



CARIBBEAN
EXAMINATIONS
COUNCIL

Caribbean Secondary
Education Certificate®

SYLLABUS

HUMAN AND SOCIAL BIOLOGY

CXC 35/G/SYLL 21

Effective for examinations from May–June **2021**



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This document *CXC 35/G/SYLL 21* replaces *CXC 35/G/SYLL 09 issued in 2009*. Please note that the syllabus was revised and amendments are indicated by italics.

First Issued 2004
Revised 2009
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Please check the website www.cxc.org for updates on CXC's syllabuses.

Human and Social Biology

◆ RATIONALE

Human beings require knowledge of the ways in which the human body functions, of the interdependence of living things, and of the ways *in which* the total environment functions to support life on earth in all its forms. *This will aid in making* intelligent decisions on matters at home, at work or in society, which routinely affect their health and, therefore, the quality of their lives. The study of Human and Social Biology provides *learners* with an opportunity to begin acquiring this knowledge.

Human and Social Biology is concerned with the study of the structure and *function* of the human body. It also involves the application of biological principles, knowledge and skills, and technological advances, to the maintenance of health and *harmonious living*. *Additionally, learners will gain an understanding of the impact of socio-cultural factors on the health of people and the community*. The subject incorporates the view that human beings have a responsibility to their environment and, as such, have an obligation to conserve, protect, maintain and improve its quality.

The CSEC® Human and Social Biology syllabus allows *learners* to *utilise* theoretical concepts in *an interactive and practical manner*. *This will facilitate the development of long-term transferable skills of ethical conduct, collaboration, problem solving, critical thinking, creativity and communication*. *It encourages the use of various teaching and learning strategies to inculcate these skills while catering to multiple intelligences and different learning styles*. Students are expected to demonstrate an appreciation for all living organisms in their environment.

The CSEC® syllabus in Human and Social Biology provides Caribbean students with a foundation for further study in fields where an understanding of the structure and function of the human body and the application of biological principles to the maintenance of health *are needed*. It also helps to provide students with knowledge, skills and attitudes that are important for maintaining a healthy lifestyle *and creates an awareness of the social determinants of disease prevention and control*. *This syllabus will also prepare students for careers in allied health, physical education, food and nutrition and social work*.

This syllabus will contribute to the development of the Ideal Caribbean Person as articulated by the CARICOM Heads of Government in the following areas: respect for human life and awareness of the importance of living in harmony with the environment; multiple literacies; independent and critical thinking; the innovative application of science and technology to problem solving; *promote physical, mental, social and spiritual well-being and contribute to the health and welfare of the community, country and region*. Based on the UNESCO Pillars of Learning, this course of study will also contribute to a person who will learn to do, learn to live together and learn to transform themselves and society.

◆ AIMS

The syllabus aims to:

1. develop an understanding of the structure and *function* of the human body;
2. increase awareness about the interdependence of living things as they live in harmony with the environment;
3. develop competencies that will enable students to adopt healthy lifestyles;
4. *create an awareness of the commercial and socio-cultural determinants of disease prevention and control;*
5. *develop long-term transferable skills of ethical conduct, collaboration, problem solving, critical thinking, creativity and communication;*
6. develop experimental, data interpretation, and *research skills;*
7. create an awareness of technological advances, *integrate information, communication and technology (ICT); and,*
8. provide a foundation for further study and *specialised training for allied health, physical education, food and nutrition and social work.*

◆ SUGGESTED TIMETABLE ALLOCATION

It is *strongly* recommended that a minimum of five 40-minute periods per week, which must include one double period, over two academic years or the equivalent be allocated to the syllabus.

◆ ORGANISATION OF THE SYLLABUS

The syllabus is organised under five main sections:

- Section A* - Living organisms and the environment.
- Section B* - Life processes.
- Section C* - Heredity and variation.
- Section D* - *Diseases and their impact on humans.*
- Section E* - The impact of health practices on the environment.

**Denotes Specific Objectives that are suitable for practical work. The practical activities for the Specific Objectives highlighted are listed at Appendix 11. The practical activities need not be limited to these objectives.*

◆ APPROACHES TO TEACHING THE SYLLABUS

It is recommended that Section A be taught first. Teachers should introduce concepts familiar to the students and ensure that their lessons stimulate the use of all of the senses during the teaching and learning process. This will help students view science as a dynamic and exciting process.

The general and specific objectives indicate the scope of the content including practical work that should be covered. However, unfamiliar situations may be presented as stimulus material in examination questions.

This syllabus caters to varying teaching and learning styles, with specific attention being drawn to the interrelatedness of concepts. Every opportunity should be made to relate the study of biological principles to the environment. An interactive and practical approach should be employed in the teaching of concepts to encourage students to make behavioural changes where necessary to their everyday lives.

*The role of the teacher is to facilitate students' learning of accurate and unbiased information that will contribute to a more scientifically literate society that is capable of making educated and ethical decisions regarding the world **in which we live**.*

◆ CERTIFICATION

The syllabus is offered for General Proficiency certification. A candidate's performance will be indicated on the certificate by an overall numerical grade on a six-point scale as well as a letter grade for each of **two** profile dimensions, namely, Knowledge and Comprehension and Use of Knowledge.

◆ DEFINITION OF PROFILE DIMENSIONS

On completion of the syllabus, students are expected to develop skills under two profile headings:

1. Knowledge and Comprehension (KC); and,
2. Use of Knowledge (UK).

Knowledge and Comprehension (KC)

Knowledge

The ability to:

identify, remember, and grasp the meaning of basic facts, concepts and principles;

Comprehension

select appropriate ideas, match, compare and cite examples of facts, concepts and principles in familiar situations.

Use of Knowledge (UK)

	The ability to:
Application	use facts and apply concepts, principles and procedures in familiar and novel situations; transform data accurately and appropriately; use formulae accurately for computational purposes;
Analysis and Interpretation	identify and recognise the component parts of a whole and interpret the relationship among those parts; identify causal factors and show how they interact with each other; infer, predict and draw conclusions; make necessary and accurate calculations and recognise the limitations and assumptions inherent in the collection and interpretation of data;
Synthesis	combine component parts to form a new and meaningful whole; make predictions and solve problems;
Evaluation	make reasoned judgements and recommendations based on the value of ideas, information and their implications.

◆ FORMAT OF THE EXAMINATION

Candidates will be required to take Paper 01, Paper 02 and Paper 031 or 032.

Paper 01
(1 hour 15 minutes) Sixty multiple-choice items drawn from all areas of the syllabus.

Paper 02
(2 hours) Six compulsory questions divided into two sections.

Section A - four compulsory structured questions drawn from all areas of the syllabus. One question will be *a data analysis type question*. Each question is worth 15 marks.

Section B - two compulsory structured essay questions drawn from all areas of the syllabus. *These questions will incorporate authentic scenarios to allow candidates to demonstrate knowledge gleaned through experiential learning.* Each question is worth 15 marks.

School-Based Assessment (SBA)

Paper 031 The School-Based Assessment will take the form of a research project. *Candidates will be required to conduct research on a current health-related or environmental issue and its socio-economic impacts in their territory. Details of the project are provided on pages 34 – 38.*

Paper 032
(1 hour 15 mins) Alternative to the School-Based Assessment is for private candidates only. This written paper will take the form of a case study and related questions and will examine the same skills as those tested in Paper 031.

MARK AND WEIGHTING ALLOCATION BY PAPERS AND PROFILE DIMENSIONS

Profile Dimension	Paper 01	Paper 02	Paper 031 SBA	Paper 032 <i>Alternative to SBA</i>	Total
Knowledge and Comprehension (KC)	60	36 [40]	-	-	96 [100]
Use of Knowledge (UK)	-	54 [60]	40	40	94 [100]
TOTAL RAW [WEIGHTED] MARKS	60	90 [100]	40	40	190 [200]
TOTAL %	30	50	20	20	100

◆ REGULATIONS FOR PRIVATE CANDIDATES

1. *Private candidates must be entered for examination through the Local Registrar or private institutions in their respective territories and will be required to sit Papers 01, 02, and EITHER Paper 031 OR Paper 032.*
2. *Paper 032 is designed for candidates whose work cannot be monitored by tutors in recognised educational and private institutions. The Paper will be of one hour duration and will consist of two questions.*
3. *Candidates entered for the examination through private institutions and who opt to sit the SBA component, Paper 031 must note the following:*
 - (a) *Candidates' work must be monitored by tutors in the institution and given feedback before the final assessment of that component. Tutors must also monitor candidates' project to determine the veracity of work submitted. Tutors should not accept projects which were not monitored during development. The marks recorded in the two components will be collated to form the final SBA mark for submission by April 30, in the year of the examination.*
 - (b) *Marks must be submitted to the Caribbean Examinations Council on the School-Based Assessment forms provided online. The forms should be submitted electronically via the SBA data capture module on the Online Registration System (ORS) on the Council's website. Candidates who do not fulfil the requirements for the School-Based Assessment will be reported as "ungraded".*
 - (c) *Candidates as well as tutors must retain a copy of the completed component as part of their portfolio.*

◆ REGULATIONS FOR RESIT CANDIDATES

Resit candidates must complete Papers 01 and 02 of the examination for the year for which they reregister.

For CSEC® candidates, SBA scores can be carried forward only ONCE and only during the year immediately following the first sitting and they may reuse any moderated score. Candidates reusing SBA scores should register as “Resit candidates” and must provide the previous candidate number when registering.

◆ REGULATIONS FOR THE JANUARY SITTING

- 1. All candidates sitting CSEC® Human and Social Biology at the January examination for the first time MUST write Paper 032.*
- 2. There is no SBA option (Paper 031) available for January candidates.*

◆ SECTION A: LIVING ORGANISMS AND THE ENVIRONMENT

GENERAL OBJECTIVES

On completion of this *section*, students should:

1. understand the processes that govern the interactions of organisms in the environment and the processes by which life is perpetuated; and,
2. understand the nature of the interdependence of the processes, structures and functions of the major systems, within an organism in the maintenance of health.

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

1. *describe* the characteristics of living organisms;

Include nutrition, respiration, excretion, growth, irritability, movement, reproduction.

(Link to Specific Objective B1.27)

2. * *compare* the structures of an unspecialised plant and animal cell and selected microbes;

Include basic structure of unspecialised *plant and animal cells and microbes*.

Include labelled diagrams of plant and animal cells and microbes which include:

(i) virus;

(ii) bacteria; and,

(iii) fungi.

(Link to Specific Objective D7).

3. state the functions of cell structures *and organelles*;

Include cell wall, cell membrane, nucleus, ribosomes, cytoplasm, mitochondria, vacuoles, chloroplasts, *endoplasmic reticulum*.

4. *relate the structure of selected cells to their function*;

Include distinguishing features of epithelial, sperm, egg, nerve, muscle and connective tissue cells.

Include labelled diagrams.

5. * explain the importance of cell specialisation in humans;

Relate cell differentiation and *specialization to the function of the organism as a whole: include cellular organisation and examples of tissues, organs and organ systems.*

SECTION A: LIVING ORGANISMS AND THE ENVIRONMENT (cont'd)

SPECIFIC OBJECTIVES	EXPLANATORY NOTES
6. <i>explain the importance of passive and active transport in living systems;</i>	<p><i>Include definition of passive transport (simple diffusion, osmosis) and active transport;</i></p> <p>Comparison among <i>simple</i> diffusion, osmosis and active transport;</p> <p><i>Include</i> examples of osmosis, <i>simple</i> diffusion and active transport occurring in plants and animals.</p> <p><i>(Link to Specific Objectives B 1.24, B1.26 and B3.1).</i></p>
7. * <i>conduct simple investigations on osmosis and diffusion;</i>	
8. explain the process of photosynthesis;	<p><i>Include a definition of photosynthesis; word and chemical equations to summarise the process; site of photosynthesis (chloroplast); fate of products of photosynthesis - glucose and oxygen.</i></p> <p>Light and dark reactions not required.</p>
9. * <i>investigate the effect of light and chlorophyll on the production of starch;</i>	<p><i>Simple starch test on variegated and variegated leaves.</i></p>
10. explain the ways in which other living organisms depend on plants directly or indirectly for food;	<p><i>Include plants as producers; human beings' dependence on plants directly or indirectly for food.</i></p>
11. explain <i>the principles of</i> a food chain and <i>food web</i> ;	<p><i>Include definitions of food chain, food web and trophic level; naming and identification of organisms feeding at each trophic level (omnivore, carnivore, herbivore, producer, primary and secondary consumers); Explanation of reduction of available energy at each trophic level; utilisation of energy at each trophic level; the effect of bioaccumulation on human health; analysis of pyramid of biomass and pyramid of numbers.</i></p>
12. * <i>construct</i> a food chain and food web from a selected habitat; and,	<p><i>Include</i> terrestrial and aquatic (marine and fresh water) habitats.</p>

SECTION A: LIVING ORGANISMS AND THE ENVIRONMENT (cont'd)

SPECIFIC OBJECTIVES

13. *describe the recycling of carbon in nature.*

EXPLANATORY NOTES

Include the importance of recycling carbon in nature;

Carbon cycle:

- (i) the importance of CO₂ in photosynthesis;
- (ii) *transformation of carbon from carbon dioxide to carbohydrates in photosynthesis;*
- (iii) the release of carbon dioxide *during respiration, decomposition and combustion and its contribution to the greenhouse effect;*
- (iv) *death and decay (due to bacterial and fungal activities) of organisms to release carbon dioxide;*
- (v) *formation of fossil fuels from the remains of dead organisms;*
- (vi) *release of carbon dioxide when fossil fuels are burnt; and,*
- (vii) *discuss the impact of global warming on the well-being of humans.*

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of this Section, teachers are advised to engage students in the teaching and learning activities listed below.

1. Arrange for students to *create charts, models, diagrams, infographics or presentations* on plants and animal cells, microbes *and the carbon cycle.*
2. Arrange for students to view *and draw plant* and animal cells as *seen* by a light microscope.
3. *Allow students to work in groups* to conduct laboratory activities pertaining to osmosis, diffusion *and photosynthesis.*
4. *Arrange field trips for students to visit terrestrial and/or aquatic ecosystems to observe, record and report feeding relationships.*
5. *Have students discuss ways in which they can reduce their negative carbon footprints/negative impact on the environment.*
6. Use video presentations and computer-assisted learning *tools* to enhance learning.

◆ SECTION B: LIFE PROCESSES

GENERAL OBJECTIVES

On completion of this *section*, students should:

1. *understand the role of nutrition in helping humans to obtain their energy and satisfy their physical needs;*
2. *understand that respiration is the means by which energy is made available for carrying out life processes;*
3. *understand the role of transport and defence in humans;*
4. *understand the mechanisms of movement and appreciate its role(s) in humans;*
5. *understand the process by which humans get rid of metabolic waste and maintain homeostasis;*
6. *understand that humans detect and respond to changes in their external and internal environment; and,*
7. *understand the processes by which life is perpetuated.*

1. NUTRITION

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

- | | | |
|-----|---|---|
| 1.1 | <i>distinguish between macro and micro nutrients;</i> | <i>Include definitions and examples of macronutrients and micronutrients.</i> |
| 1.2 | <i>discuss the functions of macro nutrients;</i> | Starch, reducing and non-reducing sugars, lipids, proteins; <i>mention</i> chemical and physical properties of carbohydrates, lipids and proteins.

<i>Include sources of macronutrients; elements that make up the macronutrients.</i>

<i>Include hidden sources of sugars; effects of sugar-sweetened beverages on health; benefits of fresh fruits and vegetables with reference to fruits and vegetables grown in the Caribbean.</i> |
| 1.3 | <i>discuss the functions of micronutrients;</i> | Vitamin A, B ₁ , C, D, E, and K and the minerals: calcium, magnesium, fluoride, iodine, phosphorous, sodium and iron.

<i>Include sources of micronutrients.</i>

<i>Include hidden sources of salt.</i> |

SECTION B: LIFE PROCESSES (cont'd)

NUTRITION (cont'd)

SPECIFIC OBJECTIVES

Students should be able to:

1.4 state the cause, symptoms and treatment of deficiency diseases;

1.5 classify vitamins as fat or water soluble;

1.6 * perform tests to distinguish among food nutrients;

1.7 state the functions of water in the body;

1.8 *explain* the role of dietary fibre in the body;

1.9 describe the causes and effects of constipation and diarrhoea;

1.10 *discuss the importance* of a balanced diet;

1.11 *discuss* the effects of malnutrition on the human body;

1.12 *determine Body Mass Index (BMI)*;

EXPLANATORY NOTES

Night blindness, *iron- deficiency* anaemia, rickets, *and goitre*.

(a) *Fat soluble - A, D, E and K*

(b) *Water soluble - B, C.*

Starch, reducing sugars, non-reducing sugars, protein and fat.

(Link to Specific Objective A8).

Include water as a solvent for hydrolysis and as a transport medium.

Including the link between fibre and obesity.

Including proper hygiene in the preparation of food.

[Link to Specific Objectives A2 and D5 (cholera, gastroenteritis)].

Must include definition, food groups, the effects of age, sex and occupation on dietary needs.

Include the definition of malnutrition (*over and under nutrition*), obesity (*adult and childhood*), *anorexia and bulimia, protein and energy malnutrition (kwashiorkor, marasmus).*

Include the sources and effects of hidden salt.

$\frac{\text{Weight (kg)}}{\text{Height}^2(\text{m})}$

Include determination of waist circumference; use of BMI and waist circumference to categorize obesity; factors and implications of obesity.

(Link to Specific Objectives B3.6, B3.11 and D9).

SECTION B: LIFE PROCESSES (cont'd)

NUTRITION (cont'd)

SPECIFIC OBJECTIVES

Students should be able to:

- 1.13 *use tables, charts and graphs to represent data on nutrition;*
- 1.14 *relate the types of teeth present in an infant and an adult human to their roles;*
- 1.15 *explain the importance of teeth in the process of digestion;*
- 1.16 *relate the structures of the tooth to their functions;*
- 1.17 *state the causes of tooth decay;*
- 1.18 *describe the process of tooth decay;*
- 1.19 *outline guidelines for the care of the teeth;*
- 1.20 *explain the properties, role and importance of enzymes involved in digestion;*
- 1.21 ** investigate the effects of temperature and pH on the activity of the enzymes, amylase and catalase in the digestive process;*
- 1.22 *identify the various structures of the digestive system;*
- 1.23 *relate the structures of the digestive system to their functions;*

EXPLANATORY NOTES

Include the prevalence and trends of childhood obesity in Caribbean countries.

Include construction and interpretation of tables, graphs and charts.

Include labelling of diagrams of teeth.

(Link to Specific Objective B1.24).

Internal and external structures; include functions of enamel, dentine, pulp cavity, cement; labelling of diagrams required.

Include the effects of sugar-sweetened beverages (through sugar and carbonation) on tooth decay.

Include conversion of food into acids by bacteria.

Include flossing, brushing at least twice daily, fluoridation, dental check-ups bi-annually and diet.

Include site of production.

Include construction and interpretation of tables, graphs and charts.

Include labelling of diagrams of digestive system.

SECTION B: LIFE PROCESSES (cont'd)

NUTRITION (cont'd)

SPECIFIC OBJECTIVES

Students should be able to:

1.24 describe the *processes* of digestion and absorption of food in the alimentary canal;

EXPLANATORY NOTES

Include mechanical (mastication) and chemical digestion.

Include osmosis, diffusion and active transport.

(Link to Specific Objective A6).

1.25 *discuss the fate of the products of digestion after their absorption;*

Include glucose, amino acids, fatty acids and glycerol; role of hepatic portal vein; role of liver; assimilation.

1.26 *relate the structure of a villus to the function of absorption;*

Include labelling of diagram.

(Link to Specific Objective A6).

1.27 *distinguish between egestion and excretion.*

(Link to Specific Objective B5.1).

2. THE RESPIRATORY SYSTEM

Students should be able to:

2.1 explain the importance of breathing in humans;

2.2 *relate the structures of the respiratory tract to their functions;*

Include labelling of diagram of respiratory system.

2.3 * describe the breathing mechanism;

Include the effects of changes in the volume of the chest cavity on internal air pressure. Demonstrate using a model.

2.4 * outline the factors affecting *the* rate of breathing;

Exercise, smoking, anxiety, drugs, environmental factors, altitude, weight/obesity.

(Link to Specific Objective D4).

2.5 *explain the* concept of vital capacity;

Interpretation of graphical representation required.

SECTION B: LIFE PROCESSES (cont'd)

THE RESPIRATORY SYSTEM (cont'd)

SPECIFIC OBJECTIVES

Students should be able to:

2.6 *distinguish between gaseous exchange and breathing;*

2.7 identify characteristics common to gaseous exchange surfaces;

2.8 differentiate between aerobic and anaerobic respiration;

2.9 explain the role of adenosine diphosphate (ADP) and adenosine triphosphate (ATP) in the transfer of energy;

2.10 *describe* the technique of *Cardiopulmonary Resuscitation (CPR)*;

2.11 *discuss* the effects of smoking; and,

2.12 *use tables, graphs and charts to represent data on the respiratory system.*

EXPLANATORY NOTES

Inclusion of gaseous exchange in the alveoli; include labelling of diagram of alveolus.

Include large and moist surface area and thin membranes; copious blood supply.

Include the definitions of aerobic and anaerobic respiration; *site*, the products of respiration; description of industrial and domestic applications of anaerobic respiration; *oxygen debt*; *worded and chemical equations to represent the processes of aerobic and anaerobic respiration.*

Include the comparison of the amount of energy released in both aerobic and anaerobic respiration.

Adenosine triphosphate as the energy currency of the cell.

Include disposal device for applying mouth-to-mouth resuscitation.

Effects of smoking (cigarette, marijuana, vaping, hookah); nicotine addiction, damage to the lungs, carcinogenic properties and reduction in oxygen-carrying capacity of the blood; hypertension and heart disease. Interpretation of data.

(Link to Specific Objectives D11 and D22)

Construction and interpretation of tables, graphs and charts.

SECTION B: LIFE PROCESSES (cont'd)

3. THE CIRCULATORY SYSTEM

SPECIFIC OBJECTIVES

Students should be able to:

3.1 explain the need for a transport system in the human body;

Include the limitations of simple diffusion; the relationship between surface area and volume.

(Link to Specific Objective A6).

3.2 identify the materials which need to be transported around the human body;

Nutrients, gases, hormones, antibodies, blood proteins and metabolic waste products.

3.3 *relate the components of the blood to its function;*

Plasma, serum, red blood cells, white blood cells, platelets. Differentiation between plasma and serum.

3.4 relate the structures of red blood cells, phagocytes and lymphocytes to their functions;

Include labelling of diagrams.

3.5 *relate the structures of the arteries, veins and capillaries to their functions;*

Include labelling of diagrams; thickness of walls, size of lumen, presence or absence of valves.

3.6 *relate the structures of the heart to their functions;*

Include chambers, valves and blood vessels, cardiac muscles; the role of the pacemaker/artificial pacemaker; comparison of the differences in thickness of the right and left ventricles; include the labelling of diagrams;

3.7 *explain the concept of blood pressure;*

Systole and diastole.

Include modifiable risk factors (salt, fat, alcohol, smoking and stress) for elevated blood pressure; trends in hypertension and obesity in children in Caribbean countries; trends in modifiable risk factors.

(Link to Specific Objectives B1.11, B1.12 and D9).

3.8 *describe the structure and function of the circulatory system in humans;*

Pulmonary versus systemic circulation.

SECTION B: LIFE PROCESSES (cont'd)

THE CIRCULATORY SYSTEM (cont'd)

SPECIFIC OBJECTIVES

Students should be able to:

3.9 *discuss blood groups;*

EXPLANATORY NOTES

Include A, B, AB and O: antigen and antibody for each group, precaution in transfusion and handling; Rh factor risk in pregnancy and precautions.

3.10 explain the process and the importance of blood clotting;

Role of platelets, calcium ions, Vitamin K, thromboplastin, prothrombin, thrombin, fibrinogen and fibrin.

(Link to Specific Objective C6 [haemophilia]).

3.11 *discuss the causes and effects of heart diseases;*

Include hypertension (high blood pressure), atherosclerosis, coronary thrombosis, and obesity.

(Link to Specific Objectives B3.7 and D9).

3.12 *use tables, charts and graphs to represent data on diseases of the circulatory system;*

Construction and interpretation of tables, graphs and charts.

3.13 describe the structure and function of the lymphatic system; and,

Include the role of tissue fluid and lymph; location and function of lymph nodes.

3.14 describe how tissue fluid and lymph are formed.

Differentiation between tissue fluid and lymph.

Include labelling of diagrams.

4. SKELETAL SYSTEM

Students should be able to:

4.1 identify the major bones of the skeleton;

*Cranium, clavicle, scapula, vertebral column, humerus, radius, ulna, **carpals, metacarpals**, rib cage, sternum, pelvic girdle, femur, tibia, fibula, **patella, tarsals, metatarsals and phalanges**.*

4.2 relate the structure of the skeleton to its *functions*;

*Movement, **locomotion**, protection, support, breathing, production of blood cells, **storage of minerals**.*

SECTION B: LIFE PROCESSES (cont'd)

SKELETAL SYSTEM (cont'd)

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

- | | | |
|------|---|---|
| 4.3 | relate the structure of a <i>long</i> bone to its functions; | <i>Include the labelling of diagram (internal and external view).</i> |
| 4.4 | distinguish between bone and cartilage; | <i>Include characteristics and functions.</i> |
| 4.5 | distinguish between tendons and ligaments; | <i>Include characteristics and functions.</i> |
| 4.6 | <i>discuss the types of joints;</i> | <i>Include definition.</i>

<i>Types, location and characteristics of joints - hinge, fixed, synovial and ball and socket.</i>

<i>Include labelling of diagrams.</i> |
| 4.7 | <i>describe movement in the hinge and ball and socket joints;</i> | <i>Include flexion and extension.</i> |
| 4.8 | <i>discuss the three types of muscles;</i> | <i>Include location and function of cardiac, skeletal and smooth muscles.</i> |
| 4.9 | explain how skeletal muscles function in the movement of a limb; | <i>Include labelling of diagrams; the role of antagonistic muscles in the movement of limbs; include definition of muscle tone and the effect of exercise on it.</i>

<i>(Link to Specific Objective B4.7).</i> |
| 4.10 | identify the biceps and triceps of the upper arm; | <i>Include labelling of diagrams;</i>

points of origin (location and definition); points of insertion (location and definition). |
| 4.11 | explain the importance of locomotion to man; and, | <i>Include labelling of diagrams;</i>

The role of antagonistic muscles in the movement of limbs; include definition of muscle tone and the effect of exercise on it. |
| 4.12 | <i>evaluate the factors which adversely affect the skeletal system.</i> | <i>Include posture and inappropriate foot-wear to the activity, lifting heavy objects.</i> |

SECTION B: LIFE PROCESSES (cont'd)

5. EXCRETION AND HOMEOSTASIS

SPECIFIC OBJECTIVES

Students should be able to:

- 5.1 *discuss* the importance of excretion in human beings;
- 5.2 explain the roles of the organs involved in excretion;
- 5.3 relate the structures of the kidney to their function;
- 5.4 relate the structures of the skin to their functions;
- 5.5 *explain* the concept of homeostasis;
- 5.6 explain the concept of feedback mechanisms;
- 5.7 *discuss* the regulation of blood sugar;
- 5.8 explain the regulation of water;
- 5.9 distinguish between heat and temperature; and,
- 5.10 *discuss* the regulation of temperature.

EXPLANATORY NOTES

Include definition of excretion.

(Link to Specific Objective B1.27).

Lungs, skin and kidney;

Include examples of metabolic wastes.

Include labelling of internal structure of the kidney, renal vessels and the nephron; structure and function of the nephron; differentiation between the renal artery and vein; ultra-filtration, selective re-absorption of substances; composition of urine; *include a brief explanation of the process and importance of renal dialysis.*

(Link to Specific Objective B3.7).

Include dermis, epidermis, adipose tissue, sweat glands, erector muscles, hair, hair follicles, nerve endings and capillaries.

Include labelling of diagrams.

Include a definition and examples.

Include positive and negative feedback and give examples.

Role of insulin and glucagon.

(Link to Specific Objective D9).

Include the role of Anti-diuretic hormone (ADH).

Include vasodilation and vasoconstriction.

Include diagrams.

(Link to Specific Objectives B5.4 and B5.6).

SECTION B: LIFE PROCESSES (cont'd)

5. COORDINATION AND CONTROL

SPECIFIC OBJECTIVES

Students should be able to:

6.1 *describe* the main divisions of the nervous system;

Central nervous system – the brain, and spinal cord.

Peripheral nervous system: spinal nerves and cranial nerves, and autonomic nervous system.

6.2 *distinguish between a neurone and a nerve;*

Include definitions;

Properties of neurones; irritability; conductivity; structures of neurones: cell- bodies, axons and dendrites.

Include labelling of diagrams.

6.3 *explain the functions of motor and sensory neurones and spinal synapses;*

Include labelling of types of neurones (motor, relay, sensory), and their functions.

Include labelling of synapses.

Include examples and functions of chemical transmitters.

6.4 *describe the functions of the parts of the brain*

Cerebrum, cerebellum, medulla oblongata, hypothalamus, pituitary gland.

6.5 * *describe the mechanisms of a reflex action;*

*Include a definition; structure of spinal cord (labelling of diagram); differentiation between the spinal reflex action (for example, knee-jerk reflex) and cranial reflex action (for example, pupil reflex); reaction to painful stimuli; include definition and examples of **conditioned** reflexes.*

6.6 explain the process by which voluntary actions occur;

Include a definition; transmission of nerve impulses; involvement of neurones in the brain, spinal cord and effector muscles.

6.7 distinguish between a voluntary and involuntary action;

Include examples of these actions.

6.8 explain the response of the sense organs to stimuli;

Include the names of sense organs and stimuli to which they respond.

SECTION B: LIFE PROCESSES (cont'd)

COORDINATION AND CONTROL (cont'd)

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

- | | | |
|------|---|--|
| 6.9 | relate the internal structures of the eye to their functions; | <i>Include labelling of the diagram of the eye (internal view).</i> |
| 6.10 | explain how images are formed in the eye; | <i>Include labelling of diagrams.</i> |
| 6.11 | explain accommodation in the eye; | <i>Include the role of ciliary muscle and the suspensory ligaments.</i> |
| 6.12 | <i>discuss</i> the causes of, and corrective measures for eye defects <i>and diseases</i> ; | <i>Include myopia (short sightedness) and hyperopia/hypermétropia (long sightedness) and astigmatism, glaucoma, and cataracts.</i>

<i>Include effect of diabetes on eyesight.</i>

<i>(Link to Specific Objective D9).</i>

<i>Include labelling of diagrams.</i> |
| 6.13 | <i>compare and contrast endocrine (hormonal) and nervous control systems</i> ; | |
| 6.14 | identify the sites of hormone production; and, | <i>Include labelling of location of endocrine glands.</i> |
| 6.15 | explain the roles of <i>selected</i> hormones in the human body. | <i>Pituitary - anti-diuretic hormone (ADH),
Follicle stimulating hormone (FSH),
Luteinising hormone (LH),
Growth hormones;
Thyroid – thyroxine.</i>

<i>Pancreas - insulin, glucagon;
Adrenal glands – adrenaline;
Ovary - oestrogen, progesterone;
Testes – testosterone.</i>

<i>(Link to Specific Objectives B5.7, B5.8, B6.13, B7.3 and D9).</i> |

SECTION B: LIFE PROCESSES (cont'd)

7. REPRODUCTIVE SYSTEM

SPECIFIC OBJECTIVES

Students should be able to:

7.1 *distinguish between sexual and asexual reproduction;*

EXPLANATORY NOTES

Sexual: meiosis, gametes, variation in offspring, two individuals involved.

Asexual: mitosis, identical offspring, one individual involved.

(Link to Specific Objectives C3 and C5).

7.2 describe the structure and function of the reproductive systems in human beings;

Include the structures and adaptation of the gametes, related disorders such as ovarian, cervical and prostate cancers.

Include labelled diagram of systems.

(Link to Specific Objective D10).

7.3 describe the menstrual cycle;

Include the use of diagram for illustration; role of hormones: follicle stimulating hormone (FSH), luteinising hormone (LH), oestrogen, progesterone.

(Link to Specific Objective B6.15).

7.4 explain ovulation, fertilisation, implantation and development of the embryo;

Include diagram of foetus in uterus; role of placenta, umbilical cord, amniotic sac and amniotic fluid;

Minute details of stages of development are not required.

7.5 *describe the stages of the birth process;*

Stage 1: contraction, dilation.

Stage 2: contraction, crowning, expulsion of foetus.

Stage 3: contraction, expulsion of the placenta.

Include the role of oxytocin.

7.6 *discuss pre-natal/ante-natal and post-natal care for mother and baby;*

Include the advantages of breastfeeding, immunisation, medical visits, proper diet;

Include conditions associated with the use of drugs, alcohol and smoking.

(Link to Specific Objective D22).

SECTION B: LIFE PROCESSES (cont'd)

REPRODUCTIVE SYSTEM (cont'd)

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

- | | | |
|------|--|--|
| 7.7 | <i>explain how birth control methods prevent pregnancy;</i> | <i>Include natural, barrier, hormonal and surgical methods.</i> |
| 7.8 | <i>discuss the advantages and disadvantages of birth control methods;</i> | |
| 7.9 | <i>discuss the issues related to abortion;</i> | <i>Include spontaneous abortion (miscarriage); reasons for; advantages and disadvantages and ethical concerns.</i> |
| 7.10 | <i>discuss the importance of family planning; and,</i> | <i>Include social and economic implications.</i> |
| 7.11 | <i>use tables, charts and diagrams to represent data on diseases of the reproductive system.</i> | <i>Construction and interpretation of tables, graphs, and charts.</i> |

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of this Section, teachers are advised to engage students in the teaching and learning activities listed below.

- Teachers should present authentic scenarios for students to discuss. For example, a family with different age groups and suggested meals; different groups of women and suggested contraceptives.*
- Present students with food labels and allow them to analyse the nutritional values of the products. Have students discuss the influence of packaging and marketing (commercial determinants) on the consumption of these products.*
- Have students keep a food log for three days to determine whether their diets are balanced.*
- Have students conduct tests on popular foods to determine the presence of the various food groups.*
- Have students create a Sugar, Salt or Fat Sense display.*
- Ask students to investigate breathing with measuring tapes, cobalt chloride paper and slides, to determine changes in the circumference of the chest cavity and the exhalation of water vapour.*

7. *Have students visit websites such as <http://sciencespot.net/> to better understand the mechanism for blood typing.*
8. *Arrange for students to view audio visuals, computer-assisted learning for reinforcement of content.*
9. Draw and use charts, models, *infographs, and concept maps* to assist students with learning of the structures of different organs *and processes*.
10. Undertake a brainstorming and discussion session to ascertain students' knowledge of topics. This type of activity may be used to generate interest before formal teaching/learning begins.
11. *Have a display of the methods of contraception, to include demonstrations where possible.*
12. Arrange for students to view displays of specimens of bones, the heart, kidney, stomach, and *digestive system* of animals. A convenient source is the local butcher.
13. Conduct demonstrations *or show simulations* of dissections or examination of specimens, for example, eye or brain.
14. *Demonstrate the effects of light in the eye, that is, pupil and spinal reflex. Use of the pin hole camera.*
15. Conduct research on the impact of diet on health and the effects of smoking especially in the Caribbean.
16. *Create social media campaigns/public service announcements (incorporating use of videos/pictures) to encourage the use of the ideal healthy plate using Caribbean food groups.*
17. *Invite personnel from the Red Cross Society or other health personnel to demonstrate Cardiopulmonary Resuscitation (CPR).*
18. *Obtain graphs/data, which depict the prevalence of obesity, smoking, hypertension, and diabetes and analyse them.*
19. *Obtain data on modifiable risk factors and determine their link to the incidence of obesity, hypertension, diabetes, and cardiovascular diseases.*
20. *Have students create model of arms to demonstrate the working of antagonistic muscles.*
21. Use flow charts to illustrate processes such as regulation of body temperature, glucose concentration in blood and osmoregulation.
22. Organise a science fair and invite members of *the* school population or immediate community to view students' displays.
23. Conduct laboratory activities.

◆ SECTION C: HEREDITY AND VARIATION

GENERAL OBJECTIVES

On completion of this *section*, students should:

1. *understand the concept of a gene as it pertains to DNA, chromosomes and alleles;*
2. *understand the role of genes and heredity in determining how traits can be altered and inherited by asexual and sexual means through the process of mitosis and meiosis respectively;*
3. *develop an awareness of the importance of genetic variation and its role in natural selection; and,*
4. *appreciate the social and ethical implications of genetic engineering.*

SPECIFIC OBJECTIVES

Students should be able to:

1. * distinguish among DNA, chromosomes, genes and alleles;
2. * describe the process of mitosis;
3. explain the importance of mitosis;
4. * describe the process of meiosis;
5. explain the importance of meiosis;

EXPLANATORY NOTES

Include the definitions of genetic terms.

Haploid as the 'n' number of chromosomes.

Diploid as the '2n' number of chromosomes.

Include the definition of mitosis; movement of chromosomes during mitosis (include names of stages); labelling of diagrams.

Include the production of identical daughter cells having the same number (diploid) and type of chromosomes as the parent cell (clones); *needed for growth, repair and asexual reproduction.*

Include the definition of meiosis; movement and separation of homologous chromosomes and the subsequent separation of chromatids

(include names of stages); labelling of diagrams.

Include the importance of halving the chromosome number (*haploid*) in the formation of gametes; importance of meiosis in introducing variation into gametes.

(Link to Specific Objective B7.1).

SECTION C: HEREDITY AND VARIATION (cont'd)

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

6. explain the inheritance of a single pair of characteristics (monohybrid inheritance);
- Include* dominant, recessive, homozygous, heterozygous, *genotype and phenotype*.
- Monohybrid inheritance to include: albinism and tongue rolling.*
- Include the use of the Punnett Square to determine genotypic and phenotypic ratios obtained from crossing homozygous and heterozygous parental and genotypes.*
7. describe the inheritance of sex in human beings;
- Include the role of sex chromosomes in determining sex and the inheritance of genetic diseases.*
- Include genetic diagrams for sex-linkage (sickle cell anaemia, haemophilia and colour blindness).*
8. * explain why genetic variation is important to living organisms;
- Include* examples of variation - height, weight, *sex*, blood type, tongue rolling; *antibiotic-resistant bacteria*.
9. distinguish between genetic variation and environmental variation;
- Include the difference between continuous and discontinuous variation; *Mutation, (Down Syndrome, Klinefelter's, Turner's Syndrome, and albinism)*.
10. *discuss natural selection;*
- Include the development of antibiotic-resistant bacteria; the prevalence of sickle cell anaemia in people of African descent.*
11. explain the concept of genetic engineering;
- Include the definition and examples.*
12. discuss the advantages and disadvantages of genetic engineering; and,
- Include recombinant DNA in the manufacture of insulin; its application in the production of food and medicine - *Genetically Modified Organisms (GMOs)*.
- Include ethical concerns.*
13. use tables, charts and graphs to represent data on heredity and variation.
- Construction and interpretation of tables, graphs and charts.*

SECTION C: HEREDITY AND VARIATION (cont'd)

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of this Section, teachers are advised to engage students in the teaching and learning activities listed below.

1. *Arrange for students to construct models of mitosis and meiosis.*
2. *Assign students to construct models with the use of coloured beads or seeds to demonstrate genetic crosses and determine genotypic and phenotypic ratios.*
3. *Construct a model showing the use of bacteria and plasmids in genetic engineering.*
4. *Use of diagrams showing karyotype to illustrate homologous chromosomes and mutation. For example, Down Syndrome and Turner's Syndrome.*
5. *Arrange for students to engage in panel discussions or debates relating to genetically modified foods and medicines.*
6. *Use of worksheets to practise genotypic and phenotypic ratios for monohybrid crosses.*
7. Use video presentations and computer-assisted learning *tools* to enhance learning.

◆ SECTION D: DISEASES AND **THEIR** IMPACT ON HUMANS

GENERAL OBJECTIVES

On completion of this *section*, students should:

1. understand the basic concepts of human well-being and disease; and,
2. appreciate the social and economic importance of disease control.

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

1. define *the terms health and disease*;
Include the World Health Organisation (WHO) definition.
2. *classify the types of diseases*;
Include communicable /pathogenic/ infectious diseases: sexually transmitted infections (STIs), fungal infections, and vector-borne diseases.
Include non-communicable diseases (NCDs)/ chronic/ degenerative/ physiological diseases: nutritional deficiency diseases, inherited disorders, lifestyle diseases and mental health problems (anxiety, neurosis, stress and depression).
3. differentiate between signs and symptoms of diseases;
Include the definitions and examples of signs and symptoms of diseases.
4. *discuss respiratory diseases*;
Include asthma, influenza and bronchitis;
Include causes, signs/symptoms, treatment, modality, prevention and the effect of these diseases on the respiratory tract.
(Link to Specific Objectives B2.4 and B2.11).
5. *discuss gastrointestinal diseases*;
Include cholera and gastroenteritis;
Include causes, signs/symptoms, treatment, modality and prevention of these gastrointestinal diseases.
(Link to Specific Objective B1.9)

SECTION D: DISEASES AND **THEIR** IMPACT ON HUMANS (cont'd)

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

6. *discuss sexually transmitted infections (STIs);*
Include gonorrhoea, syphilis, Human Papillomavirus (HPV), herpes, and chlamydia.

Include causes, signs/symptoms, treatment, modality and prevention of these sexually transmitted infections (STIs).
7. *discuss Human Immuno deficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS);*
Include causes, symptoms, method of transmission, mode of action, methods of limiting spread/prevention and possible treatment (anti-retroviral drugs - side effects) of HIV/AIDS.

Include ethical considerations. For example, discrimination.
8. *describe the effects of sexually transmitted infections (STIs) on the pregnant mother and the foetus;*
Include gonorrhoea, syphilis, and herpes.
9. *discuss chronic/lifestyle-related diseases;*
Include obesity (adult and childhood), diabetes mellitus (Type I and Type II), cardiovascular diseases (hypertension and coronary heart disease), secondary hypertension as complications of obesity;

Include causes, signs/symptoms, treatment, modality and prevention of these diseases.

Include the importance of diet and exercise.

(Link to Specific Objectives B1.12 and B3.11).
10. *discuss cancers;*
Include cancers associated with respiratory tract; cervical, breast, uterine, colon and prostate.

Include causes, signs/symptoms, treatment, modality and reduction of the risk of these cancers.
11. *discuss the impact of diseases on the human population;*
Include socio-economic implications.

Include definitions of epidemic and pandemic.

Include how NCDs affect personal productivity; assess how these affect goal- setting, occupation, and exercise.

SECTION D: DISEASES AND **THEIR** IMPACT ON HUMANS (cont'd)

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

12. *discuss* the effect of vectors on human health;
- Include the definition and examples of vectors (rats, mosquitoes, houseflies).*
- Include transmission of pathogen.*
- Analysis and interpretation of data.*
13. describe the life cycle of the mosquito and housefly;
- Include labelling of diagrams.
14. *discuss mosquito-borne diseases;*
- Include malaria, dengue (strains I - IV), Zika, chikungunya.*
- Include signs, symptoms, causative agent, method of transmission, prevention/control, and treatment of mosquito-borne diseases.*
15. *explain the importance and methods of controlling vectors which affect human health;*
- Include the spread of communicable fatal diseases, such as leptospirosis, dengue fever, gastroenteritis.*
- Biological controls; chemical controls; mechanical controls; sanitary controls.*
16. *explain how and why personal hygiene is maintained;*
- Include elimination of body odours; social acceptance; prevention of infections (ringworm); prevention of dental caries.*
- Care of genitalia - include male circumcision.*
- (Link to Specific Objectives B1.19 and B7.2).*
17. *explain the methods used to control the growth of microorganisms;*
- Include* definition of the term sterilization, methods of sterilization (ultra- high temperature, pasteurisation, autoclaving, boiling, canning).
- Include effects of high temperatures in the control of microorganisms.*
- Include* disinfection - use of chemical agents (chlorine, disinfectants, antiseptics) in the control of microorganisms.
18. *distinguish between disinfectants and antiseptics;*
- Include* definitions.
19. explain the use of common antibiotics and antifungal agents;
- Include definitions and functions of antibiotics, antigen, antibody, anti-toxin.*
- (Link to Specific Objective C8).*



SECTION D: DISEASES AND **THEIR** IMPACT ON HUMANS (cont'd)

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

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|-----|---|--|
| 20. | <i>explain the types of immunity;</i> | <i>Include artificial (active and passive); natural (active and passive). (Link to Specific Objective B3.3).</i> |
| 21. | <i>distinguish between immunity and immunisation; vaccine and vaccination;</i> | <i>Include definition of terms.</i> |
| 22. | <i>discuss the use and misuse of drugs on humans;</i> | <i>Include classification (stimulants, depressants, hallucinogens, narcotics); dependence; Prescription drugs (opioids, sedatives, pain killers and medicinal marijuana); antibiotics.</i>

<i>Non-prescription (cocaine, methamphetamine, heroin, ecstasy, alcohol, marijuana; physiological and psychological effects.</i>

<i>(Link to Specific Objective B2.11).</i> |
| 23. | <i>explain the social and economic effects of drug misuse on the individual, family and community; and,</i> | <i>Analysis and interpretation of data.</i>

<i>(Link to Specific Objective B2.11).</i> |
| 24. | <i>use tables, graphs and charts to represent data on diseases and their impact on human beings.</i> | <i>Construction and interpretation of tables, graphs and charts.</i> |

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of this Section, teachers are advised to engage students in the teaching and learning activities listed below.

1. Invite guest lecturers to discuss *health-related* issues.
2. Use video presentations and computer-assisted learning *tools* to enhance learning.
3. Arrange public visits to clinics or national associations, for example, Diabetes Association, Heart Foundation.
4. *Have students engage in panel discussions or debates on ethical behaviours in managing the spread of communicable diseases. For example, STIs, HIV/AIDS.*
5. Assign students to conduct research *and analysis of data* on *diseases as well as* the misuse of substances.
6. *Have students create brochures, posters, infographs, and pamphlets.*



◆ SECTION E: THE IMPACT OF HEALTH PRACTICES ON THE ENVIRONMENT

GENERAL OBJECTIVES

On completion of this section, students should:

1. appreciate the nature of the relationship between human beings and their environment;
2. understand that the environment is fragile and there is need to preserve it; and,
3. appreciate the contribution of modern technology to the maintenance of good health.

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

- | | |
|--|---|
| 1. identify pollutants in the environment; | <i>Include</i> definition of pollution and pollutant; including domestic, industrial (<i>thermal, heavy metals, dumping of oils</i>) and agricultural pollutants. |
| 2. discuss the causes of water and air pollution; | <i>Include</i> combustion, improper disposal of sewage. |
| 3. describe the effects of pollutants on human beings and the environment; | <i>Include</i> eutrophication; social and economic effects.

Analysis and interpretation of data.

(Link to Specific Objective B2.4, B5.2). |
| 4. explain the methods of controlling pollution; | <i>To include methods of controlling water, air, noise and land pollution. For example, the use of renewable energy sources.</i> |
| 5. describe the water cycle; | <i>Include</i> evaporation, condensation, run-off, transpiration, respiration <i>and</i> filtration through the layers of limestone.

<i>Include</i> labelling of diagrams. |
| 6. describe simple ways of purifying water in the home; | <i>Include</i> boiling, purification tablets and addition of chlorine/bleach. |
| 7. <i>describe the process of testing water for bacteria;</i> | <i>Include</i> use of Agar plate.

<i>Include</i> labelling of diagrams. |

SECTION E: THE IMPACT OF HEALTH PRACTICES ON THE ENVIRONMENT (cont'd)

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

8. *describe the processes involved in large-scale water purification;*
Include screening, sedimentation, filtration, chlorination.
Include labelling of diagrams.
9. *discuss the impact of human activities on water supplies;*
(Link to Specific Objective E2).
10. *explain why contaminated water is detrimental to human beings;*
(Link to Specific Objective D5).
11. *distinguish between proper and improper sewage disposal practices;*
(Link to Specific Objective E2).
12. *discuss the impact of improper sewage disposal practices;*
13. *outline the methods used for the treatment of sewage;*
Include biological filter and activated sludge methods.
Include the importance of screening and filtration.
Include the role of microorganisms in the treatment of sewage.
14. *evaluate the efficiency of the methods of domestic refuse disposal;*
Include composting, separation of waste, bio-diesel, dumping, burning, garbage collection.
Include ethical considerations.
Analysis and interpretation of data.
15. *differentiate between a dump and a landfill;*
16. *describe the operations at a landfill;*
Include a description of a landfill.
17. *discuss the importance of landfills in the Caribbean;*
Include the function of landfill.

SECTION E: THE IMPACT OF HEALTH PRACTICES ON THE ENVIRONMENT (cont'd)

SPECIFIC OBJECTIVES

EXPLANATORY NOTES

Students should be able to:

- | | |
|---|---|
| 18. evaluate the impact of solid waste on the environment; | <i>Analysis and interpretation of data.</i> |
| 19. analyse measures used to control solid waste volume; | <i>Include reduce, reuse and recycle; examples of recyclable materials.</i>

<i>Include operations at a recycling centre.</i> |
| 20. distinguish between the terms biodegradable and non-biodegradable; and, | <i>Include classification of biodegradable and non-biodegradable items.</i> |
| 21. discuss the impact of environmental issues on humans. | <i>Include food security, land security and health as it relates to environmental issues (for example, global warming).</i>

<i>(Link to Specific Objective A13).</i> |
| 22. use tables, charts and graphs to represent data on the impact of health practices on the environment. | <i>Construction and interpretation of tables, graphs and charts.</i> |

Suggested Teaching and Learning Activities

To facilitate students' attainment of the objectives of this Section, teachers are advised to engage students in the teaching and learning activities listed below.

- Arrange visits to landfills, sewage treatment, water treatment and recycling plants.*
- Assign students to conduct research on landfills, sewage treatment plants and water treatment plants.
- Assign students to carry out investigations involving data collection in the community or home on the impact of solid waste and make suggestions on how related problems may be resolved.
- Conduct brainstorming and discussion sessions to ascertain students' knowledge on topics.
- Use charts, *models* and other audio-visual aids to assist students with learning the processes involved in water treatment and sewage treatment.
- Have students engage in panel discussions or debates on ethical behaviours in managing garbage disposal.*
- Use video presentations and computer-assisted learning *tools* to enhance learning.

◆ GUIDELINES FOR THE CONDUCT OF THE SCHOOL-BASED ASSESSMENT IN HUMAN AND SOCIAL BIOLOGY

School-Based Assessment (SBA) is an integral part of student assessment in the course covered by this syllabus. It is intended to assist students in acquiring certain knowledge, skills and attitudes that are associated with the subject. The activities for the School-Based Assessment should form part of the learning activities to enable the student to achieve the objectives of the syllabus. Group work is encouraged.

During this course of study, students obtain marks for the competencies they develop and demonstrate in undertaking their SBA assignments. These marks contribute to the final marks and grades that are awarded to students for their performance in the examination.

The guidelines provided in this syllabus for selecting appropriate tasks are intended to assist teachers and students in the selection of assignments that are valid for the purpose of School-Based Assessment. The guidelines provided for the assessment of these assignments are intended to assist teachers in awarding marks that are reliable estimates of the achievement of students in the School-Based Assessment component of the course. In order to ensure that the scores awarded by the teachers are consistent with the Caribbean Examinations Council's standards, the Council undertakes the moderation of a sample of the SBA assignments marked by each teacher.

School-Based Assessment provides an opportunity to individualise a part of the curriculum to meet the needs of students. It facilitates feedback to the student at various stages of the experience. This helps to build the self-confidence of students as they proceed with their studies. The SBA also facilitates the development of critical skills and abilities and enhances the validity of the examination scores on which candidate performance is reported. School-Based Assessment, therefore, makes a significant and unique contribution to both the development of relevant skills and the testing and rewarding of students for the development of those skills. The guidelines provided in this syllabus are intended to assist students and teachers in undertaking the SBA.

RESEARCH PROJECT

The School-Based Assessment component of the Human and Social Biology Syllabus is a single guided research project for school candidates.

Candidates will be required to conduct research in their school or community on a current health-related or environmental issue and its socio-economic impacts in their territory. They will be expected to collect data, analyse and interpret the data and provide recommendations.

In the research project, students should:

- 1. provide a background/overview of the current health-related or environmental issue;*
- 2. provide a statement of the issue to be investigated in an appropriate form - an observation or question;*
- 3. state the objective of the research;*
- 4. describe the methodology and instruments used to collect data;*

5. *present the data obtained using at least two appropriate forms;*
6. *analyse and interpret the data with reference to the issue;*
7. *state relevant conclusions based on findings;*
8. *make recommendations (at least two) based on the findings;*
9. *provide personal reflections on completion of the project; and,*
10. *present the report in an appropriate format including a cover page, table of contents, bibliography and appendices.*

SBA REQUIREMENTS

Every candidate who enters for the **CSEC®** Human and Social Biology examination must submit a report on a project. Students may work individually or in groups to gather data. Each candidate must be identified on the report. The report should not exceed 1,000 words, *excluding bibliography, charts, graphs, tables, pictures, references and appendices*. Wherever a report exceeds the maximum length for the project by more than *150 words*, the teacher must impose a penalty of 10 per cent of the score achieved on the project. On the report, the teacher should clearly indicate the original score – that is, the score before the deduction is made – the marks which are to be deducted, and the final score awarded after the deduction has been made.

Only the final score is to be indicated on the record sheets which are submitted to **CXC®** electronically via the SBA data capture module on the Online Registration System (ORS) on the Council's website.

FORMAT OF THE REPORT

A student's report should be presented electronically and should comprise the following components in the order prescribed below:

1. *Cover Page including the candidates' number, name of subject and date of submission*
2. *Table of Contents*
3. *Introduction*
 - *Background or overview of the current health-related or environmental*
 - *Statement of the problem*
 - *Research Objective*
4. *Methodology - data collection procedures and instrumentation, limitations of research*
5. *Presentation of Data*
6. *Analysis and Interpretation of Data*
7. *Conclusion*
8. *Recommendations*
9. *Reflection*
10. *Bibliography*
11. *Appendices*

MARKSCHEME FOR SCHOOL-BASED ASSESSMENT

Reports should be marked out of an aggregate of 40 marks to be applied to the Use of Knowledge (UK) profile. The following table shows the criteria that should be used to allocate marks for the various components of the report.

ASSESSMENT CRITERIA	PROFILE <i>Use of Knowledge</i> (UK)
<p>1. Background/Overview of Issue</p> <ul style="list-style-type: none"> • Provides a clear, detailed description of a current health-related or environmental issue • Description is detailed but lacks clarity 	<p>(2)</p> <p style="margin-left: 40px;">2</p> <p style="margin-left: 40px;">1</p>
<p>2. Problem Statement</p> <ul style="list-style-type: none"> • Research problem is stated clearly • Research problem is in an appropriate form – an observation or question 	<p>(2)</p> <p style="margin-left: 40px;">1</p> <p style="margin-left: 40px;">1</p>
<p>3. Research Objective</p> <ul style="list-style-type: none"> • Objective of the research is linked to the issue • Objective of the research is realistic/feasible 	<p>(2)</p> <p style="margin-left: 40px;">1</p> <p style="margin-left: 40px;">1</p>
<p>4. Methodology</p> <ul style="list-style-type: none"> • Sample used is <u>identified</u> and <u>clearly described</u> • Data collection instrument is <u>identified</u> and <u>clearly described</u> • Method of data collection is <u>identified</u> and <u>clearly described</u> • Method of data collection is adequately justified • ONE limitation of data collection method clearly stated 	<p>(8)</p> <p style="margin-left: 40px;">2</p> <p style="margin-left: 40px;">2</p> <p style="margin-left: 40px;">2</p> <p style="margin-left: 40px;">1</p> <p style="margin-left: 40px;">1</p>
<p>5. Presentation of Data</p> <ul style="list-style-type: none"> • Data is presented in an appropriate form using tables, graphs and charts • Data is presented in at least TWO forms • Form(s) used for presentation of data is correctly labelled • Data presented are accurate 	<p>(5)</p> <p style="margin-left: 40px;">1</p> <p style="margin-left: 40px;">2</p> <p style="margin-left: 40px;">1</p> <p style="margin-left: 40px;">1</p>

ASSESSMENT CRITERIA	PROFILE <i>Use of Knowledge</i> (UK)
6. Analysis and Interpretation of Data <ul style="list-style-type: none"> • Data is analyzed using appropriate calculations/statistics/themes • Data is summarized accurately • At least TWO statements of findings based on data presented • Findings are consistent with analyses 	(5) 1 1 2 1
7. Conclusion <ul style="list-style-type: none"> • Conclusion succinctly summarizes the project • Conclusion is logical and based on findings 	(2) 1 1
8. Recommendations <ul style="list-style-type: none"> • At least TWO recommendations proposed • Recommendations are realistic • Recommendations are informed by findings 	(4) 2 1 1
9. Reflection: Candidate states the following information: <ul style="list-style-type: none"> • TWO lessons learnt after undertaking the project. • ONE way in which the lesson learnt could be applied to his/her personal life. • ONE way in which the project could be improved. • ONE social impact and ONE economic impact the issue could have on his/her school or community if not rectified. 	(6) 2 1 1 2
10. Overall Presentation <ul style="list-style-type: none"> • Layout of report follows the correct format inclusive of cover page, table of contents, bibliography and appendices If layout includes only two elements – 1 mark only • Bibliographic information contains names of authors, publishers and dates of publication • Consistent use of correct spelling and grammar 	(4) 2 1 1
TOTAL	40

MANAGEMENT OF THE PROJECT

The research project is worth 20% of the candidate's total mark. The teacher is expected to provide guidance at all stages of the project. Each candidate should know the requirements of the project and the assessment criteria should be discussed.

School-Based Assessment tasks should be completed in the course of normal teaching time and supervised and marked by the teacher. *The project should be integrated in the teaching of the subject and assessment should be conducted on a continuous basis and feedback given to students for further improvement.* Although some of the data collection and research work must be undertaken outside of normal school time, the teacher must be satisfied that the work submitted for assessment is the student's own work. The teacher must:

1. provide assistance to students in the selection of projects;
2. advise students of the nature of the task, the scope and depth required to fulfil the requirements of the SBA;
3. advise on the availability of resource materials;
4. monitor students' progress by advising them of the quality of their work and by recommending ways to improve the quality of the project;
5. collect and grade students' projects;
6. keep records of students' marks and submit these, together with samples of their work, as requested by **CXC**[®]; and,
7. ensure that the SBA guidelines are closely followed and the marking criteria are adequately met.

Planning

An early start to planning project work is highly recommended. A schedule of the dates for submitting project work (agreed by both teachers and candidates) should be established.

Authenticity

Teachers should ensure that the project presented is the work of the student. This can be achieved by systematic monitoring and evaluation of student's work throughout the development of the project. This will guard against plagiarism and ensure that the work is the intellectual property of the student.

Authenticity can also be ensured by:

1. *discussing the project and creating an outline with timelines;*
2. *offering guidance and timely feedback to students; and,*
3. *allocating some class time for students to work on the projects.*

GUIDELINES FOR THE ALTERNATIVE TO SCHOOL-BASED ASSESSMENT

Paper 032 is the Alternative to School-Based Assessment (SBA) of the **CXC**[®] examination in Human and Social Biology. Paper 01 is a multiple-choice paper and Paper 02 is a structured essay paper. Paper 031 is the SBA for school candidates and Paper 032 is for private candidates only.

The Alternative to the School-Based Assessment in Human and Social Biology (Paper 032), takes the form of a written examination. This paper will consist of a case study and related questions involving a health related issue in a named Caribbean territory.

Please note that candidates taking Paper 032 are NOT required to submit a report.

MODERATION OF SCHOOL-BASED ASSESSMENT

School-Based Assessment Record Sheets are available on the **CXC**[®]'s website (www.cxc.org). All School-Based Assessment Record of marks must be submitted online using the SBA data capture module of the Online Registration System (ORS). A sample of assignments will be requested by **CXC**[®] for moderation purposes. These assignments will be reassessed by **CXC**[®] Examiners who moderate the School-Based Assessment. Teachers' marks may be adjusted as a result of moderation. The Examiners' comments will be sent to schools.

Copies of the students' assignment that are not submitted must be retained by the school until three months after publication by **CXC**[®] of the examination results.

◆ RESOURCES

The following is a list of books that might be used for Human and Social Biology. Each student should have access to at least one text.

- | | |
|--|---|
| <i>Fosbery, R., Alleyne, T., Brown, M. and Michelle C.</i> | <i>Human and Social Biology for CSEC – A Caribbean Examinations Council Study Guide. 2014.</i> |
| <i>Fosbery, R. and Givens, P.</i> | <i>Human and Social Biology for CSEC. Oxford University Press, 2015.</i> |
| <i>Fullick, A. and Ragoobirsingh, D.</i> | Human and Social Biology for CSEC. 2 nd Edition. Essex: Pearson Education Limited, 2010. |
| Gadd, P. | <i>Human and Social Biology for CSEC Examination. 6th Edition. Oxford: MacMillian Education, 2009.</i> |
| <i>Morris, Alexia.</i> | <i>Human and Social Biology for CSEC. Pearson Education Limited, 2015.</i> |
| Waugh, A. and Grant, A. (Editors) | Ross and Wilson Anatomy and Physiology in Health and Illness. London: Churchill Livingstone, 2014. |

Websites

Sections	Topic	URLS
A: Living Organisms and the Environment	Structure of the cell Osmosis, diffusions, and Active transport	https://www.cellsalive.com/StudyAids.htm https://www.centreofthecell.org/learn-play/games/explore-a-cell/ https://www.centreofthecell.org/learn-play/games/ https://learn.genetics.utah.edu/content/cells/insideacell/ https://learn.genetics.utah.edu/content/cells/ https://www.biologyjunction.com/biology_games.htm http://workbench.concord.org/database/activities/321.html
B: Life processes	Nervous system Digestive System	https://printableworksheets.in/human-body-worksheets https://quizlet.com/subject/human-biology/ https://learn.genetics.utah.edu/content/neuroscience/crossingdivide/ https://learn.genetics.utah.edu/content/neuroscience/madneuron/ https://digestivesystemwebinquiry.weebly.com/group-activities.html https://wartgames.com/themes/humanbody/digestivesystem.html https://classroom.kidshealth.org/classroom/prekto2/body/systems/digestive.pdf
C: Heredity and Variation	Basic Genetics	https://www.biologyjunction.com/biology_games.htm https://learn.genetics.utah.edu/content/basics/
D: Disease and Their Impact on Humans		<p>Infectious disease activity: https://www.windows2universe.org/?page=/teacher_resources/infectious_disease.html</p> <p>Mosquito borne disease: https://www.hhmi.org/biointeractive/stopping-mosquito-borne-disease</p> <p>Malaria: https://www.hhmi.org/biointeractive/stopping-mosquito-borne-disease</p> <p>Infection prevention: http://www.pkids.org/infection_protection/infectious_disease_workshop.html</p> <p>Cancer basics: https://www.cancer.org/cancer/cancer-basics.html</p> <p>What is cancer? http://www.scholastic.com/browse/article.jsp?id=3751444</p> <p>Games - drug use and effects https://teens.drugabuse.gov/games</p> <p>https://www.educationworld.com/a_tech/archives/webquest.shtml</p>

<p>E: The Impact of Health Practices on the Environment</p>	<p>Human impact on the environment</p>	<p>https://www.teachertube.com/video/human-impact-on-the-environment-gcse-biology-293011</p> <p>Air pollution: https://kidsenvirohealth.nlm.nih.gov/generic/2/games</p> <p>Green activities: https://www.teachervision.com/green-activities</p> <p>Climate kids: https://climatekids.nasa.gov/</p> <p>Recycle city: https://www3.epa.gov/recyclecity/</p>
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◆ GLOSSARY

WORD/TERM	DEFINITION/MEANING	
annotate	Add a brief note to a label.	Simple phrase or a few words only; (UK)
apply	Use knowledge/principles to solve problems.	make inferences/ conclusions; (UK)
appraise	To judge the quality or worth of.	(UK)
assess	Present reasons for the importance of particular structures relationships or processes.	compare the advantages and disadvantages or the merits and demerits of a particular relationship or process; (UK)
calculate	Arrive at the solution to a numerical problem.	steps should be shown; units must be included; (UK)
classify	Divide into groups according to observable characteristics.	(UK)
comment	State opinion or view with supporting reasons.	(UK)
compare	State similarities and differences.	an explanation of the significance of each similarity and difference stated may be required for comparisons which are other than structural, (KC/UK)
construct	Use a specific format to make and/or draw a graph, histogram, pie chart or other representation using data or material provided or drawn from practical investigations, build (for example, a model), draw scale diagram.	such representations should normally bear a title, appropriate headings and legend; (UK)
deduce	Make a logical connection between two or more pieces of information; use data to arrive at a conclusion.	(UK)

WORD/TERM	DEFINITION/MEANING	
define	State concisely the meaning of a word or term.	This should include the defining equation/formula where relevant. (KC)
demonstrate	Show clearly by giving proof or evidence; direct attention to.	(KC)
derive	To deduce; determine or extract from data by a set of logical steps some relationship, formula or result.	This relationship may be general or specific. (UK)
describe	Provide detailed factual information of the appearance or arrangement of a specific structure or the sequence of a specific process.	Descriptions may be in words, drawings or diagrams or any appropriate combination. Drawings or diagrams should be annotated to show appropriate detail where necessary. (KC)
determine	Find the value of a physical quantity.	
design	Plan, and present with appropriate practical detail.	Where hypotheses are stated or when tests are to be conducted, possible outcomes should be clearly stated and/or the way in which data will be analysed and presented.
develop	Expand or elaborate an idea or argument with supporting reasons.	(KC/UK)
differentiate/distinguish (between/among)	State or explain briefly those differences between or among items which can be used to define the items or place them into separate categories.	(KC)
discuss	Present reasoned arguments; consider points both for and against; explain the relative merits of a case.	(UK)
draw	Make a line representation from specimens or apparatus that shows an accurate relationship between the parts.	In case of drawings from specimens, the magnification must always be stated. A diagram is a simplified representation showing the relationship between components.

WORD/TERM	DEFINITION/MEANING	(KC/UK)
estimate	Make an approximate quantitative judgment.	
evaluate	Weigh evidence and make judgments based on given criteria.	The use of logical supporting reasons for a particular point of view is more important than the view held; usually both sides of an argument should be considered. (UK)
explain	Give reasons based on recall; account for.	(KC)
find	Locate a feature or obtain as from a graph.	(UK)
formulate	To express in a formula or in a systematic manner.	(UK)
identify	Name or point out specific components or features	(KC)
illustrate	Show clearly by using appropriate examples or diagrams, sketches.	(KC/UK)
investigate	Use simple systematic procedures to observe, record data and draw logical conclusions.	
justify	To prove a statement or claim true.	(UK)
label	Add names to identify structures or parts indicated by pointers.	(UK)
list	Itemise without detail.	(KC)
measure	Take accurate quantitative readings using appropriate instrument.	
name	Give only the name of.	No additional information is required.
note	Write down observations.	
observe	Pay attention to details which characterise a specimen, reaction or change taking place; to examine and note scientifically.	Observations may involve all the senses and/or extensions of them, but would normally exclude the sense of taste.

WORD/TERM	DEFINITION/MEANING	
plan	Prepare to conduct an exercise.	
predict	Use information provided to arrive at a likely conclusion or suggest a possible outcome.	(UK)
record	Write an accurate description of the full range of observations made during a given procedure.	This includes the values for any variable being investigated where appropriate recorded data may be depicted in graphs, histograms or tables.
relate	Show connections between; explain how one set of facts or data depend on others or are determined by them.	(UK)
sketch	Make a simple freehand diagram showing relevant proportions and any important details.	(KC)
state	Provide factual information in concise terms, omitting explanation.	(KC)
suggest	Offer an explanation deduced from information or previous knowledge.	No correct or incorrect solution is presumed but suggestions must be acceptable within the limits of scientific knowledge; (UK).
suggest an hypothesis	Provide a generalisation which offers a likely explanation for a set of data or observations.	(UK)
test	To find out by following set procedures.	

SECTION	SPECIFIC OBJECTIVES	PRACTICAL ACTIVITIES
A: LIVING ORGANISMS AND THE ENVIRONMENT	2	<i>Draw and label cells and cell structures from electron micrographs (mag. x 2000) or prepared slides.</i>
	5	<i>Examine prepared slides or micrographs of the different tissue types. For example, blood, muscle, nerves, connective tissue.</i>
	7	<ul style="list-style-type: none"> • <i>Experimental activity to demonstrate osmosis and diffusion in living cells.</i> • <i>Osmosis: the effect of different concentrations on plant tissue.</i> • <i>Diffusion: liquid in liquid and solid in liquid.</i>
	9	<i>Simple starch test on variegated and non-variegated leaves.</i>
	12	<i>Field study of a terrestrial or aquatic ecosystem.</i>
B: LIFE PROCESSES	1.6	<ul style="list-style-type: none"> • <i>Starch: Iodine Test.</i> • <i>Protein: Biuret Test (sodium hydroxide and copper sulfate solutions).</i> • <i>Reducing sugars: Benedict's Test.</i> • <i>Non-Reducing sugars: Hydrochloric acid followed by sodium bicarbonate and Benedict's solution.</i> • <i>Fats: Grease Spot and Emulsion Tests.</i>
	1.21	<i>Experiments to determine the effects of temperature and pH on potatoes or liver.</i>
	2.3	<i>Construct a model that demonstrates the breathing mechanism.</i>
	2.4	<i>Investigate the breathing rate before and after exercise.</i>
	6.5	<ul style="list-style-type: none"> • <i>Demonstration of knee jerk reflex.</i> • <i>Conduct an experiment investigating reaction time.</i>
C: HEREDITY AND VARIATION	1	<i>Construct models of the structure of DNA and chromosomes.</i>
	2	<i>Construct models of the stages of mitosis.</i>
	4	<i>Construct models of the stages of meiosis.</i>
	8	<i>Investigate and compare discontinuous variation with continuous variation. For example: discontinuous traits (tongue rolling, widow's peak, earlobes attached or detached), with continuous traits (height, foot size, length of index finger).</i>

◆ RECOMMENDED MINIMUM EQUIPMENT LIST

Several of the items listed may be supplied within the school.

1. Beakers 400 cm³/500 cm³ (graduated)
2. Beakers 250 cm³ (graduated)
3. Bell jars with bungs
4. Bottles (reagent), assorted
5. Bunsen Burners
6. Borers, cork
7. Charts and models
 - (a) Eye, human
 - (b) Skeleton, human
 - (c) Skin, human
 - (d) Female and male reproductive systems, pregnancy
 - (e) Respiratory system
 - (f) Digestive system
 - (g) Circulatory system
 - (h) Excretory system
 - (i) Cell structure
 - (j) Cell division – mitosis and meiosis
8. Coverslips or cover glasses
9. Measuring Cylinders (assorted)
10. Petri Dishes
11. Watch glasses
12. Conical Flasks, 250 ml
13. Filter Funnels (assorted)
14. Forceps
15. Test tubes
16. Test tube brushes
17. Test tube holders
18. Test tube racks
19. Knives or scalpels
20. Hand lenses
21. Microscope, light. Magnification x 40 objective, x 10 eyepiece
22. Plane mirrors
23. Refrigerator, small
24. Metre rules
25. Scissors
26. Microscope slides
27. Retort stands with clamps
28. Tripod stands
29. Stop Clocks
30. Stoppers or bungs, assorted cork, rubber
31. Measuring tapes
32. Thermometers, -10 to 110°C (Spirit)
33. Boiling tubes
34. Tubing (glass), assorted
35. Tubes, Y-piece connector
36. Tubing (rubber), normal and heavy wall
37. Wire Gauzes, with insulated centers
38. Spatulas
39. Dissecting pan and mat

◆ RECOMMENDED MATERIAL LIST

1. *Alcohol or ethanol*
2. *Balloons*
3. *Benedict's solution*
4. *Calcium Hydroxide*
5. *Cobalt Chloride paper*
6. *Copper II Sulphate*
7. *Methylene blue solution 1%*
8. *Hydrochloric acid (conc.)*
9. *Indicator, Universal pH paper*
2. *Indicator, Universal pH solution*
3. *Iodine in potassium iodide (KI) solution*
12. *Masking tape*
4. *Cotton wool*
5. *Filter paper*
10. *Plasticine*
11. *Pipettes, teat (droppers)*
12. *Sodium Chloride (table salt)*
13. *Sodium Hydrogen Carbonate*
14. *Sodium Hydroxide (pellets)*
15. *Vaseline*
16. *Prepared slides - human blood smear, Muscles*
17. *Skeleton*
 - (a) *Skeleton, mammalian, complete*
 - (b) *Vertebrae*
 - (c) *Girdles*
 - (d) *Long bone*
 - (e) *Skulls*
 - (f) *Teeth*

Western Zone Office
29 March 2019