L-Università ta' Malta

MATSEC
Examinations Board

SEC 04 Syllabus

Biology

2026

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Introduction

This syllabus is based on the curriculum principles outlined in *The National Curriculum Framework for All* (NCF) which was translated into law in 2012 and designed using the *Learning Outcomes Framework* that identify what students should know and be able to achieve by the end of their compulsory education.

As a learning outcomes-based syllabus, it addresses the holistic development of all learners and advocates a quality education for all as part of a coherent strategy for lifelong learning. It ensures that all children can obtain the necessary skills and attitudes to be future active citizens and to succeed at work and in society irrespective of socio-economic, cultural, racial, ethnic, religious, gender and sexual status. This syllabus provides equitable opportunities for all learners to achieve educational outcomes at the end of their schooling which will enable them to participate in lifelong and adult learning, reduce the high incidence of early school leaving and ensure that all learners attain key twenty-first century competences.

This programme also embeds learning outcomes related to cross-curricular themes, namely digital literacy; diversity; entrepreneurship creativity and innovation; education for sustainable development; learning to learn and cooperative learning and literacy. In this way students will be fully equipped with the skills, knowledge, attitudes and values needed to further learning, work, life and citizenship.

What is Biology?

Biology is the study of life on Earth: the various forms of life, how they evolved and how they interact with each other and with their respective environment. Biology also looks at how living things are structured and how they function.

What does a study of Biology entail?

The approach to studying Biology enhances the candidates' understanding of the subject. It promotes a holistic and integrated view of subject matter rather than the learning of isolated facts through routine memorisation. The programme fosters autonomous learning as it induces candidates to experience different educational technologies and modes of learning such as experiments, investigations, fieldwork, projects and site visits.

How is Biology related to candidates' lives, to Malta, and/or to the world?

The course incorporates personal, social, political, economic, technological and environmental aspects of biology. It is expected that where possible the teaching of Biology treats these considerations with particular reference to Maltese settings. To achieve this, various syllabus items refer to locally occurring organisms as well as local situations to illustrate biological principles.

The aspirational programme learning outcomes for this subject are:

At the end of the programme, I can:

- acquire knowledge and understanding of basic anatomical and physiological characteristics of organisms;
- identify interactions:
    - between organisms;
    - between organisms and their environment;
- associate the role of humans in the conservation and destruction of the environment;
- distinguish between the personal, social, political, economic, technological and environmental implications of biology;

- develop a scientific approach to problem solving which includes the assessment and interpretation of experimental data;
- acquire a range of manipulative and communicative skills appropriate to Biology;
- develop a working knowledge of other fields of study (e.g. mathematics, chemistry, physics, geography etc.) which are necessary for a proper understanding of biological concepts;
- obtain a worthwhile educational experience, whether or not they intend to study Biology beyond this level or pursue a career requiring knowledge of Biology.

List of Subject Foci

- Principles and basic structures of life
- Functions of Life (Nutrition and Respiration)
- Functions of Life (Movement of substances in organisms)
- Functions of Life (Maintaining balance)
- Functions of Life (Promoting future generations)
- The environment, relationships between organisms, and human impact on the environment
- Evolution and Diversity of life
- The Science of the Living World

List of Learning Outcomes

At the end of the programme, I can:

LO 1 Identify the fundamental processes necessary for life on Earth;

LO 2 Describe the relationship between energy and food for different organisms;

LO 3 Explain the various mechanisms and processes that allow organisms to exchange substances with their environment and transport such substances internally;

LO 4 Discuss how animals carry out fundamental processes necessary for the maintenance of the basic conditions for life;

LO 5 Describe how organisms produce new offspring carrying inherited genetic material;

LO 6 Recognise how organisms relate to one another and to their environment and how human activities impact the environment;

LO 7 Understand how genetic variety leads to evolution and how evolution leads to the diversity of life;

LO 8 Demonstrate an understanding of how Biology works and is communicated.

Programme Level Descriptors

This syllabus sets out the content and assessment arrangements for the award of Secondary Education Certificate in Biology at Level 1, 2 or 3. First teaching of this programme begins in September 2022. First award certificates will be issued in 2025.

The following levels refer to the qualification levels that can be obtained by candidates sitting for SEC examinations. These are generic statements that describe the depth and complexity of each level of study required to achieve an award at Level 1, 2 or 3 in Biology. (Level 1 being the lowest and level 3 the highest).

Level 1: At the end of the programme the candidate will have obtained basic knowledge, skills and competences in the subject such as basic repetitive communication skills and the ability to follow basic, simple instructions to complete tasks. Support is embedded within the task.

Level 2: At the end of the programme the candidate will have obtained good knowledge, skills and competence in the subject such as the interpretation of given information and ideas. The candidate will have developed the ability to carry out complex tasks. Limited support may be embedded within the task.

Level 3: At the end of the programme the candidate will autonomously apply knowledge and skills to a variety of complex tasks. Candidates will utilise critical thinking skills to analyse, evaluate and reflect upon their own work and that of others. Problem solving tasks may be part of the assessment process.

Learning Outcomes and Assessment Criteria

Subject Focus:	**Principles and basic structures of life**
Learning Outcome 1: **Paper I and Paper II)**	**At the end of the programme, I can identify the fundamental processes necessary for life on Earth.** • *Cells as the basic unit of life including animal and plant cells as seen under the light microscope and the functions of the structures observed under the light microscope.* • *Roles of biological molecules and their function.* • *The cell's* basic *function in the transport of molecules in and out of cells.*

Assessment Criteria (LEVEL 1)	**Assessment Criteria (LEVEL 2)**	**Assessment Criteria (LEVEL 3)**
1.1a Identify the cell as the basic unit of life.	1.2a Identify that organelles are cellular components.	1.3a Recognize that cells are made up of organelles and structures (membranes) which are in turn made up of molecules which are in turn composed of atoms. *Knowledge of the presence/absence of a nucleus, membrane bound organelles (limited to mitochondria and chloroplasts) and cell membrane.*
1.1b Identify that most types of cells have a nucleus, organelles and structures enclosing the cell. *Knowledge of cellular structure including nucleus, cytoplasm, mitochondria, chloroplasts, cell membrane, cell wall, cell vacuole.*	1.2b Describe the functions of the structures of a cell. *Including nucleus, cytoplasm, mitochondria, chloroplasts, cell membrane and cell wall.*	
1.1c Draw a labelled diagram of a generalized animal and plant cell. *Including nucleus, cytoplasm, mitochondria, chloroplasts, cell membrane, cell wall, cell vacuole (where relevant).*	1.2c Distinguish between animal and plant cells from a drawing or description. *Including presence/absence of chloroplasts, cell wall and large central vacuole.*	1.3c Distinguish between animal and plant cells from a photomicrograph and specimens. *Including presence/absence of chloroplasts, cell wall and a permanent large central vacuole.*
	1.2d Outline the cellular organization of complex organisms.	1.3d Describe the cellular organization of complex organisms.

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
	Including organelles, cells, tissues, organs, and organ systems.	*From organelles to cells to tissues to organs and to organ systems – including a definition and example of each.*
1.1e State that a multicellular organism is made up of a variety of specialized cells.	1.2e Identify the importance of structures and cell components in cell specialization.	1.3e Briefly explain how given structures make cells more specialised for their function.
1.1f State the importance of water for life.	1.2f Describe the role of water as a reagent, solvent, heat regulator and transporter of substances in solution.	
1.1g State that carbohydrates, lipids and proteins are made up of simple elements.	1.2g Name the different elements for each group. *Carbohydrates and lipids - carbon, hydrogen and oxygen.* *Proteins - mainly carbon, hydrogen, oxygen and nitrogen.*	
1.1h State that complex carbohydrates, lipids and proteins are large molecules made from smaller molecules.	1.2h Name the large and small component molecules of each group. *Polysaccharides (e.g. starch, glycogen and cellulose) and disaccharides (e.g. sucrose and maltose) are made up of monosaccharides (e.g. glucose).* *Lipids made up of fatty acids and glycerol.* *Proteins made up of amino acids.*	
	1.2i Identify reducing monosaccharides by performing a Benedict's test and starch by performing an iodine test.	
	1.2j Identify lipids by performing a translucent stain test/emulsion test.	

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
1.1k State that carbohydrates are important as a source of energy. *No reference to ATP.*	1.2k Describe the link between solubility and carbohydrate molecular size. *Solubility decreases with increasing molecular size e.g. monosaccharides are very soluble while polysaccharides are not.*	1.3k Explain that glucose, being so soluble, allows for its transport and involvement in reactions, while starch and glycogen, being insoluble, allows for their storage.
1.1l State that lipids are important as an energy store.	1.2l Describe the functions of lipids. *Efficient energy stores; protection and insulation.*	
1.1m State that proteins are important in the development of new cells (which may result in growth), cell repair and as enzymes.	1.2m Distinguish between amino acids, polypeptides and a functional protein. *Amino acids as simple units, joined to form polypeptide chains, which are further structured to form a functional protein.*	1.3m Infer that excess amino acids are deaminated in the liver. *There is no need for the body to specifically store protein as all cells are made up of protein.*
	1.2n Identify proteins by performing a Biuret test. *Reference to copper(II) sulfate and sodium hydroxide instead of Biuret test.*	
1.1o State that vitamins assist enzyme action and are essential for cell reactions. *Candidates can refer to a specific vitamin.*		
1.1p State the importance of calcium and iron as mineral salts required in our diet.	1.2p State sources and deficiencies of calcium and iron.	

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
1.1q List the seven components of a balanced diet.	1.2q Explain why each component of the list is essential. *Importance given to fibre even though it is not digested.* *Reference to saturated and unsaturated fats in terms of source (animals/plants), benefits and harm.* *Reference to the chemical structure of fats is not required.*	1.3q Link conditions including eating disorders (anorexia, bulimia, obesity) and diabetes type II to an unbalanced diet. *No medical details about the various conditions mentioned are required.*
1.1r State that enzymes speed up the rate of reactions.	1.2r Define enzymes as biological catalysts which speed up the rate of reactions without being used up or destroyed.	
1.1s Identify enzymes as proteins.	1.2s List the chemical and biological properties of enzymes. *Being protein, enzymes function within a narrow range of temperature, are specific and are sensitive to pH.*	
	1.2t Describe how a number of factors can affect the rate of reaction. *Restrict factors to temperature and pH.*	1.3t Explain the effect of temperature on enzyme action in terms of the kinetic energy of particles.
1.1u Describe that enzymes are substrate specific.	1.2u Describe the specific, complementary bond between the active site of an enzyme and a substrate.	1.3u Apply the use of enzymes (with a few examples) in industrial processes. *Details of specific industrial processes are not required.*
1.1v Define diffusion as the passive movement of particles from a high concentration to a low concentration.	1.2v Explain diffusion as the passive movement of particles from a high concentration to a low concentration down a concentration gradient, due to the movement of these particles.	1.3v Link diffusion to the kinetic energy of particles.

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
1.1w Define osmosis as the passive diffusion of water molecules from a dilute solution to a more concentrated solution, through a selectively permeable membrane.	1.2w Explain osmosis as the net movement of water molecules from a dilute solution to a more concentrated solution through a selectively permeable membrane.	1.3w Explain the importance of reverse osmosis in a country at risk of desertification such as Malta. *Being a process of active transport, Reverse Osmosis allows us to obtain fresh water from seawater by reversing the natural process of osmosis. No detail of the process is required.*
1.1x Demonstrate diffusion through an experiment.		1.3x Perform an experiment/investigation to demonstrate osmosis.
1.1y Distinguish between turgid and plasmolysed plant cells.	1.2y Explain the changes occurring in plant tissue placed in solutions of different concentrations, distinguishing between turgid and plasmolysed cells.	1.3y Identify that plants exhibit wilting when the cells are flaccid, but not plasmolysed.
1.1z Distinguish between a burst and shrivelled animal cell.	1.2z Explain the effects on animal tissue placed in solutions of different concentrations, distinguishing between lysed, normal and shrivelled cells.	
1.1aa Define active transport as the movement of particles through a cell membrane requiring energy.	1.2aa Explain active transport as the movement of solute particles through a cell membrane from a region of lower concentration to a region of higher concentration using energy from respiration.	1.3aa Apply the concept of active transport to explain how nutrients are taken up against a concentration gradient. *Example ion uptake by root hair cells and glucose absorption by villi.*

Subject Focus:	**Functions of Life (Nutrition and Respiration)**
Learning Outcome 2: **Paper I and Paper II**	**At the end of the programme, I can describe the relationship between energy and food for different organisms.** • *An explanation of different forms of nutrition in different types of organisms.* • *An explanation of how food is converted into energy for different forms of life.*

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
2.1a Recognise that photosynthesis is a form of autotrophic nutrition. *Photosynthesis as a process where the organism (defined as a producer) produces food from water and carbon dioxide using light energy.*	2.2a Explain, using a word equation, that plants can convert simple inorganic substances to organic substances using light energy. *Use of the following terms: carbon dioxide, water, chlorophyll, light energy, glucose and oxygen.*	2.3a Explain, using a chemical equation, that photo-autotrophic organisms have the ability to harvest light energy and change it to chemical energy making it available to every other organism. *Refer to trophic levels and producers (Learning Outcome 6).*
2.1b Label a diagram of a generalised cross-section of a dicotyledonous (dicot) leaf. *Labels of the leaf to include: cuticle, lower and upper epidermis, palisade mesophyll layer, spongy mesophyll layer, stoma(ta), guard cells Diagrams with veins may be used.*	2.2b Draw a labelled diagram of a generalised cross-section of a dicotyledonous (dicot) leaf. *Labels of the leaf to include cuticle, lower and upper epidermis, palisade mesophyll layer, spongy mesophyll layer, stoma(ta) and guard cells.*	2.3b Explain external and internal adaptations of a dicotyledonous (dicot) leaf to perform photosynthesis. *Adaptations to include: large surface area; thin leaf blade; presence of chloroplasts with chlorophyll; presence of veins, stomata, transparent waxy cuticle, thin (usually one cell thick) epidermis; palisade layer at top and rich in chloroplasts; spongy mesophyll with large air spaces.*
		2.3c Perform an experiment to show the importance of light or carbon dioxide in photosynthesis.

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
2.1d State that abiotic factors may limit the rate of photosynthesis.	2.2d Explain how the maximum rate of photosynthesis is influenced by a number of factors. *Light intensity, carbon dioxide and temperature provide a limit to the plant's ability to photosynthesize.*	2.3d Interpret rate of photosynthesis graphs as to how environmental factors affect the rate of photosynthesis.
	2.2e Recognise that at specific low light intensities the uptake of carbon dioxide is equal to the production of carbon dioxide by cellular respiration. *Reference to the compensation point*.	
2.1f Identify that the process of photosynthesis produces oxygen as a by-product.	2.2f Interpret the results of an experiment using an aquatic plant to show that bubbles of oxygen are produced in the presence of light.	2.3f Explain the results of an experiment using an aquatic plant to show that bubbles of oxygen are produced in the presence of light.
2.1g Identify that holozoic nutrition is a form of heterotrophic nutrition.	2.2g Describe holozoic nutrition as a process involving ingestion, digestion, absorption, assimilation and egestion.	2.3g Infer that animals need to ingest large organic molecules from their surroundings and break them down into smaller molecules to be absorbed by the body.
2.1h Label the structure of the human alimentary canal. *Including mouth, salivary glands, oesophagus, stomach, small intestine (duodenum and ileum), pancreas, liver, gall bladder and large intestine (colon, rectum and anus).*	2.2h Draw the structure of the human alimentary canal. *Including mouth, salivary glands, oesophagus, stomach, small intestine (duodenum and ileum), pancreas, liver, gall bladder and large intestine (colon, rectum and anus).*	2.3h Explain the structure and function of the human alimentary canal and its associated glands. *Including a labelled diagram of the villus and its characteristics for its function – absorption.*
	2.2i Distinguish between physical and chemical digestion.	2.3i Explain the role of digestive enzymes and other secretions involved in the digestion of food. *Reference to salivary juices (containing amylase), gastric juices (containing pepsin as derived from pepsinogen, hydrochloric acid), bile and pancreatic juices (containing amylase, trypsin as derived from trypsinogen, lipase).*

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
2.1j Describe that cellular processes require energy for reactions to occur.	2.2j Define cellular respiration. *Knowledge of cellular respiration as a catabolic process in which energy released from glucose is converted to ATP.*	2.3j Relate ATP to the universal currency of energy for cellular reactions. *Knowledge of ATP as a molecule that releases energy to fuel cellular reactions. Detailed structure of the ATP molecule is not required.*
2.1k Distinguish between respiration in aerobic *(in the presence of oxygen)* conditions and anaerobic *(in absence of oxygen)* conditions. *Fermentation as one type of anaerobic respiration.*	2.2k Distinguish between aerobic respiration and anaerobic respiration (fermentation) in terms of products and energy output.	2.3k Distinguish between alcoholic fermentation and lactic acid fermentation in terms of products.
2.1l Write word equations that summarise aerobic and anaerobic (fermentation) respiration.	2.2l Write chemical equations that summarise aerobic respiration and alcoholic fermentation.	2.3l Perform an experiment to show that yeast produces carbon dioxide during anaerobic respiration.
2.1m State the economic importance of alcoholic and lactic acid fermentation. *Using specific examples of carbon dioxide in bread making, alcohol in winemaking and lactic acid in yoghurt production.*	2.2m Explain the economic importance of alcoholic and lactic acid fermentation. *Using the same examples as in Level 1.*	

Subject Focus:	**Functions of Life (Movement of substances in organisms)**
Learning Outcome 3: **Paper I and Paper II**	**At the end of the programme, I can explain the various mechanisms and processes that allow organisms to exchange substances with their environment and transport such substances internally.** • *A description and explanation of gaseous exchange in plants and humans.* • *The importance of water and solutes in plants as a means for all plant cells to receive components/substances for life functions.* • *Transport in animals as a means for cells to receive components/substances required for life functions.*

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
3.1a Distinguish between cellular respiration, breathing and gaseous exchange.	3.2a Identify the characteristics of an efficient gaseous exchange surface.	3.3a Predict the implications of surface area to volume ratio to develop specialised organs for gaseous exchange. *No mathematical calculations of surface area to volume ratio are required.*
3.1b Label a diagram of a generalised cross-section of a leaf. *Refer to assessment criteria 2.1b*	3.2b Draw a labelled diagram of a generalised cross-section of a leaf. *Refer to assessment criteria 2.2b*	3.3b Describe the internal structural features of the leaf important for gaseous exchange. *Including spongy mesophyll with air spaces, stoma with guard cells.*
		3.3c Relate the structural features of the leaf with the characteristics of a gaseous exchange surface. *Including large surface area, moist surface and concentration gradient.*
3.1d Describe with the help of a labelled diagram the gross structure of the human respiratory system. *Including trachea (with rings of cartilage), bronchi, bronchioles, alveoli, rib cage and diaphragm.*	3.2d Describe the passage of air through the human respiratory system. *From the nose/nasal cavity, down the trachea (on inspiration), bronchi, bronchioles and alveoli where gaseous exchange occurs.*	3.3d Relate with the help of a diagram the structural features of an alveolus with the characteristics of a gaseous exchange surface. *Characteristics to include: large surface area, moist surface, concentration gradient, thin layer and capillary network.*

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
3.1e Describe the process of ventilation mediated by the diaphragm and rib cage (intercostal muscles).	3.2e Describe ventilation as a means to gaseous exchange in the alveoli.	3.3e Describe ventilation in terms of the relationship between pressure and volume.
3.1f Describe changes in breathing rate depending on changes in activity.	3.2f Predict changes in values of breathing rate depending on changes in activity. *Reference to tidal volume and vital capacity is NOT expected.*	
	3.2g Explain the consequences of anaerobic respiration in muscles. *Resulting from a lack of oxygen in muscles leading to an oxygen debt and resulting in the production of lactate/ lactic acid.*	3.3g Relate excess oxygen consumption after exercise to oxygen debt and lactate development in muscles. *Reference to prolonged return of rest breathing rate and heart beat rate.*
3.1h Identify the negative impact of nicotine and tar found in tobacco on human health.	3.2h Describe how components of smoking may cause emphysema and/or lung cancer.	3.3h Relate how these diseases affect the characteristics of a gaseous exchange surface. *Lung diseases alter the large surface area and thin alveolar epithelium.*
3.1i Compare the position of xylem and phloem tissue in dicot angiosperm stems and roots from diagrams. *Reference only to dicotyledonous plants.*	3.2i Describe, with the help of diagrams, the position and function of xylem and phloem tissue in dicot angiosperm stems and roots as seen under the light microscope.	3.3i Relate the distribution of vascular bundles in root and stem to the provision of anchorage and stability.
	3.2j Specify the structural characteristics of the xylem vessels and phloem tissue. *Xylem are dead, hollow, continuous tubes.* *Phloem are living cells with sieve plates as cross walls allowing flow of nutrients.*	3.3j Describe how the structure of the xylem allows for the transport of water.
3.1k Define transpiration.	3.2k State the pathway taken by water from the roots, stem and leaves using the xylem. *From the root hairs to the stomata of the leaf.*	

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
	3.2l Explain how environmental factors (i.e. temperature, humidity, wind, light intensity) affect transpiration from a plant.	
3.1m Recognise that all plants living on land have water conservation adaptations. *Waxy cuticle on upper epidermis, ability to open/close stomata.*	3.2m Cite examples how plants living in dry areas are adapted to reduce transpiration (water loss).	
3.1n Define translocation.	3.2n Describe the pathway of sucrose transported in the phloem from the site where it is produced to other parts of the plant. *No reference to companion cells and their function, source and sink.*	
	3.2o Describe that diffusion is inadequate to transport solutes long distances in an organism with a low surface area to volume ratio.	3.3o State that the bigger the organism becomes, the more a complex transport system is required.
	3.2p Describe, with the help of diagrams, the human circulatory system with the position of the major blood vessels to and from the heart, lungs, kidneys and liver.	
3.1q List the four components of blood. *Limited to red blood cells, white blood cells, platelets and plasma.*	3.2q Link the structure of the four components of blood to the functions of the blood. *Reference to phagocytes and lymphocytes for white blood cells.*	3.3q Describe the importance of blood groups, relating them to antigens. *Simple treatment of ABO blood groups and Rhesus factor.*

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
3.1r Name the structures of the mammalian heart. *Namely, septum, left and right atria, left and right ventricles, valves, vena cava, pulmonary artery, pulmonary vein, aorta. Candidates are expected to label diagrams of the heart; they are NOT expected to know how to draw them. Candidates are not expected to name the specific valves.*	3.2r Identify the structures and functions of the mammalian heart. *Namely septum, left and right atria, left and right ventricles, vena cava, pulmonary artery, pulmonary vein, aorta, semi-lunar valves, tricuspid valve and bicuspid valve. Reference to coronary arteries as vessels that supply blood to the heart tissue.*	3.3r Outline the pathway of blood starting from the vena cava, throughout the heart and lung and ending in the aorta.
3.1s Describe the structure and functions of arteries, veins and capillaries.	3.2s Draw simple cross-sections of the blood vessels to illustrate their differences.	3.3s Relate the structure of the arteries, veins and capillaries to their function.
	3.2t Distinguish between plasma, tissue fluid and lymph.	3.3t Describe the function of the lymphatic system in terms of transport and immunity, maturation of some white blood cells and transport of fats to the circulatory system.
3.1u State the effect of physical activity on the heartbeat.	3.2u Interpret the effect of physical activity on the heartbeat.	3.3u Discuss the role of diet, exercise and lifestyle on the risk of developing heart disease.

Subject Focus:	**Functions of Life (Maintaining balance)**
Learning Outcome 4: **Paper I and Paper II**	**At the end of the programme, I can discuss how animals carry out fundamental processes necessary for the maintenance of the basic conditions for life.** • *A description and explanation of how nervous and hormonal communication are means to maintain balance within and respond to the environmental stimuli.* • *Homeostasis as how a constant internal balance is kept in organisms.* • *Disease can affect the life pattern of an organism and therefore may disrupt the constant internal balance.*

Assessment Criteria (LEVEL 1)	**Assessment Criteria (LEVEL 2)**	**Assessment Criteria (LEVEL 3)**
4.1a Define homeostasis as the maintenance of a constant internal state by organisms.	4.2a Acknowledge that factors might change this constant internal state. *Reference to glucose, CO_2 blood levels and temperature.*	4.3a Relate that changes in factors (stimuli) are detected by receptors and a response is generated to bring the internal state back to set point.
4.1b Recognise that the nervous and hormonal systems work to keep an internal balance.	4.2b Infer that two coordinating systems are required for the coordination of body functions: (i) one involving a slow, but sustained action that usually has long-term effects on the body, and (ii) one that is quick and achieves immediate, short-term control over specific body parts.	4.3b Explain that the nervous and endocrine systems can sometimes work together. *Under flight or fight conditions nerve impulses stimulate the adrenal glands to secrete adrenaline Details of adrenaline production are NOT required.*
4.1c Distinguish between the central and the peripheral nervous systems. *The Central Nervous System (CNS) as being made up of the brain and spinal cord. The Peripheral Nervous System (PNS) as being made up of nerves.*		
	4.2d Explain the responses of the nervous system as arising directly or indirectly from stimuli detected by sensory receptors.	

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
4.1e Identify, by means of a drawing, the different types of neurones (nerve cells): a sensory neurone, motor neurone and relay (multipolar) neurone. *Including labels of dendrites, dendron/axon, cell body, myelin sheath.*	4.2e Distinguish between the structures and functions of a sensory, motor and relay (multipolar) neurone.	
4.1f State that a nerve impulse is an electrical impulse that passes along neurones.	4.2f Describe the nerve impulse as an electrical impulse that travels in one direction only.	
4.1g Describe that neurones are not continuous throughout the body.	4.2g Describe synapses as a structure that permits a neurone to pass on an impulse to another cell.	4.3g Explain the role of neurotransmitters in synaptic transmission as the release of a chemical messenger that initiates or inhibits a nerve impulse in the next cell.
	4.2h Describe with the help of a labelled diagram, the pathway of a reflex arc.	
	4.2i Define a reflex action as being an automatic and rapid response involving effectors, which is essential for survival.	4.3i Explain that reflexes are essential for survival because they allow the animal to respond quickly to situations that might endanger it.
4.1j Label the positions of the brain's cerebrum, cerebellum and medulla oblongata. *Include brain stem and spinal cord.*	4.2j Explain the basic functions of the brain's cerebrum, cerebellum, medulla oblongata and the pituitary gland. *Functions of the pituitary gland should be limited to its role as a master gland controlling other endocrine glands, the production of ADH (see 4.2s and 4.3s) and the production of sex hormones (see 5.3h).*	

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
	4.2k Describe a hormone as a chemical produced by an endocrine gland to bring about a response by a target organ or cells. *Knowledge of specific endocrine glands and their secretions will be specified in the relevant sections of this syllabus.*	4.3k Explain that hormones are secreted directly into the blood and not through ducts. *Hormone secreting glands are also known as ductless glands or endocrine glands.*
4.1l State that hormones produced by the pancreas regulate blood glucose levels.	4.2l Describe the antagonistic role of insulin and glucagon in glucose regulation. *Reference to hormone production by the Islets of Langerhans of the pancreas*.	4.3l Explain negative feedback using blood glucose regulation as an example.
4.1m Define ectothermic and endothermic organisms. *Reference only to the terms ectothermic and endothermic.*	4.2m Cite examples of ectotherms and endotherms.	4.3m Distinguish between ectothermic and endothermic organisms. *Including few behavioural mechanisms of reptiles such as basking in sun for ectotherms and physiological mechanisms for endotherms as specified in 4.2o.*
		4.3n Describe behavioural mechanisms of ectotherms to maintain metabolic rate.
4.1o Label the structure of the mammalian skin. *Including epidermis, dermis, adipose tissue, blood vessels, hair, hair follicle, erector muscle, sweat gland, receptor/nerve endings.*	4.2o Explain mammalian thermoregulatory mechanisms. *Including sweating, vasodilation, vasoconstriction, hair/fur erection/relaxation, shivering and using physical principles of heat transfer and evaporative cooling.*	
4.1p Describe the importance of osmoregulation in unicellular freshwater organisms.	4.2p Discuss the importance of the human kidney in relation to blood toxicity and osmoregulation.	

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
4.1q Draw the cross-section of the kidney and the urinary system. *Including Urinary system - kidney, ureter, urinary bladder and urethra with the renal blood vessels Kidney – pyramids, cortex, medulla, pelvis, ureter*	4.2q Draw the structure of a nephron. *Including location within kidney and glomerulus, Bowman's capsule, loop of Henle, convoluted tubules and collecting duct.*	4.3q Describe the processes of ultrafiltration and selective absorption. *Including locations of nephron where processes occur and facts re large molecules/cells are not filtered, selective absorption of glucose, amino acids and salts. Importance of both processes.*
		4.3r Describe the role of the loop of Henle and collecting duct in osmoregulation. *Reference should be limited only to how these structures allow for further uptake of water in desert animals.*
	4.2s Describe the role of antidiuretic hormone (ADH) on the kidney nephrons.	4.3s Link the concentration of urine to secretion of ADH.
		4.3t Compare a dialysis machine to the operating mechanism of the kidney.
4.1u Define the term immunity.	4.2u Define the term immune system as a system recognising self from non self.	
4.1v Define the term microbe as a microscopic organism.		
4.1w Define the term pathogen as a harmful microbe or an agent that causes an infectious disease.	4.2w Define the term disease as having signs and symptoms, leading to disruption of normal functions.	4.3w Distinguish between transmissible and non-transmissible diseases. *Distinguish between the two types of diseases by citing a named example for each of the following: an infectious disease, a hereditary disease, a nutritional disease and a degenerative disease.*

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
4.1x Identify that infectious diseases in both animals and plants can either be viral, bacterial or fungal.	4.2x Cite a named example for each of the following: a viral disease, a bacterial disease and a fungal disease.	4.3x Explain that the transmission of diseases can happen either through direct contact (e.g. through blood and body fluids) or indirectly (e.g. contaminated surfaces and food, from animals or air).
4.1y Describe the structure of a virus. *Knowledge of a protein coat surrounding genetic material.*	4.2y Describe the reproductive cycle of a virus. *Reference to the virus attaching itself to a host cell and releasing its genetic material into the host cell; the genetic material inducing the host cell to produce multiple copies of the virus; and cell bursting releasing the newly formed viruses.*	
	4.2z Define the term antigen as an agent that is capable of stimulating an immune response.	4.3z Explain that allergens are antigens that cause an allergic reaction. *Example of pollen as an allergen to hay fever.*
	4.2aa Distinguish between innate and adaptive immunity. *Reference to skin, stomach pH, mucus and phagocytes as innate immunity and the production of antibodies for viral pathogens as adaptive.*	4.3aa Explain acquired immunity. *Reference to the passage of antibodies in maternal milk to the baby and vaccination.*
4.1ab Define vaccine. *Reference to an agent that resembles a disease causing microbe or parts of it.*	4.2ab Describe vaccines as antigens that trigger the lymphocytes to produce antibodies.	4.3ab Infer that after vaccination the body retains the ability to produce specific antibodies. *Reference to MMR.*
		4.3ac Explain that certain vaccines require a booster to retain the ability to produce antibodies.
4.1ad Observe that individuals suffering from common diseases get better with rest, increased liquid intake and time that allows the immune system to work.	4.2ad Explain that antibiotics are used to treat bacterial diseases.	4.3ad Describe how bacteria may become resistant to certain antibiotics and/or vaccines. *Reference to (a) antibiotics destroy bacteria that are not resistant; (b) resistant pathogens survive and reproduce; and (c) population of resistant bacteria increases.*

Subject Focus:	**Functions of Life (Promoting future generations)**
Learning Outcome 5: **Paper I and Paper II**	**At the end of the programme, I can describe how organisms produce new offspring carrying inherited genetic material.** • *Reproduction as a way by which organisms replicate themselves.* • *The principles of genetics.*

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
5.1a Distinguish between sexual and asexual modes of reproduction. *Including definitions, advantages and disadvantages.*	5.2a Distinguish between different forms of asexual reproduction. *To include binary fission, fungal spore formation, budding.*	5.3a Recognise the role of cell division (mitosis) in growth and reproduction. *Including the importance of DNA replication prior to cell division.*
5.1b Identify the reproductive structures and their function of an insect pollinated flower. *Including sepals, petals, stamen (anther, filament), carpel (stigma, style, ovary, ovule), nectaries.*		
5.1c Define pollination as the process by which pollen grains from the male anther of a flower are transferred to the female stigma.	5.2c Outline the processes leading to seed formation and dispersal. *Including pollination, fertilisation, seed and fruit formation.*	5.3c Describe the processes leading to seed formation and dispersal. *Reference to (a) the growth of a pollen tube; (b) fusion of male nuclei with egg nuclei; (c) change in floral structures during fruit formation.*
5.1d Distinguish between self and cross pollination.	5.2d Distinguish between insect pollination and wind pollination. *Including a drawing of an insect pollinated flower, the respective characteristics of flowers and pollen.*	
	5.2e Label a diagram of a dicot seed. *Including testa, micropyle, cotyledons, plumule and radicle.*	5.3e Explain the functions of the different structures of a seed.

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
5.1f Define the fruit as the seed-bearing structure of angiosperms responsible for seed dispersal.	5.2f Identify the method of seed dispersal by observing the characteristics of the fruit/seed. *Including animal, wind, water and explosive methods of dispersal.*	5.3f Describe the challenges faced by flowering and non-flowering plants in reproduction. *To include availability of dispersal mechanisms, large numbers and loss of gametes, competition when seeds fall close to parent for light, water and nutrients.*
5.1g Describe the process of germination as the sprouting of a plant from a seed.	5.2g Determine the conditions for germination to occur. *To include: water as stimulant (to activate digestive enzymes breaking down large molecules in cotyledon), adequate temperature and presence of oxygen.*	5.3g Perform an experiment to investigate the factors that control germination.
5.1h Identify the reproductive structures and their function of the human reproductive system. *Both male and female reproductive organs. Parts considered external and those internal.*	5.2h Label diagrams of the male and female reproductive systems.	5.3h Describe the role of hormones in the menstrual cycle, the production of male and female gametes and the development of secondary sexual characteristics. *Including FSH, LH, oestrogen and progesterone, testosterone.*
	5.2i Describe the stages of human reproduction from copulation to birth. *Including copulation, fertilisation, implantation, gestation and birth. Anatomical details of embryological development are not required.*	5.3i Describe the functions of the placenta in foetal development. *Including the importance of placenta as a gas and nutrient exchange surface with reference to folic acid, iron, vitamin D and calcium in foetal development, stops the passage of certain chemicals while allowing others to pass, produces hormones in the first trimester of pregnancy.*
	5.2j Describe the importance of parental care to a baby. *Reference to breastfeeding.*	

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
5.1k Identify Fertility Awareness methods, Hormonal-based methods and Barrier methods of birth control. *Fertility awareness methods as exemplified by the thermal and the mucus (Billing's) method. Hormonal based methods as exemplified by the contraceptive pill. Barrier methods as exemplified by the use of the condom.*	5.2k Assess methods of birth control in terms of increasing effectiveness of preventing conception as well as preventing sexually transmissible infections.	
5.1l Distinguish between DNA and chromosome. *DNA is the molecule carrying genetic information in organisms; the chromosome is the DNA molecule wound around protein (no reference to histones) that supports its structure.*	5.2l Distinguish between gene and allele.	5.3l Describe a genome as the complete set of DNA, i.e. all genetic information needed to build and maintain the organism.
	5.2m Explain that even small changes in the genetic material can have a great impact on the organism.	5.3m Explain that mutations can be genetic or chromosomal. *Citing haemophilia, thalassaemia and some types of cancer as examples of genetic mutations. Using the condition of Down's syndrome as an example of chromosomal mutation.*
5.1n Explain that DNA makes up the genetic material contained in the nucleus that determines the characteristics of an organism.		
	5.2o Describe the gross structure of the molecule of DNA. *Double helix with bases (Adenine, Cytosine, Guanine, Thymine) and their complementary pairs. (No knowledge of nucleotide chain necessary).*	5.3o Explain that within a gene, a base sequence is the code for a specific protein.

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
		5.3p Describe mutations bringing about allelic variation as being the basis of natural selection. *To include examples of mutagens e.g. UV radiation, X rays, nuclear radiation, chemicals.*
5.1q Distinguish between haploid and diploid cells. *Somatic cells have two sets (2n) of chromosomes: one set coming from the male and one set from the female. Gametes have one set (n) of chromosomes.*	5.2q Infer that haploid cells have half the number of chromosomes so that after fusion of gametes the original diploid number of chromosomes is restored.	
5.1r Define mitosis as a process of cell division that produces cells that are genetically identical to the parent cell.	5.2r Outline the process of mitosis. *In mitosis, the DNA of the parent cell is doubled and then divided into two genetically identical daughter cells. Candidates are not expected to know and draw diagrams of the different stages of mitosis.*	5.3r Conclude that mitosis is important for growth and repair of cells as well as asexual reproduction of certain organisms.
5.1s Define meiosis as a process of cell division that produces cells that are genetically different from the parent cell.	5.2s Outline the process of meiosis. *Meiosis involves: replication of DNA; pairing of homologous chromosomes; crossing over (during which there is an exchange in alleles); first division of homologous pairs; second division halves genetic material; four haploid cells are formed.*	5.3s Appraise that meiosis enables genetic variation and produces gametes.
5.1t Describe genotype and the corresponding phenotype.	5.2t Distinguish between continuous and discontinuous variation. *Give examples.*	5.3t Distinguish between homozygous and heterozygous genotypes. *Dominant homozygous and heterozygous genotypes have the same phenotype while the phenotype of a recessive characteristic is only visible if the genotype is homozygous.*

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
	5.2u Apply Punnett Square or genetic diagram to determine possible genotypes and phenotypes for offspring in a monohybrid cross (including sex determination and codominance). *To include parental phenotypes and genotypes, gametes, genetic diagram/Punnett Square, F1 generation genotype and F1 generation phenotype and ratio/percentages.*	5.3u Apply Punnett Square or genetic diagram to determine possible genotypes and phenotypes for offspring in a monohybrid cross involving sex linked characteristics (e.g. haemophilia and colour blindness). *To include parental phenotypes and genotypes, gametes, genetic diagram/Punnett Square, F1 generation genotype and F1 generation phenotype and ratio/percentages.*
	5.2v Define stem cells as undifferentiated (unspecialised) cells that can divide and become specialised cells of the body.	5.3v State that stem cells can be taken from the umbilical cord and baby teeth and stored at low temperatures to be used to treat a wide range of diseases. *Details about the sampling procedures and treatment processes are not necessary.*
5.1w Define a genetically modified organism (GMO) as an organism whose genome has been engineered to promote the expression of desired traits or to produce desired biological products.		5.3w Explain that genetic engineering involves: (a) identifying a desired gene in the genome of an organism (donor); (b) removing the desired gene and including it in the genome of the host organism; (c) the host organism will start showing the "imported" characteristic. *Use insulin produced by genetically modified bacteria as an example.*

Subject Focus:	**The environment, relationships between organisms, and human impact on the environment.**
Learning Outcome 6: **Paper I and Paper II**	**At the end of this programme, I can recognise how organisms relate to one another and to their environment and how human activities impact the environment.** • *The relationships between the organisms and their environment.* • *The effect of human action on the environment.*

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
6.1a Define the term habitat.	6.2a Distinguish between population and community.	6.3a Describe an ecosystem in terms of interactions between organisms and the surrounding environment.
6.1b Describe an ecosystem as being made up of the living things in a given area, interacting with each other, and also with their non-living environments. *Reference to the following ecosystems is expected: woodland, maquis, garigue, freshwater, sand dunes and rocky shores.*	6.2b Explain that there are many biotic and abiotic interactions within an ecosystem. *Reference to local ecosystems is expected.*	6.3b Discuss that abiotic and biotic factors limit population size distribution.
		6.3c Infer that uncontrolled growth of any species has negative effects on the environment and the survival of the same and other species. *E.g. depletion of food resources, spread of disease.*
	6.2d Describe an ecological niche of a species as the role that species has in the ecosystem.	6.3d Explain an ecological niche of a species in terms of the interaction of that species with other members of its community and the physical features of its surroundings.

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
6.1e Recognise that while certain species are regarded as native because they occur naturally in that ecosystem, others have been introduced into the ecosystem.	6.2e Infer that while indigenous (i.e. native) species have evolved and are an integral part of the natural system, alien (i.e. introduced) species cause disruptions in the ecosystem and may result in displacement of other organisms.	6.3e Distinguish between the terms "alien", "indigenous" and "endemic" and give local examples for each. *For example: Geranium Bronze Butterfly, (Cacyreus marshalli) as an example of a local alien species; Carob tree (Ceratonia siliqua) as a local indigenous species and Maltese Wall Lizard (Podarcis filfolensis) as an endemic species.*
	6.2f Explain how the biotic and abiotic components of a local ecosystem interact through competition and predation. *Explain that competition is a race for biotic and abiotic resources. Explain that predation is the most common relationship in nature that helps to keep both predator and prey in check. Support explanation with examples from the local context (besides examples from foreign contexts).*	
6.1g Explain the difference between interspecific and intraspecific competition.	6.2g Explain the difference between intra and interspecific competition for space, food and mate by using local and foreign examples.	6.3g Deduct whether a particular form of competition is interspecific or intraspecific.
6.1h Explain the meaning of parasitism and mutualism. *Candidates are expected to distinguish between an endoparasite (i.e. as living inside the body of the host) and an ectoparasite (i.e. as living outside the body of the host) and name an example of each.*	6.2h Distinguish between parasitism and mutualism with specific examples. *Details about life cycles are NOT expected*.	

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
6.1i Explain that plants are able to respond to light, water and gravity as examples of abiotic factors.	6.2i Explain the meaning of phototropism and geotropism for both roots and stems using experiments to demonstrate positive phototropism; and positive and negative geotropism.	6.3i Explain that the changes observed in the experiments are the result of auxins (plant growth hormones) that in uneven concentrations cause bending of shoots and roots.
6.1j Explain that all organisms in an ecosystem are related to one another via feeding relationships called food chains and food webs.	6.2j Infer that food webs are true representations of biotic interactions when compared to food chains.	
6.1k Construct food chains as pathways through which energy flows.	6.2k Interpret food chains as pathways through which energy flows.	
6.1l Construct food webs as pathways through which energy flows. *The direction of arrows is indicative of the flow of energy.*	6.2l Interpret food webs as pathways through which energy flows. *The direction of arrows is indicative of the flow of energy.*	6.3l Predict changes in the populations of organisms in a food web when biotic and abiotic factors are changed.
	6.2m Identify producers and different levels of consumers, in relation to carnivores, herbivores and decomposers.	6.3m Describe the general features of the different trophic levels in a local ecosystem. *Including a description of a local ecosystem (e.g. garigue) with descriptions of producers (e.g. aromatic, succulent plants), primary consumers (e.g. of herbivores - insects) and secondary consumers.*
	6.2n Represent the relationship between producers and different levels of consumers as pyramids of numbers, biomass and energy.	6.3n Infer why energy is lost as it is transferred from one trophic level to another.
	6.2o Explain that Earth is a closed system in which matter changes from one form to another, but its quantity (availability) remains approximately constant.	6.3o Infer that although Earth can be considered as a closed system there is still an exchange of energy (e.g. heat) and of some matter (e.g. meteorites, human space debris).

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
6.1p Relate the continued survival of a species to the continued availability of resources (e.g. food and water) and suitable living conditions in the environment of that species. *Reference to 6.1b and 6.2b (i.e. abiotic and biotic factors).*	6.2p Define carrying capacity as the maximum number of individuals of a species that can be supported by the resources available in a given environment. *Reference to 6.1b and 6.3b.*	6.3p Conclude that unlimited growth of a population cannot be supported by a planet with finite/limited resources. *Reference to 6.1b and 6.3b.*
	6.2q Outline the various stages of the carbon and nitrogen cycles. *No need to name specific names of bacteria species acting as decomposers, nitrifiers and denitrifiers in the nitrogen cycle.*	6.3q Conclude that when natural cycles are disrupted, other vital processes are negatively affected; resources start depleting; and wastes accumulate resulting in pollution problems. *Infer that in nature there is no accumulation of waste as it is recycled from one form to another.*
6.1r Define biodiversity as the variety of life. *Support definition with examples from the local context (besides examples from foreign contexts).*	6.2r Briefly explain biodiversity in terms of genetic diversity, species diversity and ecological diversity. *Support definition with examples from the local context (besides examples from foreign contexts).*	
6.1s Identify the major threats to biodiversity (e.g. climate change; habitat loss; overexploitation; invasive species; and pollution).		
6.1t Define the Greenhouse Effect as a natural process characterised by the trapping of solar radiation by greenhouse gases (e.g. carbon dioxide, methane and water vapour).		6.3t Explain how the Greenhouse Effect results from (a) solar radiation hitting and heating the Earth's surface; (b) the heat then radiates back out into space; and (c) greenhouse gases absorb some of the radiated heat and radiate it back warming the atmosphere. *Reference to the scale of absorption of solar energy is not expected.*

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
6.1u Infer that the Greenhouse Effect helps in maintaining a planetary temperature that supports life.	6.2u Recognise that the climate influences the conditions of different habitats that in turn affect the distribution of species.	6.3u Predict that changes in climate force species to adapt to new conditions, that and failure to do so results in extinction.
6.1v Associate an enhanced Greenhouse Effect with Global Warming and consequently with Climate Change.	6.2v Explain how the Greenhouse Effect can be enhanced through human activities that increase greenhouse gases (e.g. use of fossil fuels, intensive livestock production, urbanisation) and/or by interfering with natural cycles (e.g. deforestation, waste production).	6.3v Infer that the higher the levels of greenhouse gases in the atmosphere the greater is the heat (IR radiation) absorption causing further heating of the Earth.
	6.2w Predict how human activities speed up the process, without allowing species and ecosystems sufficient time to adapt.	
6.1x Identify specific actions to fight Climate Change. *The actions proposed should include: (a) personal changes in lifestyle (e.g. limiting the use of fossil fuels; reducing meat consumption and reducing waste generation); and (b) sustainable governance (e.g. providing cleaner energy generation alternatives, making public transport more efficient, protection of open natural spaces).*		6.3x Relate personal and local Climate Change initiatives to specific actions taken up on a global level by the United Nations through the Sustainable Development Goals (SDGs) process specifically SDG 7 and SDG 13. *Candidates are NOT expected to recite the specific targets outlined in the SDGs.*
6.1y Identify that habitat loss is a direct cause of loss of biodiversity and extinction.	6.2y Assess the negative environmental impacts incurred on local ecosystems by the unsustainable use of land, especially by the construction industry. *Reference to habitat destruction; destruction of animal and plant species; soil loss/erosion; reduction of natural green spaces in urban areas.*	

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
	6.2z Outline specific actions to reduce habitat loss in land-based ecosystems. *Reference to restoration, conservation and protection of natural environments.*	
	6.2aa Assess the negative environmental impacts incurred on marine ecosystems by (a) oil spills; and (b) marine debris (especially plastics).	6.3aa Appraise that the degradation of marine ecosystems (particularly by plastic pollution) is having a negative impact on food chains where humans are top consumers and consequently on human health.
	6.2ab Outline specific actions to reduce habitat loss in marine ecosystems. *Reference to the following proposed actions: (a) setting up of Marine Protected Areas (MPAs) and Marine Reserves; (b) protecting sea floor (particularly Posidonia meadows) by installing permanent moorings to prevent damage from bunkering; (c) reducing the size of fish farms and locating them away from the coast.*	
6.1ac Identify that overhunting and overfishing contribute greatly to the loss of biodiversity.	6.2ac Infer that the overexploitation of living organisms is (a) reducing the number of individuals in a species and (b) upsetting ecosystems (for example by killing off predatory species).	

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
	6.2ad Outline specific actions to protect living organisms. *Reference to the following proposed actions:(a) establishing and enforcing laws to protect endangered species; (b) setting up moratoria on hunting/fishing to allow the recovery of endangered species; (c) enforcing laws against poaching and illegal wildlife trade; and (d) controlling hunting/fishing methods that kill organisms indiscriminately (e.g. increasing mesh sizes of fishing nets to reduce bycatch, increasing size of fishing hooks, banning scuba spearfishing, properly disposing of abandoned fishing gear to prevent ghost fishing).*	
6.1ae Identify that the intentional and unintentional introduction of alien species can damage ecosystems by reducing biodiversity. *Reference to 6.1.e, 6.2e and 6.3e (i.e. alien, indigenous and endemic species).*	6.2ae Infer that the introduction of non-native species into an ecosystem can threaten endemic/native wildlife (either as predators or competitors for resources). *Reference to 6.1e, 6.2e and 6.3e (i.e. alien, indigenous and endemic species).*	6.3ae Conclude that the damage done by invasive species (e.g. alien insect pests and pathogens) can have a negative effect on human health (e.g. the Asian Tiger Mosquito) and on the economy (e.g. imported plant parasites like the Red Palm Weevil).
	6.2af Outline specific actions to protect local ecosystems from the invasion of alien species. *Reference to the following proposed actions: (a) enforcing laws that control the importation and rearing of exotic animals/plants; (b) adequate screening of imported materials (e.g. wood) for pest infestation; (c) effectively monitoring for new infestations; and (d) swiftly eradicating newly detected invaders.*	

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
6.1ag Understand that pollution can damage ecosystems by reducing biodiversity. *Pollution can have negative effects on the quality of the air we breathe, the water we drink, and the soil we use to grow food.*	6.2ag Explain how pollution and the discharge of toxic chemicals (e.g. pesticide runoff from fields) disrupts local ecosystems. *While they may not lead directly to extinction, pollutants have the potential to influence the habitats of species reducing their chances for survival.*	6.3ag Explain how toxic substances can accumulate in the tissues of an organism up food chains and food webs.
	6.2ah Outline specific actions to reduce pollution. *Reference to the following proposed actions: (a) making sustainable transport choices (e.g. using public transport); (b) using fewer and environmentally friendly chemical alternatives in homes (e.g. detergents); (c) reducing, reusing and recycling waste; and (d) replacing the use of pesticides and fertilizers with organic alternatives.*	
		6.3ai Relate personal and local actions protecting biodiversity to specific actions taken up on a global level by the United Nations through the Sustainable Development Goals (SDGs) process specifically SDG 14 and SDG 15. *Candidates are NOT expected to recite the specific targets outlined in the SDGs.*

Subject Focus:	Evolution and Diversity of life
Learning Outcome 7: **Paper I and Paper II**	**At the end of the programme, I can understand how evolution leads to diversity of life and how genetic variety can lead to evolution.** • *The process of genetic variation leading to evolution.* • *The diversity of life as a result of the evolutionary process.*

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
7.1a Define evolution as the process by which modern organisms have descended from ancient ancestors (i.e. descent with modification).	7.2a Explain that fossils are used as evidence of evolutionary trends. *A simple example using fossil evidence to show an evolutionary trend.*	7.3a Discuss that certain species have remained almost unchanged over time. *Constant over time or with low diversity and reasons for persistence of taxon.*
7.1b Explain the process of natural selection (also known as 'survival of the fittest') as a basic mechanism of evolution. *Knowledge that natural selection occurs when individuals with characteristics that increase their chances of survival are more successful and pass these characteristics from one generation to the next becoming predominant within a population.*	7.2b Recognise that natural selection occurs when individuals with mutations that increase their chances of survival are more successful and pass these mutations from one generation to the next until they become a predominant characteristic within a population.	7.3b Explain how natural selection operates in terms of gene pools. *Citing that a gene pool determines which phenotypes are present in a population at a given time. Favourable phenotypes become more prevalent within the gene pool.*
7.1c Define extinction as the dying out of a species because it cannot adapt to new environmental conditions. *Extinction should be seen both as a natural process and/or as a result of human activity.*	7.2c Discuss the role of Mass Extinction in evolution. *Awareness of the dual role of mass extinctions: the drastic reduction of diversity and freeing up niches for new species.* *No knowledge of any specific mass extinction event is expected.*	
7.1d Analyse evidence of common descent. *Ability to see structural (and embryonic) similarities between different organisms; the geographic distribution of organisms; and fossil remains as evidence of common descent.*	7.2d Interpret structural (and embryonic) similarities; geographic distribution of organisms; fossil remains as evidence of evolution. *Limited to an interpretation with one example of each*	

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
7.1e Describe that in the beginning, the Earth contained water and a primitive atmosphere containing greenhouse gases (e.g. carbon dioxide and perhaps some methane and ammonia), but no oxygen.		
7.1f Relate the appearance on Earth of the first anaerobic prokaryotic cells to the lack of oxygen in the primitive Earth atmosphere. S*tructure of a bacterium as an example of a prokaryotic cell.*	7.2f Describe that photosynthetic bacteria released oxygen that accumulated in the atmosphere.	7.3f Predict that the oxygen-rich atmosphere led to the mass extinction of organisms that could not survive in oxygen.
7.1g Relate the appearance on Earth of the first eukaryotic cells to the presence of oxygen in the atmosphere.	7.2g Identify that complex eukaryotic cells evolved from prokaryotic cells.	7.3g Identify that complexity is enhanced by the presence of organelles (mitochondria and chloroplasts) formed from prokaryotic cells living symbiotically in a host eukaryotic cell. *Only a cursory treatment of the endosymbiotic theory is expected.*
	7.2h Identify that single-celled eukaryotes developed sexual reproduction.	7.3h Explain how sexual reproduction increased the rate of evolution because it produces a greater variation in offspring increasing their ability to adapt to changing environments.
7.1i Explain how the first multicellular organisms developed from colonies of undifferentiated cells.	7.2i Explain the concept and advantages of division of labour in multicellular organisms.	7.3i Explain surface area to volume ratio in relation to problems of increased size in multicellular organisms.
7.1j Relate that the first eukaryotic organisms that appeared on Earth were protoctists.	7.2j Compare the structure of a named unicellular plant-like and a named unicellular animal-like protoctist to the general structure of a plant cell and an animal cell respectively. *Only reference to the structure of the organisms referred to above is expected.*	

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
		7.3k Know that the increased oxygen levels in the atmosphere formed the Ozone layer that protected life from UV radiation and facilitated land colonization.
7.1l State that fungi was another group of eukaryotic organisms to colonize the Earth.	7.2l Outline the structure of fungi with reference to a unicellular (e.g. yeast) and a filamentous fungus (e.g. *Mucor*). *Only reference to the structure of the organisms referred to above is expected.*	
7.1m List the advantages for plant life in water. *Knowledge that water provided support allowing plants to be exposed to absorb sunlight; a constant supply of water; readily available minerals; and a medium for spore/gamete transfer.*		
7.1n List the advantages for plant life on land. *Advantages should be limited to: abundant sunlight (water acted as a filter); higher concentration of carbon dioxide; and space availability (land was not yet colonized by animals)*	7.2n Discuss the challenges plants faced on land. *Challenges should be limited to: exposure to UV solar radiation could cause mutations; exposure to air increases chances of desiccation; structures need support (to increase surface area for photosynthesis) to replace the buoyancy offered by water; and male gametes require a watery medium to reach the female gametes.*	7.3n Argue that the evolution of plants on land occurred by a stepwise development of physical structures and reproductive mechanisms. *Knowledge that these structures and mechanisms: provided ways of capturing and filtering sunlight; avoided desiccation; offered structural support; and facilitated the transfer of reproductive cells.*

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
	7.2o Identify the major milestones in plant evolution. *Knowledge should be limited to:* · *growth occurring at shoot and root tips allowing them to reach additional space and resources;* · *cells developed lignin that offered support enabling the plant to grow tall and upright exposing the leaves to the sun;* · *vascular (transport) tissues enabled plants to transport nutrients and water efficiently throughout the plant body;* · *leaves developed pigments that absorb UV radiation, a waterproof cuticle layer that reduces water loss and stomata (to allow gaseous exchange); and* · *a main plant body that ensures that the new generation of plants can survive until conditions are favourable for growth.*	
7.1p Characterise land plants by the presence or absence of vascular tissue and by the way they reproduce (with or without seeds).	7.2p Distinguish between Non-vascular seedless plants; Vascular seedless plants; and Vascular seed plants.	

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
7.1q Identify mosses as non-vascular seedless plants.	7.2q Describe the basic features of mosses in terms of their adaptation to life on land. *Knowledge should be limited to the following features: plants having a very simple structure (thallus) having no proper roots, leaves and stems. Hair-like structures (rhizoids) on the lower surface to absorb moisture. Size limited by the absence of vascular tissue. Spread limited because of a heavy dependency on water (no means of preventing water loss and reproduction requires a watery medium).*	
7.1r Identify ferns as examples of vascular seedless plants.	7.2r Describe the basic features of ferns in terms of their adaptation to life on land. *Knowledge should be limited to the following features: plants having roots, stems and leaves. Vascular tissue allowed ferns to attain considerable sizes. A waxy layer allowed them to colonise drier areas, however reproduction still requires a damp environment.*	7.3r Explain that the ferns' success as land plants led to their domination of land forming vast forests and providing food for the animals that were starting to move on land.
7.1s Identify Spermatophytes as vascular seed plants.	7.2s Describe the basic features of Spermatophytes in terms of their adaptation to life on land. *Knowledge should be limited to the following features: plants that are able to conserve water and reproduce by seeds.*	

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
	7.2t Identify the two types of Spermatophytes: (a) Gymnosperms (naked seeds) whose seeds are formed in cones and are not enclosed in an ovary and (b) Angiosperms (enclosed seeds): these are the flowering plants whose seeds are formed within the ovaries of flowers which develop into fruits that aid seed dispersal.	
7.1u Explain that the plants' colonisation of land provided food prompting aquatic animals to move on land.	7.2u Identify the major adaptations that enabled animals to successfully live and reproduce on land. *Knowledge should be limited to:* · *a skin adapted to withstand drying,* · *lungs that could function in air,* · *an exo/endoskeleton to support the body,* · *an efficient nervous system providing sensitivity to the changing environment,* · *mechanisms to control their body temperature,* · *reproduction that is not dependent on the availability of free water, and* · *ways of ensuring the survival of their offspring.*	7.3u Describe that animals show a greater variety as they move around (encountering different habitats) and find diverse eating opportunities (parasites, predation, etc.).
7.1v Identify Arthropods as the first successful land animals.	7.2v Identify the characteristics that made Arthropods (especially insects) successful land animals. *Knowledge should be limited to the presence of (a) body segments and jointed legs that facilitate mobility on dry land; (b) a waterproof exoskeleton; and (c) an advanced sensory system.*	7.3v Infer that primitive arthropods (particularly insects) co-evolved with seed-plants giving rise to a diversified terrestrial vegetation. *Reference only to the appearance of insects that facilitated pollination and consequently the evolution of angiosperms*.

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
7.1w Identify Amphibians that evolved from fish as the first vertebrates to colonise land. *Detailed structural features of fish and amphibians are not required.*	7.2w Identify Amphibian features that characterised their life on land. *Knowledge should be limited to: (a) primitive lungs supplemented by gaseous exchange through a moist scale less skin; (b) limbs and strong endoskeleton to support body on land; and (c) need of a watery medium for external fertilization and egg laying.*	
7.1x Identify Reptiles as the first truly successful land vertebrates.	7.2x Identify Reptilian features that made them successful land animals. *Knowledge should be limited to: (a) dry scaly waterproof skin; (b) strong limbs support body on land; (c) internal fertilization; and (d) lay shelled eggs on land.*	
7.1y Identify the characteristics of Mammals. *Knowledge should be limited to: (a) have a body covered with hair; (b) have mammary glands that produce milk, external ears and a diaphragm separating the thorax from the abdomen; (c) are endothermic; and (d) give birth to live young.*	7.2y Indicate that there are three different reproductive methods in mammals. *Knowledge should be restricted to the fact that (a) Monotremes are the most primitive mammals and have retained the reptilian egg-laying method; (b) Marsupials give birth to live underdeveloped young whose development is completed in the marsupial; and (c) Placentals give birth to live young that have been nourished before birth in the mother's uterus through a placenta.*	7.3y Know that mammals evolved from Reptiles. *No details of time lines and fossil records is expected.*

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
7.1z State that humans and primates are not directly related, but both descend from a common ancestral animal. *No details of fossil records is expected.*	7.2z Indicate that human evolution culminated in the appearance of *Homo sapiens* and was characterised by changes in posture (becoming fully erect on two legs), in cranial capacity (with the brain size increasing) and facial angle (becoming flatter reaching a vertical face). *No details of fossil records is expected.*	7.3z Identify that human evolution was not a linear process, but was characterised by a whole series of inter-linked (branching) lines of different ancestors and descendants *Knowledge that these various ancestors and descendants appeared because of various available niches and disappeared because of competition and/or interbreeding with ancestors of modern humans.* *No details of the genus Homo, the Homo family tree and fossil records are expected.*

Subject Focus:	The Science of the Living World
Learning Outcome 8: **Paper I and Paper II**	**At the end of the programme, I can demonstrate an understanding of how Biology works and is communicated.** • *The assessment criteria of this learning outcome are to be implemented in combination with learning outcomes and refer to experiments and investigations.*

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
8.1a State that scientific knowledge changes with new evidence / observations / experiments.	8.2a Distinguish between a fact, a hypothesis and a theory.	8.3a Discuss briefly the meaning of science in terms of its healthy scepticism, aimed objectivity and the value of physical (observable / measurable) evidence.
8.1b Discuss the importance of fair (objective) testing in science.		8.3b Evaluate an experiment in terms of its objectivity.
8.1c Identify variables in an experiment.		8.3c Identify dependent and independent variables.
8.1d Follow health and safety regulations.	8.2d State general hazards for chemicals and procedures studied throughout this programme.	8.3d Evaluate an experiment in terms of health and safety.
8.1e Carry out, with guidance and prompting, a written structured procedure for an experiment (including a field investigation).	8.2e Carry out, with limited supervision, a written procedure for an experiment (including a field investigation).	8.3e Carry out, with minimal guidance, a written procedure for an experiment (including a field investigation).
8.1f Record observations / measurements in a given table.	8.2f Record observations (including drawings/diagrams) / measurements appropriately.	8.3f Determine which observations / measurements are to be measured.
	8.2g Structure a laboratory/ field investigation report in sections.	8.3g Write a scientific report for an experiment/ field investigation carried out.

Assessment Criteria (LEVEL 1)	Assessment Criteria (LEVEL 2)	Assessment Criteria (LEVEL 3)
8.1h Label diagrams.	8.2h Draw labelled diagrams from given apparatus.	8.3h Draw labelled diagrams of apparatus used during experiments.
	8.2i Identify precautions for a given experiment/investigation.	8.3i Justify precautions for a given experiment/investigation.
8.1j Read simple graphical representations.	8.2j Plot graphical representations.	8.3j Interpret graphical representations.
	8.2k Draw conclusions from an experiment/ field investigation.	8.3k Evaluate an experimental procedure and results to suggest improvements.
8.2l Plan an experiment to solve a given problem with guidance.	8.2l Plan an experiment to solve a given problem with sufficient guidance and prompting.	8.3l Plan an experiment to solve a given problem with minimal guidance.
	8.2m Carry out an experiment to solve a given problem with guidance.	8.3m Carry out an experiment to solve a given problem with minimal guidance.
8.1n Carry out, with guidance and prompting, field techniques. *Including physical measurements, plotting of survey area, quadrat sampling, and transect.*	8.2n Carry out, with limited supervision, field techniques. *Including physical measurements, plotting of survey area, quadrat sampling, and transect.*	8.3n Carry out, with minimal guidance, field techniques. *Including physical measurements, plotting of survey area, quadrat sampling, and transect.*

Scheme of Assessment

School candidates

The assessment consists of Paper I and Paper II. Paper I consists of unmoderated school-based assessment (SBA) that is to be set and assessed by the school. Paper II consists of a controlled assessment that will take place at the end of the three-year programme.

School-based assessment (SBA): is any type of assessment of a candidate made by the school relevant to the respective SEC syllabus contributing to the final level awarded in the subject.

Controlled assessment: is comprised of a two-hour written exam set at the end of the programme and differentiated between two tiers:

a. Levels 1 and 2;
b. Levels 2 and 3.

Candidates are to satisfy the examiner in Paper I and Paper II to obtain a level higher than 1.

Paper I - School Based Assessment (30% of the total mark).

The school-based assessment shall be marked out of 100 each year (9, 10 and 11). The assessment for each year will contribute to 10% of the overall mark and will be reported to MATSEC by the school in Year 11. Therefore, each year will equally contribute to the final mark of the school-based assessment. The school-based assessment shall reflect the MATSEC syllabus covered in Year 9, Year 10 and Year 11.

School-based assessment can be pegged at either of two categories:

- SBA at categories 1-2 must identify assessment criteria from these two levels. It is suggested that ACs are weighted at a ratio of 40% at Level 1 and 60% at Level 2.
- SBA at categories 1-2-3 must identify assessment criteria from each of Levels 1, 2, and 3. It is suggested that ACs are weighted at a ratio of 30% at each of Levels 1 and 2, and 40% at Level 3.

The mark for SBA at level categories 1-2 presented for a qualification at level categories 2-3 will be calculated to 60% of the original mark. The mark stands in all other cases.

Part II: Controlled Assessment (70% of the total mark)

Written Examination (100 marks; 2 hours)

Learning outcomes with assessment criteria in the psychomotor domain can be assessed by asking questions in pen-and-paper format seeking understanding of the activity.

Controlled Assessment will:

- cover all the learning outcomes of the syllabus at the appropriate levels;
- test the theoretical and practical knowledge, practical skills and abilities of comprehension, analysis and evaluation;
- consist of four obligatory sections, as follows:

- **Section A**: A number of short-answer questions totalling 40 marks. The questions may reflect any part of any learning outcome of the syllabus.
- **Section B**: An interpretation to a passage relating to any learning outcome of the syllabus. The passage will be shorter for category level 1-2. This section carries 20 marks.
- **Section C**: An analysis and/or critical evaluation of data from an experiment/investigation relation to any learning outcome of the syllabus. This section carries 20 marks.
- **Section D**: One structured essay-type question totalling 20 marks. The question may be set on any learning outcome.

- be marked out of 100 and all questions in each section are compulsory - answers are to be written on the examination paper provided.

Private Candidates

Private candidates will not be expected to carry out any school-based assessment as school candidates. Instead private candidates need to sit for another Controlled paper as an alternative to the school-based assessment. Private candidates will be assessed through the means of **TWO** Controlled papers, one of which is common with school candidates.

Paper I – Controlled Assessment - Private Candidates Only (30% of the total mark)

Written Examination (100 marks; 2 hours)

Paper I for private candidates shall be a controlled assessment assessing levels 1, 2 and 3 as described in the respective syllabus and set and marked by MATSEC. It shall mainly focus on the learning outcomes marked in the respective syllabi as suggested for school-based assessment.

Learning outcomes with assessment criteria in the psychomotor domain can be assessed by asking questions in pen-and-paper format seeking understanding of the activity.

Controlled Assessment will:

- consist of a two-hour paper including four obligatory sections, as follows:
    - **Section A**: General short- answer questions on any learning outcome. This section carries 15 marks
    - **Section B**: Two questions on experimental work with results/data given for observations, plotting of graphs, interpretations and critical analysis. This section carries 30 marks.
    - **Section C**: One question requiring short answers related to fieldwork and/or site visits. This section carries 25 marks.
    - **Section D**: One question on problem solving investigation requiring plotting of graphs, interpretation and critical analysis.
- be marked out of 100 and all questions in each section are compulsory - answers are to be written on the examination paper provided.

Paper II – Controlled Assessment (70%of the total mark).

Paper II is common with school candidates.