ZIAUDDIN UNIVERSITY
EXAMINATION BOARD

SSC A
Biology Syllabus

For exams in 2026 & onwards

INTRODUCTION TO ZUEB

The Ziauddin University Examination Board (ZUEB) is not only an awarding body but also a solution-driven educational organization dedicated to upholding the highest standards of academic excellence. ZUEB believes in Excellence, Integrity, and Innovation in Education. Established with a vision to foster a robust educational environment, ZUEB is committed to nurturing intellectual growth and development that meets international standards in an effective manner. The Ziauddin University Examination Board (ZUEB) was established through Government Gazette No. XLI on June 6th, 2018. Its purpose is to ensure a high quality, maintain global standards, and align the syllibi with national integrity within the examination system of Pakistan. ZUEB manages student appeals, regulates assessments, and reviews policies to maintain high standards.

WHY CHOOSE SSC-A AT ZUEB?

Ziauddin University Examination Board (ZUEB) offers the SSC-A (Secondary School Certificate advance) program, designed for students from international educational backgrounds. This program provides a structured, affordable, and academically strong pathway for learners to align with Pakistan's education system. It allows students to fulfil national curriculum requirements, including Urdu, Islamiyat, Pakistan Studies, or Sindhi, with academic integrity and flexible learning options. ZUEB believes no student should be left behind due to financial limitations or cross-system transitions, and SSC-A serves as a bridge between past efforts and future ambitions. It is the trusted choice for higher education in Pakistan.

SSC-ADVANCE BIOLOGY

Biology in the SSC-advance qualification at ZUEB is a fundamental subject for students aspiring to pursue careers in medicine, life sciences, biotechnology, and related fields. It provides the essential foundation for scientific inquiry, analytical reasoning, and problem-solving — skills that are critical for academic excellence and intellectual development. This subject not only deepens understanding of living systems but also equips students with the prerequisites required for success in competitive university entrance examinations across Pakistan.

Aligned with both national educational frameworks and the needs of students from international qualification backgrounds, our SSC-A Biology offers connections between global scientific knowledge and local academic standards. Students gain a solid grasp of core biological concepts in cell biology, genetics, evolution, human physiology, microbiology, and ecology, delivered through a structured, flexible, and supportive learning model.

Whether your goal is to enter a top medical or dental university, study environmental sciences, or build a strong foundation in scientific reasoning and critical thinking, SSC-A Biology ensures you're academically prepared and nationally aligned. Explore more on what SSC-A offers: ZUEB SSC-A Official Page.

Syllabus Overview

No.	Content	AO	Exam
1	Foundations of Biology: Cells, Life and Organisation	1,2,3	Combination of written exam papers (externally set and marked) and a practical demonstration of skills. **Paper 1:** Multiple Choice Questions, Theoretical Questions and Practical Component. Duration: 2 hours **Paper 2:** Multiple Choice Questions, Theoretical Questions and Practical Component. Duration: 2 hours
2	Movement into and out of cells	1,2,3	
3	Biological Molecules and Human Digestion	1,2,3	
4	Respiratory System and the Effects of Smoking	1,2,3	
5	Transport in Animals	1,2,3	
6	Disease, Immunity and Drugs	1,2,3	
7	Plant Nutrition and Transport	1,2,3	
8	Coordination, Hormonal Control and Excretion	1,2,3	
9	Cell Division and Reproduction	1,2,3	
10	Genetics, Classification and Evolution	1,2,3	
11	Ecology and Human Impact on the Environment	1,2,3	
12	Biotechnology and Genetic Engineering	1,2,3	

Description of Assessment Objectives

AO1 – Show knowledge and understanding of:

- scientific concepts and principles
- relevant methods, techniques, and procedures

AO2 – Apply knowledge and understanding to:

- use scientific ideas in various contexts
- perform and explain investigations, techniques, and procedures

AO3 – Analyse and interpret to:

- evaluate information and data
- draw reasoned conclusions and judgements
- suggest improvements to experimental methods

Weighting of Assessment Objectives

Assesement Objectives	P1 (%)	P2 (%)
A01	30	30
A02	40	40
A03	30	30

Foundations of Biology: Cells, Life and Organisation			
Aim: To develop understanding of cells as the basic unit of life, with emphasis on their structure, components, functions, and development.			
	The learner will:	**Assessment Criteria - The learner can:**	**Cognitive levels**
1	Understand the characteristics of living organisms.	**Distinguish** between living cells and non-living cells.	AO1
		Define the main characteristics of living organisms.	AO1
		Describe methods used in scientific research, such as making observations, formulating hypotheses, conducting experiments, recording data, and analyzing results.	AO2
		Explain the seven characteristics of life, specifically (i) movement (ii) respiration (iii) sensitivity (iv) growth (v) reproduction (vi) excretion (vii) nutrition.	AO2
		Describe the following forms of nutrition; autotrophic, heterotrophic, and saprotrophic nutrition.	AO1
		Define the term Photosynthesis.	AO1
		Describe the process of aerobic respiration.	AO2
		Explain how anaerobic respiration takes place in the muscle cells and yeast.	AO2
		State the meaning of the term Oxygen debt.	AO1
		Explain the uses of energy in the human body, including: (i) movement, (ii) active transport, (iii) electrical impulses, (iv) heat, and (v) synthesis of molecules (and bioluminescence, where applicable).	AO2
2	Be able to demonstrate practical awareness of the characteristics of living organisms.	**Perform** tests for the presence of carbon dioxide using: (i) the limewater test, and (ii) the hydrogen carbonate indicator test.	AO3
		Compare the initial and final colour changes to determine positive and negative results.	AO3
		Discuss how differences in colour change relate to the rate of reaction.	AO3
		Analyse colour changes in hydrogen carbonate indicator to explain differences in CO_2 concentration resulting from (i) photosynthesis and (ii) respiration.	AO3
3	Understand the basic structures and functions of cells.	**State** the meaning of the terms, unicellular and multicellular organisms.	AO1

		Describe the structure of unicellular organisms such as Amoeba and Euglena.	AO1
		Compare the similarities and differences between single celled organisms, Amoeba and Euglena.	AO1
		Compare eukaryotic cells with prokaryotic cells.	AO1
		Differentiate , by size (from smallest to largest) the following: (i) virus, (ii) bacteria, (iii) fungi, (iv) animal, and (v) plant.	AO1
		Describe the cell organelles and their functions in cells.	AO1
		Identify the examples of: (i) specialised animal cells, and (ii) specialised plant cells.	AO2
		Evaluate how specialised animal cells and specialised plant cells are structurally adapted in line with their specialised function.	AO3
		Compare the process of mitosis and meiosis.	AO1
		Compare an adult stem cell with an embryonic stem cell.	AO2
		Evaulate the benefits and limitations of using adult stem cells versus embryonic stem cells in medical treatments.	AO3
4	Be able to demonstrate practical awareness of basic structures and functions of cells.	**Draw** and accurately **label** a typical animal cell, including the following key structures: (i) nucleus, (ii) cytoplasm, (iii) cell membrane, (iv) ribosomes, and (v) mitochondria	AO2
		Draw and accurately **label** a typical plant cell, including the following key structures: (i) large permanent vacuole, (ii) cellulose cell wall, (iii) chloroplast, and (iv) amyloplast.	AO2
		Construct a venn diagram (or table) to show the similarities and differences between animal and plant cells.	AO3
		Draw and accurately label the following cells: (i) bacterial cell, (ii) fungal cell, and (iii) protocist.	AO2
5	Understand the functions of a light microscope.	**Describe** the size and structure of cells and their ability to be seen with a light microscope.	AO2
		Explain the process of slide preparation and use of the light microscope to make careful observations of cells.	AO2
		Explain the importance of the following when using a light microscope: (i) cover slip, (ii) methods of preventing damage or errors, and (iii) techniques for correcting mistakes during practical use.	AO2
		Summarise the differences between light microscopes and electron microscopes (TEM and SEM) in terms of: (i) image produced, (ii) magnification, (iii) resolution, and (iv) sample preparation.	AO3
6	Be able to demonstrate practical awareness of functions of the light microscope.	**Label all the parts of a compound light microscope.**	AO1

		Select correct chemicals when preparing animal cell slides for observation under a light microscope.	AO3
		Use appropriate stains in the preparation of plant cell slides for observation under a light microscope.	AO3
		Draw the diagram of observed cells from the sample slides.	AO2
		State the formula for magnification.	AO1
		Calculate magnification (by use of a scale bar), image size and actual size from micrographs and images.	AO3
7	Understand levels of human organisation.	**Explain** the following terms: (i) cells, (ii) tissues, (iii) organ, and (iv) organ systems.	AO1
		Describe how tissues, organs and organ systems contribute to an organism.	AO2
		State the main connecting vessels in each major organ system.	AO1
8	Be able to demonstrate practical awareness of levels of human organisation.	**Identify** the positions of the main organ systems in the human body.	AO2
		Label the main organ systems in the human body.	AO1
9	Understand levels of plant organisation.	**Identify** and **label** positions of main organ systems of a flowering plant.	AO1
		List the main organ systems of a flowering plant.	AO1
		Identify the position of the main organs of a flowering plants.	AO2
		Describe the structures and functions of the main organs of flowering plants.	AO1

Movement into and out of cells				
Aim: To promote understanding of the three main processes: diffusion, osmosis, and active transport, through which substances move into and out of cells.				
	The learner will:	**SLO #**	**Assessment Criteria - The learner can:**	**Cognitive levels**
1	Understand the processes involved in diffusion.	2.1.1	**Define** the term 'Diffusion' and give examples.	AO1
		2.1.2	**Explain** the importance of diffusion of gases and solutes.	AO1
		2.1.3	**Describe** the importance of water as a solvent.	AO1
		2.1.4	**Describe** the factors which affect the rate of diffusion.	AO1
		2.1.5	**Explain** how to calculate the rate of diffusion.	AO2
2	Be able to demonstrate practical awareness of the	2.2.1	**Conduct** experiments to observe diffusion in the following conditions:	AO3
3	Understand the processes involved in osmosis.	2.3.1	**Define** the term 'Osmosis' and give examples.	AO1
		2.3.2	**Define** the following terms: (i) hypertonic, (ii) hypotonic, and (iii) isotonic solutions.	AO1
		2.3.3	**Explain** turgor pressure in plants.	AO1
		2.3.4	**Analyse** how, i) plant cells become turgid, flaccid and plasmolysed, ii) animal cell become lysed and crenated. (iii) where no changes occur in both the cells.	AO3
		2.3.5	**Describe** the role of the cellulose cell wall in plant cells.	AO1
		2.3.6	**Describe** how percentage mass change in potato cores can be compared.	AO2
4	Be able to demonstrate practical awareness of the processes involved in osmosis.	2.4.1	**Perform** experiments to observe the process of osmosis using the following practical methods: (i) thistle funnel experiment (ii) visking tubing and water potential (iii) use of an osmometer (iv) osmosis in potato cells.	AO3
		2.4.2	**Represent** data using graphs or tables to: (i) show percentage change in mass, (ii) determine the water potential within the cells.	AO3
5	Understand the process of active transport.	2.5.1	**Define** the term 'Active transport'.	AO1
		2.5.2	**Explain** how carrier proteins assist in the transport of substances across the cell membrane.	AO2
		2.5.3	**Describe** how active transport consumes energy through respiration.	AO2
		2.5.4	**Identify** the ions and molecules transported through active transport in both animals and plants.	AO2
		2.5.5	**Describe** where in the body active transport of specific ions and molecules takes place.	AO3
		2.5.6	**Justify** why non-living (artificial) membranes are unable to produce Adenosine Triphosphate (ATP) for active transport.	AO3

Biological Molecules and Human Digestion				
Aim: To enhance understanding of biological molecules and the human digestive system, its key purpose and functions and the way in which nutrients are absorbed into the body.				
	The learner will:	**SLO #**	**Assessment Criteria - The learner can:**	**Cognitive levels**
1	Understand the structure of biological molecules.	3.1.1	**Identify** the elements that make up biological molecules (e.g., carbohydrates, proteins, lipids).	AO1
		3.1.2	**Explain** the basic shape of carbohydrates, proteins and fats.	AO1
		3.1.3	**Describe** the properties of the following biological molecules (i) antibodies, (ii) enzymes, and (iii) hormones.	AO1
		3.1.4	**Explain** the properties of the following carbohydrates: (i) glucose, (ii) sucrose, (iii) starch, (iv) glycogen, and (v) cellulose.	AO1
		3.1.5	**Describe** appropriate tests that are used to detect (i) carbohydrates, (ii) proteins, and (iii) fats in food samples.	AO1
2	Understand the properties of Deoxyribonucleic Acid (DNA).	3.2.1	**Describe** the key features of DNA.	AO1
		3.2.2	**Describe** how complementary base pairing works.	AO2
		3.2.3	**Explain** the double helix structure and overall shape of DNA.	AO2
3	Be able to demonstrate practical understanding of the properties of DNA.	3.3.1	**Draw** and **label** the diagram of DNA nucleotide that is composed of a phosphate group, pentose sugar and nitrogenous base.	AO2
4	Understand the function of enzymes.	3.4.1	**Describe** and **analyse** the effects of enzymes in different metabolic reactions.	AO3
		3.4.2	**Describe** the three core functions of enzymes.	AO1
		3.4.3	**Describe** the process of an enzyme catalysed reaction in terms of; substrate, complementary shape of the active site of the enzyme to the substrate, enzyme-substrate complex and products with examples.	AO1
		3.4.4	**Describe** how the specificity of enzymes allows them to catalyse reactions during replication.	AO3
		3.4.5	**Describe** the specific conditions required for different enzymes to function effectively.	AO1
		3.4.6	**Explain** how temperature influence the enzyme activity.	AO3

		3.4.7	**Describe** the effects of pH on enzymatic activity.	AO2
		3.4.8	**Explain** the effects of substrate and enzyme concentration on the rate of enzyme activity.	AO2
5	Be able to demonstrate practical skills in investigating the role of enzymes in chemical reactions.	3.5.1	**Conduct** the iodine test to detect the presence of starch.	AO3
		3.5.2	**Perform** Benedict's test for reducing sugar and record the observations.	AO3
		3.5.3	**Perform** Biuret test to investigate the presence of protein in a food sample and record the observations.	AO3
		3.5.4	**Perform** Emulsion test for fats and record the observations.	AO3
		3.5.5	**Perform** and observe the chemical test for Vitamin C.	AO3
6	Understand nutrition in humans and the process of digestion.	3.6.1	**Define** the term nutrition.	AO1
		3.6.2	**Describe** the importance of nutrition.	AO1
		3.6.3	**Discuss** the significance of balanced diet and the functions of its key components: carbohydrates, proteins, fats, water, vitamins, minerals, and fibre.	AO2
		3.6.4	**Explain** and **observe** how dietary requirements are influenced by: (i) age (ii) gender (including during pregnancy), and (iii) physical activity.	AO3
		3.6.5	**Define** the term 'basal metabolic rate'.	AO1
		3.6.6	**Explain** how the following dietary imbalances affect health: (i) excess fat, (ii) insufficient fibre, (iii) vitamin C deficiency, (iv) vitamin D deficiency, (v) iron deficiency, and (vi) calcium deficiency.	AO2
		3.6.7	**Outline** the effects of a higher energy intake to energy output.	AO1
		3.6.8	**Define the following terms:** (i) ingestion, (ii) digestion, (iii) absorption, (iv) assimilation, and (v) egestion.	AO1
		3.6.9	**Define** the terms mechanical and chemical digestion.	AO1
		3.6.10	**Explain** the roles of the following enzymes, including their specific substrates and resulting products: (i) amylase, (ii) protease, and (iii) lipase.	AO1
		3.6.11	**Describe** the basic structure and types of human teeth and their functions.	AO1
		3.6.12	**State** the causes of tooth decay and how to prevent tooth decay.	AO2

		3.6.13	**Explain** the movement of food through the alimentary canal, from the mouth to the anus.	AO1
		3.6.14	**Describe** the events that take place during the chewing and swallowing process.	AO1
		3.6.15	**Describe** the function of saliva.	AO1
		3.6.16	**Describe** the coordination of muscles (circular and longitudinal) during peristalsis in the oesophagus to propel the food forward through the digestive tract.	AO1
		3.6.17	**Describe** the processes of chemical digestion and mechanical digestion.	AO1
		3.6.18	**Describe** the functions of the following components in digestion: (i) gastric juice (ii) pepsin (iii) hydrochloric acid.	AO1
		3.6.19	**Explain** the importance of bile and pancreatic juice in digestion.	AO1
		3.6.20	**Describe** the role of the following enzymes: (i) amylase (ii) trypsin (iii) lipase	AO1
		3.6.21	**Explain** the role of villi in the digestive process.	AO1
		3.6.22	**Describe** the importance of absorption in digesting food molecules.	AO1
		3.6.23	**Explain** the role of peristalsis in transporting undigested food through the intestines.	AO2
		3.6.24	**Describe** the role of the large intestine in the digestive system.	AO1
		3.6.25	**Explain** the reason for faeces being retained in the rectum before egestion from the body.	AO2
		3.6.26	**Describe** the impact of the autoimmune disease celiac on infants and adults.	AO3
		3.6.27	**Explain** the role of the gall bladder in digestion.	AO1
		3.6.28	**Describe** the signs and symptoms of cholera.	AO1
		3.6.29	**Define** lactose intolerance and its effects on the body.	AO2
7	Be able to demonstrate practical awareness of calculating energy contents of the food.	3.7.1	**Demonstrate** practical techniques for: (i) measuring food energy through calorimetry, and (ii) calculating the energy content of food.	AO3

Respiratory System and the Effects of Smoking				
Aim: To develop an understanding of the respiratory system, including the mechanisms of breathing (inhalation and exhalation), as well as the composition of gases in the air and their role in respiration.				
	The learner will:	**SLO #**	**Assessment Criteria - The learner can:**	**Cognitive levels**
1	Understand the role of gas exchange in human beings.	4.1.1	**Explain** how the bell jar model demonstrates the process of ventilation and identify its limitations.	AO3
		4.1.2	**Describe** the function of epiglottis.	AO1
		4.1.3	**Describe** the role of the C-shaped cartilage rings in trachea.	AO1
		4.1.4	**Describe** how the bronchiole network resembles a tree or branching structure.	AO2
		4.1.5	**Describe** how ventilation is different from respiration.	AO1
		4.1.6	**Obsreve** and **explain** the process of ventilation (both inhalation and exhalation) in terms of pressure changes in the lungs.	AO3
		4.1.7	**Explain** the route/pathway of air from atmosphere into a body cell.	AO2
		4.1.8	**Explain** the difference in the percentage composition of atmospheric air compared with exhaled air.	AO1
		4.1.9	**Describe** the process of exchange of gases (oxygen and carbondioxide) in the alveoli by diffusion.	AO1
		4.1.10	**Describe** the adaptations of alveoli in terms of: (i) large surface area, (ii) good blood supply / capillary network, (iii) moist surfaces and (iv) thin cell walls.	AO1
		4.1.11	**Describe** gaseous exchange surfaces in the gills of fish.	AO1
		4.1.12	**Explain** how to measure breathing rate by counting breaths per minute.	AO2
		4.1.13	**Define** the term vital capacity.	AO1
		4.1.14	**Describe** and **observe** the changes in breathing rate and depth before, during and after exercise.	AO3

		4.1.15	**Discuss** the relationship between aerobic and anaerobic respiration in the body across different stages(before, during and after) exercise/ physical activity.	AO3
		4.1.16	**Explain** the role of liver in breaking down lactic acid.	AO1
		4.1.17	**Define** the term 'oxygen debt' and explain its significance.	AO1
		4.1.18	**Explain** how changes in carbon dioxide levels in the blood help regulate the breathing rate.	AO2
		4.1.19	**Explain** the role of cilia and goblet cells in keeping the airways clean.	AO1
		4.1.20	**State** the composition of tobacco smoke and explain the effects on respiratory system and other organs in the body.	AO2
		4.1.21	**Define** the term 'passive smoking'.	AO1
		4.1.22	**Explain** and **analyse** how the following chronic obstructive pulmonary diseases (COPD) occur as a result of smoking: (i) lung cancer, (ii) bronchitis, (iii) emphysema, and (iv) heart disease.	AO3
		4.1.23	**Describe** correlation versus causation in health conditions associated with smoking.	AO1
2	Be able to demonstrate practical awareness of gaseous exchange in different situations.	4.2.1	**Label** (on diagrams) the location of the following in the human gaseous exchange system: (i) larynx, (ii) trachea, (iii) bronchi, (iv) bronchioles and alveoli, (v) pleural membrane, (vi) pleural fluid,(vii) intercostal muscles, (viii) ribs, (ix) sternum, (x) diaphragm, and (xi) associated capillaries.	AO1
		4.2.2	**Make** a model of lungs / bell jar and **perform** the process of breathing.	AO3
		4.2.3	**Demonstrate** the presence of tar in cigarette smoke using a model with filters.	AO3
		4.2.4	**Apply** the limewater test to detect and compare carbon dioxide concentration in various samples.	AO3
		4.2.5	**Examine** the effects of physical exercise on: (i) breathing rate and depth, and (ii) vital capacity measurement.	AO3

Transport in Animals				
Aim: To enhance understanding of the human circulatory system, its main purpose and functions, the role of heart in circulation, and the impact of poor diet on heart function.				
	The learner will:	**SLO #**	**Assessment Criteria - The learner can:**	**Cognitive levels**
1	Understand the function of the human heart and the circulatory system.	5.1.1	**Describe** the one-way flow of blood around the body.	AO1
		5.1.2	**Explain** the term single and double circulatory system.	AO1
		5.1.3	**Discuss** the advantages of a double circulatory system compared to a single circulatory system.	AO1
		5.1.4	**Explain** the role of the coronary artery.	AO1
		5.1.5	**Outline** the location of the pacemaker (where required) within the human heart**.**	AO2
		5.1.6	**Describe** the role of septum in separating oxygenated and deoxygenated blood in the heart.	AO1
		5.1.7	**Describe** differences in structure and function between the left and right side of the heart.	AO1
		5.1.8	**Compare** the differences between atria and ventricles based on the thickness of their muscular walls.	AO1
		5.1.9	**Describe** how the thickness of heart chambers influences the pressure of blood as it leaves the heart.	AO3
		5.1.10	**Explain** the sequence of events in one heartbeat, including the contraction and relaxation of the atria and ventricles.	AO1
		5.1.11	**Explain** and **observe** the purpose of an electrocardiogram (ECG) as being the method by which a heartbeat can be measured.	AO3
		5.1.12	**Explain** the effects of physical activity on the heart rate.	AO2
		5.1.13	**Define** the term ‘pulse rate’ and 'resting pulse rate'.	AO1
		5.1.14	**Observe** and **explain** how a pulse rate and resting pulse rate can be used to determine a person’s fitness.	AO3
		5.1.15	**Explain** the nature of coronary heart disease (CHD) as a non-communicable disease.	AO1

		5.1.16	**Describe and observe** the possible causes and preventive measures of CHD, specifically: (i) lifestyle,(ii) heredity, (iii) age, and (iv) gender.	AO3
		5.1.17	**Explain** methods of treatment for CHD, specifically: (i) change in diet, (ii) angioplasty, (iii) coronary stent, (iv) drugs, (v) coronary bypass, and (vi) heart transplant.	AO1
		5.1.18	**Discuss** the benefits and drawbacks of the following methods for treating heart disease: (i) dietary changes, (ii) angioplasty, (iii) coronary stents, (iv) medication, (v) coronary bypass surgery, and (vi) heart transplantation.	AO2
		5.1.19	**Describe** the functions of (i) arteries, (ii) veins, and (iii) capillaries.	AO1
		5.1.20	**Compare** the structural features of arteries, veins and capillaries in terms of: (i) thickness of muscle, (ii) thickness of elastic fibres, (iii) diameter of lumen, (iv) presence of valves, (v) smooth or rough endothelium.	AO2
		5.1.21	**Describe** differences in blood pressure in each blood vessel.	AO1
		5.1.22	**Describe** the function of (i) arterioles, (ii) venules. and (iii) shunt vessels.	AO1
		5.1.23	**Describe** how the composition of blood differs in various blood vessels with respect to: (i) Oxygen concentration (ii) Carbon dioxide concentration (iii) Urea concentration (iv) Nutrient concentration (e.g., glucose and amino acids)	AO2
		5.1.24	**List** the main components of blood along with their relative percentages in a healthy individual: (i) Red blood cells (ii) White blood cells (iii) Plasma (iv) Platelets	AO1
		5.1.25	**Explain** the purpose of centrifugation as a method of separating blood and its components.	AO2
		5.1.26	**Describe** the role of red blood cells.	AO1
		5.1.27	**Explain** the structural adaptations of red blood cells.	AO2
		5.1.28	**Explain** the importance of haemoglobin and describe the formation of oxyhaemoglobin in the lungs, including its reversible reaction at body cells.	AO1
		5.1.29	**Describe** the role of plasma in the transport of following nutrients: (i) wastes, (ii) blood proteins, and (iii) hormones.	AO1
		5.1.30	**Describe** how materials are exchanged between capillaries and body cells, and explain how tissue fluid is formed.	AO2
		5.1.31	**Describe** the term ‘lymph’.	AO1

		5.1.32	**Describe** the differences in composition between lymph and blood.	AO1
		5.1.33	**Explain** how the lymphatic system functions separately from the circulatory system.	AO1
		5.1.34	**Describe** the role of lymph nodes being the site of maturation for lymphocytes.	AO2
		5.1.35	**Describe** the function of white blood cells.	AO2
		5.1.36	**Explain** the process of phagocytosis.	AO2
		5.1.37	**Describe** how antibodies can defend the body against pathogens.	AO2
		5.1.38	**Describe** the relationship between antibodies and pathogens.	AO1
		5.1.39	**Explain** the function of platelets in blood clotting.	AO1
2	Be able to demonstrate practical awareness of the role of the human heart and the circulatory system.	5.2.1	**Identify** and **label** the structure of heart, specifically: (i) left atrium, (ii) right atrium, (iii) left ventricle, (iv) right ventricle, (v) septum, (vi) bicuspid and tricuspid valves, (vii) aortic, and (viii) pulmonary valves.	AO1
		5.2.2	**Analyze** a cardiogram and **explain** the events that take place during one heartbeat.	AO3
		5.2.3	**Investigate** the effect of physical activity on pulse rate.	AO3
		5.2.4	**Identify and label** the main blood vessels in the body, specifically: (i) vena cava and aorta, (ii) hepatic artery and vein, (iii) hepatic portal vein, and (iv) renal artery and vein.	AO2
		5.2.5	**Perform** a heart dissection and **examine** its internal and external structures.	AO3
		5.2.6	**Identify** components of blood from micro pictographs.	AO1

Disease, Immunity and Drugs				
Aim: To enhance understanding of the human body and the ways in which lifestyle, genetics, and behaviours can negatively affect health. This topic also aims to cover immunity and its types, communicable and non-communicable diseases, and build knowledge of medicinal and recreational drugs, their effects on the body, and the risks linked to drug.				
	The learner will:	**SLO #**	**Assessment Criteria - The learner can:**	**Cognitive levels**
1	Understand the effects of diseases and the role of immunity in both humans and plants.	6.1.1	**Define** communicable and non-communicable diseases.	AO1
		6.1.2	**Explain** examples of communicable and non-communicable diseases.	AO1
		6.1.3	**Describe** how certain communicable diseases can be transmitted from a host to other non-infected individuals.	AO2
		6.1.4	**Define** the term pathogen.	AO1
		6.1.5	**Summarize** the symptoms of the following diseases: (i) influenza, (ii) tuberculosis, (iii) cholera / typhoid, (iv) athletes' foot, (v) HIV/AIDS, (vi) hepatitis, and (vii) chlamydia.	AO2
		6.1.6	**Explain** preventive methods of the following diseases: (i) influenza, (ii)tuberculosis, (iii) cholera / typhoid, (iv) athletes' foot, (v) HIV/AIDS, (vi) hepatitis, and (vii) chlamydia.	AO1
		6.1.7	**Define** the role of vaccinations.	AO1
		6.1.8	**Explain** the body's primary defences against disease.	AO1
		6.1.9	**Summarise** and **analyse** the function of phagocytes in the human immune system.	AO3
		6.1.10	**Summarise** the role of lymphocytes and antibodies in the human immune system.	AO2
		6.1.11	**Define** the term 'active immunity'.	AO1
		6.1.12	**Describe** how active immunity is acquired.	AO1
		6.1.13	**Explain** how mutation of pathogens could lead to a primary response after vaccination.	AO2

		6.1.14	**Explain** why vaccination is important for infants and people travelling to other countries.	AO2
		6.1.15	**Describe** why regular vaccinations are needed for certain pathogens.	AO3
		6.1.16	**Describe** the terms primary immune response and secondary immune response in terms of:(i) antibody concentration before and after exposure to pathogen, (ii) presence of memory cells, and (iii) duration of patient sickness / symptoms expressed.	AO1
		6.1.17	**Define** the term passive immunity.	AO1
		6.1.18	**Describe** the importance of breast feeding for infants and passive immunity.	AO1
		6.1.19	**Describe** Type 1 diabetes as an autoimmune disease.	AO1
		6.1.20	**Explain** the symptoms and treatments for Type 1 diabetes.	AO1
		6.1.21	**Explain** how plants can catch communicable diseases.	AO2
		6.1.22	**Identify** the type of pathogen that affects a plant.	AO1
		6.1.23	**Analyse** the symptoms of a plant infected by a pathogen.	AO3
		6.1.24	**Describe** and **analyse** symptoms of plant diseases such as: (i) stunted growth, (ii) spots on plant organs, (iii) malformed stems / leaves, (iv) discolouration, (v) areas of decay, and (vi) presence of pests.	AO3
		6.1.25	**Explain** various deficiency diseases on plants for named minerals, specifically: (i) magnesium, (ii) nitrates, and (iii) phosphates.	AO1
2	Be able to demonstrate practical understanding of how diseases and immunity affect humans and plants.	6.2.1	**Illustrate** and **label** the typical structures of the following microorganisms: (i) fungi, (ii) bacteria, (iii) protoctists, and (iv) viruses.	AO1
		6.2.2	**Identify** each type of pathogen, specifically: (i) fungi, (ii) bacteria, (iii) protoctists, and (iv) viruses.	AO1
		6.2.3	**Determine** from given information (e.g., graph or comprehension) whether a primary or secondary immune response is being observed.	AO3

3	Understand the impact of medicinal and recreational drugs on the human body.	6.3.1	**Define** drug as a substance taken into/ingested into the body that influences the chemical reactions in the body.	AO1
		6.3.2	**Outline** the derivative characteristics of drugs.	AO1
		6.3.3	**Explain** how penicillin was discovered.	AO2
		6.3.4	**Explain** the use of antibiotics against bacterial diseases.	AO2
		6.3.5	**Discuss** the role of pain killers and anaesthetics as symptom relievers.	AO2
		6.3.6	**Explain** why antibiotics cannot be used to treat viral infections.	AO3
		6.3.7	**Describe** the use of fungicides as a treatment for fungal diseases.	AO2
		6.3.8	**Explain** what is meant by 'over-the-counter' medicines.	AO1
		6.3.9	**Describe** antibiotic resistance in terms of natural selection.	AO1
		6.3.10	**Explain** the importance of correct use of antibiotics and drugs in the fight against diseases.	AO1
		6.3.11	**Describe** the strategies that can be used to reduce the development of antibiotic resistant bacteria.	AO3
		6.3.12	**Outline** the steps involved in developing modern drugs for treatment.	AO2
		6.3.13	**Describe** why thorough testing is important in drug development and highlight related ethical concerns.	AO3
		6.3.14	**Differentiate** between a stimulant and a depressant drug.	AO1
		6.3.15	**Identify** drugs which functions as: (i) depressants, (ii) stimulants, and which deemed socially acceptable.	AO1
		6.3.16	**Identify** and **explain** the non-communicable diseases linked to excessive intake of: (i) alcohol,(ii) nicotine, and (iii) caffeine.	AO3
		6.3.17	**Explain** how alcohol affects the body, including: (i) reduced coordination, (ii) impaired judgment and body control, (iii) delayed reaction times, and (iv) decreased self-control.	AO1

		6.3.18	**Explain** social issues associated with alcohol abuse.	AO2
		6.3.19	**List** the illegal recreational drugs.	AO1
		6.3.20	**Describe** how drugs can lead to addiction.	AO1
		6.3.21	**Explain** the effects of heroin abuse.	AO1
		6.3.22	**Explain** how injecting heroin can increase the risk of HIV and hepatitis.(discuss and observe a scenario)	AO3
		6.3.23	**Explain** the impact of heroin addiction.	AO1
		6.3.24	**Explain** how heroin interacts and affects the synapses in the nervous system.	AO3
4	Understand the use of drugs in sports.	6.4.1	**Discuss** the use of anabolic steroids in sports.(analyse an example)	AO3
		6.4.2	**Explain** the side effects of anabolic steroids for both male and female athletes.	AO3
		6.4.3	**Discuss** the ethical issues associated with the use of performance enhancing drugs.	AO3
5	Be able to demonstrate practical awareness of the role of drugs.	6.5.1	**Examine** how antiseptics and/or antibiotics influence bacterial growth using agar plates.	AO3
		6.5.2	**Analyse** the effect of antiseptics and/or antibiotics on bacterial growth by measuring zones of inhibition.	AO3

Plant Nutrition and Transport				
Aim: To enhance understanding of plant tissues and their essential role in the transport system, particularly in relation to photosynthesis, respiration, and transpiration.				
	The learner will:	**SLO #**	**Assessment Criteria - The learner can:**	**Cognitive levels**
1	Understand the role of photosynthesis in plants.	7.1.1	**State** the balanced chemical equation for photosynthesis.	AO1
		7.1.2	**Describe** the method used to test the presence of starch in a green leaf.	AO2
		7.1.3	**Explain** the role of chlorophyll in photosynthesis.	AO1
		7.1.4	**Describe** experiments to prove that light, chlorophyll, water and carbon dioxide are required for the process of photosynthesis.	AO1
		7.1.5	**Describe** how each of the following factors effects the rate of photosynthesis: (i) light, (ii) temperature, (iii) carbon dioxide concentration, (iv) humidity, (v) presence of wind / air flow.	AO3
		7.1.6	**Name** the products of photosynthesis and how they are used by the plant.	AO1
		7.1.7	**Describe** how to investigate the effects of the following variables on the rate of photosynthesis: (i) carbon dioxide concentration, (ii) temperature, and (iii) light intensity.	AO3
		7.1.8	**Describe** the results of each of the above variables.	AO1
		7.1.9	**Define** the term limiting factor.	AO1
		7.1.10	**Describe** how greenhouses artificially control abiotic factors such as temperature, light intensity, carbon dioxide, and water to promote optimum conditions for plant growth.	AO3
2	Understand the structure of plant tissues and their key functions.	7.2.1	**Name** all the main plant organs.	AO1

		7.2.2	**Explain** the role of the following plant organs: (i) flower, (i) root, (iii) stem, and (iv) leaves.	AO1
		7.2.3	**Describe** the features of a root hair cell and how it is adapted to its function.	AO2
		7.2.4	**Describe** the function of plant roots for absorption of substances by (i) diffusion, (ii) osmosis, and (iii) active transport.	AO3
		7.2.5	**Compare** the structural and functional differences in xylem and phloem transport vessels.	AO2
		7.2.6	**Explain** how the following structures promote photosynthesis in leaves/plants: (i) upper epidermis, (ii) palisade layer, (iii) spongy mesophyll layer, (iv) vascular bundle/vein including xylem and phloem, (v) lower	AO2
		7.2.7	**Describe** the processes involved in the opening and closing of stomata by guard cells.	AO1
		7.2.8	**Describe** environmental factors that can affect the rate at which stomata opens and closes.	AO2
		7.2.9	**Explain** how diffusion affects the concentration levels in stomata.	AO3
		7.2.10	**Describe** the role of roots in providing anchorage for the plant.	AO1
3	Understand the plant transport function.	7.3.1	**Define** the terms (i) transpiration (ii) translocation.	AO1
		7.3.2	**Differentiate** between transpiration and translocation.	AO2
		7.3.3	**Define** the term ‘mass flow’.	AO1
		7.3.4	**Describe** the movement of water and mineral ions from root hair cells to leaf cells through xylem vessel.	AO2
		7.3.5	**Outline** the chemical properties of water.	AO1
		7.3.6	**Explain** movement of substances from source to sink.	AO1

		7.3.7	**Explain** how substances are transported in xylem and phloem.	AO2
		7.3.8	**Explain** how different parts of a plant can act as source or a sink, at different times in a plant life.	AO2
		7.3.9	**Explain** translocation of sucrose as an active process.	AO1
		7.3.10	**Describe** how changes in humidity, temperature and light intensity can affect the rate of transpiration.	AO2
		7.3.11	**Describe** the process of wilting in terms of water availability and turgor pressure.	AO2
		7.3.12	**Describe** how to investigate the rate of transpiration using a potometer.	AO3
		7.3.13	**State** that minerals can be absorbed by diffusion and active transport with example.	AO1
		7.3.14	**State** the importance of the following minerals for plant nutrition: (i) nitrates, (ii) phosphates, and (iii) magnesium.	AO1
		7.3.15	**Explain** the impact of mineral deficiency and diseases in plants.	AO1
4	Be able to demonstrate practical awareness of the role of transpiration, photosynthesis and plant tissues.	7.4.1	**Calculate** the surface area of a leaf using a grid paper.	AO3
		7.4.2	**Calculate** the number of stomata from a micro pictograph.	AO3
		7.4.3	**Deduce** from a diagram which method of absorption is occurring based on concentration gradient.	AO3
		7.4.4	**Describe** how to test a leaf for the presence of starch.	AO3
		7.4.5	**Investigate** the necessity of chlorophyll for photosynthesis.	AO3
		7.4.6	**Investigate** the necessity of carbon dioxide for photosynthesis.	AO3

		7.4.7	**Investigate** the necessity of light for photosynthesis.	AO3
		7.4.8	**Investigate** the rate of photosynthesis by measuring volume of oxygen produced over a period of time.	AO3
		7.4.9	**Investigate** the effect of light intensity on the rate of photosynthesis.	AO3
		7.4.10	**Investigate** the effect of temperature on the rate photosynthesis.	AO3
		7.4.11	**Investigate** the effect of carbon dioxide on the rate of photosynthesis.	AO3
		7.4.12	**Name** the reactants and products of a balanced chemical equation of photosynthesis (including light and chlorophyll on the arrow).	AO1
		7.4.13	**Investigate** the effect of the following variables on the rate of photosynthesis: (i) carbon dioxide concentration, (ii) temperature, and (iii) light intensity.	AO3
		7.4.14	**Recognize** the following structures in a transverse section of a root: (i) root hair cells, (ii) cortex, (iii) root tip, (iv) root cap, and (v) phloem and xylem.	AO2
		7.4.15	**Recognize** the following structures in a transverse section of a stem: (i) cambium, (ii) cortex, (iii) pith,(iv) epidermis, and (v) phloem and xylem.	AO2
		7.4.16	**Identify** and **label** the following parts in a transverse section of a leaf: (i) upper epidermis, (ii) palisade layer, (iii) spongy mesophyll layer, (iv) vascular bundle/vein, (v) xylem and phloem, (vi) lower epidermis, (vii) guard cells, and (viii) stomata.	AO2
		7.4.17	**Investigate** the plant metabolism, respiration and photosynthesis when using a hydrogen carbonate indicator in light and dark conditions.	AO3

Coordination, Hormonal Control and Excretion				
Aim: To promote understanding of nervous and chemical coordination in humans, along with chemical coordination (the hormonal system) in plants. Learners will also deepen their understanding of the excretory system, including the structure and function of the nephron and the role of the kidneys in excretion of wastes.				
	The learner will:	**SLO #**	**Assessment Criteria - The learner can:**	**Cognitive levels**
1	Understand the nervous system in the human body.	8.1.1	**Explain** the meaning of the term sensitivity.	AO1
		8.1.2	**Differentiate** between central nervous and peripheral nervous system.	AO1
		8.1.3	**Explain** the structure of the human nervous system in terms of: (i) brain, (ii) spine, (iii) cranial, and (iv) spinal nerves.	AO1
		8.1.4	**Describe** receptors as specialised cells that can detect a range of stimulus.	AO1
		8.1.5	**Describe** the purpose of the following sense organs and the stimuli they detect: (i) eye, (ii) ear, (iii) skin, (iv) nose, (iv) tongue.	AO1
		8.1.6	**Describe** the purpose of effectors within muscles/glands.	AO1
		8.1.7	**Describe** how electrical impulses pass along neurons.	AO2
		8.1.8	**Describe** the sequence of events that occur from the detection of a stimulus to the resulting response.	AO1
		8.1.9	**Differentiate** between voluntary and involuntary actions.	AO1
		8.1.10	**Explain** the adaptations of neurons to increase impulse transmission.	AO1
		8.1.11	**Explain** the difference between white and grey matter in the spinal cord.	AO1
		8.1.12	**Explain** and **analyse** how neurons are involved in coordination for nervous responses and reflex arcs with examples.	AO3
		8.1.13	**Explain** the importance of reflex arcs as a process that prevents damage to the human body.	AO1
		8.1.14	**Explain** the process of reflex arc in terms of: Stimulus > sensory neuron > relay neuron > motor neuron > effector > response.	AO1
		8.1.15	**Define** the term synapse.	AO1

		8.1.16	**Explain** how impulses pass across a synapse.	AO1
		8.1.17	**Describe** how drugs can influence the transmission of nerve impulses across synapses by the help of an example.	AO2
		8.1.18	**Describe** the functions and features of the following structures in the eye: (i) Sclera, (ii) Cornea, (iii) Iris, (iv) Pupil, (v) Lens, (vi) Ciliary muscles, (vii) Suspensory ligaments, (viii) Vitreous humor, (ix) Retina,(x) Yellow spot (Fovea), (xi) Blind spot, and (xii) Optic nerve.	AO1
		8.1.19	**Describe** the pupil reflex, including how it responds to changes in the light intensity. **Draw** a reflex arc and **explain** about the muscles that control the pupil's size.	AO2
		8.1.20	**Discuss** and **analyse** how the eye adjusts to focus on objects at different distances, highlighting the roles of the ciliary muscles, suspensory ligaments, and lens shape.	AO3
		8.1.21	**Discuss** the specific roles of rod and cone cells in detecting light and colour, and describe where each type is mainly found in the retina.	AO1
2	Understand chemical coordination in humans.	8.2.1	**List** the hormones secreted by each gland of the human body.	AO1
		8.2.2	**Describe** the effects of adrenaline on the heart, lungs, liver, and pupils.	AO1
		8.2.3	**Describe** how adrenaline increases the supply of glucose and oxygen to support aerobic respiration and enhance ATP (Adenosine Triphosphate) production .	AO2
		8.2.4	**Describe** how adrenaline affects muscle contractions and enhances blood flow.	AO2
		8.2.5	**Explain** how the nervous and endocrine systems differ wi	AO2
		8.2.6	**Define** the term homeostasis.	AO1
		8.2.7	**Describe** the term 'negative feedback' within the context of hormonal control in humans.	AO1
		8.2.8	**Explain** how feedback mechanisms help in:(i) Regulating blood glucose levels, and (ii) Maintaining body temperature.	AO2
		8.2.9	**Explain** the key roles played by the skin in the human body.	AO1
		8.2.10	**Define** the terms (i) vasodilation, and (ii) vasoconstriction.	AO1
		8.2.11	**Describe** why maintaining stable conditions of (i) blood glucose, (ii) body temperature, and (iii) water balance is essential for human survival.	AO1
3	Understand chemical coordination in plants.	8.3.1	**Define** the following terms: (i) tropism, (ii) phototropism, (iii) gravitropism, and (iv) hydrotropism with examples.	AO2/1

		8.3.2	**Describe** the importance of positive and negative tropisms in assisting plants growth and survival.	AO1
		8.3.3	**Explain** the role of auxin in responses to stimuli in both root and shoots.	AO2
		8.3.4	**Explain** how synthetic hormones function as selective weed killers.	AO2
4	Be able to demonstrate practical awareness of the nervous system and chemical coordination in humans and plants.	8.4.1	**Label** structures of the following neurons: (i) sensory, (ii) relay, and (iii) motor neuron.	AO1
		8.4.2	**Label** the following parts of the human eye: (i) sclera, (ii) cornea, (iii) iris, (iv) pupil, (v) lens, (vi) ciliary muscles, (vii) suspensory ligaments, (viii) vitreous humor, (ix) retina, (x) yellow spot/fovea, (xi) blind spot, and (xii) optic nerve.	AO1
		8.4.3	**Identify** and **label** the diagram of the following endocrine glands: (i) adrenal glands, (ii) the pancreas, (iii) pituitary gland, (iv) thyroid, (v) the testes, and (vi) ovaries.	AO2
		8.4.4	**Examine** a diagram of human skin and describe the role of each identified structure.	AO2
		8.4.5	**Outline** the steps involved in dissecting an eye and identifying its internal structures.	AO2
		8.4.6	**Conduct** a ruler drop experiment to measure reaction time.	AO3
		8.4.7	**Carry** out an experiment to measure the rate of plant growth towards stimuli.	AO3
5	Understand the role of excretion in human beings.	8.5.1	**Define** the term 'excretion'.	AO1
		8.5.2	**Summarise** the functions of the following excretory organs: (i) lungs, (ii) kidneys, and (iii) skin.	AO1
		8.5.3	**Differentiate** between excretion and egestion.	AO1
		8.5.4	**Define** the term assimilation.	AO1
		8.5.5	**Describe** the importance of the liver in assimilation.	AO1
		8.5.6	**Describe** the various roles performed by the liver in the body.	AO1
		8.5.7	**Outline** the structure and function of the urinary system, including the roles of the renal artery, renal vein, ureters, bladder, and urethra.	AO1
		8.5.8	**Describe** how the composition of blood differs between the renal artery and the renal vein.	AO1

		8.5.9	**Describe** the role of kidneys in excretion.	AO1
		8.5.10	**Describe** the structure of a nephron.	AO1
		8.5.11	**Describe** the roles of the following in the process of urine formation: (i) nephrons in filtration, (ii) blood supply, and (iii) selective reabsorption of substances.	AO1
		8.5.12	**Explain** the structural adaptations of an epithelial cell in the kidney tubule.	AO1
		8.5.13	**Explain** the composition of blood and urine of a healthy person and a person who has kidney damage or disease.	AO1
		8.5.14	**Describe** how analysing urine can lead to the detection of kidney disease/damage.	AO3
		8.5.15	**Explain** how dialysis works to remove waste products from the blood.	AO3
		8.5.16	**Compare** the advantages and disadvantages of dialysis and kidney transplantation.	AO2
		8.5.17	**Explain** the main functions carried out by the kidneys in the human body.	AO1
6	Be able to demonstrate practical awareness of the role of excretion in human beings.	8.6.1	**Label** and **identify** the internal structures of the kidney using a diagram.	AO1
		8.6.2	**Perform** a kidney dissection and identify its main internal structures.	AO3
		8.6.3	**Perform** Benedict's and Biuret tests on urine samples to test for the presence of glucose and protein.	AO3

Cell Division and Reproduction				
Aim: To develop a deeper understanding of the reproductive systems of both animals and plants. The aim of this topic is also to help students understand issues related to human reproduction and birth control, as well as to study the parts of a flower as the reproductive organ of a plant.				
	The learner will:	**SLO #**	**Assessment Criteria - The learner can:**	**Cognitive levels**
1	Understand reproductive cell division.	9.1.1	**Define** reproduction and its types; sexual and asexual reproduction.	AO1
		9.1.2	**Describe** the process of mitosis in detail.	AO1
		9.1.3	**Explain** the pupose of mitotic index.	AO1
		9.1.4	**Describe** the significance of mitosis in growth, tissue repair, and as a method of asexual reproduction and discuss examples.	AO1
		9.1.5	**Describe** the importance of mitosis as a form of asexual reproduction.	AO1
		9.1.6	**Summarise** how each of the following demonstrates asexual reproduction: cloning, binary fission, hyphal development, and stem tuber formation.	AO2
		9.1.7	**Explain** the process of meiosis and formation of gametes.	AO1
		9.1.8	**Compare** the process of mitosis and meiosis.	AO2
2	Understand plant and human reproduction.	9.2.1	**Describe** the functions of the internal reproductive parts of a flowering plant.	AO1
		9.2.2	**Define** the term pollination.	AO1
		9.2.3	**Discuss** how different types of pollen are adapted to improve the chances of successful pollination in plants.	AO2
		9.2.4	**Differentiate** between self-pollination and cross-pollination in plants.	AO1
		9.2.5	**Describe** the stages that occur from pollination to the formation of a seed.	AO1
		9.2.6	**Explain** the conditions necessary for germination.	AO1
		9.2.7	**Discuss** the advantages and disadvantages of both sexual and asexual reproduction in plants.	AO2

		9.2.8	**Explain** the functions of the male and female reproductive system.	AO1
		9.2.9	**Describe** the structural differences between male and female gametes.	AO1
		9.2.10	**Explain** how meiosis leads to the formation of gametes through cell division.	AO2
		9.2.11	**Describe** how sex hormones influence the development of reproductive organs and secondary traits in men and women.	AO2
		9.2.12	**Describe** the role of (i) hormones, (ii) their site of secretion, and (iii) their effects on the body.	AO2
		9.2.13	**Describe** the process of menstruation.	AO1
		9.2.14	**Explain** the process of fertilisation in humans.	AO1
		9.2.15	**Describe** the early stages of zygote development leading to the formation of a ball of cells.	AO1
		9.2.16	**Describe** the process of implantation by example.	AO1
		9.2.17	**Describe** the roles of (i) placenta, (ii) umbilical cord, (iii) amniotic sac, and (iv) ammonitic fluid during pregnancy.	AO1
		9.2.18	**Describe** the growth and development of the fetus.	AO1
		9.2.19	**Explain** the meaning of the term gestation period.	AO1
		9.2.20	**Discuss** how toxins and pathogens can cross the placenta and affect the fetus.	AO3
		9.2.21	**Describe** why antenatal care is essential for the health of the mother and developing baby.	AO3
		9.2.22	**Explain** the process of labour and birth.	AO1
		9.2.23	**Discuss** the advantages and disadvantages of breast feed and the use of formula milk.	AO2
		9.2.24	**Describe** methods of birth control to prevent pregnancy, specifically: (i) chemical, (ii) surgical, (iii) barrier, and (iv) natural.	AO1

		9.2.25	**Describe** how hormones and fertility drugs can increase the chances of pregnancy.	AO2
		9.2.26	**Explain** the process of in vitro fertilisation.	AO1
		9.2.27	**Describe** the steps involved in the process of artificial insemination.	AO1
		9.2.28	**Explain** the social implications of using contraception and fertility treatments.	AO1
		9.2.29	**Define** the term sexually transmitted diseases.	AO1
		9.2.30	**Describe** the methods of HIV transmission and preventative measures.	AO1
		9.2.31	**Describe** how HIV affects the human immune system and can lead to AIDS.	AO3
3	Be able to demonstrate practical awareness of reproduction in seeds, insects and flowers.	9.3.1	**Identify** and **label** internal structures of insect and wind pollinated flowers.	AO1
		9.3.2	**Label** the key components of a seed and describe their functions.	AO1
		9.3.3	**Determine** whether a flower is insect-pollinated or wind-pollinated based on its diagram.	AO2
		9.3.4	**Outline** the key differences in the appearance and characteristics of pollen in insect- versus wind-pollinated plants.	AO2
		9.3.5	**Identify** and **label** the male and female reproductive organs using diagrams.	AO1

Genetics, Classification and Evolution				
Aim: To enhance understanding of genetics and inheritance, the history of classification, and how organisms are grouped based on observable characteristics. This topic also aims to deepen knowledge of variation among organisms and the different selection processes that occur in the environment.				
	The learner will:	**SLO #**	**Assessment Criteria - The learner can:**	**Cognitive levels**
1	Understand the concept of genetics and inheritance.	10.1.1	**Define** the terms: (i) DNA, (ii) genes, and (iii) chromosomes.	AO1
		10.1.2	**Outline** the structure of DNA.	AO1
		10.1.3	**State** the diploid and haploid number of chromosomes in humans.	AO1
		10.1.4	**Define** the terms (i) alleles, (iii) dominant, and (iii) recessive.	AO1
		10.1.5	**Describe** the process of transcription and translation in protein synthesis.	AO1
		10.1.6	**Describe** the term inheritance and heredity.	AO1
		10.1.7	**Define** the term phenotype.	AO1
		10.1.8	**Define** the terms (i) genotype, (ii) heterozygous, and (iii) homozygous.	AO1
		10.1.9	**Interpret** pedigree diagrams to determine if alleles are dominant or recessive.	AO3
		10.1.10	**Define** the term monohybrid and dihybrid inheritance.	AO1
		10.1.11	**Describe** and **explain** the term incomplete dominance and codominance of allele.	AO1
		10.1.12	**Define** the term 'sex linkage'.	AO1
2	Be able to demonstrate practical awareness of the role of genetics and inheritance.	10.2.1	**Calculate** probability of genotypes and phenotypes of offspring using a punnet square / test cross.	AO2

		10.2.2	**Draw** punnet squares / test cross to successfully predict probabilities based on information provided from(i) pedigree diagrams, and (ii) comprehension of offspring or parents.	AO3
		10.2.3	**Use** a Punnett square to calculate the probability of the following scenarios: (i) gender determination, and (ii) inheriting recessive or dominant diseases.	AO3
		10.2.4	**Use** pedigree diagrams to determine if a genetic condition is linked.	AO3
3	Understand the history of classification.	10.3.1	**Summarise** the process used to classify organisms into different groups.	AO2
		10.3.2	**Define** the term 'binomial system'.	AO1
		10.3.3	**Define** the terms 'morphology' and 'anatomy'.	AO1
		10.3.4	**Summarise** the traits of organisms found in each of the five kingdoms.	AO2
		10.3.5	**Explain** the importance of classification in understanding evolution.	AO1
		10.3.6	**Discuss** the significance of fossil evidence in understanding the history of life and evolutionary relationships.	AO2
4	Understand classification of animals.	10.4.1	**Define** the following terms 'vertebrate' and 'invertebrate'.	AO1
		10.4.2	**Describe** the features of the following five vertebrate groups: (i) fish, (ii) mammals, (iii) amphibians, (iv) reptiles, and (v) birds.	AO1
		10.4.3	**Compare** and **contrast** features of different vertebrate groups.	AO1
		10.4.4	**Explain** the external characteristics of arthropods and how they are classified into the following groups: (i) Insects, (ii) Crustaceans, (iii) Myriapods, and (iv) Arachnids.	AO1
5	Understand classification of plants.	10.5.1	**Describe** the cellular structures that identify an organism as a plant.	AO1

		10.5.2	**Describe** differences between monocotyledons and dicotyledons.	AO1
		10.5.3	**Explain** the features that are used to classify plants into the following categories: (i) ferns, (ii) conifers, (iii) moss, and (iv) flowering plants.	AO1
		10.5.4	**Identify** similarities and differences in the characteristics of various plant groups.	AO1
6	Be able to demonstrate practical awareness of classification of animals and plants.	10.6.1	**Draw** and **use** simple dichotomous keys to identify plants and animals.	AO3
		10.6.2	**Identify** and **classify** unknown species using visible external features observed in images or described characteristics.	AO3
7	Understand the role of variation in organisms.	10.7.1	**Define** the term 'variation'.	AO1
		10.7.2	**Discuss** geneotypic and phenotypic variations.	AO1
		10.7.3	**Explain** the differences between continuous and discontinuous variation with examples.	AO1
		10.7.4	**Describe** continuous variation in terms of genes and environment.	AO1
		10.7.5	**Explain** discontinuous variation in terms of genes only.	AO1
		10.7.6	**Describe** the causes of variation of individuals caused by sexual reproduction (meiosis) and mutation.	AO2
		10.7.7	**Define** the term mutation.	AO1
		10.7.8	**Identify** and **explain** factors that can cause mutations, including (i) carcinogens, (ii) harmful chemicals, and (iii) radiations.	AO1
		10.7.9	**Discuss** the potential beneficial and harmful effects of mutations that result in the formation of new alleles within a population.	AO2
		10.7.10	**Describe** sickle cell anaemia.	AO2
		10.7.11	**State** heterozygous sickle cell anaemia with examples.	AO2

8	Understand the role of adaptations in organisms.	10.8.1	**Define** the term 'adaptive feature'.	AO1
		10.8.2	**Discuss** the structural and behavioral adaptations of animals for different environments.	AO2
		10.8.3	**Explain** and **analyse** different adaptations of predators and prey, focusing on: (i) camouflage, (ii) the shape of their teeth, and (iii) the position of their eyes.	AO3
		10.8.4	**Describe** the adaptive features of plants in varying climatic conditions, including (i) hydrophytes, and (ii) xerophytes.	AO1
9	Understand selection and evolution in organisms.	10.9.1	**Describe** the term 'natural selection'.	AO1
		10.9.2	**Define** the term 'speciation'.	AO1
		10.9.3	**Define** the term 'fitness'	AO1
		10.9.4	**Describe** how Darwin's finches provide evidence for the process of natural selection.	AO2
		10.9.5	**Explain** how antibiotic resistance of bacteria occurs by the process of natural selection.	AO3
		10.9.6	**Describe** how fossils provide clues about evolutionary changes in species.	AO3
		10.9.7	**Define** evolution as a result of natural selection leading to changes in organisms' adaptive characteristics over generations.	AO1
		10.9.8	**Explain** how natural selection maintains adaptive features.	AO2
		10.9.9	**Describe** the importance of over population of offspring of animals and plants.	AO1
		10.9.10	**Describe** the process of selective breeding/artificial selection with examples.	AO1

		10.9.11	**Explain** how selective breeding is used to enhance traits in organisms for economic benefit.	AO3
		10.9.12	**Differentiate** between natural selection and artificial selection with examples.	AO1
		10.9.13	**Define** the term 'hybrid vigour'.	AO1
		10.9.14	**Describe** what is meant by inbreeding and outbreeding in the context of reproduction.	AO1
		10.9.15	**Explain** the risks of artificial selection in terms of reduction of genetic diversity and harmful recessive alleles.	AO2

Ecology and Human Impact on the Environment				
Aim: To develop students' understanding of the relationships between organisms and their environment, focusing on populations and communities, and to explore food chains, food webs, and the role of agricultural and technological advancements in improving food availability and security.				
	The learner will:	**SLO #**	**Assessment Criteria - The learner can:**	**Cognitive levels**
1	Understand organisms and their environment.	11.1.1	**Define** the following key words: (i) ecosystem, (ii) biotic factors, (iii) abiotic factors, (iv) habitat, (v) niche, (vi) biodiversity, (vii) population, (viii) community, (ix) producers, (x) consumers, (xi) decomposers, and(xii) trophic level.	AO1
		11.1.2	**Describe** a food chain and its different feeding stages.	AO1
		11.1.3	**Differentiate** between a food chain and food web.	AO1
		11.1.4	**Define** the term 'dry mass'.	AO1
		11.1.5	**Explain** why a food web is a better representation of energy flow in a community than a food chain.	AO2
		11.1.6	**Describe** pyramids of numbers and pyramids of biomass with appropiate examples.	AO1
		11.1.7	**Differentiate** between pyramids of number and pyramids of biomass.	AO1
		11.1.8	**Describe** the limitations of pyramids of numbers and biomass when compared to the pyramid of energy in representing a community.	AO2
		11.1.9	**Explain** loss of energy between trophic levels in food chains.	AO1

		11.1.10	**Describe** how using green plants as a direct food source for humans is more efficient than using them to feed animals first.	AO2
		11.1.11	**Describe** methods of sampling populations, including the use of quadrats, Tullgren funnels, pooters, pitfall traps, and line and belt transects.	AO1
		11.1.12	**Explain** the importance of random sampling and avoiding bias in producing an accurate representation of a population in a habitat.	AO1
		11.1.13	**Explain** the benefits of releasing organisms near their capture site to maintain ecological balance.	AO2
2	Understand nutrient cycles.	11.2.1	**Describe** the stages of carbon cycle in terms of (i) respiration, (ii) photosynthesis, (iii) decomposition,(iv) death, (v) Fossilisation, and (vi) combustion.	AO1
		11.2.2	**List** the name of C based compounds at each stage of the cycle.	AO1
		11.2.3	Explain how respiration and photosynthesis keeps carbon dioxide at relative equilibrium.	AO2
		11.2.4	**Explain** why the combustion of fossil fuels is a key factor in the release of additional carbon dioxide into the atmosphere.	AO2
		11.2.5	**Explain** the role of decomposers in the carbon cycle.	AO1
		11.2.6	**Describe** the stages of the water cycle: (i) evaporation, (ii) transpiration, (iii) evapotranspiration,(iv) condensation, (v) precipitation.	AO2
		11.2.7	**Describe** the nitrogen cycle in terms of (i) nitrogen fixation, (ii) excretion, (iii) nitrification, (iv) denitrification, and (v) ammonification.	AO2
		11.2.8	**Identify** the nitrogen-containing compounds present at each stage of the nitrogen cycle.	AO1
		11.2.9	**Describe** the chemical changes of nitrogen-based compounds to form nitrates.	AO1

		11.2.10	**Describe** the importance of nitrates as a nutrient for plant growth.	AO1
		11.2.11	**Explain** the process by which nitrates are absorbed by plants.	AO1
3	Understand populations.	11.3.1	**Define** the factors that affect population size in terms of: (i) birth rate, (ii) death rate, (iii) immigration, and(iv) emigration.	AO1
		11.3.2	**Explain** the biotic and abiotic factors that influence population growth.	AO1
		11.3.3	**Identify** various stages of a sigmoid population growth curve, specifically: (i) lag phase, (ii) log phase,(iii) stationary phase, and (iv) death phase.	AO2
		11.3.4	**Explain** each stage of a sigmoid population growth curve.	AO2
		11.3.5	**Describe** the demographic transition model as a method of representing human population growth.	AO2
		11.3.6	**Explain** the different stages which affect countries in the demographic transition model.	AO2
		11.3.7	**Analyse** the changes in human population through time and discuss the following consequences: (i) social impacts, and (ii) environmental impacts.	AO3
		11.3.8	**Describe** the human population pyramids.	AO1
		11.3.9	**Define** the term ‘fertility rate’ as the average number of children born per female in a country.	AO1
		11.3.10	**Interpret** human population pyramids.	AO3
		11.3.11	**Describe** various strategies to reduce human population growth with named examples.	AO1

4	Be able to demonstrate practical awareness of the relationships between organisms and their environment.	11.4.1	**Perform** and **analyse** the following different techniques of population sampling: (i) quadrats,(ii) Tullgren funnel, (iii) pooter, (iv) pitfall traps, and (v) line and belt transect.	AO3
		11.4.2	**Draw** food chains and food webs.	AO2
		11.4.3	**Draw** and **interpret** pyramids of numbers and pyramids of biomass.	AO3
		11.4.4	**Choose** a relevant method for sampling populations according to the characteristics of the organisms.	AO3
5	Understand the influence of humans on the environment.	11.5.1	**Describe** changes in farming over time, from hunter-gatherer societies to modern farming practices.	AO3
		11.5.2	**Analyse** how advancements in agriculture and technology have led to greater food availability and improved food security.	AO3
		11.5.3	**Explain** the negative environmental impacts of intensive farming practices causing reduction in biodiversity due to monoculture organisms.	AO1
		11.5.4	**State** reasons for land clearance other than agriculture.	AO2
		11.5.5	**Describe** the impact of habitat reduction on local flora and fauna.	AO2
		11.5.6	**Explain** the effects of deforestation on the environment.	AO2
6	Understand the effects of pollution on the environment.	11.6.1	**Explain** the different types of pollution caused by farming, including land pollution and water pollution.	AO1
		11.6.2	**Describe** the environmental and health risks associated with the use of fertilisers and pesticides.	AO1
		11.6.3	**Explain** how and why salinisation and eutrophication occur.	AO2

		11.6.4	**Identify** the main categories of waste: (i) domestic, (ii) industrial, and (iii) agricultural.	AO2
		11.6.5	**Analyse** how each of the following types of waste affects the local environment: (i) domestic, (ii) industrial, and (iii) agricultural waste.	AO3
		11.6.6	**Explain** the impacts of non-biodegradable plastics on living organisms and the environment.	AO2
		11.6.7	**Discuss** the impact of hormonal contraceptives in water systems on aquatic organisms.	AO1
		11.6.8	**Define** the terms ‘bioaccumulation’ and ‘biomagnification’.	AO1
7	Understand the impact of greenhouse gases on the environment.	11.7.1	**Explain** the impact of methane and carbon dioxide on the environment.	AO2
		11.7.2	**Explain** the 'Greenhouse Effect'.	AO1
		11.7.3	**Define** the term ‘enhanced greenhouse effect’.	AO1
		11.7.4	**Explain** that global warming is a result of the greenhouse effect.	AO1
		11.7.5	**Describe** how global warming can lead to climate change.	AO2
		11.7.6	**Explain** the effects of climate change on the environment.	AO2
		11.7.7	**Analyse** strategies that can be implemented at the (i) local, (ii) governmental, and (iii) international levels to reduce the production of greenhouse gases.	AO3
8	Understand the cause and effect of acid rain on the environment.	11.8.1	**Explain** and **analyse** how sulphur dioxide and nitrogen oxides contribute to acid rain.	AO3

		11.8.2	**Explain** why carbon dioxide does not significantly contribute to acid rain.	AO2
		11.8.3	**State** the major sources of sulphur dioxide and nitrogen oxides.	AO1
		11.8.4	**Describe** the process of acid rain formation.	AO1
		11.8.5	**Explain** the effects of acid rain on organisms and the environment.	AO1
		11.8.6	**Describe** strategies that can be used to reduce the formation of acid rain.	AO2
		11.8.7	**Describe** methods that can be implemented to reduce the impact of acid rain.	AO2
9	Understand factors which contribute to ozone depletion.	11.9.1	**Explain** how chlorofluorocarbons (CFCs) and halon gases contribute to ozone depletion.	AO2
		11.9.2	**State** the major sources of CFCs.	AO1
		11.9.3	**Describe** how CFCs and halon gases damage the ozone layer.	AO1
		11.9.4	**Describe** the impact of ozone depletion on organisms and the environment.	AO1
		11.9.5	**Describe** strategies that can be implemented to reduce the release of CFCs and halon gases into the atmosphere.	AO2
10	Understand sustainability.	11.10.1	**Define** the terms 'sustainable resource' and 'sustainable development'.	AO1
		11.10.2	**Describe** the following processes: (i) sustainable logging, (ii) sustainable fishing, and (iii) sustainable agriculture.	AO1

		11.10.3	**Evaluate** the need for sustainable management of natural resources.	AO3
		11.10.4	**Explain** why there is a need to conserve fossil fuels.	AO1
		11.10.5	**Explain** strategies that can be implemented to reduce the use of fossil fuels, including: (i) efficient combustion, (ii) reduction of wastage, (iii) provision of alternative transport, (iv) use of renewable resources for energy production, and (v) recycling of specified wastes.	AO3
		11.10.6	**Summarise** the steps involved in the treatment of sewage.	AO1
11	Understand endangered species and conservation.	11.11.1	**Define** the term endangered and extinct.	AO1
		11.11.2	**Explain** why organisms have become endangered or extinct.	AO2
		11.11.3	**Explain** how a decrease in population size can lead to reduced genetic variation within a species.	AO2
		11.11.4	**Describe** and **analyse** how endangered species are conserved through (i) zoos, (ii) natural parks, (iii) natural reserves, (iv) seed banks, (v) breeding in captivity programs, (vi) increased education and community programs, and (vi) NGOs.	AO3
		11.11.5	Evaluate the following strategies as forms of conservation: (i) zoos, (ii) natural parks, (iii) nature reserves, (iv) seed banks, (v) breeding in captivity programs, (vi) increased education and community programs, and(vi) NGOs.	AO3
		11.11.6	**Describe** the need for conservation of species in an environment.	AO1

Biotechnology and Genetic Engineering				
Aim: To enhance understanding of biotechnology, genetic engineering, and the process involved in the production of penicillin.				
	The learner will:	**SLO #**	**Assessment Criteria - The learner can:**	**Cognitive levels**
1	Understand biotechnology and genetic engineering.	12.1.1	**Define** the term 'genetic engineering'.	AO1
		12.1.2	**Explain** the importance of bacteria in genetic engineering and biotechnological applications.	AO1
		12.1.3	**Explain** how yeast contributes to the process of bread making.	AO2
		12.1.4	**Explain** the process of anaerobic respiration in yeast to produce ethanol and biofuels.	AO2
		12.1.5	**Describe** and **observe** the use of enzymes in the following scenarios: (i) extraction of fruit juice, (ii) biological washing powders, and (iii) production of lactose free products.	AO3
		12.1.6	**Explain** the function and purpose of a fermenter in industrial fermentation processes.	AO1
		12.1.7	**Describe** how the components of a fermenter help maintain internal conditions that support optimal microbial growth.	AO2
		12.1.8	**Describe** the process of producing penicillin using a fermenter, including the conditions maintained for optimal yield.	AO2
		12.1.9	**Describe** and **analyse** the uses of genetic engineering in modern society, specifically: (i) human medicines, (ii) herbicide and pesticide resistant crops, (iii) drought resistant crops, (iv) increase nutritional content of crops, (v) production of insulin, and (vi) production of other human hormones.	AO3
		12.1.10	**Describe** the process of genetic modification, specifically (i) restriction enzymes, (ii) plasmid, (iii) ligase,(iv) recombinant DNA, and (v) transgenic organism.	AO1
		12.1.11	**Discuss** the advantages and disadvantages of genetic engineering.	AO2

Mathematical Requirements

Candidates may use calculators for all sections.

Candidate should be able to:

1. Solve problems involving addition, subtraction, multiplication, and division.
2. Calculate percentages with accuracy.
3. Determine percentage increases and decreases.
4. Apply different formulas to find missing values.
5. Convert between various units of measurement.
6. Judge suitable orders of magnitude and sense of scale.
7. Find the surface area and volume of common shapes (e.g., circles, squares, rectangles, triangles).
8. Estimate values by identifying patterns or trends.
9. Express data in standard form.
10. Round numbers appropriately.
11. Record results according to the precision of measuring equipment.
12. Find averages such as mean, mode, and median.
13. Calculate probabilities.
14. Understand and use ratios effectively.

Safety in the laboratory

General Conduct

- Wear a lab coat/apron, safety goggles, and closed-toe shoes at all times.
- Tie back long hair and secure loose clothing or accessories.
- Avoid eating, drinking, chewing gum, or applying cosmetics in the lab.
- Read the experiment instructions thoroughly before starting.
- Work only under supervision; never work alone in the lab.
- Keep your workspace tidy; store bags and books away from benches.
- Handle all equipment and materials with care; report any damage immediately.
- Follow your teacher's instructions exactly; do not improvise procedures.

Equipment and Chemical Safety

- Use apparatus only after proper training.
- Check glassware for cracks before use; handle hot glass with tongs or heat-resistant gloves.
- Never touch electrical equipment with wet hands.
- Read chemical labels carefully and know the hazard symbols.
- Handle the apparatus/ equipment/ chemicals appropriately.
- Use fume cupboards for volatile, toxic, or strong-smelling chemicals.
- Handle the microscope properly and use correct focusing techniques.

Biological Safety

- Wash hands before and after handling biological specimens.
- Wear gloves when dealing with biological materials.
- Dispose of biological waste in designated containers.

Fire and Heat Safety

- Ensure the safety of yourself, others, and your surroundings.
- Keep flammable materials away from open flames.
- Light Bunsen burners only when ready to use; turn them off immediately afterward.
- Know the location of fire extinguishers, fire blankets, and emergency exits.

Waste Disposal

- Dispose of chemicals, broken glass, and biological waste in the correct containers; never pour them down the sink unless instructed.
- Follow your school's waste segregation rules.

Emergency Procedures

- Report all accidents, spills or injuries to the teacher immediately.
- Know the location of first aid kits and emergency contact numbers.
- In case of evacuation, follow the designated route calmly.