MINISTRY OF PRIMARY AND SECONDARY EDUCATION

ZIMBABWE

BIOLOGY SYLLABUS

FORMS 5 and 6
(2015 – 2022)

Curriculum Development Unit
P. O. Box MP 133
Mount Pleasant
HARARE

ACKNOWLEDGEMENTS

The Ministry of Primary and Secondary Education would like to acknowledge contributions made by the following towards the development and production of this syllabus:

- The National Biology Syllabus Panel
- Zimbabwe School Examinations Council(ZIMSEC)
- Government Departments
- Ministry of Higher and Tertiary Education, Science and Technology Development
- UNICEF
- UNESCO

TABLE OF CONTENTS

Contents

10 PREAMBLE

1.1 INTRODUCTION

The Biology Syllabus is designed for learners in Forms 5 and 6. The learners are expected to acquire theory, practical, research and problem solving skills. The syllabus will enable learners to appreciate the local flora and fauna and to utilize them sustainably for their own development and for the development of the nation at large. It encourages research on contemporary issues related to Biology as well as use of several tools of Information and Communication Technology (ICT).

1.2 RATIONALE

This syllabus empowers learners to employ biological skills in solving real life problems and also emphasizes the link between human activities and the environment. Students acquire knowledge and skills of inquiry that help them to examine critical issues that arise in their own lives and in the public domain, to contribute to debate and make informed decisions about their own health and well-being and that of the society. The skills will be learnt through practical application and understanding of biological concepts. The syllabus enables learners to cherish team work, to be innovative, enterprising and self-reliant leading to the socio-economic development of the nation.

1.3 SUMMARY OF CONTENT

This syllabus covers theory and practical skills in the following broad branches of Biology: Biochemistry, Cell Biology, Microbiology, Genetics, Biotechnology, Anatomy, Physiology, Human Health and Disease, Ecology and Biodiversity.

1.4 ASSUMPTIONS

The syllabus assumes that learners:

- have studied and passed Sciences and Mathematics at form 4
- can use appropriate apparatus to perform a given task
- have developed an awareness and interest in the importance of conservation of the environment
- can integrate concepts and skills learnt from other learning areas in the learning of Biology
- have knowledge on use of ICT tools

1. 5 CROSS- CUTTING THEMES

In order to foster competency development for life and work, the following crosscutting priorities have been taken into consideration:

- Gender and inclusivity
- Environmental issues
- Information and Communication Technology
- Disaster and Risk Management
- Collaboration

- Sexuality, HIV and AIDS
- Animal rights
- Human rights
- Enterprise
- Health Education

2.0 PRESENTATION OF SYLLABUS

The Biology Syllabus is presented as a single document for Forms 5 and 6 with thirteen compulsory topics.

3.0 AIMS

The syllabus aims to:

3.1 develop abilities and skills that enable learners solve day to day challenges and become self-reliant

3.2 provide the basis for further studies in Biological Sciences and other related professional and vocational courses

3.3 develop attitudes of concern for accuracy and precision, innovativeness, objectivity and integrity in the study of Biology

3.4 develop enterprising skills that lead to value addition of natural resources

3.5 develop an awareness of the diversity of life, global environmental issues and understand the need for conservation and its relevance to society

3.6 promote an awareness of the use of Information Technology (IT) for communication as an aid to biological research

3.7 develop an appreciation of health issues in a global context

4.0 SYLLABUS OBJECTIVES

Learners should be able to:

4. 1 apply biological knowledge to solve day-to-day challenges

4. 2 use scientific research methods and techniques for self-reliance

4. 3 demonstrate an understanding of biological knowledge and concepts in novel situations

4. 4 measure with accuracy and precision

4. 5 manipulate numerical and other forms of data

4. 6 design practical experiments and projects to solve problems

4. 7 suggest ways of sustainable use of natural resources for socio economic development

4. 8 explain the importance of conserving biodiversity and the environment

4. 9 use appropriate ICT tools to solve scientific problems

4. 10 demonstrate an understanding of global distribution of diseases

5.0 METHODOLOGY AND TIME ALLOCATION

METHODOLOGY

The syllabus is based upon interactive, multi-sensory, learner centered and practical approaches. Principles of independence, teamwork, completeness and stimulation must be applied to enhance the learning – teaching process. The learners should be allowed to apply their experiences, knowledge, skills and attitudes in the learning of the subject. The following are the suggested methods:

5.1 Experimentation
5.2 Discovery
5.3 Demonstrations
5.4 Problem solving
5.5 Discussions
5.6 e-learning
5.7 Group work
5.8 Educational tours
5.9 Project based learning
5.10 Research
5.11 Observations
5.12 Simulations

TIME ALLOCATION

- For adequate coverage of the syllabus, a time allocation of 12 periods per week is required to adequately cover the syllabus. Each period should be at least 35 minutes long. Four double periods and one block of four periods per week are recommended. Learners should be engaged in at least two Educational Tours (educational visits by students to local and away sites) per year. Participation in at least two Biology seminars and one Science exhibition per year is recommended.

6.0 TOPICS

The syllabus consists of thirteen compulsory topics listed below:

6.1 Cell Structure and Function
6.2 Biological Molecules and Water
6.3 Cell and Nuclear Division
6.4 Genetic Control
6.5 Gene Technology
6.6 Inherited Change and Evolution
6.7 Energetics
6.8 Transport Systems
6.9 Nervous Control
6.10 Sexual Reproduction
6.11 Ecology
6.12 Biodiversity
6.13 Human Health and Disease

7.0 SCOPE AND SEQUENCE

TOPIC	FORM 5	FORM 6
7.1 Cell Structure and Function	• Microscopy • Plant and Animal Cells • Organelles and their functions • Eukaryotic and Prokaryotic cells • Movement of substances into and out of cells	---
7.2 Biological Molecules and Water	• Carbohydrates • Lipids • Proteins • Water	---
7.3 Cell and Nuclear Division	• The Cell cycle • Mitosis • Meiosis	---
7.4 Genetic Control	• Nucleic Acids • Structure and replication of DNA • Protein synthesis	---
7.5 Gene Technology	---	• Insulin Production • Genetic Screening and Finger Printing • Gene Therapy • Benefits and Hazards of Gene Technology • Ethical implications of Gene Technology
7.6 Inherited Change and Evolution	• Nature of Gene • Monohybrid and Dihybrid Crosses	• Natural selection • Artificial selection

7.7 Energetics	• ATP Structure and Synthesis • Photosynthesis • Respiration	---
7.8 Transport Systems	• Structure and Mechanisms of transport systems in plants	• Mammalian circulatory system
7.9 Nervous Control	---	• Need for communication • Action potential • Cholinergic synapse
7.10 Sexual Reproduction	---	• Sexual Reproduction in Plants • Sexual Reproduction in Humans
7.11 Ecology	---	• Levels of ecological organization • Nitrogen cycle • Conservation • Anthropogenic impact on ecosystems
7.12 Biodiversity	---	• Classification • Importance of Biodiversity
7.13 Human Health and Disease	• Drug and substance abuse • Global distribution of Diseases • Immunity	---

FORM 5

8.0 COMPETENCY MATRIX

8.1 TOPIC 1 CELL STRUCTURE AND FUNCTION

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.1.1Microscopy	• Calibrate eyepiece graticule • Draw and determine linear dimensions of specimens • distinguish between magnification and resolution • prepare temporary slides	- calibration and measurement - units of measurement (millimetre, micrometre and nanometre) -magnification and resolution (refer to light and electron microscopes) - wet mounts - staining	• Calibrating eyepiece graticule. • Observing cells using light microscope. • Measuring linear dimensions of specimens. • Discussing the concepts magnification and resolution. • Mounting temporary slides. • Staining wet mounts with appropriate stains.	• Relevant reference materials • ICT tools • Braille software/Jaws • Light Microscope (X4, X10, X40 objective lenses) • Hand lenses • Graticules • Stage micrometers • Stains • Prepared slides
8.1.2 Plant and Animal Cells	• identify plant and animal cells	- Ultra structure of the plant and animal cells	• Observing plant and animal cells. • Drawing plant and animal cells.	• Photomicrographs • Print media • ICT tools • Braille

	• compare plant and animal cells	- Rough and smooth endoplasmic reticula, Golgi body, mitochondria,ribosomes, chloroplasts, cell surface membrane, nuclear envelope, centrioles, nucleus and nucleolus	• Discussing the similarities and differences between plant and animal cells.	software/Jaws • Microscope • Prepared slides • Models
8.1.3 **Organelles and their functions**	• outline the functions of organelles	- Functions of cell organelles listed above	• Discussing functions of cell organelles.	• Photomicrographs • Print media • ICT tools • Braille software/Jaws
8.1.4 Eukaryotic and Prokaryotic Cells	• compare eukaryotic and prokaryotic cells	- Structure of eukaryotic and prokaryotic cells	• Observing and drawing eukaryotic and prokaryotic cells. • Discussing the similarities and differences between the cells.	• Prepared slides • Microscope • Print media • ICT tools • Braille software/Jaws
8.1.5 Movement of substances into and out of cells	• describe and explain the cell surface membrane structure • relate the structure of the membrane to movement of substances into	- Fluid mosaic model including the roles of phospholipids, cholesterol, glycolipids, proteins and glycoproteins - Diffusion - Facilitated diffusion	• Drawing the cell surface membrane. • Identifying the components. • Discussing the functions of parts of the cell surface membrane.	• Print media • Photomicrographs • ICT tools • Braille software/Jaws

	•		• Designing and carrying	•
	• and out of cells	- Osmosis - Active uptake - Endocytosis - Exocytosis	• out experiments to demonstrate osmosis (include serial dilutions).	• Onion • Potatoes • Slides • Microscope • Egg membrane • Visking tubing

8.2 TOPIC 2 BIOLOGICAL MOLECULES AND WATER

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.2.1 Carbohydrates	• carry out tests to identify carbohydrates • describe the formation and breakage of glycosidic bond • describe the synthesis and molecular structure of polysaccharides • relate structures of	- Reducing sugars - Non- reducing sugars - Starch - (Qualitative and Quantitative tests) - Glycosidic bond - Starch - Glycogen - cellulose	• Performing the reducing and non-reducing sugar tests. • Carrying out the starch test. • Illustrating formation and breakage of glycosidic bonds. • Discussing the synthesis and molecular structure of starch, glycogen and cellulose.	• Benedict's solution • Reducing sugars • Non-reducing sugars • Potassium iodide solution • Colorimeters • ICT tools • Braille software/Jaws • models

	polysaccharides to their functions in living organisms		• Observing molecular structures of polysaccharides. • Discussing the link between the structure and the function of each polysaccharide.	
8.2.2 Lipids	• identify lipids in different substances • describe the molecular structures of a triglyceride and a phospholipid • relate the structures of triglycerides and phospholipids to their functions in living organisms	- emulsion test - triglycerides - phospholipids	- Carrying out the emulsion test. - Illustrating the molecular structures of a triglyceride and a phospholipid. - Observing the molecular structures - Discussing the relationship between structures and functions.	• Lipids • Alcohol • ICT tools • Braille software/Jaws • Models
8.2.3 Proteins	• Identify proteins in different food substances • describe the structure of an amino acid • outline the	- Biuret test - Amino acid structure - Peptide Bond - Dipeptides - Polypeptides	- Carrying out the Biuret test for proteins. - Observing the molecular structure of amino acid. - Demonstrating peptide bond	• Biuret reagents • ICT tools • Braille software/Jaws • Print media • Models (buttons/beads

	formation and breakage of a peptide bond • explain the meaning of the terms primary, secondary, tertiary and quaternary structures of proteins • describe the types of bonds which hold the protein molecules in shape • describe the molecular structures of haemoglobin and collagen • relate the structures of haemoglobin and collagen to their functions in living organisms • explain the mode of action of enzymes	- Primary, Secondary, Tertiary, Quaternary structures - Hydrogen, ionic, disulphide and hydrophobic interactions - Haemoglobin - Collagen - Lock and key hypothesis - Induced fit hypothesis - Enzyme catalyzed reactions	formation and breakage. - Illustrating structures of proteins. - Discussing the various bonds in proteins. - Making models of haemoglobin and collagen. - Discussing the relationship between structure and function. - Constructing models to demonstrate the mode of action of enzymes. - Measuring the rate of formation of	threads) • Catalase • Amylase • Substrates

	• follow the progress of an enzyme catalyzed reaction • explain factors affecting rate of enzyme catalysed reactions • explain the effect of competitive and non – competitive inhibitors on enzyme activity	- Effects of temperature, pH, enzyme concentration and substrate concentration - Reversible and non- reversible inhibition Inhibitors such as heavy metals (cyanide, mercury), insecticides	products or rates of disappearance of substrates. - Carrying out experiments to show effects of the factors on the rate of reactions. - Demonstrating effects of inhibitors on enzyme catalysed reactions.	• Buffers • Acids and bases • Inhibitors • Models of enzymes
8.2.4 Water	• describe the structure and properties of water	- Structure of a water molecule - Physical and chemical properties of water - Roles of water in	- Constructing a water molecule model. - Performing experiments illustrating various properties of water. - Visiting water	• ICT tools • Braille software/Jaws • Models

	• explain the roles of water in living organisms and as an environment	living organisms	bodies. - Discussing the roles of water in living organisms.	

8.3 TOPIC 3 CELL AND NUCLEAR DIVISION

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.3.1 The Cell Cycle	• outline the cell cycle • describe interphase	- Interphase - Mitosis - Cytokinesis - Growth - DNA replication	• Illustrating the cell cycle. • Outlining DNA replication.	• ICT tools • Braille software/Jaws • Print media
8.3.2 Mitosis	• describe the behaviour of chromosomes, nuclear envelope, cell membrane, centrioles and spindles during	- Prophase - Metaphase - Anaphase - Telophase	• Observing behavior of chromosomes in a root tip squash • Drawing of diagrams showing	• Onion root tips • Microscope • Stains • Prepared slides • ICT tools • Braille

	mitosis • distinguish between cytokinesis in plants and animals • explain the importance of mitosis • identify factors that increase chances of cancerous growth • outline the stages involved in the development of cancer	- Cytokinesis - Growth - Repair - Asexual reproduction - Production of genetically identical cells - Carcinogens - Mutations - Radiation - Uncontrolled cell division	phases of mitosis. • Discussing cytokinesis in plant and animal cells. • Discussing the importance of mitosis. • Discussing factors associated with cancerous growth. • Watching and analysing cancer video clips.	software/Jaws • Print media • Cancer video clips
8.3.3 Meiosis	• explain the meanings of the terms haploid, diploid and homologous chromosomes • Describe the behaviour of chromosomes, nuclear	- Haploid - Diploid - Homologous - Chromosomes - Interphase	• Illustrating haploid cells, diploid cells and homologous chromosomes. • Observing	• ICT tools • Braille software/Jaws • Print media

	envelope, cell membrane, centrioles and spindles during meiosis • discuss the importance of meiosis • compare and contrast mitosis and meiosis	- Meiosis I - Meiosis II - Cytokinesis - Gamete formation - Genetic variation - Similarities and differences between mitosis and meiosis	behaviour of chromosomes during pollen grain formation • Drawing of diagrams showing phases of meiosis. • Discussing the importance of meiosis. • Discussing the similarities and differences.	• Microscope • Prepared slides • Flowers

8.4 TOPIC 4 GENETIC CONTROL

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.4.1 Nucleic Acids	• describe the structure of a nucleotide • describe formation of	- Nucleoside - Nucleotide - Dinucleotide - Phosphodiester	• Illustrating the structure of a nucleotide. • Demonstrating the	• Models • ICT tools • Braille software/Jaws

	a dinucleotide • distinguish between Ribonucleic acid (RNA) and Deoxyribonucleic acid (DNA) nucleotides	bonds - RNA nucleotides - DNA nucleotides	formation of a phosphodiester bond. • Discussing the differences. between RNA and DNA nucleotides.	
8.4.2 Structure and replication of DNA	• describe the structure of DNA • explain how DNA replicates	- DNA structure - semi - conservative replication of DNA - Messelson and Stahl experiment	• Constructing models of DNA. • Making DNA models illustrating replication.	• ICT tools • Braille software/Jaws • Print media • Models (zips, beads, soft wires)
8.4.3 Protein synthesis	• outline the process of protein synthesis	- Transcription - Translation including role of messenger RNA, transfer RNA and ribosomes	• Viewing simulations and videos of protein synthesis.	• ICT tools • Braille software/Jaws

8.5 TOPIC 5 INHERITED CHANGE AND EVOLUTION

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.5.1 Nature of Gene	• discuss the gene concept	- Gene as unit of inheritance	• Discussing the gene concept.	• ICT tools • Braille software/Jaws

				• Print media
8.5.2 Monohybrid and Dihybrid crosses	• use genetic diagrams to solve problems involving monohybrid and dihybrid crosses • use chi – squared test to test whether there is a significant difference or not between observed and expected results	- Co-dominance - Sex linkage - Multiple alleles - Test crosses - Chi – squared test	• Performing genetic crosses. • Demonstrating genetic crosses using beads, seeds or pebbles. • Applying the chi-squared test to results obtained from the demonstrations.	• Print media • Seeds • Pebbles • Beads • Scientific calculator • Statistical tables

8.6 TOPIC 6 ENERGETICS

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.6.1 ATP Structure and Synthesis	• outline the need for energy in living	- Anabolic reactions - Active transport	• Discussing uses of energy.	• Print media • ICT tools

	organisms • describe ATP structure as a phosphorylated nucleotide • describe synthesis of ATP by chemiosmosis	- Movement - Maintenance of body temperature - Structure of ATP - Chemiosmosis	 • Illustrating the structure of ATP. • Illustrating the chemiosmosis coupling of ATP synthesis.	• Braille software/Jaws • Model
8.6.2 Photosynthesis	• draw detailed structure of chloroplast • identify chloroplast pigments • discuss the role of chloroplast pigments in absorption and action spectra • describe the photo - activation of chlorophyll	- chloroplast structure - Chloroplast pigments - Absorption and Action spectra - Light dependent reactions (cyclic and non-cyclic photo phosphorylation)	• Drawing and labeling chloroplast. • Separating pigments by paper chromatography. • Collecting different colored leaves. • Finding out other uses of pigments in life. • Analysing absorption and action spectra. • Outlining the light dependent reactions of photosynthesis.	• Print media • Filter paper • Acetone • Different coloured leaves • Leaf extracts • ICT tools • Braille software/Jaws

	• outline the Calvin Cycle • discuss photosynthesis in C_4 plants • discuss the concept of limiting factors	- Light – independent reactions (Calvin Cycle) - Carbon fixation in C_4 plants - Light intensity and wavelength - Carbon dioxide concentration - Temperature	• Illustrating the Calvin Cycle. • Discussing carbon fixation in C_4 plants. • Investigating the effects of limiting factors on rate of photosynthesis.	
8.6.3 Respiration	• Draw detailed structure of mitochondrion • outline the process of glycolysis • describe the formation of acetyl Coenzyme A (CoA) from pyruvate • outline the Krebs Cycle	- Mitochondrion - Glycolysis - Link reaction - Krebs Cycle - Decarboxylation	• Drawing and annotating mitochondrion. • Outlining the process of glycolysis. • Discussing the conversion of pyruvate to acetyl CoA. • Illustrating the steps in the conversion of citrate to	• ICT tools • Print media • Braille software/Jaws

	• explain decarboxylation and dehydrogenation in relation to the link reaction and the Krebs cycle • describe the process of oxidative phosphorylation in the mitochondrion • outline the process of anaerobic respiration in plant/ yeast and animal cells • design experiments to compare rates of fermentation • explain the relative energy values of carbohydrates, lipids and proteins as respiratory substrates	- Dehydrogenation - Election transport chain - Role of oxygen - Role of Nicotinamide Adenine Dinucleotide (NAD) - Anaerobic respiration - fermentation - Carbohydrates - Proteins - Lipids - RQ - Effect of temperature on respiration rates	oxaloacetate. • Discussing the processes of decarboxylation and dehydrogenation • Discussing oxidative phosphorylation. • Discussing anaerobic respiration. • Designing and carrying out experiments to compare rates of fermentation. • Performing experiments to determine energy values. • Designing and carrying out	• Yeast • Sucrose/Glucose • Food samples • Respirometer

	define the term Respiratory Quotient (RQ) • calculate RQ		experiments using simple respirometers to measure RQ. • Calculating RQ.	• Small animals such as beetles, harurwa caterpillars, amacimbi • Water bath • Incubator

8.7 TOPIC 7 TRANSPORT SYSTEMS

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.7.1 Structure and mechanisms of transport systems in plants	• describe the structures of the xylem vessels, sieve tube elements and companion cells	- Structure and adaptations of xylem vessels, sieve tube elements and companion cells	• Examining fresh monocotyledonous and dicotyledonous plant roots and stems. • Drawing cross sectional diagrams of monocot and dicot plant roots and stems.	• microscope • Slides • Prepared slides • Staining dyes • Microtome • ICT tools • Braille software/Jaws • Print media • Scalpel blades • Visking tubing • Live plants
	• explain how the xylem vessels and phloem tubes are adapted to their functions		• Discussing adaptations of xylem and phloem.	
	• describe, clearly	- Osmosis - Apoplast	• Discussing the	

	stating the pathways, how water is transported from the soil to the xylem • explain the mechanisms by which water is transported from soil to xylem and from roots to leaves • explain the translocation of sucrose	- Symplast - Vacuolar - Role of the Casparian strip - Osmosis - Root pressure - Transpiration pull - Capillary effect - Mass flow hypothesis	pathways. • Observing effect of root pressure by cutting a stem of a live plant. • Demonstrating mass flow hypothesis.	

8.8 TOPIC 8 HUMAN HEALTH AND DISEASE

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
KEY CONCEPT	**OBJECTIVES Learners should be able to:**	**CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)**	**SUGGESTED LEARNING ACTIVITIES AND NOTES**	**SUGGESTED RESOURCES**
8.8.2 Global distribution of diseases	• discuss the global distribution of diseases	- Malaria - Tuberculosis - Ebola - HIV/AIDS - Cholera - Coronary heart	• Discussing and evaluating epidemiological evidence of diseases. • Visiting clinics.	• Resource person • Print media • ICT tools • Braille software/Jaws

		disease - Sickle cell anaemia		

FORM 6

8.9 TOPIC 1 GENE TECHNOLOGY

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.9.1 Insulin Production	• outline the synthesis of human insulin by bacteria	- Steps involved in the production of human insulin by bacteria	• Illustrating genetic engineering using paper and scissors. • Conducting educational tours to Biotechnology laboratories.	Paper and scissors models • ICT tools • Braille software/Jaws
	• explain the advantages of treating diabetics with human insulin produced by gene technology	- Advantages of human insulin produced by gene technology in treating diabetes	• Discussing the advantages of use of insulin from gene technology.	
8.9.2 Genetic Screening and Fingerprinting	• describe how genetic screening is carried out	- Genetic screening	• Discussing how genetic screening is carried out.	• ICT • Braille software/Jaws

	• discuss the roles of genetic screening for genetic conditions and need for genetic counselling • explain the theoretical basis of genetic fingerprinting • outline how the process of genetic fingerprinting is carried out	- Roles of genetic screening - Genetic fingerprinting	• Discussing the roles of genetic screening. • Observing simulations of electrophoresis process. • Discussing genetic fingerprinting.	• Ink pads • Bond paper • Hand lense
8.9.3 Gene Therapy	• outline the basis of gene therapy	- Gene therapy	• Discussing gene therapy.	• ICT tools • Braille software/Jaws
8.9.4 Benefits and hazards of Gene Technology	• explain the benefits and hazards of gene technology	- Gene technology - Its benefits and hazards	• Discussing benefits and hazards of gene technology.	• ICT tool • Braille software/Jaws
8.9.5 Ethical implications of Gene Technology	• discuss the social and ethical implications of gene technology	- Social and ethical implications of gene technology	• Researching and debating on the social and ethical implications of gene technology.	• ICT tools • Braille software/Jaws

8.10 TOPIC 2 INHERITED CHANGE AND EVOLUTION

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.10.1 Natural selection	• explain, with examples, how mutations and environment may affect phenotype • explain, with examples, how environmental factors act as forces of natural selection • explain how natural selection may bring about evolution	- Natural Selection - Mutations - Natural selection - Environmental factors - Evolution	• Discussing how mutations and environment may affect phenotype. • Discussing with examples how environmental factors act as forces of natural selection. • Researching and presenting on how natural selection may bring about evolution.	• Print media • ICT tools • Braille software/Jaws
8.10.2 Artificial selection	• describe one example of artificial selection	- Artificial selection	• Outlining the examples of artificial selection.	• ICT tools • Print media • Braille software/Jaws

8.11 TOPIC 3 TRANSPORT SYSTEMS

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.11.1 Mammalian circulatory system	• identify arteries, veins and capillaries	- Arteries, veins and capillaries	• Recognising the vessels under the light microscope. • Drawing plan diagrams of blood vessels.	• Microscope • Prepared slides • Photomicrographs • ICT tools • Print media • Braille software/Jaws
	• explain the role of haemoglobin in the transportation of oxygen and carbon dioxide	- Transportation of oxygen and carbon dioxide	• Discussing the transportation of oxygen and carbon dioxide.	
	• explain the Bohr effect • explain the significance of the difference in the affinity for oxygen between: i. Haemoglobin and myoglobin ii. Maternal and foetal haemoglobin	- Oxygen dissociation curves - Difference in oxygen affinity between: i. Haemoglobin and myoglobin ii. Maternal and foetal haemoglobin	• Analysing oxygen dissociation curves. • Discussing the differences in oxygen affinity.	
	• describe the cardiac cycle			• Heart models

	• explain how heart action is initiated and controlled • explain the meaning of the terms systolic blood pressure, diastolic blood pressure and hypertension • discuss the long term consequences of exercise on the cardiovascular system	- Cardiac cycle - Pacemaker - Myogenic control - Systolic and diastolic blood pressure - Hypertension - Improved cardiac output - Normal resting pulse rate - Efficient cardiovascular system	• Observing cardiac cycle simulations. • Observing heart initiation simulations. • Measuring blood pressure. • Analysing the results. • Discussing the long term consequences of exercise.	• Sphygmomanometer • Stethoscope • Research tools

8.12 TOPIC 4 NERVOUS CONTROL

KEY CONCEPT	OBJECTIVES Learners should be	CONTENT (ATTITUDES, SKILLS	SUGGESTED LEARNING	SUGGESTED RESOURCES

	able to:	AND KNOWLEDGE)	ACTIVITIES AND NOTES	
8.12.1 Need for communication	• recognise the need for communication systems within living organisms	- Neurones - Need for communication	• Drawing neurones from prepared slides • Discussing the need for communication in living organisms.	• Prepared slides
8.12.2 Action potential	• describe the generation of an action potential • explain the transmission of an action potential along a myelinated neurone • explain the importance of myelin sheath and the refractory period in determining speed of impulse transmission	- Action potential - Resting potential - Myelinated neurone (importance of sodium and potassium ions in the impulse transmission to be emphasized). - Myelin sheath - Saltatory conduction - Refractory period	• Illustrating the generation of an action potential. • Watching simulations on transmission of an action potential. • Demonstrating saltatory conduction in myelinated neurones	• ICT tools • Braille software/Jaws • Print media

8.13 TOPIC 5 SEXUAL REPRODUCTION

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.13.1 Sexual Reproduction in Plants	• describe anther structure and pollen formation • describe ovule development • describe double fertilization • explain the significance of double fertilisation in the embryo sac	- Anther structure - Pollen formation - Ovule development - Double fertilisation	• Discussing anther structure and pollen formation. • Observing and drawing anther structure and pollen grains. • Dissecting flowers. • Observing and drawing the cross section of the ovary. • Discussing ovule development. • Discussing double fertilisation and its significance. • Conducting educational tours to plant breeders.	• ICT tools • Braille software/Jaws • Flowers • Microscope • Slides • Scalpels
8.13.2 Sexual Reproduction in Humans	• recognise the microscopic structure of the ovary and testis	- Structure of the ovary and testis	• Observing the microscopic structures of ovary and testis from	• Mammalian specimens • Models • Microscope

	• describe gametogenesis • explain how gametogenesis is controlled by hormones • explain in detail the role of hormones in the menstrual cycle • describe the process of fertilisation • describe the structure of the placenta • explain the roles of the placenta • discuss contraception and abortion from biological and ethical view points • outline the role	- gametogenesis - hormonal control of gametogenesis - Menstrual cycle and hormones - Capacitation - Acrosome reaction - Cortical reaction - Fertilisation - Structure of the placenta - Transport - Hormonal production - Contraception - Invitro fertilization - Abortion	photomicrographs and prepared slides. • Observing gametogenesis simulations. • Outlining the processes of gametogenesis. • Discussing homornal control of gametogenesis. • Interpreting graphical representation of the menstrual cycle. • Observing simulation of fertilization. • Observing and drawing the structure of the placenta. • Observing simulation of the mechanisms in placental transfer. • Debating on biological and ethical viewpoints. • Discussing the role of hormones.	• Prepared slides • Photomicrographs • ICT • Braille software/Jaws • Print media

	of hormones in pre-menstrual tension, replacement therapy and menopause	- Role of hormones		

8.14 TOPIC 6 ECOLOGY

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.14.1 Levels of Ecological Organisation	• define the terms used to describe levels of ecological organisation	- Species - Habitat - Population - Niche - Community - ecosystem	• Explaining the terms. • Stating examples of each of the terms.	• print media
8.14.2 Nitrogen Cycle	• outline the nitrogen cycle	- Nitrogen cycle - Roles of: - nitrogen – fixing bacteria (*Rhizobium*) - nitrifying bacteria *(Nitrosomonas* and *Nitrobacter)* - denitrifying bacteria (*Pseudomonas* and *Clostridium)*	• Illustrating the nitrogen cycle. • Observing leguminous root nodules.	• Print media • ICT tools • Braille software/Jaws • legumes

8.14.3 Anthropogenic Impact on Ecosystems	• describe the effects of human activities on ecosystems	- Human settlement - Deforestation - Industrial activities - Agricultural activities - Mining - Global warming - Invasive plant species	• Discussing the human activities that affect the ecosystems. • Carrying out case studies.	• Ecosystems • ICT tools • Braille software/Jaws
8.14.4 Conservation	• explain, using specific examples, how conservation may involve preservation, management and reclamation • discuss the conservation of the African Elephant *(Loxodonta africana)* and the White Rhinoceros (*Ceratotherium simum)*	- conservation - role of Environmental Management Agency (EMA) and CAMPFIRE - The African Elephantand White Rhinoceros - Population numbers - Reasons for concern, measures introduced - International co-operation, conflict of interests	• Discussing the concept of conservation. • Evaluating trends in the population numbers of the African Elephant and White rhinoceros. • Researching on other endandered species. • Discussing economic implications to Zimbabwe.	• ICT tools • Braille software/Jaws • Environmental Management Act

			• Conducting Educational Tours.	

8.15 TOPIC 7 BIODIVERSITY

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.15.1 Classification	• identify organisms using diagnostic	- Diagnostic features of the five Kingdoms	• Observing organisms.	• ICT tools • Braille software/Jaws

	features of the five Kingdoms • use diagnostic features to divide kingdoms into phyla • state the taxonomic hierarchy • observe the rules of binomial nomenclature	- Diagnostic features of phyla - Kingdom - Phyla - Class - Order - Family - Genus - Species - Binomial nomenclature - Genus and species names	• Classifying organisms into the five Kingdoms. • Collecting and classifying organisms. • Outlining the taxonomic hierarchy. • Discussing the rules of binomial nomenclature.	• Samples of organisms • Dichotomous key
8.15.2 Importance of Biodiversity	• describe the socio-economic importance of the five Kingdoms	- socio-economic importance of I. Kingdom Prokaryotae o fermentation o bio-technology o food spoilage o decompositio n	• Discussing the socio-economic importance of the five kingdoms.	• ICT tools • Brail software/Jaws

		II. Kingdom Protista o *Plasmodium sp* - malaria o *Schistosoma sp* – schistosomiasis o *Trypanosoma sp* - Trypanosomiasis III. Kingdom Fungi o Fermentation o Penicillin production o Decomposition o Food spoilage o Food IV. Kingdom Plantae o Producers o Carbon sink o Timber o Medicinal		

		use o Tourism V. Kingdom Animalia o Tourism o Food o Hunting o Leather o Fishing		

9.0 ASSESSMENT

9.1 Scheme of Assessment

Forms 5 and 6 Biology assessment will be based on 30% continuous assessment and 70% summative assessment.

The syllabus' scheme of assessment is grounded in the principle of equalisation of opportunities hence does not condone direct or indirect discrimination of learners.
Arrangements, accommodations and modifications must be visible in both continuous and summative assessments to enable candidates with special needs to access assessments and receive accurate performance measurement of their abilities. Access arrangements must neither give these candidates an undue advantage over others nor compromise the standards being assessed.
Candidates who are unable to access the assessments of any component or part of component due to disability (transitory or permanent) may be eligible to receive an award based on the assessment they would have taken.
NB For further details on arrangements, accommodations and modifications refer to the ZIMSEC Assessment Procedure Booklet.

a) Continuous Assessment

Continuous assessment for Forms 5 and 6 will consist of practical tests, written theory tests and a project.

Practical tests

These are practical tests that teachers give to learners individually once a term. The tests should cover manipulation of apparatus, following procedures, result collection, presentation, analysis and evaluation. A practical test consists of 100% skill C.

i) Written Tests

These are tests set by the teacher to assess the concepts covered during a term. The tests consist of multiple choice, structured and free response questions. Each test consists of 50% skill A and 50% skill B.

ii) End of course Project

Learners should have a project that will be assessed at the end of the course. The project can be set at school/district/provincial level but innovative learners should be allowed to come up with their own projects. The project consists of 70% skill C and 30 % skills A and B.

Summary of Continuous Assessment Tasks

In Terms 1 to 5, candidates are expected to have done at least the following recorded tasks:

- 5 practical tests
- 5 written theory tests
- 1 project

Detailed Continuous Assessment Tasks Table

Term	Practical tests	Written Tests	Project	Total
1	1	1		
2	1	1		
3	1	1		
4	1	1		
5	1	1	1	
6	National Examination			
Weighting	10%	10%	10%	30%

SUMMATIVE ASSESSMENT
Assessment Objectives
These describe the knowledge, skills and abilities which candidates are expected to demonstrate at the end of the course. They reflect those aspects of the aims which will be assessed.

Skill A: Knowledge with understanding

Candidates should be able to demonstrate knowledge and understanding in relation to:
1. biological phenomena, facts, laws, definitions, concepts, theories;
2. biological vocabulary, terminology, conventions (including symbols, quantities and units);
3. scientific instruments and apparatus used in biology, including techniques of operation and aspects of safety;
4. scientific quantities and their determination;
5. biological and technological applications with their social. economic and environmental implications.

The syllabus content defines the factual materials that candidates need to recall and explain. Questions testing the objectives above will often begin with one of the words: define, state, name, describe, explain, outline or suggest..

Skill B: Handling information and solving problems

Candidates should be able to use oral, written, symbolic, graphical and numerical material to:
1. locate, select, organise and present information from a variety of sources;

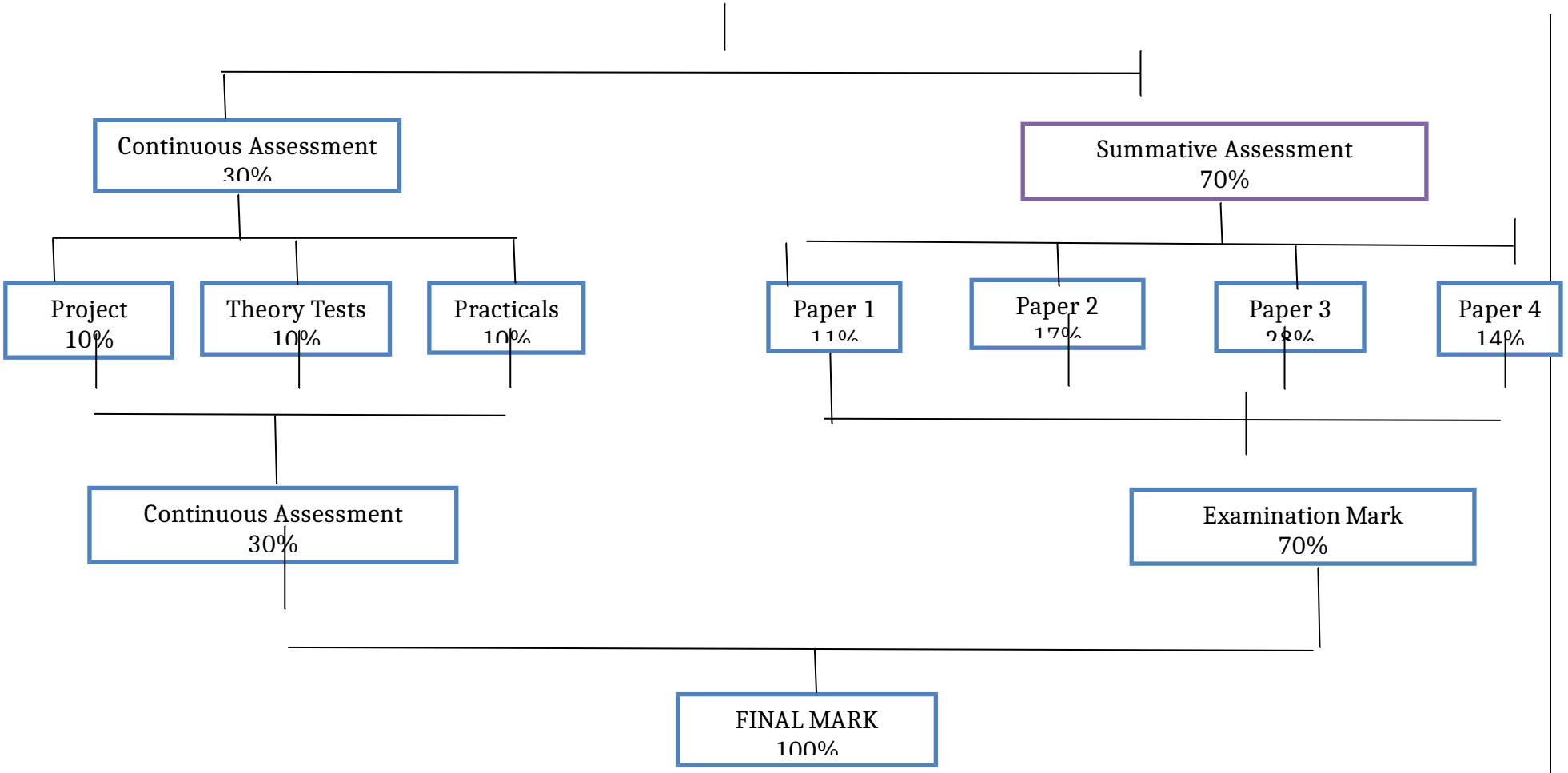
2. translate information from one form to another;
3. manipulate numerical and other data;
4. use information to identify patterns, report trends and draw inferences;
5. present reasoned explanation for phenomena, patterns and relationships;
6. make predictions and propose hypotheses;
7. apply knowledge, including principles, to novel situations;
8. solve problems.

Skill C. Experimental skills and investigations
candidates should be able to:
1. follow a sequence of instruction;
2. use techniques, apparatus and materials;
3. make and record observations, measurements and estimates;
4. interpret and evaluate observations and experimental data;
5. devise and plan investigations, select techniques, apparatus and materials;
6. evaluate methods and techniques, and suggest possible improvements.

SCHEME OF ASSESSMENT

Paper	Type of paper	Duration	Marks	Weighting
1	Multiple choice	1 Hour	40	11%
2	Theory- structured	1 Hour 30 minutes	60	17%
3	Theory- short free response essay type	2 Hours	100	28%
4	Practical test	2 Hours 30 minutes	50	14%

ASSESSMENT OF LEARNER PERFORMANCE IN FORM 5 AND 6 BIOLOGY
100%



WEIGHTING OF ASSESSMENT OBJECTIVES

	Assessment Objective	Marks

Paper 1		
Knowledge and comprehension	**A**	**18**
Handling information and solving problems	**B**	**22**
Paper 2		
Knowledge and comprehension	**A**	**25**
Handling information and solving problems	**B**	**35**
Paper 3		
Knowledge and comprehension	**A**	**40**
Handling information and solving problems	**B**	**60**
Paper 4		
Experimental skills and investigations	**C**	**50**

PAPER 1 (1 Hour - 40 marks)
This paper consists of 40 multiple choice questions. All questions will be of the direct choice type with four options. Candidates attempt all questions.

PAPER 2 (1Hour 30 minutes - 60 marks)
This paper consists of a variable number of structured questions which are compulsory.

PAPER 3 (2 Hours - 100 marks)

This paper consists of seven (7) short essay type questions. Candidates are to answer five (5) questions. Each questions carries twenty (20) marks.

PAPER 4 (2 Hours 30 minutes - 50 marks)
This paper will be a practical test set and marked by ZIMSEC. The question paper will include experiments and investigations. This paper consists of three compulsory questions of variable marks. Candidates will be expected to show evidence of the following skills in the handling of familiar and unfamiliar biological material:

- Planning
- Implementing

- Interpreting, concluding and evaluating

Where unfamiliar materials/techniques are required, full instructions will be given.
Observation may be made using a microscope and/or a hand lens.
Questions involving an understanding of the use of chi- squared test may be set, but detailed computation of these tests will not be required in the examination.
Candidates will be expected to show evidence of the following skills:

- Implementing skills

(a) Carrying out experimental work in a methodical and organised way with due regard for safety and living organisms.
(b) Using apparatus and materials in an appropriate way.
(c) Making and recording:
(i) accurate and detailed observations including low power and high power drawings of a specimen.
(ii) measurements to the appropriate degree of precision allowed by the apparatus.

- Interpreting, concluding and evaluating skill

(a) Assessing the reliability and accuracy of experimental data and techniques by identifying and assessing errors.
(b) Applying knowledge to explain and interpret experimental results to reach valid conclusions.
(c) Communicating information, results and ideas in clear and appropriate ways, including tabulation, line graphs and continuous prose.

NOTE: Examination questions on all papers may be set requiring candidates to apply knowledge to novel situations.

SPECIFICATION GRID

TOPIC	Paper 1		Paper 2		Paper 3		Paper 4
	Skill A	Skill B	Skill A	Skill B	Skill A	Skill B	Skill C
Cell structure and function							
Biological molecules and water							

Cell and nuclear division							
Genetic control							
Gene Technology							
Inherited change and evolution							
Energetics							
Transport systems							
Nervous control							
Sexual Reproduction							
Ecology							
Biodiversity							
Human health and disease							
TOTAL MARKS	18	22	25	35	40	60	100

10.0 GLOSSARY OF TERMS

The syllabus hopes that the glossary (which is relevant only to Biology) will be helpful to candidates as a guide, although it does not cover every command word that might be used in Biology exams. We have deliberately kept the glossary brief, both in numbers of terms included and also in the descriptions of their meanings. Candidates should be aware that the meaning of a term must depend, in part, on its context.

1. Define (the term(s)…): only a formal statement or equivalent paraphrase is required.

3. State: give a concise answer with little or no supporting argument (for example, a numerical answer that can easily be obtained ‘by inspection’).

4. List: give a number of points, generally each of one word. Do not give more points than the number specified.

5. (a) Explain: this may imply reasoning or some reference to theory, depending on the context. It is another way of asking candidates to give reasons for. The candidate needs to make sure that the examiner is told why something happens.

(b) Give a reason/Give reasons: this is another way of asking candidates to explain why something happens.

6. (a) Describe: state in words the key points that can be found from the data or information given in a graph, table or diagram. Where possible, the candidate should refer to numbers taken from the

material.

(b) Describe a process: give a step by step description of what happens during the process.

Describe and explain may be used together, as may state and explain.

7. Discuss: the candidate should give a critical account of the points involved in the topic.

8. Outline: the candidate should be brief, restricting the answer to giving essentials, without supporting details.

9. Predict: the candidate should produce the required answer by making a logical connection between other pieces of information. The question may provide this information, or the information may depend on answers calculated in an earlier part of the question. The answer should be concise, with no supporting statement required.

10. Deduce: the candidate should follow the guidance for predict, but a supporting statement is also required: for example, reference to a law, a principle or the necessary reasoning should be included in the answer.

11. (a) Suggest: this may imply that there is no single correct answer (for example, in biology, there are a number of factors that might limit the rate of photosynthesis in a plant in a greenhouse).

(b) Suggest: this may also imply that the candidate must apply their general knowledge and understanding of biology to a ‘novel’ situation, one that may not formally be ‘in the syllabus’. Many

data-response and problem-solving questions are of this type.

12. Find: a general term that can be interpreted as calculate, measure, determine, etc.

13. Calculate: a numerical answer is required. In general, working should be shown, especially where two or more steps are involved. The candidate should give suitable units where possible.

14. Measure: this implies that a suitable measuring instrument will give the quantity in question: for example, length, using a rule, or mass, using a balance. The candidate should give suitable units where possible.

15. Determine: this often implies that the quantity in question cannot be measured directly but must be found by calculation, placing measured or known values of other quantities into a standard formula.
It may also be used when the candidate must carry out a procedure to find a numerical answer.
For example, the candidate might be asked to find the energy absorbed by a plant and calculate its efficiency.

16. Estimate: the candidate should give a reasoned order of magnitude statement or calculation of the quantity in question, making any necessary simplifying assumptions about points of principle and about the values of quantities not otherwise included in the question.

17. Show: the candidate must make an algebraic deduction to prove a given equation. The candidate must make sure to state clearly the terms being used.

18. (a) Sketch, when applied to graph work: this implies that the shape and/or position of the curve only needs to be qualitatively correct. However, the candidate should be aware that, depending on the context, some quantitative aspects may be looked for, such as passing through the origin or having an intercept, asymptote or discontinuity at a particular value. On a sketch graph, the candidate must show clearly what is being plotted on each axis.

(b) Sketch when applied to diagrams: this implies that simple, freehand drawing is allowed. However, the candidate should take care over proportions and should show important details clearly.

19. Compare: the candidate must give both the similarities and differences between things or concepts.

20. Recognise: the candidate should identify facts, characteristics or concepts that are relevant and/or appropriate to understanding a situation, event, process or phenomenon.

21. Classify: the candidate should group things based on common characteristics.

In all questions, the number of marks are shown on the examination paper and candidates should use these as a guide to how much detail to give. When describing a process, the candidate should use the number of marks to decide how many steps to include. When explaining why something happens, the candidate should use the number of marks to decide how many reasons to give, or how much detail to give for each reason.

22. Evaluate: to judge the value or condition of something in a careful and thoughtful way