

For exams January, May and November onwards
For teaching from September 2021 onwards

SPECIFICATION 



Learning
Resource Network



LRN INTERNATIONAL GCSE **BIOLOGY (6210)**



THE QUEEN'S AWARDS
FOR ENTERPRISE:
INTERNATIONAL TRADE
2020

Contents

Background to LRN	Page 03
Introduction	Page 04
Objective	Page 04
Mode of Delivery	Page 04
Progression	Page 04
Qualification Overview	Page 05
Assessment	Page 06
Guided Learning Hours	Page 06
Entries Codes	Page 06
Private Candidates	Page 06
Grading	Page 06
Results	Page 06
Re-takes	Page 06
Customer Service Statement	Page 07
Diversity and Equality	Page 07
Subject Content	Page 08
Appendix	Page 53

BACKGROUND TO LRN

Learning Resource Network (LRN) is a recognised Awarding Organisation that offers a range of qualifications to candidates, educational institutes, training providers, schools and employers.

LRN is recognised for its high quality qualifications that enable candidates to progress to other areas of study and employment in their designated fields.

In producing its qualifications, LRN uses the experience and expertise of academics, professionals working in the pertinent industries and assessment practitioners with a wealth of best practice and knowledge of validation, verification, delivery and assessment.

ACCOLADES

Queen's Award

In April 2020, LRN received the Queen's Award for Enterprise for International Trade. LRN is one of 220 organisations in the UK to be recognised with this prestigious accolade. This was in recognition of the expansion LRN brought to the overseas qualification market.

MANAGEMENT SYSTEMS

LRN has been awarded international accreditation as part of its quality controls, policies, systems and overall approach to its management systems. These awards are externally validated by the British Assessment Bureau. LRN has achieved accreditation in the form of ISO 9001: Quality Management Systems, ISO 14001: Environment Management Systems and ISO 27001: Information Security Management Systems.

CUSTOMER SERVICE EXCELLENCE

LRN has achieved the prestigious award of Customer Service Excellence. This is in recognition of its customer service practices, approach to managing and dealing with UK and Overseas customer needs, including the diverse needs of its centres.

LRN was the first UK Awarding Organisation to achieve Customer Service Excellence. Following reaccreditation in 2019, LRN received an award for Customer Service Excellence: Compliance Plus, demonstrating that LRN went above and beyond the delivery of its customer service principles.



INTRODUCTION

This specification provides an overview to the LRN International GCSE Biology¹. This document is suitable for various users, including candidates, centres, administrators, employers, parents/guardians, teachers (and other related staff) and examiners. The specification outlines the key features and administrative procedures required for this international qualification.

OBJECTIVE

The LRN International GCSE Biology is designed to enable international candidates to demonstrate their ability, to work scientifically in both practical and theoretical terms across a range of biological concepts, functions and processes. The qualification is designed to promote understanding of the complex and diverse phenomena of the natural world including plants cell biology, animals cell biology, human body (including heart and the circulatory system, digestion and the respiratory system), disease, health and drug use.

MODE OF DELIVERY

This qualification has been constructed to be delivered within centres. Centres will need to demonstrate to LRN, through the centre recognition processes, that they have the resources, facilities and competence to deliver. However, centres must be able to demonstrate, in line with LRN's criteria, that they have the means, capability, capacity and resources (including suitably qualified centre staff) to deliver by the method chosen by the centre.

PROGRESSION

The LRN International GCSE Biology has been designed to reflect the wide variation in candidates' origins, levels of education and career aims. Progression opportunities may, therefore, take a variety of paths. Depending on the level of qualification achieved, it may be appropriate for the candidate to progress to:

1. Similar level 2 qualification in Biology;
2. LRN Level 2 Certificate or Diploma in Pre-A Foundation Studies;
3. LRN Level 3 Diploma in Pre-U Foundation Studies;
4. A higher level of any qualification – e.g. A-Level, Diploma
5. Vocationally Related Qualifications

¹ LRN International GCSEs are globally recognised qualifications designed specifically for international candidates and are available outside the United Kingdom. Candidates based in England refer to the Ofqual register.

QUALIFICATION OVERVIEW

Number	Subject Content	AO	Exam
1	Cell formation, structure and functions.	1, 2 and 3	Combination of written exam papers (externally set and marked) and a practical demonstration of skills. Paper 1: Multiple Choice, Extended Theory and practical based skills. Duration: 2 hours Paper 2: Multiple Choice, Extended Theory and practical based skills. Duration: 2 hours
2	Movement in and out of cells.	1, 2 and 3	
3	Biological molecules and human digestion	1, 2 and 3	
4	Respiratory system	1, 2 and 3	
5	Transport in animals	1, 2 and 3	
6	Disease, immunity and drugs	1, 2 and 3	
7	Plants	1, 2 and 3	
8	Coordination, response and excretion	1, 2 and 3	
9	Reproduction	1, 2 and 3	
10	Genetics, inheritance, classification, variation and selection	1, 2 and 3	
11	Organisms and human influence on the environment	1, 2 and 3	
12	Biotechnology and genetic engineering	1, 2 and 3	

BREAKDOWN OF ASSESSMENT OBJECTIVES

AO1 - demonstrate knowledge and understanding of:

- scientific ideas
- scientific techniques and procedures

AO2 – apply knowledge and understanding of:

- scientific ideas
- scientific enquiry, techniques and procedures I

AO3 – analyse information and ideas to:

- interpret and evaluate
- make judgements and draw conclusions
- develop and improve experimental procedures

ASSESSMENT

The assessment for this qualification consists of (i) written exam papers, and (ii) practical demonstration of skills, set and marked by the LRN.

Assessment objectives (AOs)	Weighting	
	Paper 1	Paper 2
AO1	30%	30%
AO2	40%	40%
AO3	30%	30%

GUIDED LEARNING HOURS

The guided learning hours (GLH) for this qualification are 130. Please note the hours stated are indicative.

ENTRIES CODES

One entry per qualification is sufficient and will cover all the question papers including certification.

PRIVATE CANDIDATES

Centres are advised that private candidates are only to be enrolled with prior agreement and confirmation from LRN.

GRADING

Results are reported, as 9 to 1.

RESULTS

Exam series are in:

- January (results released in March)
- June (results released in August)
- November (results released in January)

RE-TAKES

Whereas candidates can re-take the whole qualification as often as they wish, individual components cannot be re-taken as it is a traditional linear specification.

Please remember, one entry per qualification is sufficient and will cover all the question papers including certification.

CUSTOMER SERVICE STATEMENT

Learning Resource Network (LRN) is committed to ensuring all customers are dealt with promptly and in a professional and helpful manner. In order to guarantee this, we commit to ensuring the following in our day to day interactions with candidates, assessment centres and our stakeholder network:

- All customers will be treated equally and with respect;
- All customer information will only be used in a way which has been agreed in advance, unless we are informed of something that places them or others at risk of harm;
- All customers will be treated by staff in a professional manner.

LRN has arrangements in place to provide a telephone and e-mail helpdesk which will be staffed from 09:00 to 17:00 from Monday to Friday. Furthermore, it will respond to each e-mail, letter or telephone message it receives regarding feedback on its qualifications, centre approvals process or other matters relating to its products and/or services. The timetable for responding is as follows:

- E-mail: 5 working days
- Letter: 5 working days
- Telephone message: 5 working days

DIVERSITY AND EQUALITY

Learning Resource Network (LRN) is committed to ensuring fair and equal access to its qualifications, examinations and support materials. Our Diversity and Equality policy seeks to eliminate unjustifiable discrimination, harassment and/or victimisation and to advance equality of opportunity, thereby ensuring all candidates are treated fairly, in accordance with the protected characteristics of the Equality Act 2010. Specifically, we comply fully with the requirements laid out in the Equality Act 2010. In addition, and within the constraints of this policy, LRN will have due regard for the General data Protection Regulations (GDPR) in the retention of information which is unnecessary.

1	Cell formation, structure, and functions		
Aim			
Biology is the study of living organisms. The aim of this subject content is to enhance understanding of how cells are created, developed, and used within living organisms. Candidates will learn about cell development, including their components, functions, and structures.			
Learning Outcomes - The learner will:		Assessment Criteria - The learner can:	
1	Understand the characteristics of living organisms.	1.1	Identify examples of (i) living cells, and (ii) non-living cells.
		1.2	Define the main characteristics of living organisms.
		1.3	Outline methods used in scientific research, including noting observations and capturing results.
		1.4	Describe the seven characteristics of life, specifically (i) movement, (ii) respiration, (iii) sensitivity, (iv) growth, (v) reproduction, (vi) excretion, and (vii) nutrition.
		1.5	Explain the following forms of nutrition: (i) autotrophic, (ii) heterotrophic, and (iii) saprotrophic.
		1.6	Define photosynthesis.
		1.7	Outline the process of aerobic respiration.
		1.8	Describe the process of anaerobic respiration in muscle cells and yeast.
		1.9	Define the term oxygen debt.
		1.10	Explain uses of energy in the human body via (i) movement, (ii) active transport, (iii) electrical impulses, (iv) heat, (v) synthesising molecules and bioluminescence.
2	Be able to demonstrate a practical awareness of the characteristics of living organisms.	2.1	Carry out a series of tests for carbon dioxide (CO ₂) by use of limewater and hydrogen carbonate indicator.
		2.2	Review observations of initial and final colour tests to determine positive and negative results.
		2.3	Discuss findings of differences in colour change on rate reaction.
		2.4	Discuss findings of differences in colour change on hydrogen carbonate indicator

			related to CO ₂ concentration from (i) photosynthesis, and (ii) respiration.
3	Understand the basic structures and functions of cells.	3.1	Define the term unicellular, and multi-cellular.
		3.2	Describe the structure of an amoeba and an euglena.
		3.3	Summarise the differences and similarities of an amoeba and an euglena.
		3.4	Define the term eukaryote and prokaryote.
		3.5	Outline the process of mitosis and meiosis.
		3.6	Differentiate , by size (smallest to largest) the following: (i) animal, (ii) plant, (iii) fungi, (iv) bacteria, and (v) viruses.
		3.7	Describe the organelles and their functions in cells.
		3.8	State examples of: (i) specialised animal cells, and (ii) specialised plant cells.
		3.9	Explain how specialised animal cells and specialised plant cells are structurally adapted in line with their specialised function.
		3.10	Differentiate between adult stem cells and embryonic stem cells.
		3.11	Discuss the advantages and disadvantages for using adult stem cells and embryonic stem cells in medical treatments.
4.	Be able to demonstrate a practical awareness of basic structures and functions of cells.	4.1	Draw a typical animal cell, along with accurate labelling, and to a significant degree of accuracy, the following: (i) nucleus, (ii) cytoplasm, (iii) cell membrane, (iv) ribosomes, and (v) mitochondria.
		4.2	Draw a typical plant cell, along with accurate labelling, and to a significant degree of accuracy, the following: (i) large permanent vacuole, (ii) cellulose cell wall, (iii) chloroplast, and (iv) amyloplast.
		4.3	Draw a Venn diagram (or table) in which similarities and differences, between animal and plant cells, are shown.

		4.4	Draw and accurately label to a significant degree of accuracy, the following: (i) bacteria, (ii) fungi cells, and (iii) protozoist.
5	Understand the working functions of a light microscope.	5.1	Summarise the size and structure of cells and their ability to be seen with a light microscope.
		5.2	Describe the process of slide preparation and operation of the light microscope in order to make careful observations of cells.
		5.3	Explain the importance of the following when using a light microscope: (i) cover slip, (ii) methods of prevention, and (iii) correction on practical application.
		5.4	Summarise the differences between using a light microscope and electron microscope (TEM and SEM) in terms of: (i) Image observed, (ii) magnification, (iii) resolution and (iv) method of sample preparation.
6	Be able to demonstrate a practical awareness of the working functions basic structures and functions of cells.	6.1	Label all parts of a light microscope.
		6.2	Use correct chemicals when observing animal cells under a light microscope.
		6.3	Use correct chemicals when observing plant cells under a light microscope.
		6.4	Draw observed cells from sample slides.
		6.5	Manipulate the formula for magnification.
		6.6	Calculate (by use of a scale bar) magnification, image size and actual size from micrographs and images.
7	Understand levels of human organisation.	7.1	Define the following terms: (i) cells, (ii) tissues, (iii) organs, and (iv) organ systems.
		7.2	Explain how tissues, organs and organ system contribute to organisms.
		7.3	State the main organ connecting vessels in each main organ system.
8	Be able to demonstrate a practical awareness of levels of human organisation.	8.1	Label positions of main organ systems in the human body.
		8.2	Label main organ systems in the human body.
9	Understand levels of plant organisation.	9.1	Identify positions of main organ systems of a flowering plant.

		9.2	List the main organ systems of a flowering plant.
		9.3	Outline the position of the main organs of flowering plants
		9.4	Explain the functions of the main organs of flowering plants.

2		Movement in and out of cells	
Aim			
Movement in and out of cells is fundamental to the entire Biology and is intertwined into nearly every topic. The aim of this subject content is to ensure clear understanding of the three main processes diffusion, osmosis and active transport by which substances enter and exit cells.			
Learning Outcomes - The learner will:		Assessment Criteria - The learner can:	
1	Understand the processes involved in diffusion.	1.1	Explain the term diffusion.
		1.2	Describe the importance of diffusion of gases and solutes.
		1.3	Describe the importance of water as a solvent.
		1.4	Explain the factors which affect the rate of diffusion.
		1.5	Explain how the rate of diffusion is calculated.
2	Be able to demonstrate a practical awareness of the processes involved in diffusion.	2.1	Carry out technical processes involving the observation of diffusion in given circumstances, specifically: (i) different temperatures, (ii) use of starch, (iii) use of chemicals.
3	Understand the processes involved in osmosis	3.1	Explain the term osmosis.
		3.2	Define the following terms: (i) hypertonic, (ii) hypotonic, and (iii) isotonic solutions
		3.3	Outline the term 'turgor pressure'.
		3.4	Explain how plant cells become (i) turgid, (ii) flaccid, (iii) plasmolysed, (iv) lysed, (v) crenated, and (vi) where no changes occur.
		3.5	Outline the function of the plant cellulose cell wall.
		3.6	Explain how comparisons can be made in percentage mass in potato cores.
4	Be able to demonstrate a practical awareness of the processes involved in osmosis.	4.1	Carry out technical processes involving the observation of osmosis in given circumstances, specifically: (i) thistles funnel experiment, (ii) visking tubing of water potential, (iii) use of an osmometer, and (iv) osmosis in potato cells.

		4.2	Use graphs/tables to show data, specifically (i) percentage change in mass, (ii) plot data, and (iii) identifying water potential within cells.
5	Understand the process of active transport.	5.1	Define the term active transport.
		5.2	Describe how carrier proteins assist in the transport of substances across the cell membrane.
		5.3	Describe how active transport consumes energy through respiration
		5.4	List ions and molecules that move by active transport in animals and plants.
		5.5	Outline the location of ions and molecules that move by active transport within the body.
		5.6	Explain why non-living artificial membranes are unable to provide Adenosine Triphosphate for active transport.

3		Biological molecules and human digestion	
Aim			
The aim of this subject content is to enhance understanding of biological molecules and the human digestion system, its key purpose and functions, the way in which nutrients are processed by the body.			
Learning Outcomes - The learner will:		Assessment Criteria - The learner can:	
1	Understand the structure of biological molecules.	1.1	State the elements found in biological molecules.
		1.2	Outline the basic shape of each biological molecules carbohydrates, proteins and fats.
		1.3	Describe the properties of the following carbohydrates: (i) antibodies, (ii) enzymes, and (iii) hormones.
		1.4	Describe the properties of the following carbohydrates: (i) glucose, (ii) sucrose, (iii) starch, (iv) glycogen, and (v) cellulose.
		1.5	Describe suitable food tests for (i) carbohydrates, (ii) proteins, and (iii) fats.
2	Understand the properties of Deoxyribonucleic Acid (DNA).	2.1	Outline the characteristics of DNA.
		2.2	Describe how complimentary base pairing works.
		2.3	Describe the helix-based structure and basic shape of DNA.
3	Be able to demonstrate a practical awareness as to the properties of DNA.	3.1	Draw and label a nucleotide that is composed of a phosphate group, pentose sugar and nitrogenous base.
4	Understand the function of enzymes.	4.1	Define the effect which enzymes have in terms of metabolic reactions.
		4.2	Describe the three core functions of enzymes.
		4.3	Describe the process of an enzyme catalysed reaction in terms of substrate, active site, complimentary, enzyme-substrate complex and products
		4.4	Explain how enzymes are specific and catalyse a reaction in order to replicate.

		4.5	Outline specific conditions in which different enzymes function.
		4.6	Describe the effects of temperature on enzyme activity.
		4.7	Explain the effects of pH on enzymatic activity.
		4.8	Describe substrate concentration and enzyme concentration on enzymatic activity
5	Be able to demonstrate a practical awareness as to the function of enzymes.	5.1	Carry out technical processes involving the observation for chemical tests for starch using iodine.
		5.2	Carry out technical processes involving the observation for chemical tests for reducing sugars using Benedict's solution.
		5.3	Carry out technical processes involving the observation for chemical tests for proteins using biuret solution.
		5.4	Carry out technical processes involving the observation for chemical tests for fats.
		5.5	Carry out technical processes involving the observation for chemical tests for Vitamin C
6	Understand animal nutrition and the digestive system.	6.1	Define the term nutrition.
		6.2	Explain the importance of nutrition.
		6.3	Describe the importance of a balanced diet, specifically the need for: (i) carbohydrates, (ii) proteins, (iii) fats / lipids, (iv) water, (v) vitamins, (vi) minerals, and (vii) fibre.
		6.4	Describe how factors affect dietary needs, specifically: (i) age, (ii) gender (including pregnancy), and (iii) physical activity.
		6.5	Outline the term 'basal metabolic rate'.
		6.6	Describe the impact of the following on a diet: (i) excess fat, (ii) not enough fibre, (iii) lack of vitamin C, (iv) lack of vitamin D, (v) lack or iron, and (vi) lack of calcium.

	6.7	Outline the effects of a higher energy intake to energy output.
	6.8	Define the following terms: (i) ingestion, (ii) digestion, (iii) absorption, (iv) assimilation, and (v) egestion.
	6.9	Define the terms mechanical and chemical digestion.
	6.10	State the function of (i) amylase, (ii) protease, and (iii) lipase including substrates and products.
	6.11	Describe the structure of human teeth and their functions.
	6.12	State the causes of tooth decay and how to prevent tooth decay.
	6.13	Describe the passage of food along the alimentary canal from mouth to anus
	6.14	Describe the events that take place during the chewing and swallowing process.
	6.15	Outline the function of saliva
	6.16	Describe the movement of food through the oesophagus by way of peristalsis.
	6.17	Describe the processes of chemical digestion and mechanical digestion.
	6.18	Outline the role of (i) gastric juices, (ii) pepsin, (iii) hydrochloric acid, and (iv) chyme.
	6.19	Explain the importance of bile and pancreatic juices.
	6.20	Describe the role of the following: (i) amylase, (ii) trypsin, and (iii) lipase
	6.21	Describe the role of bile and villi in the digestive process.
	6.22	Describe the importance of the absorption process in digesting food molecules.
	6.23	Describe the passage of undigested food through the intestines by peristalsis.
	6.24	Outline the function of the large intestine.

		6.25	Explain why the body retains faeces in the rectum prior to its egestion from the body.
		6.26	Explain the impact of the autoimmune disease celiac on infants and adults.
		6.27	Describe the role of the gall bladder.
		6.28	Outline the symptoms of cholera.
		6.29	Describe the condition lactose intolerance
7	Be able to demonstrate a practical awareness as to the processes of animal nutrition and the digestive system.	7.1	Carry out technical processes involving the observation of practical food tests, including (i) calorimetry of various foods, and (ii) calculate the energy content of food.

4 Respiratory system	
Aim	
The aim of this is to enhance understanding of the respiratory system and understand the mechanisms involved in the process of breathing.	
Learning Outcomes - The learner will:	Assessment Criteria - The learner can:
1 Understand the role of gaseous exchange in human beings.	1.1 Describe how the bell jar model can be used to demonstrate ventilation and explain limitations of this experiment.
	1.2 Outline function of epiglottis.
	1.3 Outline function of C ring cartilage in trachea.
	1.4 Outline how the bronchiole network is visualised as a tree / branch.
	1.5 Define the term ventilation and be able to describe how it is different from the term respiration.
	1.6 Describe the process of ventilation both inhalation and exhalation in the lungs in terms of pressure changes.
	1.7 Describe the pathway of air from atmosphere into a body cell.
	1.8 Describe the composition of atmospheric air compared exhaled air.
	1.9 Describe the process of gas exchange in the alveoli by diffusion.
	1.11 Explain the adaptations of alveoli in terms of: (i) large surface area, (ii) good blood supply / capillary network, (iii) moist surfaces, (iv) thin cell walls, and (v) ventilation of the lungs.
	1.12 Describe gaseous exchange surfaces in the gills of fish.
	1.13 Describe how to measure breathing rate by counting breaths per minute.
	1.14 Define the term vital capacity.

		1.15	Explain changes in breathing rate and depth before, during and after exercise.
		1.16	Explain the relationship between aerobic and anaerobic respiration before, during and after exercise.
		1.17	Explain the role of the liver in breaking down lactic acid.
		1.18	Explain the term oxygen debt.
		1.19	Describe the importance of carbon dioxide changes in the blood to regulate breathing rate.
		1.20	Explain the role of cilia and goblet cells in keeping the airways clean.
		1.21	State the composition of tobacco smoke and explain effects on respiratory system and other organs in the body.
		1.22	Define the term 'passive smoking'.
		1.23	Describe 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.
		1.24	Outline factors relating to the correlation and causation of conditions linked to smoking.
2	Be able to demonstrate a practical awareness as to the role of gaseous exchange in human beings.	2.1	Identify (on diagrams) the location of the following in the human body: (i) larynx, (ii) trachea, (iii) bronchi, (iv) bronchioles alveoli, (v) pleural membrane, (vi) pleural fluid, (vii) intercostal muscles, (viii) ribs, (ix) sternum, (x) diaphragm, and a (xi) associated capillaries.
		2.2	Create a model of lungs / bell jar.
		2.3	Use a model to represent the presence of tar in smoke by way of filters.
		2.4	Use limewater to identify differences in carbon dioxide concentration.
		2.5	Investigate the effects of physical exercise on: (i) rate and depth of breathing, and (ii) measure vital capacity.

5	Transport in animals		
Aim			
The aim of this is to enhance understanding of the human circulatory system, its key purpose and functions, the importance of the lungs on the human circulatory system and how poor diet impacts on the function of the heart.			
Learning Outcomes - The learner will:		Assessment Criteria - The learner can:	
1	Understand the function of the human heart and the circulatory system.	1.1	Describe the one-way flow of blood around the body.
		1.2	Define the term single and double circulatory system.
		1.3	Describe the advantages of a double circulatory system compared to a single circulatory system.
		1.4	Describe the role of the coronary artery.
		1.5	Outline the location of the pacemaker (where required) within the human heart.
		1.6	Explain the importance of the septum in creating a division between oxygenated and deoxygenated blood.
		1.7	Describe differences in structure between the left and right side of the heart and
		1.8	Outline the differences between atrium and ventricles in terms of muscle thickness.
		1.9	Explain how this affects pressure of blood exiting the heart.
		1.10	Describe the actions involved during 1 heartbeat including the relaxation phase and contraction phase of atria and ventricles.
		1.11	State the purpose of an electrocardiogram (ECG) as being the method by which a heartbeat can be measured.
		1.12	Explain the effects of physical activity on the heart rate.
		1.13	Define the term 'pulse rate' and 'resting pulse rate'.

	1.14	State how a pulse rate and resting pulse rate can be used to determine a person's fitness.
	1.15	Describe the nature of the non-communicable disease coronary heart disease (CHD)
	1.16	State the possible causes and preventative measures of CHD, specifically: (i) lifestyle, (ii) hereditary, (iii) age, and (iv) gender.
	1.17	Describe methods of treatment for CHD, specifically: (i) change in diet, (ii) angioplasty, (iii) coronary stent, (iv) drugs, (v) coronary bypass, and (vi) heart transplant.
	1.18	Describe the advantages and disadvantages of: (i) change in diet, (ii) angioplasty, (iii) coronary stent, (iv) drugs, (v) coronary bypass, and (vi) heart transplant.
	1.19	Explain the function of (i) arteries, (ii) veins, and (iii) capillaries.
	1.20	Describe 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, (vi)
	1.21	Describe differences in blood pressure in each blood vessel.
	1.22	State the function of (i) arterioles, (ii) venules. and (iii) shunt vessels.
	1.23	Describe the differences in composition of blood in blood vessels in terms of: (i) oxygen concentration, (ii) carbon dioxide concentration, (iii) urea concentration, (iv) nutrient concentration (e.g. – glucose, amino acids).
	1.24	List the main components of blood and relative percentage in healthy individuals: (i) red blood cells, (ii) white blood cells, (iii) plasma, and (iv) platelets.
	1.25	State the purpose of centrifugation as a method of separating blood and its components.

		1.26	Describe the role of red blood cells.
		1.27	Outline the structural adaptations of red blood cells
		1.28	State the importance of haemoglobin and the chemical reaction oxyhaemoglobin at the lungs and its reversible reaction at body cells.
		1.29	Describe the role of plasma in the transport of named nutrients: (i) wastes, (ii) blood proteins, and (iii) hormones.
		1.30	Describe the exchange of materials between capillaries and the formation tissue fluid.
		1.31	Describe the term 'lymph'.
		1.32	Describe differences in composition between lymph and blood.
		1.33	Outline the lymphatic system as being separate to the circulatory system.
		1.34	Outline the role of lymph nodes being the site of maturation for lymphocytes.
		1.35	Describe the function of white blood cells.
		1.36	Describe the process of phagocytosis.
		1.37	Describe how antibodies can defend the body against pathogens.
		1.38	Explain the relationship between antibodies and pathogens
		1.39	Describe the role of platelets in the clotting process
2	Be able to demonstrate a practical awareness as to the role of the human heart and the circulatory system.	2.1	Label the structure of the heart, specifically: (i) left atrium, (ii) right atrium, (iii) left ventricle, (iv) right ventricle, (v) septum, (vi) bicuspid and tricuspid valves, (vi) aortic, and (vii) pulmonary valves.
		2.2	Interpret a cardiogram and describe what occurs during one heartbeat.
		2.3	Investigate the measures as to the effect of physical activity on pulse rate.

		2.4	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.
		2.5	Carry out a dissection of the heart.
		2.6	Identify blood components from micro pictographs.

6		Disease, immunity and drugs	
Aim			
The aim of this is to enhance understanding of the human body and how lifestyle factors, genetics and behaviours can have a detrimental impact on the body. The subject content will also cover communicable and non-communicable diseases, as well as enhance understanding of medicinal and recreational drugs, their effect on the body and risks associated with drug abuse.			
Learning Outcomes - The learner will:		Assessment Criteria - The learner can:	
1	Understand the impact on the human body and plants from diseases and immunity.	1.1	Define communicable and non-communicable diseases.
		1.2	State examples of communicable and non-communicable diseases.
		1.3	Define the term pathogen.
		1.4	Describe how certain communicable diseases can be transmitted from a host to other non-infected individuals.
		1.5	Outline symptoms of the following diseases: (i) influenza, (ii) tuberculosis, (iii) cholera / typhoid, (iv) athletes' foot, (v) HIV/AIDS, (vi) hepatitis, and (vii) chlamydia.
		1.6	Explain prevention methods of the following diseases: (i) influenza, (ii) tuberculosis, (iii) cholera / typhoid, (iv) athletes' foot, (v) HIV/AIDS, (vi) hepatitis, and (vii) chlamydia.
		1.7	Define the role of vaccinations.
		1.8	Outline the body's primary defences against disease.
		1.9	Outline the role undertaken by phagocytes within the human immune system.
		1.10	Explain the role undertaken by lymphocytes and antibodies within the human immune system.
		1.11	Define the term 'activity immunity'.
		1.12	Explain how activity immunity is acquired.

		1.13	Describe how mutation of pathogens could lead to a primary response after vaccination.
		1.14	Explain the importance of vaccination for infants and individuals travelling to other countries.
		1.15	Explain the need for regular vaccinations of specific pathogens.
		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.
		1.17	Define the term passive immunity.
		1.18	Explain the importance of breast feeding for infants and passive immunity.
		1.19	Describe Type 1 diabetes as an autoimmune disease.
		1.20	Outline the symptoms and treatments for Type 1 diabetes.
		1.21	Outline how plants can catch communicable diseases.
		1.22	State the type of pathogen on a plant:
		1.23	Describe symptoms of a pathogen on a plant.
		1.24	Describe 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
		1.25	Describe various deficiency diseases on plants for named minerals, specifically: (i) magnesium, (ii) nitrates, and (iii) phosphates.
2	Be able to demonstrate a practical awareness as to the role of the impact on the human body and plants from	2.1	Draw and label typical structures, specifically: (i) fungi, (ii) bacteria, (iii) protoctists, and viruses.

	diseases and immunity	2.2	Identify each type of pathogen, specifically: (i) fungi, (ii) bacteria, (iii) protoctists, and viruses.
		2.3	Identify from information provided (e.g., graph/comprehension) whether a primary versus secondary immune response is being observed.
3	Understand the impact of medicinal and recreational drugs on the human body.	3.1	Define the term drug as a substance ingested into the body that influences chemical reactions in the body
		3.2	Outline the derivative characteristics of drugs.
		3.3	Outline the basis on which penicillin was discovered.
		3.4	Describe and explain the use of antibiotics against bacterial diseases.
		3.5	Describe the role of pain killers and anaesthetics as symptom relievers.
		3.6	Explain why antibiotics cannot be used to treat viral infections.
		3.7	Describe the use of fungicides as a treatment for fungal diseases.
		3.8	Describe what is meant by “over-the-counter” medicines.
		3.9	Explain antibiotic resistance in terms of natural selection.
		3.10	Explain the importance of correct use of antibiotics and drugs in the fight against disease.
		3.11	Explain strategies that can be used to reduce the development of antibiotic resistant bacteria.
		3.12	Describe the stages involved in modern drug development for treatments.
		3.13	Explain the importance of thorough testing in the development of drugs and associated ethical issues.
		3.14	State the difference between a stimulant and depressant drug.

		3.15	Identify drugs which act as a: (i) depressant, (ii) stimulant), and which deemed socially acceptable.
		3.16	Describe the non-communicable diseases associated with the excess consumption of (i) alcohol, (ii) nicotine, and (iii) caffeine.
		3.17	Describe the effects of alcohol on the body such as: (i) loss of coordination, (ii) judgement and control of the body, (iii) slower reaction times, and (iv) loss of self-control.
		3.18	Describe social issues associated with alcohol abuse.
		3.19	State the names of illegal recreational drugs.
		3.20	Explain how drugs have the potential become addictive.
		3.21	Describe the effects of the abuse of heroin
		3.22	State how injecting heroin can increase the risk of HIV and hepatitis.
		3.23	Explain the impact of heroin addiction.
		3.24	Explain how heroin interacts and affects the synapses in the nervous system.
4	Understand the use of drugs in sport.	4.1	Discuss the use of anabolic steroids in sports.
		4.2	Describe the side effects of anabolic steroids for both male and female athletes.
		4.3	Discuss the ethical issues associated with the use of performance enhancing drugs
5	Be able to demonstrate a practical awareness as to the role of drugs.	5.1	Investigate the effect of antiseptics and/or antibiotics on bacterial growth using agar plates
		5.2	Investigate the effect of antiseptics and/or antibiotics on bacterial growth by measuring zones of inhibition.

7		Plants	
Aim			
The aim of this subject content is to enhance understanding of plant tissues and their key functions.			
Learning Outcomes - The learner will:		Assessment Criteria - The learner can:	
1	Understand the role of photosynthesis in plants.	1.1	State the chemical and balanced chemical equation for photosynthesis.
		1.2	Describe the method to test for starch on a green leaf.
		1.3	Describe the role of chlorophyll in photosynthesis.
		1.4	Describe experiments that prove that light, chlorophyll, water and carbon dioxide are required for photosynthesis to occur.
		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.
		1.6	State the products of photosynthesis and how they are used in plant.
		1.7	Describe how to investigate how each of the following variables effects the rate of photosynthesis: (i) carbon dioxide concentration, (ii) temperature, and (iii) light intensity.
		1.8	Explain the results of each of the variables stated above
		1.9	Define the term limiting factor.
		1.10	Explain how greenhouses arterially control abiotic factors to promote optimum conditions for growth of plants such as temperature, light intensity, CO ₂ and water.
2	Understand the structure of plant tissues and their key functions.	2.1	List the main plant organs.
		2.2	Outline the role of the following organs: (i) flower, (i) root, (iii) stem, and (iv) leaves.

		2.3	Describe the features of a root hair cell and how it is adapted to function.		
		2.4	Describe the role of plant roots for absorption of substances by (i) diffusion, (ii) osmosis, and (iii) active transport.		
		2.5	Explain structural differences in xylem and phloem transport vessels.		
		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 epidermis, (vi) guard cells, and, and (vii) stomata.		
		2.7	Describe the processes involved that allow guard cells to open and close.		
		2.8	Describe environmental factors that can affect the rate at which stomata opens and closes.		
		2.9	Explain how diffusion affects the concentration levels in stomata.		
		2.10	Describe the role of roots for plant anchorage.		
		3	Understand the plant transport function.	3.1	Define the term transpiration and translocation
				3.2	Compare differences between the processes of transpiration and translocation
3.3	Define the term 'mass flow'.				
3.4	Describe movement of water and mineral ions from root to leaf in the xylem.				
3.5	Outline the chemical properties of water.				
3.6	Explain movement of substances from source to sink.				
3.7	Explain how substances transported in xylem and phloem.				
3.8	Explain how at different times in a plant's life, different parts of a plant can act as source or a sink				
3.9	Explain translocation of sucrose as an active process.				

		3.10	Describe how changes in humidity, temperature and light intensity can affect the rate of transpiration.
		3.11	Explain the process of wilting in terms of water availability and turgor pressure.
		3.12	Describe how to investigate the rate of transpiration using a photometer.
		3.13	State that minerals can be absorbed by diffusion and active transport
		3.14	State the importance of the following minerals for plant nutrition: (i) nitrates, (ii) phosphates, and (iii) magnesium.
		3.15	Describe the impact of mineral deficiency and diseases in plants.
4	Be able to demonstrate a practical awareness as to the role of transpiration, photosynthesis and plant tissue.	4.1	Calculate surface area of a leaf using grid paper.
		4.2	Calculate the number of stomata from a micro pictograph.
		4.3	Deduce from a diagram which method of absorption is occurring based on concentration gradient.
		4.4	Test a leaf for starch.
		4.5	Investigate the need for chlorophyll for photosynthesis
		4.6	Investigate the need for carbon dioxide for photosynthesis.
		4.7	Investigate how light is needed for photosynthesis
		4.8	Measure the rate of photosynthesis by measuring volume of oxygen produced over a period of time.
		4.9	Investigate the effect of light intensity and rate of photosynthesis
		4.10	Investigate the effect of temperature on the rate photosynthesis
		4.11	Investigate the effect of carbon dioxide on the rate of photosynthesis.

	4.12	List the balanced chemical equation for photosynthesis (including light and chlorophyll on the arrow).
	4.13	Investigate the results of the following variables on the rate of effect on photosynthesis: (i) carbon dioxide concentration, (ii) temperature, and (iii) light intensity.
	4.14	Identify from a transverse section of a root the follow sections: (i) root hair cells, (ii) cortex, (iii) root tip, (iv) root cap, and (v) phloem and xylem.
	4.15	Identify from a transverse section of a stem the follow structures: (i) cambium, (ii) cortex, (iii) pith, (iv) epidermis, and (v) phloem and xylem.
	4.16	Label the following parts on 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.
	4.17	Investigate plant metabolism respiration and photosynthesis when using a hydrogen carbonate indicator in light and dark conditions.

8		Coordination, response and excretion	
Aim			
The aim of this subject content is to enhance understanding of nervous and chemical coordination system in humans alongside understanding chemical coordination in plants. Learners will also enhance their understanding as to the excretory system and the role of the kidneys.			
Learning Outcomes - The learner will:		Assessment Criteria - The learner can:	
1	Understand the nervous system in the human body.	1.1	State the meaning of the term sensitivity.
		1.2	Explain the difference between central nervous and peripheral nervous system.
		1.3	Describe the structure of the human nervous system in terms of: (i) brain, (ii) spine, (iii) cranial, and (iv) spinal nerves.
		1.4	Explain receptors as specialised cells that can detect a range of stimulus.
		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.
		1.6	Describe the purpose of effectors within muscles / glands.
		1.7	Describe how electrical impulses pass along neurones.
		1.8	Outline the sequences of events that take place between stimulus and responses.
		1.9	Compare differences between voluntary and involuntary actions.
		1.10	Describe the adaptations of neurones to increase impulse transmission.
		1.11	Explain the difference between white and grey matter in the spinal cord.
		1.12	Describe how neurones are involved in coordination for nervous responses and reflex arcs.
		1.13	Explain the importance of reflex arcs as a process that prevents damage to the human body.

		1.14	Describe the reflex arc in terms of: Stimulus > sensory neurone > relay neurone > motor neurone > effector > response.
		1.15	Define the term synapse.
		1.16	Describe the processes involved of how impulses are pass across a synapse.
		1.17	Outline how drugs can affect nerve transmission across synapses.
		1.18	Describe the function of structures found in the eye, specifically: (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.
		1.19	Explain the pupil reflex in terms of changes of light intensity and reflex arc involved including the muscles involved.
		1.20	Describe the process of accommodation including actions carried out by the (i) ciliary muscles, (ii) suspensory ligaments, and (iii) change in lens shape for near and far objects.
		1.21	Explain functions carried out by rod and cone cells in the retina and relative distribution.
2	Understand chemical coordination in humans.	2.1	State the hormones released by each gland.
		2.2	Describe the effects of adrenaline on the heart, lungs, liver, and pupils
		2.3	Explain the effects of adrenaline in terms of provisions of glucose and oxygen to promote aerobic respiration for more Adenosine Triphosphate release.
		2.4	Explain the effects of adrenaline for muscle contractions and for increasing blood flow.

		2.5	Compare differences of nervous system and endocrine system in terms of: (i) structures involved, (ii) method of transmission, (iii) pathway taken, (iii) rate of transmission, (iv) duration of effect, (v) target organs / tissues, and (vi) responses.
		2.6	Define the term homeostasis
		2.7	Define the term 'negative feedback' in the context of chemical coordination in humans.
		2.8	Outline the process of feedback loops for the following scenarios: (i) controlling blood glucose, and (ii) controlling body temperature.
		2.9	Outline the functions of the skin.
		2.10	Define the terms (i) vasodilation, and (ii) vasoconstriction.
		2.11	Explain the importance of conditions such as (i) blood glucose, (ii) temperature, and (iii) water regulation on the survival of the human body.
3	Understand chemical coordination in plants.	3.1	Define the following terms: (i) tropism, (ii) phototropism, (iii) gravitropism, and (iv) hydrotropism.
		3.2	Describe the importance of positive and negative tropisms in assisting plants growth and survival.
		3.3	Explain the role of auxin in responses to stimuli stated above in both root and shoots.
		3.4	Describe the effect of synthetic hormones acting as selective weed killers.
4	Be able to demonstrate a practical awareness as to the role of the nervous system and chemical coordination in humans.	4.1	Label structures of the following neurones: (i) sensory, (ii) relay, and (iii) motor neurone.

		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.
		4.3	Identify from a diagram the following endocrine glands: (i) adrenal glands, (ii) the pancreas, (iii) pituitary gland, (iv) thyroid, (v) the testes, and (vi) ovaries.
		4.4	Identify and label substructures from a diagram of human skin
		4.5	Carry out an eye dissection.
		4.6	Carry out a ruler dropping experiment to measure reaction time.
		4.7	Carry out an investigation the rate of plant directional growth to stimuli.
		5	Understand the role of excretion in human beings
5.2	Outline the functions carried out by the following excretory organs: (i) lungs, (ii) kidneys, and (iii) skin.		
5.3	Differentiate between excretion and egestion		
5.4	Define the term assimilation		
5.5	Explain the importance of the liver in assimilation.		
5.6	Describe roles of the liver in detail.		
5.7	Describe the structure of the urinary system in terms of: (i) renal artery, (ii) renal vein, (iii) ureters, (iv) bladder, and (v) urethra.		
5.8	Explain differences in blood composition between renal artery and veins.		
5.9	Describe the role of kidneys in excretion.		
5.10	Describe the structure of a nephron.		

		5.11	Explain the role performed by (i) nephrons in filtration, (ii) blood, (iii) selective reabsorption of substances.
		5.12	Describe structural features of an epithelial cell in a kidney tubule.
		5.13	Explain composition of blood and urine for a healthy person and a person who has kidney damage or disease.
		5.14	Describe how analysing urine can lead to the detection of kidney disease/damage.
		5.15	Describe the process of dialysis
		5.16	Discuss advantages and disadvantages of dialysis versus kidney transplant.
		5.17	Describe functions of the kidneys.
6	Be able to demonstrate a practical awareness as to the role of role of excretion in human beings.	6.1	Identify from a diagram internal structures of the kidney.
		6.2	Carry out a kidney dissection.
		6.3	Carry out a Benedict's / Biuret test on urine samples.

9		Reproduction	
Aim			
The aim of this subject content to gain an enhancing understanding of the reproductive system of both animals and plants.			
Learning Outcomes - The learner will:		Assessment Criteria - The learner can:	
1	Understand reproductive cell division.	1.1	Define the term 'sexual reproduction' and 'asexual reproduction'.
		1.2	Describe the process of mitosis in detail.
		1.3	Describe the purpose of the mitotic index.
		1.4	Outline the importance of mitosis for growth and repair, and importance as a form of asexual reproduction
		1.5	Explain the importance of mitosis as a form of asexual reproduction.
		1.6	Outline the following examples of asexual reproduction (i) cloning, (ii) binary fission, (iii) formation of hypha, and (iv) stem tubers.
		1.7	Describe the process of meiosis and formation of gametes
		1.8	Compare the process of mitosis and meiosis.
2	Understand plant reproduction.	2.1	Describe the functions of internal reproductive structures within flowering plants.
		2.2	Define the term pollination
		2.3	Explain adaptations of different pollen types to increase chance of pollination.
		2.4	Describe the differences between self-pollination and cross-pollination.
		2.5	Outline the steps involved from pollination to seed formation.
		2.6	Explain conditions needed for germination.

	2.7	Discuss advantages and disadvantages of both sexual and asexual reproduction in plants.
	2.8	Describe the functions of the male and female reproductive system.
	2.9	Compare structural differences of male and female gametes.
	2.10	Explain methods of cell division through meiosis.
	2.11	Describe roles of sex hormones in terms of primary and secondary sexual characteristics in men and women.
	2.12	Outline the role of (i) hormones, (ii) site of secretion, and (iii) their effect on the body.
	2.13	Describe the process of menstruation.
	2.14	Explain the process of fertilisation in humans.
	2.15	Explain the early development of a zygote to a ball of cells.
	2.16	Describe the process of implantation.
	2.17	Describe the roles of (i) placenta, (ii) umbilical cord, (iii) amniotic sac, and (iv) amniotic fluid during pregnancy.
	2.18	Describe the growth of and development of the fetus.
	2.19	Define the term gestation period.
	2.20	Discuss how toxins and pathogens can cross the placenta and affect the fetus.
	2.21	Describe the purpose of ante-natal care during pregnancy.
	2.22	Explain the processes of labour and birth
	2.23	Discuss the advantages and disadvantages of breast feed and use of formula milk.

		2.24	Describe methods of birth control to prevent pregnancy, specifically: (i) chemical, (ii) surgical, (iii) barrier, and (iv) natural.
		2.25	Explain how hormones and fertility drugs can increase chances of pregnancy.
		2.26	Explain the process of in vitro fertilisation
		2.27	Describe the process of artificial insemination.
		2.28	Describe social implication of contraception and fertility treatments.
		2.29	Define the term sexually transmitted diseases.
		2.30	Describe methods of HIV transmission and preventative measures.
		2.31	Describe how HIV affects the immune system and can lead to AIDS.
3	Be able to demonstrate a practical awareness as to the role of reproduction in seeds, insects and flowers.	3.1	Label internal structures of insect and wind pollinated flowers.
		3.2	Label structures of a seed.
		3.3	Identify whether a flower is insect or wind pollinated from a diagram.
		3.4	Compare differences in pollen structure between insect and wind pollinated flowers.
		3.5	Label male and female reproductive organs from diagrams

10	Genetics, inheritance, classification, variation and selection.		
Aim			
The aim of this subject content is to enhance understanding of genetics and inheritance, to enhance understanding of the history of classification and how various organisms are grouped together based on observed features and to enhance understanding of variation in organisms and the various processes of selection that occur in the environment.			
Learning Outcomes - The learner will:		Assessment Criteria - The learner can:	
1	Understand the concept of genetics and inheritance.	1.1	Describe the term inheritance and hereditary.
		1.2	Outline the terms: (i) DNA, (ii) genes, and (iii) chromosomes.
		1.3	State the diploid and haploid number of chromosomes in humans.
		1.4	Outline the structure of DNA.
		1.5	Describe the process of transcription and translation in protein synthesis.
		1.6	Define the terms (i) alleles, (ii) dominant, and (iii) recessive.
		1.7	Explain the terms (i) genotype, (ii) heterozygous, and (iii) homozygous.
		1.8	Define the term phenotype.
		1.9	Interpret pedigree diagrams to determine if alleles are dominant or recessive.
		1.10	Define the term monohybrid inheritance
		1.11	Describe and explain the term codominance of allele.
		1.12	Define the term 'sex linkage'.
2	Be able to demonstrate a practical awareness as to the role of genetics and inheritance.	2.1	Correctly calculate probability of genotypes and phenotypes of offspring using a punnet square / test cross.

		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.
		2.3	Determine probability using a punnet square of the following scenarios: (i) gender determination, and (ii) inheriting recessive or dominant diseases.
		2.4	Use pedigree diagrams to determine if a genetic condition is linked.
3	Understand the history of classification.	3.1	Outline how organisms are classified.
		3.2	Define the term 'binomial system'.
		3.3	Explain the terms 'morphology' and 'anatomy'.
		3.4	List features of organisms classified in the five kingdoms.
		3.5	Describe the importance of classification to evolution.
		3.6	Explain the importance of fossil evidence to support theory of evolution.
4	Understand classification of animals.	4.1	Define the terms 'vertebrate' and 'invertebrate'.
		4.2	Describe the features of the following five vertebrate groups: (i) fish, (ii) mammals, (iii) amphibians, (iv) reptiles, and (v) birds.
		4.3	Compare and contrast features of different vertebrate groups.
		4.4	Describe the external features of arthropods and how they are classified: (i) insects, (ii) crustaceans, (iii) myriapods, and (iv) arachnids.
5	Understand classification of plants.	5.1	Describe cellular structures that classify organisms as plants
		5.2	Describe the differences between monocotyledons and dicotyledons

		5.3	Explain the features that are used to classify plants into the follow categories: (i) ferns, (ii) conifers, (iii) moss, and (iv) flowering plants.
		5.4	Compare and contrast features of different plant groups.
6	Be able to demonstrate a practical awareness as to the classification of animals and plants.	6.1	Draw and use simple dichotomous keys to identify plants and animals.
		6.2	Classify unknown species based on visible external features from pictures of descriptions of organisms.
		6.3	Classify unknown species based on visible external features from pictures of descriptions of organisms
7	Understand the role of variation in organisms.	7.1	Define the term 'variation'.
		7.2	Describe differences between genetic and phenotypic variation.
		7.3	State the differences between continuous and discontinuous variation.
		7.4	Describe continuous variation in terms of genes and environment.
		7.5	Explain discontinuous variation in terms of genes only
		7.6	Describe the causes of variation of individuals caused by sexual reproduction (meiosis) and mutation.
		7.7	Define the term mutation.
		7.8	State the causes of mutation such as (i) carcinogens, (ii) harmful chemicals, and (iii) radiation.
		7.9	Explain possible positive and negative effects on mutation forming new alleles in a population.
		7.10	Describe sickle cell anaemia.
		7.11	State heterozygous sickle cell anaemia.

8	Understand the role of adaptations in organisms.	8.1	Define the term 'adaptive feature'.
		8.2	Explain adaptive features of animals in varying climates.
		8.3	Describe various predator and prey adaptations in terms of: (i) camouflage, (ii) teeth shape, and (iii) eye location.
		8.4	Explain the adaptive features of plants in varying climates, including (i) hydrophytes, and (ii) xerophytes.
9	Understand selection and evolution in organisms.	9.1	Describe the term 'natural selection'.
		9.2	Define the term 'speciation'.
		9.3	Define the term 'fitness'.
		9.4	Explain how Darwin's finches demonstrate natural selection.
		9.5	Explain how antibiotic resistance of bacteria occurs by the process of natural selection.
		9.6	Describe how fossil evidence can be used to identify changes
		9.7	Describe evolution as a natural selection results in a change of adaptive features over time
		9.8	Explain how natural selection maintains adaptive features.
		9.9	Describe the importance of over population of offspring of animals and plants.
		9.10	Describe the process of selective breeding/artificial selection.
		9.11	Explain selective breeding in terms improving characteristics of economic gain.
		9.12	Describe the differences between natural selection and artificial selection.

		9.13	Define the term 'hybrid vigour'.
		9.14	Describe the terms outbreeding and inbreeding.
		9.15	Explain the risks of artificial selection in terms of reduction of genetic diversity and harmful recessive alleles.

11	Organisms and human influence on the environment.		
Aim			
The aim of this subject content is to enhance understanding of organisms in their environment.			
Learning Outcomes - The learner will:		Assessment Criteria - The learner can:	
1	Understand organisms and their environment.	1.1	Define the following key words: (i) ecosystem, (ii) biotic factors, (iii) abiotic factors, (iv) habitat, (v) niche, (vi) biodiversity, (vii) population, (vii) community, (viii) producers, (ix) consumers, (x) decomposers, and (xi) trophic level.
		1.2	Describe a food chain and its feeding stages.
		1.3	Differentiate between a food chain and food web.
		1.4	Describe pyramids of numbers and pyramids of biomass.
		1.5	Explain why a food web is a better representation of energy flow in a community than a food chain.
		1.6	Define the term 'dry mass'.
		1.7	Compare pyramids of numbers and pyramids of biomass.
		1.8	Explain limitations of pyramids of numbers and biomass compared to pyramid of energy as a representation of a community.
		1.9	Explain energy losses between trophic levels in food chains
		1.10	Explain the increased efficiency in supplying green plants as human food compared to feeding crop plants to animals.
		1.11	Describe methods of sampling of populations such as quadrats, Tullgren funnel, pooter, pitfall traps, line and belt transect.

		1.12	Explain the importance of random sampling and avoiding bias in producing an accurate representation of a population in a habitat
		1.13	Explain the importance of releasing captured organisms nearby to site of capture
2	Understand nutrient cycles.	2.1	Describe stages of carbon cycle in terms of (i) respiration, (ii) photosynthesis, (iii) decomposition, (iv) death, (v) Fossilisation, and (vi) combustion.
		2.2	State the name of C based compounds at each stage of the cycle.
		2.3	Define how respiration and photosynthesis keeps carbon dioxide at relative equilibrium.
		2.4	State why combustion of fossil fuels are a key factor in the release of additional carbon dioxide into the atmosphere.
		2.5	Explain the role of decomposers in the carbon cycle.
		2.6	Describe the stages of the water cycle: (i) evaporation, (ii) transpiration, (iii) evapotranspiration, (iv) condensation, (v) precipitation, and (vi) water vapour.
		2.7	Describe the nitrogen cycle in terms of (i) nitrogen fixation, (ii) excretion, (iii) nitrification, (iv) denitrification, and (v) ammonification.
		2.8	State the name of N based compounds at each stage of the cycle.
		2.9	Describe the chemical changes of nitrogen-based compounds to form nitrates.
		2.10	Describe the importance of nitrates as a nutrient for plant growth.
		2.11	State the process by which nitrates are absorbed by plants.
3	Understand populations.	3.1	Outline factors that affect population size in terms of: (i) birth rate, (ii) death rate, (iii) immigration, and (iv) emigration.
		3.2	Explain factors that biotic and abiotic factors that influence population growth.

		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.
		3.4	Explain each stage of a sigmoid population growth curve.
		3.5	State the demographic transition model as a method of representing human population growth.
		3.6	Explain the different stages which affect countries in the demographic transition model.
		3.7	Describe the changes in human population through time and discuss the following consequences: (i) social impacts, and (ii) environmental impacts.
		3.8	Interpret human population pyramids.
		3.9	Define the term fertility rates in terms of average number of children per female a country.
		3.10	Describe human population pyramids
		3.11	Describe various strategies to reduce human population growth with named examples.
4	Be able to demonstrate a practical awareness as to organisms and their environment.	4.1	Carry out a series of population sampling techniques using (i) quadrats, (ii) Tullgren funnel, (iii) pooter, (iv) pitfall traps, and (v) line and belt transect.
		4.2	Draw simple food chains and food webs.
		4.3	Draw and interpret pyramids of numbers and pyramids of biomass.
		4.4	Identify suitable method of population samples based on provided information about organisms
5	Understand human influence on the environment	5.1	Describe changes in farming over time from hunter gather to modern farming practices.

		5.2	Describe how changes have led to an increase food production and food security.
		5.3	Explain the negative environmental impacts of intensive farming practices: Reduction in biodiversity due to monoculture.
		5.4	Outline reasons for land clearance other than agriculture.
		5.5	Explain the impact of a reduction in habitat on local flora and fauna.
		5.6	Explain the effects of deforestation on the environment. .
6	Understand the effects of pollution on the environment.	6.1	Identify the different types of land pollution and water pollution caused by farming
		6.2	Describe the harmful effects of fertilisers and pesticides.
		6.3	Explain how and why salinisation and eutrophication occur.
		6.4	Identify the waste categories: (i) domestic, (ii) industrial, and (iii) agricultural.
		6.5	Explain the impact each of the following waste categories have on the local environment: (i) domestic, (ii) industrial, and (iii) agricultural.
		6.6	Explain the impacts of non-biodegradable plastics on organisms and the environment.
		6.7	Describe the negative impact of female contraceptives in bodies of water on aquatic organisms.
		6.8	Define the terms 'bioaccumulation' and 'biomagnification'.
7	Understand the impact of greenhouse gases on the environment.	7.1	State the impact from methane and carbon dioxide on the environment.
		7.2	Define the term 'an enhanced greenhouse effect'.
		7.3	Describe the process of greenhouse effect.

		7.4	Describe that a consequence of greenhouse effect is global warming
		7.5	Describe how global warming can lead to climate change.
		7.6	Explain the effect of climate change on environments.
		7.7	Explain strategies that can be implemented at (i) local, (ii) governmental, and (iii) international level, to reduce the production of greenhouse gases.
8	Understand the cause and effect of acid rain on the environment.	8.1	State how sulphur dioxide and nitrogen oxide contribute to acid rain.
		8.2	Explain how carbon dioxide does not contribute to acid rain.
		8.3	State the sources of sulphur dioxide and nitrogen oxides.
		8.4	Describe the process of acid rain formation
		8.5	Explain the effect of acid rain on organisms and environments.
		8.6	Explain strategies that can be implemented to prevent acid rain formation.
		8.7	Describe methods that can be implemented to reduce the impact of acid rain.
9	Understand factors which contribute to ozone depletion.	9.1	State how chlorofluorocarbons (CFC'S) and halon gases are responsible for ozone depletion.
		9.2	State the sources of CFC's.
		9.3	Describe how these gases damage the ozone layer.
		9.4	Describe the impact of ozone depletion on organisms and the environment.
		9.5	Describe strategies that can be implemented to reduce the release of CFC's and Halon gases into the atmosphere.
10	Understand sustainability.	10.1	Define the term sustainable resource and sustainable development.

		10.2	Describe the following processes: (i) sustainable logging, (ii) sustainable fishing, and (iii) sustainable agriculture.
		10.3	Evaluate the need for sustainable management of natural resources.
		10.4	Explain the need to conserve fossil fuels.
		10.5	Describe strategies that can be implemented to reduce the use of fossil fuels including, (i) efficient combustion, (ii) reduction of wastage, (iii) provision of alternatives transport, (iv) use of renewable resources for energy production, and (v) recycling of named wastes.
		10.6	Outline the process involved in sewage treatment.
		11	Understand endangered species and conservation.
		11.2	Explain why organisms have become endangered or extinct.
		11.3	Describe the effect of reduced populations leading to less genetic variation in a species.
		11.4	Describe how endangered species are conserved, by way of: (i) zoos, (ii) natural parks, (iii) nature reserves, (iv) seed banks, (v) breeding in captivity programs, (vi) increased education and community programs, and (vi) NGO's.
		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) NGO's.
		11.6	Explain the need for conservation of species.

12	Biotechnology and genetic engineering		
Aim			
The aim of this subject content is to enhance understanding of biotechnology and genetic engineering.			
Learning Outcomes - The learner will:		Assessment Criteria - The learner can:	
1	Understand biotechnology and genetic engineering	1.1	Define the term 'genetic engineering'.
		1.2	Describe how bacteria is useful in biotechnology and genetic engineering
		1.3	Describe the role of yeast in bread making
		1.4	State the anaerobic respiration process in yeast to produce ethanol and biofuels.
		1.5	Describe the use of enzymes in the following scenarios: (i) extraction of fruit juice, (ii) biology washing powders, and (iii) production of lactose free products.
		1.6	Describe the purpose of a fermenter.
		1.7	Explain the components of a fermenter in maintaining internal conditions for optimum conditions of microbial growth.
		1.8	Describe how fermenters can be used in the production of penicillin
		1.9	Describe 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.
		1.10	Describe the process of genetic modification, specifically (i) restriction enzymes, (ii) plasmid, (iii) ligase, (iv) recombinant DNA, and (v) transgenic organism.
		1.11	Discuss the advantage and disadvantages of genetic engineering.

APPENDIX

MATHEMATICAL REQUIREMENTS

Calculators may be used in all parts of the examination.

Candidates should be able to:

1. Complete equations involving addition, subtraction, multiplication, and division
2. Calculate percentages
3. Calculate percentage change
4. Manipulate a range of formula to identify the unknown variable.
5. Carry out unit conversions
6. Judge appropriate orders of magnitude and scale
7. Calculate surface area and volume of a range of shapes circle, square, rectangle and triangle
8. Estimate values based on trends / sequences
9. Apply standard form to data
10. Able to sufficiently round data correctly
11. Provide answers to significant figures
12. Present values in line with equipment measurements e.g., 1.1cm^3 for a burette
13. Calculate energy efficiency
14. Calculate mean, mode and median
15. Calculate probability
16. Understand ratios.

SAFETY IN THE LABORATORY

Candidates should be able to:

1. Identify relevant hazards and associated risks of equipment used
2. Identify relevant hazards and associated risks chemicals used
3. Carry out practical procedures carefully and thoroughly applying good practice
4. Individual core practical hazards and risks can be found at <https://www.cleapss.org.uk/> (Members only)

The safety of candidates and staff are the responsibility of the centre involved, full guidance can be found on <https://www.cleapss.org.uk/> (Members only).