, seven in number, situated in the region of the neck; twelve thoracic vertebrae, situated at the back of the chest; five lumbar, situated at the back of the abdomen; five sacral and four coccygeal, the sacral and coccygeal entering into the formation of the pelvis.

Give a short description of the vertebral (spinal) column. The vertebral column is a series of bones placed one on the other with the intervention of cartilages. The bones forming this column are irregular in shape, having a body from which is projected an arch forming the spinal canal for the reception of the spinal cord and its membranes. Between the arches of these bones there are small openings for the exit of the spinal nerves coming from the spinal cord.

What are the true and false vertebrae? True vertebrae are those that remain movable throughout life and are those of the cervical, thoracic and lumbar regions. False vertebrae are those that become fused in adult life and form one bone, as exemplified by the sacrum and coccyx.

What are the curves of the vertebral column? Looking at the vertebral column from the side we notice several curves. In the region of the neck there is a slight curve forward, in the thoracic region there is a marked curve backward, in the lumbar region a curve forward again, then the sacrum makes a sharp curve backward, then forward and ends with the coccyx pointing forward. There are no lateral curves in the normal spinal column.

What terms are used to describe the relation of one part to another in anatomy? Anterior, in front of, sometimes spoken of as ventral; posterior, in back of, or dorsal. On one side or the other is called lateral; the outside is referred to as external and inside as internal; on top is superior and below is inferior.

Give a short description of the bony chest. The bony chest, or thorax, is formed by the thoracic vertebrae posteriorly, by the ribs laterally, and by the cartilages of the ribs and the sternum, or breast bone in front. It is conical in shape, being smaller above than below, and is flattened on its anterior and posterior surfaces; its purpose is to protect the vital organs of respiration and circulation that are contained within its cavity.

Give a short description of the ribs. The ribs are flat, elastic arches of bone, twenty-four in number, twelve on either side. They are called true, false and floating. The true ribs are connected with the breast bone by a cartilage and are seven in number on either side; the cartilages of the eighth, ninth and tenth ribs are fused together and are therefore called false ribs; the eleventh and twelfth ribs have no cartilages and are therefore called floating ribs.

Describe the breast bone. The breast bone is a flat bone formed of three parts and situated in the median line of the front of the chest. It is called the sternum. The upper part of the bone, called the manubrium, is triangular in shape, the apex of the triangle joining the middle part of the sternum. The base of the manubrium has notches on either side for articulation with either clavicle. Immediately below this articulation is a notch for the cartilage of the first rib and near the apex is another notch for the reception of part of the cartilage of the second rib. The second piece of the sternum is called the gladiolus and joins the manubrium above and the third part of the breast bone below, called the ensiform cartilage. The lateral borders of the gladiolus are notched for the reception of the cartilages of the

third, fourth, fifth, sixth and part of the second and seventh ribs. The third part of the sternum, or ensiform cartilage, is a small, thin piece of bone, cartilaginous in youth, that extends from the lower end of the gladiolus. Its upper border is notched for the reception of the cartilage of the seventh rib.

Name the bones of the upper extremity. The bones of the upper extremity are the shoulder bones, clavicle and scapula; the bone of the arm, or humerus; those of the forearm, ulna and radius; the eight bones of the wrist, called carpal bones, and five metacarpal and fourteen phalanges in the hand.

Give a short description of the clavicle. The clavicle, or collar bone, is a long bone situated above the first rib anteriorly and extends from the upper border of the sternum to the acromion process of the scapula. This bone is somewhat S-shaped, curves forward at its internal end and backward externally; internally it is bound to the upper border of the sternum by the ligaments of the sterno-clavicular articulation and externally to the acromion process of the scapula by the acromio-clavicular ligaments. It is also held firmly in position by the costo-clavicular and rhomboid ligaments. The principal muscular attachments are auxiliary muscles of respiration and the great muscle of the shoulder; namely, the deltoid. The function of the clavicle is to hold the shoulders backward, this maintaining the erect posture. Fracture of this bone causes the shoulder to fall downward, inward and forward.

Describe the scapula. The scapula or shoulder blade, is a flat, triangular bone, situated in the upper lateral aspect of the trunk, its inner border being about one inch from the vertebral column. On its posterior surface it has a spine that terminates externally in a large process of bone called the acromion process, which articulates with the outer end of the clavicle; above and below this spine are smooth surfaces of bone called fossae. From the upper and external border there is another hook-like process called the coronoid process, and inferior to both the coronoid

and acromion process is a smooth concave surface, called the glenoid fossa, for articulation with the head of the humerus.

The anterior surface of the scapula is smooth and is practically covered with the subscapularis muscle.

There are seventeen muscles attached to the scapula, their principal actions being as auxiliary respiratory muscles; moving the arm and moving the head.

Describe the humerus. The humerus is a long bone having a shaft and two extremities, and is situated between the shoulder and elbow. The upper extremity, or head, is smooth and hemispherical, and articulates with the scapula, forming the shoulder joint. Just below the head of the bone is the anatomical neck, to which is attached the capsular ligament of the shoulder joint. Below the anatomical neck are two knobs known as the greater and lesser tuberosities, to which are attached the muscles holding the bone in place and assisting in the action of the joint. Below the tuberosities is the shaft of the bone, the first part of which is called the surgical neck, because of the frequency of fracture occurring at this point. The shaft is round in the upper part, but becomes flattened in the lower one-third and terminates in the surfaces that articulate with the ulna and radius. External to either side of this articular surface is a protuberance called a condyle, and groups of muscles controlling the action of the hand have their origin at these points.

Describe briefly the bones of the forearm. The bones of the forearm are the ulna and radius. They are both long bones, the ulna being placed on the inner side and the radius on the outer side of the forearm. They are both prismatic in shape, the ulna being largest at the elbow, where it forms the greater sigmoid cavity, while the radius is largest at its distal end. Both bones articulate with the humorous forming the elbow joint above. The radius is held firmly to the ulna above by a sling-like ligament, which is attached to borders of the lesser sigmoid cavity of the ulna and passes around the head of the radius below by an anterior and a

posterior ligament. In the space between the two bones is a tough membrane called the interosseous membrane.

The ulna below enters into the articulation of the wrist, but the radius is separated from this joint by a cartilage.

The muscles having their origin on the anterior surfaces of the bones of the forearm are inserted into the phalanges, their action being to flex the hand. Those having their origin on the posterior surfaces are attached to the back of the phalanges, their action being to extend the hand. There are also muscles attached to these bones for the purpose of supinating and pronating the hand.

What are the bones of the wrist? The bones of the wrist are called carpal bones and are arranged in two rows. In the upper row from the radial to the ulnar side are the scaphoid, semilunar, cuneiform and pisiform; the lower row consists of the trapezium, trapezoid, os magnum and unciform, in the same order.

Give a short description of the bony pelvis. The bony pelvis consists of the two hip bones, or ossa innominata, the sacrum and the coccyx. The hip bones are irregular in shape and are made up of three segments called the ilium, pubes and ischium. The former is the broad, flat part of the bone, the crest of which is commonly spoken of as the hip. It articulates posteriorly with the sacrum. The public portion is angular and forms that part of the pelvis which, with its fellow on the opposite side, makes the bony arch anteriorly that is called the symphysis pubis. The third portion of the os innominatum, called the ischium, is also angular, the angle being that portion of bone which the body rests upon when in the sitting posture, and is called the tuberosity. These three portions of bone unite to form the acetabular cavity and the obturator foramen or opening; the former for articulation with the femur, forming the hip joint; the latter for the passage of vessels and nerves.

The muscles attached to the pelvis are those of the abdominal walls and back, above; and the muscles moving the thigh and leg, to the sides and below.

Describe the femur. The femur, or thigh bone, is a long bone situated between the hip and the knee joints. It has a shaft and two extremities. The head is hemispherical in shape and fits into the acetabular cavity of the os innominatum. Below the head is the neck of the bone which forms an obtuse angle with the shaft, and where it joins the shaft forms two bony prominences, the upper and larger being the greater tuberosity, the lower the lesser tuberosity.

The shaft is cylindrical in its upper and middle portions, but expands inferiorly into two large eminences called condyles, which form an articular surface for articulation with the tibia, and allow for the origin of certain muscles moving the leg.

Describe the bones of the leg. The bones of the leg are the tibia, or shin bone, and the fibula. They are both long bones. The fibula is placed external to the tibia, and is a slender bone articulating above with the external tuberosity of the tibia and below with the tibia and the astragalus, forming part of the ankle joint. The tibia is much larger than the fibula and is prismatic in shape, being larger above than below. Its upper expanded portion forms two tuberosities, called external and internal respectively. The shaft is triangular in shape, the anterior angle forming the ridge of bone easily felt in the front of the leg, called the shin. The tibia articulates below with the astragalus, the three bones, fibula, tibia and astragalus, forming the ankle joint.

Like the bones of the forearm, the tibia and fibula have a membrane stretched between them, in the interval, called the interosseous membrane, but, unlike the bones of the forearm, there is no motion existing between the fibula and tibia. The muscles arising on the bones of the leg are for the movements of the ankle and foot.

What are the tarsal bones? The tarsal bones are seven in number, namely, the astragalus, os calcis, cuboid, scaphoid and internal, middle and external cuneiform bones.

What is the function of the skeleton? The function of the skeleton is to assist in keeping the body shape, to protect certain vital organs from injury and to form a framework for the attachment of the muscles in order that complicated movements may be effected.

What are the three types of joints? The three types of joints are (1) the immovable joint, such as the sutures of the skull; (2) the partly movable joints, this type being found where the front of the pelvic bones join in the symphysis pubis; (3) the true, or moveable joint, such as the shoulder and hip joints.

What are the different types of movable joints? They are the gliding, such as is found in the spine; the ball and socket type, such as the hip and shoulder; the hinge joint, exemplified by the ankle and elbow; the rotary joint, found between the first and second vertebrae, and saddle joints like that of the trapezium and first metacarpal bone.

In the description of a joint what is to be considered? (1) Name of the joint; (2) the type, such as hinge, or ball and socket; (3) the bones, and parts of bones, entering into its formation; (4) the ligaments; (5) the synovial membrane; (6) the synovial fluid; (7) the movements of the joint; (8) the muscles acting on the joint.

What is the synovial membrane? The synovial membrane is a thin membrane lining joints; it is not connected with the external air and resembles in structure the peritoneum and pleura; it is lubricated by the synovial fluid, thus forming a smooth, well-oiled surface for free action of the joint.

THE MUSCLES.

How are the muscles of the body divided for the purpose of description? Into those of the face, head and neck, those of the trunk, those of the upper extremity and those of the lower extremity.

Of what do the muscles of the head and face consist and what is their action? The muscles of the head and face consist of numerous groups of small muscles, and have for their action the movements of the eyes, face, scalp, and assist in deglutition, talking, drinking, singing and expression.

What is the action of the muscles of the neck? The muscles of the neck move the head from side to side, forward and backward, and rotate it; they also act as auxiliary muscles of respiration, assist in deglutition, speaking and all other complicated motions of the head and neck not included in the actions of the muscles of the face.

How are the muscles of the trunk divided? Into those of the back, thorax, abdomen and perineum. The muscles of the back are arranged in five layers, and, acting on the spinal column, keep the trunk in the erect posture when sitting or standing. Those of the thorax are the muscles of respiration and include the diaphragm, the great muscle that divides the abdomen from the thorax. The muscles of the abdomen are arranged in three layers, and form the sides and front of the belly wall; they assist micturition and defecation.

The muscles of the perineum are those surrounding the root of the penis and the rectum. Their action is to assist in micturition and defecation.

How are the muscles of the upper extremities divided? Into those of the shoulder, their action being to move that joint; those of the arm, forearm and hand. The muscles on the front of the arm flex the forearm, those on the back extend it. The same applies generally to muscles arising on the forearm and attached to the fingers, some of the muscles going from the arm to the forearm, pronate (turn the palmar surface down), other supinate (turn the palmar surface upward), the hand.

How are the muscles of the lower extremity divided? Into the muscles of the hip, thigh, those of the leg and those of the foot.

What is the action of the muscles of the hip? Those on the anterior surface flex the thigh on the abdomen; those on the posterior surface extend it; the muscles on the internal side adduct or bring the thigh toward the middle line; and those on the external side abduct or draw the thigh away from the middle line.

What is the action of the muscles attached to the leg? Those attached to the upper and back part of the leg, called hamstring muscles, flex the leg on the thigh; those attached to the upper anterior surface, by one large tendon, called the ligamentum patellae, extend the leg, and those having their origin on the anterior and posterior surfaces of the bones of the leg and inserted into the bones of the foot, flex and extend the foot respectively.

To what is the contraction of a muscle due? It is due to the nerve impulse being received either from the brain or spinal cord, and, muscle tissue being sensitive to nerve impulses, a contraction occurs; during contraction the muscle changes shape, becoming shorter and broader; there is a slight shrinking in volume and there is an increased production of carbon dioxide (CO_2) and absorption of oxygen.

THE CIRCULATORY AND RESPIRATORY SYSTEMS.

Describe the heart. The heart is a hollow muscular organ, pyramidal in shape, located in the front and center of the thoracic cavity, and extends from the second costal cartilage above to the interval between the fifth and sixth ribs on the left side, and from about one-half inch to the right of the right border of the sternum to about three-quarters of an inch to the left of the left border of the sternum. Its base is directed upward, backward and to the right, while the apex is directed downward and to the left.

The heart is enclosed in a serous membrane sac called the pericardium, and this membrane is reflected over the outer sur-

face of the organ; between the two surfaces is a small quantity of fluid called the pericardial fluid which lubricates the surfaces and prevents friction during the movements of the heart. The inside of the heart is also lined with a serous membrane called the endocardium. The muscular portion of the heart is called the myocardium, and is made up of branched involuntary muscular fibers.

How is the heart divided into its cavities? It is divided into four unequal cavities: first, by a longitudinal partition dividing it into a right and left cavity, and between which there is no communication in the normal adult; these cavities are each divided in two, the upper ones being known as auricles and the lower as ventricles.

Communication exists between the auricles and ventricles through openings called auricular ventricular openings, both of which are protected by valves to prevent the blood from going back to the auricles when the ventricles contract. On the right side this valve is called the tricuspid valve because it has three cusps or segments, and on the left side the mitral or bicuspid valve, it having but two cusps.

Describe the circulation of the blood through the heart. The impure blood, returning from the general circulation, enters the right auricle by way of the superior and inferior venae cavae, and from here passes through the right auricular ventricular opening to the right ventricle, which when filled contracts, sending the blood through the pulmonary artery, the tricuspid valve having closed to prevent the blood from passing back into the right auricle, to the lungs. After being purified in the lungs the blood returns to the left auricle via the pulmonary veins, passes through the left auricular ventricular opening to the left ventricle and this, contracting, forces the blood out into the aorta for distribution throughout the body; the mitral valves having been closed to prevent return to the left auricle.

The openings into the pulmonary artery and aorta are guarded by valves having three cusps, and are called semilunar valves, or the aortic and pulmonary valves respectively. These valves prevent the return of the blood to the ventricle.

Explain the action of the heart in pumping the blood throughout the body. There are three periods in what is called the cardiac cycle. First, the contraction of the auricles forcing the blood into the ventricles; second, the contraction of the ventricles forcing the blood into the aorta or pulmonary artery, and lastly, a period of rest. This cycle is completed 72 times per minute in the normal adult.

Describe the aorta. The aorta is the largest artery in the body and begins at the aortic opening of the left ventricle, arches upward and backward, then passes downward on the left side of the spinal column through an opening in the diaphragm, and at the level of the fourth lumbar vertebra divides into the right and left common iliac arteries. The aorta is the beginning of the arterial system and is divided into two parts, that which is contained within the thorax being the thoracic aorta, and that part which is found in the abdomen the abdominal aorta.

What are the branches of the thoracic aorta? They are the innominate artery, which soon divides into the right common carotid and right subclavian, the left common carotid and the left subclavian; the two coronary arteries supplying the heart muscle itself; the bronchial which supplies the tissues of the lung; esophageal; pericardial; besides numerous small branches to supply the ribs and the muscles between them.

What region do the carotid arteries supply? The carotid arteries pass upward on either side of the front of the neck, dividing into the external and internal carotid arteries. The former supplies the face and scalp, the latter supplies the interior of the cranium and brain.

What region do the subclavian arteries supply? The subclavian artery passes outward over the first rib to the axilla,

where it becomes the axillary artery, and this artery in turn becomes the brachial as passes beyond the arm pit; the brachial artery passes down on the inside of the arm along the border of the biceps muscle to the bend of the elbow, where it divides into the radial and ulnar, and these in turn pass down on either side of the forearm to the wrist and hand, terminating in the superficial and deep palmar arches. This series of arteries supplies the muscles of the chest, arm, forearm and hand. The subclavian artery also gives off a branch called the vertebral for the supply of the spinal cord and brain, and a second branch supplying the thyroid gland.

What are the branches of the abdominal aorta? They are the celiac axis which divides into the gastric for the stomach, the hepatic for the liver and the splenic supplying the spleen; the next branches are the superior and inferior mesenteric which supply the small and large intestines, the suprarenal for the suprarenal gland, the renal going to the kidney and the spermatic in the male, supplying the spermatic cord. There are also muscular branches for the diaphragm and lumbar muscles.

How do the iliac arteries divide? They divide into the external which gives off several branches for the supply of the abdominal muscles and becomes the femoral artery at the upper border of the front of the thigh; and the internal iliac which supplies the pelvic organs and by its sciatic and gluteal branches supplies the muscles at the back of the thighs.

What becomes of the femoral artery? It passes down the front and inner side of the thigh, giving off numerous branches to the muscles and the femur, then passing through Hunter's canal, a membranous sheath in the adductor muscles, to the back of the knee, becomes the popliteal artery. The popliteal artery passes downward, and just below the back of the knee divides into the anterior and posterior tibial. The former passes forward between the tibia and fibula, then down the front of the leg to the ankle, where it becomes the dorsalis pedis artery and supplies the back of the foot. The posterior tibial passes down

the back of the leg and, at the inner side of the ankle, passes to the plantar surface of the foot, where it divides into the internal and external plantar arteries for the supply of the muscles and skin of the foot.

Describe an artery. An artery is an elastic tube made up of three coats, the middle one being made up of involuntary muscular fibers. The walls of arteries are much thicker and more elastic than those of veins. Arteries carry pure blood to be distributed throughout the body, with the exception of the pulmonary artery, which carries the impure blood from the right ventricle to the lungs.

Describe a vein. A vein has much the same structure as an artery, except the coats are thinner. Veins usually have valves to support the column of blood as most of the force of the cardiac impulse is lost during the course of the blood through the capillaries.

What is the capillary system? The capillary system is a network of very fine tubes about 1/2000 of an inch in diameter, extending over the entire body. The blood passing through these fine tubes gives off nourishment to the different organs and structures of the body.

Into what three sets may the veins be divided? Into the pulmonary veins, the systemic veins and the portal system.

What are the pulmonary veins? They are the veins that collect the blood after it has been aerated in the lungs and return it to the left auricle.

What are the systemic veins? The systemic veins are arranged in two sets, deep and superficial; the deep veins accompany their corresponding arteries, each of the large arteries of the leg, forearm and arm having two veins; the deep veins communicate with the superficial set. The superficial veins lie just under the skin where they can, in many localities, be plainly seen; those of the lower extremity are, the internal saphenous, which starts on the top and inner side of the foot, runs up the in-

side of the leg and thigh and terminates in the femoral just below the groin, and the external saphenous, starting in like manner on the outer side of the foot and emptying into the popliteal behind the knee.

Those of the upper extremity are the radial on the outer side, the ulnar on the inner side, and the median in the middle; opposite the bend of the elbow the median splits into two veins, the one, known as the median cephalic, joining with the radial to form the cephalic, and the other, the median basilic, uniting with the ulnar to form the basilic; the basilic and cephalic both empty into the axillary. The median cephalic is the vein ordinarily opened in bleeding. The great superficial vein of the neck is the external jugular, which passes down from the angle of the jaw to the middle of the clavicle; it may be brought into view by pressing with the finger just above the middle of the clavicle.

What is the portal system of veins? The portal system is composed of four large veins which collect the venous blood from the viscera of digestion. The trunk formed by their union (vena porta) enters the liver and breaks up into capillaries from which another set of veins, the hepatic veins, arise, which terminate in the inferior vena cava. This circulation is for the purpose of subjecting the products of digestion contained in these veins to the special action of the liver before they go into the general circulation.

Describe the blood. The blood is one of the body fluids, and is made up of serum or liquor sanguinis and blood cells. The serum is a straw-colored fluid containing a substance known as fibrin, which is instrumental in forming a blood clot when the blood comes in contact with the air. It also contains certain salts that make it alkaline in reaction.

Describe the cellular contents of the blood. There are two kinds of cells in the blood: the red cells, numbering 5,000,000 per cubic millimeter in the healthy adult, called erythrocytes; and the white cells, or leukocytes, numbering 7000 to 8000 per

cubic millimeter, normally. The red cells are biconcave disks about 1/3200 of an inch in diameter, and when viewed by the aid of a microscope are straw colored. They have no nucleus and their important constituent is hemoglobin, which has the power of taking up oxygen in the lungs and giving it off for the nourishment of the tissues and at the same time collecting CO_2 and discharging it through the lungs.

The white blood cells are nucleated spherical cells about 1/2500 of an inch that act as the scavenger of the blood, taking up germs and other irritating substances that may be introduced or formed in the body. An increase in the number of leukocytes is called leukocytosis.

RESPIRATORY APPARATUS.

Of what does the respiratory apparatus consist? It consists of the larynx, trachea, bronchi and lungs.

What is the larynx? The larynx or Adam's apple, is the organ of voice and is situated in the middle line of the neck where it may be seen moving up and down during the act of swallowing. It lies between the trachea and the base of the tongue, and its upper opening is closed during swallowing by a cartilaginous flap called the epiglottis.

Describe the trachea or wind-pipe. The trachea or wind-pipe is a cartilaginous and membranous tube which extends downward about four and one-half inches from the larynx to its division into the two bronchi, one of which goes to each lung. The cartilages of the trachea and bronchi are arranged in rings, and serve the purpose of keeping the wind-pipe open. The right bronchus is larger and shorter than the left, and foreign bodies which get into the wind-pipe usually lodge in this bronchus.

Describe the bronchi. The bronchi are two in number, one going to each lung. They divide into branches like a tree and finally the smallest branches end in little sacs called air vesicles;

these air vesicles are very numerous and go to make up the greater part of the lung substance.

Describe the lungs. There are two lungs, one on either side of the thoracic cavity; the right lung has three lobes, the left but two. There are two types of circulation in the lungs, the blood coming from the right ventricle through the pulmonary arteries to give off CO_2 and receive a fresh supply of oxygen, and that coming from the bronchial branch of the aorta for the supply of the lung tissue itself.

What is the pleura? The pleura is a serous membrane lining the inner side of the thorax and reflected over the outer surface of the lungs. It is lubricated by a fluid called the pleuritic fluid, allowing a free movement of the lungs during respiration.

Explain the act of respiration. Respiration is somewhat similar to the action of a bellows. When the handles of the bellows are pulled apart the air rushes in to the body of the bellows (as the pressure of the air outside the bellows is greater than that inside) to equalize the pressure; in human beings the chest cavity is drawn open by the muscles of respiration. If air did not rush in there would be a greater pressure outside the chest than inside, thus producing a partial vacuum and causing much distress to the person. Normally this does not occur; the air having free access to the lungs by way of the nose, larynx, trachea and bronchi, thereby equalizing the air pressure.

The cycle of respiration is divided into three stages, (1) the inspiration or the flow of air into the lungs; (2) expiration, or the forcing of air from the lungs, and lastly a period of rest. This cycle is completed about eighteen times per minute in the normal adult while at rest.

Describe the aeration of the blood. The impure blood brought to the lungs by the pulmonary arteries, passes into thousands of little capillaries that surround the air vesicles; this leaves the blood in the capillaries separated from the pure air in the vesicles only by a very thin membrane, and owing to the law

of diffusion of gases and the ability of the hemoglobin of the blood corpuscles to take up oxygen and give off CO_2, the blood becomes purified, passes on to be taken up by the pulmonary veins and returned to the heart for the general circulation.

What is the difference between inspired and expired air? Expired air contains a higher percentage of CO_2, a lower percentage of oxygen and an increase in moisture.

THE DIGESTIVE SYSTEM.

What are foods that must be considered in connection with digestion? The foods are divided into three principal groups, (1) the protein group, (2) the hydrocarbon or fatty group, and (3) the carbohydrate group; other than the above groups there are certain inorganic foods, namely, water, and the salts of sodium, potassium, magnesium, calcium, phosphorus and iron.

What are the proteins? Proteins are frequently called the nitrogenized foods, as they contain a comparatively large amount of this element in their makeup; they are exemplified by the flesh of animals, the albumen of eggs and the protein content of milk and cheese, called casein. There is also a small amount of protein matter in vegetables, bread and bone.

What are the hydrocarbons? The hydrocarbons are the fatty foods and are found in the animal fats, oils of seeds, grain, nuts and other vegetables.

What are the carbohydrates? They are the sugars and starches, and are found in cane sugar, milk sugar, fruit sugar, and the starches of cereals and various vegetables.

What is meant by the term digestion? Digestion is that process by which the various foods taken into the body are so changed in their chemical composition that they may be taken into the general system for the purpose of feeding the body tissues.

What are the component parts of the digestive tract? They are the mouth, pharynx, esophagus, stomach, small intestines, large intestines, terminating in the anus.

What part of digestion takes place in the mouth? Mastication and insalivation. The former is accomplished by the teeth, dividing the food into small particles; the latter is the mixing of the food with saliva.

What is the saliva? The saliva is an opalescent fluid, alkaline in reaction and contains a ferment ptyalin that has the power of changing starch into sugar. Saliva is secreted by the salivary glands of which there are three, the parotid, the sublingual and submaxillary.

How many permanent teeth are there in the mouth? There are thirty-two permanent teeth, sixteen in each jaw, or four incisors, two canines, four bicuspids and six molars.

What is deglutition? Deglutition is the act of transferring the food from the mouth to the stomach. In its passage the bolus of food passes into the pharynx then into the esophagus, a muscular tube extending from the pharynx to the cardiac opening of the stomach.

Describe the stomach. The stomach is a hollow organ about thirteen inches long by three and one-half inches wide by five inches deep, and has a capacity of about five pints. It has two openings, the esophageal, or cardiac, and the duodenal, or pyloric. The stomach has three coats, the external or serous coat, the middle or muscular coat, and the internal or mucous coat; the latter is arranged in many folds and contains numerous glands for the secretion of gastric juice.

What are the principal constituents of the gastric juice? The gastric juice contains hydrochloric acid and two ferments, pepsin, which acts on the acidulated proteins, and rennin, which acts on the protein of milk and cheese, namely, casein.

Describe gastric digestion. The food when received in the stomach is thoroughly churned about and mixed with the gastric juice; this substance acts principally on proteins, gradually changing them to peptones so that they will be capable of absorption. The duration of stomach digestion is from three to five hours.

What is the next step in the digestion of foods? The partly digested food called chyme is forced through the pyloric opening of the stomach into the first part of the intestine, which is called the duodenum, and here intestinal digestion begins.

Describe the intestine. The intestine is a musculo-mucous tube about twenty-eight feet long, beginning at the pyloric orifice of the stomach, and ending in the anus. It is divided into the large and the small intestine. The latter is about twenty-two feet in length and is divided into three parts, the first being the duodenum, which is about twelve inches in length, the second the jejunum, and third the ileum, which is about thirteen feet in length. The small intestine is made up of three coats, the outer or serous coat, made up of the peritoneum, the middle or muscular coat and the inner or mucous coat. The mucous coat is arranged in little elevations called villi, and inside these villi are small capillaries belonging to the absorption system, that collect the properly digested foods and transmit them to the general circulation *via* the thoracic duct. There are numerous glands found in the mucous coat of the small intestine that manufacture and secrete the intestinal juice. This contains a ferment, invertin, that acts on cane sugar, preparing it for absorption. The intestine has a vermicular sort of motion, due to its muscular coat, which is called peristalsis, thus causing a gradual movement onward of the food and thorough mixing of the food with the digestive juices. The large intestine is about six feet long and is divided into the following parts: the cecum, ascending colon, the transverse colon, the descending colon, the sigmoid flexure and the rectum. The appendix is a small outshoot from the lower end and back of the cecum.

The large intestine has the same number of coats as the small intestine arranged in the same order; it is larger in lumen, and its surface is lubricated by a secretion from its glands. At the entrance of the small into the large intestine is a valve made up of mucous membrane called the ileocecal valve; it prevents

the regurgitation of foods to the small intestine. The rectum acts as a storage place for the unused portion of the food, it being expelled from the rectum at intervals in the voluntary act of defecation.

What fluids are emptied into the intestines, other than those mentioned, that assist in the digestion of the food? The bile and the pancreatic juice are emptied into the duodenum by a common duct.

Describe the bile. The bile is the secretion of the liver; it is also an excretion, in that it carries off certain waste products. It is golden brown in color, either neutral or alkaline in reaction; and its action is to assist in the emulsification of fats, stimulate peristalsis and thereby aid in the prevention of putrefaction.

What large organs may be considered as part of the digestive system? The liver and the pancreas.

Describe the pancreas. The pancreas is a gland about six inches long, three-fourths of an inch broad and one-quarter of an inch thick, situated behind the stomach at about the level of the second lumbar vertebra. It has a head, body and tail, the former being surrounded by the duodenum. The duct of this gland empties into the duodenum a fluid known as the pancreatic juice, which contains three ferments called amylopsin, acting on the undigested starchy foods, steapsin, which acts on the fatty foods, and trypsin, acting on proteins that have not been completely changed during stomach digestion.

Describe the liver. The liver is a large organ situated in the upper right side of the abdomen directly under the upper surface of the diaphragm, and held in this position by ligaments formed of the peritoneum. It has five lobes and on its under surface in the front is found the gall bladder, a small sac for storing bile until it is needed. The liver is supplied with blood by the hepatic artery, which enters the organ in a fissure on the under surface together with the portal vein which is made up of the gastric, splenic, superior and inferior mesenteric veins.

The blood from the portal vein, after having certain nutritive products removed, leaves the liver by the hepatic veins, which in turn empty into the ascending vena cava. The functions of the liver are to make and store glycogen and to manufacture bile; the latter is secreted through the two hepatic ducts which join the duct of the gall bladder or cystic duct, making up what is called the common bile duct.

What is the peritoneum? The peritoneum is a serous membrane covering the inner wall of the abdomen and being reflected of the various organs contained therein. It completely covers some of the organs and only partially covers the remainder. It is lubricated by the peritoneal fluid, thus making a smooth surface for the free movement of the intestines. Part of the duodenum, the colon and kidneys are not covered by peritoneum; the remaining principal organs are completely surrounded by this membrane.

Into what divisions is the abdomen divided for the purpose of description? It is divided into nine regions by dropping a perpendicular line from the junction of the eighth costal cartilage, with its rib, on either side; this divides the abdomen into three sections. A horizontal line is now drawn at the level of the crests of the ilium and a second horizontal line at the level of the ninth costochondral articulation.

The nine regions are called, from above downward, right and left hypochondriac with the epigastric in the middle; then the right and left lumbar and umbilical in the center; and the right and left inguinal with the hypogastric in the center.

THE LYMPHATIC SYSTEM AND DUCTLESS GLANDS.

Of what is the lymphatic system composed? It is composed of small glands usually found in bunches and lymphatic vessels; these lymph vessels are very numerous and are found

distributed over the entire body. They carry a fluid called lymph, which takes up waste material and carries it to the lymph glands. The principal sets of lymph glands are the axillary inguinal, the anterior and posterior cervical, the mediastinal and the mesenteric. The thoracic duct is the largest of the lymphatic vessels and empties its contents into the venous system at the junction of the internal jugular and left subclavian veins.

Describe the spleen. The spleen is a dark red organ, somewhat bean-shaped, situated in the left hypochondriac region. It is about four inches by two inches by one and one-half inches and its principal function is the manufacture of leucocytes and the destruction of red cells.

What are the ductless glands? They are glands, the product of which is filtered directly into the blood without the intervention of a duct; the principal ones are the thyroid and thymus glands, the suprarenal capsules and the hypophysis cerebri.

THE EXCRETORY APPARATUS.

What organs are to be considered as instrumental in eliminating the waste products of the body? The lungs, rectum, skin and kidneys.

Describe the skin. The skin is a tough, elastic membrane forming the outer covering of the body. It is made up of two principal layers, the derma or true skin, and the epiderma or cuticle. The former is thick and supports the blood vessels, hair follicles, sebaceous and sweat glands. The appendages of the skin are the hair and the nails, the latter being modified cuticle.

The sebaceous glands secrete an oily substance which keeps the skin soft and pliable.

The skin acts as a excretory organ through the sweat glands, which are found in vast numbers through the derma of the entire body. The glands empty their contents through orifices known as pores, and excrete perspiration, which is made up of water and waste material. The functions of the skin, other than an

excretory organ, are to form a protective covering and to receive the specialized nerve endings which carry impressions of heat, cold, touch and pain to the central nervous system.

Describe the kidneys. The kidneys are two in number. They are situated deep in the abdomen, one on either side of the spinal column and just below the twelfth rib, the right being slightly lower than the left. They are bean-shaped, being about four inches by two and one-half inches by one and one-quarter inches, and weigh about five ounces. They have a cortex and a medulla and pelvis. The cortex is formed of thousands of capillary tufts surrounded by a capsule. The water and salts are extracted from the blood in the tuft and pass into the capsule, which empties into a small tubule; and this, after making many turns, empties this fluid into a collecting tubule; large numbers of these collecting tubules passing toward the pelvis of the kidney give the appearance of rays and form the medulla.

The pelvis of the kidney is an open space into which the collecting tubules empty their contents. It is somewhat funnel-shaped, the spout of the funnel going to make up the beginning of the ureter.

Describe the urine. The urine is a light amber-colored fluid, acid in reaction, having a specific gravity of 1015 to 1025. There are about 1200 to 1500 cubic centimeters excreted daily, and the principal solid constituent is urea; it also contains uric acid, urates, phosphates, carbonates and chlorides.

Describe the ureters. The ureters are two musculo-membranous tubes about the size of a goose quill in diameter and about fifteen inches long. They extend from the pelvis of the kidney to the lower and back part of the bladder where they pierce this organ and deliver the excretion of the kidneys.

Describe the bladder. The bladder is a musculo-membranous sac situated in the front of the pelvis, and when distended rises behind the symphysis pubis into the abdomen. It acts as a reservoir for the urine until it is convenient to discharge this fluid.

The bladder has three openings, one for each ureter. These are protected by valves of mucous membrane to prevent regurgitation into the ureters, and the opening of the urethra for the final discharge of the urine.

Describe the urethra. The urethra is a membranous tube passing from the bladder along the under surface of the penis to the distal end of that organ where it terminates in the meatus. It is about eight inches long and is divided into three parts, the first being the prostatic part, which is surrounded by the prostate gland, the second is called the membranous portion and is surrounded by the constrictor urethrae muscle, which prevents the escape of the urine until convenient for the individual, and the third, or penile portion, is that part found on the under surface of the penis.

THE NERVOUS SYSTEM.

Of what is the nervous system made up? The central nervous system includes the brain and spinal cord, the peripheral nervous system, or the nerves coming off from the brain or spinal cord, which are ultimately distributed to the special organs or the muscles and skin, and lastly the sympathetic nervous system, which acts principally on the involuntary muscular tissues of the body.

Describe the brain. The brain is contained within the cranium and may be divided into four parts, (1) the cerebrum, (2) the cerebellum, (3) the pons varolii, and (4) the medulla oblongata. The brain is surrounded and protected by membranes called the meninges and the same is true of the spinal cord. The cerebrum is divided into two halves by a longitudinal fissure; these are made up of many convolutions, those in the anterior part of the brain being for the higher psychical thought, in back of this is the section for movement and sensation, and at the posterior and lower part is a section that has to do with sight and hearing. The cerebellum is below the posterior half of the cerebrum and has

to do with proper coordination of muscle movements; the medulla oblongata is the beginning of the spinal cord and contains numerous centers of reflex actions; the pons varolii is located below the cerebrum and in front of the cerebellum and medulla, it transmits motor and sensory fibers. The substance of the brain is divided into white and gray matter, the latter being external to the white matter; the left side of the brain controls the right side of the body as the fibers transmitting the impulses cross from the left to the right side before arriving at the seat of action.

Describe the spinal cord. The spinal cord is about eighteen inches long and extends from the first cervical to the second lumbar vertebra. It is surrounded by the meninges and is contained within the bony canal formed by the arches of the bones of the vertebral column; it is formed of white and gray matter, the latter being internal and the former external; it gives off thirty-one pairs of spinal nerves, each containing sensory and motor fibers. These nerves go to form the greater part of the motor and sensory peripheral nervous system, either through separate nerve trunks or via certain plexuses, such as the brachial, cervical and lumbar plexuses.

Name the cranial nerves and explain why they are called such. There are twelve pairs of cranial nerves named and numbered in the following order: (1) olfactory, (2) optic, (3) motor oculi, (4) patheticus, (5) trifacial, (6) abducens, (7) facial, (8) auditory, (9) glossopharyngeal, (10) pneumogastric, (11) spinal accessory, (12) hypoglossal. They are called cranial nerves because they come off directly from the brain and pass through several foramina at the base of the skull.

Which of the cranial nerves are connected with the special senses? The first, or olfactory, is distributed to the nose and has to do with the sense of smell; the second, or optic, is the nerve of sight; the eighth, or auditory, is the nerve of hearing, and the ninth, or glossopharyngeal, presides partly over the sense of taste.

What do you mean by volitional movement? Volitional movement is that which is controlled by the brain by association of the several centers, causing a certain amount of thought before the movement is executed. For instance, an individual walking along the street suddenly comes to a puddle of water; by the aid of his sight he sees the water. This impression is immediately transferred to the thinking part of the brain, where the higher psychical centers, knowing that to walk through the water may bring about some ill effects, immediately inform the motor centers that certain movements must be made to carry the individual around the puddle. In this event walking, which is ordinarily a reflex action, becomes volitional action.

What is a reflex action? A reflex action is one which is performed without the intervention of the higher psychic powers and may be exemplified by breathing.

What is the sympathetic nervous system? The sympathetic nervous system consists of a chain of small ganglia (small bunches of nerve cells) connected by fine nerve fibers; there are thirty of these ganglia, the largest being the semilunar ganglion situated on either side of the celiac axis, a branch of the abdominal aorta; these two ganglia form what is called the solar plexus.

What is the function of the sympathetic nervous system? Its principal action is on the muscular coats of the arteries, the intestines and non-striated muscular fibers in general.

THE SPECIAL SENSES.

Describe the eye. The eyeball, or organ of sight, is contained within the bony orbital cavity of the face and protected by the eye lids and lashes; it is suspended in such a way that it has very free motion.

There are three membranes that enclose the refractive media, they are the sclerotic, including the cornea, the choroid and iris, and the retina.

There are three refracting media also, the aqueous humor, the crystalline lens and the vitreous humor.

The eyeball is divided into two unequal chambers by the crystalline lens and it capsule; the anterior chamber contains the aqueous humor and the posterior chamber, which is by far the larger, forming the greater part of the eyeball, contains the vitreous humor.

The optic nerve, which enters the eye at the back, spreads out to form the retina and it is on this membrane that the optical picture is received to be transmitted via the optic nerve to the visual centers in the brain.

The iris is a muscular diaphragm which dilates or contracts to allow a sufficient amount of light into the eye to allow a clear picture to be received on the retina. It contains a certain amount of pigment, giving the blue, brown or gray color as the case may be. The crystalline lens is made more or less convex, depending on the contraction of a muscle pulling on its capsule; this brings the proper focus of the object on the retina.

The eyeball is moved by six muscles called the external, internal, superior and inferior recti, the superior and inferior oblique.

Describe the ear. The ear is the organ of hearing, and for purposes of description is divided into three parts, the external, middle and internal ear.

The external ear is made up of the auricle, which collects the sound waves, and the external auditory canal.

The middle ear is a cavity in the temporal bone; it contains three small ear bones, arranged in series, one of which rests against the ear drum, which is stretched across the opening to the external canal.

The internal ear contains the perceptive organ of hearing. Hearing is accomplished by sound waves striking against the

ear drum and then being transmitted through the series of ear bones, which in turn cause vibrations in the internal ear which act on the nerve endings of the auditory nerve, and the impression is then transferred to the perceptive centers of hearing in the brain.

Explain the sense of smell. The nerve endings of the olfactory nerve are distributed to the mucous membrane of the nose and small particles of certain kinds of matter coming in contact with these nerve endings cause impressions to be carried to the perceptive centers of smell in the brain.

Explain the sense of taste. On the back of the tongue there are certain special types of cells, which, when soluble substances are taken into the mouth, receive impressions of taste, and they are transmitted to the cerebral centers of taste in the brain.

Explain the voice and speech. The larynx contains two cords stretched across it from before backward, leaving a small slit-like opening between them; these cords are separated or brought together by muscles depending on the pitch of tone required. When the air is forced out of the lungs through this narrow slit certain sounds are produced, and with the help of the pharynx, tongue, mouth and cheeks articulate speech is accomplished.

FIRST AID.

Q. Define "First Aid" as applied to naval conditions.

A. First aid includes measures employed in the immediate treatment of wounds, accidents and emergencies incident to the service.

Q. What measures are included:

A. The resuscitation of the apparently drowned, those poisoned by noxious gases, those suffocated from other causes. The treatment of accidents and emergencies. The checking of hemorrhages. The application of first aid dressings in gunshot wounds. The preparation of the wounded for transportation.

Q. What are the steps in resuscitation of the apparently drowned?

A. Remove water from the lungs; clear the air passages; restore breathing; stimulate by heat and friction.

Q. How is water removed from the lungs?

A. Remove upper clothing, place patient on his face, clasp your hands under his abdomen and raise him so that the water drains out from his lungs.

Q. How should the air passages be cleared?

A. Turn patient on his back, a roll of clothing under shoulders; wipe out throat and nose; pull tongue forward and tie or hold it by string or handkerchief.

FIG. 1.

Q. How is artificial respiration applied?

A. First motion: Place the shocked person on his belly, with his face turned to one side; kneel beside him and place the palms on the small of his back just below the ribs (Fig. 1); lean forward and gradually bring the weight of the body on the hands, thus forcing the air out of the lungs (Fig. 2). *Avoid roughness.* Second motion: Release the pressure quickly and return to the original position.

FIG. 2.

The first motion should occupy two or three seconds. After returning to the original position there should be a wait of about two seconds before repeating; thus, there will be about twelve respirations each minute. Imitation of natural breathing is the object. These efforts should be kept up for at least two hours or until natural breathing is restored.

Q. How is stimulation applied?

A. Remove wet clothes, place patient on a warm, dry blanket; apply friction to the skin, rubbing from extremities toward the body; apply hot water bags, hot bricks, or sand bags. Do not give stimulants by mouth until patient is conscious and breathing naturally.

Q. What measures are employed in suffocation?

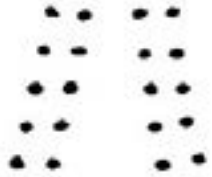
A. Remove foreign bodies from throat or remove patient from place where poisonous gases are present; apply artificial respiration and stimulation as described above.

Q. How should bites and stings of insects be treated?

A. Extract the sting if possible, squeeze the part lightly to expel some of the poison; apply a little ammonia water, wet salt or alcohol; cold, wet applications may then be applied. The stings of poisonous spiders, tarantulas, scorpions and centipedes may make the victim very ill, but are rarely fatal. Cut off the circulation with a string or tourniquet; suck the wound; apply ammonia water and cold, wet applications.

Q. What snakes may be poisonous?

A. The poisonous snakes of North America, except the coral snake, belong to the pit viper family, which includes rattlesnakes, copperheads and water moccasins. These snakes have a pit, or depression between the eye and nostril; the heads are heart-shaped and the bodies thick. The teeth are arranged in two rows with a fang on each side, outside the teeth near the front of the jaw. Fangs are characteristic of poisonous snakes. Non-poisonous snakes have four rows of teeth without fangs.



Q. What is the treatment of poisonous snake bites?

A. Ligate the limb above the wound if possible; incise would freely with pocket or other knife; suck the wound; rub in potassium permanganate crystals. Do not give alcohol. At the end of a half hour, and from time to time afterward, loosen the tourniquet for a few seconds to prevent gangrene of the limb.

Q. How should burns be treated?

A. Shock may be severe and should receive attention first. Remove clothing with great care, cutting it if necessary, avoid breaking blisters; if clothing adheres it may be loosened by soaking in oil or warm water. Picric acid, 1% in one part alcohol and two parts water, is the best preparation to keep on hand for emergency burns; apply on gauze or lint. Normal salt solution or a solution of washing soda may be applied on lint or boric acid ointment on lint. If burns are severe and extensive a greased sheet wrapped around the entire body makes an excellent temporary dressing. For bathing and cleansing burns use normal salt solution; avoid antiseptics. If burn is caused by an acid, begin treatment by flushing with water and then with a saturated solution of washing soda (sodium carbonate). If caused by an alkali, flush with water and then with dilute solution (1/4) of vinegar in water. Sunburn should be treated the same as other burns. Lime water with liquid carbolic acid (phenol liquefactum, U. S. P.), two drops to one ounce, is an excellent application.

Q. What are the symptoms of sunstroke?

A. Headache, dizziness, redness of the eyeballs, dry skin, followed by unconsciousness, labored breathing, and possibly convulsions.

Q. What is the treatment of sunstroke?

A. Lower the temperature or remove the patient to a cool, shaded spot, remove as much clothing as possible; pour cold water over head and body; rub with ice or place in cold bath.

Q. What is heat exhaustion?

A. Great depression of the system due to heat; the skin is cool and moist and the patient may be in collapse.

Q. What is the treatment of heat exhaustion?

A. Small doses of aromatic spirits of ammonia or whiskey in water; remove to a cool place and bathe with cool water. Keep patient quiet on his back for several hours.

Q. What is the treatment of frost bite?

A. Gradually bring the temperature to normal and maintain it there. Rub gently with warm, wet cloths, or soak in moderately warm water while rubbing.

Q. What is the treatment of freezing?

A. Restore the bodily temperature by hot blankets or rubbing in a warm room; give hot stimulating drinks if the subject is conscious; place in warm bath and gradually raise its temperature.

Q. What is the treatment of electric shock?

A. First remove the subject from the source of danger. This must be done with care, the rescuer's hands being protected by rubber gloves or wrapped in dry clothing or other dry non-conductor. Artificial respiration may be necessary and should be performed as described under the treatment of drowning.

Q. What is the emergency treatment of unconsciousness?

A. If pale, with cool skin and sighing breathing, place on back, keep quiet, hold smelling salts under nose, give hot drinks when consciousness has returned, apply external heat. If skin is hot and flushed, apply cold to head and body.

Q. How should a person who has fainted be treated?

A. Lay flat on back, head low, loosen tight clothing, smelling salts or ammonia inhalations; after consciousness has returned give aromatic spirits of ammonia, half teaspoonful in a table-spoonful of water, or whisky in hot water.

Q. How should a person having an epileptic fit be treated?

A. Lay on back, loosen clothing about neck, place cork or folded handkerchief between teeth to protect tongue, restrain only the movements which may injure him. Do not disturb the sleep which follows the fit.

Q. What is the general treatment of poisoning?

A. Give a large quantity of warm salt water and pass the finger down the throat to induce vomiting, or give a tablespoonful of powdered mustard in warm water; repeat the water and vomiting several times, then give liquids such as oil, milk, raw

eggs or flour and water. If collapse occurs, give stimulants, such as hot tea without milk, alcoholic drinks in small doses, apply warm blankets, hot water bottles or hot bricks.

Q. What is the special treatment of poisoning by an acid?

A. Give alkaline drinks, aromatic spirits of ammonia, baking soda (sodium bicarbonate), chalk, plaster, tooth powder or soap; follow with oil, milk or beaten eggs.

Q. What is the special treatment of poisoning by an alkali?

A. Give vinegar in considerable quantities; follow by milk, oil or beaten eggs.

EMERGENCY SURGERY.

Q. What equipment should be always ready for immediate use?

A. Hand brushes, soap, fountain syringe, hypodermic syringe and tablets, sterile dressings, sutures and needles, bandages, splints and instruments, such as are contained in the pocket case. Hand brushes should be sterilized and well wrapped; fountain syringe, tube, cannula and glass nozzles should all be sterilized and wrapped; gauze sponges and compresses should be wrapped and sterilized; sutures should be of various sizes of silk and silkworm gut, preferably in sealed glass tubes.

Q. Tell the advantages and disadvantages of each anesthetic.

A. *Chloroform:* small in bulk; no special apparatus required; pleasant and quick; but it is dangerous, even in the hands of the skilled. *Ether:* safer than chloroform, but is inflammable, bulky, and may be followed by bronchial affections. *Ethyl chloride:* is quick and safe and requires no special apparatus, but relaxation is not complete except in deep anesthesia. *Nitrous oxide* alone or combined with oxygen is safe and quick, but relaxation is not complete and the necessary apparatus is bulky and expensive. Local anesthetics: *Cocaine* is more active than *stovaine,* but not so safe. *Ethyl chloride*, as a spray, produces anesthesia, but hardens the tissues and makes careful dissection difficult.

Q. Name the materials used as sutures and give the uses of each.

A. *Silk:* this can be sterilized by boiling in plain water; it is not absorbable and so is not often used in buried sutures; usually used in interrupted skin sutures and sutures of nerves, tendons and intestines. *Catgut,* either plain or chromicized, is usually used for buried sutures; plain catgut for tissues which unite quickly, peritoneum and small vessels; chromicized catgut resists absorption and is used in positions where this characteristic is important. *Silkworm gut* is strong, non-elastic and non-absorbable; it is used

in large and deep wounds, in skin and fascia after laparotomy. *Celluloid linen* may be used in the same circumstances as silkworm gut. *Silver wire* is sometimes used for skin sutures.

Q. What are the objects and methods of drainage?

A. It prevents sepsis by removing bacteria and would exudates; it relieves tension and so relieves pain. It is most often required in emergency surgery, in infected wounds or accidental wounds which may be infected. The methods used are rubber tubes for large spaces, plain sterile gauze for removing serum and blood by capillarity, gauze wicks, cigarette drains, glass tubes.

Q. What substances are used for dressings and how used?

A. Sterile gauze and sterile absorbent cotton are most important; medicated gauze is sometimes used. In emergencies use muslin, linen or cheese cloth, sterilized by boiling. For aseptic wounds use dry dressing; for septic wounds moist dressings may be used. The dressing should be ample in quantity. Septic wounds should be dressed daily; aseptic wounds at longer intervals. In changing dressings every precaution must be taken against infection.

Q. What are the purposes of bandaging?

A. To protect the part; to give support; to limit motion; to fix a dressing; to act as a tourniquet.

Q. What are the uses of splints?

A. To immobilize a part; to prevent muscular contractions; to secure rest.

Q. What is shock?

A. Shock is a constitutional state characterized by lowered blood pressure, due to vaso-motor paralysis (Sluss).

Q. What may cause shock?

A. Severe crushing injuries, excessive hemorrhage, grave emotional disturbances, extensive operations involving much handling of peritoneum, pleura or dura.

Q. What are the symptoms of shock?

A. Thirst, pallor, subnormal temperature, perspiration, shallow breathing, frequent sighing or yawning, rapid pulse,

relaxed sphincters, faintness, nausea or vomiting, unconsciousness. These may vary greatly in degree.

Q. What is the treatment for shock?

A. Disturb the patient as little as possible; lower the head; keep the body warm; avoid any operation, except to check hemorrhage. Adrenalin chloride 1/1000, 5 to 15 minims, may be given hypodermically. Adrenalin chloride 1/1000, one teaspoonful in one quart of normal salt solution, may be given intravenously or hypodermically. It may often be prevented by administration of morphia, blocking nerves with cocaine and avoiding unnecessary handling of viscera during operation.

Q. What are the principal kinds of hemorrhage?

A. *Arterial,* from the arteries; blood is bright red and comes in spurts. *Venous,* from the veins; blood is dark and flows steadily. *Capillary*, oozes steadily and tends to stop spontaneously. *Primary* hemorrhage occurs immediately after the injury. *Intermediate* or *reactionary* hemorrhage occurs within the first four hours after injury and may be due to release of clots or slipping of ligatures. *Secondary* occurs after twenty-four hours, usually due to sloughing, suppuration or premature absorption of ligatures. *Internal* hemorrhage is bleeding into one of the large body cavities.

Q. What are the symptoms of hemorrhage?

A. Pallor, dizziness, faintness, rapid and weak pulse, subnormal temperature, rapid and irregular breathing, yawning or sighing, nausea or vomiting. If severe, there may be blueness of the nails, paleness of mucous membranes, dyspnea, syncope, collapse and unconsciousness, followed by death.

Q. What is the treatment of hemorrhage?

A. First stop the flow of blood. Strychnia (gr. 1/60 to 1/20) or adrenalin chloride 1/1000 hypodermically, may be given hourly until improvement is apparent. Keep warm with blankets and hot water bottles. Keep quiet with head lowered and give warm drinks when swallowing is possible. Give normal salt

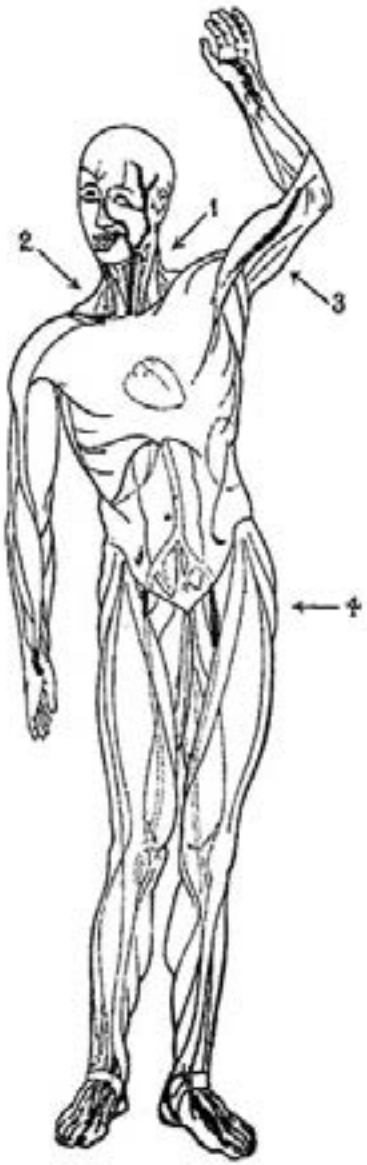
solution by enema, hypodermoclysis or intravenous infusion; the latter only after the hemorrhage is arrested.

Q. What are the means of arresting hemorrhage?

A. *Chemical*: for capillary bleeding, hydrogen peroxide and adrenalin are the most commonly used. *Thermal*: hot water will often stop moderate hemorrhage; the cautery may be used in spongy tissues. *Mechanical*: direct pressure may be used in emergencies and in slight bleeding; compression of the vessel above or below the wound by hand or tourniquet; acupressure, a needle is passed under the vessel and ligature wound around its free ends; forcipressure, pinching the bleeding vessels with forceps; torsion may be combined with forcipressure; ligation is necessary in bleeding from larger vessels.

Q. At what points may pressure be applied to stop hemorrhage?

A. The temporal artery in front of the upper level of the ear. The occipital artery between the tip of the mastoid and the occipital protuberances. In severe bleeding from the scalp a tourniquet passing around the forehead above the ears, to the base of the skull will occlude all the arteries mentioned. The facial artery can be compressed as it crosses the lower border of the mandible in front of the masseter muscle. The coronary arteries in the lips by pressure near the bleeding point. The carotids by pressure on the common carotid over the transverse process of the sixth cervical vertebra. Wounds of vessels of the neck are often so dangerous as to justify direct pressure with the finger in the wound. The subclavian may be compressed against the first rib behind the middle of the clavicle, thus controlling the circulation of the whole upper extremity. The brachial may be compressed against the middle of the humerus. The palmar arches by grasping a round body and bandaging the hand firmly over it. The femoral artery may be compressed in the groin or lower down against the shaft of the femur. The dorsal and plantar arteries of the foot can be compressed against the bones.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Q. What is a wound?

A. A wound is a solution of the continuity of the soft tissues, due to trauma (Sluss).

Q. Name the various types of wounds.

A. *Contused* or subcutaneous wounds are lesions of the deeper tissues without any break in the skin. *Incised* wounds are open wounds produced by a sharp edged instrument. *Stab* wounds are those produced by a sharp pointed instrument. *Punctured* wounds are those produced by blunt pointed instruments. *Lacerated* wounds are produced by crushing or tearing. *Gunshot* wounds are produced by projectiles from guns. *Penetrating* wounds are those which reach a body cavity. *Perforating* wounds extend through a body cavity. *Aseptic* wounds are free from pathogenic organisms. *Septic* or infected wounds contain such organisms. *Poisoned* wounds are those in which some agent destructive to tissue is present. *Operative* wounds are produced by the surgeon's knife.

Q. What are the symptoms of wounds?

A. Pain, hemorrhage and loss of function are present in all; shock may be present.

Q. Give briefly the treatment of wounds of each type.

A. *Contused* wounds: keep the part at rest; evaporating lotions; heat. *Incised* wounds: stop hemorrhage by compress wrung out of hot water or salt solution, ligation of vessels may be necessary; remove clots and foreign bodies: if wound is known to be sterile, it may be sutured without drainage; if infection is feared, an antiseptic may be applied (e.g., tincture of iodine), and, if sutured, wound should be drained. *Stab* wounds should be treated on the same general principles as the incised, but it may be necessary to enlarge the wound to control hemorrhage, secure antisepsis or repair injured organ. *Punctured* wounds should be considered as infected. It may be necessary to open widely to secure thorough cleanliness: drainage should be used. *Lacerated* wounds: treatment for shock may be required; careful hemostasis is necessary because of the danger of secondary hemorrhage; antisepsis should be thorough,

tincture of iodine is useful for this purpose; drainage is usually necessary; dressings should be large and loose. *Penetrating* and *perforating* wounds: secure rest, hemostasis and antisepsis if possible: further treatment depends upon the part involved. *Aseptic* wounds: carefully avoid introducing infection, secure rest and hemostasis, protect by sterile dressings. *Septic* wounds: avoid excessive handling of tissues and strong antiseptics, hydrogen peroxide and tincture of iodine are useful; drainage is usually necessary.

Q. Describe the treatment of wounds of the eye.

A. If they do not penetrate below the aponeurosis, shave an area about the wound, stop the flow of blood, clean thoroughly and suture, preferably with silk; drain if infection is feared. If the aponeurosis is perforated the danger of serious infection is great and all the steps must be carried out with great care. Drainage is usually necessary.

Q. Describe the treatment of wounds of the eye.

A. *Foreign bodies*: remove by irrigation with boric acid solution, or by cotton wound on a toothpick if possible; no instruments should be used except by skilled hands. *Contusions:* rest and application of cold. *Penetrating wounds*: boric acid irrigation and a sterile dressing; rest in bed. Sutures and applications of atropine or cocaine solutions may be necessary, but should be used only by skilled hands.

Q. What principles are to be observed in treating incised wounds of the extremities?

A. Hemostasis by direct pressure or tourniquet; exposure and ligation of the bleeding vessels; repair of injured structures where possible; thorough cleanliness; free drainage; sterile dressings; rest.

Q. What is the emergency treatment of wounds of the chest involving the pleura and lung?

A. Avoid rough handling; cut away clothing; clean the surrounding skin; wash the wound; stop bleeding; cover with large sterile dressing and a tight bandage.

Q. What is the emergency treatment of wounds of the abdomen?

A. *Contusions:* if severed, the symptoms will probably be those of shock. Place in bed; remove clothing; lower head; keep extremities warm; hypodermoclysis or intravenous infusion of normal salt solution with or without adrenalin. Prepare for immediate laparotomy. *Penetrating* wounds: treat shock; stop bleeding if possible; keep at rest; apply sterile compress and tight bandage; nothing by mouth; prepare for laparotomy.

Q. What is a fracture?

A. A fracture is a solution of the continuity of bone due to traumatism (Sluss).

Q. What are the kinds of fractures?

A. *Simple* fracture: has a single line of solution without injury to the soft parts. *Multiple* fracture: has more than one line of solution of the same bone or several bones. *Comminuted* fracture: has many small fragments. *Complete* fracture: involves the whole thickness of the bone; *Incomplete* fracture: does not involve the whole thickness of the bone; includes greenstick; fissured; separation of an epiphysis. *Compound* fracture: communicates with the surface through an injury of soft parts.

Q. What is the emergency treatment of injuries involving the cranium?

A. Rest in bed; head elevated and ice bags applied; clean and dress any open wound; if shock is present, depress the head, maintain bodily heat; artificial respiration if necessary.

Q. What are the symptoms of fractures in general?

A. History of injury, deformity, abnormal mobility, pain, loss of function, crepitus, and result of X-ray examination.

Q. What are the principles of emergency treatment of fractures?

A. Reduction; fixation in corrected position by splints and dressings; avoid unnecessary manipulation. If fracture is compound, cleanliness, drainage and sterile dressings will be necessary.

Q. What are the general symptoms of dislocation?

A. Deformity, pain, loss of function, fixation.

Q. What are the principles of emergency treatment of dislocations?

A. Reduction and fixation in corrected position.

Q. What is a sprain?

A. Injury of a joint with partial rupture of the ligamentous structures. Fracture is often associated.

Q. What is the treatment of sprains?

A. Put joint at rest; apply moist heat; bandage. Later the joint may be strapped or plaster bandage applied. Still later, massage should be applied.

Q. What is an abscess?

A. A circumscribed collection of the liquefied products of infective inflammation (Sluss).

Q. How should abscesses be treated?

A. Evacuate pus as soon as its presence is evident. Incise, evacuate, drain. Strict asepsis should be observed. Never squeeze the abscess.

Q. Under what conditions may immediate tracheotomy be necessary?

A. Laryngeal spasm; edema following burns; injuries or disease, such as diphtheria or cancer; foreign bodies in the larynx.

BANDAGING.

Q. What materials are usually used for bandaging?

A. Muslin, gauze, crinoline, flannel, rubber. Substances such as plaster of paris and sodium silicate may be incorporated.

Q. What conditions govern the amount of tension to be applied in bandaging?

A. The circumference of the part; the greater the circumference the more force must be used, the thigh requiring greater force than the ankle. When a bandage is applied over splints, greater force is required to produce a certain pressure. When a bandage leaves the extremity of a limb uncovered, the extremity is liable to swell and increase the tension under the bandage; allowance for this must be made. Where a bandage covers a large dressing, greater force is required to produce a certain pressure. Change of position of a limb after the bandage is applied may alter the tension; a spica of the shoulder, applied with the arm elevated, is increased in tension when the arm is brought to the side. Each additional turn applied to the same part of a limb increases the pressure. Muslin shrinks when wet and the possibility of this should be considered. Greater pressure is required by hard infiltrated tissue, like that around a leg ulcer, than can be employed in bandaging a loose flabby part. An acutely inflamed part will not tolerate as much pressure as an edematous part. Interference with the function of a part must be considered.

Q. How should a bandage be started?

A. Place the outer surface of the free end on the point where it is to be started and hold it with the left hand, hold the roll in the right hand and make two turns.

Q. How may a bandage be secured?

A. By pinning; by splitting the end into two tails which are carried around in opposite directions and tied; by adhesive plaster strips.

Q. What principles should be observed in applying a bandage?

A. Place the limb in the position it is to occupy. Begin at the extremity and bandage toward the body. Protect opposing skin surfaces by dusting powder or cotton. Make the pressure equal throughout. Observe the effect of the bandage on the blood supply of the limb.

Q. What are the common types of bandage?

A. Circular, spiral, spiral reverse, figure of 8, spica.

Q. How is a figure of 8 of the eye applied?

A. Fix by two turns around occiput and forehead; from occiput, under ear, over eye, to opposite temple, to occiput, make these two turns alternately.

Q. How is a Barton bandage of the jaw applied?

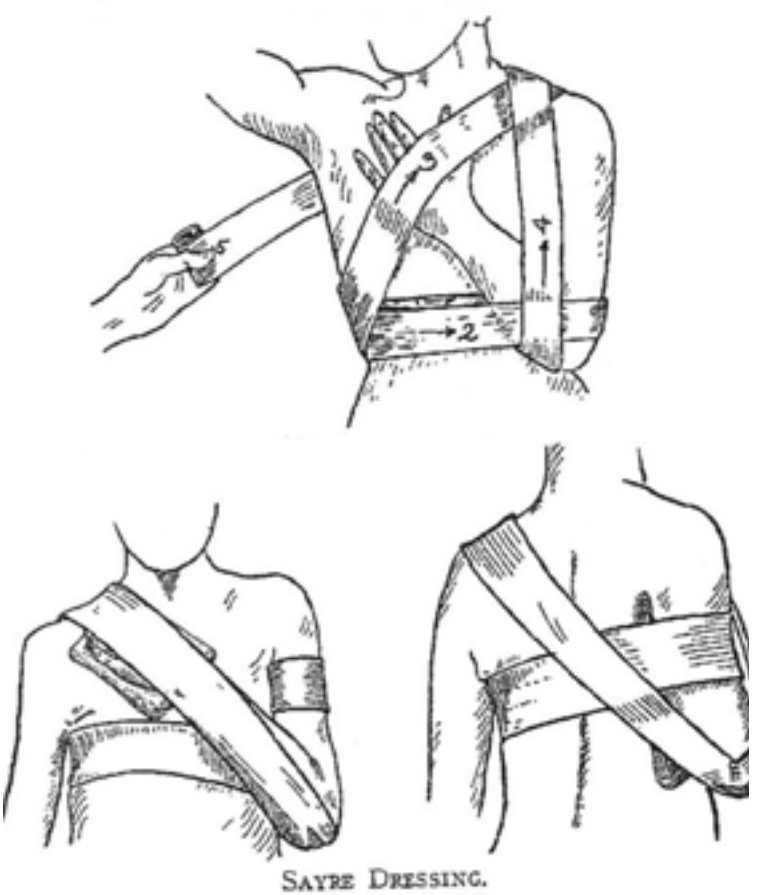
A. Start below occiput, obliquely over parietal bone, across vertex, down over temple in front of ear, under chin, up in front of ear over temple, across vertex, back to starting point; alternate these turns.

Q. How is the Velpeau bandage applied?

A. Place the hand of the injured side on the opposite shoulder with padding between arm and chest wall. First turn: around body under elbow; second turn: around body over elbow; third turn: obliquely over front of chest to injured shoulder, down back of arm, under elbow; fourth turn: up in front of arm, over injured shoulder, across back to starting point.

Q. How is the Sayre dressing applied?

A. (1) A folded towel around upper arm; hold by strap of adhesive plaster. (2) Take a strip of adhesive plaster four inches wide and long enough to extend one and one-half times around the body; pass one end around folded towel and secure with safety pin; while assistant holds shoulder well back, arm is carried back and held by fastening the adhesive strap around the



SAYRE DRESSING.

body. (3) A similar adhesive strap, with a hold to admit the point of the elbow, is started on the posterior surface of the injured shoulder, passes down the back of the arm, over the elbow, along the flexed forearm and hand to the well shoulder. A third strap may be passed around the body and arm and the whole covered by a Velpeau bandage.

Q. How should a spiral reverse bandage of the upper extremity be applied?

A. Fix by two turns at the wrist, across back of hand to fingers, a circular turn and spiral reverse turns to thumb, figure of

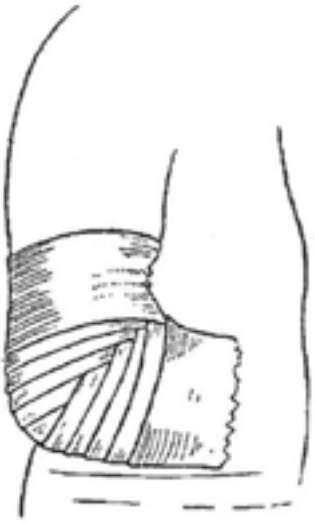
8 turns below and above thumb, spiral reverse up forearm to elbow, spiral turns at elbow, spiral reverse up the arm, complete by a few spiral turns.

Q. How should a figure of 8 bandage of the elbow be applied?

A. Fix by several circular turns over point of the elbow, then carry one turn about one-third its width above the point of the elbow, the next about the same distance below, alternate above and below the point, increasing the same distance each turn, crossing in front; secure by pinning in front.

Q. How should a spica bandage of the groin be applied?

A. Fix by turns about the upper part of thigh, carry across groin above crest of ilium of opposite side, around body, back to starting place, crossing in front, and each turn about one-third its width above the preceding.



Q. How should a spica bandage of the foot be applied?

A. Fix by turns around the ankle, pass across dorsum to toes, one circular turn, then a spiral and pass to the heel, the lower border here being on a level with the sole of the foot, across dorsum of foot to make the first spica; continue foot and heel turns as an ascending spica, crossing in front.

Q. What are the uses of splints?

A. Immobilization, prevention of muscular contraction, functional rest.

Q. What principles should be observed in applying splints?

A. They must be well padded. There must be no pressure over points of bones. Strappings and bandages must not be applied too tightly and circular constriction must be avoided. The splints should reach beyond the joints on each side of the fracture. They should be examined twenty-four hours after application and thereafter should not be disturbed unnecessarily.

FIELD HYGIENE AND SANITATION.

Q. What are the requirements for a site for a camp or field hospital?

A. It should be on high, well-drained ground with plenty of wood, water and grass available, but the vegetation should not be very rank. The soil should be dry and pervious, old camp grounds should be avoided, as the soil is apt to be polluted; and so should clay and other impermeable soils, as they retain water, make the air damp and cause various catarrhal affections. The camp should not be placed near marshes or lagoons, but if this is unavoidable, it should be so located that the winds will not blow from them toward the camp.

Q. What are some of the most necessary precautions to be taken when a site is selected?

A. A guard should be placed over the water supply at once, separate places being designated for drinking and cooking and for bathing, washing clothes and watering animals, and steps taken to turn the drainage away from it. Latrines should be dug at once at a considerable distance from and in the lee of the camp and where they will not pollute the water supply. The kitchen and kitchen pits should also be placed to the leeward, but as far removed as practicable from the latrines. The ground should be cleaned up and all underbrush, weeds and rank vegetation cut away for some distance around the camp.

Q. What are some of the most necessary precautions in regard to tents?

A. A good trench should be dug around each tent to keep out water. The walls should be kept triced up for proper ventilation as tents are generally crowded, only about 80 cu. ft. of air space being available for each occupant. About twice a week tents should be struck, removed to an adjacent area, turned inside out and aired and sunned. The whole camp should be

moved every ten days or two weeks when practicable. Tents should have wooden floors if the camp is to be permanent, and they should be in sections in order that they may be removed two or three times a week and the ground cleaned under them. In the absence of wooden floors the ground should be well packed and covered with cinders, sand or gravel. No food should be kept in any tents except the kitchen, mess and store tents.

Q. What necessary precautions should be observed in camp at night?

A. A man should not sleep on the ground, but should use leaves, hay, straw, boughs, an improvised bunk or his poncho. He should protect the abdomen well when asleep and use mosquito nets. The bedding should be aired daily if practicable.

Q. What are the chief dangers of camp life?

A. Pollution of the water supply by excreta, dejecta and other refuse of the camp.

Contamination of the food by dust, flies, ants and other insects. The spread of disease by mosquitoes which are known to transmit malaria, yellow fever and other diseases.

Q. What precautions should be taken against flies?

A. The camp should be kept clean, all refuse, garbage and etc., burned, excreta and dejecta covered up or disinfected, to prevent the breeding of flies or the transference of infection by them to the food or water supplies. The kitchen pits, kitchen and mess tent should be well screened. The food and drink should be kept well covered, especially after cooking and boiling, to prevent contamination, as should also the dishes and kitchen utensils. A clean, well-ordered camp is the best protection against flies and other sources of infection.

Q. What precautions should be taken against mosquitoes?

A. Clear away the underbrush and rank vegetation for some distance from camp, drain or fill all stagnant pools to destroy the breeding places, or cover them and the ponds and swamps with petroleum to destroy the mosquito larvae. Do not allow any

vessels containing water to remain uncovered around the camp and clear away all broken bottles, tin cans and other containers that act as breeding places.

Use screens wherever practicable and especially for the tents used as wards for the sick. When mosquitoes are very numerous and malaria is prevalent it is best to give prophylactic doses of quinine to every one and active treatment to those infected until the disease is eradicated.

Q. Describe the construction of latrines.

A. They should be dug 2 feet wide, 10 to 20 feet long and of varying depths in accordance to the probable length of stay. The earth should be thrown to the rear and a stout pole placed lengthwise of the pit on forked uprights for a seat. When there is no natural screen use canvas, boards, bushes or brush for this purpose.

Q. Describe the care of a latrine.

A. Dejecta should be covered at once with a shovelful of earth by the person using the latrine which should be inspected two or three times a day and covered with a layer of a few inches of earth. Straw or paper saturated with kerosene should be burned in the pit once or twice a day.

Quicklime, when available, should be used to cover the dejecta and the trench should be filled when within two feet of the top and when the camp is abandoned.

Urinals should be conveniently located, kept under surveillance, quicklimed frequently and kept covered. Tubs, cans or other vessels for this purpose should be placed in the company streets every night and removed, emptied and cleaned in the morning.

Q. How would you dispose of kitchen refuse?

A. The liquid refuse should be poured into pits near the kitchen. These should be kept covered or screened to exclude flies, should be treated with kerosene once a day and filled up when the camp is abandoned.

The solid refuse should be burned daily and a garbage incinerator should be constructed for this purpose if the camp is to be occupied for a lengthy period.

Q. What other precautions are necessary in camp?

A. Unless the water is known to be pure it should be boiled before drinking, the kitchen should be screened, the utensils and food containers kept perfectly clean and the food protected from flies. The camp should be well policed and cleaned daily and rubbish and etc. burned. The streets should be sprinkled daily when necessary to keep down the dust, which is not only disagreeable but spreads disease and infection. Milk and soft drinks should be treated with suspicion, over-ripe and unripe fruits forbidden. Raw foods are dangerous, but thorough cooking removes all danger of germ infection. Men should sleep under proper cover at night and not lie directly upon the ground. They should protect themselves with mosquito nets at night and be careful about exposing themselves to the sun in summer and in the tropics between the hours of 9 a.m. and 4 p.m.

Q. What other precautions are necessary in camp life, as well as other times, as regards the person, clothing, food, drink and exercise?

A. The clothes and person should be kept clean, and men should take a bath every day when practicable; the head and neck should be bathed twice a day and the hands frequently. They should take regular exercise by engaging in sports and practice marches, sleep and eat regularly and avoid the use of alcoholic liquors. The clothing should be adjusted to meet the vicissitudes of service as the body should be protected against the varying conditions of the weather.

Q. How should a field hospital be located with reference to the general camp?

A. It should be located apart from it so that the daily routine, drills, noises and traffic of the camp will not disturb the sick or interfere with the work of the medical officers and assistants.

The field hospital should be located and established on the same general principles as the general camp. On account of the various diseases that have to be treated, the sanitary precautions should be very strictly enforced to prevent the spread of infection, and to this end antiseptics and disinfectants should be freely used and all excreta, dejecta, refuse, waste, etc., disinfected or destroyed.

Q. Give the general arrangement of a field hospital.

A. The hospital or ward tents should be centrally located with the administration tent or office, operating and dispensary tents in front, the kitchen and commissary store tents in the rear, the officers' tents on one side and the Hospital Corps' tents on the other side. The latrines, sinks, crematories, etc., should be placed well to the leeward away from the camp. The infectious wards or tents should be well removed from the rest of the tents and the same sanitary precautions observed as for the infectious camp and wards of a hospital. The arrangement of the field hospital will often depend on the character of the ground where it is located.

Q. What is a very necessary precaution in regard to the hospital tents or wards?

A. They, as well as the kitchen and food, should be well screened to keep out flies and mosquitoes and other insects and thus prevent them spreading infection. All feces, urine and other excreta of patients should be treated with antiseptic solutions before disposed of, and dressings and other refuse should be burned.

ON THE MARCH.

Q. Who should be excluded from expeditionary forces and landing parties?

A. Men who have venereal diseases; deformed or sore feet; bad teeth or diarrheal diseases; or men convalescing from disease or injury or not in robust health, or who are very fat; and men under 20 or over 45 years of age, except in special cases.

Q. What are the most necessary precautions to be taken on the march?

A. Probably the most important consideration is the care of the feet, and the shoe is the most important single article of uniform. To avoid foot soreness, the first requisite is a properly shaped and fitted shoe, and the next is clean feet and clean, dry socks. The feet should be washed at the end of the march, the socks changed and those taken off, washed and dried, or at least sunned for the next day. The toe nails should be kept clean and cut square across but not too short; corns should be kept trimmed close and blisters should be punctured at the lowest point, painted with iodine and protected by adhesive plaster.

Q. How would you treat soreness of the feet and excessive and foul sweating?

A. Sore feet are very often due to excessive and foul sweating. This can often be prevented by washing the feet and dusting on them, or into the shoe before marching, the following powder: Salicylic acid 3 parts, powdered starch, 10 parts, talcum, 87 parts; or by sprinkling a few drops of formalin into the shoe each morning.

In severe cases, soak the feet in a 1 to 6 per cent solution of permanganate of potash every night for two or three weeks, after washing them and using the dusting powder in the day.

For soreness, vaseline or tallow as an ointment, especially between the toes, is very effective. The feet may be toughened by soaking them in strong, tepid alum water.

Q. What other precautions are necessary on the march?

A. If the sun shines warm, green leaves or a wet towel or handkerchief should be put into the top of the hat, the neck, arms and legs should be covered to protect from sun burn; proper clothing should be worn to meet the varying conditions of temperature. The hair should be kept short, and a bath taken every day when practicable. The head, neck, armpits and genitals should always be bathed once a day or oftener.

Q. How would you treat chafing and body vermin?

A. Cleanliness is the best prevention for these. For chafing, bathe the part with salt water or some antiseptic solution, dry and use vaseline or the foot power. If infected with vermin, cut the hair of the parts close and wash with 1/500 bichloride solution, or apply mercurial ointment.

Q. What precautions should be observed in regard to drinking water on the march?

A. This should be abstained from to a great extent. Boiled water may be drunk liberally at the start and the end of the march. The canteen should be filled with boiled water and thirst relieved by small quantities from it at intervals as necessary. Very cold or ice water should not be drunk or if it is, it should be held in the mouth sometime before swallowing.

HYGIENE AND SANITATION.

Q. What is hygiene?

A. It is the science which treats of the preservation and improvement of health.

Q. What is sanitation?

A. It is the devising and applying of measures to promote public health.

Q. In the preservation and promotion of health, what are the most important factors?

A. Food and drink, personal cleanliness, clothing and shelter.

FOODS.

Q. Define food.

A. Food is any substance which, when taken into the body, produces constructive metamorphosis, that is, produces growth or repair of the tissues, heat, energy, or functional activity.

Q. Of what elements are foods composed?

A. Principally of carbon, hydrogen, oxygen and nitrogen, with which are combined in varying amounts calcium, sodium, potassium, magnesium, chlorine, sulphur and iron.

The first four are the nutrient elements of food.

Q. How are foods classified?

A. As organic and inorganic, both of which substances are present in varying amounts in all ordinary articles of food either animal or vegetable.

Q. How are organic foods classified?

A. As nitrogenous and non-nitrogenous.

Q. What other classification have they?

A. (1) Proteins, as meats, etc.; (2) hydrocarbons or fats and oils; (3) carbohydrates or starches and sugars.

Q. What are nitrogenous foods?

A. They are the proteins, as meats, etc., and contain nitrogen, carbon, oxygen, hydrogen and sulphur.

Q. What are the non-nitrogenous foods?

A. They are (1) hydrocarbons, or fats and oils which are compounds of glycerin and fatty acids, and contain carbon, hydrogen and oxygen; (2) carbohydrates, or vegetable foods, embracing the various starches and sugars, and containing carbon, hydrogen and oxygen, the two latter being in the proportion to form water (H_2O).

Q. What are vegetable acids?

A. They are non-nitrogenous substances and, though not strictly foods, play an important part in the preservation of health.

Q. What are inorganic foods?

A. They are water and mineral salts: the principal ones being chloride of sodium or common salt, the phosphates of lime, potash, soda and magnesium, with small quantities of sulphates and iron.

Q. What are the principal articles of food of the protein group?

A. They are lean meats, poultry, game, fish, whites of eggs, cheese and milk. The cereals and some other vegetables (peas and beans) of the carbohydrate group contain considerable protein substance. Milk contains protein, fat and carbohydrate in nearly equal amounts. If is capable of sustaining life indefinitely and is almost an ideal food.

Q. What are the principal articles of food of the hydrocarbon group?

A. They are all animal and vegetable fats and oils. Nuts contain a great deal of oil, and some cereals have considerable quantities of it. The yolk of an egg is mostly fat.

Q. What are the principal foods of the carbohydrate group?

A. All cereals, peas, beans and vegetables generally, fruits, starches and sugars.

Q. What are accessory foods?

A. This group includes a great number of condiments and beverages which, although not necessary to existence, are of importance as stimulants, aids to digestion and as relishes to make other food more palatable.

Q. What are the principal accessory foods?

A. Tea, coffee, cocoa, meat extracts, alcohol, pepper, mustard, spices, flavoring extracts and various other condiments.

Q. What is the value of alcohol as an accessory food?

A. Alcohol should never be included in the dietary of a normal person, as it is absolutely unnecessary and positively harmful when used regularly or to excess. A person can do quite as hard, if not harder, work and keep it up longer without alcohol than with it. Experience in wars and expeditions in all climates, where abstinence was either enforced by order or by circumstances, shows that soldiers endure more fatigue, are healthier and fight better without alcoholic stimulants than with them.

Alcohol should never be taken during working hours or on an empty stomach. If taken at all, it should be after a full meal when the day's work is done. It is of value in certain diseases as a medicine, and should only be used as such, as should strychnia, opium, arsenic, cocaine and other narcotics.

Q. In making up a dietary what is very important?

A. To have a variety of foods and to use the right proportions of nitrogenous and non-nitrogenous foods or proteins, fats and carbohydrates.

Q. About what is the proper proportion of fats, protein and carbohydrate for a dietary?

A. About 1 part of fat, 2 parts protein and 8 parts carbohydrate.

Q. What is a calorie?

A. It is the unit of measure of heat or energy produced by food when eaten and is equal to the amount of heat or energy that is required to raise the temperature of 1 liter of water 1 degree centigrade.

Q. What is the approximate value in calories per gram of the chief alimentary principles?

A. Proteins 4 calories, fats 9 calories, carbohydrates 4 calories.

Q. About how many calories are required per day by a man doing moderate muscular work?

A. About 3000 calories.

Q. What then would be about the proper amounts of the chief alimentary principles for the day's ration?

A. Fats 60 grams, proteins 120 grams and carbohydrates 500 grams. In addition to these, mineral salts and vegetable acids are essential for repair and growth and preservation of health. Some condiments are also desirable.

Q. Upon what does the amount of food that the body needs depend? Give examples.

A. Upon the kind and amount of work done and upon the climate or exposure to heat and cold. Men doing hard physical work require more food than those doing clerical work, and men exposed to cold require more food than those not exposed. Men doing clerical or professional work need from 2500 to 3000 calories, while those doing moderate to hard work require from 3000 to 5000 calories.

Q. How is the Commissary Department of a hospital conducted?

A. This is in charge of the pharmacist, assisted by such other hospital corpsmen and civil employees as may be necessary. He has charge of the mess hall, kitchen, pantry and commissary store rooms. He purchases all the food, inspects and weighs, measures or counts it when delivered and issues it to the cooks and others who have to prepare it.

Q. What are the chief points to be observed when inspecting fresh meats?

A. They should have the stamp of the U.S. inspector on them; should be firm on pressure; should have a bright color; smell fresh; be clean and well protected for handling.

Q. What are the chief characteristics of good beef, veal and mutton and pork?

A. They should be clean; have a bright red or pink color, mutton and veal being not so bright as beef, and pork being of a much lighter color; should be firm on pressure; have a sufficient but not too large amount of fat and should have a fresh, sweetish smell. Meat that is dark or reddish brown, moldy and dirty, very soft on pressure, very lean and with a stale, bitter or putrid smell is not good.

Q. What are the chief characteristics of good poultry?

A. It should be a creamy white or a bright yellow or lemon color, plump, fat and firm on pressure, clean and have a fresh smell. Poultry that is very dark with skin shriveled up, very soft or very tough, with a stale or putrid smell is not good.

Q. What are the chief characteristics of good fish?

A. They should be firm on pressure; the gills should be bright red or pink and they should smell fresh. Fish that are very soft, that have very dark or gray gills, or smell stale or putrid, are not good. Fish spoil very quickly and easily, and very often cause ptomaine poisoning, and great care should be exercised in examining them.

Q. What are the chief characteristics of good fruits and vegetables?

A. They should be firm, fresh and ripe, not wilted, shrivelled or dried up, not unripe, over-ripe, moldy or decayed.

Q. What are the characteristics of good milk?

A. It should have from 3-½ to 4 per cent of fats as cream; its specific gravity should be greater than water; it should be creamy white and not of a bluish caste, and should be sweet to taste and smell and there should be no sediment in it. Sour milk generally denotes that it is very old or dirty and contains a very large number of bacteria.

Q. What are the chief points to be noted in the inspection of cereals, dried fruits, canned goods, etc.?

A. See that all packages and cans are well sealed and that they have not been broken into. Examine carefully for worms,

weevils, and other insects, molds, dirt and other foreign matter. Note the odor whether sweet and fresh or musty, moldy, sour, fermented or putrid. In canned goods bulged out ends denote that they are spoiled, while concave ends denote they are good.

Q. What are the chief factors in the preservation of fresh goods?

A. That they should be well protected and kept clean and cold. The commissary store rooms should be clean, dry and well ventilated. They should be well screened against flies. Roaches, ants and other vermin should be destroyed.

MESS MANAGEMENT.

Q. What is the arrangement for mess management in a naval hospital?

A. The pharmacist and his assistants have charge of the general mess hall, kitchen, pantry and the preparing and serving of the food for patients on full diet, members of the Hospital Corps and civil employees. After it is prepared by the cooks and served, it is inspected by the officer of the day.

The chief nurse and special nurses have charge of the special diet kitchens and pantries, and the preparation of special diets which are prepared by special cooks or nurses. These diets are inspected by the chief nurse or officers having charge of the patients to which they are served.

Q. What classes of diets are there?

A. (1) Full diet and (2) special diets, which latter are designated as (a) soft, semi-solid, or half diet; (b) liquid diet.

Q. What is very necessary in serving foods?

A. The food, dishes and linen should be perfectly clean and arranged with taste. The attendant should have clean hands and clean clothes, as nothing is so disgusting to a patient as unclean, badly served food served by a dirty attendant.

REFERENCE—Mason's "Hand Book for the Hospital Corps," pages 238 to 259 for cooking and receipts.

WATER.

Q. What is water?

A. Water is a chemical compound of two atoms of hydrogen and one of oxygen (H_2O). In addition to these there is usually present nitrogen, carbon dioxide, ammonia and various mineral substances in small amounts.

Q. In what forms does water appear?

A. (1) In a gaseous state as steam or vapor; (2) in a liquid state as water; (3) in a solid state as ice, snow, hail or frost.

Q. What are the boiling and freezing points of water?

A. Water boils at 212° Fahrenheit or 100° Centigrade, and freezes at 32° Fahrenheit or 0° Centigrade. Its maximum density is at 39° Fahrenheit or 4° Centigrade.

Q. Into what two classes are waters divided?

A. Into surface waters and ground waters.

Q. From what sources are they derived?

A. Surface waters from rain, small streams, rivers, ponds and lakes, and ground waters from deep springs and wells.

Q. What is potable water?

A. Water that is fit to drink.

Q. How do waters compare as to potability?

A. Ground waters are more generally potable than surface water.

Q. Why is this so?

A. Because ground waters are generally purified by filtration through thick layers of earth. Deep well water and deep spring waters are usually potable, while shallow well water and that from springs which go dry are suspicious. Ground waters may become contaminated by insanitary surroundings, and thus be unfit for drinking.

Q. Upon what does the potability of surface water depend?

A. Upon the sanitary surroundings. Rain water is very pure, but may become contaminated from the water shed or by being stored in dirty tanks or a leaky cistern. Water collected from moun-

tain streams where the country is sparsely settled or uninhabited is generally potable. Small streams, ponds, rivers and lakes in thickly settled communities are usually contaminated. Rivers and lakes purify themselves to some extent by oxidation and sedimentation.

Q. What characteristics should potable water possess?

A. Potable water should be clear, colorless, sparkling, odorless and agreeable to taste. It should contain no suspended matter or sediment. These characteristics, however, do not make water pure, as impure water may possess all of them, while potable water may be more or less colored from vegetable and mineral matter. In determining the potability of water the sanitary surroundings and character of the country are perhaps the greatest factors. Water that is not known to be potable should be boiled, filtered or chemically treated before it is drunk.

Q. What amount of water is required per day for drinking purposes by the average man?

A. This varies with the temperature of the air and the character and amount of exercise taken. Men require more water in warm weather and when performing hard manual labor. The average amount required per day exclusive of that used for cooking is about four pints.

Q. What amount per man should be allowed for drinking, cooking and washing?

A. The minimum allowance for field operations should be not less than two gallons per day, and when practicable it should be five gallons, or unlimited. The amount of water allowed generally depends on the available supply.

Q. What is hard water?

A. It is water which will not lather well with soap owing to the presence of a considerable amount of the salts of lime. Ground water is usually hard, while surface water is usually soft.

Q. How may water be purified?

A. (1) By heat, as in boiling or distillation; (2) mechanically by filtration; (3) by chemical treatment.

Distilled water is used aboard all ships of the Navy for drinking and cooking purposes and often for bathing also.

Q. What method of purifying water is most applicable to field operations?

A. Boiling is the most convenient and effective. Five minutes boiling will destroy all disease germs usually found in water. It does not clear the water or remove dissolved organic matter. After boiling it should be aerated by shaking or pouring from one vessel to another. The Forbes sterilizer is a convenient apparatus for boiling, cooling and aerating water.

Q. What is filtration?

A. It is a mechanical process by which water is freed from its impurities as by a very fine strainer. Filtration cannot generally be depended on for purifying water, except on a large scale at regular military posts or stations or at municipal plants. In the field filtration is often a great aid in making water potable, as it clarifies and removes suspended matter and sediment; but the water should be boiled after such filtration. The Berkefeld and other filters need careful attention and must be in perfect condition and sterilized frequently to be efficient, otherwise they are dangerous.

Q. How would you purify water by chemical treatment?

A. The simplest way is to dissolve 1 gram of alum in 3 gallons of water, stir it up well and allow it to settle. The alum forms a sediment which carries down with it the suspended matter and bacteria. Ozone, chlorine, iodine, permanganate of potash and sulphate of copper (1/100000 for the latter) have also been successfully used in purifying water. The use of chemicals for purifying water is undesirable except in emergencies.

Q. How would you improvise a filter for use in the field?

A. This is done by taking a large barrel and putting a layer of coarse sand or gravel in the bottom of it. The put a small barrel with the bottom perforated inside of this, letting it rest on the sand or gravel. Then put a layer of fine sand about six inches thick on this, then a layer of charcoal on the fine sand and a layer

of gravel on the charcoal. Pour the water into the large barrel and it will filter through the gravel, charcoal and sand and rise in the smaller barrel.

Q. What are some of the most common water-borne diseases?

A. The germs of typhoid fever, cholera, dysentery and a great many intestinal parasites are carried by water. Hard water or water containing certain minerals often causes various intestinal disorders as diarrhea and constipation.

Q. What are the chief sources of water contamination?

A. Sewage and surface drainage in thickly settled districts.

Q. How would you detect an excess of salt or chlorides in water?

A. By adding a few drops of weak solution of nitrate of silver which gives a milky precipitate in proportion to the amount of salt present.

Q. What denotes organic matter in water?

A. An offensive, putrid or ammoniacal odor, especially on heating, or a brownish or yellowish color. Pure water is usually of a bluish or greyish color. In noting the color, a layer of water one foot high in a glass tube or cylinder on white paper should be used.

Q. How would you collect a sample of water for examination?

A. For chemical analysis about two liters are necessary, and about one-quarter liter for bacteriological examination. The flask and cork should be perfectly sterile. If taken from a tap, enough water should run to empty the branch pipes before taking sample; if from a pump, the stock should be emptied, and if from an open well, spring, stream, pond or lake it should be taken from below the surface. The bottle should then be corked and the mouth protected with a sterile dressing.

PERSONAL HYGIENE.

Q. What is one of the first requisites for good health?

A. Cleanliness of the person and clothing. A daily bath should be taken when practicable. The hair should be kept short, fingernails kept trimmed and cleaned, teeth brushed twice daily and the exposed parts of the body, face and neck bathed frequently, and the arm pits and genitals at least once a day. Dirty bodies and dirty and infected clothing are very often the cause of skin and other diseases.

Q. What are the main purposes of clothing?

A. To protect the body from cold, heat, wind and rain; maintain warmth; protect it from injury and to adorn it.

Q. From what sources are the materials for clothing derived?

A. From wool, hair, fur, feathers, silk and skins of animals, and various vegetable fibers.

Q. What determines the character of clothing that should be worn?

A. The condition of the weather and the character of the service to be performed.

Q. What material is generally used next to the body and what for outer garments?

A. Underclothing is usually made of cotton and linen and while wool and silk are often used thus, they are more generally used for outer garments, as are the other materials procured from animal sources.

Q. What materials are most suitable for warm and cold weather?

A. Generally speaking, cotton, linen and silk are most suitable for summer, and wool, hair, fur and feathers for the winter. As a rule, the vegetable fibers are used for underclothing in both warm and cold weather. They are good conductors of heat and

poor absorbers of moisture, and hence are good for outer clothing also in warm weather. Wool, hair, and etc., are generally used for outer clothing. They are poor conductors of heat and good absorbers of moisture; keep in the body heat in winter and keep out the heat of the sun in summer.

Q. What precautions are most necessary in regard to clothing?

A. It should be kept clean and dry. Underclothing should be washed frequently and well dried before putting on to wear. When water is not available for washing underclothes, they should be dried and aired in the sun frequently. Woolen clothing does not stand washing and scrubbing well, so this should be done as little as possible.

Q. What effect has the color of clothing upon the body?

A. Color has very little effect upon the temperature of the body, except in the direct rays of the sun. Black and dark colors absorb the rays of the sun and are thus warmer, while white and light colors reflect these rays and are thus cooler. Some authorities think that dark colors have great influence in excluding certain injurious chemical elements of the sun's rays.

Q. What effect has texture on the warmth of clothing?

A. Loosely woven materials which have much air in their textures are warmer, as air is a poor conductor. Leather, rubber, paper and other impervious material keep out winds and are warm for that reason.

Q. What is probably the greatest danger to which the sailor and soldiers are exposed?

A. Venereal disease, that is, gonorrhea, chancroid and syphilis, which are very injurious to health, are often followed by the most serious consequences, such as bladder and kidney disease, frightful sores and ulcers, loss of vision and voice, aneurysm, locomotor ataxia, paralysis and insanity. Venereal diseases are the cause of many discharges from the service for physical disability, and more admissions to the sick list than any other disease.

Syphilitics can never be certain of a permanent cure. They are liable to infect others, and if they marry may infect their wives and beget syphilitic children with all the evil consequences.

Q. What is a great factor in acquiring venereal disease?

A. Alcoholism, which incites and leads to sexual indulgence, and the two should be considered together. Neither one is necessary to health and alcohol is very harmful. Alcohol lowers the resistance of the body to disease, and though it temporarily stimulates, this is promptly followed by diminished resistance to both heat and cold. A man under the influence of alcohol is not cleanly in his habits or careful of his associates, does not observe sanitary precautions, lacks judgment and is therefore much more liable to contract venereal diseases.

Q. What is the only certain protection against venereal disease?

A. The avoidance of impure sexual intercourse, and, as practically all prostitutes are infected sometime, the only safety from venereal infection is to abstain from sexual intercourse until after marriage.

Q. What precautions should be observed after exposure to venereal infection?

A. The urine should be passed directly after exposure, the parts should be thoroughly washed with a 1/2000 bichloride solution, or with soap and water, after which a good prophylactic remedy should be used.

Q. Give the method for venereal prophylaxis.

A. (1) Wash the penis thoroughly with a 1/2000 solution of bichloride of mercury; (2) pass the water and inject the urethra with a 2 per cent solution of protargol and hold for one minute; (3) rub 50 per cent calomel ointment well into the foreskin, frenum, head and shank of the penis.

This treatment should be taken as soon as possible after exposure, as the danger of infection increases rapidly with delay. Even

with the most prompt and careful treatment venereal infection sometimes occurs.

Q. What are some other very important considerations in personal hygiene?

A. Regular habits, systematic exercise and regular hours for sleeping and eating. Great care should be taken in the selection of food and drink, especially in the tropics, where it is best to avoid all native prepared foods and drinks. Native fruits may be eaten when not overripe or unripe, but the skins should be removed or washed thoroughly.

In the tropics, or in warm weather, protection against the heat of the sun to avoid sunstroke is necessary. The head, neck, arms and legs should be protected to avoid sun burn. The abdomen should be protected at night to prevent chilling.

AIR AND VENTILATION.

Q. What is air?

A. It is a mixture of about 79 parts of nitrogen and 21 parts of oxygen by volume, and about 77 parts nitrogen and 23 parts oxygen by weight. It contains also small quantities of carbon dioxide and aqueous vapors. Thus nitrogen constitutes about four-fifths and oxygen about one-fifth of the volume of the atmosphere.

Q. What are the functions of these two elements?

A. Nitrogen acts as a diluent for the oxygen which supports all animal life. Oxygen is always being taken from the air by respiration and combustion and returned to it combined with carbon dioxide. Vegetable life takes up carbon dioxide and decomposes it, retaining the carbon and returning free oxygen to the air, thus maintaining the equilibrium.

Q. What is humidity of the air?

A. It is the moisture or watery vapor contained in the air, and the higher the temperature the greater is the capacity of the air for moisture. When air will contain no more moisture it is said to be saturated. When cold air comes into contact with saturated air the excess moisture is precipitated as rain or dew.

Q. What are the chief impurities found in air?

A. Dust, bacteria, organic matter and carbon dioxide.

Q. Of what are the organic impurities composed?

A. Particles of epithelium, emanations from the lungs, mouth, nose, throat, skin and intestinal tract, pus cells from suppurating wounds and bacteria of various diseases. Dust contains various kinds of bacteria and organic impurities.

Q. What are some of the ill effects of overcrowding and vitiated air?

A. Headache, dizziness, insomnia, nausea and loss of appetite; when long continued there is loss of strength and diminished resistance to disease. Besides many diseases, such as tuberculosis,

pneumonia, erysipelas, influenza and the eruptive fevers come from inhalation of bacteria from the air.

Q. In what other ways may air be polluted?

A. By the products of combustion in heating and lighting, as carbon dioxide is thus liberated in large quantities.

Q. What amount of carbon dioxide is there in fresh air?

A. About 4 parts in 10,000. This is normal but the amount varies somewhat with the locality and surroundings. It is probably not harmful until after it exceeds 4 parts in 1000, which limit is not often reached, even in very badly ventilated compartments.

Q. How is impurity of the air best indicated?

A. By the amount of carbon dioxide present. While carbon dioxide may not be present in sufficient quantities to do harm,

an excess of it generally indicates that there are other impurities present in harmful amounts.

Q. What is ventilation?

A. It is the process of removing vitiated air from compartments and replacing it with fresh air.

Q. How is ventilation designated?

A. As (1) natural, (2) artificial.

Q. How is natural ventilation produced?

A. By having openings in the walls, floors, or ceilings of compartments which permit of free natural circulation of the outside air. This can be best attained by having the openings on opposite sides.

Q. What is a very great factor in effecting natural ventilation?

A. The difference of temperatures between the outside air and the inside air, and consequently different densities which cause motion and diffusion in order to establish an equilibrium.

Q. Why is proper ventilation easier to accomplish in warm weather?

A. Because all windows and doors can be left open and the breezes and natural circulation supply fresh air in sufficient

quantities. When the air is very still it is sometimes necessary to use fans to put it in motion.

Q. How is artificial ventilation produced?

A. By fans, blowers, pumps, windsails, air scoops and other mechanical appliances.

Q. What two systems of artificial ventilation are there?

A. (1) The supply system in which fresh air is forced into a compartment; (2) the exhaust system in which vitiated air is sucked or pumped out of a compartment.

Q. How are living spaces ventilated on shore and at sea?

A. On shore, natural ventilation is generally sufficient to furnish all the necessary fresh air; but at sea, artificial ventilation is very necessary, especially on the lower decks and in the holds, and on the upper decks when the ports have to be closed in bad weather. Toilets, pantries, provision storerooms and compartments below the water line, or that have no side ventilation should have exhaust as well as supply systems of ventilation.

Q. What is necessary in any system for proper ventilation?

A. At least two openings which should be on opposite sides of the compartment.

Q. How much air per hour is necessary to maintain a person in health and vigor?

A. About 3000 cubic feet; and as this much space is not available in buildings for each person, the air must be renewed frequently.

Q. How frequently should the air of a room be changed?

A. Not over five times an hour, as oftener than this would create too much draft and thus be harmful.

Q. What then is the minimum size of a properly ventilated room that one person should occupy?

A. About 600 cubic feet, or about 8 feet square by 9 feet high. As ventilation is rarely perfect, a much larger space is usually required.

Q. What proportion of floor space should there be in a living room?

A. Not less than one-twelfth of the cubic capacity; that is, the ceiling should not be over 12 feet high as there is little movement in the air above that, so that it is not available for use.

Q. How many cubic feet of fresh air are required in hospital wards?

A. Owing to increased effluvia and impurities from the sick, each patient should have about 4000 cubic feet of fresh air per hour.

Q. In supplying fresh air to patients and others what precautions are necessary?

A. That the patient be protected from direct drafts by screens and that the fresh air be of the proper temperature.

Q. What are some methods for promoting natural ventilation of wards and rooms?

A. In the absence of artificial ventilation, the supply of air must be regulated by the doors and windows. Ventilation is best secured by opening the windows at both top and bottom and on opposite sides of the room. Another method is to place a board under the lower sash and air will enter between the upper and lower sashes, or, better still, put a frame with muslin stretched on it under the lower sash and the air will filter through the muslin as well as come in between the sashes. It is sometimes necessary to flush out wards by opening wide the doors and windows, and in such cases the patients should be well wrapped and protected as if out of doors.

HEAT AND LIGHT.

Q. How is heat distributed?

A. (1) By radiation in which heat is thrown off from a body in straight lines in all directions with equal intensity, which diminishes as the square of the distance increases; (2) by conduction

through all solids, but to a very limited degree by liquids and gases; metals are the best conductors, then stone, then wood and least of all, wool and silk; (3) by convection in gases and liquids in which those portions, which are heated, rise and colder portions take their places. Thus a circulation of the liquid or gas is set up and the whole mass is warmed.

Q. How is the heating of rooms accomplished?

A. Mostly by convection, partly by radiation and hardly appreciably by conduction.

Q. Is there any relation between heat and ventilation?

A. There is a very close connection between the two, especially in winter. Natural ventilation depends a great deal upon the difference between the temperature of the room and that outside, and the temperature of a room depends greatly upon the ventilation.

Q. What is the ideal method of ventilation?

A. When all the fresh air is supplied at the proper temperature; but this is rather difficult to accomplish.

Q. At what temperature should living spaces be kept?

A. From 65° to 70° Fahrenheit, or 18° to 21° Centigrade.

Q. How is heat usually supplied?

A. By open fires; by stoves; by hot air from furnaces; by hot water and by steam. Gas, oil and electric stoves and radiators are used to some extent.

Q. How do they compare as to efficiency and economy?

A. Open fires are the least efficient and economical, although they and hot air furnaces are a very great aid to ventilation. Next to open fires, stoves are least efficient and then follow hot air furnaces, steam and hot water, which latter heat is the most economical of all after the system is installed. Rooms are sometimes heated by gas or oil stoves and radiators, but they are not very generally used. Electricity is sometimes employed for heating rooms, and though probably the most sanitary method it is very expensive.

Q. What methods of heating are most generally used at present?

A. Open fires, stoves and hot air furnaces are generally out of date, but are still much used in the country, villages, towns and small cities, while hot air is still often used in the older houses of large cities. Hot water is generally used for dwellings in cities and for buildings not over four stories high, while steam is used for the larger buildings and on board ships.

Q. What is the principle on which hot water and steam systems of heating work?

A. They work on the principle of convection. A portion of the water is heated or turned into steam and it becomes lighter, rises and goes into the pipes and radiators, while other portions take its place. Circulation is thus set up and the whole system becomes heated. The rooms are then heated by radiation and convection from the pipes and radiators. Each radiator has a feed and a return pipe.

Q. Explain the different systems of heating by steam and hot water?

A. (1) In the direct system the radiators are placed in the rooms and furnish the heat direct; (2) in the indirect system the radiators are placed in the basement or another room in a sheet-iron box, fresh air is let in from the outside, warmed, and then conducted to the room; or, (3) the radiators may be placed in the room, the fresh air brought in directly under them and passing up between the pipes, warmed and distributed about the room. This might be called the direct-indirect system.

Q. Where should radiators generally be located?

A. Near the windows or doors or openings that supply ventilation, so the fresh air can be warmed somewhat as it comes in.

Q. What is very necessary in heated dwellings, especially where stoves or hot air furnaces are used?

A. Sufficient moisture should be maintained in the air by the use of pans of water on the furnaces, stoves or radiators.

Q. What is a very necessary precaution where gas light and coal furnaces are used?

A. To see that there are no leaks in the pipes or furnace allowing the escape of illuminating or coal gas.

Q. How is the heat of wards regulated?

A. In some hospitals it is regulated automatically by valves which open up and let in heat when the ward gets below a certain temperature and close and shut off the heat when it gets above a certain temperature. Where there is no automatic device the thermometer in the room should be watched and the temperature regulated by turning the heat off and on as necessary, or by opening or closing the doors and windows. Care should be taken that good ventilation be not sacrificed for the purpose of increasing the temperature.

It is best to put more cover on the patients and let them have fresh air.

Q. What precautions should be taken in lighting wards, sick rooms and living spaces?

A. Wards, sick rooms and living spaces should have plenty of sunlight. Patients should not have to face the windows or lights as the constant glare of the light is trying and disagreeable to the eyes. The light should come from their backs or sides, and the windows should have shades in order to properly regulate the light.

Q. What is the best artificial light?

A. Electric lights, as they are in vacuums and give off no disagreeable odors or poisonous gases and consume none of the oxygen of the air. Lights should generally be placed high or shaded so as to prevent the direct glare in the eyes.

Q. What are the chief objections to gas and oil lights?

A. They consume much of the oxygen of the air in the process of combustion; they often give off noxious gases and bad odors and vitiate the air; they are more trouble and there is much danger of fires from them.

PREVENTION OF DISEASE.

INFECTION AND ITS PREVENTION.

Q. What is probably the greatest factor in the spread of disease and infection?

A. Insects, and the chief of these is the common house fly. Disease and infection are also spread by other flies, mosquitoes, ants, cockroaches, bed-bugs, ticks, fleas, lice and other insects.

Q. How do flies carry infection?

A. They light on infected substances as feces, sputum, foul ulcers, pus and other excretions and persons in active stages of disease, and carry some of the infected material on their feet directly to other persons, or contaminate food and drink, and thus cause disease.

Q. What favors the propagation of flies?

A. Putrid or decaying animal and vegetable matter. Stable manure is the greatest known factor in breeding flies.

Q. What is the best way to prevent the breeding of flies?

A. By destroying putrid and decaying material and keeping stable manure well covered so as to exclude the light, as flies do not breed in the dark.

Q. What methods are used for destroying flies?

A. They are killed by "swatters"; trapped with fly paper and mechanical traps; killed with pyrethrum and other insect powders, or by fumigation with sulphur and by poisons placed around in open vessels. One of the best poisons is formalin in solution 1/500 in sweetened water.

Q. What is the best method of protection from flies?

A. Living places, especially sick rooms and hospital wards, should be thoroughly screened, as should kitchens, dining rooms, mess halls, pantries and provision storerooms, and all food should be very carefully screened and protected from flies.

When flies get into a room or ward where there are contagious cases or infected material, they should be killed and not driven out as they would then spread the infection.

Q. What diseases do mosquitoes transmit?

A. Malarial and yellow fevers, filariasis and other diseases.

Q. How do mosquitos transmit disease?

A. By biting an infected person or animal and then biting another person after a period of incubation.

Q. What mosquitoes carry disease?

A. Principally the *Anopheles maculipennis,* or malarial mosquito, and the *Stegomyia calopus* or yellow fever mosquito. The female only bites and therefore she alone conveys the disease. Mosquitoes generally bite at night, hence the necessity for protection against them at night. The stegomyia also bites in the day and when mosquitoes are found biting in the day they are generally of that variety.

Q. How would you recognize a female anopheles or malarial mosquito?

A. She is of a brownish color, her palpi are as long as her proboscis, her body and proboscis form a straight line, and, when resting, her body is nearly perpendicular to the surface on which she rests.

Q. How would you recognize a female stegomyia or yellow fever mosquito?

A. She is very black and has white bands around the legs at the joints and around the after part of the body, and a white lyre-shaped figure on the back of the thorax or forward part of the body. Her palpi are shorter than her proboscis. She is humpbacked, and, when resting, her body is nearly parallel to the surface upon which she rests.

Q. How do you distinguish male from female mosquitoes?

A. Males have feather-like antennae, or woolly heads, and females have not.

Q. What are the habitats of mosquitoes?

A. Yellow fever mosquitoes breed in small collections of water around houses and do not go far from home, while the

malarial fever mosquito breeds in the country in large pools, streams, swamps and ditches and is found far away from human habitations.

Q. What is the incubation period for the malarial mosquito?

A. A week or ten days is required for the parasite to develop in the mosquito after biting an infected person. If the mosquito then bites a person some of the parasites are injected into his blood, and after another period of incubation malarial fever develops.

Q. What is the incubation period for the yellow fever mosquito?

A. The mosquito must bite a yellow fever case within the first three days of the onset of the disease. The germ then develops in about twelve days and is transmitted to other cases by the mosquito biting them, and after an incubation period of from two to five days yellow fever develops.

Q. How would you differentiate between yellow fever and malarial mosquito larvae?

A. Malarial larvae lie almost parallel to the surface of the water, and yellow fever larvae hang nearly perpendicular. The positions of the two larvae are just the opposite of the adult mosquito when at rest.

Q. What is the best protection against mosquitoes?

A. Destruction of their breeding places, which are stagnant waters, and protection of those who have malarial and yellow fever from mosquitoes by screens.

Where mosquitoes are present, all living spaces should be well screened, especially at night.

Q. How are the breeding places of mosquitoes destroyed?

A. By clearing away dense undergrowth and rank vegetation, and by draining or filing in all stagnant pools, ponds, ditches, lagoons and swamps; and where this is impracticable, by covering their surface with a thin film of kerosene oil to destroy the larvae and prevent breeding. All vessels or collections of fresh

water around a house should be emptied, screened or covered with kerosene.

Q. How is disease transmitted by cockroaches, ants, etc.?

A. Usually by contaminating the food and drink.

Q. What are their principal habitats?

A. Kitchens, galleys, pantries, dining rooms, mess halls and any places where food is kept.

Q. What is the best method for getting rid of them?

A. By keeping their habitats clean and keeping food out of their reach. Fluoride of sodium is probably the most efficient exterminator of them. It should be blown into cracks, crevices, dead spaces and the run-ways of the vermin with powder-blowers, and put on the back part of shelves and in drawers and left there. It should be in a very thin film and be so distributed that the vermin will have to walk through it and get it on their legs. They clean themselves up with the mouths and thus are killed.

Q. What are the eruptive fevers and what is the best mode of preventing their spread?

A. They are measles, scarlet fever, small pox and chicken pox, and they should be isolated as soon as recognized to prevent their spread, and all precautions carried out as described under infectious camps.

Q. What other case should be isolated?

A. Mumps, erysipelas, cerebrospinal fever, bubonic plague, diphtheria, and some forms of tonsillitis. Tuberculosis, pneumonia, typhoid fever, influenza, malaria, yellow fever, dysentery, cholera, syphilis and gonorrhea should be segregated; there is not the same necessity for strict isolation as in the other diseases mentioned, but the attendants should take just as strict antiseptic precautions and disinfect utensils, clothing, dejecta, etc., as in the eruptive fevers.

Q. In what other ways are diseases transmitted?

A. By rats, mice and various domestic animals, and by direct contamination of the person, food and clothing. Rats transmit

plague; dogs and cats, rabies and various intestinal parasites; horses and cattle, glanders and anthrax, hogs, trichinosis, tapeworm, etc. Many diseases are transmitted by contamination of water and food as typhoid fever, cholera, dysentery, diarrhea and other intestinal disorders. In many sections of the country, especially in the southern states, the hook worm is very prevalent in the soil and is transmitted by contact with infected dejecta and soils.

Q. How is tuberculosis generally contracted?

A. By association with tuberculous cases and by unsanitary surroundings.

Q. What precautions should be taken to prevent the spread of tuberculosis?

A. Tuberculous cases should be segregated and association with them avoided. They should have a mild equable climate and live in the open air as much as possible. Their sputum should always be disinfected as should their dejecta and clothing, table ware and utensils.

Q. What are the cardinal points in preventing the spread of infection?

A. (1) The patient should be isolated and screened; (2) the attendants should observe strict antisepsis; (3) all the excreta, dejecta, dishes, utensils, clothing, etc., should be disinfected; (4) when discharged the patient and his effects should be disinfected; (5) the room or ward and furniture should then be fumigated.

Q. What diseases can be prevented or cured by vaccines and serums?

A. (1) Small pox is prevented by vaccination, which was discovered by William Jenner, in England, and made known in 1798; (2) diphtheria is prevented and cured by hypodermic injections of antitoxin, which is the serum of a horse immunized to diphtheria; (3) rabies is prevented by the injection of broth made from the spinal cords of infected rabbits; (4) tetanus is prevented and sometimes cured by injections of tetanus antitoxin; (5) typhoid fever is prevented by injecting killed cultures of typhoid bacilli; (6) cere-

brospinal fever in often cured by Flexner's serum; (7) pneumonia, erysipelas, septicemia, boils, and gonorrhea are often treated and cured by vaccines made from their respective bacteria.

Q. What is quarantine?

A. It is the detention of ships, persons, animals or goods that are infected with certain contagious diseases or arriving from infected ports, for certain periods of time, before allowing them to enter the country.

Q. What diseases are quarantined by the Public Health Service, and what are their quarantine or incubative periods?

A. (1) Cholera, five or six days; (2) bubonic plague, seven days; (3) yellow fever, five or six days; (4) typhus fever, twelve days; (5) small pox, fourteen days; (6) leprosy, not allowed to enter.

DISINFECTION.

Q. How would you prevent the spread of contagion from infectious camps, wards or cases?

A. The infectious camp should be isolated from all other buildings and no communications had with it except what is absolutely necessary. The wards and kitchen should be thoroughly screened, the grounds kept clean and all trash, garbage, refuse and excreta burned. The patient's effects should be thoroughly sterilized on admission and stored in some other place than the camp. Inter-communication between wards with different diseases should be prohibited. Patients should not be allowed to leave the spaces allotted to them, and nurses and attendants should wash and sterilize themselves before going from one kind of disease to another kind, and when in actual attendance on a contagious case should not be allowed to leave camp until relieved from duty and thoroughly sterilized and clad in clean clothes. All bedding, linen, clothing, utensils, etc., used in the camp should be sterilized. Attendants should keep a 1/1000 bichloride solution convenient in order to sterilize their hands frequently. When a patient is ready for discharge he should be

given a bath, sponged off with an antiseptic solution, transferred to a non-infected room and given clean clothes.

When a ward becomes vacant it should be thoroughly fumigated with formalin or sulphur, the furniture, bedding, etc., being left during the fumigation. Then the floor, walls, ceiling and furniture should be scrubbed with soap and water and a 1/500 acid bichloride solution. When tents are vacated they should be sprayed with an antiseptic solution, moved, turned inside out, set up and exposed to the air and sunlight. If they are to be transferred elsewhere they should be fumigated with formalin or sulphur. Nothing should leave the camp or wards until after it is thoroughly sterilized.

Q. What is meant by disinfection?

A. It is the process of killing all germs of disease.

Q. How is it accomplished?

A. (1) By dry heat, which is little used; (2) by steam heat; (3) by boiling; (4) by chemical substances, known as antiseptics, in solution and by fumigation.

Q. Name the principal chemical disinfectants.

A. (1) Bichloride of mercury from 1/500 to 1/1000 acid solution; (2) phenol, five per cent solution; (3) cresol, one per cent solution; (4) chlorinated lime, four per cent solution; (5) formalin, two and one-half per cent solution or by fumigation; (6) sulphur, by fumigation; (7) quick lime, which is uncertain.

Q. How would you prepare a room for disinfection by fumigation?

A. The furniture should remain and the bedding and clothing should be spread out or hung up so as to be fully exposed to the fumes. All cracks and openings should be sealed, the fumigation started and the door closed tightly and sealed and kept closed from four to twelve hours.

Q. How do you generate formaldehyde gas for fumigation in disinfecting rooms?

A. (1) By liberating the gas from wood alcohol by heating in a special generator, and about 1000 cc. of alcohol is used per

1000 cu. ft. of air space; (2) by liberating the gas from formalin of which about 500 cc. is used for 1000 cu. ft. of air space; the gas may be liberated by heating in a generator of the autoclave type, or by putting 500 cc. of formalin into a metal pail, placing it in a tub of water and then putting 250 gm. of permanganate of potash into it; (3) by vaporizing with heat solid paraform pastiles, about 30 to 1000 cu. ft. of air space.

Q. How do you fumigate with sulphur?

A. Four pounds of sulphur are required for each 1000 cu. ft. of air. Break up the sulphur well, place it in a pan and pour a small quantity of alcohol over it. The pan is then placed on bricks in a tub of water, the alcohol ignited, the room closed and left from four to twelve hours before opening. Bright metals should be removed or covered with carbolated vaseline, as sulphur tarnishes them badly.

Q. After fumigation what steps are to be taken?

A. Open up the room from opposite sides so it can be ventilated and the fumes gotten rid of. Put the clothing and bedding out to air. Then scrub the floor, walls, ceiling and furniture with an acid bichloride solution.

Q. Which is the more efficient disinfectant, sulphur or formaldehyde gas, and why?

A. Sulphur is the more efficient as it destroys vermin, insects and the higher forms of life as well as bacteria, while formaldehyde gas destroys only bacteria.

Q. What objections are there to the use of sulphur?

A. It blackens metals and injures certain fabrics and destroys colors.

Q. How would you disinfect mattresses, pillows and thickly padded articles?

A. By steam sterilization, as fumigation only disinfects surfaces and would not penetrate these articles sufficiently.

Q. Describe the operation of a steam disinfector.

A. The mattress and other articles should be placed in the chamber from the infected side and the doors tightly closed. The

steam should be turned into the jacket to heat up the chamber and the vacuum valve should be opened to exhaust all the air in the chamber after which it is closed and steam under fifteen or twenty pounds pressure turned into the chamber for twenty minutes, then exhausted, air let in and the articles dried by the heat from the jacket of the chamber and then removed by the non-infected side.

Q. How would you sterilize clothing and other fabrics with antiseptic solutions?

A. They should be placed in a suitable size vessel, covered with the solution and allowed to stand from two to four hours.

Q. What precautions should be taken with bichloride of mercury solution?

A. It should never be used in metallic vessels nor on metallic instruments, utensils or apparatus as it corrodes them and would render them useless in a short while.

Q. What are the best antiseptic solutions for metallic articles?

A. Phenol, or carbolic acid and cresol.

DISPOSAL OF WASTE.

Q. Why is the proper disposal of waste so necessary?

A. Because infection and disease are generally due to contamination from wastes, such as excreta from people and animals and organic refuse of all kinds which often contain bacteria of disease.

Q. How is this contamination transmitted?

A. By flies and various other insects and animals direct to persons, or to the food and drink; or by direct contact of the person or food and drink with the wastes.

Q. What are the principal wastes to be disposed of?

A. Night soil (urine and feces), garbage and refuse food, slops, waste water, trash, etc.

Q. How are wastes disposed of in cities and large towns?

A. By systems of drain or waste pipes which empty into sewers, and by crematories and dump heaps.

Q. What wastes are disposed of by sewers and what by cremation?

A. Night soil, slops and waste water are disposed of by sewers, and solid organic matter, such as garbage, by cremation. Trash and inorganic matter are generally dumped in out of the way places where trash is usually burned.

Q. How are wastes disposed of in the country and villages?

A. Night soil is discharged into pans, pits or cesspools. When pans and pits are used the waste should be covered with earth, ashes or lime. They are objectionable as they pollute the soil and scatter infection. Cesspools are excavations in the ground and may or may not have an impermeable lining; if they do not have this lining they are known as leeching cesspools. They are objectionable for the same reason as pits and pans. In some communities night soil is discharged upon the surface of the ground and scattered on the land for fertilizer. This is very objectionable and insanitary.

Q. What is the final disposition of sewage?

A. It is discharged into cesspools; into running streams or the sea; upon sewage farms and into septic tanks.

Q. What is a septic tank?

A. In consists of two parts: a closed tank in which bacteria work in the absence of air and liquefy the organic matter, and a series of filter beds in which air-using bacteria continue the putrefaction until the sewage emerges as a clear liquid.

Q. How are wastes disposed of on shipboard?

A. At sea the disposal of waste is very simple as everything goes overboard. On all ships there is a drainage system by which the night soil, slops and waste water are discharged overboard, while the trash, garbage and other refuse are thrown overboard. In port the trash, garbage and refuse are placed on lighters or in receptacles on shore and disposed of by the local authorities.

Q. How are wastes disposed of in field operations?

A. Night soil in latrines and covered with earth; slops in pits and sterilized; trash, garbage and other refuse are burned.

Q. What is necessary in the drainage systems of houses and cities?

A. That the plumbing should be good. There should be no leaks in the pipes and they should be well trapped so as not to allow any back flow of sewer gas or foul air into the dwellings.

PHARMACY.

(Based on Remington's Pharmacy.)

Q. What is pharmacy?

A. Pharmacy is the science which treats of medicinal substances and the arts of preparing and dispensing them.

Q. Into what two great classes is pharmacy divided?

A. Theoretical and practical.

Q. What is theoretical pharmacy?

A. A knowledge of the substances used as medicines—animal vegetable and mineral, comprising *botany*, the science of plants; *mineralogy*, the science of inorganic substances; *zoölogy*, the science which treats of animals; *physics*, the science which explains the changes produced in bodies without changing their identity; *chemistry*, the science which treats of those changes affecting specific identity of the bodies; *materia medica*, the medicinal materials or substances used as medicine; *pharmacognosy*, the science of crude drugs; *toxicology*, the science of poisons; *microscopy*, the art of examining the minute structure of bodies by the aid of artificial lenses arranged for magnifying; *bacteriology*, the science which treats of micro-organisms.

Q. Of what does practical pharmacy treat?

A. The operations, processes and methods used in applying the principles of theoretical pharmacy.

PHARMECOPEIAS AND DISPENSATORIES.

Q. What is a pharmacopeia?

A. An authoritative list of medicinal substances, with definitions, descriptions, or formulae for their preparation, accepted as authoritative by the general government, and by the government of the United States.

Q. What is the United States Pharmacopeia?

A. The United States Pharmacopeia was originally devised, and is revised every ten years, by a committee appointed from

the professions of medicine and pharmacy. It should be a representative list of the drugs and preparations employed in the treatment of disease.

Q. How are the titles of the medicinal substances indicated in the United States Pharmacopeia?

A. (1) By the official Latin title; (2) by the official English title; (3) by the synonym; (4) by the botanical name (in the case of plants); (5) by the symbolic formula (in the case of chemicals).

Q. Give examples of each.

A. Cannabis indica (official name); Indian cannabis (English name); Indian hemp (synonym). Zinci iodidum (O.N.); zinc iodide (E. N.); ZnI_2, 316.70 (symbolic formula). Prunus Virginiana (O.N.); wild cherry (E. N.); *Prunus serotina* (botanical name).

Q. Why should the official Latin title be used?

A. The official Latin title should be used in designating the drug when precision is required—labels, prescriptions, specimens, etc.

Q. Why is the Latin language employed?

A. Because it is a dead language and not likely to change, as in the case of a living tongue.

Q. When should the official English title be used?

A. In ordinary conversation; in commercial transactions, etc.

Q. What is the botanical name?

A. The systematic name recognized by botanists for plants.

Q. What is the symbolic formula?

A. The symbolic formula is a combination of symbols representing the chemical structure of the articles to which it refers.

Q. What is the official definition?

A. The official definition states explicitly what kind or variety of the substance should be used.

Q. What is meant by the purity rubric?

A. It fixes the amount of permissible harmless impurities.

Q. What is the official description.

A. The official description follows the official definition in the pharmacopeia. It consists of, in drugs: a concise statement

of physical characteristics; tests of identity and description of adulterants. In chemicals: statement of physical characteristics; solubilities; tests of identity and purity.

Q. What is to be said of assay processes?

A. The assaying of drugs and preparations has become necessary in order definitely to fix their value as medicinal agents.

Q. What doses are given in the United States Pharmacopeia?

A. The average approximate (but within a minimum or maximum) dose for adults; the metric system to be used, and the equivalents in ordinary weights or measures inserted in parentheses.

Q. What is a dispensatory?

A. It is a commentary on a pharmacopeia. It aims to present information concerning important non-official drugs and those official in other pharmacopeias, as well as those in the United States Pharmacopeia.

Q. What is weight?

A. Weight is the difference between the attraction of the earth and that of surrounding bodies for bodies on the surface of the earth. It depends upon its bulk and density. Density is the amount of matter in given bulks of bodies.

Q. What is meant by weighing?

A. Balancing a body of known gravitating force with one whose gravity is not known, for the purpose of estimating the gravitating force of the latter, which is called its weight.

Q. What are weights?

A. Weights are bodies of known gravitating force used for weighing.

Q. What name is given to the apparatus used for weighing?

A. Scales and weights.

Q. What standards is the system of weights based on?

A. The grain and the meter.

Q. How was the grain weight derived?

A. By act of Henry III of England, in 1226—"An English silver penny, called the sterling, round and without clipping, shall

weigh thirty-two grains of wheat, well dried and gathered out of the middle of the ear."

Q. What is a meter?

A. One 40-millionth of the circumference of the earth at its poles.

Q. What systems of weights based on the grain are used in pharmacy?

A. The troy or apothecaries' system and the avoirdupois system.

Q. What are the denominations of each?

A. Troy or apothecaries' weight: 20 grains = 1 scruple; 3 scruples = 1 drachm; 8 drachms = 1 ounce; 12 ounces = 1 pound. Avoirdupois weight: 437½ grains = 1 ounce; 16 ounces = 1 pound.

Q. What are the symbols of each?

A. Troy: grain, or grains, gr.; scruple, ℈; drachm, ʒ; ounce, ℥. Avoirdupois: ounce, oz.; pound, lb.

Q. How many grains does an ounce of each system con tain and what is the difference in grains between the troy and avoirdupois ounce?

A. Avoirdupois ounce = 437½ gr.; troy ounce = 480 gr. A troy ounce weighs 42½ gr. more.

Q. What is the difference in grains between the avoirdupois and troy pound?

A. Avoirdupois pound, 7000 gr.; troy pound, 5760. Avoirdupois pound therefore weighs 1240 gr. more.

Q. What is measure?

A. The bulk or extension of bodies.

Q. What systems of measure are used in pharmacy?

A. Apothecaries' or wine measure, imperial or British measure and the metric system.

Q. What are denominations of each?

A. Apothecaries' measure: 60 minims = 1 fluidrachm; 8 fluidrachms = 1 fluidounce; 16 fluidounces = 1 pint; 8 pints = 1 gallon. Imperial measure: 60 imperial minims = 1 imperial

fluidrachm; 8 imperial fluidrachms = 1 imperial fluidounce; 20 imperial fluidounces = 1 imperial pint; 8 imperial pints = 1 imperial gallon. The U.S. fluidounce is equal to 480 U.S. minims, and to 500 imperial minims. The standard imperial gallon is the volume of 70,000 grains, or 10 avoirdupois pounds of pure water at +62°F., barometer at 30 inches. One imperial minim of pure water at +62°F., weighs only 0.911458 grain.

Q. What are the symbols of each?

A. Apothecaries' measure: Minim, ɱ; fluidrachm, f℥; fluid ounce, f ℥; pint, O; gallon, Cong. Imperial measure: Minim, min.; fluidrachm, fl. dr.; fluidounce, fl. oz; pint, O; gallon, C.

Q. What are approximate measures of ordinary containers?

A. A tumblerful, f ℥ viij (240 cc.); a teacupful, f ℥ iv (120 cc.); a wineglassful, f ℥ ij (60 cc.); a tablespoonful f ʒ iv (16 cc.); a dessertspoonful, f ʒ ij (8 cc.); a teaspoonful, f ʒ i (4 cc.).

Q. What is the metric system?

A. A system of weights and measures which originated with Prince de Talleyrand, Bishop of Autun, France, in 1790; it has been legally adopted by the majority of all civilized nations.

Q. What is a meter?

A. The unit of length of the metric, French or decimal system, from which all other denominations are derived.

Q. How is it obtained?

A. It was obtained by a measurement of the quadrant of a meridian of the earth, and is about one 40-millionth of the circumference of the earth at the poles.

Q. What is it practically?

A. Practically, it is the length of certain carefully preserved bars of metal from which copies have been taken.

Q. What is its equivalent in feet and inches?

A. It is equal to about 3 feet 3 $^{3}/_{8}$ inches.

Q. What is the unit of surface and how is it derived?

A. The unit of surface is the arc, which is the square of 10 meters (the square of a dekameter), a square whose side is 11 yards.

Q. What is the unit of capacity and how is it derived?

A. The liter, which is a cube of a tenth of a meter (the cube of a decimeter), 2.1134 pints.

Q. What is the unit of weight and how is it obtained?

A. The unit of weight is the gramme, which is the weight of that quantity of distilled water, at its maximum density (4° C.), which fills the cube of the one-hundredth part of the meter (cube of a centimeter, or the cubic centimeter, cc.), 15.43235 grains, or about 15½ grains.

Q. What are the denominations of the metric system, multiplied and divided?

A. They are multiplied by the Greek words, "Deka," ten; "Hecto," hundred; "Kilo," thousand; and divided by the Latin words, "Deci," one-tenth; "Centi," one-hundredth; "Milli," one-thousandth.

Q. Give a table showing how metric units are multiplied and divided.

A.

Quantities.	Length.	Surface.	Capacity.	Weight.
1000	Kilo-meter.	.....	Kilo-liter.	Kilo-gramme.
100	Hecto-meter.	Hectare.	Hecto-liter.	Hecto-gramme.
10	Deka-meter.	.....	Deka-liter.	Deka-gramme.
1 (units)	Meter.	Are.	Liter.	Gramme.
.1	Deci-meter.	.....	Deci-liter.	Deci-gramme.
.01	Centi-meter.	Centare.	Centi-liter	Centi-gramme.
.001	Milli-meter.	.....	Milli-liter.	Milli-gramme.

Q. What is the use of the gramme and of the cubic centimeter (fluigramme) as units of weight and measure?

A. The gramme and its divisions are used for weighing, and the cubic centimeter (cc. or fluigramme) for measuring liquids. A gramme and a cubic centimeter of distilled water are the same, but owing to greater or less density, cubic centimeters of other

liquids weigh more or less than a gramme as the case may be. If the cc. is taken as a unit of capacity only, and the gramme as the unit of weight, all difficulty is avoided. Dissolve 1 gramme of salt in q.s. water to make 10 cc. Each cc. of this solution contains 1 decigramme of salt. By keeping the cc. intact and varying the strength of the solution, each cc. can be made to contain any stated amount of salt from saturation to an infinitesimal quantity.

Q. Give the table of equivalents (metric and troy).

A.

One cubic centimeter . .	=	16.23	minims.
Four cubic centimeters. .	=	1.08	fluidrachms.
Thirty cubic centimeters	=	1.01	fluidounces.
One minim	=	0.06	cubic centimeters.
Four minims.	=	.25	cubic centimeters.
Ten minims	=	.62	cubic centimeters.
One troy drachm	=	3.888	grammes.
One troy ounce	=	31.103	grammes.

Q. What is the signification of the micromillimeter and the kilo?

A. The micromillimeter (mkm, or micron) is a term used in microscopy, and signifies the one-thousandth part of a millimeter. Kilo. is an abbreviation of the word kilogramme, and is used for convenience and brevity.

Q. How are metric weight and measures converted into those in ordinary use?

A. Multiply the metric quantities by the corresponding equivalent. Example: to convert—

Meters into inches	multiply by	39.370
Liters into fluidounces.	"	" 33.815
Cubic centimeters into fluidounces.	"	" 0.0338
Cubic centimeters into imperial fluidounces. . .	"	" 0.0352
Grammes into grains.	"	" 15.432
Decigrammes into grains	"	" 1.5432
Centigrammes into grains.	"	" .15432
Milligrammes into grains	"	" .015432

Q. How are weights and measures in ordinary use converted into metric weights and measures?

A. Multiply the quantities by the corresponding metric equivalent. Example: To covert—

Inches into meters	multiply	by	0.0254
Fluidounces into cubic centimeters	"	"	29.572
Grains into grammes	"	"	0.0648
Avoirdupois ounces into grammes	"	"	28.3495
Troy ounces into grammes	"	"	31.1035

Q. What is a balance?

A. An instrument for determining the relative weight of substances.

Q. How many kinds of balances are there?

A. There are five kinds: (1) Single beam, equal arm; (2) single beam, unequal arm; (3) double beam, unequal arm; (4) compound lever balances; (5) torsion balances.

Q. How are balances protected?

A. By enclosing them in glass cases with convenient sliding doors.

Q. How are liquids measured?

A. In graduated vessels of glass, tinned copper, or other metals, graduated on the sides.

Q. What is the size of a drop?

A. A drop will vary greatly in size. Thick, viscous liquids produce large drops; heavy, mobile liquids small ones. A drop of a heavy syrup may be five times greater than a drop of chloroform. The shape and surface of the receptacle from which a drop is poured causes appreciable difference in size.

SPECIFIC GRAVITY.

Q. What is specific gravity?

A. The comparative weight of bodies, of equal bulk, ascertained by weighing the bodies with an equal bulk of pure

water at a given temperature and atmospheric pressure, which is expressed as one (1. or 1.000).

SPECIFIC VOLUME.

Q. What is specific volume?

A. The volume of one body compared with the volume of an equal weight of another body selected as its standard, both bodies having the same temperature. Directly opposite to specific gravity, temperature chosen, usually 25° C. (77° F.).

Q. What is a thermometer?

A. A thermometer consists of a glass tube with capillary bore sealed at one end, and the other end terminating in a bulb. The bulb is filled with mercury or other fluid, which being expanded by heat, rises in the tube and registers the degree of heat, either on an index scratched on the tube, or marked on a piece of paper placed on the side of the tube.

Q. How many different scales for marking thermometric degrees are now in use?

A. Three. Centigrade, Fahrenheit, and Reaumur. In the centigrade scale, the freezing point of water is zero, the boiling point 100° and the intervening space is divided into 100 equal parts called degrees. In the Fahrenheit scale, the freezing point of water is 32°, the boiling point 212°, and the intervening space is divided into 180 equal parts called degrees. In the Reaumur scale, the freezing point is zero, and the boiling point 80°.

Q. What ratios do the three scales bear to each other, and how is one scale converted into the other?

A. Ratio C. 5: F. 9: R. 4. To convert centigrade degrees into those of Fahrenheit above 32, multiply by 1.8 and add 32. To convert Fahrenheit degrees above 32 into those of centigrade, subtract 32 and divide by 1.8.

Q. What processes in pharmacy require the application of high heat?

A. (1) Ignition, (2) fusion, (3) calcination, (4) deflagration, (5) carbonization, (6) torrefaction, (7) incineration, (8) sublimation.

Q. Describe each.

A. Ignition consists in strongly heating solid or semi-solid substances to obtain a definite residue. Example: The official quantitative tests for purified sulphide of antimony, phosphoric acid, etc.

Fusion is the process of liquefying solid bodies by heat. Example: Melting of iron or lead, or of wax.

Calcination is the process of driving off volatile substances, such as gas or water from inorganic matter by heat without fusion. Example: Magnesia and lime prepared by calcination.

Deflagration is the process of heating one inorganic substance with another capable of yielding oxygen (usually a nitrate or a chlorate) decomposition ensures, accompanied by a violent, noisy, or sudden combustion. Example: Salts of As. and Sb. made by this process.

Carbonization is the process of heating organic substances without the access of air until they are charred. The volatile products are driven off, but combustion is prevented. Example: Charcoal is made in this way.

Torrefaction is the process of roasting organic substances. The constituents are modified but not charred. Example: The roasting of coffee. Torrefied rhubarb is obtained in this way. It loses its cathartic properties by this process, but retains its properties as an astringent.

Incineration means the burning of organic substances to ashes in air. The ash is the part sought. Example: Determining the amount of fixed matter in organic substances by burning them and examining the ashes.

Sublimation is the process of distilling solid volatile substances from non-volatile substances. Example: Camphor is separated from strips of wood from the camphor trees in this way.

Q. What various forms of apparatus are used to modify and control heat?

A. The water bath, salt water bath, sand bath, oil bath, glycerin bath, etc.

Q. What is the limit of temperature range of the several forms of bath?

A. The water bath can only be used for temperatures below the boiling point of water, 100° C. (212° F); a saturated solution of salt in water boils at 108.4° C. (227.1° F.). The salt water bath may be used up to this temperature. Glycerin may be heated to 250° C. (480° F.). The oil bath is used to furnish a regulated temperature below 260° C. (500° F.), and the sand bath may be used at any temperature required by a pharmaceutical process.

Q. What is distillation?

A. The separation of one liquid from another, or a liquid from a solid, by vaporization and condensation. The volatile part is usually the object sought.

Q. What is a still?

A. Different forms of apparatus embodying the principles of the alembic and retort, either singly or combined, used for distillation. When the neck of the retort is prolonged into a coil and immersed in water to condense the vapors it is called a worm.

Q. What is sublimation?

A. The process of distilling volatile solids; the product is called a sublimate. When a volatile product condenses at a temperature but slightly lower than the condensing point, deposition is slow and a large mass of crystals results. When the vapor is condensed rapidly at a low temperature, a powder results.

Q. What is desiccation?

A. The operation of drying medicinal substances.

Q. Give three objects for drying medicinal substances.

A. (1) Preservation; (2) reduction of bulk; (3) to render comminution less difficult. The process is accomplished by different kinds of ovens and drying closets.

Q. What is comminution?

A. The process of tearing drugs to pieces, or reducing them to very fine particles.

Q. What are some of the processes for comminuting drugs?

A. Cutting, rasping, grating, chopping, contusing, rolling, stamping, grinding, powdering, triturating, levigating, elutriating, granulating, etc.

Q. What instruments are used for cutting, slicing or chopping?

A. Pruning-knife, pruning-shears, tobacco-knife or herb-cutter.

Q. What instrument is used for grating?

A. A half-round rasp.

Q. What instruments are used for contusion?

A. Iron pestle and mortar; or the pestle and mortar may be made of wood or earthenware.

Q. What is grinding and pulverizing?

A. Grinding comprehends the reduction of substances to coarse particles; pulverizing to fine particles.

Q. What is a drug mill?

A. A mill for comminuting drugs.

Q. What is trituration?

A. Rubbing substances to fine particles by means of a mortar and pestle.

Q. What is the process?

A. The pestle is given a circular motion with downward pressure. Beginning in the center of the mortar, work outward in increasing circles till the side of the mortar is touched, then reverse the process and decrease the size of the circles till the center is reached.

Q. How should the pestle fit its mortar?

A. The pestle should have as much bearing on the interior surface of the mortar as its size will permit to secure the maximum triturating surface.

Q. Of what substances are pestles and mortars made?

A. Wedgewood, porcelain and glass.

Q. What is a spatula?

A. A flexible steel blade fixed in a handle (or made entirely of horn) used for various purposes in pharmacy. In trituration

it may be used to remove the substance from the sides of the mortar when it becomes packed thereon. An excellent type of spatula is one known as the balance handle.

Q. How is the fineness of powders regulated?

A. By sieves of various construction, with meshes of different sizes, as required. It is important that all portions of the sifted powder be thoroughly mixed in order to secure uniform composition. Powders are known as very fine (sieve with 80 meshes to the linear inch); fine (60 m. to 1. i.); moderately fine (50 m. to 1. i.); moderately coarse (40 m. to 1. i.); coarse (20 m. to 1. i.). These powders are also known by numbers 80, 60, 50, 40 and 20, respectively. Iron wire, brass wire, bolting cloth, and horsehair are the materials usually chosen for sieves.

Q. What is levigation?

A. The process of reducing substances to a state of minute division by triturating them after they have been made into paste with water or other liquid. A slab and muller are used for this process; when made of porphyry it is termed porphyrization.

Q. What is elutriation?

A. If an insoluble powder be suspended in water, the heavier particles will precipitate first. By decantation of the liquid the finer portions may be separated; prepared chalk is obtained by this process. The process of making the pasty mass obtained by elutriation into small cones is called trochiscation. A tinned iron cone, with a handle is used for this purpose. The handle has a short leg in the center, which is tapped gently on a slab, upon which the substance forced through the aperture at the bottom of the cone by shock falls in the form of a little conical mass. Successive shocks are employed and the resulting conical masses deposited in this manner on the slab soon dry, the moisture being absorbed by the slab.

Q. What is pulverizing by intervention?

A. The process of reducing substances to powder through the use of a foreign method. Example: Camphor may be powdered with the aid of a few drops of alcohol. The foreign substance is freed from the powder by subsequent evaporation.

Q. What is a solution?

A. The permanent and complete incorporation of a solid or gaseous substance with a liquid. The product is called a solution, the liquid used a solvent, and if the solvent will dissolve no more of the substance the product is called a saturated solution.

Q. What is the difference between a simple and a chemical solution?

A. In simple solution no change occurs in the chemical structure of the dissolved substance (sugar in water); but in chemical solution the reverse is the case. Example: The official solution of nitrate of mercury.

Q. How are saturated solutions used as solvents?

A. A liquid saturated with one substance is still a solvent for another substance.

Q. What is the effect of solution upon temperature?

A. Simple solution lowers temperature; chemical solution raises temperature.

Q. What is the best manner of effecting the solution of a solid?

A. Crush the substance in a mortar with the pestle, then pour on the solvent, continually stirring the mixture.

Q. What solvents are used in pharmacy?

A. Water, first in importance, then alcohol, glycerin, ether, benzin, chloroform, bisulphide of carbon, acids, and oils, take their respective rank as solvents.

SEPARATION OF FLUIDS FROM SOLIDS.

Q. What are some of the processes for separating fluids from solids?

A. Lotion, decantation, colation, filtration, clarification, expression, percolation, etc.

Q. What is lotion or displacement washing?

A. The process of separating soluble matter from a solid, by pouring a liquid upon it which will dissolve and wash out the soluble portion. Example: The washing of a precipitate in a

funnel by means of a Spritz bottle. Various automatic apparatus for continuing washing are described in works on pharmacy.

Q. What is decantation?

A. Separating a liquid from a solid by pouring it off. This is sometimes better effected by a siphon.

Q. What is a siphon?

A. A siphon is an inverted U-tube with one leg longer than the other. It is first filled with the liquid, the shorter arm immersed in the liquid contained in the vessel, and a current established in this way: The column of liquid in the shorter arm is overbalanced by the longer arm, the shorter arm drawing a fresh supply from the vessel, which is thus finally emptied.

Q. What is colation?

A. Straining; the process of separating a solid from a fluid by pouring the mixture upon a cloth or porous substance which will permit the fluid to pass through, but will retain the solid.

Q. What materials are used for strainers?

A. Gauze, muslin, flannel, felt, etc.

Q. What is filtration?

A. The process of separating liquids from solids, with the view of obtaining the liquids in a transparent condition. Filters are made of paper, paper pulp, sand, asbestos, ground glass, charcoal, porous stone, etc.

Q. What two general classes of paper filters are used?

A. Plain and plaited. Plain filters are used for retaining and washing precipitates; plaited filters for ordinary filtering operations.

Q. How are filter papers supported?

A. In funnels.

Q. What method for producing rapid filtration is used?

A. Various methods are used, such as suction with the mouth, or by a volume of falling water, to produce a partial vacuum beneath the filter and thus hasten the process by increasing atmospheric pressure.

Q. What is clarification?

A. The process of separating from liquids, without the use of strainers or filters, solid substances which interfere with their transparency.

Q. Give eight principal methods of clarification.

A. (1) By the application of heat. Heat, by diminishing the specific gravity of viscid liquids, permits the precipitation of the heavier particles, the lighter ones rising to the top. Boiling facilitates the separation, as the minute bubbles of steam adhere to the particles and rise with them to form scum, which may be skimmed off. (2) By increasing the fluidity of the liquid. This may be done by diluting it with water. Owing to the diminished specific gravity, the heavier particles sink and the liquid may then be decanted. (3) Through the use of albumen. If albumen be added to the turbid liquid and heat applied, on coagulating it will envelop the particles and rise to the top with them. Skimming will remove the scum. (4) Through the use of gelatin. Gelatin will form with tannin and insoluble compound, and where cloudiness is due to the presence of tannin, will clarify the liquid in this way. (5) Through the use of milk. Acids will precipitate the casein of milk. It is used in sour wines, etc., the precipitated casein carrying with it the insoluble particles. (6) Through the use of paper pulp. Agitate the liquid with the pulp and let it stand till clear; or throw the whole on a muslin strainer; the pulp will form an excellent filtering medium by partially closing the meshes of the linen. (7) By fermentation. Many substances soluble in the natural juices of plants are insoluble in the dilute alcoholic solutions resulting when these juices are fermented and subside as deposits. (8) By subsidence through long standing. The deposit formed is called a sediment.

Q. What is the difference between a sediment and a precipitate?

A. Sediment is solid matter separated merely by the action of gravity from a liquid in which it has been suspended. A

precipitate, on the other hand, is solid matter separated from a solution by heat, light, or chemical action.

Q. What is decoloration?

A. The process of depriving liquids or solids in solution of color by the use of animal charcoal.

Q. How are immiscible liquids separated?

A. By the use of a pipette, a glass syringe, a separating funnel, or a Florentine receiver. A funnel with a stop-cock to stop the flow as soon as the heavier liquid has all passed through is called a separating funnel. A Florentine receiver, used in the distillation of volatile oils, differs from an ordinary receiver in having an overflow arranged to permit the escape of the condensed water while retaining the volatile oil.

Q. What is precipitation?

A. The process of separating solid particles from a solution by the action of heat, light, or chemical substances. The solid particles separated are called the precipitate; the precipitate producer, a precipitant; and the liquid remaining, supernatant liquid. A precipitate may either fall or rise to the top of the supernatant liquid. The physical characteristics of precipitates are described by the words curdy, granular, flocculent, gelatinous, crystalline, bulky, etc. A magma is a thick tenacious precipitate. Precipitation by heat is illustrated by the coagulation and precipitation of albumin when albuminous fluids are heated, and the precipitation of silver salts by light illustrates precipitation by light. Precipitation by chemical reaction occurs in a large number of instances when making official chemical salts. Example: The preparation of precip. carb. calcium.

Q. What is exsiccation?

A. Depriving a solid crystalline substance of its water of crystallization or moisture by heating it strongly.

Q. What is dialysis?

A. The separation of crystallizable from non-crystallizable substances by osmosis.

Q. What is a dialyzer?

A. A vessel with a parchment head, like a drum-head, at one end into which the substances to be separated are placed in the form of solution. This is floated on distilled water, and by osmosis the crystallizable substance transudes through the membrane into the water below, leaving the non-crystallizable substance behind.

Q. What are crystalloids?

A. Crystallizable substances: sugar, salt, chemical substances.

Q. What are colloids?

A. Non-crystallizable substances: glue, gum, starch, dextrine, etc.

Q. What is the diffusate?

A. The distilled water impregnated with crystalloids.

Q. What is extraction?

A. The separation of the soluble principles from drugs by treating them with a liquid in which the principles are soluble. The solvent is called a menstruum.

Q. Give five modes of extraction.

A. (1) Maceration and expression, (2) percolation, (3) digestion, (4) infusion, (5) decoction.

Q. What is maceration?

A. Soaking a drug in a solvent until the soluble portion is dissolved.

Q. What is expression?

A. The process of forcibly separating liquids from solids.

Q. Name six mechanical principles employed in constructing presses.

A. (1) Spiral twist press, (2) screw press, (3) roller press, (4) wedge press, (5) lever press, (6) hydraulic press.

Q. What is digestion?

A. Maceration with gentle heat.

Q. What is percolation?

A. Percolation, also called displacement, is the process whereby a powder contained in a suitable vessel is deprived of its soluble constituents by the descent of a solvent through it.

Q. What is a percolator?

A. A percolator is a cylindrical vessel with a porous diaphragm below into which the drug, in the form of a powder, is introduced and its soluble portions extracted by the descent of a solvent through it.

Q. What is the process?

A. The solvent, which is poured on the top of the powder, in passing downward exercises its solvent power on the successive layers of the powder until saturated, and is impelled downward by the combined force of its own gravity and that of the column of liquid above, minus the capillary force with which the powder tends to retain it.

Q. What is a menstruum?

A. The solvent is known technically by this name.

Q. What is a percolate?

A. The liquid coming from the percolator impregnated with the soluble principles of the drug.

Q. Why is percolation called the process of displacement?

A. Because it was first observed that ether, poured on powdered bitter almonds, displaced the fixed oil which it contains without materially mixing with it.

Q. Of what does percolation consist?

A. As directed in the United States Pharmacopeia, it consists in subjecting a substance, in powder, contained in a vessel called a percolator, to the solvent action of successive proportions of menstruum in such manner that the liquid, as it traverses the powder in its descent to the receiver, shall be charged with the soluble portion of it, and pass from the percolator free from insoluble matter.

Q. Why is maceration used?

A. Percolation is not suitable for exhausting some drugs, and the process of maceration is employed for some of the tinc-

tures (aloes, asafetida, sweet orange peel, tolu, etc.). Maceration should be conducted preferably at a temperature of about 15° to 20° C. (59° to 68° F.)) and in a shady place.

Q. What is the best percolator for common use?

A. An ordinary glass funnel.

Q. What objection to the glass funnel is offered?

A. It is too broad for use in percolating drugs for fluid extracts when the quantity of drug is large in proportion to the quantity of menstruum.

Q. What is a desirable shape for making this class of preparations?

A. A tall, narrow percolator.

Q. Why does the pharmacopeia direct that the drug shall be passed through a coarse sieve after moistening?

A. To render it uniform.

Q. Why should the powder be moistened?

A. (1) A moist powder, like a moist sponge, greedily absorbs moisture, but a dry powder, like a dry sponge, repels attempts to moisten it; (2) dry powders have a tendency to swell when moistened, which, owing to the pressure of the particles against each other and the sides of the percolator, prevents moisture from penetrating them.

Q. What are aquae or waters?

A. Aqueous solutions of volatile substances. There are eighteen official waters.

Q. What are the official directions?

A. The medicated waters, when prepared from volatile oils, are intended to be, as nearly as practicable, saturated solutions, which must be clear and free from solid impurities.

Q. Give methods of preparation.

A. (1) Simple solution in cold water, agitation; aqua amygdalae amarae, chloroformi, creosoti; passing gases through water, aqua ammoniae, ammoniae fortior, hydrogenii dioxidi, liquor chlori compositus.

(2) Solution in hot water: shake the oil with hot water; let stand until cold; decant and filter. Volatile oils are made more soluble in hot than in cold water.

(3) Filtration through an absorbent powder. Aqua anisi, camphorae, cinnamoni, feniculi, menthae piperitae, and menthae viridis are made by percolation through impregnated purified talc. In preparing aqua camphorae a little alcohol is used to aid in the trituration of the camphor.

(4) Filtration through pulp or shredded filter paper. Permitted by United States Pharmacopeia (8th Rev.). Drop volatile oil upon white filtering paper, tear paper into shreds, transfer to flask or stoneware jar, add boiling water in portions, shake thoroughly, cool, filter, and adjust quantity by pouring distilled water through the filter.

(5) Distillation. Aqua aurantii florum fortior, aurantii florum, hamamelidis, rosae fortior, rosae, and aqua distillata.

Q. What is a liquor?

A. An aqueous solution of a chemical substance. Liquors are divided into two classes, according to the method of preparation, *viz.*, simple solutions and chemical solutions.

Q. What is a syrup?

A. A dense saccharine solution, generally medicated or flavored.

Q. What is sugar?

A. Sugar is in white, dry, hard, distinctly crystalline granules, permanent in the air, odorless, having a purely sweet taste and a neutral reaction; commercially known as "granulated sugar." Simple syrup: when water alone is used in making the solution of sugar. Medicated syrups: when the water contains soluble principles from various medicinal substances. There are twenty-nine official syrups.

Q. What are mellita or honeys?

A. Thick liquid preparations closely allied to syrups, differing merely in the use of honey as base instead of syrup.

Q. What are mucilages?

A. Thick, viscid, adhesive liquids produced by dissolving gum in water, or by extracting with water the mucilaginous principles from vegetable substances both with and without heat.

Q. What is an emulsion?

A. A soft, liquid preparation resembling milk, and consisting of an oily or resinous substance suspended in water by means of gum, yolk of egg, or other viscid matter. Emulsions may be divided into three classes: natural emulsions, gum-resin and seed emulsions and oil or artificial emulsions. Natural emulsions: those that exist ready formed in nature. Examples: milk, egg yolk, various plant juices, etc.

Q. What is a mixture?

A. An aqueous liquid preparation intended for internal use which contains suspended insoluble substances.

Q. What are glycerites?

Mixtures or solutions of medicinal substances in glyceria.

Q. What are spirits?

A. Alcoholic solutions of volatile substances. They may be classified according to the method of preparation as follows: (1) simple solution; (2) solution with maceration; (3) gaseous solution; (4) chemical reaction; (5) distillation.

Q. How many official spirits are in existence?

A. Twenty. Those made from volatile oils are frequently called essences.

Q. What is an elixir?

A. Elixirs are aromatic, sweetened, spiritous preparations, containing small quantities of active medicinal substances. There are three official elixirs.

Q. What are collodions?

A. Collodions are liquid preparations intended for external use, having for the base a solution of pyroxylin, or gun-cotton, in a mixture of ether and alcohol. They leave a film on evaporation,

which serves as a protection or an application of a medicinal ingredient to the skin.

Q. What are liniments?

A. Solutions of various substances or mixtures in oily or alcoholic liquids containing fatty oils, intended for application to the skin by rubbing. There are eight official liniments: three with fixed oil base—ammoniae, calcis and camphorae; four with alcohol as the principal fluid—belladonnae, chloroformi, saponis and saponis mollis; one contains oil of turpentine, *viz*., turpentine liniment.

Q. What are oleates?

A. The official oleates are liquid preparations, made by dissolving metallic salts, or alkaloids, in oleic acid. There are not assumed to be definite chemical compounds.

Q. What are infusions?

A. Infusions are liquid preparations, made by treating vegetable substances with either hot or cold water. They are no boiled, though boiling water is often employed.

Q. What is a tincture?

A. A tincture is an alcoholic solution of a medicinal substance.

Q. What is the difference between a tincture and a spirit?

A. The latter, with one exception, are solutions of volatile substances in alcohol, while the former are of non-volatile substances.

Q. What processes are used?

A. Percolation, maceration, solution or dilution.

Q. What is the menstruum employed?

A. Alcohol, diluted alcohol of various strengths; aromatic spirits of ammonia; or mixtures of alcohol and water and glycerin.

Q. What is an example of a tincture made by solution or dilution?

A. Tr. iodine, made by dissolving iodine in alcohol.

Q. Give two general classes of tinctures.

A. Simple and compound tinctures.

Q. Why is glycerin used in tinctures?

A. To prevent precipitation on standing.

Q. How many official tinctures are in the United States Pharmacopeia?

A. Sixty-three.

Q. Classify them in groups; give the menstruum of each. In compound tinctures give the percentage of each drug of which they are composed.

A.

Tinctures.	Formulae.	Menstrua.	Dosage.
1.6 Per Cent. Opii Camphorata.....	Pwd. opium, Benz. acid, Camp, each 4 gm.; Ol. anise, 4 cc.	G., 40; D.A. to 1000.	8 cc. (2 fl. dr.).
2 Per Cent. Nucis Vomicae.....	Ext. Nux. Vom., 20 gm.	A., 750; W.,25.....	0.6 cc. (10 m.).
4.5 Per Cent. Lavandulae Compositа.....	Ol. lav. fl., 8 cc.; Ol. rosem, 2 cc.; S. cin., 20 gm.; Cloves, 5 gm.; Nutmeg, 10 gm.; R. saund., 10 gm.	A., 750; W., 250.....	2 cc. (30 m.).
5 Per Cent. Gambir Composita....	Gambir, 50 gm.; S. cin., 25 gm.	D. Alcohol.....	4 cc. (1 fl. dr.).
Kino.....	Kino, 50 gm.....	G., 150; A., 650; W., 200.	4 cc. (1 fl. dr.).
Moschi.....	Musk, 50 gm.....	A., 50; W., 50.....	4 cc (1 fl. dr.).
6.2 Per Cent. Cardamomi Compositа.....	Card, 25 gm.; S. cin., 25 gm.; Caraway, 12 gm.; Coch., 5 gm.	G.; 50; D. Alcohol.	4 cc. (1 fl. dr.).
7 Per Cent. Iodi.....	Iodine, 70 gm.; K1, 50 gm.	Alcohol.....	0.1 cc. (1 ½ m.).
10 Per Cent. Aconiti.....	Aconite, 100 gm.....	A., 700; W., 300.....	0.6 cc. (10 m.).
10 Per Cent. Aloes.....	Aloes, 100 gm.; Glycer., 200 gm.	D. Alcohol.....	2 cc. (30 m.).
Belladonnae Foliorum..	Belladonna 1vs., 100 gm.	D. Alcohol.....	0.5 cc. (8 m.).
Cannabis Indicae.....	Indian cannabis, 100 gm.	Alcohol.....	0.6 cc. (10 m.).
Cantharidis.....	Cantharides, 100 gm...	Alcohol.....	0.3 cc. (5 m.).
Capsici.....	Capsicum, 100 gm.....	A., 950; W., 50.....	0.5 cc. (8 m.).
Colchici Seminis.....	Colch. Seed (0.55 per cent Colchicine), 100 gm.	A., 600; W., 400.....	2 cc. (30 m.).
Digitalis.....	Digitalis, 100 gm.....	D.; Alcohol.....	1 cc. (15 m.).

A. = Alcohol. W.=Water. D.A.=Dilute Alcohol. G.=Glycerin. Ac. A.=Acetic Acid.

Gelsemii.....	Gelsemium, 100 gm....	A.; 650; W., 350....	0.5 cc. (8 m.).
Gentianae Compos-ita.	Gent., 100 gm.; B. Or. Peel, 40 gm.; Card., 10 gm.....	A.; 600; W., 400....	4 cc. (1 fl. dr.).
Lobeliae.....	Lobelia, 100 gm.....	D. Alcohol.....	Ex., 1 cc. (15 m.). Em., 4 cc. (1 fl. dr.).
Opii.....	Gr. opium (12 to 12.5 cryst. morph.). 100 gm.	A., 50; W., 50.....	0.5 cc. (8 m.).
Opii Deodorati.....	Gr. Opium (12 to 12.5 cryst. morph.), 100 gm.	A., 200; P. benz., 75; W., to 1000 cc.	0.5 cc. (9 m.).
Physostigmatis.....	Physostig, (0.15 per cent eth.-sol. alk.), 100 gm.	Alcohol.....	1 cc. (15 m.).
Sanguinariae.....	Sanguinaria, 100 gm....	Ac. A., 20; A., 600; W., 400.	1 cc. (15 m.).
Scillae.....	Squill, 100 gm.....	A., 750; W., 250.....	1 cc. (15 m.).
Stramonii.....	Stram. (0.35 per cent myd. alk.), 100 gm.	D. Alcohol.....	0.5 cc. (8 m.).
Strophanthi.....	Strophanthus, 100 gm.	A., 650; W., 350.....	0.5 cc. (9 m.).
Vanillae.....	Vanilla, 100 gm.; Sugar, 200 gm	A., 650; W., 350.....	
Veratri.....	Veratrum, 100 gm.....	Alcohol.....	1 cc. (15 m.).
13.3 Per Cent. Ferri Chloridi.....	Sol. ferric chlor., 350 cc.	A., 750; W., 250....	0.5 cc (8 m.).
20 Per Cent. Aloes et Myrrhae.....	Aloes, Myrrh., Glycer., each 100 gm.	A., 750; W., 250....	2 cc. (30 m.).
Arnicae.....	Arnica, 200 gm.....	D. Alcohol.....	1 cc. (15 m.).
Asafetidae.....	Asafetida, 200 gm.	Alcohol.....	1 cc. (15 m.).
Aurantii Amari.....	Bitter orange peel, 200 gm.	A., 600; W., 400	4 cc. (1 fl. dr.).
Benzoini.....	Benzoin, 200 gm.....	Alcohol.....	1 cc. (15 m.).
Calendulae	Calendula, 200 gm.	Alcohol…….	
Calumbae.....	Calumba, 200 gm.....	A., 600; W., 400...	4 cc. (1 fl. dr.).
Cardamomi.....	Cardamom, 200 gm....	D. Alcohol.....	4 cc. (1 fl. dr.).
Cimicifugae.....	Cimicifuga, 200 gm....	Alcohol……	4 cc. (1 fl. dr.).
20 Per Cent. Cinchonae.....	Cinch. (4 per cent A. eth.-sol. alk.), 200 gm.	A., 675; W., 250; Glycerin, 75.	4 cc. (1 fl. dr.).
Cinchonae composita...	R. cinchon. 100 gm.; Bitter orange peel, 80 gm.; Serpent, 20 gm.	G., 75; A., 675; W., 250.	4 cc. (1 fl. dr.).
Cinnamomi.....	Saigon cin., 200 gm.....	G., 75; A., 675; W., 250...	2 cc. (30 m.).
Gallae.....	Nutgall, 200 gm.....	G., 100; A., 900.....	4 cc. (1 fl. dr.).
Guaiaci.....	Guaiac, 200 gm.....	Alcohol.....	4 cc. (1 fl. dr.).

A. = Alcohol. W.=Water. D.A.=Dilute Alcohol. G.=Glycerin. Ac. A.=Acetic Acid.

Guaiaici Ammoniata...	Guaiac, 200 gm.....	Spts. Ammon. Arom.....	2 cc. (30 m.).
Hydrastis.....	Hydrastis, 200 gm.....	A., 650, W., 350.....	4 cc. (1 fl. dr.).
Ipecacuanhae et Opii..	Tr. deod. opium, 1000, cc.; Fld. ext. ipecac, 100 cc.	D. Alcohol.....	0.5 cc. (8 m.).
Krameriae.....	Krameria, 200 gm.....	D. Alcohol.....	4 cc. (1 fl. dr.).
Myrrhae.....	Myrrha, 200 gm.....	Alcohol.....	1 cc. (15 m.).
Pyrethri.....	Pyrethrum, 200 gm.....	Alcohol.....	
Quassiae.....	Quassia, 200 gm.....	A., 350; W., 650.....	2 cc. (30 m.).
Quillajae.....	Quillaja, 200 gm.....	Decoction, A., 350 ..	
Rhei.....	Rhubarb, 200 gm.; Card., 40 gm.	G., 100; A., 500; W., 400.	4 cc. (1 fl. dr.).
Rhei Aromatica.....	Rhub., 200 gm.; S. cin., 40 gm.; Cloves 40 gm; Nutmeg, 20 gm.	G., 100; A., 500, W., 400.	2 cc. (30 m.).
Serpentariae.....	Serpentaria, 200 gm.	A., 650; W., 350.....	4 cc. (1 fl. dr.).
Tolutana.....	Balsam of tolu, 200 gm.	Alcohol.....	2 cc. (30 m.).
Valerianae.....	Valerian, 200 gm.....	A., 750; W., 250.....	4 cc. (1 fl. dr.).
Valerianae Ammoniata	Valerian, 200 gm.....	Spts. Ammon. Arom.....	2 cc. (30 m.).
Zingiberis	Ginger, 200 gm.....	Alcohol.....	2 cc. (30 m.).
24 Per Cent. Benzoini Compos-ita...	Benz., 100 gm.; P., aloes, 20 gm; Storax, 80 gm.; B. tolu., 40 gm.	Alcohol.....	4 cc (1 fl. dr.).
50 Per Cent. Aurantii Dulcis.....	Sweet orange peel from fresh fruit, 500 gm.	Alcohol.....	1 cc. (15 m.).
Lactucarii.....	Lactucarium, 500 gm...	G., 250; P. benz., D.A...	2 cc. (30 m.).
Limonis Corticis.....	Lemon peel from fresh fruit, 500 gm.	Alcohol.....	
50 Per Cent. Tincturae Herbarum Recentium.	500 gm.....	Alcohol.....	

A. = Alcohol. W.=Water. D.A.=Dilute Alcohol. G.=Glycerin. Ac. A.=Acetic Acid.

Q. Give the standardized tinctures required by the United States Pharmacopeia to have a definite alkaloidal strength and the alkaloidal percentage of each.

Should contain in 100 cc.

A. Aconiti . . . . . .0.045 gm. aconitine.
Belladonnae Foliorum . .0.035 gm. alkaloids.
Cinchonae . . . . . .0.750 gm. anhydrous ether soluble alkaloids.

Colchici Seminis. . . . . .0.050 gm. colchicine.
Hydrastis . . . . . .0.400 gm. hydrastine.
Hyoscyami . . . . . .0.007 gm. mydriatic alkaloids.
Nucis Vomicae . . . . . .0.100 gm. strychnine.
Opii . . . . . .1.2 to 1.25 gm. cryst. morphine.
Opii Deodorati. . . . . .1.2 to 1.25 gm. cryst. morphine.
Physostigmatis . . . . . .0.014 gm. ether soluble alkaloids.
Stramonii . . . . . .0.030 gm. mydriatic alkaloids.

Q. What are Tincturae Herbarum Recentium?

A. These tinctures when not otherwise directed are to be prepared by the following formula:

The fresh herb, bruised or crushed, 500 grammes or 500 gm.
Alcohol . . . . . .1000 cc.

Macerate the herb with the alcohol for fourteen days with occasional stirring; then strongly express the liquid and filter through paper.

Q. What are vina medicata, or medicated wines?

A. Medicated wines are liquid preparations containing the soluble principles of medicinal substances dissolved in wine. The United States Pharmacopeia does not recognize any special variety of wine, but only the general classes of white and red.

Q. What amount of alcohol should wine contain?

A. Not less than 7 nor more than 12 per cent, by weight (equivalent to 8.5 to 15 per cent by volume), of absolute alcohol.

Q. What are fluidextracts?

A. Liquid alcoholic preparations of nearly uniform and definite strength, made by percolating drugs with menstrua, and concentrating a portion of the percolate so that in each case a cubic centimeter represents the medicinal virtue of one gramme of the drug. They are mostly concentrated tinctures.

Q. Give a typical formula for an official fluidextract.

A. 1000 grammes of the powdered drug are moistened with a certain quantity of menstruum, packed in a suitable percolator, and enough menstruum added to saturate the powder and leave a stratum above it. The lower orifice of the percolator is

closed when the liquid begins to drop; the percolator is closely covered to prevent evaporation and permit maceration for a specified time; additional menstruum is poured on and percolation continued slowly until the drug is exhausted. Usually about 800 cc. of the first portion of the percolate is reserved and the remainder evaporated at a temperature not exceeding 50° C. (122° F.) to a soft extract. This is to be dissolved in the reserved portion and enough menstruum added to make the fluidextract measure 1000 cc.

Q. Give the standardized fluidextracts and their alkaloidal percentages.

A.

Aconiti	100 cc. = 0.40 gm. aconitine.
Belladonnae Radicis	100 cc. = 0.50 gm. mydriatic alkaloids.
Cinchonae	100 cc. = 400 gm. anhydrous ether soluble alkaloids.
Cocae	100 cc. = 0.50 gm. anhydrous ether soluble alkaloids.
Colchici Seminis	100 cc. = 0.50 colchicine.
Conii	100 cc. = 0.45 gm. coniine.
Guaranae	100 cc. = 3.50 gm. alkaloids.
Hydrastis	100 cc. = 2.00 gm hydrastine.
Hyoscyami	100 cc. = 0.075 gm. alkaloids.
Ipecacuanhae.	100 cc. = 1.75 gm. alkaloids.
Nucis Vomicae	100 cc. = 1.00 gm. strychnine.
Pilocarpi.	100 cc. = 0.40 gm. alkaloids.
Scopolae.	100 cc. = 0.50 gm. mydriatic alkaloids.
Stramonii.	100 cc. = 0.35 gm. mydriatic alkaloids.

Q. What are oleoresins?

A. Official liquid preparations, consisting principally of natural oils and resins extracted from vegetable substances by percolation with acetone. They are the strongest liquid preparations of drugs produced.

Q. What is their general formula for preparation?

A. Percolate the powdered drug in a cylindrical percolator provided with a stop-cock cover and receptacle suitable for volatile liquids, with acetone, until exhausted, recovering the greater

part of the acetone by distillation, and exposing the residue, in a capsule, to spontaneous evaporation until the remaining acetone has evaporated.

Q. What are aceta or vinegars?

A. Medicated vinegars are solutions of the active principles of drugs in diluted acetic acid, the latter being chosen as a menstruum because acetic acid is not only a good solvent, but also possesses antiseptic properties. Their use dates from the time of Hippocrates. Acetic acid is also of value as a menstruum, as it produces soluble salts with the alkaloidal principles existing in plants.

Q. What are extracts?

A. Extracts are solid, or semi-solid preparations, produced by evaporating solutions of vegetable substances.

Q. Give the standardized extracts of the United States Pharmacopeia and their alkaloidal percentages.

A. Belladonnae Foliorum . . . 1.4% mydriatic alkaloids.
Colchi Cormi . . . . . 1.4% colchicine.
Hyoscyami. . . . . 0.3% mydriatic alkaloids.
Nucis Vomicae. . . . . 5.0% strychnine.
Opii . . . . . 20.0% morphine.
Physostigmatis . . . . . 2.0% either soluble alkaloid.
Scopolae . . . . . 2.0% mydriatic alkaloids.

Q. What are resinae or resins?

A. The official resins are solid preparations, consisting principally of the resinous principles from vegetable bodies, prepared by precipitating them from their alcoholic solution with water.

Q. What are triturations?

A. A class of powders first introduced into the United States Pharmacopeia of 1880, for the purpose of fixing a definite relation between the active ingredient and the diluent. They contain:

Of the substance. . . . . .10 gm.
Sugar of milk, in moderately fine powder . . . . .90 gm.

Q. What are confections?

A. Saccharine, soft solids, in which one or more medicinal substances are incorporated, with the object of affording an agreeable form for their administration and a convenient method for their preservation. Old names, conserves and electuaries, under which they have been in use for centuries.

Q. What are pilulae, or pills?

A. Small, solid bodies, of a globular, ovoid, or lenticular shape, which are intended to be swallowed and thereby produce medicinal action.

Q. Of what is a pill mass composed, and what is required of it?

A. It is composed of ingredients and excipients. It is required that the mass be: (1) adhesive, (2) firm, (3) plastic.

Q. How are pills finished to keep them from adhering together?

A. Finish them either by rolling between the thumb and finger, or rotating them under an adjustable pill finisher. To prevent them from adhering together, dust with rice flour, powdered magnesium carbonate, lycopodium, powdered althaea or powdered licorice root.

Q. What are trochisci or troches?

A. Troches, or lozenges, are solid discoid, or cylindrical masses, consisting chiefly of medicinal powders, sugar, and mucilage. They are prepared by making the ingredients into a mass, which is rolled into a think sheet and cut into proper shape with a lozenge cutter.

Q. What are cataplasms?

A. They are soft, ointment-like, medicated substances, of such consistency that they may be easily spread upon muslin or similar material and produce local or systematic effects.

Q. What are cerata or cerates?

A. Cerates are unctuous substances of such consistency that they may be easily spread, at ordinary temperatures, upon

muslin or similar material, with a spatula, and yet not so soft as to liquefy and run when applied to the skin.

Q. Why are they called cerates?

A. Owing to the presence of wax (*cera*).

Q. What substances are used for bases?

A. Oil, lard, petrolatum. Wax, and sometimes paraffin or spermaceti in the presence of wax, are used to raise the melting-point of the basis.

Q. What are unguenta or ointments?

A. Fatty preparations, of a softer consistency than cerates, intended to be applied to the skin by inunction.

Q. What are emplastra or plasters?

A. Substances intended for external application of such consistency that they adhere to the skin, and require the aid of heat in spreading them.

Q. How are they usually spread?

A. On muslin, leather, paper, etc., and have a basis, lead plaster, a gum-resin, or Burgundy pitch. As plasters are usually bought of the manufacturer ready-made, a description of the process for spreading them is omitted.

Q. What are chartae or papers?

A. A small class of preparations intended for external application. Made by applying the medicinal substance to the surface of the paper by the addition of some adhesive liquid.

Q. What are suppositories?

A. Solid bodies of various weights and shapes, adapted for introduction into the different orifices of the human body and melting readily at blood heat.

Q. What vehicles are used in suppositories?

A. The vehicles usually employed are oil of theobroma, glycerinated gelatin, or sodium stearate. They should be prepared of materials of sufficient consistency to retain their shape when inserted, and at the same time melt at the temperature of the body.

Q. From what kingdoms are the materials of the United States Pharmacopeia obtained?

A. From the animal, vegetable and mineral kingdoms.

Q. Are all parts of substances used as medicines active?

A. They are not. All materials of the vegetable and animal kingdoms from which medicines are obtained contain both active and inert substances. In a number of plants the active principles are termed either alkaloids or glucosides. In the animal kingdom the therapeutic principle is frequently an enzyme or ferment (as pepsin), or is referred to simply as an active principle. A crude vegetable drug may contain a number of alkaloids, as cinchona and opium, and an animal substance may contain a number of ferments, as pancreatin.

Q. What is an alkaloid?

A. An alkaline substance occurring in the tissues of an animal or plant. It contains nitrogen, has a definite chemical composition and is capable of combining with acids to form salts. Their names terminate in "ine" in English and "ina" in Latin.

Q. What are glucosides?

A. Glucosides or neutral principles occur in many vegetable substances; when treated with dilute acids they yield glucose as a product of decomposition. Their names terminate in "in" in English and "inum" in Latin. Santonin and elaterium are glucosides.

Q. Into what classes are acids divided?

A. Mineral acids and organic acids; the former are obtained from the mineral kingdom, as sulphuric and nitric acids; the latter from the vegetable and animal kingdoms, as citric and oleic acids.

Q. Enumerate the principal terms descriptive of the therapeutic action of medicines and give the meaning of each.

A. *Absorbents*: drugs used to produce absorption of exudates or diseased tissues. *Abstergents*: detergents. *Alteratives*: medicines used to so modify nutrition as to overcome morbid processes. *Anesthetics*: medicines used to produce anesthesia or unconsciousness. *Analgesics*: medicines used to allay pain. *Anodynes*: medicines

used to allay pain. *Antacids*: medicines used to neutralize acid in the stomach and intestines. *Anthelmintics*: medicines used to destroy intestinal worms. *Antiperiodics*: medicines used for the relief of malarial fevers. *Antipyretics*: medicines used for the reduction of bodily temperature in fevers. *Antiseptics*: Substances which have the power of preventing putrefaction. *Antispasmodics*: medicines used for the relief of nervous irritability and minor spasms. *Antisyphilitics*: medicines used for the relief of syphilis. *Aperients*: mild purgatives. *Aromatics*: medicines characterized by a fragrant or spicy taste and odor, and stimulant to the gastrointestinal mucous membrane. *Aromatic bitters*: medicines which unite the properties of the aromatics and the simple bitters. *Astringents*: medicines having the power of influencing vital contractility, thereby condensing tissues. *Bitters, simple*: medicines which have a bitter taste and have the power of stimulating the gastro-intestinal mucous membrane, without affecting the general system. *Blisters*: medicines which when locally applied cause inflammatory exudation of serum from the skin, and are used as revulsants. *Cardiac depressants*: medicines used to lower the heart's action. *Cardiac stimulants*: medicines used to increase the heart's action. *Carminatives*: medicines containing a volatile oil used to excite intestinal peristalsis and provoke an expulsion of flatus. *Cathartics*: purgatives. *Caustics*: medicines used to destroy living tissue. *Cholagogues*: medicines which provoke a flow of bile. *Correctives*: medicines used to correct or render more pleasant the action of other remedies, especially purgatives. *Corrigents*: correctives. *Demulcents*: mucilaginous principles which are used in solution to soothe and protect irritated mucous membranes or other tissues. *Deodorants*: substances which destroy or hide foul odors. *Depilatories*: substances used to remove hair. *Detergents*: medicines which cleanse wounds, ulcers, etc. *Diaphoretics*: medicines which produce sweating. *Digestants*: ferments and acids which have the power of aiding in the solution of food. *Diluents*: medicines which dilute secretions and excretions. *Disinfectants*: substances

which have the power of destroying disease germs or the noxious properties of decaying organic matter. *Diuretics*: medicines which increase the secretion of urine. *Drastics*: purgatives which cause much irritation. *Emetics*: medicines which cause vomiting. *Emollients*: substances used to mechanically soften and protect tissue. *Epispastics*: blisters. *Errhines*: medicines which increase the nasal secretions. *Escharotics*: caustics. *Evacuants*: medicines which evacuate; chiefly applied to purgatives. *Excitants*: stimulants. *Excito-Motors*: medicines which increase motor activity. *Expectorants*: medicines which act upon the pulmonic mucous membrane and increase or alter its secretions. *Febrifuges*: medicines which dissipate fever. *Hemostatics*: medicines which arrest hemorrhages. *Hydragogues*: purgatives which cause large watery discharges. *Hypnotics*: medicines which cause sleep. *Laxatives*: mild purgatives. *Local anesthetics*: medicines which when applied locally destroy sensation. *Mydriatics*: medicines which cause mydriasis, or dilatation of the pupil. *Myotics*: medicines which cause myosis, or contraction of the pupil. *Narcotics*: powerful anodyne hypnotics. *Neurotics*: medicines which act upon the nervous system. *Nutriants*: medicines which modify the nutritive processes. *Nutrients*: substances which nourish. *Peristaltics*: medicines which increase peristalsis. *Prophylactics*: medicines which prevent the taking or development of disease. *Protectives*: medicines which protect a part when applied to it. *Purgatives*: medicines which produce copious discharges from the bowels. *Refrigerants*: medicines which lessen the bodily temperature. *Rubefacients*: medicines which cause irritation and redness, and are used as revulsants. *Sedatives*: medicines which lower functional activity. *Sialagogues*: medicines which excite the salivary glands to secretion. *Soporifics*: medicines which cause sleep. *Specifics*: medicines which have a direct curative influence on certain individual diseases. *Stimulants*: medicines which increase functional activity. *Stomachics*: stimulants to the stomach. *Stypics*: hemostatics. *Sudorifics*: medicines which produce sweating. *Tenicides*: medicines which kill the tape-worm.

Tonics: medicines which permanently increase the systemic tone by stimulating nutrition. *Vermicides*: medicines which kill intestinal worms. *Vermifuges*: medicines which cause the expulsion of intestinal worms. *Vesicatories*: blisters.

MEDICINES AND MEDICINAL AGENTS OF THE U. S. NAVY SUPPLY TABLE.

References: United States Dispensatory;
Mason's Handbook for the Hospital Corps.

Q. Enumerate the medicinal substances of the Supply Table of the Medical Department, U.S. Navy, and give their principal properties, uses and dosage.

A. Acacia (gum arabic): A gummy exudation from *Acacia senegal* and other species of acacia. A translucent substance in fragments; insipid taste, soluble in water; used as a vehicle. The powder is white. Mucilago Acaciae (acacia 340; lime water 330; water 1000).

Acetanilidum (acetanilid): A derivative of aniline. A colorless, crystalline powder; odorless, with a slightly burning taste; soluble in 179 parts water; used in neuralgia. Dose: ¼ gm. (4 gr.).

Acetphenetidinum (acetphenetidin; phenacetin): A phenol derivative; white, glistening scales, or crystalline powder; odorless and tasteless; soluble in 925 parts of water or 12 parts of alcohol; antipyretic and antineuralgic. Dose: ½ gm. (7½ gr.).

Acidum Aceticum (acetic acid): A clear, colorless liquid, having a strong vinegar-like odor and an acid taste. Acidum Aceticum Dilutum (acetic acid 100; water 500). Dose: 2 cc. (30 minims).

Acidum Boricum (boric acid): Colorless scales or a light white powder; odorless and slightly bitter; soluble in 18 parts of water; used as mild antiseptic. Dose: ½ gm. (7½ gr.).

Acidum Citricum (citric acid): Usually prepared from lime or lemon juice; colorless, odorless, acid-tasting crystals; efflorescent in dry air and deliquescent in moist air; soluble in 0.54 part of water. Dose: ½ gm. (7½ gr.).

Acidum Hydrochloricum (hydrochloric acid): A colorless, fuming liquid which should be kept in glass-stoppered bottles.

Acidum Hydrochloricum Dilutum (hydrochloric acid 100; water 219). Dose: 1 cc. (15 minims).

Acidum Nitricum (nitric acid): A colorless, fuming liquid; very caustic; should be kept in glass-stoppered bottles. Acidum Nitricum Dilutum (nitric acid 100; water 580). Dose: 2 cc. (30 minims).

Acidum Oxalicum (oxalic acid): Small colorless crystals, very poisonous; surgical use only; odorless and has a very sour taste. Its close resemblance to sulphate of magnesia (Epsom salts) has made occasional fatal accidents. It decolorizes a solution of permanganate of potash, which sulphate of magnesia does not.

Acidum Picricum (picric acid): Pale yellow, shining scales; not used internally. A saturated solution in water (1.2%) is used in the treatment of burns.

Acidum Salicylicum (salicylic acid): An organic acid existing naturally in some plants, but generally prepared from phenol. Light, fine, white needles, or a crystalline powder, or a bulky powder with a faint odor and sweetish taste; soluble in 308 parts of water; used in rheumatic troubles; in collodion for corns. Dose: ½ gm. (7 ½ gr.).

Acidum Sulphuricum (sulphuric acid): A colorless, oily, very corrosive liquid; should be kept in glass-stoppered bottles.

Acidum Sulphuricum Aromaticum (aromatic sulphuric acid): Sulphuric acid 3, tincture of ginger 50, oil of cinnamon 1, alcohol to 1000. Dose: 1 cc. (15 minims).

Acidum Tannicum (tannic acid): An organic acid obtained from nut-galls. A light yellow powder with a faint odor, and strongly astringent taste; soluble in about 0.34 part of water; used as an astringent. Dose: ½ gm. (7½ gr.).

Acidum Tartaricum (tartaric acid): An organic acid occurring in colorless crystals or a white powder; odorless and with an acid taste; soluble in 0.71 part of water. Dose: ½ gm. (7½ gr.).

Aconiti Tinctura (tincture of aconite): 10 per cent strength. In the Pharmacopeia of 1890 the strength was 35 per cent. Used to decrease the frequency of the pulse. Dose: ½ cc. (7½ minims).

Adeps Benzoinatus (benzoinated lard): (Benzoin, 20; lard, 1000; in warm weather substitute 5 per cent of the lard by an equal quantity of white wax.) Use as a basis for ointments.

Adeps Lanae Hydrosus (hydrous wool-fat): The purified fat of the wool of sheep (*Ovis aries*, Linné) mixed with not more than 30 per cent of water. A yellowish white or nearly white ointment-like mass, having a faint peculiar odor; used as a basis for ointments.

Adrenalin chloridum, solution of 1 to 1000. (Solution of adrenalin chloride in physiologic salt solution prepared from the suprarenal glands of the sheep (*Ovis aries*), or ox (*Bos Taurus*). The desiccated glands are official in the United States Pharmacopeia as Glandulae Suprarenales Siccae. A powerful styptic; applied locally and hypodermically.

Æther (ether or ethyl oxide): A transparent, colorless liquid, having a characteristic odor and a burning sweetish taste. Its vapor when mixed with air and ignited explodes violently. Used chiefly as an anesthetic by inhalation. Dose, internally: 1 cc. (15 minims).

Ætheris Spiritus Compositus (compound spirits of ether, Hoffman's anodyne): (Ether, 325; alcohol, 650; ethereal oil, 25.) Used as a stimulant and carminative. Dose: 4 cc. (1 drachm).

Ætheris Spiritus nitrosi (spirits of nitrous ether, sweet spirits of niter): A clear, volatile liquid of a pale yellowish tint, fragrant odor and burning taste; used as a diuretic and carminative. Dose: 2 cc. (30 minims).

Æthylis Chloridum (ethyl chloride): An extremely volatile liquid kept in hermetically sealed glass tubes. Used chiefly in the form of a spray as a local anesthetic by reason of its freezing properties; also as a general anesthetic by inhalation.

Alcohol (ethyl alcohol): A colorless volatile liquid containing about 95 per cent by volume of absolute alcohol. It is obtained by the distillation of grain.

Aloe (aloes): The inspissated juice of the leaves of *Aloe vera* and other species of aloe.

Aloes pulvis (powdered aloes): A brownish-yellow powder of bitter taste; used as a laxative. Dose: ¼ gm. (4 gr.).

Alumen (alum): The powder is white, with a sweet, astringent taste; soluble in 9 parts of water; used as an astringent and as an emetic. Astringent dose: ½ gm. (7½ gr.); emetic dose: 4 gm. (1 drachm).

Ammoniae Aqua (ammonia water): A 10 per cent (by weight) solution of ammonia gas. A colorless, volatile liquid, have a very pungent odor. It should be kept in glass-stoppered bottles and a cool place; a powerful stimulant. Dose: 1 cc, well diluted (15 minims).

Ammoniae Spiritus Aromaticus (aromatic spirits of ammonia): (Ammonium carbonate, 34; ammonia water, 90; alcohol, 700; aromatics q.s. water to 1000.) A yellowish liquid used as a stimulant. Dose: 2 cc., well diluted (30 minims).

Ammonii Carbonas (ammonium carbonate): White translucent or opaque masses, having a strong odor of ammonia. Only the translucent portions should be dispensed. Used as a stimulant. Dose: ¼ gm. (4 gr.).

Ammonii Chloridum (ammonium chloride): A white, odorless powder, with a cooling taste; used as an expectorant. Dose: ½ gm. (7½ gr.).

Amylis Nitris (amyl nitrite): A clear, yellow liquid of a peculiar, penetrating odor. A powerful stimulant; used by inhalation only. Dose: 0.2 cc.

Antipyrina (antipyrine): A colorless, almost odorless, crystalline powder obtained from coal tar, having a bitter taste; soluble in less than 1 part of water. Dose: ¼ gm. (4 gr.).

Apomorphinae Hydrochloridum (apomorphine hydrochloride): The hydrochloride of an artificial alkaloid prepared from morphine by the abstraction of one molecule of water. White, glistening crystals, becoming green on exposure to light; used hypodermically as an emetic. Dose: 5 milligrammes.

Aqua Hydrogenii Dioxidi (solution of hydrogen dioxide or peroxide) (10 per cent by volume): A colorless, odorless liquid, rapidly deteriorating upon exposure. Used chiefly externally to cleanse suppurating wounds.

Argenti Nitras (silver nitrate): Colorless crystals, soluble in 0.54 part of water, and decomposed by light; used externally principally.

Argenti Nitras Fusus (lunar caustic): White or gray pencils, external use.

Arseni Trioxidum (white arsenic, the acidum arsenosum of the U. S. P., 1890): An opaque, white poisonous powder; odorless and tasteless; soluble in about 100 parts of water. Dose 2 milligrammes.

Asafetida (asafetida): A gum-resin from the root of *Ferula foetida*, and other species of ferula. Yellowish-white masses having a garlicky odor. Dose: ¼ gm.

Aspidii Oleoresina (oleoresin aspidium): A thick, dark-green liquid usually depositing a granular crystalline substance on standing; this granular part should be well mixed with the liquid portion before dispensing; used especially for the expulsion of tapeworms. Dose: 2 gm. (30 gr.).

Atropinae Sulphas (sulphate of atropine): The sulphate of an alkaloid obtained from *Atropa belladonna* and other plants of the same family. A white odorless, bitter powder; very poisonous; used especially to dilate the pupil. Dose: 0.4 milligramme (1/160 gr.).

Balsamum Peruvianum (balsam of Peru): A viscid, dark-brown liquid, of agreeable odor; used as a wound dressing.

Belladonnae Foliorum Extractum (extract of belladonna leaves): Used chiefly externally. Dose: 10 milligrammes (1/5 gr).

Benzoini Tinctura Composita (compound tincture of bezoin): Used chiefly by inhalation, with the vapor of hot water. Dose: 4 cc. (1 drachm).

Bismuthi Subgallas (bismuth subgallate, dermatol): An amorphous yellow powder; insoluble in water; odorless and tasteless; colors the stools black; used in diarrheal diseases. Dose: ¼ gm. (4 gr.).

Bismuthi Subnitras (bismuth subnitrate): A white powder; odorless; tasteless and insoluble in water; used in diarrheal diseases; colors the stools black. Dose: ½ gm (7½ gr.).

Buchu Fluidextractum (fluidextract of buchu): A greenish-black liquid; used as a diuretic. Dose: 2 cc. (30 minims).

Caffeina Citrata (citrated caffeine): A white, odorless, bitter, powder; used as a diuretic and heart stimulant. Dose: ⅛ gm. (2 gr.).

Calcii Phosphas Precipitatus (precipitated phosphate of calcium): An amorphous, white powder; insoluble; odorless; tasteless; permanent. Dose: 1 gm. (15 gr.).

Calx Chlorinata (chlorinated lime): Often improperly called "chloride of lime." A white powder containing not less than 30 per cent of chlorine, and decomposing on exposure to air. Used as a disinfectant. Dose: ¼ gm. (4 gr.).

Camphora (camphor): White masses; obtained from *Cinnamonum camphora* Linné; sparingly soluble in water, but readily soluble in alcohol and in oils. Used principally externally. Dose: ⅛ gm. (2 gr.).

Cantharidis Tinctura (tincture of cantharides): An alcoholic preparation of powdered Spanish flies. Used chiefly externally. Dose: ⅓ cc. well diluted (5 minims).

Capsici Tinctura (tincture of capsicum): Used chiefly externally. Dose: ½ cc. well diluted (8 minims).

Capsici Fluidextractum (fluidextract of capsicum): Used in the same manner as the tincture. Dose: 0.05 cc. (1 minim).

Cardamomi Tinctura Composita (compound tincture of cardamom). Used chiefly as a bitter tonic.

Caryophylli Oleum (oil of cloves): A volatile colorless or pale yellow oil distilled from cloves. Used principally for toothache; applied on cotton to cavity. Dose: 0.2 cc. (3 minims).

Cartharticae Composite Pilulae (compound carthartic pills): Contain calomel, colocynth, jalap, and gamboge. Each pill contains 60 milligrammes of calomel. Average dose: 2 pills.

Chloralum Hydratum (hydrated chloral, chloral): Colorless transparent crystals, with an aromatic odor and bitterish taste; freely soluble in water and alcohol. Used as a hypnotic. Dose: 1 gm. (15 gr.), dissolved in water.

Chloroformum (chloroform): A clear, colorless liquid of characteristic odor and sweetish, burning taste; should be kept in amber-colored glass-stoppered bottles in a cool, dark place. Used chiefly as an anesthetic by inhalation. Dose ⅓ cc. (5 minims).

Cinchonae Tinctura Composita (compound tincture of cinchona): Used as a tonic and in malarial diseases. Dose: 4 cc. (1 drachm).

Cocaine Hydrochloridum (cocaine hydrochloride): A salt of an alkaloid obtained from several varieties of coca; a colorless, odorless, crystalline powder; soluble in 0.4 part of water. Used chiefly as a local anesthetic. Dose: 30 milligrammes (½ gr.).

Codeina (codeine): An alkaloid from opium; a crystalline powder; odorless, with a faintly bitter taste. Used as a sedative. Dose: 30 milligrammes (½ gr.).

Colchici Seminis Fluidextractum (fluidextract of colchicum seed): Used chiefly in gout. Dose: 1/5 cc. (3 minims), well diluted.

Collodium Cantharidatum (cantharidal collodion): (Cantharides, 60; flexible collodion, 85; chloroform to 100.) Used externally to blister.

Collodium Flexile (flexible collodion). Collodium, U.S.P., is a solution of gun-cotton in ether and alcohol. Five per cent Canada turpentine and 3 per cent castor oil are added to give flexibility.

Creosoti Carbonas (creosotal): Contains 90 per cent creosote. A thick, oily, amber-colored liquid, with but little taste or odor. Insoluble in water; soluble in 95 per cent alcohol and in oils. Used in pulmonary diseases. Dose: ½ cc. (7 ½ minims).

Creosotum (creosote): A mixture of phenols and phenol derivatives obtained by the distillation of wood tar, preferably from the beech; a yellowish, oily liquid having a penetrating, smoky odor and a burning taste. Used principally in phthisis. Dose: 1/5 cc. (3 minims).

Cresol (cresol, tricresol): A mixture of three cresols obtained from coal tar; a straw-colored liquid, having a phenol-like odor; soluble in 60 parts of water. Used externally as a disinfectant. Dose: 0.05 cc. (1 minim).

Creta Preparata (prepared chalk): A white powder; odorless; tasteless; insoluble; permanent. Used in diarrhea. Dose: 1 gm. (15 gr.).

Cubebae Oleoresina (oleoresin of cubeb). Used in gonorrhea. Dose: ½ gm. (7 ½ gr.)

Cupri Sulphas (sulphate of copper): Deep blue crystals; odorless; efflorescent; soluble in 2.2 parts of water. Used as an astringent. Dose: 10 milligrammes (1/6 gr.).

Digitalinum (digitalin): A glucoside, and one of the active principles of digitalis. Dose: 1 milligramme (1/60 gr.).

Digitalis Tinctura (tincture of digitalis): Used as a heart tonic. Dose: 1 cc. (15 minims).

Elaterinum (elaterin): A neutral principle obtained from elaterium, a substance deposited by the juice of the squirting cucumber; a powerful hydragogue cathartic. Dose: 5 milligrammes (1/10 gr.).

Ergotae Fluidextractum (fluidextract of ergot): Used chiefly to control bleeding. Ergot is a morbid growth on rye (*Secale cereale* Linné) replacing the grain. Dose: 2 cc. (30 minims).

Eucaine hydrochloras (beta): A synthetic preparation closely resembling cocaine, for which it is often used as a substitute in the production of local anesthesia. Dose: 30 milligrammes (½ gr.).

Eucalyptol (eucalyptol): An oxide from the oil of eucalyptus. A colorless liquid of aromatic odor and pungent taste. Dose: ½ cc. (7½ minims).

Ferri Chloridi Tinctura (tincture of ferric chloride): A bright brownish liquid having an astringent styptic taste; injures the teeth; should be taken through a glass tube and well diluted. Used as a tonic. Dose: ½ cc. (7½ minims).

Ferri et Quininae Citras Solubilis (soluble iron and quinine citrate): Thin, greenish, odorless, deliquescent scales; completely soluble in water; partly soluble in alcohol. Used as a tonic. Dose: ¼ gm. (4 gr.).

Ferri Pyrophosphas Solubilis (soluble ferric pyrophosphate): Thin, apple-green, odorless scales; decomposed by light; soluble in water; insoluble in alcohol. Used as a tonic. Dose: ¼ gm. (4 gr.).

Frumenti, Spiritus (whiskey): An alcoholic liquid obtained by the distillation of grain, especially corn and rye. It should be at least four years old. An amber-colored liquid.

Gentianae Tinctura Composita (compound tincture of gentian): Used as a tonic. Dose: 4 cc. (1 drachm).

Glycerinum (glycerin): A liquid obtained by the decomposition of fats or fixed oils (S. G. 1.246); clear; colorless; odorless; sweet. Used externally. Dose: 4 cc. (1 drachm).

Glycerylis nitratis tabellae (nitroglycerin tablets): Heart stimulant. Dose: One tablet containing 1.2 milligrammes (1/50 gr.).

Glycyrrhizae Extractum Purum (pulvis) (pure extract of licorice): A brown powder used for flavoring. Dose: 1 gm. (15 gr.).

Glycyrrhizae Mistura Composita (compound licorice mixture; brown mixture): Contains paregoric, wine of antimony, sweet spirits of niter, licorice, gum arabic, syrup and water; 8 cc. contain about 1 cc. of paregoric and ½ cc. of sweet spirits of niter. Used as a cough mixture. Dose: 8 cc. (2 drachms).

Glycyrrhizae Pulvis Compositus (compound licorice powder): Conains senna, sulphur, licorice, oil of fennel, and sugar; about ¾ gm. of senna and ⅓ gm. of sulphur in each 4 gm. Used as a laxative. Dose: 4 gm. (1 drachm).

Gossypii Seminis Oleum (cottonseed oil): A fixed oil expressed from cotton seed. Dose: 16 cc. (4 fluidrachms).

Guaiaci Tinctura Ammoniata (ammoniated tincture of guaiac): Used especially in tonsillitis. Dose: 2 cc. (30 minims).

Hamamelidis Foliorum Fluidextractum (fluidextract of hamaelis leaves; witch hazel): Used chiefly externally. Dose: 2 cc. (30 minims).

Heroini hydrochloridum (heroin hydrochloride): A morphine derivative; a white powder, soluble in water. Used chiefly to control cough. Dose 5 milligrammes (1/10 gr.).

Hexamethylenamina (hexamethylenamine; urotropine): Colorless, odorless crystals; soluble in 1.5 parts of water and 10 parts of alcohol. Used as a urinary disinfection. Dose: ¼ gm. (4 gr.).

Homatropinae Hydrobromidum (homatropine hydrobromide): An artificial alkaloid derived from atropine; soluble in 10 parts of water. Used to dilate the pupil. Dose: 0.5 milligrammes (1/128 gr.).

Hydrargyri Chloridum Corrosivum (corrosive chloride of mercury; corrosive sublimate): Colorless, odorless, permanent crystals; soluble in 13 parts of water, 3 parts of alcohol. Used as an antiseptic and in syphilis. Dose: 3 miligrammes (1/20 gr.), dissolved in abundance of water.

Hydrargyri Chloridum Mite (mild mercurous chloride; calomel): A white powder; insoluble; odorless; tasteless; permanent.

Used as a laxative and in syphilis. Dose: laxative, 125 milligrammes (2 gr.); alterative, 65 milligrammes (1 gr.).

Hydrargyri Iodidum Flavum (yellow mercurous iodide): A bright yellow powder; odorless; tasteless; insoluble; decomposed by exposure to air. Used in syphilis. Dose: 10 milligrammes (⅙ gr.).

Hydrargyri Nitratis Unguentum (ointment of mercuric nitrate; citrine ointment): A bright yellow ointment. Used externally.

Hydrargyri Oleatum (oleate of mercury): A thick, yellowish liquid. Used externally.

Hydrargyri Oxidum Flavum (yellow mercuric oxide): A yellow amorphous powder. Used in Unguentum Hydrargyri Oxidi Flavi. An ointment for various eye affections.

Hydrargyri Salicylas (salicylate of mercury): A white amorphous powder; antisyphilitic. Dose: 32 milligrammes (½ gr.); hypodermically 10 milligrammes (1/6 gr.).

Hydrargyri Unguentum (mercurial ointment; blue ointment): A blue ointment; contains 50 per cent mercury. Used externally in syphilis and as a parasite destroyer.

Hyoscinae Hydrobromidum (hyoscine hydrobromide): The salt of an alkaloid obtained from hyoscyamus or henhane; colorless, odorless crystals; soluble in 1.5 parts of water. Used as a sedative. Dose: ½ milligramme (1/128.).

Hyoscyami Extractum (extract of hyoscyamus): Used as a sedative. Dose: 65 milligrammes (1 gr.).

Ammonium ichthyol sulphate (ichthyol): A black, tarry substance obtained from bituminous oil and containing about 15 per cent of sulphur. Used externally in skin diseases.

Iodoformum (iodoform): A yellow powder with a peculiar penetrating odor: very insoluble in water. Used externally as a mild antiseptic. Dose: 250 milligrammes (4 gr.).

Iodum (iodine): Bluish-black crystals; very insoluble in water: soluble in 10 parts of alcohol; valuable antiseptic. Used to make the tincture.

Ipecacuanhae Pulvis (powdered ipecac): A yellowish powder. Used as an emetic and in dysentery. Dose: as an emetic: 1 gm. (15 gr.).

Ipecacuanhae et Opii Pulvis (powder of ipecac and opium; Dover's powder): (Powdered ipecac, 10; powdered opium, 10; sugar of milk, 80.) A yellowish-white powder. Used as a diaphoretic. Dose: ½ gm. (7½ gr.).

Ipecacuanhae Fluidextractum (fluidextract of ipecac): Expectorant. Dose: 0.05 cc. (1 minim).

Lithii Citras (lithium citrate): A white, delinquescent powder; odorless, and having a cooling alkaline taste; soluble in about 2 parts of water; insoluble in alcohol. Used in gout. Dose: ½ gm. (7½ gr.).

Magnesii Carbonas (magnesium carbonate): White, insoluble, permanent powder. Used in acidity of the stomach. Dose: 3 gm. (45 gr.).

Magnesii Oxidum (magnesium oxide; magnesia): A white, bulky powder; odorless, and having an earthy taste; almost insoluble in water. Used chiefly as an antidote in arsenical poisoning. Dose: 2 gm. (30 gr.).

Magnesii Sulphas (magnesium sulphate; Epsom salt): Small, colorless needles; odorless; efflorescent; soluble in 0.85 parts of water. Used as a laxative. Dose: 16 gm (240 gr.).

Menthol (menthol): An alcohol obtained from oil of peppermint; colorless crystals, having an odor of peppermint; sparingly soluble in water; freely soluble in alcohol. Used externally. Dose: 65 milligrammes (1 gr.).

Methylis Salicylas: Chemically identical with oleum gaultheriae. A colorless liquid having a characteristic odor and a sweetish, aromatic taste. Antirheumatic, antiseptic. Dose 1 cc. (15 minims).

Morphinae Sulphas (sulphate of morphine): The salt of an alkaloid obtained from opium; white, feathery crystals; odorless; permanent and bitter; soluble in 15.3 parts of water; sometimes mistaken for quinine which it closely resembles, with fatal results;

may be distinguished by the action of nitric acid, which with morphine gives an orange-red color, fading to yellow, and with quinine does not give the color reaction. Used to relieve pain. Dose: 15 milligrammes (¼ gr.).

Morrhuae Oleum (cod-liver oil): A fixed oil expressed from fresh livers of codfish (*Gadus morrhua,* Linné). Used chiefly in tuberculosis. Dose: 15 cc. (4 fluidrachms).

Myrrhae Tinctura (tincture of myrrh): Used chiefly in mouth washes. Dose: 1 cc. (15 minims).

Nucis Vomicae Tinctura (tincture of nux vomica): Used as a tonic and stimulant. Dose: ½ cc. (7½ minims).

Nucis Vomicae Extractum (extract of nux vomica): Used as a tonic and stimulant. Dose: 15 milligrammes (¼ gr.).

Opii Tinctura (tincture of opium; laudanum): Used to relieve pain and control diarrhea. Dose: ½ cc. (7½ minims).

Opii Tinctura Camphorata (camphorated tincture of opium; paregoric): Contains opium, benzoic acid, camphor, and oil of anise, each 4; glycerin, 40; alcohol, 950. Dose 8 cc. (2 fluidrachms).

Opii Pulvis (powdered opium): A brownish powder. Dose: 65 milligrammes (1 gr.).

Pepsinum (pepsin): A digestive ferment obtained from the stomach of the hog (*Sus scrofa*); yellowish scales of a white powder. Dose: ¼ gm. (4 gr.).

Petrolatum (vaseline): A petroleum product. Used externally as a basis for ointments.

Petrolatum Liquidum (liquid petrolatum; liquid vaseline): A yellowish, oily liquid used externally, chiefly in sprays for the nose and throat.

Phenol (carbolic acid): Obtained by distillation from coal tar, or prepared synthetically; a white, crystalline mass sometimes acquiring a reddish tint; soluble in 19.6 parts of

water and liquefying in the presence of 13.6 per cent of water. In poisonous doses it colors the urine dark green. Used chiefly as an antiseptic; locally as a superficial caustic. Dose: 65 milligrammes (1 gr.).

Phenylis Salicylas (phenol salicylate; salol): A white powder having a faint aromatic odor and a slight taste; soluble in 2333 parts of water. Used as an intestinal antiseptic. Dose: ½ gm. (7½ gr.).

Physostigminae Sulphas (sulphate of physostigmine): A salt of an alkaloid obtained from physostigma or calabar bean; a yellow powder; deliquescent; odorless; contracts the pupil. Dose: 1 milligramme (1/64 gr.).

Pilocarpinae Hydrochloridum (pilocarpine hydrochloride): A salt of an alkaloid obtained from pilocarpus or jaborandi. Used as a diaphoretic. Dose: 10 milligrammes (1/5 gr.).

Plumbi Acetas (lead acetate; sugar of lead): Colorless crystals; efflorescent; soluble in 2 parts of water; having a sweetish taste. Used as an astringent. Dose 65 milligrammes (1 gr.).

Podophylli Resina (resin of podophyllum): A grayish-white powder of peculiar odor and bitter taste. Used as a laxative; acts slowly, 6 to 12 hours. Dose: purgative, 15 milligrammes (¼ gr.).; laxative, 5 milligrammes (1/10 gr.).

Potassii Acetas (potassium acetate): A white, very deliquescent powder; soluble in 0.4 parts of water. Used as a diuretic. Dose: 2 gm. (30 gr.).

Potassii Arsenitis Liquor (solution of potassium arsenite, Fowler's solution): Contains 1 per cent of arsenic trioxide. Used in malarial and skin diseases. Dose: 0.2 cc. (3 minims), well diluted.

Potassii Bicarbonas (potassium bicarbonate): A colorless, granular, permanent powder. Used in rheumatism. Dose: 2 gm. (30 gr.).

Potassii Bromidum (potassium bromide): Colorless crystals; odorless; permanent; soluble in 1.5 parts of water; should be administered dissolved in plenty of water. Dose: 1 gm. (15 gr.).

Potassii Chloras (potassium chlorate): Colorless plates, or a white granular powder; odorless; permanent; soluble in 16 parts of water. Handle with care, as dangerous explosions are likely to follow trituration with organic substances, like sugar, or oxidizable substances, such as sulphur. Used as a gargle and mouth wash in saturated aqueous solution. Dose: ¼ gm. (4 gr.).

Potassii et Sodi Tartras (potassium and sodium tartrate; Rochelle salt): A white, odorless powder; soluble in about 1.2 parts of water. Used as a laxative. Dose: 8 gm. (120 gr.).

Potassii Hydroxidum (potassium hydroxide; potassa): Fused white masses; odorless; acrid tasting; deliquescent; caustic. Not used internally.

Potassii Iodidum (potassium iodide): A white granular powder; deliquescent; soluble in 0.7 part of water; should be given in solution with plenty of water. Used especially in syphilis and rheumatism. Dose: ½ gm. (7½ gr.).

Potassii Permanganas (potassium permanganate): Slender, dark-purple prisms; permanent; soluble in about 15 parts of water. Used chiefly externally as a skin disinfectant. Dose: 65 milligrammes (1 gr.).

Protargol: A protein silver compound containing 8.3 per cent of silver, and non-irritating in character; a yellowish powder soluble in water. Used externally in inflammation of mucous membranes. 1 to 5 per cent solutions.

Quininae Chlorhydrosulphas (quinine chlorhydrosulphate): A salt of an alkaloid of cinchona bark; colorless crystals; odorless and bitter; soluble in 1 part of water. The best salt for hypodermic; antimalarial. Dose: ⅓ to 1 gm. (5 to 15 gr.).

Quininae Sulphas (quinine sulphate): Has the same qualities as the chlorhydrosulphate, but less soluble in water, 1:720. Used in malaria. Dose: ⅓ to 1 gm. (5 to 15 gr.).

Rhamni Purshianae Fluidextractum (fluidextract of cascara sagrada): Used as a laxative; acts as such in 8 to 10 hours. Dose: 1 cc. (15 minims).

Rhamni purshinae pilulae extracti (cascara extract pills): Each ¼ gm. (4 gr.) of extract of cascara. Dose: 1 to 2 pills.

Santoninum (santonin): Obtained from santonica flowers; colorless crystals turning yellow on exposure to light; odorless; nearly tasteless; insoluble; permanent; colors the urine a greenish yellow or reddish purple; large doses cause yellow vision. Vermifuge. Dose: 65 milligrammes (1 gr.).

Sapo Mollis (soft soap): A soft, unctuous, yellowish-brown mass made by saponifying linseed oil. Used externally.

Serum Antidiphthericum (diphtheria antitoxin): A fluid separated from the coagulated blood of the horse (*Equus caballus*, Linné), immunized through the inoculation of diphtheria toxin; should be kept in a sealed glass container in a dark, cool place. A yellowish, transparent or slightly turbid liquid, which gradually loses its power. Dose: hypodermically, 3000 units; immunizing dose; 500 units.

Sinapis Nigra Pulvis (powdered black mustard): Used principally in preparing mustard plasters.

Sodii Bicarbonas (sodium bicarbonate): A white, odorless powder having an alkaline taste; soluble in 12 parts of water; antacid. Dose: 1 gm. (15 gr.).

Sodii Boras Pulvis (powdered borax): A white, odorless, efflorescent powder, having a sweetish taste; soluble in 20.4 parts of water. Used as an antiseptic. Dose: ½ gm. (7½ gr.).

Sodii Bromidum (sodium bromide): A white, granular powder; odorless; soluble in 1.7 parts of water. Used as a sedative. Dose: 1 gm. (15 gr.), well diluted with water.

Sodii Carbonas Monohydras (monohydrated sodium carbonate): A white crystalline, granular powder, prepared by heating sodium carbonate at a temperature above 35° C. For surgical use.

Sodii Phosphas (phosphate of sodium): A white, hygroscopic powder. Used as a laxative. Dose: 2 gm. (30 gr.).

Sodii Salicylas (sodium salicylate): White scales, or a colorless powder with a faint pink tinge; odorless and having a sweetish taste; soluble in about 0.8 part of water; irritating to stomach and should be dissolved in an abundance of water. Used in rheumatism. Dose: 1 gm. (15 gr.).

Sodii Thiosulphas (sodium thiosulphate; hyposulphite): Colorless crystals; odorless and having a cooling taste; soluble in 0.35 part of water. Used chiefly externally in parasitic diseases of the skin. Dose: 1 gm. (15 gr.).

Strophanthi Tinctura (tincture of strophanthus): Used as a cardiac stimulant. Dose: ½ cc. (7½ minims).

Strychninae Sulphas (strychnine sulphate): The salt of an alkaloid obtained from nux vomica; colorless, efflorescent crystals or a white powder; odorless; intensely bitter; soluble in 31 parts of water. Dose: 1 milligramme (1/64 gr.).

Sulphonethylmethanum (trional): Colorless, odorless scales, with a bitter taste; soluble in 195 parts of cold water, more readily in hot water. Used as a hypnotic. Dose: 1 gm. (15 gr.).

Sulphonmethanum (sulphonal): Colorless, inodorous, and nearly tasteless crystals; soluble in 360 parts of cold or 15 parts of boiling water. Used as a hypnotic. Dose: 1 gm. (15 gr.).

Sulphur Lotum (washed sulphur): A fine, yellow powder; odorless, tasteless and insoluble. Used as a laxative. Dose: 4 gm. (60 gr.).

Terebenum (terebene): Obtained by the action of sulphuric acid on oil of turpentine. A thin, colorless liquid with an agreeable odor; becomes resinified on exposure to air and light. Used as an expectorant. Dose: ½ cc. (7½ minims).

Thymol (thymol): A phenol occurring in the oil of thyme; colorless crystals having an aromatic odor and taste; soluble in 1100 parts of water; freely soluble in alcohol and in oils; antiseptic and vermifuge. Dose: 125 milligrammes (2 gr.).

Tolutanum Balsamum (balsam of tolu): A yellowish-brown solid; readily soluble in alcohol; sparingly soluble in water. Dose: 1 gm.

Zinci Oxidum (zinc oxide): A fine, white powder; insoluble; odorless and tasteless. Used externally in ointments. Dose: ¼ gm. (4 gr.).

Zinci Sulphas (zinc sulphate): Colorless, efflorescent crystals; odorless and having an astringent, metallic taste; soluble in 0.53 part of water. Used externally and as an emetic. Dose: as an emetic, 1 gm. (15 gr.).

Zingiberis Fluidextractum (fluidextract of ginger). Dose: 1 cc. (15 minims).

PRESCRIPTIONS.

Q. What is a prescription?

A. A formula which a physician writes, specifying the substances he intends to have administered to a patient.

Q. In what language is it written and for what reason?

A. Latin; it is the language of science and is understood throughout the civilized world; it is a dead language and not subject to change.

Q. What are the parts of a prescription?

A. (1) The superscription or heading; (2) the name of the patient; (3) the inscription, or the names and quantities of the ingredients; (4) the subscription, or the directions to the compounder; (5) the *signa* (mark) or the directions for the patient; (6) the name or initials of the physician, with the date.

Q. What is the superscription?

A. It consists of the Latin symbol Rx, which is an abbreviation of the word *recipe* ("take"), the imperative of the Latin word *recipio*.

Q. Why should the name be on every prescription?

A. To avoid being given to the wrong person.

Q. Of what four parts may the inscription be composed?

A. (1) the basis, the chief, active ingredient; (2) the adjuvant or aid to the basis to assist its action; (3) the corrective, which is intended to qualify the action of the basis and adjuvant; (4) the vehicle, the ingredient which gives the whole the proper consistency, form and color.

Q. Give a model inscription:

A.	Basis	Chloralis	ʒii
	Adjuvant	Potassii bromidi	ʒiv
	Corrective	Syrupi bromidi	f℥i
	Vehicle	Syrupi	f℥iii

Q. What numerals are used to designate quantities and where are they written?

A. Roman, as i, v, x, c, etc. Where more than one i is used, the j is often used, as ij. They are always written after the ingredient.

Q. What is usually included in the subscription?

A. The letter M, or *misce*; S, or *solve*; F, *fiat*; etc.

Q. What should be included in the *signa*?

A. The directions to the patient, written in English. The date should also be included.

Q. What is to be said of the signature?

A. The signature is necessary to indicate that the prescription has been written by one duly qualified, as required by law.

Q. Enumerate the principal words used in prescription writing; give their contractions or abbreviations and the meaning of each.

A.

Word or phrase.	Contraction.	Meaning.
Ad	Ad	To, up to.
Ad conciliandum gustum.		To suit the taste.
Add, addantur, addendus, addendo	Add	Add, or let them be added, to be added, by adding.
Ad libitum	Ad lib	At pleasure.

Word or phrase.	Contraction.	Meaning.
Ana	A., aa	Of each.
Aqua bulliens	Aq bull	Boiling water.
Aqua communis	Aq. comm	Common water.
Aqua tervins	Aq. ferv.	Hot water.
Bene		Well.
Bis		Twice.
Bis in die	Bis in d.	Twice a day.
Charta	Chart.	Paper.
Cibus		Food.
Cochlear or cochleare cochleatim	Coch., cochleat.	Spoonful, by spoonfuls.
Cochleare amplum	Coch. amp.	A tablespoonful.
Cochleare magnum	Coch. mag.	A large spoonful, (about half an ounce.)
Cochleare medium or modicum	Coch. med	A dessertspoonful (about two fluidrachms.).
Cochleare parvum	Coch. parv	A teaspoonful (about one fluidrachm.).
Cola	Col	Strain.
Collyrium	Collyr., Coll	An eye wash.
Congius	Cong	A gallon.
Contra		Against.
Cortex	Cort	The bark.
Cum	C	With.
Dividatur	D. in p. aeq	Let it be divided into equal parts.
Eadem (fem)		The same.
Ejusdem	Ejusd	Of the same.
Et.		And.
Fac. Fiat	F., Ft.	Make, let it be made, let them be made.
Fiant chartulae xii	Ft. Chart. xii	Make 12 powders.
Fiant pilulae xii	Ft. pil. xii	Make 12 pills.
Fiant pulveres xii	Ft. pulv. xii	Make 12 powders.

Word or phrase.	Contraction.	Meaning.
Fiat secundum artis regulas	F. S. A. R.	Let it be made according to the rules of art.
Fiat solution	Ft. solut	Make a solution.
Filtra		Filter (thou).
Gargarisma	Garg	A gargle.
Gutta	Gtt	A drop.
Guttae	Gtt	Drops.
Guttatim	Guttat	By drops.
Idem		The same.
Partes aequales	P. ae	Equal parts.
Pro re nata	P. r. n	Occasionally.
Quantum sufficiat, quantum satis	Q. s.	As much as is sufficient.
Secundum artem, secundum naturam	S. A., S. N.	According to art.
Semis	Ss.	A half.
Signa	Sig.	Mark thou.
Solve		Dissolve.
Supra		Above.
Ter in die, or Ter die	T. i. d., or t. d.	Three times a day.
Uncia		An ounce.

Q. What is understood by incompatibility?

A. It is a term used to express the effects produced in pharmaceutical mixtures by chemical decomposition, physical dissociation, incomplete solution or therapeutic opposition. It may be divided into three classes: chemical incompatibility, physical incompatibility and therapeutic incompatibility.

Q. What is chemical incompatability?

A. The result of chemical action which results in the decomposition of one or more of the ingredients entering into the prescription. It may result in unintentional precipitate, explosives or poisonous compounds.

Q. Give examples of chemical incompatibility.

A. A preparation containing tannic acid when combined with iron salts produces tannate of iron, resulting in an inky mix-

ture: as a mixture of the tinctures of chloride of iron and gentian compound; a solution of an alkaloid with an alkali precipitates the alkaloid, as a solution of morphine sulphate to which bicarbonate of potash is added would precipitate the morphine; permanganate of potash and gylcerine mixture would result in an explosive compound.

Q. What is physical incompatibility?

A. The condition arising from the mixture of pharmaceutical preparations which results in the physical dissociation of one or more constituents.

Q. Give examples of physical incompatibility.

A. A solution of sulphate of magnesia to which tincture of orange is added would result in a mass of crystals of the salt as a result of the insolubility in alcohol; tincture of chloride of iron added to syrup of acacia would gelatinize; codliver oil added to syrup of orange would separate unless made into an emulsion.

Q. What is therapeutic incompatibility?

A. The condition arising from the combination of remedies which are mutually opposed to one another in therapeutic effect.

Q. Give examples of therapeutic incompatibility.

A. A solution of bromide of potash and strychnine; a pill of opium and caffeine. In both examples the drugs are mutually antagonistic. A solution of pepsin to which an alkali has been added is inert, as pepsin is effective only in acid solutions.

CHEMISTRY.

Acquiring a knowledge of chemistry is important for practically everybody, since chemical facts and principles are involved, to a considerable extent, in every science and in every branch of industry, and chemical questions arise in nearly every sphere of human activity. To prove how essential this knowledge is to a member of the Hospital Corps it need only be stated that his daily duties bring him into contact with such subjects as hygiene, sanitation, fumigation, disinfection, aseptic surgery, dietetics, urine analysis, pure food and drink, and these are all, primarily, problems of chemistry. Furthermore, in addition to its material value, which has to do with our health, wealth and happiness, the study of chemistry has an educational value as a mental discipline that can perhaps be acquired from the study of no other subject. It gives the student accuracy in his powers of observation; it enables him to draw correct conclusions from what he sees and to test experimentally the truth of every statement. This training in the interpretation of evidence is one of the most valuable factors in the study of chemistry.

The magnitude of the scope and operations of chemistry renders it difficult to treat the subject satisfactorily in a space so limited as its presentment is here made necessary. The study of chemistry is, however, inseparable from such studies as pharmacy, therapeutics, toxicology and other subjects with which members of the Hospital Corps will have to become familiar, and as noted, a fair understanding of chemistry is absolutely necessary for the intelligent performance of the duties with which hospital corpsmen are charged.

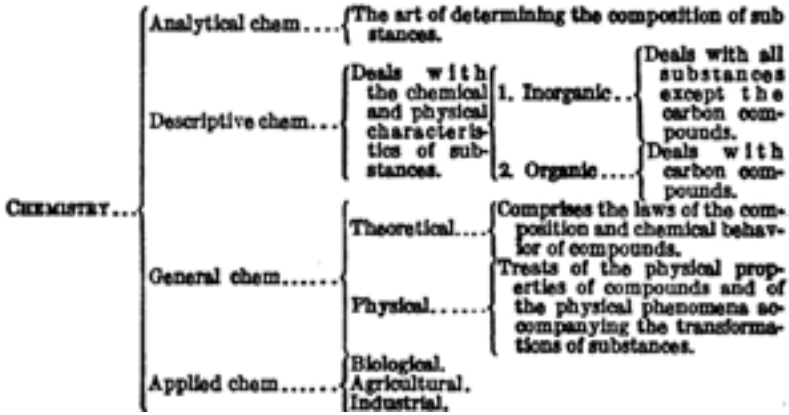
The manner of presenting the subject, in the form of questions and answers, and the omission of instructions for practical experiments is a departure from the usual order of chemical studies. This is made necessary for the reason that most of the

students will not have access to a properly equipped laboratory for carrying out the experiments usually recommended for beginners in the study of this science. An additional reason for this is the probability that the lessons will be interrupted, and that not many of the students will be able to complete as continuous and full a course in chemistry as the subject warrants. Under these conditions it is believed that a knowledge of the fundamental principles of chemistry will prove more valuable and lasting than a scattering knowledge of data concerning individual elements and compounds. However, the importance of laboratory work as a part of a course in chemistry cannot be emphasized too strongly, and every student of the subject should embrace the first opportunity to carry out intelligently the experiments given in one of the standard elementary text-books on the subject. But it must always be remembered that to make such problems an exercise for the memory, or to fail to understand their meaning or what they signify, haphazard experimenting in other words, has little or no value and is soon forgotten.

A very close relation exists between the sciences of chemistry and physics, and a knowledge of certain parts of physics is essential for the proper understanding of chemistry. Both sciences have for their object the study of matter and the changes which it undergoes. Those changes which do not affect the composition of substances are studies under physics, while those changes which do affect the composition of matter and give rise to the formation of new substances with new properties are studied under the head of chemistry. These two series of phenomena cannot be studied altogether independently of one another, but the study of such subjects as matter, force, energy, gravitation, weight, heat, light, etc.—all of importance in understanding chemistry—comes properly under the head of physics. Every opportunity, however, should be taken advantage of by the student to familiarize himself in a practical way with such processes as filtration, evaporation,

crystallization, etc., as well as the construction of such laboratory apparatus as may come under his observation.

The shelf bottles in the dispensaries and sick bays should be labeled with the chemical symbols as well as the correct pharmacopeial names of the substances; in this way the student learns these symbols and names without effort and thus becomes familiar with what he should know, but should not be compelled to memorize.



The facts of chemistry have been grouped in a variety of ways, and such titles as animal, vegetable, medical, pharmaceutical, astronomical and metallurgical chemistry in a general way explain themselves. Chemistry proper, however, may be divided into the four branches indicated above (the student may refer to the division later as he becomes more familiar with the subject.) Most chemistries, however, divide the study of this science in two branches, inorganic and organic chemistry, and this division is followed in the answers and questions given.

Q. What is matter?

A. Matter is that which occupies space and possesses weight and is apprehended by the aid of our senses.

Q. To what two changes of distinctive character is matter constantly subjected? Define each.

A. Physical and chemical changes. Physical changes are those which do not affect the nature or identity of matter; for example when water is converted into vapor or steam by heat. Chemical changes are those which result in the formation of new substances, that is, substances which are different in composition and properties from the materials out of which they have been produced; for example, the burning or explosions of gunpowder.

Q. What is the principle or law of the conservation of matter?

A. It is believed that matter as such is indestructible; that is, however it changes its form or whatever reactions it undergoes the amount of matter after the change is the same as before.

Q. In what three states or forms is matter known to exist? Define each.

A. Solid, liquid, and gas. A solid is a mass of matter having definite shape and size of its own, and its shape cannot be changed permanently and greatly without fracture. A liquid is a body in that state in which the particles move freely among themselves, but remain in one mass, keeping the same volume, and taking the shape of the containing vessel. A gas is such a form of matter that being contained without any closed vessel, it distributes itself uniformly throughout the space open to it, thus having neither a shape nor size of its own.

Q. How may all matter be broadly subdivided?

A. Into simple or elementary matter and compound matter, termed, relatively, elements and compounds.

Q. What is chemistry?

A. Chemistry is the study of matter and the changes produced in it by the action of chemical force or other forms of energy upon it. Strictly speaking it treats of a particular class of changes, i. e., chemical changes that matter undergoes.

Q. What is one of the first objects of chemistry?

A. Its first object consists in learning the constituents of which the material world is composed, in reducing these constituents to their simplest forms, and in building up new chemical compounds from the latter.

Q. What are the two distinctive methods to which chemists resort in determining the composition of any substance? Define each.

A. Analysis and synthesis. By analysis a body is separated into its component parts, which are then identified. Synthesis consists in the building up of a compound from two or more simpler substances by causing these to combine.

Q. What is an element?

A. An element is the simplest form of matter and one that cannot be decomposed by any means known to science.

Q. What is a compound?

A. A compound is a substance the composite nature of which can be proven.

Q. What is an atom?

A. Matter of all kinds is assumed to be composed of extremely minute, indivisible particles, and the single particle so small that it is entirely beyond our power of observation, even with the aid of the most powerful microscope. These particles are called atoms. Hence, an atom is the smallest portion into which matter can be divided, and the smallest quantity of substance which can enter into chemical union or take part in any chemical change.

Q. What is a molecule?

A. A molecule is the smallest combination of atoms that will form a given chemical compound; in other words, the aggregate of atoms which are produced when two or more unlike atoms combine together to form the smallest particles of a compound substance are called molecules.

Q. How many elements, and therefore different kinds of atoms, are known?

A. About eighty are definitely known as such.

Q. What is a symbol?

A. In chemistry the elements are represented by accepted abbreviations, called symbols, each of which indicates a single atom of the element.

Q. How are these symbols for the different elements chosen?

A. The symbol of an element is usually the first letter, sometimes the first and a succeeding letter, of the English or of the Latin name for the element; thus, H is the symbol for hydrogen, Cu (cuprum) the symbol for copper, and so on.

Q. What does the symbol for each element represent?

A. (1) The name of the element; (2) an atom of the element; (3) a definite weight, in grammes of the element. This is the number representing the atomic weight of the element taken as grammes. Thus, the symbol for hydrogen represents 1 gramme of hydrogen because the atomic weight of hydrogen is 1; the symbol of copper, 63.1 grammes of copper, because the atomic weight of copper is 63.1, and so on.

Q. Give a list of the most important of the elements with their symbols and atomic weights.

ELEMENTS, SYMBOLS, AND ATOMIC WEIGHTS

Name.	Symbol.	Atomic weight.	Name.	Symbol.	Atomic weight.
Aluminum.	Al.	26.9	Neodymium	Nd.	142.5
Antimony	Sb.	119.3	Neon	Ne.	19.9
Argon.	A.	39.6	Nickel.	Ni.	58.3
Arsenic.	As.	74.5	Nitrogen.	N.	13.93
Barium	Ba.	136.4	Osmium	Os.	189.6
Bismuth	Bi.	206.9	Oxygen	O.	15.88
Boron.	B.	10.9	Palladium.	Pd.	105.7
Bromine	Br.	79.36	Phosphorus	P.	30.77
Cadium	Cd.	111.6	Platinum.	Pt.	193.3
Caesium	Cs.	131.9	Potassium	K.	38.85
Calcium	Ca.	39.7	Praseodymium. .	Pr.	139.4

Name.	Symbol.	Atomic weight.	Name.	Symbol.	Atomic weight.
Carbon.	C.	11.91	Radium	Ra.	223.3
Cerium.	Ce.	139.2	Rhodium	Rh.	102.2
Chlorine	Cl.	35.18	Rubidium	Rb.	84.9
Chromium	Cr.	51.7	Ruthenium	Ru.	100.9.
Cobalt	Co.	58.55	Samarium	Sa.	149.2
Columbium	Cb.	93.3	Scandium.	Sc.	43.8
Copper.	Cu.	63.1	Selenium	Se.	78.6
Erbium	Er.	164.8	Silicon	Si.	28.2
Fluorine	F.	18.9	Silver	Ag.	107.11
Gadolinium	Gd.	154.8	Sodium	Na.	22.88
Gallium	Ga.	69.5	Strontium	Sr.	86.94
Germanium	Ge.	72.0	Sulphur	S.	31.82
Glucinum	Gl.	9.03	Tantalum	Ta.	181.6
Gold.	Au.	195.7	Tellurium	Te.	126.6
Helium	He.	4.0	Terbium	Tb.	128.8
Hydrogen.	H.	1.0	Thallium.	Tl.	202.6
Indium	In.	114.1	Thorium	Th.	230.8
Iodine.	I.	126.01	Thulium	Tm.	169.7
Iridium	Ir.	191.5	Tin	Sn.	118.1
Iron	Fe.	55.5	Titanium.	Ti.	47.7
Krypton	Kr.	81.2	Tungsten	W.	182.6
Lanthanum.	La.	137.9	Uranium	U.	236.7
Lead.	Pb.	205.35	Vanadium.	V.	50.8
Lithium	Li.	6.98	Xenon	Xe.	127.0
Magnesium	Mg.	24.18	Ytterbium	Yb.	171.7
Manganese	Mn.	54.6	Yttrium	Yt.	88.3
Mercury	Hg.	198.5	Zinc	Zn.	64.9
Molybdenum . . .	Mo.	95.3	Zirconium.	Zr.	89.9

NOTE:—**Only the most important of the elements need be considered. A list of these will be found further on.**

Q. What is atomic weight?

A. The shape, size and mass of atoms have not been determined and at best must be regarded as approximations only; but experimental evidence points to the atoms of different elements possessing very different *weights.* So while the mass is not known in the case of any atom, the ratio to each other of the weights of

atoms of different elements can be determined with accuracy. A series of numbers which represent the *relative weights* of the different kinds of atoms has accordingly been drawn up and such a number (the relative atomic weight of the element) is known in chemistry as its atomic weight.

Q. In determining these relative atomic weights what atom serves as the comparative unit or standard?

A. Hydrogen, its atomic weight being rated 1.

Q. What is molecular weight?

A. The sum of the atomic weights of a molecule.

Q. What is a chemical formula? Illustrate.

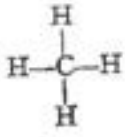
A. A chemical formula usually consists of two or more (a series of) symbols written side by side, as CO, which represents carbonic oxide.

Q. What is meant by an empirical formula?

A. An empirical formula is one which expresses the number of the several atoms present but with no information as to how they are joined together, thus CH_4.

Q. What is meant by a structural or graphic formula?

A. A structural or graphic formula is one which shows the method of linking of the constituent atoms, thus,



Q. When two or more atoms are to be represented, how is it expressed?

A. This is done by numerals added to the right of and on a lower level than the symbol, *e.g.*, H_2, H_3, H_4, and so on.

Q. What does the formula for a substance represent?

A. (1) The kinds of atoms of which the substance consists; (2) the ratio of the number of atoms of each kind; (3) a definite weight, in grammes, of the substance. This weight is the sum

of the atomic weights of the atoms represented by the formula taken as grammes. It is called the formula weight.

Q. What is meant by valency?

A. Elements combine with one another because of their attractive force or chemical affinity. For different elements this varies in power, and a measure of it may be had by comparison of the several elements with hydrogen, which combines with the lowest saturating power. This combining or saturating value of an element is termed its valence, univalence or quantivalence. Hence, the capacity of an elementary atom for uniting with other atoms is its valency.

Q. What are the group names of elements as regards their valency?

A. Elements which combine with or replace hydrogen atom for atom are said to be univalent (or monads); those of which one atom will combine with or replace two atoms of hydrogen are said to be bivalent (or diads); when with three, trivalent (or triads); when with four, quadrivalent (or tetrads); when with five, quinquivalent (or pentads); when with six, sexivalent (or hexads), etc.

Q. Name and define the chief laws of chemical combination.

A. (1) The law of definite proportions, which assets that any given chemical compound always contains precisely the same elements in exactly the same proportions; (2) the law of multiple proportions, which states that when two elements unite to form several compounds the higher proportions of each are even multiples of the lowest; (3) the law of gaseous volume, which states that when gases combine with one another the volumes which unite stand in a simple relation to each other and also to the volume of the product when this is a gaseous substance.

Q. What is Avogadro's hypothesis?

A. Equal volumes of all gases, under the same conditions of pressure and temperature contain the same number of molecules.

Q. What is meant by a chemical reaction?

A. The mutual action of chemical agents which cause a change to take place between two or more molecules.

Q. How many kinds of chemical reactions are there?

A. There are four kinds: (1) direct combination; (2) direct decomposition; (3) substitution; (4) double decomposition.

Q. What are reagents?

A. The several substances that take part in a chemical reaction or change.

Q. What is a base? Acid? Salt?

A. A base is a chemical compound which is capable of so uniting with an acid as in whole or part to displace its hydrogen, neutralize its acid properties, and so form a salt.

An acid is a compound of hydrogen in which all or a part of the hydrogen may be exchanged for a metal or a basic radical, forming a new compound.

When an acid and a base are brought together, water is the first product of the reaction, the other product is called a salt. Broadly speaking, a salt is a substance formed by substituting a metallic element for the hydrogen of an acid.

Q. How are salts named?

A. Salts are named according to the names of acids and the bases from which they are formed.

Q. What is meant by the term radical in chemistry?

A. The name radical is used in chemistry to designate a group of atoms which is common to a number of compounds and is capable of being transferred from one compound to another without itself breaking up.

Q. What are the characteristics of an acid?

A. An acid usually possesses a sour taste when diluted, reddens blue litmus paper and saturates bases (oxides and hydroxides of metals).

Q. What is meant by basicity of acids?

A. Acids are called monobasic, dibasic, tribasic, etc., according as they contain in their molecules one, two, three, etc., hydrogen atoms displaceable by metals.

Q. Mention and define the several classes of salts.

A. Neutral, normal, acid, and basic. Neutral salts when dissolved in water yield solutions which show neither the acid nor the alkaline reaction. Normal salts are formed when the whole of the replaceable hydrogen of an acid is replaced by a metal (normal salts are frequently neutral but not necessarily so). Acid salts contain some of the replaceable hydrogen of the original acid unreplaced by metal. Basic salts are intermediate in composition between basic oxide, or hydroxide, and normal salts.

Of the known elements enumerated on page 120, the study of about forty is essential for the proper comprehension of chemistry. About two-thirds of the forty are metals and one-third non-metals. The remainder of the elements are either seldom met with in nature, or have not received any practical application in medicine or manufacture. The student should now take up a systematic study of these forty elements and their compounds with the aid of a chemistry, the pharmacopeia and a dispensatory. To facilitate this study the divisions appended may be followed to advantage, the subjects being taken up in the order enumerated. Occurrence in nature, source, appearance, properties, atomic weight, chemical symbol, valency, relation to animal and vegetable life, official name, official preparation, etc., are questions that will naturally arise in this study and they should be given particular attention.

Non-metallic Elements.

Oxygen, hydrogen, nitrogen, chlorine, sulphur, carbon, iodine, phosphorus, bromine, boron.

Metallic Radicals.

Potassium, sodium, ammonium, lithium, barium, strontium, calcium, magnesium, zinc, manganese, cobalt, nickel, aluminum, iron, chromium, arsenic, antimony, tin, gold, platinum, copper, mercury, lead, bismuth, silver, cadmium.

Acid Radicals.

Hydrochloric acid and other chlorides.
Hydrobromic " " bromides.

Hydriodic	"	"	iodides.
Hydrocyanic	"	"	cyanides.
Nitric	"	"	nitrates.
Hypochlorous	"	"	hypochlorites.
Chloric	"	"	chlorates.
Acetic	"	"	acetates.
Hydrosulphuric	"	"	sulphides.
Sulphurous	"	"	sulphites.
Sulphuric	"	"	sulphates.
Carbonic	"	"	carbonates.
Oxalic	"	"	oxalates.
Tartaric	"	"	tartrates.
Citric	"	"	citrates.
Phosphoric	"	"	phosphates.
Boric	"	"	borates.

ORGANIC CHEMISTRY.

The elements and compounds studied in the previous lessons have been, with a few exceptions, of mineral origin. The two other kingdoms of nature, the animal and vegetable, furnish a very much larger number of definite compounds.

In the early days of chemistry a sharp distinction was drawn between the compounds derived from plants and animals (organized matter), and those obtained from the mineral (inorganic) kingdom. The older chemists believed that the organic compounds, that is, those belonging to the vegetable and animal kingdoms, were produced in the same way under the influence of plant or animal vitality; in other words, that living plants or animals were necessary for their production, and that they could not be made artificially in the laboratory, while inorganic compounds could be and were built up artificially by appropriate chemical reactions. This distinction no longer exists and the same chemical forces undoubtedly act in both the organic and inorganic worlds.

This separation, in a broad way, of chemistry into inorganic and organic chemistry is therefore an arbitrary one, and is ad-

hered to as a matter of convenience only. Students should understand that the term "organic" chemistry is only conventionally and not etymologically correct.

These organic compounds, so called, are remarkable for their great number and complexity. They all agree in containing carbon, and organic chemistry deals solely with compounds of carbon. Organic chemistry, then, is the chemistry of the element carbon.

The element carbon possesses a greater range of combining powers than that of any other, and the very great number of the compounds produced thereby, as well as the complexity of many of them, together with the general readiness which they usually exhibit to enter into new combinations, may be mentioned as the reasons for their separate study.

The element carbon in these compounds is generally united with hydrogen, oxygen, nitrogen, or all three, and organic chemistry is distinguished from inorganic chiefly in being concerned with the arrangement in different proportions or in different positions of these four elements, namely, carbon, hydrogen, oxygen and nitrogen, though other elements occasionally enter into the composition of organic compounds.

In studying the structure of carbon compounds three fundamental principles are to be observed: (1) the carbon atom is quadrivalent, whatever the nature of its combinations; (2) the four valencies of the carbon atom are equal and similar; (3) carbon atoms can unite with one another by either one, two, or three valencies.

Carbon by virtue of its quadrivalencies is capable of building up the most complicated molecular structures, and in doing so seems to combine with itself to form chains or rings of carbon atoms, that serve as centers around which, in accordance with laws of valency, other elements can be grouped.

The chief classes of these compounds are the hydrocarbons, the alcohols, haloid derivatives, the aldehydes, the ketones, the acids, the ethers, the esters or ethereal salts, ammonia derivatives, phenols and carbohydrates.

A noteworthy feature of organic compounds is the fact that often two or more entirely different substances are represented by the same formula. This is termed *isomerism*, and such compounds are called *isomeric*. These compounds owe their differences to different groupings of the atoms within the molecules; they have the same percentage and the same molecular weight but different properties. Compounds which have the same percentage composition but different molecular weights are called *polymeric,* and the term *polymerism* is used.

Hydrocarbons.

Compounds known as hydrocarbons contain the elements hydrogen and carbon only, and are exceedingly numerous. Though the number of hydrocarbons is very great, investigation has shown that quite simple relations exist between these compounds, hence their study is not as difficult as might be expected.

While it is not an easy matter to effect combination between carbon and hydrogen in the laboratory, except in a few simple cases, in nature a large number of these compounds are found, petroleum containing perhaps the most important. The simplest hydrocarbon contained in petroleum is methane, or marsh gas, CH4; the next has the composition C2H6, the next C3H8 , and so on. It will be seen that, as far as composition is concerned, these compounds bear a simple relation to one another. They are the first members of a series the names and symbols of the first eight members of which are:

CH_4	methane or marsh gas.
C_2H_6	ethane.
C_3H_8	propane.
C_4H_{10}	butane.
C_5H_{12}	pentane.
C_6H_{14}	hexane.
C_7H_{16}	heptane.
C_8H_{18}	octane.

This is the methane or marsh gas series of hydrocarbons, the general formula of which may be written C_nH_{2n+2}.

The first member of the series differs from the second by CH_2; there is the same difference between any two consecutive members of the series. This relation is known as homology, and such a series is called a homologous series.

Besides this series there are other homologous series of hydrocarbons. There is one beginning with ethylene, C_2H_4, examples of which are:

Ethylene	C_2H_4.
Propylene	C_3H_6.
Britylene	C_4H_8.

This is the olefin series having the general formula C_nH_{2n}. There is a series called the acetylene series having the general formula C_nH_{2n-2}, examples of which are:

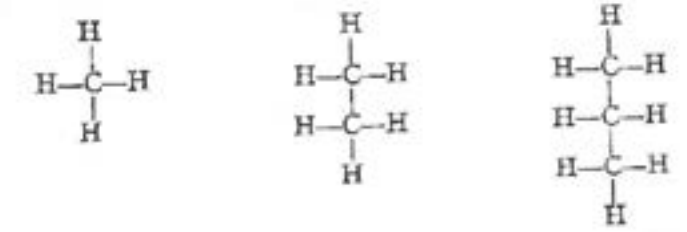
Acetylene	C_2H_2.
Allylene	C_3H_4.

Another series begins with benzene C_6H_6, some of the members of which are:

Benzene	C_6H_6.
Toluene	C_7H_8.
Xylene	C_8H_{10}

The methane or marsh gas series of hydrocarbons is of the utmost importance both in theory and practical work. Structurally, the series is very simple, the carbon atoms forming a regular chain around which the hydrogen atoms are symmetrically arranged, as illustrated:

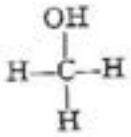
Methane CH_4 Ethane C_2H_6 Propane C_3H_8

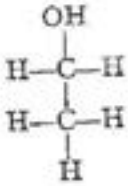


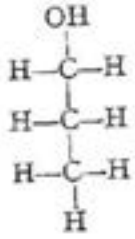
In properties these hydrocarbons vary regularly. Methane ethane, propane and butane are gases. Pentane, hexane, etc., volatile liquids, and so on through a series of liquids that grow less and less volatile as we ascend until at last semi-solid and solid compounds are reached which are known as paraffins. The whole series is sometimes called the paraffin group. These products are found in petroleum and may be separated by subjecting petroleum to fractional distillation. One of these products is petrolatum, a mixture of hydrocarbons of this series.

Alcohols.

If, by proper reactions, we replace one atom of hydrogen in each of the foregoing hydrocarbons by a hydroxyl group OH, we shall obtain a series of most important compounds which are called alcohols. Thus:







CH_3OH methyl alcohol C_2H_5OH ethyl alcohol C_3H_7OH propyl alcohol

and so on through the series.

Alcohols, then, are derived from the hydrocarbons by the replacement of one or more hydrogen atoms by oxygen and hydrogen, OH, hydroxyl; or from water by replacing one of the hydrogen atoms of the water by a group composed of carbon and hydrogen. An alcohol, therefore, is a hydroxide, just as a metallic base is; only, instead of consisting of a metal in combination with hydroxyl, it consists of a compound of carbon and hydrogen in combination with hydroxyl. Thus:

Metallic Bases.	Alcohols.
K(OH)	$CH_3(OH)$.
Na(OH)	$C_2H_5(OH)$.

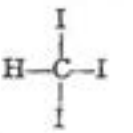
Three of the alcohols so formed, methyl, ethyl, and amyl, are encountered in the study of pharmacy and have practical importance.

Haloid Derivatives.

Marsh gas and other hydrocarbons undergo change when treated with the halogens chlorine, bromine and iodine. The change consists in the substitution of one or more atoms of chlorine, bromine or iodine for the same number of atoms of hydrogen, thus:

Methane CH_4

Choloroform $CHCl_3$



Iodoform CHI_3

Aldehydes and Acids.

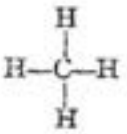
By the action of oxidizing agents upon the foregoing alcohols, two new series of compounds may be obtained. The reactions with any given alcohol are as follows: First, 2 atoms of hydrogen are withdrawn, forming water and leaving a compound called an aldehyde:

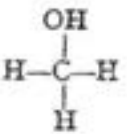
$$C_2H_5OH + O = C_2H_4O + H_2O.$$

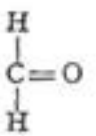
By further oxidation the alcohol takes up an atom of oxygen and an acid is produced:

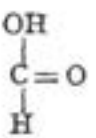
$$C_2H_4O + O = C_2H_4O_2.$$

The relations of these sets of compounds to each other, and to the methane series, may be represented structurally:

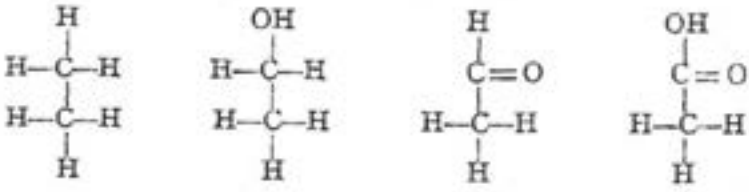








Methane. Methyl alcohol. Formaldehyde. Formic acid.



Ethane. Ethyl alcohol. Acetaldehyde. Acetic acid.

Thus, corresponding to every hydrocarbon in the methane series we have an alcohol, an aldehyde and an acid.

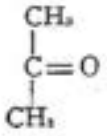
The acids of this series are important. The lower members are volatile liquids, the higher are waxy or greasy solids; they are called fatty acids for the reason that many of them have the consistency of fats. The more important members of this homologous series are:

Formic acid . . . . . CH_2O_2 or HCOOH.
Acetic acid . . . . . $C_2H_4O_2$ or CH_3COOH.
Propionic acid . . . $C_3H_6O_2$ or C_2H_5COOH.
Butyric acid . . . . . $C_4H_8O_2$ or C_3H_7COOH.
Valeric acid . . . . . $C_5H_{10}O_2$ or C_4H_9COOH.
Stearic acid . . . . . $C_{18}H_{36}O_2$ or $C_{17}H_{35}COOH$.

In each of these acids is found the group COOH, which is characteristic of organic acids. In monobasic acids like these, it occurs once; in diabasic acids, twice; tribasic acids, three times, etc. In the formation of salts from these acids it is only the hydrogen of the COOH group which is replaceable by metals or by bases.

Ketones.

Ketones are isomeric with the aldehydes, but have entirely different constitutions. Ketones are structurally formed by the union of two univalent radicals with bivalent carbonyl CO. The official liquid acetone is dimethyl-ketone, and may be structurally represented thus:



Esters and Ethereal Salts.

When an acid acts upon an alcohol it is neutralized, though not as readily as when it acts upon a base. The product is a substance which resembles a salt and is called an ethereal salt, or ester. Thus, when nitric acid acts upon alcohol this reaction takes place:

$$C_2H_6O + HNO_3 = C_2H_5NO_3 + H_2O.$$

The product $C_2H_5NO_3$ called ethyl nitrate, is an ethereal salt. The alcohol acts as if it were a substance like caustic potash and made up thus, C_2H_5OH.

Saponification.

When an ethereal salt is boiled with a caustic alkali it is decomposed, the products being an alcohol and an alkali salt. Thus, when ethyl nitrate is boiled with caustic potash, potassium nitrate and alcohol are formed:

$$C_2H_5NO_3 + KOH = C_2H_5OH + KNO_8$$

This process is called saponification, because the most important example is furnished by soapmaking. The natural fats and oils from which soap is made are simply ethereal salts, which when treated with alkalies yield the triatomic alcohol glycerin

$C_3H_5(OH)_3$ while the corresponding alkaline salts produced are soaps.

This process is illustrated in the following equation representing the formation of common hard soap:

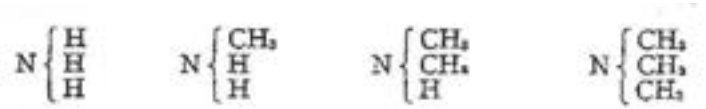
$$3NaOH + C_3H_5(C_{18}H_{33}O_2)_3 = 3NaC_{18}H_{33}O_2 + C_8H_5(OH)_3.$$

Sodium hydroxide (Caustic soda)	Glyceryl oleate (Vegetable oil)	Sodium oleate (Hard soap.)	Glyceryl hydroxide (Glycerin)

Amines and Amides.

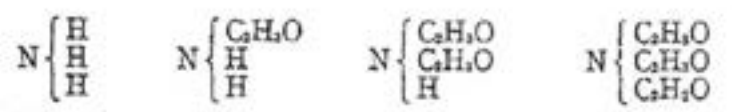
The ammonia derivations, amines and amides are other classes of substitution compounds of the highest importance.

The introduction of an alcohol or basic radical, such as methyl CH_3, or ethyl C_2H_5, into the ammonia molecule, replacing one or more hydrogen atoms, gives us an amine. They are constituted as follows:



Ammonia. Methylamine. Dimethylamine. Trimethylamine.

The introduction of an acid radical into the ammonia molecule, replacing one or more hydrogen atoms, gives us an amide, as follows:

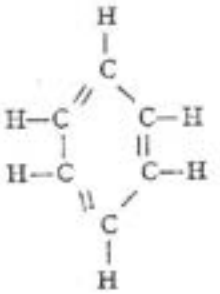


Ammonia. Acetamide. Diacetamide. Triacetamide.

The Aromatic Series.

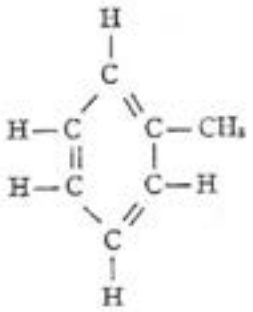
The benzene or aromatic series having the general formula C_2H_{2n-6}, is of great general interest. These hydrocarbons are the starting points for the preparation of a very large number of compounds of carbon which are commonly called the "aromatic compounds," as many of them have a pleasant aromatic odor.

Considered from the standpoint of structural arrangement of the atoms there are two great divisions of organic compounds: (1) the *open chain* series, including the paraffin series; (2) the *closed chain* series, in which the ring is composed entirely of carbon atoms, *e. g.*, benzene, C_6H_6:

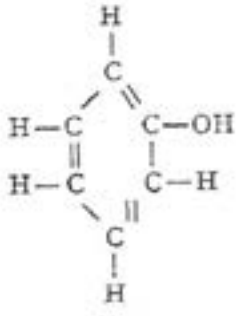


Benzene is a hydrocarbon of remarkable interest. It is obtained chiefly from coal tar and used mostly in the preparation of its derivatives; and these are of the highest importance. They are all derived from benzene by the substitution of other elements or radicals for the hydrogen, while the six carbon atoms remain as a permanent nucleus. Since every hydrogen atom in benzene is replaceable, the possible number of benzene derivatives is almost infinite. Thousands are actually known, and many more are discovered each year.

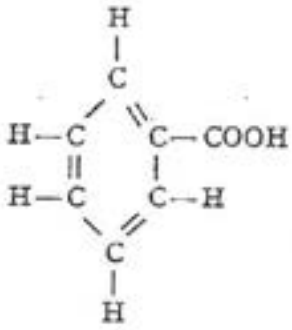
From the structural formula of benzene noted above, the formulae of the benzene derivatives are easily deduced, as the following will indicate:



Methyl-benzene, C_7H_8



Phenol, C_6H_5OH



Benzoic acid, $C_7H_6O_2$

While the hydroxyl (OH) derivatives of the methane series of hydrocarbons were all called alcohols, in the case of benzene and its homologues we must distinguish between the case where the OH group replaces a hydrogen atom of the nucleus and where it replaces a hydrogen atom of the side group. In the former case the compounds are called phenols and in the latter aromatic alcohols.

Phenols then are alcohols in the sense of being hydroxyl derivatives of hydrocarbons. They possess in a slight degree the character of acids, forming compounds with metals which to some extent resemble salts; unlike the paraffin alcohols, they do not yield aldehydes, acids or ketones on oxidation.

As mentioned, the number of benzene derivatives is infinite, but their further study may not be taken up in a treatise so limited.

Carbohydrates.

The carbohydrates form an important group of carbon compounds which includes the most abundant substances found in the vegetable kingdom. Besides carbon, most of them contain hydrogen and oxygen in the proportions to form water; hence they have been called carbohydrates. The chief compounds included under this head are; grape sugar or glucose, cane-sugar, starch, cellulose, gum and dextrin.

Besides the groups enumerated, the alkaloids, glucosides, terpenes, camphors, etc., are some of the more important classes of compounds included in the study of organic chemistry.

NAVAL HOSPITALS.

GENERAL PLAN, ARRANGEMENT AND MANAGEMENT OF A NAVAL HOSPITAL.

Q. Describe a naval hospital.

A. The plan of the hospital at Portsmouth, New Hampshire, has been adopted by the Bureau of Medicine and Surgery as the type hospital for the U. S. Navy. This plan has many features to commend it from a standpoint of economy, convenience, utility and architectural beauty.

The general plan of the hospital resembles a "T." The administration building occupies the front and center, with the wards situated on each side and the operating and subsistence building in the rear, all of which are connected to the central building by corridors.

In the basement are located the various store rooms, heating, refrigerating and disinfecting plants, recreation, hydrotherapeutic, wash, toilet and X-ray, and some of the dining rooms, kitchen, library, dispensary, mortuary and autopsy room.

On the first floor are the administrative and executive offices, laboratory and examination room, two wards of 26 beds each, with dressing, quiet and toilet rooms, diet kitchens and solaria attached, and the general mess hall and pantry are to the rear of the central building.

On the second floor are two wards, counterparts of the wards below. There are eight rooms, with toilets and dining room, for sick officers, a dressing room, a room for nurses and a diet kitchen. In the rear are the operating, sterilizing, etherizing, dressing, wash and recovery rooms.

On the third floor there are six rooms with toilets for sick officers, a dressing room, a room for nurses, a diet kitchen and a large recreation room.

Q. What other buildings should there be?

A. The hospital grounds should be large and should contain, in addition to the main building, quarters for the commanding officer, executive surgeon, junior medical officers, Hospital Corps and Female Nurse Corps, power house, laundry, stables and infectious camp and wards.

Q. Who commands naval hospitals and hospital ships?

A. The commanding officer of a naval hospital is a medical officer of the Navy and, in his absence, the executive surgeon or senior medical officer present on duty is in command.

Q. What authority has the executive surgeon?

A. The executive surgeon has charge of the junior medical officers, Hospital Corps, Female Nurse Corps, all patients, civil employees and all departments of the hospital, and is directly responsible to the commanding officer for the discipline and management of the personnel and the conduct of all other affairs of the hospital.

Q. By whom and where is the clerical work done and the records kept?

A. The clerical work and the records of the hospital are under the direct supervision of the pharmacist, assisted by such hospital stewards and hospital apprentices as may be necessary. The work is usually done and the records kept in the executive surgeon's office. All official correspondence and records are examined by the executive surgeon prior to signing by the commanding officer.

Q. Describe the dispensary.

A. This is a room usually located centrally for convenience to the wards and contains small amounts of the various medical supplies for daily use, the larger supplies being kept in the medical store rooms. The dispensary is in charge of a hospital steward assisted by one or two hospital apprentices, who compounds all prescriptions, dispenses all medicines, and is responsible for all medical stores in his custody and for keeping the room, apparatus

and medicines in proper condition. A record is kept of all prescriptions and medical supplies that are received, issued or dispensed.

The more powerful and dangerous poisons are kept in a locker to themselves and great care is exercised in dispensing them. No unauthorized person should be permitted to enter the dispensary.

Q. Describe the medical store rooms.

A. The medical store rooms are in charge of the hospital steward and hospital apprentice, who have the dispensary, and contain all the medical and surgical supplies, except what are in the dispensary and wards for daily use. They should be near the dispensary when practicable for convenience in replenishing the supply there. When practicable, medicines should be kept in one room, surgical dressings and apparatus in another and all explosives, inflammables and stronger acids should be kept in a fireproof room apart from the other store rooms. All alcoholic liquors, morphine, cocaine and other narcotics should be kept together in a strong room, and access to them had only by a medical officer or the hospital steward in charge.

Medical stores should be arranged systematically, either alphabetically or by class, in order that they may be easily found.

In each store room there should be a record book or card index system containing an inventory of stores in that room, and all supplies deposited in or taken from it should be noted so that the amount on hand can be accurately determined without the necessity of making an inventory.

Q. Describe the laboratory.

A. This is a room set apart for the purpose of making chemical, bacteriological and pathological examinations, and has the necessary apparatus and chemical reagents for these purposes.

It is in charge of a medical officer, assisted by a hospital steward and hospital apprentice, whose duties are to perform the routine work of examination under his direction and to keep the room, apparatus and reagents in proper condition at all times. A

complete record is made of each examination, a copy of which is sent to the medical officer requesting it and the original retained in the laboratory.

Q. Describe the bag and hammock room and its management.

A. This is in charge of a hospital apprentice 1st class, and in it are stowed all the clothing and other effects of patients received at the hospital, except toilet articles, etc., that are needed for daily use and are kept in the patients' lockers. The effects of contagious patients should not be stowed until after thorough disinfection.

A card index system or a record book should be kept in the room and when a patient is admitted, his name and the numbers on his bag and hammock should be recorded, the clothing inventoried and the list checked by the apprentice in charge and the patient himself, if able, or by a hospital apprentice from the patient's ward. This should be done again when the patient is discharged from the hospital.

Bags and hammocks should be stowed so as to be readily accessible, and at a certain hour of the day patients should have access to the room in order to procure such articles as may be necessary.

Q. Describe the infectious camp and wards.

A. Infectious camps and wards should be located some distance from the hospital and other buildings, preferably in the rear of them. Their personnel and outfit should be such that little or no communication with the hospital should be necessary. There should be at least six different wards or tents, isolated from each other, for the various contagious diseases so that the different classes would not come in contact with each other. Each class of diseases should have its separate toilet and wash room. Part of the camp or wards should be set aside for the detention of suspected cases.

Q. Describe the linen store room and its management.

A. This contains all the hospital linen and is under the charge of the chief nurse and a nurse. It is their duty to inspect all linen, carefully supervise the mending and marking, and keep a careful record of all linen received and issued and make accurate inventories at stated periods. Nothing but clean linen should be received and stowed.

HOSPITAL DUTIES AND WARD MANAGEMENT.

Q. Under whose management are hospital wards of the U.S. Navy?

A. Hospital wards are under the general supervision of the executive surgeon, and each ward is under the direct supervision of a medical officer detailed for that purpose.

The chief nurse has general charge of the wards, and each ward is under the direct charge of a nurse detailed for that purpose.

Members of the Hospital Corps detailed for ward duty are under the direction of the nurse in charge, who is responsible for the care and nursing of the patients and the management of the ward. In the absence of the nurse, the senior member of the Hospital Corps is in charge of the ward.

Q. Who have charge of venereal wards?

A. Venereal wards are in charge of members of the Hospital Corps with others detailed to assist. Under the direction of a medical officer they administer all medicines, give all treatment, including venereal prophylaxis, do all dressing and are responsible for the care and nursing of the patients and the order and cleanliness of the wards.

Q. Who have charge of wards and patients aboard ships of the Navy.

A. Hospital stewards and apprentices have charge of the sick quarters on board fighting ships and the wards on hospital ships, and have to perform all the duties of the Female Nurse Corps.

Q. What duties have members of the Hospital Corps to perform on hospital ships other than their professional duties?

A. They are detailed as signal men on the bridge, as orderlies for the commanding officer, as messmen for the Hospital Corps and for other special duties.

Q. What steps would you take upon admission of a patient?

A. Take his name, rate and ship or station from which received. When necessary and practicable give a shower, tub or sponge bath, as the case may require; put on a clean hospital shirt or pajamas and put to bed until seen by a medical officer. Inspect the patient carefully, note pulse, temperature and respiration, and examine carefully for skin eruptions, ulcers, tumors, swellings, vermin, hemorrhoids, varicocele, hernia, gonorrhea or other evidences of venereal or contagious diseases and any other abnormalities. His money and valuables should be listed, put into an envelope with his name on it and turned over to the executive surgeon for safe keeping. The patient's toilet articles, papers, books, trinkets and articles of clothing needed in the ward should be placed in his bedside locker and his other effects turned over to the master-at-arms or bag room keeper.

Q. Describe briefly the routine duties of a ward.

A. Bed patients should be bathed, teeth brushed and hair combed as soon after reveille as practicable and given their breakfast promptly, after which their medicines should be served.

The dishes should be cleared away and the beds made up as soon as practicable after breakfast, and then the floors should be swept and the ward dusted, or the vacuum cleaner used. The ward should then be straightened up and patients' temperatures, pulses and respirations taken before sick call, after which treatment should be given, dressings done, diet sheets made out, medicines and other supplies for the day obtained and other directions of the medical officer carried out. Dinner should be served at the regular hour, dishes cleaned away, temperatures, pulses and respirations taken, medicines served and wards policed. Between dinner and supper there is usually considerable time for recreation; but the necessary work of the ward must be carried on.

After supper clear away dishes, police ward, take temperatures, pulses and respirations and serve medicines before sick call. After sick call draw medicines, police ward and see that all patients are present and in bed at taps.

Q. What records should be kept in the ward?

A. (1) A record book of patients, with their names, rates, stations, diagnosis and treatment.

(2) A ward property book in which are listed all apparatus, utensils, linen, furniture and other articles issued to the ward. An inventory of the linen should be made every week and of other property once a month.

(3) A ward order book in which are recorded directions from the medical officers and nurses in charge, instructions to night nurses and list of patients detailed for light duty in wards and elsewhere.

(4) A daily ward medicine sheet should be kept by the nurse in charge on which should be kept a record of all medicines drawn and to be administered.

There should be a ward medicine closet which should be kept locked, except when the nurse is present or medicine is being served.

Medicines should never be left in the ward or with patients to take, but should be given by the nurses in charge or hospital corpsmen on duty.

Q. Give general precautions to be observed in the care and making of beds.

A. Beds must be kept clean, free from vermin and comfortable. The lower sheet should be kept smooth by firmly tucking under the mattress, pinning it when necessary. No clothing, papers, books, food, pipes, tobacco or other articles should be kept under the pillow or mattress.

Q. What is very necessary in a fracture bed?

A. Prevent sagging by placing under the mattress either a full size perforated board, a frame of slats or a number of separate slats.

Q. Describe the different steps taken in bed-making.

A. The mattress with cover on it should be placed evenly upon the springs and smoothed out. The sheet should then be unfolded,

placed upon the bed and neatly tucked under the head, foot and sides of the mattress. The top sheet should then be placed on the bed with the upper border even with the head of the mattress. The blanket and spread when used should be placed on the bed with the upper border about a foot from the head of the mattress, the end of the upper sheet turned down over them and all neatly tucked under the foot and sides of the mattress, and the pillow placed at the head of the bed. In the case of bed patients, the lower sheet should be fastened to the mattress, when necessary, with safety pins at each corner and the sides.

Q. How would you prepare a bed for an operative case?

A. In the same manner as for a bed patient, except that the pillow should be removed and a draw-sheet pinned on the mattress in its place, as the patient's head should be kept low, since nausea will then be less probable and the bedding will not be soiled in case of vomiting. The bed should be warmed with hot water bags or bottles in order to diminish shock. An extra blanket should be rolled up at the foot of the bed for use if necessary. The pillow should be pinned on the head bar to protect the patient from draughts and injury.

Q. What equipment should you have convenient for an operative case?

A. A bedside table on which should be towels, gauze pads, mouth gag, tongue depressor, tongue forceps, hypodermic syringe, hot water bags and two pus basins.

Q. When and how would you apply a draw-sheet?

A. A draw-sheet should be used in the case of a patient that is likely to soil the bedding. It is a rubber sheet about 3 x 4 feet, covered by a folded cotton sheet, spread across the bed on top of the lower sheet where the hips will rest, tucked under the mattress and when necessary fastened at each corner of the sheet with a safety pin. The upper sheet, blanket and spread are placed over this as in ordinary bed making.

Q. How would you change the lower sheet of a bed patient?

A. First loosen all the clothing from the head, foot and sides of the mattress; remove pillow and all the upper clothing except the sheet; then turn the patient on one side close to and facing the side of the bed from you; fold or roll up the lower sheet lengthwise close up to the patient's back; then fold or roll up a clean sheet lengthwise to its middle and place the fold or roll close up to the dirty sheet, being careful not to soil it; then turn the patient on his opposite side, remove the soiled sheet, smooth out the clean sheet, tucking the borders under the mattress and securing as before. If there is a draw-sheet, remove it with the soiled sheet and put on another with the clean one.

Q. How would you change the lower sheet in case of a patient who could not be turned on his side?

A. This will require assistance. There should be one attendant on each side of the bed. Loosen the clothing all around; remove pillow and support the head, shoulders, body and hips successively, folding or rolling the sheet down as you go and following it up with a clean sheet, which has been rolled or folded and which is unrolled or unfolded as the soiled one is withdrawn.

Q. How would you change a bed patient from one bed to another?

A. Move the beds close beside each other and then lift the patient gently across on the sheet.

Q. How would you change a bed patient's mattress?

A. Place the patient near one side of the mattress and pull the mattress half way off the bed on the other side. Place a fresh mattress alongside the other and lift the patient gently onto it on the sheet. Remove the old mattress and slide the new mattress over on the bed.

Q. What other precautions should be observed in the care of the bed?

A. The linen should be changed once a week or whenever it becomes soiled or wet, or when a patient is discharged. The

lower sheet should be kept smoothed out as wrinkles in it may produce bed sores. The beds and linen should be inspected daily for bed bugs, and once a week the mattress and pillow covers should be removed and the bed, mattress, pillows and covers given a thorough examination for bed bugs. If any are found, the bed should be thoroughly cleaned with an antiseptic and the mattress, pillow and linen sterilized by steam.

Q. What attention should be given bedside lockers?

A. They should be inspected daily by a nurse or hospital apprentice. When able patients should be required to keep their lockers clean and the articles arranged in an orderly manner, and when unable to do so this should be done by a hospital apprentice. Only toilet articles, letters, books, trinkets and necessary clothing should be allowed in the lockers, and food should never to stowed therein.

Q. Describe the care of the toilet, bath and wash rooms.

A. These are in charge of a hospital apprentice, who is responsible for their cleanliness and order, assisted by one or two convalescent patients. The floors should be scrubbed every morning and at other times during the day when necessary; the water closets should be kept clean at all times and scrubbed out with chlorinated lime once or twice a week, and no dressings, bandages or other articles, except toilet paper, should be thrown therein. The wash bowls and bath tubs should always be cleaned after use. The walls, etc., should be scrubbed once a week and at such other times as may be necessary.

Q. How would you dispose of dressings, excreta, etc.

A. All dressings should be burned as soon as practicable after they are removed. Sputum cups should always contain a strong antiseptic solution (1 per cent formaldehyde, 5 per cent carbolic acid, 1 per cent cresol, or 1/500 bichloride of mercury) so the sputum can be sterilized at once. They should be frequently emptied into the bowls of the water closets, cleaned, sterilized and a fresh solution placed in them. Bed pans and urinals should be emptied into the bowls of the water closet, cleaned and sterilized.

In cases of typhoid fever, dysentery, cholera, etc., the stool should be covered and the urine diluted with one of the above antiseptic solutions and allowed to stand an hour or two before emptying. Bed pans, urinals, sputum cups and other utensils should be cleaned and sterilized by steam.

Q. What disposition should be made of soiled linen?

A. When practicable, all linen should be sterilized before going to the laundry. In contagious or infectious cases the linen should always be sterilized by steam, or by immersing in one of the antiseptic solutions previously mentioned, before going to the laundry.

Q. What steps should be taken to prevent the spread of typhoid fever?

A. The ward should be thoroughly screened against flies and other insects. Should any get into the ward they should be killed and not driven out as they would then spread the infection. The attendants should be very careful in handling patients to keep from being infected. A basin of 1/1000 solution of bichloride of mercury and clean towels should be kept convenient in order that the attendant may sterilize his hands after handling the patient. Never eat in the ward or with unwashed hands. Sterilize all stools, urine and other excreta thoroughly and all dishes, sputum cups, urinals, bed pans and other utensils used by the patient, and also the bed and other linen. The water used for baths should be sterilized with an antiseptic before emptying. Sterilize clinical and bath thermometers after use.

The floors, walls and furniture of the ward should be scrubbed periodically with soap and water and a strong bichloride solution.

NURSING.

Q. What qualifications are essential in those who care for the sick?

A. (1) Physical: good health, personal cleanliness. (2) Mental: education: observation, judgement and order. (3) Moral: truthfulness, obedience, dignity, tact, courtesy and sympathy.

Q. Outline briefly the daily routine care for an average bed case.

A. Bathe the face and hands and cleanse the mouth before breakfast. General sponge bath three times a week, and on days when bath is omitted back should be thoroughly rubbed with alcohol. Make bed every morning and change linen when necessary. At bed-time, bathe the face and hands, cleanse the mouth, rub the back with alcohol, brush out the bed and smooth draw-sheet. See that prescribed diet is properly cooked, and hot food served hot. Report to the medical officer if patient's bowels do not move regularly.

Q. Mention nursing care to prevent bed-sores.

A. Keep parts of the body in contact with bed scrupulously clean and dry; keep the under sheet smooth and free from crumbs; remove pressure from any part where redness of the skin is noticed; give frequent light massage to points of pressure.

Q. Mention several methods of relieving discomfort and restlessness.

A. Give alcohol rub; change draw sheet; turn pillows and alter position of patient's body.

Q. How would you relieve strain on abdominal muscles?

A. Flex knees and support them with pillows.

Q. Where is the temperature of the body usually taken and why?

A. The mouth in normal cases; axilla, groin or rectum when indicated by delirium, unconsciousness or dyspnea. Temperature taken by axilla, groin or rectum should be recorded accordingly.

Q. State differences as compared with temperature taken by the mouth.

A. Axilla and groin, .3 to .5 degrees lower; rectum, 1 degree higher.

Q. Describe taking temperature.

A. Shake thermometer to 95 degrees. (1) Temperature by mouth; ascertain whether the patient has recently taken anything very hot or cold; place thermometer under the tongue close to arteries, and direct lips be kept closed at least three minutes while the thermometer is in the mouth. (2) Axilla; wipe surface thoroughly dry; keep the thermometer in place by holding the arm close to the side and flexing the elbow for at least five minutes. (3) Rectum; cavity must be free from feces, thermometer remaining in place about ten minutes.

Q. What care should be given the clinical thermometer?

A. It should be washed in cold water after using; kept in an antiseptic solution, from which it should be rinsed in cold water and wiped dry before using. Rectal thermometer should be marked and kept separate, as should thermometers used in infectious cases.

Q. What is normal temperature?

A. 98.4 degrees Fahrenheit, but may fluctuate from a fraction to a degree.

Q. When is temperature of the body (1) maximum and (2) minimum?

A. (1) 5 P.M. to 8 P.M.. (2) 2 A.M. to 6 A.M.

Q. Give some deviations of temperature and their significance.

A.

Collapse	95	degrees to		97	degrees.
Subnormal	97	"	"	98.4	"
Fever	100	"	"	103	"
Pyrexia	103	"	"	106	"

Q. Name the arteries most conveniently used in taking the pulse?

A. Those lying near the surface immediately over a bone against which the artery can be compressed; the radial, temporal, facial and common carotid are the most easily accessible.

Q. Describe taking the pulse.

A. Place two or three fingers firmly over the arteries for not less than one minute, alternately making and removing pressure. The body should be at rest and the arm recumbent if the usual radial pulse is recorded.

Q. Describe normal pulse.

A. The artery should feel firm and elastic; the blood stream should fill the vessel with moderate force at the rate of from 72 to 78 beats to the minute rhythmically and regularly.

Q. Describe relation of pulse to bodily temperature.

A. In many diseases the pulse rises with bodily temperature about ten beats to one degree of temperature.

Q. Mention common exceptions.

A. In typhoid fever the pulse is low in proportion to fever; in scarlet fever it is disproportionately high.

Q. Mention varieties of pulse.

A. Slow or quick; low or high tensioned, frequent and running when difficult to count; intermittent, when there is an intermission of a beat; irregular, when unequal in time and character; dicrotic, characterized by secondary impulse, sometimes mistaken for a beat.

Q. What is respiration?

A. The manner in which breathing is performed; it comprises inspiration, a period of rest and expiration.

Q. Describe breathing.

A. An involuntary act accomplished under normal conditions without exertion, audible sound or pain, accompanied by a rhythmatic rising and falling of the chest wall and abdomen.

Q. What is rate of respiration?

A. Adults, 16 to 20; children, 20 to 25.

Q. What is the ratio between respiration and pulse?

A. 1 to 4; it is varied by excitement and chilling or overheating of the surface of the body.

Q. Enumerate types of respiration.

A. Shallow, when volume of air is less than usual; dyspnea, when there is difficult breathing; tidal, or Cheyne-Stokes, beginning quietly, each succeeding respiration being louder and deeper until a climax is reached, which is followed by a complete pause before inspiration is again resumed.

Q. For what different purposes are baths given?

A. (1) Cleanliness; (2) inducing sweating and muscular relaxation; (3) reduction of fever.

Q. How are baths classified with regard to temperature?

A. Tepid (body temperature); hot, 100 to 110 degrees Fahrenheit; cold, 90 to 70 degrees Fahrenheit.

Q. With reference to extent?

A. General baths are either (1) tub or (2) sponge; local baths (1) sitz or pelvic, (2) foot.

Q. Mention three baths most frequently used in routine nursing.

A (1) The cleansing bath; (2) bath to reduce temperature; (3) bath or pack to induce perspiration.

Q. What preparation would you make for giving a cleansing bath and describe process.

A. Close windows, if any should be open near the patient; bring to bedside hot water bag, bath blanket, towels, bottle of alcohol, soap, sponge or wash rag and foot tub of hot water; (2) remove bed clothes; cover patient with bath blanket; place hot water bag at feet; (3) beginning at head, bathe in order the face, ears, neck and dry them; proceed with rest of the body, exposing only one limb at a time, drying each part and giving

short vigorous rub with alcohol before exposing another part. The water should be changed once during bath.

Q. How much time would you give to a bath for the reduction of temperature?

A. About twenty minutes.

Q. In giving such bath, what two symptoms should you watch with unceasing attention?

A. The pulse in particular and for any evidence of collapse.

Q. In the event of collapse what would you do?

A. Discontinue bath; wrap patient in warm blankets; apply hot water bags and administer stimulation as prescribed by the medical officer.

Q. Describe the giving of a cold pack.

A. Protect the bed with a rubber sheet; pass a wet sheet under and around the patient's body, tucking it in around the arms and legs so that no two skin surfaces are in contact; keep the sheet wet by squeezing over it water of the required temperature; rub briskly over the sheet.

Q. What are the most important points to be remembered in giving a hot pack?

A. Protect the bed thoroughly; do not expose the patient during or after the pack; do not place hot water bags next to a wet blanket; watch the pulse at temporal artery; give fluids freely; leave the patient in wet pack twenty minutes; follow wet pack by warm, dry blankets for one hour, keeping ice on head and hot bags at feet; give vigorous alcohol rub when blankets are removed.

Q. What preparation would you make for giving a salt glow and how should treatment be given?

A. Prepare two large pads of gauze by dipping them in saturated solution of common table salt and allow to dry thoroughly before using. The treatment should follow warm bath. Rub with the pads, using gently vigor until the whole body shows a pink, warm glow.

Q. In preparing routine case for operation, what are the give vital points to be remembered?

A. (1) Have the skin clean; (2) have the stomach empty; (3) have the bowels as empty as possible; (4) have the patient urinate before entering the operating room; (5) examine the mouth for artificial teeth; remove if found.

Q. What is the one most important precaution to be taken in preparing an acute abdominal case?

A. Avoiding the rupture of a possible pus sac.

Q. What measures should be taken to avoid the rupture of a pus sac?

A. Do not subject the patient to the slightest strain in lifting or moving him, and if enema is ordered, introduce the tube carefully and regulate the flow of water so as to avoid any sudden inflation of the bowel.

Q. Describe the routine care of patient following operation.

A. Have room about 70 degrees; admit fresh air, but avoid having bed in draught. Carefully place patient in warmed bed and avoid leaning on bed or jerking it; cover carefully with warm blankets, but do not retain hot water bottles unless so ordered. Note and record pulse and respiration; do not leave patient alone; watch for restlessness and for tongue falling back over trachea. If patient vomits keep head turned to the side, placing fingers behind angle of jaw and throwing it forward. In case of laparotomy, when vomiting is accompanied with severe straining, place hands on either side of wound, being careful not to uncover patient. Take the temperature as soon as practicable and thereafter q. 3. h. unless otherwise ordered. Note pulse at frequent intervals. Watch for symptoms of hemorrhage. Do not give water until ordered, but relieve thirst by washing out the mouth with lubricating mouth wash and by moistening the lips and tongue. Keep the mouth and naval passages free from mucous. When water is allowed, give it hot or very cold, as warm water increases nausea. When ice is ordered crush finely so that

it can be swallowed. Note time elapsing before urine is voided and if eight hours pass, report the fact. Note such symptoms as tightening of bandage and evidences of severe pain. Flex knees over pillow to relieve abdominal strain. Flatulence may be relieved by introducing well lubricated rectal tube or by ordered carminative enemata or turpentine stupes applied to abdomen.

Q. Describe "Fowler's position."

A. Place the patient in a semi-sitting posture, supported by pillows or back rest, at an angle of about 45 degrees; let buttocks rest against the pillow which may be secured to head of bed by long bandages to prevent slipping; place pillows under knees and elbows.

Q. What is an enema?

A. A fluid injected into the lower bowel by way of the rectum.

Q. What special care must be exercised in giving an enema?

A. Have nozzle well lubricated; avoid injecting air or chilled fluid. The tube must be filled with fluid which should be allowed to escape until the fluid in the tube is the desired temperature; the tube should then be clamped to retain fluid while being inserted. If funnel is used, replenish before it is empty.

Q. Describe position of the patient.

A. Lying on left side or flat on back with knees flexed.

Q. Special points to observe in giving enema.

A. Insert the tube gently, upward, backward and toward the left, using no force. Do not move nozzle about; proceed slowly; pause frequently to avoid peristalsis. When finished withdraw the tube gently, pinching it to avoid spilling any remaining fluid.

Q. State the difference between low and high enemas.

A. In giving a low enema the tube is passed only into the rectum, four or eight inches. In giving high enema, the tube must be passed beyond the sigmoid flexure, more than eight inches, requiring patience and skill, as force must on no account be used.

Q. What is enteroclysis and how is it administered?

A. Intestinal irrigation which is given for shorter or longer periods, high or low, may be continuous, or given by injecting stated amount and siphoning off the same; use special double tube and give treatment very slowly. Receptacle containing fluid should be about two feet above the body and pelvis of the patient should be raised higher than the shoulders.

Q. Describe seepage.

A. A continuous flow, usually of hot normal salt solution, into the rectum. The fluid is placed in a receptacle very little higher than the patient's head. The tube is partially clamped so that the fluid flows drop by drop. Guard against tube being rejected and consequent wetting of bed.

Q. Give temperatures and approximate amounts of various enemas.

A. (1) Purgative: simple, soap-suds; temperature, 100 to 105 degrees F.; amount from 2 to 4 pints. (2) Stimulating: saline coffee with brandy or whisky; temperature, 105 to 110 degrees F.; saline, amount about 1 pint at a time; coffee, amount, about 4 ounces, with whisky, 2 ounces. (3) Nutritive: about 98.6 degrees; amount from 4 to 6 ounces given slowly. (4) To arrest hemorrhage, 110 to 120 degrees or iced cold. (5) Oil enema; about 90 degrees; amount, 6 to 8 ounces, given high and very slowly; follow with suds enema in 2 to 4 hours.

Q. Describe the insertion of a suppository.

A. A rectal suppository should be lubricated with oil and passed as far into the passage as finger will reach, the patient lying on the left side; protect finger with finger-cot also lubricated.

Q. What is a douche?

A. A local bath of running water used to cleanse cavity; to apply heat or cold to inflamed surface; to arrest local hemorrhage, and to apply medicinal treatment.

Q. Describe ear douche.

A. Temperature of douche, 100 to 105 degrees. Have patient sit erect in good light; place small basin under ear;

hold auricle slightly backward and upward; do not push nozzle beyond opening of auditory canal; carry out irrigation very gently; when finished sop moisture from canal with small bits of cotton until perfectly dry.

Q. Describe eye douche.

A. Place patient in chair with head held backward and slightly to the side of the eye under treatment. Douche should be elevated from six to twelve inches according to nature of infection, but force must not be used. Hold upper lid well away from eye ball; direct stream from inner corner outward; douche gently, but thoroughly; repeat same process, holding loose tissue of lower lid gently down against the cheek bone. In case of infection and treatment for both eyes, use second syringe; observe strict asepsis.

Q. What is catheterization and how is it effected?

A. Catheterization is the emptying of the bladder of urine by means of a tubular surgical instrument. A soft rubber catheter, previously rendered sterile, should be used if possible. Strict aseptic precautions must be observed to avoid infecting the bladder. The catheter, lubricated with sterilized oil, should be gently inserted into the urethra and passed in carefully until the urine begins to flow. When the bladder is empty, carefully remove catheter and compress the end to prevent the escape of the remaining urine.

Q. What special care should be observed in catheterization for distended bladder?

A. The entire quantity should not be withdrawn at one time.

Q. What special points should be observed in bladder irrigation?

A. Solution generally 100 to 110 degrees; amount 1 or 2 pints. If funnel is used, inject about 8 ounces, then siphon off half the quantity, repeating injections of 4 or 5 ounces until bladder is sufficiently irrigated. Guard against introducing air. With use of double catheter about half a pint at a time may be injected.

Q. What is lavage?

A. A process to irrigate the stomach.

Q. Describe lavage.

A. Articles required: rubber sheet on floor, a rubber tube, fairly large caliber, about 3 feet long, a bucket to receive contents, a pitcher suitable for pouring with one hand. Patient is in bed or seated in low chair; tube is moistened, placed far back on tongue; care is taken to direct tube over the epiglottis into the esophagus, patient assists by act of swallowing; insert 18 or 20 inches; hold funnel about 1 foot above patient; pour in from a half to 1 pint of water; lower funnel and siphon off contents. Repeat until water is returned clear.

Q. What is gavage?

A. Introduction of food into the stomach through a stomach tube.

Q. What special precautions should be taken in gavage?

A. Allow a few seconds to elapse after passage of tube that the muscular contraction may be quieted. Pour the liquid slowly; remove tube quickly and gently.

Q. Why are local applications employed?

A. To relieve pain; allay inflammation; to overcome nervous conditions; to stimulate activity of an organ.

Q. Differentiate between applications of heat and cold.

A. Both act as local anesthetics, but heat penetrates further than cold, and moist heat further than dry; heat also affects muscular relaxation; cold is preferable in superficial inflammation.

Q. Mention cold applications.

A. Ice coil; ice poultice.

Q. Mention rules in applying hot applications.

A. Water must not be hot enough to scald; fill bag only half full, press out superfluous air; never give a patient uncovered hot water bag; be sure that blanket intervenes between covered bag and body of unconscious patient; guard ether patient from

contact with hot water bags; do not leave same in bed with ether patient unless so ordered.

Q. Describe a pneumonia jacket.

A. It is made of cotton placed between two layers of thin muslin cut to fit body, with arm holes and shoulder pieces covering thorax. Leave one side open, and fasten by tapes under the arm and over the shoulder. Tack cotton in place.

Q. What is a poultice?

A. An application of any substance which, when parboiled, holds heat and moisture.

Q. Describe making and applying flaxseed poultice.

A. The water must be boiling; the basin, etc., hot; all appliances at hand so that the poultice may not cool during preparation. Muslin to hold poultice should be two inches larger than required poultice. Pour boiling water into the basin; stir in the flaxseed meal to which has been added one-third bran, stirring all the time. When mixture is cohesive and comes clean from side of basin turn out on muslin prepared on flat board, smooth with spatula to thickness of half an inch, dipping spatula in boiling water. Turn margins of muslin, roll poultice in warm towel and carry to patient. Test the poultice against the cheek before applying. The poultice should be applied directly to the skin unless containing an irritating ingredient; cover with thin rubber sheeting and with a layer of cotton; keep in place with binder or bandage; remove in an hour or sooner if cold. On removal, dry surface and carefully observe the skin; cover with a layer of well warmed cotton to remain on until the next application, or as ordered.

Q. Decribe stupes.

A. Take two layers of soft flannel, wringing as dry as possible out of boiling water, using stout roller toweling for purpose of wringing; apply directly to the skin and cover with light rubber sheeting and absorbent cotton; keep in place with bandage or binder. If stupe is ordered over broken surface, use sterile gauze and wring in a sterile towel, observing the strict asepsis.

Q. Describe effects of counter irritants and division of same.

A. (1) Stimulation of circulation promoting absorption and secretion; (2) dilation of blood vessels to relieve congestion; (3) irritation of nerves produces a reflex action by which sensitiveness of other nerves is reduced. Divided into rubefacients, which redden the skin; vesicants, which produce a blister; escharotics, those which cause sloughings.

Q. Describe making and applying mustard plaster (sinapism).

A. A paste made of flour and warm water into which is stirred mustard in proportion varying from an eighth to a half, the latter proportion usually applied to the chest; if skin is sensitive mix with white of egg. Spread paste on thick muslin, turn in edges, cover the surface next to the skin with gauze. It is left on from five to fifteen minutes. If official mustard leaf is used, dip in tepid water, allow to drip, apply directly to the skin or with layer of thin muslin for five to eight minutes. After removal of sinapisms dry surface and cover until redness has disappeared.

Q. Describe dry cupping.

A. Use set of glass cups; wet rim to prevent it becoming too hot; rub inside with cotton soaked in alcohol; light; just before flame is extinguished invert cup over affected area. To remove the cup insert tip of finger under rim.

Q. Describe the application of Spanish fly blister.

A. The skin should be surgically prepared. Apply cantharidal collodion to covered surface with a camel's hair brush, having first outlined space with Vaseline; allow a few moments for application to dry; cover with gauze and finally with waxed paper. Examine area from time to time, four to eight hours being allowed for bleb to form. If it does not rise in this time, remove application and apply poultice over site. When blister is raised open by making snip at most dependent point; gently press out fluid with sterile cotton; apply dry sterile dressing. Observe strict aseptic precautions.

Q. What should characterize the reporting of symptoms?

A. Knowledge of the relative value of facts observed and accuracy in describing the same.

Q. How are symptoms divided?

A. (1) Subjective: reported by patient, such as pain, discomfort, nausea, etc., these should be reported in words of patient. (2) Objective: the general condition of patient and the manifestations of the disease from which he is suffering as interpreted by the nurse.

Q. Mention some important symptoms nurses should train themselves to observe.

A. Evidence of bodily strength, condition of body with regard to flesh and muscles; condition of skin, presence and locality of sores and eruptions; color of skin and especially of face, and mucous membrane, presence and locality of abnormal prominences; swellings; dropsy in any part, especially the feet; abdominal tenderness; temperature of body; character of pulse and respiration; mental condition; facial expression; odor of breath; appearance of eyes; condition of nose, mouth, teeth, tongue.

Q. What should a nurse know about medicines?

A. The maximum and minimum doses; over-dosage and treatment for poisoning of drugs in common use; idiosyncracies.

Q. For what signs should a nurse watch?

A. Symptoms due to idiosyncracy of patient and of over-dosing cumulative action of certain drugs not readily excreted from system.

Q. How are medicines introduced into the circulation?

A. By the stomach, rectum, cellular tissue, skin and lungs.

Q. What governs length of time required for absorption?

A. Solubility of remedies; method of giving and state of circulation.

Q. Mention quickest and slowest methods of administering medicine.

A. Subcutaneous, about five minutes; rectal, absorption requires three quarters of an hour.

Q. Give general rules regarding time to administer medicines.

A. For prompt action, when stomach is empty; bitter-tonics, shortly before meals; saline cathartics and quickly acting purgatives, before breakfast; laxatives, at night; acids, iron, etc., after meals and well diluted. A.C. medicines are given one-half hour before eating; P.C. medicines twenty minutes after meals are finished.

Q. Mention several important rules for giving medicine.

A. (1) Strict attention to this duty; (2) absolute accuracy with regard to dose; (3) observe time ordered and administer promptly; (4) read label twice before taking bottle from shelf, also before and after pouring medicine; (5) use graduated glasses and pipettes; (6) when pouring keep mark of quantity level with eye; (7) do not interchange minims and drops, there is a marked difference; (8) shake bottle before pouring medicine; (9) hold bottle with label on upper side and wipe rim of bottle with gauze before replacing cork; (10) re-cork bottle immediately after use; (11) never mix medicines nor give at same time unless so ordered; (12) never allow one patient to carry medicine to another; (13) do not dilute more than is ordered nor than is necessary; (14) endeavor to make dose palatable, never dilute with warm water, use water very hot or icy cold; (15) place powders and cachets far back on tongue; (16) pulverize hard pills or triturates; (17) observe absolute cleanliness with regard to measuring glasses, pipettes, tubes, etc.

Q. What general rules should be observed with regard to medicines and food?

A. Starchy foods to be avoided when free iodine is given; milk and acids should not be given near together; avoid giving acids, salts or salty food near a dose of calomel.

Q. Give relative strength of a drug administered as compared with that given by mouth.

A. (1) Subcutaneously: usually one-quarter to one-half the dose by mouth. (2) Rectum: usually twice as large.

Q. Describe giving a hypodermic injection of medicine.

A. The drugs are generally specially prepared in concentrated form and should not be given unless fresh. Sterilize syringe by alternately filling with alcohol or carbolic 1/20 and emptying it, rinsing with sterile water. Sterilize needle carefully by same method or boiling one minute. Attach needle to syringe; load barrel of syringe with one or two drops more than are necessary; point needle upward, press piston until all bubbles of air disappear and only the required amount of medicine remains in syringe, holding mark of same on a level with eye. Wash part chosen for injection (outer surface of arm, leg, thigh or abdomen, avoiding course of blood vessel or bony prominence) well with alcohol; take up and hold firmly between thumb and first finger a cushion of muscle, stretching the skin; insert needle quickly in almost vertical direction and press piston gently; remove needle, pressing sponge quickly over hole to prevent escape of fluid; knead the spot gently for a few seconds; clean instrument carefully and thoroughly dry needle; leave wire in needle; guard point of needle.

Q. Describe method of giving medicine by inhalation.

A. (1) Dry: such as burning leaves of drug, patient inhaling smoke through cone, and by administering oxygen. (2) Steam: using inhaler, or utilizing kettle over alcohol lamp, croup tent, etc.

Q. Into what classes are diseases divided?

A. (1) Communicable: transmitted directly or through an intermediary. (2) Contagious: contracted by direct contact with patient or by coming in contact with anything near patient which has not been promptly disinfected. (3) Infectious: caused by entrance into the body of pathogenic microorganisms.

Q. Mention stages of infectious disease.

A. (1) Incubation period between exposure to disease and appearance of symptoms; (2) invasion, appearance of active symptoms; (3) febrile or active stage; (4) eruptive stage peculiar to some diseases.

Q. Give general rules in caring for infectious diseases.

A. Discharges and excreta should be burned or disinfected. The linen and utensils used by patients, hands of nurse and hands of patients should be thoroughly disinfected. Never place soiled linen taken from bed patient on tables or chairs, but put same immediately into pail containing water kept for this purpose, and keep submerged until such time as the linen can be disinfected. Disinfect linen by live steam, boiling or soaking in formalin solution one-half per cent, or carbolic 1/40. Wear gown while caring for patient; disinfect hands immediately before touching anything.

Q. General rules to be observed in contagious diseases.

A. Isolation; entire absence of all articles not absolutely essential; a hanging sheet, wet with disinfectant, inside of closed door; take nothing from room until disinfected. Dishes should be placed in metallic vessel containing water and boiled. Bed linen should be taken away in wet sheet; excreta removed in vessel containing disinfectant, keeping disinfectant in vessels not in use rinsing same in hot water before giving to patient. Observe absolute cleanliness for patient, giving special care to mouth, nose, ears, hands, nails, buttocks and perineum. After recovery, patient should be given a warm antiseptic bath. Hot water and soap should be in readiness for medical officers' use. At close of disease, upon removal of patient, seal all cracks and openings in room thoroughly fumigate before giving routine cleaning.

Q. Give general rules for febrile cases.

A. Fresh air, quiet; observe extreme cleanliness with regard to patient and nurse; apply cold to head and heat to feet; keep mouth, teeth and tongue clean; give necessary cooling drinks; follow prescribed diet; guard against sudden delirium; watch for sudden fall in temperature; watch pulse closely; screen food from flies and keep from sight of patient.

Q. What important precautions and special symptoms should be kept in mind by the nurse in certain diseases.

A. *Diphtheria*—Exercise great care when spraying throat of patient; watch pulse for cardiac weakness; note regurgitation of food as indicative of paralysis.

Dysentery—Watch for signs of hemorrhage; fresh air, quiet and application of external heat are necessary.

Influenza—Use precautions for infectious diseases.

Malaria—Keep patient well covered with blankets during chill; apply heat to feet, axilla and over heart; give hot drinks unless there is nausea; apply cold to head; not time between chills.

Measles—Precautions for contagious disease; give special care to eyes, cleansing and bathing same with 2 per cent boric acid; guard against chilling of skin, which may cause a nephritis.

Meningitis—Precautions for infectious disease; keep room cool and dark and watch for symptoms of otitis media and for inflammation of eyes.

Mumps—Contagious disease; frequently cleanse mouth.

Pneumonia—Infectious disease; note stages; watch pulse and respiration; note color of sputum; keep patient quiet; never leave an ill pneumonia patient alone; do not restrain so as to interfere with movements of chest; watch for heart failure and edema of lungs. Act promptly when temperature drops suddenly; apply heat and give hot drinks.

Scarlet Fever—Contagious disease; watch pulse; look for evidences of suppuration of lymphnodes in neck; keep room well ventilated at about 68 degrees; measure urine and note change.

Typhoid Fever—Note temperature and pulse for evidences of hemorrhage, perforation or cardiac failure; keep patient quiet and in a recumbent position, supporting back with pillow when turned on side; give special care to mouth, tongue and hands of patient, disinfecting the latter; note character of stools and measure urine; guard against over-distention of bladder; insert rectal tube for relief of gas in intestine; guard against bed sores, which are prone to develop due to protracted course of fever and emaciation. Rigidly follow diet ordered; guard against over-feeding during convalescence.

Tuberculosis—Careful disinfection of discharge, bed clothes and dishes; give fresh air, but protect from draught and

avoid chilling of patient. The nurse should make a special effort to induce patient to eat nourishing food.

Q. What knowledge is essential in giving massage?

A. Knowledge of anatomy; general knowledge of origin and insertion of principal muscles; location of larger arteries, veins and nerves and their functions.

Q. Give general rules for massage treatment.

A. Wash hands before and after treatment; place patient in a comfortable position; in beginning a manipulation, loosen all bands and restricted articles; use moderate force, increase gradually and decrease toward end of movement; begin with effleurage given toward the heart with palms of hands or cushions of fingers and thumbs. (2) Give friction with heel of hand or cushion of thumb or finger in successive circles, using considerable pressure; follow friction effleurage. (3) Petrissage or kneading done with hands or cushions of fingers and thumbs. The muscles are stretched away from bone in direction of vein current beginning above and working downward. Never allow hand to move on skin; follow with effleurage. Give movements slowly and evenly.

Q. When is massage counterindicated.

A. In all inflammatory conditions associated with pus; in skin diseases.

Q. What general knowledge should a nurse have of food?

A. A nurse should have some knowledge of the chemical contents of food; the action of different food material on the body and the food suitable to be given under certain conditions.

Q. Give some general rules for diet in disease.

A. Patients suffering from diseases of nutrition should have easily digested foods, rich salts, milk, eggs, rare beef, sweet fruit. Cardiac cases, limit liquids, fats and carbohydrates; give highly nutritious food.

Diarrhea—No solids; give foods that will be partially or entirely digested in stomach.

Dyspepsia—Give food that is simple, in small quantities; avoid gravies and sauces; direct food be well masticated.

Nephritis—Limit proteins; give a general milk diet, vegetables and farinaceous food.

Q. Give general rules for service of food.

A. Prepare tray with absolute cleanliness in appointments and such regard to daintiness a possible; have sufficient articles on tray, but avoid appearance of crowding; do not serve too many foods at one time and do not serve large portions. Note seasoning of food and temperature; have hot food served hot, in heated dishes and cover same in transit; remove all trays and traces of food as soon as possible; discourage having foods and drinks in sick room, but when this is unavoidable, cover same closely and keep from sight of patient.

[Complied from reference books: Maxwell-Pope, Saunders, Pattee, etc.]

THE OPERATING ROOM AND SURGICAL TECHNIQUE.

Q. Describe briefly an operating room.

A. An operating room should have good overhead and sidelights. The floor and walls should be made of tiles and there should be no sharp angles, crevices or ornamentations to harbor dust, dirt and microbes. It should be well ventilated and thoroughly screened against flies and other insects. There should be no unnecessary apparatus or furniture in the room, and what there is should be simple and easy to keep clean. The sterilizing, etherizing, wash and dressing rooms should adjoin the operating room and be easily accessible. The instruments and dressing and linen should be kept in cabinets in a room adjoining the operating room when there is one available.

Q. What are the necessary apparatus for an operating room?

A. A good operating table and attachments with a stand or table on each side for instruments, sponges, dressings, etc., during an operation; a stand and stool for the use of the anesthetist; stands for various antiseptic and sterile solutions; a portable stand with an electric motor on it and attachments for lights, cauteries, saws, trephines, burrs, drills, etc.

Q. Describe the apparatus of a sterilizing room.

A. They consist of sterilizers for dressings in which the heat is supplied by superheated steam under pressure; a tank for hot water and one for cold sterile water, each of from 10 to 20 gallons capacity; a small tank for keeping normal sterile salt solution at the proper temperature for use; an instrument sterilizer; a utensil sterilizer for operating gowns and caps, sheets, towels, utensils, etc., and containers for sterile dressings.

Q. In preparing for a surgical operation, what is the prime object to be attained?

A. Asepsis of the operating room, apparatus, instruments, dressings, patient, surgeon and assistants.

Q. When is an object aseptic?

A. When it is surgically clean, that is, free from all germs.

Q. What is sepsis?

A. Sepsis means putrefaction, which is due to germ infection.

Q. What are antiseptics?

A. Substances that prevent putrefaction by destroying germs or preventing their development.

Q. What two general classes of germs or bacteria are there?

A. (1) Bacilli or rod-shaped bacteria; (2) micrococci, or spherical bacteria, which are subdivided into staphylococci, which are formed in clusters like bunches of grapes, and streptococci which are formed in chains.

Q. How is asepsis produced?

A. By the application of heat, either dry, as steam or as boiling water.

Q. How are objects made antiseptic?

A. By chemical substances usually in solution.

Q. How are articles sterilized?

A. Either by application of heat or chemical agents.

Q. What are the principal antiseptics and antiseptic solutions used in surgery?

A. (1) Alcohol, pure and dilute (50 per cent water).
(2) Corrosive sublimate or bichloride of mercury, 1/1000 to 1/5000.
(3) Carbolic acid or phenol, 1/100 to 1/20.
(4) Cresol, 1/200 to 1/100.
(5) Boracic acid, saturated solution.
(6) Tincture of iodine.
(7) Permanganate of potash solution, 1/100 to 1/500.

(8) Oxalic acid solution.

(9) Harrington's solution (bichloride, 8 gm.; hydrochloric acid, 60 cc.; alcohol, 640 cc.; water, 300 cc.).

Q. What is a normal salt solution?

A. It is a .9 per cent solution of sodium chloride (common salt) in sterile water.

Q. Of what do surgical dressings consist?

A. They consist of gauze or cheese cloth, muslin, cotton batting, flannel, wool, oil silk and oil muslin, rubber dam, bandages of different kinds, adhesive plasters, drainage tubes, sutures, ligatures, etc.

Dressings that are applied directly to wounds are usually gauze and are either dry or wet. Dry dressings are pads of sterile gauze and are generally used in aseptic wounds. Wet dressings are pads of sterile gauze soaked in some antiseptic solution, usually bi-chloride of mercury 1/2000, and are generally used in infected wounds.

Q. How are gauze dressings made up?

A. There are various kinds of gauze dressings.

Gauze wipes or sponges, large and small, are very necessary during operations. They are made by cutting the gauze the proper sizes and folding in the cut edges so that they will not be exposed and threads left in the wound.

Gauze pads for walling-off purposes are of various sizes. The cut edges should be folded in and stitched so threads will not remain in the wound.

Mikulicz pads are walling-off pads which have tapes from 6 to 12 inches long sewed to one corner.

Dressing pads are of various sizes and should have the cut edges folded in.

Sponges and pads are done up in muslin covers, each package containing one-half to one dozen, and sterilized by steam.

Q. How would you prepare the operating room for performing an operation?

A. The floor, walls and apparatus and furniture should be thoroughly clean, having been scrubbed after the last operation; the operating table should be covered with a folded blanket, over which a rubber sheet is placed and a sterilized sheet over that. The instrument tables should be covered with a sterilized sheet and the sterilized instruments and dressings arranged upon them. The basins for the antiseptic and sterile solutions should be sterilized, the solutions placed in them and covered with a sterile sheet or towels. The apparatus for saline solution for intravenous infusion should be set up ready for use.

Q. Describe the sterilization of instruments, dressings, utensils, etc.

A. The instruments, safety pins and needles should be arranged on towels or gauze on the trays; the gloves wrapped in gauze and all boiled in a 1 per cent carbonate of soda solution for about ten minutes. Instruments having cutting edges should be protected by wrapping the blades with cotton. Needles and pins should be stuck into gauze pads.

The sponges, pads and other dressings having been made into packages should be placed in containers which are placed in the dressing sterilizer and subjected to steam heat under about 15 pounds pressure for half an hour.

The operating gowns, caps, sheets, towels and all utensils used in the operation should be subjected to steam sterilization for one hour in the utensil sterilizer.

Hot water, sterile water and normal saline solution should be on hand in abundance. Instruments, dressings, utensils, etc., that have been sterilized should be handled with great care and only by attendants who have been sterilized.

Q. Give the technique of sterilization of the surgeon and his assistants for an operation.

A. Trim or scrape the nails close, remove all dirt from beneath them with a nail cleaner; apply green soap and water to the

hands and forearms and scrub thoroughly for five minutes with a stiff brush, paying particular attention to the nails; clean the nails again with a sterile cleaner; rinse the hands in sterile water, then in alcohol; scrub for five minutes with a gauze sponge.

The surgeon and the assistant should then have their chins, mouths and nostrils covered with sterile gauze and sterile caps placed upon their heads, coming well down to the ears. They should then immerse their hands and forearms in a strong solution of permanganate of potash, then decolorize them with a solution of oxalic acid; rinse them off in a 1/1000 bichloride solution, then sterile water, then alcohol.

They should then put on sterile operating owns, being careful not to let the hands come in contact with anything that is not sterile. They should then put on sterile rubber gloves, pulling them well up over the sleeves of the gowns, after which they are ready for operating.

In emergency cases and when there is not sufficient time for going through with the above process of sterilizing the hands, one of the following methods is very satisfactory:

(1) Clean the nails well and apply tincture of iodine thoroughly to all parts of the hands and well above the wrists. Do not apply any water to the hands.

(2) Clean the nails; scrub the hands and immerse them for three minutes in Harrington's solution.

Q. What is a very necessary precaution to be observed during an operation?

A. Never touch any sterilized instruments, dressings or apparatus used in the operation unless sterilized yourself, and be careful not to touch against the operator or his assistants. When practicable every one in the room should have on a sterile gown.

Q. How would you prepare a patient for operation?

A. When practicable give a bath the day before and put on a clean night shirt or pajamas. Give a light supper of semi-solid and liquid food, castor oil at bedtime and nothing but liquids

after this. Give a high enema the morning of the operation and see that patient voids urine before going to operating room. Dry shave the site of operation and sterilize with tincture of iodine and apply a sterile dressing. When directed, give a hypodermic of ¼ gr. of morphine one hour before operation. Clean mouth thoroughly and remove false teeth or other loose articles found therein before giving the anesthetic.

Q. How would you manage a case after operation?

A. Keep patient's head low, and remain with him until well out of the anesthetic; restrain him from tossing about or disturbing the site of operation; give nothing unless ordered; save first urine voided for examination; take pulse, temperature and respiration frequently; keep complete clinical notes and report any unfavorable symptoms at once to the surgeon having charge of the case.

[Reference: Mason's "Hand Book for the Hospital Corps," pp. 190 to 213 for list of surgical instruments and apparatus.]

CLERICAL DUTIES.

The clerical work required in performing the duties charged to the Medical Department of the Navy at hospitals, shore stations and on board ships is performed largely by members of the Hospital Corps of the navy, and is incidental to their most important duty, namely, the care and comfort of the sick and wounded.

For a member of the Hospital Corps to perform such clerical work satisfactorily it is necessary: (1) that he be conversant with the Navy and its personnel as at present constituted; (2) that he have a knowledge of the history and establishment of the Bureau of Medicine and Surgery, the regulations defining its duties, and the sources and applications of moneys under its control; (3) that he thoroughly understand the duties ashore and afloat with which the Medical Department of the Navy, of which he is an integral part, is charged, and (4) that his work be uniformly neat and accurate.

DEPARTMENT OF THE NAVY.

The President is, by the Constitution, the commander-in-chief of the Navy.

The Navy Department is one of the ten executive departments of the United States Government charged with the general control and administration of the Navy.

At the head of this department is the Secretary of the Navy, a civil officer and a member of the Cabinet, appointed by the President by and with the advice and consent of the Senate. He performs such duty as the President of the United States may assign him and has the general superintendence of construction, manning, armament, equipment and employment of vessels of war.

The Secretary's deputy is the Assistant Secretary of the Navy.

NAVY DEPARTMENT BUREAUS.

For purposes of administration, and segregation of duties, the Navy Department is divided into seven bureaus, each bureau charged with certain specific duties and in charge of an officer of the Navy appointed by the President of the United States by and with the advice and consent of the Senate. The chiefs of the several bureaus of the Navy Department are appointed for four years and hold the rank of Rear Admiral while performing such duties.

BUREAUS OF THE NAVY DEPARTMENT.	OFFICER IN CHARGE.
1. Navigation	Chief of the Bureau.
2. Yards and Docks	Chief of the Bureau.
3. Ordnance	Chief of the Bureau.
4. Construction and Repair	Chief Constructor and Chief of the Bureau.
5. Steam Engineering	Engineer-in-Chief and Chief of the Bureau.
6. Medicine and Surgery	Surgeon General and Chief of the Bureau.
7. Supplies and Accounts	Paymaster General and Chief of the Bureau.

These bureaus are charged with the following duties:

Bureau of Navigation.

(1) The duties of the Bureau of Navigation comprise the issue, record, and enforcement of the orders of the Secretary to the individual officers of the Navy; the training and education of the line officers and of enlisted men (except of the Hospital Corps) at schools and stations and in vessels maintained for that purpose; the upkeep and operation of the Naval Academy, of technical schools for line officers, of the apprentice seaman establishments of schools for the technical education of enlisted

men, and of the Naval Home at Philadelphia, PA.; the upkeep and the payment of the operating expenses of the Naval War College; the enlistment, assignment to duty, and discharge of all enlisted persons, and the preparation of estimates for the pay of all officers and enlisted men, the operating of the radio service and naval militia and naval districts.

(2) It has under its direction all rendezvous and receiving ships, and provides transportation for all enlisted persons under its cognizance.

(3) It establishes the complements of all ships in commission.

(4) It keeps the records of service of all officers and men and prepares an annual navy register for publication, embodying therein data as to fleets, squadrons, and ships, which shall be furnished by the aid for operations. To the end that it may be able to carry out the provisions of this paragraph, all communications to or from ships in commission relating to the personnel of such ships are forwarded through this bureau, whatever their origin.

(5) It is charged with all matters pertaining to applications for appointments and commissions in the Navy, and with the preparation of such appointments and commissions for signature.

(6) It is charged with the preparation, revision, and enforcement of all regulations governing uniform, and with the distribution of all orders and regulations of a general or circular character.

(7) Questions of naval discipline, rewards, and punishments are submitted by this bureau for the action of the Secretary of the Navy. The records of all general courts-martial and courts of inquiry involving the personnel of the Navy before final action are referred to this bureau for comment as to disciplinary features.

(8) It receives and brings to the attention of the Secretary of the Navy all applications from officers for duty or leave.

(9) It receives all reports of services performed by individual officers or men.

(10) It is charged with the enforcement of regulations and instructions regarding naval ceremonies and naval etiquette.

(11) It is charged with all matters pertaining to the naval militia and naval defense districts.

Bureau of Yards and Docks.

The duties of the Bureau of Yards and Docks comprise all that relates to the design and construction of public works, such as dry docks, marine railways, building ways, harbor works, quay walls, wharves, slips, dredging, landings, floating and stationary cranes, power plants, coaling plants, heating, lighting, telephone, water, sewer and railroad systems; roads, walks, and grounds, bridges, radio towers, and all buildings, for whatever purposes needed under the Navy and Marine Corps. It provides for the general maintenance of the same except at the naval proving grounds, the naval torpedo station, and naval training stations, the Naval Academy, and the naval magazines. It designs and makes the estimates for the public works after consulting as to their operating features with the bureau or office for whose use they are primarily intended. It has charge of all means of transportation, such as derrick shears, locomotives, locomotive cranes, cars, motor trucks, and all vehicles, horses, teams, subsistence and necessary operators and teamsters in the navy yards. It provides the furniture for all buildings except at the naval magazines, hospitals and the Naval Academy. It provides clerks for the office of the commandant, captain of the yard, and public works officer. In general, the work of the bureau is carried out by commissioned officers of the Corps of Civil Engineers, United States Navy, whose major duties comprise the construction and maintenance of the public works of the Navy.

Bureau of Ordnance.

The duties of the Bureau of Ordnance comprise all that relates to the upkeep, repair and operation of the torpedo station, naval proving ground and magazines on shore, to the manufacture of

offensive and defensive arms and apparatus (including torpedoes and armor), all ammunition and war explosives. It requires for or manufactures all machinery, apparatus, equipment, material and supplies required by or for use with the above.

It determines the interior dimensions of resolving turrets and their requirements as regards rotation.

As the work proceeds it inspects the installation of the permanent fixtures of the armament and its accessories on board ship and the methods of stowing, handling, and transporting ammunition and torpedoes, all of which work shall be performed to its satisfaction. It designs and constructs all turret ammunition hoists, determines the requirements of all ammunition hoists, and the method of construction of armories and ammunition rooms on shipboard, and, in conjunction with the Bureau of Construction and Repair, determines upon their location and that of all ammunition hoists outside the turrets. It installs all parts of the armament and its accessories, which are not permanently attached to any portion of the structure of the hull, excepting turret guns, turret mounts, and ammunition hoists, and such other mounts as require simultaneous structural work in connection with installation or removal. It confers with the Bureau of Construction and Repair respecting the arrangements for centering the turrets and the character of the roller paths and their supports.

It has cognizance of all electrically operated ammunition hoists, rammers, and gun-elevating gear which are in turrets; of electric training and elevating gear for gun mounts not in turrets; of electrically operated air compressors for charging torpedoes; and of all range finders and battle order and range transmitters and indicators.

Bureau of Construction and Repair.

The duties of the Bureau of Construction and Repair comprise the responsibility for the structural strength and stability

of all ships for the Navy; all that relates to designing, building, fitting, and repairing the hulls of ships, turrets, and electrical turret turning machinery, spars, capstans, windlasses, deck winches, boat cranes, steering gear and hull ventilating apparatus (except portable fans), and after consultation with the Bureau of Ordnance and according to the requirements thereof as determined by that bureau, the designing, construction and installation of independent ammunition hoists, the same to conform to the requirements of the Bureau of Ordnance as to power, speed, and control, and the installation of the permanent fixtures of all other ammunition hoists and their appurtenances; placing and securing armor, placing and securing on board ship to the satisfaction of the Bureau of Ordnance the permanent fixtures of the armament and its accessories as manufactured and supplied by that bureau; installing the turret guns, turret mounts, and turret ammunition hoists, and such other mounts as require simultaneous structural work in connection with installations or removal.

It has charge of the docking of ships and is charged with the operating and cleaning of dry docks.

It is responsible for the care and preservation of ships not in commission.

It has cognizance of electric launches and other boats supplied with electric motive power.

It has charge of the manufacture of anchors and cables; the supplying and fitting of rope, cordage, rigging, sails, awnings, and other canvas, and flags and bunting; it supplies to the satisfaction of the Bureau of Supplies and Accounts galley ranges, steam cookers, and other permanent galley fittings, and installs and repairs the same.

It supplies and installs, in consultation with the Bureau of Steam Engineering all voice tubes and means of mechanical signal communications.

Bureau of Steam Engineering.

The duties of the Bureau of Steam Engineering comprise all that relates to designing, building, fitting out and repairing machinery used for the propulsion of naval ships; the steam pumps, steam heaters, distilling apparatus, refrigerating apparatus, all steam connections of ships, and the steam machinery necessary for actuating the apparatus by which turrets are turned.

It has cognizance of the entire system of interior communications. It is specifically charged with the design, supply, installation, maintenance, and repair of all means of interior and exterior electric signal communications (except range finders and battle-order and range transmitters and indicators), and of all electrical appliances of whatsoever nature on board naval vessels, except motors and their controlling apparatus used to operate the machinery belonging to the other bureaus.

It has charge of the design, manufacture, installation, maintenance, repair and operation of wireless telegraph outfits on board ship and of wireless telegraph outfits and stations on shore.

It maintains and repairs coaling plants not at navy yards, and operates all mechanical coaling plants, whether at a navy yard or elsewhere. Such operation includes the providing of all labor and supplies connected with the handling of coal; it passes upon the operating features of all plans for the construction of such plants prepared by the Bureau of Yards and Docks; it inspects all coal for the fleet.

It has supervision and control of the Engineering Experiment Station.

It designs the various shops at navy yards and stations when its own work is executed, so far as their internal arrangements are concerned.

Bureau of Medicine and Surgery.

The Bureau of Medicine and Surgery shall have charge of the upkeep and operation of all hospitals and of the force employees

there; it shall advise with respect to all questions connected with hygiene and sanitation affecting the service and, to this end, shall have opportunity for necessary inspection; it shall provide for physical examinations; it shall pass upon the competency from the professional standpoint of all men in the Hospital Corps for enlistment and promotion by means of examinations conducted under its supervision, or under forms prescribed by it; it shall have information as to the assignment and duties of all enlisted men of the Hospital Corps; it shall recommend to the Bureau of Navigation the complement of medical officers, dental officers, and Hospital Corps for hospital ships, and shall have power to appoint and remove all nurses in the Nurse Corps (female), subject to the approval of the Secretary of the Navy.

Except as otherwise provided for, the duties of the Bureau of Medicine and Surgery shall include the upkeep and operation of medical supply depots, medical laboratories, naval hospitals, dispensaries, technical schools, for the Medical and Hospital Corps and the administration of the Nurse Corps (female), Dental Corps and Medical Reserve Corps.

It shall approve the design of hospital ships in so far as relates to their efficiency for the care of the sick and wounded.

It shall require for all supplies, medicines and instruments used in the Medical Department of the Navy. It shall have control of the preparation, reception, storage, care, custody, transfer, and issue of all supplies of every kind used in the Medical Department for its own purposes.

Bureau of Supplies and Accounts.

The duties of the Board of Supplies and Accounts comprise all that relates to the supply of funds for disbursing officers and the keeping of the money accounts of the naval establishments; the purchase, reception, storage, care, custody, transfer, shipment, and issue of all supplies, including coal and water, for the naval establishment, and the keeping of a proper system of

accounts for the same, except supplies for the Marine Corps, and except the reception, storage, care, custody, transfer, and issue of medical supplies, the requiring for, preparing or manufacture of provisions, clothing, and small stores; and the keeping of the cost of manufacture at the various navy yards and stations.

Judge Advocate General and Solicitor.

Attached to the Secretary of the Navy's office is the office of the Judge Advocate General of the Navy and the office of the Solicitor of the Navy. The Judge Advocate General of the Navy is appointed for four years by the President, by and with the advice and consent of the Senate, from the officers of the Navy or Marine Corps, and has the rank of captain in the Navy or a colonel in the Marine Corps, as the case may be.

The solicitor is appointed from civil life by the Secretary of the Navy.

The duties of these officers are as follows:

OFFICE OF THE JUDGE ADVOCATE GENERAL.

The duties of the Judge Advocate General of the Navy are as follows: To revise and report upon the legal features of and have recorded the proceedings of all courts-martial, courts of inquiry, boards of investigation, inquest, and boards for the examination of officers for retirement and promotion in the naval service; to prepare charges and specifications for courts-martial, and the necessary orders convening courts-martial in cases where such courts are ordered by the Secretary of the Navy; to prepare court-martial orders promulgating the final action of the reviewing authority in court-martial cases; to prepare the necessary orders convening courts of inquiry in cases where such courts are ordered by the Secretary of the Navy, and boards for the examination of officers for promotion and retirement, and for the examination of candidates for appointment as commissioned officers in the Navy other than midshipmen, and to conduct all

official correspondence relating to such courts and boards. It is also the duty of the Judge Advocate General to examine and report upon all questions relating to rank and precedence, to promotions and retirements, and those relating to the validity of proceedings in court-martial cases; all matters relating to the supervision and control of naval prisons and prisoners, disciplinary barracks and detentioners; the removal of the mark of desertion; the correction of records of service and reporting thereupon in the Regular or Volunteer Navy; certification of discharge in true name; pardons, bills and resolutions introduced in Congress relating to the personnel referred to the department for report, and the drafting and interpretation of statutes relating to the personnel; references to the Comptroller of the Treasury with regard to pay and allowances of the personnel; questions involving points of law concerning the personnel; proceedings in the civil court in all cases concerning the personnel as such; and to conduct the correspondence respecting the foregoing duties, including the preparation for submission to the Attorney General of all questions relating to subjects coming under his own cognizance which the Secretary of the Navy may direct to be so referred.

OFFICE OF THE SOLICITOR.

The duties of the solicitor comprise and relate to examination and report upon questions of law, including the drafting and interpretation of statutes and matters submitted to the accounting officers not relating to the personnel; preparation of advertisements, proposals, and contracts, insurance; patents; the sufficiency of official, contract and other bonds and guaranties; proceedings in the civil courts by or against the government or its officers in cases relating to material and not concerning the Attorney General, except such as are under the cognizance of the Judge Advocate General; bills, and congressional resolutions and inquiries not relating to the personnel and not elsewhere assigned; the searching of titles, purchase, sale, transfer and

other questions affecting lands and buildings pertaining to the Navy; the care and preservation of all muniments of title to land acquired for naval uses; and the correspondence respecting the foregoing duties and rendering opinion upon any matter or question of law referred to him by the Secretary or Assistant Secretary.

Personnel of the Navy.

To comprehend clearly matters pertaining to the personnel of the Navy it is necessary to understand the general divisions of this personnel and the several corps comprising it, as well as the different ranks, or grades of the officers and the many ratings held by the enlisted men.

The personnel of the Navy is composed of officers and enlisted men, their numbers varying in accordance with the authorized strength of the Navy allowed by law, and regulated largely by service requirements.

An officer is one appointed to a certain rank and authority by the President of the United States by and with the advice and consent of the Senate. In the Navy an officer is appointed by either commission or warrant. This divides the officers as a whole into two classes, commissioned officers and warrant officers.

An officer's tenure in the Navy is for life, unless sooner terminated by removal, resignation, disability or other casualty.

The enlisted men of the Navy, as the term indicates, are enlisted or engaged for periods of service, at present four years, and discharged from the service at the expiration of such enlistment.

The entire personnel of the Navy is included in the divisions "the line" (the military branch), and "the staff" (the civil branch).

COMMISSIONED OFFICERS OF THE LINE.

Commissioned officers of "the line" are those who succeed to a command and who automatically assume command in order of seniority, even in the presence of staff officers of higher rank.

Officers of the line in the Navy, with the exception of men promoted from the warrant grades, are all graduates of the

Naval Academy at Annapolis, Md., where they receive training by the government in the duties essential to naval science. While attending the Naval Academy they rank as midshipmen; midshipmen, though not commissioned, enjoy privilege and consideration as officers of the Navy. Upon graduation midshipmen are commissioned ensigns.

The commissioned officers of the line in the Navy have rank as rear admiral, captain, commander, lieutenant commander, lieutenant, lieutenant junior grade, and ensign.

COMMISSIONED OFFICERS AND STAFF

The staff is a body of officers not having command but entrusted with special duties peculiar to their training. They may be classed as specialists in particular professions who received their training in civil life, and were appointed in the Navy after passing a professional examination (An exception to this is the Corps of Naval Constructors, which is made up of officers selected from the graduates of the Naval Academy.)

The commissioned staff of the Navy comprises medical officers, pay officers, dental officers, naval constructors, professors of mathematics, civil engineers and chaplains. These officers are divided into corps in accordance with the designation of their professions as indicated, *i. e.*, Medical Corps, Pay Corps, Dental Corps, Construction Corps, Corps of Professors of Mathematics, Corps of Civil Engineers, Corps of Chaplains.

The Medical Corps of the Navy, of particular interest to men in the Hospital Corps, is comprised of medical officers having the following ranks: medical director, medical inspector, surgeon, passed assistant surgeon, assistant surgeon and acting assistant surgeon.

WARRANT OFFICERS.

Warrant officers in the Navy are of two classes, the highest (called chief warrant officers), ranking with, but after, ensigns and the other ranking with, but after, midshipmen. A warrant officer is eligible for promotion to chief warrant officer after six

years' service as such and after passing a satisfactory examination prescribed by the Secretary of the Navy.

There are six divisions of warrant officers, as follows: boatswains, gunners, machinists (belong to the line); carpenters, sailmakers, and pharmacists (belong to the staff).

Enlisted Personnel.

As previously mentioned, all enlisted men enter the Navy for a stated period.

The enlisted force of the navy is divided into five branches; seaman, artificer, special, messmen, marines. Several of these branches have assimilated ratings and the tabular classification entered below, taken from the Navy Regulations, will make clear the several branches with their different ratings.

CHIEF PETTY OFFICERS.

Seaman Branch.	Artificer Branch.	Special Branch.	Marines.
Chief masters at arms.	Chief machinists' mates.	Chief yeomens	Sergeants majors
Chief boatswains' mates	Chief electricians.	Hospital stewards.	First sergeants . Gun'ry sergeants.
Chief gunner's mates.	Chief carpenter's mates.	Bandmasters.	Quartermaster sergeants.
Chief turret captains.	Chief water tenders.	Chief commissary stewards	Drum majors.
Chief gun captains.			Leaders of band.
Chief quartermasters.			Second leaders of band.

PETTY OFFICERS, FIRST CLASS.

Seaman Branch.	Artificer Branch.	Special Branch.	Marines.
Masters at arms, first class.	Machinists' mates first class.	First musicians.	
Boatswains mates, first class.	Electricians, first class.	Yeomen, first class.	
Turret captains, first class.	Boilermakers.	Commissary stewards.	
Gunners' mates, first class.	Coppersmiths.	Ship's cooks, first class.	
Gun captains, first class	Blacksmiths.	Bakers, first class	
Quartermasters, first class.	Plumbers and fitters. Sailmaker's mates. Carpenter's mates, first class. Water tenders. Ship's fitters, first class. Painters, first class.		

PETTY OFFICERS, SECOND CLASS.

Seaman Branch.	Artificer Branch.	Special Branch.	Marines.
Masters at arms, second class.	Machinists'mates, second class.	Yeomen, second class.	Sergeants.
Boatswains' mates, second class.	Electricians, second class.	Ship's cooks, second class.	
Gunner's mates, second class.	Carpenters' mates, second class.		
Gun captains, second class	Printers.		
Quartermasters, second class.	Oilers.		
	Ship's fitters, second class. Painters, second class.		

PETTY OFFICERS, THIRD CLASS.

Seaman Branch.	Artificer Branch.	Special Branch.	Marines.
Masters at arms, third class. Coxswains. Gunners' mates, third class. Quartermasters, third class.	Electricians, third class. Carpenters' mates third class. Painters, third class.	Yeomen, third class. Hospital apprentices, first class.	Corporals.

SEAMEN, FIRST CLASS.

Seaman Branch.	Artificer Branch.	Special Branch.	Marines.
Seaman gunners. Seamen.	Firemen, first class..	Musicians, first class. Ship's cooks, third class. Bakers, second class.	Musicians. Privates.

SEAMEN, SECOND CLASS.

Seaman Branch.	Artificer Branch.	Special Branch.	Marines.
Ordinary seamen.	Firemen, second class. Shipwrights.	Musicians, second class. Buglers. Hospital apprentices. Ship's cooks, fourth class.	

SEAMEN, THIRD CLASS.

Seaman Branch.	Artificer Branch.	Special Branch.	Marines.
Apprentice seamen.	Coal passers. Landsmen.	Bandsmen.	

MESSMAN BRANCH.

Stewards to commanders-in-chief.	Steerage stewards.
Cooks to commanders-in-chief.	Steerage cooks.
Stewards to commandants.	Warrant officers' stewards.
Cooks to commandants.	Warrant officers' cooks.
Cabin stewards.	Mess attendants, first class.
Cabin cooks.	Mess attendants, second class.
Wardroom stewards.	Mess attendants, third class.
Wardroom cooks.	

The Fleet and the Naval Stations for Its Upkeep.

The Navy is primarily the fleet—the vessels of war with their auxiliaries.

The composition of the fleet includes battleships, armored cruisers, cruisers, monitors, destroyers, submarines, gunboats, transports, supply ships, fuel ships, tugs, and tenders, and is divided as follows: Atlantic Fleet, Pacific Fleet, Asiatic Fleet, unattached vessels in active service.

The Navy Department has under its control a number of naval stations, both at home and in its outlying territories and possessions. The most important of these, with their locations are as follows:

Navy Yards or Stations at Portsmouth, N.H.; Boston, Mass.; New York; Philadelphia, Pa.; Norfolk, Va.; Charleston, S.C.; Mare Island, Cal.; Puget Sound, Wash.; Guam; Cavite, P.I., and Olongapo, P.I. Naval Training Stations at Newport, R.I.; Norfolk, Va.; Great Lakes, Ill., and San Francisco, Cal. Naval

Academy at Annapolis, Md. Gun Factory at Washington, D.C. Torpedo Station at Newport, R.I. Ordnance Proving Ground at Indian Head, Md., and magazines and depots for storage of combustibles, etc.

The following definitions taken from Navy Regulation (I 5354) will be of interest in connection with this subject:

"A Naval Station is any establishment for building, manufacturing, docking, repair, supply, or training under the control of the Navy. It may include several such establishments.

"A Navy Yard is a single establishment for docking, repair, and supply. It may include building and manufacturing facilities. Either alone or with other naval establishments it constitutes a naval station.

"A Naval Base is a point from which naval operations may be conducted and which is selected for that purpose. Its essential feature is an adequate anchorage for a fleet with its auxiliaries, preferably sheltered from the sea and fortified against attack. Naval Bases are permanent or temporary. The latter would generally be established nearer the theater of war than any permanent base and would be called an advanced base. A permanent base would have docking and repair facilities.

"Strategy applies to the distribution of naval forces, their armament and supplies in preparation for war or in the prosecution of war. It includes logistics. It refers to naval movements and dispositions made before contact with the enemy's forces.

"Tactics applies to all naval movements and operations made after contact with the enemy's forces. The term 'contact' is here employed in a broad sense, meaning such proximity to the enemy as affects fleet formation and renders a battle imminent.

"Naval Policy.—Everything that includes the fixed condition of preparation for war; that is, the strength, character, and composition of the Navy, fortification of ports and bases, etc. (This will be based upon our political relations and the probability of war with different powers. It will also be influenced by the

conclusions of a comprehensive study of the political relations between other powers throughout the world and their influence upon coalitions and alliances.)"

United States Marine Corps.

The United States Marine Corps forms a military branch of the Navy under control of the Secretary of the Navy, and is subject to the laws and regulations for the government of the Navy. The United States Marine Corps may, by order of the President of the United States, be detached for service with the United States Army, when it becomes subject to the rules and articles of war prescribed for the government of the Army.

The headquarters of the United States Marine Corps is in Washington, D.C. The head of the Marine Corps is designated commandant of the Marine Corps, has the rank of a major general, and is appointed from officers in the Marine Corps by the President, by and with the advice and consent of the Senate, for four years.

The commandant of the Marine Corps is charged with the following duties:

The commandant of the Marine Corps is responsible to the Secretary of the Navy for the general efficiency and discipline of the corps, makes such distribution of officers and men for duty at the several shore stations as shall appear to him to be most advantageous for the interests of the service; furnishes detachments for vessels for the Navy, according to the authorized scale of allowance; under the direction of the Secretary of the Navy, issues orders for the movement of officers and troops, and such other orders and instructions for their guidance as may be necessary and has charge and exercises general supervision and control of the recruiting service of the corps, and of the necessary expenses thereof, including the establishment of recruiting stations.

The duties of the United States Marine Corps are defined by an executive order of November 12, 1908, as follows:

"To garrison the different navy yards and naval stations, both within and beyond the continental limits of the United States.

"To furnish the first line of the mobile defense of naval bases and naval stations beyond the continental limits of the United States.

"To man such naval defenses, and to aid in manning, if necessary, such other defenses as may be erected for the defense of naval bases and naval stations beyond the continental limits of the United States.

"To garrison the Isthmian Canal Zone, Panama.

"To furnish such garrisons and expeditionary forces for duties beyond the seas as may be necessary in time of peace."

THE BUREAU OF MEDICINE AND SURGERY.

As previously stated, the business of the Navy Department is conducted through bureaus, one of which is the Bureau of Medicine and Surgery. The existence of this bureau as a separate and distinct bureau in the Navy Department dates from its establishment by Congress, with other Navy Department bureaus, in the Act of August 31, 1842.

From the inception of our government to August 31, 1842, the history of the Medical Department of the Navy is interwoven with that of other branches of the service. (For a history of these events see United States Naval Medical Bulletin, Vol. 7, No. 1, p. 39, *et seq.*)

The following is a list of the names of the Chiefs of the Bureau of Medicine and Surgery and Surgeons General, U.S. Navy, from 1842 to date:

Wm. P. C. Barton	Sept.	2,	1842,	to	April	1,	1844.
Thomas Harris	April	1,	1844,	to	Sept	30,	1853.
William Whelan	Oct.	1,	1853,	to	June	11,	1865.
P. J. Horwitz	July	1,	1865,	to	June	30,	1869.
Wm. M. Wood	July	1,	1869,	to	Oct.	31,	1871.
J. M. Folz	Nov.	1,	1871,	to	June	8,	1872.
J. C. Palmer	June	10,	1872,	to	July	8,	1873.
Joseph Beale	July	9,	1873,	to	Feb	2,	1877.
William Grier	Feb.	3,	1877,	to	Oct.	5,	1878.
J. W. Taylor	Oct.	28,	1878,	to	Aug.	19,	1879.
P. S. Wales	Aug.	20,	1879,	to	Jan.	27,	1884.
F. M. Gunnell	April	1,	1884,	to	April	1,	1888.
J. M. Browne	April	2,	1888,	to	May	10,	1893.
J. R. Tryon	May	11,	1893,	to	Sept.	7,	1897.
N. L. Bates	Oct.	1,	1897,	to	Oct.	18,	1897.
W. K. VanReypen	Oct.	23,	1897,	to	Jan.	25,	1902.
P. M. Rixey	Feb.	5,	1902,	to	Feb.	4,	1910.
C. F. Stokes	Feb.	7,	1910,	to	Feb.	6,	1914.
W. C. Braisted	Feb	7,	1914,	present incumbent.			

Duties.

The duties of the Bureau of Medicine and Surgery as defined by Navy Regulations (R133) are as follows:

"The Bureau of Medicine and Surgery shall have charge of the upkeep and operation of all hospitals and of the force employed there; it shall advise with respect to all questions connected with hygiene and sanitation affecting the service and, to this end, shall have opportunity for necessary inspection; it shall provide for physical examination; it shall pass upon the competency, from a professional standpoint, of all men in the Hospital

Corps for enlistment and promotion by means of examinations conducted under its supervision or under forms prescribed by it; it shall have information as to the assignment and duties of all enlisted men of the Hospital Corps; it shall recommend to the Bureau of Navigation the complement of medical officers, dental officers, and Hospital Corps for hospital ships, and shall have power to appoint and remove all nurses in the Nurse Corps (female), subject to the approval of the Secretary of the Navy."

"Except as otherwise provided for, the duties of the Bureau of Medicine and Surgery shall include the upkeep and operations of medical supply depots, medical laboratories, naval hospital dispensaries, technical schools for the medical and hospital corps and the administration of the Nurse Corps (female), Dental Corps and Medical Reserve Corps."

"It shall approve the design of hospital ships in so far as relates to their efficiency for the care of the sick and wounded."

"It shall require for all supplies, medicines and instruments used in the Medical Department of the Navy. It shall have control of the preparation, reception, storage, care, custody, transfer, and issue of all supplies of every kind used in the Medical Department for its own purposes."

To carry out the duties enumerated above a detail of officers and enlisted men of the Medical Department of the Navy will necessarily be found wherever the activities of the Navy lead.

The primary duty of the Medical Department of the Navy is to preserve the Navy's personnel—its fighting force—from sickness and injury; to reduce its impairment by reason of sickness or injury to the minimum; and to return men so incapacitated to active duty in the shortest period consistent with circumstances. To accomplish more readily this object naval hospitals have been established by the Bureau of Medicine and Surgery at the geographical points where concentration of naval activities occur. Officers and enlisted men, afloat or ashore, in need of hospital

treatment, are transferred to the naval hospital most convenient to the ship or station on which they are serving at the time.

Quite naturally it is here, in our naval hospitals, where the Medical Department's utility as a conserving force of the personnel of the Navy becomes most apparent, where its sphere of usefulness is best demonstrated, and where all that pertains to the sick and injured finds its greatest intensity and fullest development.

The naval hospitals controlled by the Bureau of Medicine and Surgery, at present in commission, number seventeen, and are located as follows: Portsmouth, N.H.,; Chelsea, Mass.; Newport, R.I.; Brooklyn, N.Y.; Philadelphia, Pa.; Washington, D.C.; Annapolis, Md.; Norfolk, Va.; Port Royal, S.C.; Great Lakes, Ill.; Las Animas, Col.; Mare Island, Cal.; Puget Sound, Wash.; Guam; Yokohama, Japan; Cañacao, P.I.; Olongapo, P.I.

The hospital at Las Animas, Col., is for the treatment of tuberculosis patients only, and is situated in the southeastern part of Colorado, a region most favorable, on account of its climate, to the control of the disease.

Patients in the Navy may be admitted to an Army and Navy General Hospital as prescribed by Navy Regulations (R4531).

The Public Health Service hospitals and their contract stations are also available for treatment of the Navy's sick when a naval hospital is not convenient.

In an emergency a patient may be transferred to a civil hospital as prescribed in Navy Regulations (R4532).

The insane of the Navy are all ultimately transferred to the Government Hospital for the Insane, located in Washington, D.C., and under the control of the Interior Department.

Source and Application of Moneys Pertaining to the Bureau of Medicine and Surgery.

Since all moneys set apart for the Navy are placed for their expenditure under the cognizance of the several bureaus to which they pertain, one of the most important duties devolving

upon the administrative head of the Bureau of Medicine and Surgery is the application of moneys coming under control of that bureau.

Moneys controlled by the Bureau of Medicine and Surgery are the means for the procurement of services, supplies, medicines, instruments, etc., for the Medical Department of the Navy on ships, stations and at hospitals, and as such supplies and services may only be required by means of requisitions and vouchers, it is very important that hospital corpsmen, whose duty it becomes to prepare requisitions and vouchers for supplies, etc., in the Medical Department of the Navy, have a clear comprehension of the source and applicability of moneys under cognizance of the bureau.

It should be made clear in this connection that while the Bureau of Medicine and Surgery has control over certain moneys for the purpose of defraying necessary expenses incident to the various duties with which it is charged, the actual disbursement of such moneys is not made by any officer connected with that bureau, but devolves, as does the disbursement of all moneys expended for the Navy, upon officers of the Pay Corps under the Bureau of Supplies and Accounts.

Moneys controlled by the Bureau of Medicine and Surgery are received from two general sources, *i. e.,* annual appropriations made by Congress, and the Naval Hospital Fund.

Annual appropriations are made by Congress for the expenses during the fiscal year for which made—the fiscal year begins July 1 and ends June 30. These appropriations are based upon careful estimates prepared by the several bureaus for the Secretary of the Navy, and transmitted by him to Congress through the Secretary of the Treasury.

The annual appropriations included in the Naval Appropriation Bill that pertain to the Bureau of Medicine and Surgery are classified under the following fixed titles:

(1) Medical Department.
(2) Contingent, M. and S.

(3) Bringing Home Remains of Officers, etc., Navy Department.

The detailed object of expenditures under these appropriations can best be made clear by quoting in full the phraseology of the several bureau appropriations taken from the Naval Act of March 4, 1913, making appropriations for the fiscal year 1914.

MEDICAL DEPARTMENT.

For surgeon's necessaries for vessels in commission, navy yards, naval stations, Marine Corps, and for the civil establishment of the several naval hospitals, navy yards, naval medical supply depots, Naval Medical School, Washington, and Naval Academy, $510,000.

CONTINGENT, BUREAU OF MEDICINE AND SURGERY.

For tolls and ferriages, care, transportation, and burial of the dead; purchase of books and stationery, binding of medical records, unbound books, and pamphlets; hygienic and sanitary investigation and illustration; sanitary and hygienic instruction; purchase and repairs of wagons, automobile ambulances, and harness; purchase of and feed for horses and cows; trees, plants, garden tools and seeds; incidental articles for the Naval Medical School and Naval Dispensary, Washington; rent of rooms for Naval Dispensary, Washington, District of Columbia, not to exceed $1200; naval medical supply depots, sick quarters at Naval Academy and Marine Barracks; washing for medical department at Naval Medical School and Naval Dispensary, Washington; naval medical supply depots, sick quarters at Naval Academy and Marine Barracks, dispensaries at navy yards and naval stations, and ships; and for minor repairs on buildings and grounds of the United States Naval Medical School and naval medical supply depots; for the care, maintenance and treatment of the insane of the Navy and Marine Corps on the Pacific coast; for dental outfits and dental material, not to exceed $38,000, and all other necessary contingent expenses; in all, $142,000.

TRANSPORTATION OF REMAINS

To enable the Secretary of the Navy, in his discretion, to cause to be transferred to their homes the remains of officers and enlisted men of the Navy and Marine Corps who die or are killed in action ashore, or afloat, and also to enable the Secretary of the Navy, in his discretion, to cause to be transported to their homes the remains of civilian employees who die outside of the continental limits of the United States, $15,000.

Naval Hospital Fund.

This is not an appropriation made by Congress, and expenditures from this fund may be made only for expenses incurred in connection with naval hospitals and for the support of patients in civil hospitals at home and abroad.

Moneys held under this title, and the property and investments, including buildings and grounds purchased or otherwise acquired, constitute a trust fund of which the Secretary of the Navy is trustee. The moneys are deposited in the United States Treasury, and expenditures are safeguarded by the same laws, regulations, and procedures as govern the expenditures of appropriations that do belong to the United States government.

The several sources of revenue of the fund are: (1) 20 cents per month "hospital tax," deducted from the pay of each officer, seaman and marine, including members of the Navy Nurse Corps and Naval Auxiliary Service (sec. 4808, R. S.); (2) the value of one ration (30 cents) per day during the period that each patient remains in the hospital (sec. 4812, R. S.); (3) the pensions of naval patients and supernumeraries while under treatment in hospitals (sec. 4813, R. S.); (4) all fines imposed by sentence of courts-martial (sec. 4809, R. S.); (5) all forfeitures on account of desertions (act approved June 7, 1900); (6) proceeds of sales of hospital property; (7) payments made by navy yard employees for subsistence under authority of General Order No. 148, dated January 10, 1912,

and Supplies and Accounts Memoranda for the Information of Officers, etc., No. 131, dated February 1, 1912.

For a history of the Naval Hospital Fund see the Manual of the Medical Department of the Navy.

Organization of Bureau of Medicine and Surgery.

The following outline of the organization of the Bureau of Medicine and Surgery as at present conducted will make plain its several divisions and activities. With a knowledge of the duties of the other Navy Department bureaus heretofore enumerated, the reciprocal relations of the Bureau of Medicine and Surgery to these bureaus will be evident.

The Surgeon General of the Navy is chief of the Bureau of Medicine and Surgery, and its administrative head. The assistant to bureau acts as executive, coordinating the entire organization and work of the bureau, under the supervision of the Surgeon General, and acts as chief of the bureau in the temporary absence of the Surgeon General.

1. Division A (finance, General Correspondence, etc.).
   Subdivision I.
   - (a) Finance.
   - (b) Correspondence.
   - (c) Clerical force.
   - (d) Files.

   Subdivision 2. Pharmacist in charge.
   - (a) Supplies.
   - (b) Requisitions.
   - (c) Public Bills.

2. Division B (Personnel). Medical officer in charge.
   Subdivision I.
   - (a) Medical Corps.
   - (b) Medical Reserve Corps.
   - (c) Dental Corps.
   - (d) Red cross.

   Subdivision 2. Medical officer in charge.
   Hospital corps.
   Subdivision 3. Superintendent Nurse Corps in charge.

Nurse Corps.

3. Division C (Records and Pensions). Medical officer in charge.
   Subdivision I.
   (a) Physical qualifications of candidates for enlistment, appointment, promotion, etc.
   (b) Medical surveys.
   (c) Health records.
   Subdivision 2. Pharmacist in charge.
   (a) Pensions.
   (b) Records for promotion and retirement.
   (c) Vital statistics.
4. Division D. Medical officer in charge.
   (a) Construction.
   (b) Sanitary features, ships and stations.
   (c) Legislation.
5. Division E. (Publications). Medical officer in charge.
   (a) Report of the Surgeon General.
   (b) Naval Medical Bulletin.
   (c) Miscellaneous.

CLERICAL WORK IN THE MEDICAL DEPARTMENT OF THE NAVY.

This clerical work in the Medical Department of the Navy required of the hospital corpsmen may be explained and studied most advantageously if separated into three divisions, *viz.*, (1) general correspondence, i. e., letters, endorsements, etc.; (2) requisition and voucher forms for the procurement of supplies and services; (3) reports and returns other than requisition and voucher forms.

General Correspondence, i. e., Letters, Endorsements, etc.

Official correspondence within the naval service is carried on in a manner prescribed in detail by Navy Regulations (chapter 44, I 5301, *et seq.*) and must in each instance conform to the instructions promulgated therein. While the substance of official correspondence, concerning the Medical Department of the Navy is determined by the officers charged with such duty, its transcription in official form for signature and forwarding is quite usually entrusted to hospital corpsmen.

Most important of all for one entrusted with correspondence work is to keep a copy of every letter or endorsement prepared, and to have a systematic method of numbering and filing all papers, so that they can be referred to readily.

A hospital corpsman detailed to perform this clerical work should of necessity have access to a copy of the Navy Regulations, and the instructions in chapter 44 thereof should be referred to whenever there is any doubt as to the proper form to be used, or method of procedure to be followed, the intention here being to extract only so much of the official instructions as will make clear the essential features of service correspondence by letter and endorsements.

EXTRACTS FROM NAVY REGULATIONS BEARING ON OFFICIAL CORRESPONDENCE.

I 5352. All officers shall file and preserve all official documents received and copies of all official letters and indorsements sent. Suitable files containing copies of all orders given and official letters written, and the original of all letters received on public service in all offices on board naval vessels and at shore stations shall be kept and preserved. Commanding officers may take copies of orders or letters sent or received. The system of filing shall be such as to safeguard all official papers and to render them readily accessible for reference. A flat-filing system shall be used when practicable.

I 5310. Officers commanding fleets, squadrons or stations, and other officers having a regular correspondence with the Navy Department shall number their letters.

All correspondence shall be typewritten if practicable, but should a typewriter be unavailable, the communication must be legibly written without erasures of interlineations.

Record (non-copying) typewriter ribbons shall be used.

Letters and indorsements shall not be press copied, but a sufficient number of carbon copies shall be made in lieu thereof for the files or other purposes. The name of the signing officer shall be stamped or otherwise placed on all copies.

I 5311. For official correspondence in the Navy, whether letter or indorsements, letter paper shall habitually be used. For the original or first copy, it shall be white linen typewriter paper, 8 by 10 ½ inches in size, weighing approximately 4 ½ pounds per ream of 500 sheets of that size. For file copies, a green-tinted paper of the same size and weighing 3 pounds per ream shall be used. For additional carbon copies, thin paper other than green shall be used.

Typewriter cap, used only in special cases, shall be 8 by 13 inches in size, but otherwise similar to letter paper.

Paper for letters and indorsements shall have two holes punched in it, the upper edges of the holes to be ½ inch from the top of the sheet and the center of the holes to be 2 ¾ inches apart and equal distant from the center of the sheet in order that the sheets may be uniformly fastened together.

I 5312. The forms prescribed in this article shall apply to all correspondence within the naval service, with the state naval militia organizations, and with such department as may adopt similar form of correspondence, but not with departments, officials and persons that have not adopted these or similar forms.

Letters shall begin with the ship or station, place, and date. The upper line of the heading shall be about 1 ½ inches from the top of the page.

The official designation of all vessels of the Navy shall be the name of the vessel proceeded by the letters U. S. S. The word flagship shall follow the name of the vessel in the heading of a communication emanating from the office of a flag officer.

In communications dated on board a vessel at sea, the latitude and longitude shall be stated if exactness be necessary, otherwise the expression "Passage.....to....." shall be used.

Following the heading and date, in letters and indorsements, the official designation, or having no other official designation than title, the name and rank of the writer, preceded by the word "From" shall be written at the left side of the page. "From" shall not be used when the letterhead indicates the writer.

On the line below "From," if used, otherwise in place of it, and preceded by "To" at the left of the page, shall appear the official designation of the office or official addressed; following this the channel through which the communication is to pass.

Following the address, the subject of the correspondence, briefed, shall be written across the page, preceded by "Subject."

The brief of the subject should be written in about the same form and terms as would be used in indexing the communication in filing; for example: "Delaware; feed pumps; recommends

change in type." "Navy Yard, New York; Dry Dock No. 1; reports damage to caisson struck by tug."

The subject shall not be repeated at the beginning of an indorsement except when required by the filing system of the writer's office to identify the file copy, or when the indorsement begins on a new sheet.

After the subject, the references to previous correspondence on the same subject, if any, shall be briefly indicated, preceded by "Reference."

In acknowledging, answering, or referring to official communications, the file number (letters as well as figures) and date shall be indicated in the "Reference." References shall be lettered in small letters, and may be referred to in the communications as "Reference (a)," etc.

When the plan that has been given a file number is referred to in the correspondence, this number should be stated in connection with such reference.

Following "Reference," if any, the inclosures shall be briefly indicated, preceded by "Inclosure" at the left of the page.

Inclosures shall be lettered in capitals and, where necessary, the method of forwarding, whether inclosed, under separate cover, or by express, shall be indicated. The absence of "Reference" or "Inclosure" will indicate that no reference or inclosure accompanies the communication.

The file number of the letter or indorsement shall be placed in the upper right corner, about 1 inch from top and 1 inch from the right edge of the page. The abbreviation or initials of the section or division to which the correspondence is prepared shall appear just below the file number in the upper right corner.

The body of letters and indorsements shall be written single spaced, with one double space between paragraphs. Each indorsement shall where possible, be written on the same sheet as the preceding letter of indorsement, with a space of about ½ in intervening. A line, or line of dashes, shall be drawn across the

sheet below the letter and each indorsement, leaving a ¾-inch space between this line and the last line of writing for the signature.

Paragraphs in letters and indorsements, or other official paper shall be numbered. Subparagraphs shall be lettered, thus: (a), (b), etc. The lettering of subparagraphs shall run consecutive irrespective of the paragraphs. Thus, if the first paragraph contains subparagraphs (a) and (b), subparagraphs in the second paragraph should be lettered (c), (d), etc.

The body of the letter shall begin and end without any ceremonial form or expression, such as "Sir," "I have the honor to report," "Very respectfully," etc., and shall be followed by the signature of the writer without designation of rank, title or office. Information will be imparted, reports made, and questions asked directly, dispensing with such introductory phrases as, "The bureau informs you that," "Information is requested as to," "If directed," etc. With the exception of "M. C.," to distinguished members of the Marine Corps, such words and initials as "U. S. Navy," "U. S. S." "U. S. N.," shall not be used in the body of the letter. "Bureau of Ordnance" and "Navy Department (Operations)" shall be used instead of "Chief of Bureau of Ordnance." "Navy Department (Division of Operation of the Fleet)," etc.

When any article referred to in a communication is forwarded under separate cover, it shall be tagged and plainly marked in the following manner: "From Commanding Officer, U. S. S.....accompanying letter (or indorsement) No. .....date..... If possible this shall appear also on the box or package carrying the inclosure.

Stamps showing the date of receipt of papers shall be so placed as not to occupy any writing space. If stamps constituting pro forma indorsements, such as "Received and forwarded," "Referred for action," etc., are used, they will be placed on the face of pages as though written in a more formal manner, and will be numbered.

Indorsements, whether written or stamped, except those referred to in the next paragraph, shall be placed in regular order, beginning on the last page of the letter, immediately below the signature, if there be room there; if not, additional full-sized sheets shall be appended to the letter to accommodate them. Indorsement slips shall not be used, except on correspondence with other departments using such slips.

All indorsements affecting pay, mileage, transportation, and traveling expenses shall be placed on the face of the original order involving travel, if practicable, otherwise on the back of the order. Such indorsements shall never be placed on sheets which might be detached from the original order.

Only one side of the sheet shall be written upon, and a margin of ¾ inch shall be left on each side and at the bottom of the sheet.

I 5313. The sheets of a letter or report shall be arranged in regular order from bottom to top, *i. e.*, the first sheet on the bottom, the last sheet on top. Inclosures, if any, shall be attached in regular order on bottom of the letter, all securely fastened together, the head of the fastener underneath and the ends turned over the face of the correspondence in order that the last sheet may be readily removed to place indorsements thereon. Additional sheets bearing indorsements shall be attached, each on top of the preceding one, on the face of the correspondence, so that the last endorsement shall be uppermost. Whenever an indorsement begins on a new sheet, the subject shall be repeated. Each page of letters and indorsements shall be numbered in the middle of the page about ½ inch from the bottom. These numbers shall run consecutively throughout the correspondence.

When folding is necessary, letter paper shall be folded in three and typewriter cap in four equal folds parallel to the writing.

I 5322. In general, all communications shall be addressed to those who, by regulation or law, have cognizance of the subject presented, or are authorized to take action thereon.

All official communications intended for officers holding positions with recognized titles shall be addressed to them by title and not by name, as "The Secretary of the Navy," "Bureau of Navigation," "The Commandant," "The Commander in Chief.....Fleet (or Squadron)," "The Commander, ...Squadron (or Division)," "The Commanding Officer."

An officer left in temporary command of a station, fleet, squadron or division, or, in general, of any command, shall be addressed as if he were the regular commanding officer, on the principle that it is the office and not the person that is addressed. The temporary incumbent shall so transact the business that necessary copies shall be preserved in the files of the absent superior officer's office, using the stationery of that office when practicable.

Except from ships in commission, communications relating solely to subjects with which a bureau is intrusted shall be addressed to the chief of that bureau.

I 5307. As a general rule, a letter shall be answered by a separate letter and not by indorsement. This regulation is not intended to prevent the use of stamped or written indorsements on papers or reports of which copies are not retained, or to prevent the use of indorsements on papers necessarily referred to several bureaus or offices; it is intended to prevent the practice of having an original letter returned to the writer by an indorsement containing the report or information requested, and having in the indorsement a request for the return of the papers to the office or person to which they were originally sent, as such procedure necessitates increased clerical work in copying the indorsement and requires the papers to be mailed three times. When the original is answered by a separate letter each office has a complete record of the correspondence without extra work, and the papers are sent through the mails twice instead of three times.

Separate letters shall be written on separate subjects unless the subjects are of like nature.

All communications, except such as require neither action nor reply, shall be acknowledged. If received by telegraph or cable the acknowledgment shall be made by the same means.

I 5308. Communications received by a bureau or office containing information, a knowledge of which is necessary or would be useful to the department, or any other bureau or office, shall be promptly referred accordingly, or copies thereof shall be furnished.

Examples of the forms of correspondence described above may be seen by referring to I 5312, Navy Regulations.

Requisition and Voucher Forms.

When the procurement of supplies in the Medical Department of the Navy becomes necessary the first step is to determine the source from which the supplies are to come, that is, are they such as are carried in stock or can most conveniently be furnished by a naval medical supply depot; are they kept in store for issue by a general storekeeper, or, will it be necessary to purchase them in the open market. In the procural of supplies from either of these sources a requisition is required, and the source decides the proper form of requisition to submit. The several requisition forms in use by the Medical Department of the Navy may, therefore, be classed as follows:

1. Supply Depot { Form B, Form Ba Form 4 }

2. Open purchase { Medicine and Surgery Form No. 1 (supplies and services, shore stations). Supplies and Accounts Form No. 44 (supplies and services afloat). }

3. General Storekeeper—Stub Requisition—Supplies and Accounts forms, ashore and afloat.

It should be stated that the Bureau of Medicine and Surgery has established naval medical supply depots at Brooklyn, N. Y., Mare Island, Cal., and Cañacao, P. I., where most of the medical supplies used in the Navy are purchased in large quantities for the depots by the Bureau of Supplies and Accounts on requisi-

tions submitted by the depots and approved in the usual way by the Bureau of Medicine and Surgery. These supplies are stored for issue from time to time upon approved requisitions to the medical departments of the several ships and stations.

An open purchase requisition, as the name indicates, is one under which the supplies are to be purchased in the open market after competition. Certain classes of medical supplies are exempt by law from *newspaper* advertisement, but none may be purchased, except by the proper representative of the Bureau of Supplies and Accounts, after competition between two or more dealers by means of proposals or bids, and all purchases and payments are made by that bureau.

Any stores carried in stock by a general storekeeper for issue in the service may be procured on stub requisitions (S. and A. forms) prepared and submitted by the head of the department concerned.

All requisitions concerning the medical department of a ship, hospital or other shore station, except stub requisitions, are numbered consecutively throughout the fiscal year, which begins on July 1 and ends on June 30 of the following year. On June 30 of each year, therefore, the series for that fiscal year becomes complete, and the first requisition after that begins again with number 1 of the new fiscal year. Duplication of requisition numbers in one fiscal year, a common occurrence, should be scrupulously avoided. This causes confusion both in the bureau and in other offices handling the requisitions, and complicates any correspondence that may become necessary in connection with such requisitions. This duplication is an evidence of inexcusable carelessness in the clerical department concerned.

REQUISITIONS FOR STORES FROM A SUPPLY DEPOT.

A Supply Table of the Medical Department of the Navy is issued by the bureau which is intended as a basis for requisitions for stores from supply depots. It contains a printed list, arranged

alphabetically and by classes, of supplies kept on hand for issue, with allowances for quantities based on the complement of men on a ship or station. It also contains an appendix giving itemized lists of the cases, pouches, etc., included in the Supply Table. Every office where requisitions for the medical department are prepared should have a copy of this Supply Table on file.

Full instructions for preparing requisitions for stores to be drawn from a supply depot are printed on the several forms, and these instructions must be followed in each instance

A brief description only of these requisition forms is here necessary.

Form B contains a printed list of the medical supplies as given in the Supply Table, and is intended for use when a large number of the articles is required.

Form 4 is a blank form to be used when a limited number of articles listed on Form B is required; also for indispensable, articles not on Form B, which can most conveniently be furnished by a supply depot. Separate requisitions must, however, be prepared in each instance for articles listed on Form B, and for articles not listed on Form B. The latter requirement is important and should be strictly adhered to, for the reason that supply depot accounts are kept in accordance with this classification. When a Form 4 requisition is submitted for articles not on the Supply Table a letter of explanation as to their necessity should accompany the same.

Form Ba is a special requisition form embracing a supplementary list of articles (on charge, but not included in the Supply Table) in store at the naval medical supply depot.

These three separate forms, B, Ba, and 4, are all prepared in quadruplicate (and retained copy) giving the number of the requisition, and marked, FIRST, SECOND, THIRD, FOURTH. They should be forwarded for approval as directed on the forms. It should be evident that no money values are to be entered by the maker on the face of any supply depot requisition, since the

stores are purchased in the open market on requisition for the supply depot and their issue value determined in that way. When priced in the depot the FIRST and SECOND are returned to the maker of the requisition as priced invoices, and he is to enter the values on the THIRD. After receipt of the stores the forms are signed by the receiving officer, and they then become vouchers. The FIRST is returned to the supply depot, the SECOND to the bureau, and the THIRD is retained for the files of the ship or station. The FOURTH, retained in the bureau on approval of the requisition, is destroyed when the receipted SECOND has been received and filed.

A supply depot must necessarily have some authority and a system of accountability for making expenditures from their stock. The FIRST of every approved requisition is then not only a depot's authority for the issue of the stores enumerated thereon, but becomes, when receipted, a voucher in the depot's system of accounting for the expenditure of their stock. It should be plain therefore that no stores may be issued from a supply depot except upon an approved requisition, and in every instance requests for such supplies should be submitted for approval on the proper Medicine and Surgery requisition forms and not by letter.

REQUISITIONS FOR OPEN PURCHASE.

Medicine and Surgery Requisition Form 1 is used for all purchases of supplies and services on shore for the Medical Department of the Navy.

Supplies and Accounts Requisition Form 44 is used by the Medical Department of the Navy for all purchases of supplies and services afloat.

Blank forms are used that indicate the information required concerning the necessity and character of and quantity and estimated cost of the supplies or services to be purchased.

Each requisition is accompanied by so many memorandum copies as may be required. The estimated cost of each item and the total is entered upon the memorandum copies only. The

original bears signatures, and, except in the cases of formal contracts, accompanies the original of the public bill, and finally lodges with the accounting officer (auditor) of the Treasury. One memorandum copy of the requisition remains in the Bureau of Medicine and Surgery, two in the Bureau of Supplies and Accounts, and one in the office of the purchasing pay officer.

Requisitions must give such accurate information as will enable the purchasing pay officers and the bidders readily to understand what is required, and items must be arranged so that articles of a similar nature may be grouped. Articles or services coming under different appropriations may not be combined on one requisition. Proprietary articles must not be called for when it can possibly be avoided, but when called for the officer making the requisition must certify that "the article and no other will answer the necessities of the service."

A hospital corpsman preparing requisitions for open purchase should be familiar with Section 3, Chapter 39, Navy Regulations, and the instructions contained therein must be carefully followed.

Copies of all instructions issued from time to time by the Bureau of Supplies and Accounts relative to the preparation of open purchase requisitions should be filed so that ready reference thereto may be made.

Particular attention should be given the question of procuring materials under standard specifications, and requisitions should adhere strictly to such specifications.

SUPPLIES FROM GENERAL STOREKEEPERS ON STUB REQUISITION.

Stub requisitions on a general storekeeper ashore or afloat are prepared by the head of the medical department on the prescribed forms (S. & A.) and do not require the approval of the Bureau of Medicine and Surgery. For the latter reason and the further fact that this arrangement is local, sub requisitions

are not numbered in the regular series of the fiscal year. They should, however, be numbered consecutively by fiscal years in a series of their own, and duly filed as vouchers when the transaction has been completed.

Whenever practicable, advantage should be taken of this means of securing needed supplies that are carried in stock by a general storekeeper. These supplies are purchased in large lots at a reduced cost; they are standard goods and their quality can be depended upon. Furthermore, this method of procural is direct and so avoids the delay consequent upon the bureau's approval of a more formal requisition and the purchase and delivery of supplies thereunder.

PUBLIC BILLS.

When supplies purchased under an open purchase requisition have been received and accepted, the next step is the preparation of a public bill for their payment.

Public bills are prepared on blank forms furnished for the purpose. Medicine and Surgery Bill Form 5 is used with Requisition Form 1; Supplies and Accounts Bill Form 51a is used with Requisition Form 44. These blank forms have been previously submitted to the comptroller of the treasury, whose approval of same as to completeness is required by law before they may be used. An original and a sufficient number of memorandum copies are required. The original, accompanied by the original of the requisition, finally lodges with the auditor. One memorandum copy remains in the Bureau of Medicine and Surgery, two in the Bureau of Supplies and Accounts, one with the pay officer who makes the payment, one with the accounting officer of the yard, and one stamped "Dealer's Copy," accompanies the check to the payee as an identification of the payment. The office in which the requisition and public bill originate, of course, retains copies of each which are recorded in the billbook. Signatures are only affixed upon the original copy of a public bill. The

memorandum copies are true copies, except that the places, for signatures are filled by stamping or typing therein the names.

All articles on a requisition may not be procured from one dealer, in which case two or more public bills may be necessary in connection with but one requisition; in such instances the original of the requisition accompanies the first public bill made, and notation of the disposition is appropriately made on all subsequent public bills under the requisition.

Medical officers are responsible for the correctness of the certificate of inspection and acceptance, and the purchasing pay officers for the correctness of the certificate as to method of purchase and as to prices. It is expected of both to exercise special care not only as to accuracy of figures, but that the appropriation involved shall be correctly stated in title and fiscal year.

The requisition and voucher forms have been carefully prepared to meet every legal requirement, and it is forbidden that the phraseology of the forms should be altered when either supplies or services are furnished or performed.

Special Exigency Voucher.

Medicine and Surgery Bill Form 6 (on shore only).

This voucher form is for use at hospitals and at shore stations in cases of sudden emergency, such as broken water, steam, or gas pipes; falling walls or ceilings; broken heating or cooking apparatus; and in all cases where the work must be done immediately; also for the immediate purchase of articles not provided for on approved requisitions for the care and welfare of the sick. It shall never be used if time will allow for the procurement of the articles or services on an approved requisition. The exigency clause on bill form 6 is certified to by the senior medical officer of the hospital or station, after which it is forwarded to the Surgeon General for approval, and subsequently transmitted to the Bureau of Supplies and Accounts for action prescribed for other public bills.

Special Supplies and Method of Procural.

Vaccine is procurable upon application by letter or telegram to the Bureau of Medicine and Surgery. On the Pacific coast, from the supply depot, Mare Island.

Antityphoid prophylactic, serums, etc., are procurable by letter or telegram to the Bureau of Medicine and Surgery.

Tubes, culture medium are procurable upon application by letter or telegram to the United States Naval Medical School, Washington, D.C.

Microscopical Outfits are furnished by the Naval Medical School, Washington, D. C.; should be required on Form 4, the requisition to contain this item and no other.

Transfer of Labor from Navy Yard.—S. & A. Form required direct request upon head of department; approval of commandant.

Supplies under Navy Pay Office Contracts.—Medical officer in command makes order upon contractor.

Articles Supplied on Annual Contract of the Bureau of Yards and Docks.

When it becomes necessary to prepare a requisition at a naval hospital or shore station for furniture, rugs, etc., the contract schedule covering annual contracts entered into by the Bureau of Yards and Docks, copy of which may be found in the office of the public works officer of the station, should be examined to ascertain whether items supplied under the annual contract will not fulfill requirements.

Articles desired under such contract should appear on a separate requisition prepared in the usual way on Form 1, and, in making selections from the contract the following information should be given in every instance on the face of the requisition and in the order here indicated:

(a) Item No. of contract.
(b) Name of article required.
(c) Pattern No. of article required.

(d) Kind of wood of article required.
(e) Upholstering No. when applicable.

This information is necessary to make clear to the Bureau of Yards and Docks what is desired when placing the order with the contractor.

The contractor ships the articles to the general storekeeper of the station for inspection and delivery to the medical department concerned. The general storekeeper also prepares the necessary vouchers for the payment for the stores, so that copy of vouchers to complete the files of the medical department of the station must be procured from the general storekeeper.

DEPARTMENTAL CONTRACTS.

When a formal departmental contract is entered into by the government for material or services for the Medical Department of the Navy and the work is carried on under supervision of the Bureau of Yards and Docks, vouchers for payment of bills under the contract are prepared by the public works officer having direct supervision of the work, and copies of all vouchers to complete the files of the medical department of the station concerned should be procured from the office preparing the vouchers.

It is very important that a full set of vouchers for each contract be recorded and filed so that a complete record of the cost, date of completion, etc., of work will show on the billbook.

Blank Forms and Returns of the Medical Department of the Navy, Other Than Requisition and Voucher Forms.

With the object of securing uniformity and accuracy of the reports and returns connected with the duties of the Medical Department of the Navy certain blank forms have been established, and the specific purposes designated for which such forms shall be used. The data contained in these reports are the basis for all of the bureau's statistical compilations, and further, these reports become

permanent and highly important records upon which the bureau is compelled to rely for the medical histories of the officers and enlisted men of the Navy when furnishing specific information of importance demanded by other departmental bureaus, and of vital concern to the individual. It should, therefore, be obvious that these reports must be without error; furthermore, in combining and tabulating these reports, an error in any one makes the whole faulty, and impairs any deductions made from such statistics.

To further the uniformity and accuracy desired and to aid those preparing these forms, detailed instructions for preparing each particular form is printed on the form itself, or the information desired is fully indicated in the printing and wording on the form. The great difficulty with printed instructions of this character is to have the men for whose guidance they are intended read them and then comply strictly with the directions given. This is most important, for only in this way can mistakes, and the needless correspondence entailed thereby, be eliminated, and a repetition or correction of the work be avoided.

Before attempting then to prepare any bureau form or report it becomes necessary to carefully read the instructions pertaining to the form and to understand their meaning.

These forms, as well as the instructions for preparing them, are subject to change, so that the form itself should be resorted to for the necessary directions in its preparation.

In the table of the forms here given they are arranged in groups according to the time when each form is to be submitted, *i. e.*, weekly, monthly, quarterly, annually, etc., with additional columns to make clear their handling in general. Forms peculiar to a few stations and those whose use is limited have been omitted; their acquaintance may well be delayed until such time as their preparation becomes necessary by the individual.

BLANK FORMS OF THE MEDICAL DEPARTMENT OF THE NAVY OTHER THAN REQUISITION AND VOUCHER FORMS.

(Also consult Chapter 43, Navy Regulations)

	Name of report.	Form number, etc.	No. of copies	To whom sent	Remarks
1.	*Daily.* Morning report of sick.	Special M. & S.	1	Commanding Officer.	Made after sick call.
2.	Binnacle list	Special M. & S.	1	Officer of deck.	Do
3.	*Weekly.* Memorandum of Hospital Corps.	Special form.	1	Bureau M.& S.	Forwarded Saturdays.
4.	Report of sick.	Special form 1	2	Bureau and Comdt.	Do
5.	Pay roll.	S.& A. 84.	1	Pay Officer.....	For civil employees. Monthly summary to Bureau M. & S.
6.	*Monthly.* Summary of payroll	S.& A. 184.	2	.....do.....	Civil employees
7.	Recapitulation of payroll.	S. & A. 184a.	1	.....do.....	Do
8.	Estimate of funds.	S. & A. 144.	1	.....do.....	Not later than 3d of month.
9.	Return of nurses.	115148-7.	1	Bureau M. & S. To Comdt....	Nurse Corps form.
10.	Sanitary report.	Letter	1	To Comdt.....	
11.	*Quarterly.* Abstract of patients.	F.	1	Bureau M.& S.	Also when out of commission.
12.	Statistical report.	K.	1	.....do.....	Do
13.	Subsistence report. Hospital Corps	88051.	2	.....do.....	For auditor.
14.	Return of medical stores	V.	1	.....do.....	Supply Depots only.
15.	Recruiting statistics.	X.	1	.....do.....	Prepared from rough X.
16.	*Annually.* Sanitary report.	Letter.	1	.....do.....	Jan. 1 and when out of commission.
17.	Report of operations	P.	1	.....do.....	Do
18.	Priced invoice	Y.	1	.....do.....	Not later than June 15.
19.	Inventory of property	D. & Da.	1	.....do.....	June 30.
20.	Statement of cost of maintenance	125345	2	.....do.....	Made up from billbook.

SHIPS: 1, 2, 11, 12, 16, 17, 19, 22, 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 45,46.

HOSPITALS: 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 16, 17, 18, 19, 20, 21, 22, 25, 26, 27, 28, 29, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 42, 43, 44, 45, 47, 48, 49, 50, 51.

NAVY YARDS AND STATIONS: 1, 5, 6, 7, 10, 11, 12, 16, 17, 19, 22, 23, 25, 26, 27, 28, 29, 31, 32, 33, 34, 35, 36, 37, 38, 40, 41, 45.

TRAINING STATIONS: 1, 3, 10, 11, 12, 16, 17, 19, 22, 23, 25, 26, 27, 28, 29, 31, 32, 33, 34, 35, 36, 37, 38, 40, 41, 45.

	Name of report.	Form number, etc.	No. of copies	To whom sent	Remarks
21.	*Annually.* Application for headstones.	126221.	2	.....do.....	For unmarked graves in naval cemeteries.
22.	Medical history (officers.)	H-green.	All loose sheets.	.....do.....	Except in the case of midshipmen, when they will be retained until termination of service as such.
23.	Recruiting statistics	X.	1	.....do.....	From rough X.
24.	*When Necessary.* Survey of property	C.	2	.....do.....	Supply Depots only.
25.	Survey of property	Ca.	2	.....do.....	
26.	Hospital ticket	G.	1	To hospital.....	R-2961.
27.	Abstract of patients	Rough F.	1	Retain in files.	
28.	Health record	H-Gray.	1	Bureau M. & S.	Upon termination of enlistment or promotion to off., R-2961 (2), I-2117.
29.	Health record	H-Green	1	.....do.....	Upon termination of active service, R-2957.
30.	Casualty report	K_2	2	Bureau M. & S. and Fleet Surgeon	After an engagement only.
31.	Request for survey	L.	1	Senior officer present.	R-2960
32.	Report of survey	M.	3	Bureau M. & S.	Additional copy to Fleet Surgeon, if in squadron.
33.	Report of death	N.	2	.....do.....	3 copies required in case of officer, R-2963.
34.	Request for blank forms	O.	1	.....do.....	
35.	Clinical chart	Q.	1	Retain for files.	
36.	Eff. report H.C	Nav. form 238.	1	Bureau M. & S.	I-5222 (y)
37.	Change in H.C.	125682.	1	.....do.....	Postcard

	Name of report.	Form number, etc.	No. of copies	To whom sent	Remarks
38.	Exam report H.C.	37481.	2	Bureau M. & S. and C.O. having accts.	R-3551 (8)
39.	Transfer of patients to other than Naval Hospital.	Letter.	2	Bureau M. & S. and Fleet Surgeon.	R-2962, R-3582. R-4532-34. R-2966
40.	Report of epidemics.	Letter.	2	.....do.....	
41.	Journal of Med. Dept	Book.	1	Bureau M. & S.	When out of commission.
42.	Ration notice	S.	1	Pay Officer. When Nav. Aux. Service to Master of ship.	"S" for admission of patient.
43.	*When Necessary.* Ration notice	T.	1	.....do.....	"T" for discharge of patients.
44.	Retention or admission of supernumeraries.	Letter.	1	Bureau M. & S.	
45.	Transfer of stores.	D. & Da.	3	Bureau M.& S., receiving officer, transferring officer.	
46.	Sanitary conditions and suggestions.	Letter.	1	Commanding officer of ship.	R-2953, R-2954.
47.	Admission and discharge of officer.	Letter.	1	To Comdt.....	
48.	Burial records	Book.		Bureau M. & S.	When hospital is out of commission.
49.	Ambulance book	Book.		.....do.....	Do
50.	Register of patients	Book.		.....do.....	Do
51.	Billbook and commissary Ledger.	Books.		.....do.....	Do

Navy Regulations and Instructions That Concern the Hospital Corps and With Which Hospital Corpsmen Should be Familiar.

The Medical Department, Hospital Ships and Medical Officers

Chapter 27, Navy Regulations.

The Medical Officer of a Ship, Chapter 19, Naval Instructions.

Duties of a Pharmacist, R 3236 and I 2351, 2352.

Appointment of Pharmacists, R 3317.

Classification of Pharmacists as Staff Officers, R 1013.

General Duties of Hospital Steward, R 3402.

Enlistment of Hospital Corpsmen, R 133 and 3525.

Rating, Promotion, etc., Hospital Corps, R 3551, pp. 8 and 9.

Pay of Enlisted Men of Hospital Corps, R 4427 and 4428.

Instruction of Members of Hospital Corps, I 2642.

Duty of Hospital Corps Restricted, R 1540.

Division on Board Ship to Which Hospital Corpsmen Belong, I 2130

Hospital and Ambulance Service Performed by Hospital Corpsmen, I 3261.

Hospital Corps Members Forbidden to Have Any Financial Dealings With Patients, I 3260.