National Assessment At Form III 2012

A Handbook for Schools

English
French
Mathematics
Computer Studies/Literacy
Biology
Chemistry
Physics

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National Assessment at Form III

1. Aims and Objectives

The National Assessment at Form III has specific aims and objectives. It serves to reflect achievement after three years of secondary education and is also meant for formative purposes to promote quality learning and teaching by helping to identify the strengths and weaknesses in the knowledge and skills that students have acquired.

It is expected that, along with the National Curriculum Framework (Secondary), the National Assessment at Form III will assist in the reshaping of the Lower Secondary Curriculum by impacting positively on classroom practices and promoting greater engagement in learning at school on the part of the students. The aims and objectives can be summarised under the following main headings:

- Evaluate the skills and competencies acquired by the students
- Identify the strengths and weaknesses in the knowledge and skills of students
- Promote quality in the teaching and learning process

2. What will be assessed in 2012?

The Assessment in 2012 will be carried out in the following subjects: English, French, Mathematics, Computer Studies/Literacy, Biology, Chemistry and Physics. Particular emphasis will be placed on:

- Communication skills related to reading and writing in English and French
- Mathematical skills and concepts
- Computer skills and competencies
- Scientific skills and concepts

For each of these skills, specific assessment objectives/learning outcomes have been defined.

3. Proposed Assessment Scheme and Format of Question Papers

A proposed assessment scheme and paper format for each learning area are given below.

3.1 Languages (English and French) – 100 marks

In both English and French, emphasis will be laid on reading and writing skills. Communicative competence in those languages will be assessed through a range of given situations and pupils will need to provide appropriate answers to these stimuli. Knowledge and application of grammar will be assessed in context.

Single papers will be set and will last for 1 hour 45 minutes. Each paper will be made up of two sections, Section A (Reading) and Section B (Grammar and Writing). A number of reading and writing tasks will be set and these will be graded in terms of difficulty, ranging from simple exercises to progressively more complex ones. A range of question types will be used, including True/False items, multiple choice items, structured and open ended questions. All the questions are compulsory. A choice will be given for the Essay question. A description of the papers is given in table 1.

Table 1: Paper Description for English and French

Section	Questions	Weighting
Section A (Reading)	A range of reading tasks, graded in terms of difficulty level	**40%**
Section B (Writing and Grammar)	A range of tasks, assessing grammatical knowledge and writing skills	**60%**

3.2 Mathematics – 100 marks

In Mathematics, emphasis will be laid on problem solving skills. Ability to apply mathematical concepts in given contexts will be tested in varied ways. The weighting of the two main assessment competencies is given in table 2.

Table 2: Paper Description for Mathematics

Assessment Objectives	Weighting
Knowledge and understanding	**30%**
Problem solving skills	**70%**

A single Mathematics paper will be set. It will last for 1 hour 45 minutes. The paper will consist of one section. The questions set will be graded with easy questions at the beginning of the paper and more challenging questions at the end of the paper.

15 to 20 questions will be set and some questions may have sub-parts.

3.3 Computer Studies/Literacy – 100 marks

In Computer Studies/Literacy, the items will focus on the content knowledge and on the basic computer skills which students are expected to have acquired after three years of secondary schooling.

The paper will comprise two sections: **Section A** and **Section B**. **Section A** will carry a weighting of 55%. The weighting of **Section B** will be 45%. All the questions set in **Section A** will be compulsory and will consist of a range of types of questions, including Multiple Choice items, Filling in the blanks, Matching, True/False items, Short Answer questions, Tick boxes and Structured questions. **Section B** will consist of four options based on the computer packages (Word Processing, Spreadsheet, Database) and Program Flowchart. Students will be required to answer **all** questions from **any three options**. Each option will carry a weighting of 15%.

The Computer Studies/Literacy paper will be of **1 hour 45 minutes** duration and will carry **100 marks**.

Table 3: Paper Description for Computer Studies/Literacy

Section	Types of Questions	Marks
A **All** questions compulsory	Multiple Choice items, Filling in the blanks, Matching, True/False items, Short Answer questions, Tick boxes and Structured questions	55
B Choice of **3 options** with all questions compulsory	Option A: Word Processing Option B: Spreadsheet Option C: Database Option D: Program Flowchart	45

3.4 Biology, Chemistry and Physics

Biology, Chemistry and Physics will be assessed through three separate papers. **Each paper will be of one hour duration and will carry 50 marks.** Students will have to attempt **all** the questions. The use of calculators is not allowed. Students are expected to bring along all materials (such as mathematical sets and rulers) as may be required during the conduct of the examinations.

The Science papers will comprise different types of items, namely Multiple Choice Questions, Short Answer and Open-ended Questions.

The assessment objectives and their respective weighting for the three different papers are given in table 4.

Table 4: Assessment Objectives for Biology, Chemistry and Physics

Assessment Objectives	Weighting
Knowledge with understanding	60%
Handling information and problem solving	30%
Scientific investigation	10%

4. Specimen Question Papers

The specimen papers are currently being updated in the light of changes brought to the different syllabuses.

5. Syllabus Aims and Assessment Objectives

Overarching syllabus aims as well as more specific learning objectives have been defined for each subject and these are detailed below.

5.1 ENGLISH

Syllabus Aims

1. Develop students' ability to communicate effectively in English.
2. Encourage students to enjoy and appreciate the variety of texts available in the English Language.
3. Develop imagination and creativity.

Assessment Objectives

Reading

Students will be assessed on their ability to:

1. respond to texts and organize information read;
2. understand explicit meanings;
3. identify central themes and ideas;
4. draw inferences;
5. identify characters and follow the sequence of events;
6. provide a personal response to the text;
7. interpret and evaluate the information read;
8. explain the meaning of words.

Writing

Students will be assessed on their ability to:

1. communicate and demonstrate adequate control of spelling, punctuation, grammar and syntax;
2. produce narrative and non-narrative texts (informal letters, simple and factual reporting);
3. use a varied range of vocabulary and sentence structures;
4. write for different purposes and different audiences (e.g. to inform, to describe, to entertain, etc.);
5. use stylistic devices to write for effects (e.g. create suspense, humour, irony, etc.);
6. display originality and creativity.

5.2 FRENCH

Objectifs Généraux

L'élève doit être capable:

1. de lire et de comprendre une variété de textes;
2. de lire avec plaisir et intérêt des textes sur des sujets variés;
3. de communiquer efficacement à travers différents types d'écrits;
4. de faire preuve d'imagination et de créativité.

Objectifs Spécifiques

Lecture/Compréhension

L'élève doit être capable:

1. de reconnaître, de lire et de comprendre des textes de la vie de tous les jours (mode d'emploi, dépliant, programme de télé, …);
2. d'obtenir des informations de différentes sources (dictionnaire, encyclopédie, média, …), les organiser et s'en servir;
3. lire une variété de textes, de différentes longueurs et sur des sujets différents et
    a) retrouver des informations spécifiques;
    b) identifier des personnages;
    c) suivre l'ordre logique et chronologique;
    d) comprendre les thèmes (idées/éléments principaux);
    e) identifier l'idée centrale;
    f) inférer et déduire;
    g) donner son opinion;
    h) expliquer des mots/expressions.

Production Ecrite

L'élève doit être capable:

1. d'écrire lisiblement et de manière soignée;
2. d'avoir une bonne orthographe;
3. de maîtriser les signes de ponctuation;
4. d'employer une variété de structures syntaxiques;
5. d'utiliser correctement les notions grammaticales se rapportant aux verbes et aux accords dans les productions écrites;
6. de remplir une fiche;
7. d'écrire une lettre simple pour demander/donner des informations;
8. de produire de courts textes (carte de voeux, carte postale, mot d'excuse, petite annonce, …);
9. de produire des paragraphes/des textes cohérents (narration, description, …) sur des sujets variés;
10. de faire preuve d'originalité et de créativité dans ses écrits.

5.3 MATHEMATICS

Syllabus Aims

Students should:

1. acquire and apply skills and knowledge related to number, measure, geometry, algebra, probability and statistics;
2. develop problem solving skills and an ability to reason logically;
3. develop mathematical language as a means of communication and investigation;
4. acquire a foundation appropriate for further studies in Mathematics as well as skills and knowledge pertinent to other disciplines.

Specific Objectives

Students should be able to:

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1. Numbers	• use whole numbers, integers (positive, negative and zero), prime numbers, rational, irrational numbers, real numbers; • represent integers on a number line; • continue given number sequences, recognise patterns within and across different sequences and generalise to simple algebraic statements.
2. Factors and Multiples	• use common factors and multiples; • perform and use prime factorization; • find H.C.F and L.C.M.
3. Squares, square roots, cubes and cube roots	• calculate square, square roots, cubes and cube roots of numbers.

4. Directed numbers	• use directed numbers in practical situations (e.g. temperature change, tide levels).
5. Vulgar and decimal fractions	• use the language and notation of simple vulgar and decimal fractions; • recognise equivalence and convert between these forms.
6. Ordering	• order quantities by magnitude and demonstrate familiarity with the symbols: $=$, $\neq$, $>$, $<$, $\geq$, $\leq$.
7. Order and Properties of operations	• use the four operations for calculations with whole numbers, decimal fractions, vulgar and mixed fractions, including correct ordering of operations and use of brackets.
8. Measures	• use current units of mass, length, time, area, volume and capacity in practical situations; • express quantities in terms of larger or smaller units.
9. Time	• calculate time in terms of the 12-hour and 24-hour clock; • read clocks, dials and timetables.
10. Speed	• calculate average speed in practical situations.
11. Money	• solve problems involving money and convert from one currency to another.
12. Estimation	• make estimates of numbers, quantities and lengths; • give approximations to specified numbers of decimal places **[Upper bounds & lower bounds are excluded].**

13. Set language and notation

- use set language and set notation;
- use Venn diagrams to describe sets and represent relationships between sets as follows:

  Definition of sets, e.g. A = $\{x: x\ is\ a\ natural\ number\}$

  B = $\{(x, y):\ y = mx + c\}$

  C = $\{x:\ a \leq x \leq b\}$

  D = $\{a, b, c, \dots\}$

Notation:

Union of A and B	$A \cup B$
Intersection of A and B	$A \cap B$
Number of elements in set A	$n(A)$
"… is an element of…"	$\in$
"… is not an element of …"	$\notin$
Complement of set A	A'
The empty set	$\emptyset$
Universal set	ξ
A is a subset of B	$A \subseteq B$
A is a proper subset of B	$A \subset B$
A is not a subset of B	$A \nsubseteq B$
A is not a proper subset of B	$A \not\subset B$

14. Ratio, proportion, rate

- demonstrate an understanding of the elementary ideas and notations of ratio, direct and inverse proportion and common measures of rate;
- divide a quantity in a given ratio;
- solve simple word problems involving ratios, proportions and rates;
- use scales in practical situations

  [Limited to linear scale factor only].

15. Percentages

- calculate a given percentage of a quantity;
- express one quantity as a percentage of another;

- calculate percentage increase or decrease.

16. Personal and Household Finance

- use given data to solve problems on personal and household finance involving earnings, simple interest, discount, profit and loss;
- solve simple problems on commission and hire purchase.

17. Geometrical Terms and Relationships

- use and interpret geometrical terms: point, line, plane, parallel, perpendicular, right angle, acute, obtuse and reflex angles;
- use and interpret vocabulary of triangles, circles, special quadrilaterals;
- draw circles and triangles using a protractor and a compass.

18. Angles

- use a protractor to find unknown angles;
- calculate unknown angles and give simple explanations using the following geometrical properties:

  (a) Angles on a straight line;
  (b) Angles at a point;
  (c) Vertically opposite angles;
  (d) Angles formed by parallel lines;
  (e) Supplementary and complementary angles.

19. Polygons

- use and apply angle properties of triangles and quadrilaterals;
- use and apply angle properties of polygons including angle sum;
- solve problems involving angles and number of sides of regular polygons.

20. Bearings

- interpret and use three-figure bearings measured clockwise from the north (i.e. $000^0 – 360^0$).
  [Diagrams will be given]

21. Circles

- use and interpret vocabulary of circles;
- solve problems involving the circumference and area of a circle;
- determine arc length and area of sector.

22. Algebraic Representation and Formulae

- use letters to express generalised numbers and express basic arithmetic processes algebraically;
- substitute numbers for words and letters in formulae.

23. Algebraic manipulation

- manipulate directed numbers;
- perform binomial expansions;
- factorise expressions of the form:

$$ax + ay$$
$$ax + bx + kay + kby$$
$$x^2 - y^2$$
$$a^2 + 2ab + b^2$$

$ax^2 + bx + c$ (**where *a* = 1**)

- manipulate simple algebraic fractions;
- transform simple and more complicated formulae.
  [Including cases where factorisation is required].

24. Solutions of equations and inequalities

- solve simple linear equations in one unknown;
- solve fractional equations with numerical and linear algebraic denominators;
- solve simultaneous equations in two unknowns by substitution and elimination methods
  [Application and formulation excluded];

- solve quadratic equations by factorisation
  [Restricted to coefficient of $x^2 = 1$];
- formulate and solve linear equations in one unknown from given situations;
- formulate and solve quadratic equations from given situations;
- solve simple linear inequalities.

25. Mensuration

- solve problems involving the perimeter of squares, rectangles and triangles;
- solve problems involving the area of squares, rectangles, triangles, parallelograms and trapezia;
- find surface area using nets;
- calculate the surface area and volume of cubes, cuboids, cylinders and right-prisms.

26. Symmetry

- recognise and draw lines of symmetry in two dimensions.
  [Rotational symmetry excluded]

27. Coordinate Geometry

- calculate the gradient of a straight line from the coordinates of two points on it;
- calculate the gradient of parallel lines;
- interpret the equation of a straight line graph in the form of $y = mx + c$ and obtain the equation of a straight line in any appropriate form;
- generate coordinate points using equations of straight lines.

28. Trigonometry

- apply Pythagoras Theorem and the sine, cosine and tangent ratios for acute angles;
- solve trigonometrical problems in two dimensions
  [Angles of elevation & depression are excluded].

29. Indices

- express numbers in index form;
- use and apply the multiplication and division laws;
- use and apply the power law of indices;
- use zero index

[Negative and fractional indices are excluded].

30. Matrices

- display information in the form of a matrix of any order;
- solve problems involving the calculation of the sum and product (where appropriate) of two matrices and interpret the results;
- calculate the product of a scalar quantity and a matrix;
- solve matrix equations involving addition & subtraction

[Algebra of 2×2 matrices excluded].

31. Statistics

- collect, classify and tabulate statistical data;
- read, interpret and draw simple inferences from tables and statistical diagrams;
- construct and use bar charts, pie charts, pictograms and simple frequency distributions;
- calculate the mean, median and mode for individual data and for ungrouped frequency distributions.

32. Probability

- calculate the probability of simple and combined events in simple cases;
- construct and use possibility diagrams.

33. Vectors in two dimensions

- describe a translation by using a vector represented by $\binom{x}{y}, \overrightarrow{AB}, \underline{a}$;
- represent vectors graphically;
- demonstrate an understanding of the different types of vectors: equal vectors, negative vectors, displacement vectors, and parallel vectors;

- add and subtract vectors;
- multiply a vector by a scalar;
- calculate the magnitude of a vector $\begin{pmatrix} x \\ y \end{pmatrix}$ as $\sqrt{x^2 + y^2}$.

5.4 COMPUTER STUDIES/LITERACY

Syllabus Aims

Develop an understanding of basic computer techniques and foster confidence in the use of computer applications in everyday life.

Assessment objectives are organised around the following topics:

1. Computer System
2. Impact of ICT on society
3. Networking and Internet Applications
4. Program Flowchart
5. Application Packages

1) Computer System

Students should be able to:

- distinguish the features and applications of the four types of computers: microcomputers (desktops, laptops, notebooks), minicomputers, mainframes, supercomputers;
- distinguish between hardware and software and give examples of each;
- identify and state the function of the main components of a general-purpose computer: central processing unit, main/internal memory (including ROM, RAM), input & output devices [keyboard, mouse, joystick, microphone, bar code reader, scanner, monitor, printer (dot matrix, inkjet, laser), graph plotter, speakers, webcam, secondary/backing storage (hard disk, floppy disk, CD Rom, DVD, pen drive and memory cards)];
- state the different units of measurement of storage capacity: bit, byte, kilobyte (**KB**), megabyte (**MB**), gigabyte (**GB**), terabyte (**TB**).

2) Impact of ICT on society

Students should be able to:

- state the meaning of ‘multimedia’ and give some of its uses;
- show an understanding of the following ICT applications and their effects in everyday life: e-learning, e-commerce, e-banking, tele-working, video-conferencing and tools such as webcams and digital cameras;
- state the advantages and disadvantages of the use of the ATM;
- describe the potential health hazards related to the prolonged use of ICT equipment, for example, repetitive strain injury (RSI), back problems, eye problems;
- list ways of preventing the above health hazards;
- state the meaning of ‘computer virus’ and its effects;
- list ways of preventing a computer virus from infecting a computer.

3) Networking and Internet Applications

Students should be able to:

- state the meaning of ‘network’ and list its advantages and disadvantages;
- differentiate between Local Area Network (LAN) and Wide Area Network (WAN);
- define the terms ‘Internet’, ‘www’, ‘e-mail’;
- list the advantages and disadvantages of e-mail over postal systems;
- state the meaning of a ‘search engine’ and its uses.

4) Program Flowchart

Students should be able to:

- identify and use common flowchart symbols: start and end boxes, process box, input/output box, decision box;
- draw flowcharts (involving use of sequence and selection constructs) to solve simple problems;
- dry run flowcharts to determine their outputs.

5) Application Packages

Students should be able to:

- name and describe the uses of various computer applications such as word processing, spreadsheet and database;
- state the advantages of using a word processor, a spreadsheet and a computerized database over manual methods;
- identify the different features of different application packages (word processing, spreadsheet, database) and state their functions (for example, title bar, scroll bar and status bar).

I. Word Processing

Students should be able to:

- apply basic skills to edit and format a text such as:
    - set page orientation;
    - change margins (top, bottom and sides);
    - change the font type (e.g. Arial, Courier, Times New Roman, etc.), font size, font style (bold, italic, underline) and font colour;

- do paragraph formatting – change line spacing, alignment, indentation;
- apply bullets and numbering;
- cut and paste/copy and paste;
- find and replace based on keywords;
- insert graphics, pictures and textbox in the document body;
- add and manipulate tables in the main body of the document;
- make use of spell checkers and the thesaurus;
- insert page number, header and footer;
- save a document;
- save a document under a different name using Save As;
- preview a document.

II. Spreadsheet

Students should be able to:

- show an understanding of the concept of cell, active cell, range, spreadsheet, workbook, formulae and functions;
- apply the following skills when using spreadsheet:
  - set page orientation;
  - change margins (top, bottom and sides);
  - identify cell content: label, number and date;
  - format cells, e.g., changing font type, style, size, alignment, row height, column width, borders and numbers;
  - add and delete: rows, columns, sheets;
  - rename, move and copy worksheets;
  - use formulae and functions (Sum, Average, Min, Max);
  - replicate formula using Copy & Paste and Drag & Drop;
  - sort data;
  - save a workbook.

III. Database

Students should be able to:

- state the meaning of the terms ‘database’, ‘file’, ‘record’, ‘field’ and ‘key field’;
- show an understanding of the structure of a database (field name, field type and field width);
- create and modify a database structure;
- set primary key;
- create, modify and save: tables, queries, forms and reports;
- carry out simple query search;
- append and browse data;
- sort data.

5.5 SCIENCE

The aims of the science curricula are the same for the three Sciences. They are set below and describe the educational purpose of teaching and learning Science at Form III.

The aims are to:

1. provide a relevant and meaningful educational experience for all students, irrespective of whether they go on to study science beyond this level or not;
2. help them gain sufficient understanding and knowledge to develop an informed interest in scientific matters;
3. help them comprehend the value and limits of scientific methods;
4. nurture their appreciation of science and its application in other disciplines as well as in their everyday life;
5. enable them to develop abilities and skills that are relevant to the study and practice of science;
6. promote the development of attitudes relevant to science and other subjects such as concern for accuracy and precision, objectivity, enquiry and inventiveness;
7. promote interest in and care for both the local and global environment;

Assessment Objectives

The assessment objectives describe the knowledge, skills and competencies that students are expected to demonstrate.

A Knowledge with Understanding

Students should be able to demonstrate knowledge with understanding in relation to:

1. scientific phenomena, facts, laws, definitions, concepts;
2. scientific vocabulary, terminology, conventions (including symbols, quantities and units);
3. scientific instruments and apparatus, including techniques of operation and aspects of safety;
4. scientific quantities and their determination.

B Handling Information and Solving Problems

Students should be able – using visual and written (including symbolic, diagrammatic, graphical and numerical) information – to:

1. locate, select, organize and present information from a variety of sources including everyday experience;
2. translate information from one form to another;
3. manipulate simple numerical and other data;
4. use information to identify patterns, report trends and draw inferences;
5. present reasoned explanations for phenomena, patterns and relationships;
6. solve simple problems.

C Scientific Investigation

Candidates should be able to:

1. follow instructions;

2. carry out procedures, use apparatus, handle measuring devices and materials effectively and safely;
3. make and record observations, measurements and estimates with due regard to precision, accuracy and units;
4. interpret, evaluate and report on observations and experimental data.

Other Competencies

Besides the learning outcomes given for each of the science subjects Biology, Chemistry and Physics, it is also expected that students will be able to demonstrate ability in:

- developing a plan of action to remedy a given problem;
- evaluating the solutions proposed to solve a problem;
- solving numerical problems;
- supporting ideas with appropriate justifications;
- looking for relevant information;
- following instructions.

These competencies cut across all the three Science subjects and may be assessed in the three examination papers.

5.5.1 BIOLOGY

1. CELLS

Students should be able to:

(a) define cell as the basic unit of life consisting of various structures performing specific functions;

(b) *examine under a simple light microscope an animal cell and a plant cell (any suitable, locally available material), using an appropriate temporary staining technique, such as iodine or methylene blue*;

(c) draw diagrams to represent observations of a plant cell and an animal cell;[1]

(d) identify, from fresh preparations or on diagrams, the cell membrane, nucleus and cytoplasm in an animal cell;

(e) identify, from diagrams, the cell wall, cell membrane, sap vacuole, cytoplasm, nucleus and chloroplasts in a plant cell;[2]

(f) compare the visible differences in the structure of the animal and the plant cells examined;

(g) state the function of the cell membrane in controlling the passage of substances into and out of the cell;

(h) state that the genetic material, consisting of chromosomes and genes, are found in the nucleus;[3]

(i) state, in simple terms, the relationship between cell function and cell structure for the following:

- absorption – root hair cells;
- conduction and support – xylem vessels;
- transport of oxygen – red blood cells;

1. The learning outcome: 'draw diagrams to represent observations of a prokaryotic cell, a plant cell and an animal cell' has been modified.
2. The learning outcome: 'define mitosis as cell division giving rise to genetically identical cells in which the chromosome number is maintained' has been removed.
3. This learning outcome was formerly stated as two distinct outcomes: 'state that the genetic material is found in the nucleus' and 'state that the nucleus contains the genetic material consisting of chromosomes and genes'.

(j) differentiate *cell, tissue, organ* and *organ system* with examples;

(k) explain the role of specialized cells in an organism.

2. DIFFUSION AND OSMOSIS

Students should be able to:

(a) define *diffusion* as the movement of molecules from a region of their higher concentration to a region of their lower concentration, down a concentration gradient;

(b) define *osmosis* as the passage of water molecules from a region of their higher concentration to a region of their lower concentration, through a partially permeable membrane;

(c) state the importance of diffusion and osmosis in plant and animal tissues.

3. LIFE PROCESSES

A) Food and Digestion

Students should be able to:

(a) list the principal sources and describe the dietary importance of carbohydrates, fats, proteins, vitamins (C and D only), mineral salts (calcium and iron only), fibre (roughage) and water;

(b) list the components of a balanced diet;[4]

(c) identify the main regions of the alimentary canal and the associated organs: mouth (buccal) cavity, salivary glands, oesophagus, stomach, pancreas, liver, small intestine, rectum and anus;

(d) outline digestion in the mouth, stomach and small intestine (knowledge of the functions of different enzymes during digestion is not required).[5]

4. This learning outcome has been reworded to exclude the word 'define'.
5. More precision has been brought to this learning outcome. It formerly read as: 'describe digestion in the mouth, stomach and small intestine'.

B) Transport in Organisms (Humans)

Students should be able to:

(a) describe the circulatory system as a system consisting of blood, heart and blood vessels (arteries, veins and capillaries);
(b) list the components of blood as red blood cells, white blood cells, platelets and plasma;
(c) state the functions of blood:

- red blood cells – haemoglobin and oxygen transport;
- white blood cells – phagocytosis, antibody formation;
- platelets – causing clotting;
- plasma – transport of blood cells, ions, soluble food substances, carbon dioxide, urea, vitamins and plasma proteins etc;

(d) list the factors that may lead to cardiovascular diseases, such as thrombosis, stroke, heart attack and hypertension;[6]
(e) list preventive measures for cardiovascular diseases.

C) Transport in plants

Students should be able to:

(a) explain the movement of water from the soil to the leaves with reference to osmosis;[7,8]
(b) define the process of transpiration;
(c) list the factors affecting the rate of transpiration;
(d) outline the process of photosynthesis in plants.

6. This learning outcome has been reworded. It previously read as: 'describe the causes of cardiovascular diseases, e.g. thrombosis, stroke, heart attack and hypertension'.
7. The learning outcome: 'demonstrate an experiment to show the movement of water in plants' has been removed.
8. More precision has been brought to this learning outcome. It previously read as: 'explain the movement of water from the soil to leaves'.

D) Excretion

Students should be able to:

(a) define excretion as the removal of toxic materials and the waste products of metabolism from organisms;
(b) outline the removal of carbon dioxide from the lungs;
(c) state the role of the kidney in removing urea, excess salts and water from the blood.

E) Breathing and Gas Exchange

Students should be able to:

(a) identify on diagrams and name the nostrils, pharynx, larynx, trachea, bronchi, bronchioles, alveoli and associated capillaries;
(b) state that breathing is a physical process taking place in both aquatic and terrestrial organisms;
(c) name the organs involved in breathing in a terrestrial organism (e.g. in human) and in an aquatic organism (e.g. in fish);[9]
(d) describe the sequence of events occurring during inspiration and expiration;
(e) state the difference in the percentages of the gases in inhaled air and exhaled air;
(f) *investigate an experiment to compare carbon dioxide content between inspired and expired air;*
(g) state the causes and health effects of common respiratory diseases.

F) Respiration

Students should be able to:

(a) state the need for energy in humans;
(b) define *respiration;*

9. This learning outcome has been reworded to include an example of a terrestrial and an aquatic organism.

(c) define *aerobic respiration;*

(d) state the equation (in words) for aerobic respiration;

(e) *d*efine *anaerobic respiration;*

(f) *demonstrate an experiment to find out whether carbon dioxide is given off during respiration.*

G) Reproduction [10, 11, 12]

Students should be able to:

(a) define reproduction as the process that maintains the continuity of life;

(b) define *asexual reproduction* as the production of a new individual by a single parent involving cell division;

(c) define *sexual reproduction* as the production of a new individual by the fusion of two gametes;

(d) identify on diagrams the parts of the male reproductive system;

(e) identify on diagrams the parts of the female reproductive system;

(f) describe the menstrual cycle, with reference to the alternation of menstruation and ovulation, the natural variation in its length and the fertile and infertile phases of the cycle;

(g) describe fertilisation and early development of the zygote simply in terms of the formation of a ball of cells that becomes implanted in the wall of the uterus;

(h) describe the symptoms, signs, effects and treatment of sexually transmitted diseases.

4. ECOLOGY AND SOCIETY

Students should be able to:

(a) define the terms: ecosystem, biodiversity and environment;

10. The topic 'Reproduction in Plants' has been removed. Three learning outcomes namely, (a), (b) and (c) which fell under that topic have now been moved under the topic 'Reproduction'.
11. The topic: 'Reproduction in Humans' has been renamed 'Reproduction'.
12. The learning outcome: 'state the function of the amniotic sac and the amniotic fluid and describe the function of the placenta and umbilical cord in relation to exchange of dissolved nutrients, gases and excretory products' which was found under the topic 'Reproduction in Humans' has been removed.

(b) give examples of marine and terrestrial ecosystems;[13]

(c) define the following terms and establish the relationship of each in the ecosystem: producer, consumer, herbivore, carnivore, decomposer, food chain and food web;

(d) describe the effects of humans on the ecosystem;

(e) explain the importance of keeping a balanced ecosystem;

(f) name the threats to biodiversity;

(g) explain how these threats can affect the ecosystem, biodiversity and the whole environment;

(h) give ways to reduce the impacts of these threats.

5. DISEASES: COMMUNICABLE AND NON-COMMUNICABLE

Students should be able to:

(a) define non-communicable disease as a disease which is non-infectious or non-contagious;

(b) define communicable disease as an illness caused by microorganism and transmitted from an infected person to another person or animal;

(c) give examples of communicable and non-communicable diseases that are prevalent in the country (e.g. AIDS, Syphilis, Tuberculosis, H1N1, Influenza, Malaria, Diabetes, Cardio vascular diseases);[14]

(d) explain what is a sexually transmitted disease and give examples.

13. The word 'ecosystems' has been used to replace 'environment'.
14. Examples of communicable and non-communicable diseases have been added.

5.5.2 CHEMISTRY

1. CHEMICAL SUBSTANCES

Students should be able to:

(a) define the following terms:

- Element
- Mixture
- Compound
- Symbol
- Formulae
- Atom
- Molecule

(b) distinguish between elements, mixtures and compounds and give examples of each;

(c) recall that some metals are reactive and others are not;

(d) demonstrate an understanding of the reactivity series;

(e) arrange metals in order of reactivity (Sodium, Calcium, Magnesium, Zinc, Iron, Copper, Silver and Gold);

(f) recall what are acids and bases;

(g) state the importance of acids and bases;

(h) recall the colours of indicators (methyl orange, phenolphthalein, litmus) in acids and alkalis.

2. THE LANGUAGE OF CHEMISTRY

Students should be able to:

(a) describe physical changes giving examples;

(b) describe chemical changes giving examples;

(c) give the symbols and valencies of common elements;[1]

1. The word 'common' has been added.

(d) work out the formulae of compounds;

(e) define the term radical and give the names and valencies of the following radicals: hydroxide, carbonate, sulfate, ammonium and nitrate;

(f) demonstrate an understanding of chemical reactions, reactants and products;

(g) represent chemical reactions by word equations;

(h) convert word equations to balanced chemical equations;

(i) write and balance chemical equations.

3. CHEMICAL REACTIONS IN GENERAL

Students should be able to:

(a) describe the reaction of selected metals (sodium, magnesium, iron and copper) with oxygen;

(b) describe the reaction of these selected metals with water and/or steam;

(c) describe the reaction of these selected metals with dilute acids;[2]

(d) describe displacement reactions using these selected metals;[3]

(e) predict the reaction of a particular metal using its position in the reactivity series;

(f) explain displacement reactions;

(g) explain the thermal decomposition of metal carbonates with respect to their position in the reactivity series;

(h) describe how hydrogen, oxygen and carbon dioxide can be prepared in the laboratory;

(i) state the conditions for rusting of iron;

(j) discuss ways to prevent the rusting of iron (oiling, greasing, painting, galvanizing, alloying);

(k) write word equations and balanced chemical equations for reactions all throughout the chapter.

2. The words 'these selected' has been added.
3. The phrase 'using these selected metals' has been added.

4. IMPORTANT CHEMICAL REACTIONS

Students should be able to:

(a) define neutralization reaction;

(b) define 'salt' and 'acid salt';

(c) classify salts as 'soluble salts' and 'insoluble salts';

(d) describe the preparation of soluble salts by reactions of:

- Metals with acids;
- Metal oxides with acids;
- Metal carbonates with acids;

(e) draw labelled diagrams to show the steps in preparing a salt with safety;

(f) state the uses of salts, for example:

- Sodium chloride for food preservation and enhancement of taste;
- Sodium bicarbonate in baking and indigestion treatment;
- Ammonium sulfate in fertilizers;
- Calcium sulfate in plaster of Paris;
- Sodium fluoride in toothpaste;

(g) explain the importance of neutralization reaction in cases of indigestion, insect stings, in agriculture and in the prevention of acid rain;

(h) describe the process of combustion, respiration and photosynthesis;

(i) give the importance of combustion, respiration and photosynthesis in everyday life;

(j) recall the percentage composition of air;

(k) state the importance of respiration and photosynthesis in maintaining the composition of air;

(l) identify carbon monoxide, oxides of nitrogen, sulfur dioxide, CFCs, smoke as pollutants;

(m) state the sources, effects and prevention of air pollution caused by the pollutants listed above;

(n) describe the greenhouse effect with reference to carbon dioxide (causes, effects and prevention);

(o) demonstrate an understanding of global warming, its causes, effects and ways to prevent it.

5. EXPERIMENTAL TECHNIQUES IN CHEMISTRY

Students should be able to:

(a) define the terms ‘solute’, ‘solvent’, ‘solution’ and ‘suspension’;

(b) recall what are ‘mixtures’;

(c) recall the different changes in state happening in: evaporation, freezing, melting, boiling and condensation;

(d) define the terms boiling point, melting point and freezing point;

(e) identify a suitable technique to separate a given mixture based on the properties of the components:

- Magnetic separation for mixtures containing iron;
- Decantation for a mixture of solid and liquid with the solid having a higher density;
- Filtration for a mixture of a solid and liquid forming a suspension;
- Crystalisation to obtain pure crystals of solute from a solution;
- Distillation to obtain pure solvent from a solution;
- Sublimation to separate mixture of solids where one of the solids can sublime;
- Chromatography to separate different components dissolved in a solvent;

(f) show an appreciation of the relevance and importance of separating techniques in everyday life.

5.5.2 PHYSICS

1. MEASUREMENTS

Students should be able to:

(a) choose the appropriate apparatus to measure length, mass, volume, time and temperature in different situations;
(b) read measuring scales such as metre rule, measuring tapes, vernier callipers, electronic balance, measuring cylinders, digital and analogue stop-watch and thermometer accurately;
(c) record measurements in their correct units;
(d) explain a few types of errors in measurement and their prevention (end error, zero error, parallax error);
(e) list a few precautions taken during measurement of simple quantities;
(f) determine the volume of irregular solids using the displacement method.

2. MOTION

Students should be able to:

(a) distinguish between scalar and vector quantities;
(b) distinguish between distance and displacement;
(c) calculate distance and displacement in different situations;
(d) distinguish between speed and velocity;
(e) calculate speed and velocity using $speed = \frac{distance}{time}$ and *velocity* = $\frac{displacement}{time}$;
(f) define acceleration;
(g) calculate acceleration for uniform motion using $a = \frac{change\ in\ velocity}{time}$;[1]
(h) sketch speed time graphs to illustrate and interpret motion.[2]

1. This learning outcome has been rephrased. Formerly, it read as: 'calculate acceleration using $a = \frac{(v-u)}{t}$'.
2. This learning outcome has been amended to exclude calculations from graphs. Previously, it was: 'sketch speed time graphs and (i) interpret motion, (ii) calculate distance covered from area under the graph, (iii) calculate the acceleration from gradient of a line'.

3. ENERGY

Students should be able to:

(a) explain the meaning of energy as the capacity to do work;[3]

(b) list some forms of energy (heat energy, light energy, sound energy, chemical energy, kinetic energy, potential energy and electrical energy);[4]

(c) state the law of conservation of energy giving simple examples;[5,6]

(d) define work done and use the formula, $W = Fd$, where d is the distance travelled in the direction of the force, to calculate work done;[7]

(e) define kinetic and potential energies and use the appropriate formulae, $E_k = \frac{1}{2}mv^2$ and $E_p = mgh$, to calculate kinetic energy and potential energy respectively;[8]

(f) define power and use the formula, $power = \frac{work\ done}{time}$, to calculate power.[9]

4. REFLECTION AND REFRACTION

Students should be able to:

(a) show an understanding that light travels in a straight line;[10]

(b) differentiate between luminous and non-luminous objects;

(c) state the laws of reflection of light;[11]

(d) illustrate and/or construct simple ray diagrams for a plane mirror to show reflection of light;

(e) show an understanding of the characteristics of an image formed by a plane mirror;[12]

3. This learning outcome has been rephrased.
4. This learning outcome has also been rephrased to specify the forms of energy.
5. This learning outcome has been reworded.
6. The learning outcome: 'distinguish between renewable and non-renewable energy sources' has been removed.
7. This learning outcome has been reworded.
8. This learning outcome has been reworded.
9. This learning outcome has been reworded.
10. This learning outcome has been reworded.
11. This learning outcome has been modified. It previously read as: 'state and apply the laws of reflection of light in a given context'. It has been split into two learning outcomes, (c) and (d).
12. This learning outcome has been reworded. It previously read as: 'discuss common applications of reflection of light'.

(f) state the laws of refraction of light (no calculation required);[13]

(g) illustrate refraction of light at a boundary by means of ray diagrams;

(h) describe simple applications of refraction of light (dispersion of light is not required).[14]

5. ELECTRICITY

Students should be able to:

(a) show an understanding that:

  (i) matter is made up of two types of charges;

  (ii) an electric current is a flow of charges;[15]

(b) distinguish between conductors and insulators;

(c) identify the symbols of basic components of a circuit (cell, battery, bulb, open-switch, closed switch, connecting wires, resistor);

(d) set up and draw simple circuits;

(e) explain what is meant by potential difference;

(f) explain resistance as opposition to current flow in a conductor;

(g) define resistance as the ratio of the potential difference across a conductor to the current flowing through it and use the formula $R = \frac{V}{I}$ to calculate resistance;[16,17]

(h) determine effective resistance of combination of resistors arranged in series and in parallel;[18]

(i) calculate the current, potential difference and resistance in simple circuits.

13. This learning outcome has been modified. It previously read as: 'state and apply the laws of refraction (no calculation) of light in a given context'. It has been split into two learning outcomes, (f) and (g).
14. This learning outcome has been reworded. It previously read as 'discuss common applications of refraction of light'.
15. The learning outcomes (a) to (d) have been added.
16. The learning outcome: 'state Ohm's law' has been removed.
17. This learning outcome has been modified. It previously read as: 'calculate the resistance using $R = \frac{V}{I}$'.
18. The word 'circuits', which appeared as the last word in that learning outcome, has been deleted.