ZIMBABWE

MINISTRY OF PRIMARY AND SECONDARY EDUCATION

BIOLOGY SYLLABUS

FORMS 3 - 4

2015 - 2022

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ACKNOWLEDGEMENT

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

- Panelists for Form 3 and 4 Biology syllabuses
- Zimbabwe School Examinations Council (ZIMSEC)
- Government Departments
- Ministry of Higher and Tertiary Education, Science and Technology Development
- United Nations Children's Fund (UNICEF)
- United Nations Educational Scientific and Cultural Organization(UNESCO)

CONTENTS

1.0 PREAMBLE

1.1. Introduction

The Biology Syllabus is designed for learners in Forms 3 and 4. The learners are expected to acquire theory and practical skills as well as develop cognitively, emotionally, physically and socially. The syllabus aims at balancing knowledge, understanding and practical skills in order to produce effective learners. The content provides a firm foundation for careers such as in Medicine, Food Technology, Biotechnology and Environmental Science.

1.2. Rationale

Biology is the study of the dynamic relationships between living things, their interdependence, their interactions with the non-living environment and the processes that maintain life and ensure its continuity. This syllabus encourages learners to employ biological skills in solving real life problems and also emphasizes the link between human activities and the environment. Learners acquire knowledge and skills of inquiry that help them to critically examine issues that arise in their own lives and in the public domain. The skills will be acquired through understanding of biological concepts and practical application. It is therefore important that the learners be afforded an opportunity to study Biology as they prepare for self-reliance and future careers.

1.3. Summary of Content

The content covered by this syllabus includes theory and practical skills in the broad areas of Biology such as Biochemistry, Cytology, Anatomy, Physiology, Genetics, Ecology, Systematics, Health and Disease.

1.4 Asumptions

The syllabus assumes that learners have:

- acquired skills in handling apparatus
- learnt about the hazards and safety precautions during experiments
- knowledge of the basic concepts of Biology
- developed an awareness of and interest in the conservation of the environment
- a basic understanding of health and disease issues

1.5 Cross- Cutting Themes

In order to foster competency development for further studies, life and work, the following cross-cutting priorities have been taken into consideration:

- Gender and inclusivity
- Environmental issues
- Information and Communication Technology Tools
- Children's Rights and Responsibilities
- Disaster Risk Management
- Life Skills
- Collaboration
- Sexuality, HIV and AIDS
- Respect for life
- Heritage studies

2.0 PRESENTATION OF SYLLABUS

The Biology syllabus is presented as a stand-alone document with content to be covered in Forms 3 and 4.

3.0 AIMS

The syllabus aims to help learners:

3.1 appreciate the contribution of Biology to the sustainable socio-economic development of the country
3.2 develop practical skills such as accuracy, objectivity, integrity and enquiry
3.3 develop good practices for health and safety
3.4 apply scientific method in solving everyday life challenges
3.5 recognise that the study and practice of Biology are inter-related.
3.6 appreciate that the study and practice of Biology are subject to economic, technological, social, political, ethical and cultural influences
3.7 develop an interest in caring for the local and global environment

4.0 SYLLABUS OBJECTIVES

Learners should be able to:

4.1 demonstrate knowledge of biological terms, laws, facts, concepts, principles, theories and phenomena

4.2 use appropriate technological instruments to collect and analyse data
4.3 conduct experiments using the scientific methods of enquiry
4.4 apply health and safety precautions in everyday life
4.5 draw biological diagrams in two dimension
4.6 carry out simple scientific calculations
4.7 translate information from one form to another
4.8 draw logical conclusions based on the examination of evidence
4.9 communicate information logically and concisely
4.10 apply biological principles in solving problems and understanding new situations
4.11 identify the practical constraints affecting biological investigations
4.12 use biological principles, methods and techniques in value addition
4.13 explain the effects of technological applications on the environment
4.14 interpret the relationship between living organisms and their environment

5.0 METHODOLOGY AND TIME ALLOCATION

5.1 Methodology

The syllabus is based upon interactive, multi-sensory, learner centered and practical approaches. Principles of individuality, team work, wholeness and stimulation must be applied to enhance the learning and 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:

5.1.1 Experimentation
5.1.2 Discovery
5.1.3 Demonstrations
5.1.4 Problem solving
5.1.5 Discussions
5.1.6 Visual tactile
5.1.7 e-learning
5.1.8 Group work
5.1.9 Educational tours
5.1.10 Project based learning
5.1.11 Case studies
5.1.12 Observations
5.1.13 Simulations

5.2 Time Allocation

For adequate coverage of the syllabus, a time allocation of 8 periods of at least 35 minutes each per week is recommended. Double periods are recommended.

6.0. TOPICS

The syllabus consists of eleven topics

6.1 Branches of Biology
6.2 Chemicals of life
6.3 Cells and cellular activities
6.4 Enzymes
6.5 Plant science
6.6 Animal science
6.7 Microbiology and Biotechnology
6.8 Genetics
6.9 Biodiversity
6.10 Ecosystems
6.11 Health and Disease

7.0. SCOPE AND SEQUENCE

TOPIC		FORM 3	FORM 4
7.1	**Safety, Careers and Branches in Biology**	• Safety in the laboratory • Branches of Biology • Careers	• Safety labels and symbols
7.2	**Chemicals of life**	• Constituents and identification of : - Water - Carbohydrates - Proteins - Lipids - Nucleic acids	Classification ,chemical structure and uses: - Carbohydrates - Proteins - Lipids - Nucleic acids
7.3	**Cells and cellular activities**	• Plant and animal cell structure • Cell specialization • Cellular transport	
7.4	**Enzymes**	• Nature and properties of enzymes • Mode of action	• Industrial application of enzymes
7.5	**Plant Science**	• Nutrition • Productivity • Transport	• Reproduction • Coordination and response
7.6	**Animal Science**	• Nutrition • Gaseous exchange • Respiration • Transport • Immunity • Sexual reproduction in humans	• Productivity • Homeostasis • Coordination and response • Endocrine system • Skeletal system
7.7	**Microbiology and Biotechnology**	• Characteristics Types and economic importance of microorganisms	• Recombinant Gene Technology
7.8	**Genetics**	• Chromosomes and Genes • Monohybrid inheritance • Mutations	• Variation • Selection
7.9	**Biodiversity**	• Classification	• Threats and conservation measures

7.10 Ecosystems	• Ecosystems • Natural systems • Artificial systems	• Management of ecosystems
7.11 Health and Diseases	• Health • Diseases (Infectious and non-infectious)	• Drug use and abuse

FORM 3

8.0 COMPETENCY MATRIX

8.1 TOPIC 1 SAFETY, CAREERS AND BRANCHES IN BIOLOGY

KEY CONCEPT	LEARNING OBJECTIVES Learner should be asble to	CONTENT (Attitudes, Knowldege and Skills)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.1.1 Safety in the laboratory	• identify causes of accidents in the laboratory • outline laboratory safety rules • perform fire drills • memorise the local emergency numbers • make a fire guard around the laboratory • demonstrate use of the First Aid Kit	• Causes of accidents in the laboratory - Fire - Fumes - Acids and strong bases - Handling of micro organisms - Improper handling of apparatus - Electricity • Laboratory safety rules - Fire drills - Local emergency call numbers	• Identifying causes of accidents in the laboratory. • Listing accidents that may occur during experiments. • Demonstrating proper handling of apparatus. • Discussing electrical hazards. • Discussing laboratory safety rules. • Performing mock fire drills. • Demonstrating emergency call. • Preparing a fire guard around the laboratory. • Demonstrating use of the contents of the First Aid Kit.	• Charts showing electrical hazards • ICT tools • Brail software/Jaws • Fire extinguishers • Fire blankets • Sand buckets • Fire alert bells • Fume cupboards • Goggles and masks • Gloves • First Aid Kit
8.1.2 Branches of Biology	• identify various branches of Biology	• Branches - Cytology - Anatomy - Physiology - Ecology - Genetics - Biotechnology - Microbiology - Zoology - Botany	• Discussing the various branches of Biology	• Relevant reference materials • ICT tools

8.1 TOPIC 1 SAFETY, CAREERS AND BRANCHES IN BIOLOGY

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.1.3 Careers	• list Biology related careers	• Careers such as: - Medicine - Research scientists - Ecologists - Conservationists - Dieticians	• Researching on careers related to various branches of Biology.	• ICT tools • Braille software/Jaws • Career guidance booklet • Resource persons

8.2 TOPIC 2 CHEMICALS OF LIFE

SUB TOPIC	LEARNING OBJECTIVES Learner should be asble to	CONTENT (Attitudes, Knowl-deg and Skills)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
8.2.1 Water	• state the constituent elements of water • describe the chemical structure of water • relate the properties of water to its uses in living organisms and as a habitat for living organisms	• Constituent elements • Chemical structure • Properties - transparent - solvent - high specific heat capacity - reagent • Uses - photosynthesis - solvent - cooling - habitats - reagent	• Naming the constituents of water. • Constructing the model of a water molecule. • Demonstrating the unusual behavior of water when it freezes • Relating the properties of water to its uses in living organisms	• Liquid and frozen water models of a water molecule • ICT tools • Braille software/Jaws
8.2.3 Carbohydrates Proteins, Lipids and Nucleic Acids	• state the constituent elements of carbohydrates, proteins, lipids and nucleic acids	• Constituent elements	• Identifying the constituent elements of carbohydrates, proteins, lipids and nucleic acids	• Iodine solution • Benedict's solution • Biuret solution/sodium hydroxide and copper

8.2 TOPIC 2 CHEMICALS OF LIFE CONTD..

SUB TOPIC	LEARNING OBJECTIVES Learner should be asble to	CONTENT (Attitudes, Knowldeg and Skills)	SUGGESTED NOTES AND ACTIVITIES	SUGGESTED RESOURCES
	• perform tests to identify reducing sugars, non-reducing sugars, proteins and lipids	• Sub-units - Glucose as sub units of starch, cellulose, glycogen - Amino acids as sub-units of proteins - Fatty acids and glycerol as sub-units of lipids - Nucleotides as sub units of nucleic acids • Identification of reducing sugars, non-reducing sugars, starch, proteins and lipids	• Carrying out the following identification tests: - Iodine test for starch - Benedict's test for reducing sugar - Biuret test for proteins - Emulsion/spot test for lipids	sulphate • Hydrochloric acid • Sodium hydrogen carbonate • Ethanol • Water • Filter paper

8.3 TOPIC 3 CELLS AND CELLULAR ACTIVITIES

SUB TOPIC	LEARNING OBJECTIVES Learner should be able to:	CONTENT (Attitudes, Knowldege and Skills)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.3.1 Plant and Animal Cells	• define a cell • identify parts of the cells • outline functions of cell organelles • compare the structures of plant and animal cells	• Structural and functional units • Plant and animal cell structure - Nucleus - Cytoplasm - Cell membrane - Vacuole - Cell wall - Mitochondrion - Chloroplast	• Defining a cell. • Observing cells under the microscope and bioviewers. • Drawing and labeling plant and animal cells. • Comparing the structures of plant and animal cells	• Microscope • Biosets and bioviewers • Print media

8.3 TOPIC 3 CELLS AND CELLULAR ACTIVITIES CONTD..

KEY CONCEPT	LEARNING OBJECTIVES Learner should be able to	CONTENT (Attitudes, Knowldeg and Skills)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.3.2 Cell Specialisation	• identify specialized cells • relate cell structure to function	• Palisade – photosynthesis • Root hair – absorption • Neurone – transmission of impulse • Red blood cell – transport of oxygen • White blood cell – immunity • Muscle cell – contraction • Sperm –fertilization and motility • Ovum – fertilization and food reserve	• Relating cell structure to function • Examining specialised cells using bioviewers, microscopes and photomicrographs. • Drawing labeled specialised cells	• Biosets • Bioviewers • Photomicrographs • Print media • Microscopes • ICT tools • Braille software/Jaws

8.4 TOPIC 4 ENZYMES

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.4.1 Nature and properties of enzymes	• define an enzyme • explain the properties of enzymes	• Biological catalyst • Protein nature and substrate specificity	• Discussing the concept of enzyme • Carrying out experiments to investigate properties of enzymes such as: amylase from germinating rapoko seedling and catalase from fresh plant and animal tissue (N.B. No tissues from human or wild animals)	• Rapoko or any other grain • Fresh tissues from plants e.g. peas beans and potato • Fresh tissue from domestic animals e.g. liver • ICT tools • Braille software/Jaws • Models • Hydrogen peroxide

8.4 TOPIC 4 ENZYMES CONTD..

KEY CONCEPT	LEARNING OBJECTIVES Learner should be able to	CONTENT (Attitudes, Knowldeg and Skills)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.4.2 Mode of enzyme action	• explain enzyme action • investigate factors that affect the rate of enzyme catalyzed reactions	• Mode of action (The lock and key hypothesis) • Factors affecting enzyme activity; - Temperature - pH	• Using models and animations to illustrate the lock and key concept • Investigating effects of temperature and pH on enzyme activity.	

8.5 TOPIC 5 PLANT SCIENCE

KEY CONCEPT	LEARNING OBJECTIVES Learner should be able to	CONTENT (Attitudes, Knowldeg and Skills)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.5.1 Nutrition	• define photosynthesis • State the word equation for photosynthesis • investigate conditions necessary for photosynthesis • explain the importance of photosynthesis in an ecosystem • investigate factors affecting the rate of photosynthesis • relate the structure of the leaf to its function in photosynthesis • investigate gaseous exchange in plants	• Photosynthesis • Word equation • Conditions necessary: chlorophyll, light, carbon dioxide • Fate of end products of photosynthesis • Importance of photosynthesis • Factors affecting the rate of photosynthesis (light intensity, • carbon dioxide	• Describing the process of photosynthesis. • Carrying out controlled experiments to show conditions necessary for photosynthesis • Discussing the fate of end products • Carrying out experiments to show the effects of these factors. • Observing the external structure of leaf.	• Apparatus for starch testing • Potted plants • Iodine solution • Hand lenses • Microscopes • Bioviewers • Lime water / bicarbonate indicator

8.5 TOPIC 5 PLANT SCIENCE CONTD..

KEY CONCEPT	LEARNING OBJECTIVES Learner should be able to	CONTENT (Attitudes, Knowldeg and Skills)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.5.1 Nutrition		• concentration and temperature) • Adaptation of the leaf to photosynthesis • Gaseous exchange in leaves	• Observing prepared slides of leaf internal structure. • Carrying out experiments to demonstrate gaseous in plants.	• Apparatus for starch testing • Potted plants • Iodine solution • Hand lenses • Microscopes • Bioviewers
	• describe the functions of nitrogen phosphorus and potassium on plant growth • describe the effects of deficiencies of nitrogen, phosphorus and potassium	• Mineral Nutrients - Nitrogen (N) – protein synthesis and • chlorophyll formation - Phosphorous (P) – synthesis of ATP and - nucleic acids - Potassium (K) – ion and osmotic balance • Defiency signs - N – stunted growth and chlorosis - P – Stunted root growth and purplish leaf colouring - K – yellow and brown leaf margins and premature death (poor flowering and fruiting)	• Discussing the functions of nitrogen, phosphorus and potassium on plant growth. • Carrying out culture experiments	• Lime water / bicarbonate indicator • ICT tools • Braille software/Jaws • Culture solutions • Plants

8.5 TOPIC 5 PLANT SCIENCE CONTD..

KEY CONCEPT	LEARNING OBJECTIVES Learner should be able to	CONTENT (Attitudes, Knowldeg and Skills)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.5.2 Productivity	• define biomass • define productivity	• Organic content • Increase in biomass overtime	• Carrying out experiments to measure biomass • Discussing productivity in terms of increase in biomass .	• Balances • Ovens • Print media
	• explain factors affecting productivity • define pest	• Factors affecting productivity - Light - Mineral salts - Temperature - Water availability - Pests and diseases	• Discussing factors affecting productivity	
	• identify types of plant pests and diseases • explain how pests and diseases affect productivity	• Pest as an organism which reduces productivity	• Observing plants affected by various pests and diseases • Classifying pests • Discussing effects of plant pests and diseases on productivity.	• School grounds and neighboring fields • Preserved plant pests and affected plants • Resource person
	• describe methods of controlling pests and diseases • outline the advantages and disadvantages of each method	• Pests: - Tissue – eating - Sap-sucking pests • Diseases: - Bacterial wilt - Fungal rust - Reduction of yields • Management, cultural, chemical and biological	• Discussing methods of controlling plant pests and diseases with specific reference to maize, cotton and tobacco	

8.5 TOPIC 5 PLANT SCIENCE CONTD..

KEY CONCEPT	LEARNING OBJECTIVES Learner should be able to	CONTENT (Attitudes, Knowldeg and Skills)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.5.3 Transport	• describe the general structure of a plant • distinguish between monocotyledonous and dicotyledonous plants • identify parts of the internal structure of a young dicotyledonous stem and root • compare internal structure of dicotyledonous stem and root • state the functions of xylem and phloem vessels • define transpiration • describe the functions of transpiration • investigate factors affecting rate of transpiration • describe adaptations of leaves to minimize water loss • describe how wilting occurs • define translocation • describe the effect of ring barking	• External Plant structure • Stem , leaves, flowers ,seeds and roots • Plant stem and root internal structure • Stem: Epidermis, cortex and vascular tissue and pith • Root: Epidermis, cortex, vascular tissue and root hairs • Xylem – support and transport • Phloem – transport • Transpiration • Functions of transpiration - Water and ion movement in xylem - Cooling effect • Factors affecting rate of transpiration - Surface area - Stomata distribution - Temperature - Wind - Humidity - Light intensity • Adaptations - Reduction of surface area - Thickness of cuticle - Distribution of stomata - Presence of hairs • Wilting and its significance • Translocation • effects to plants and the environment	• Educational tour to observe the general structure of plants • Comparing the structures of dicotyledonous and monocotyledonous plants • Observing prepared slides showing internal structures of stem and root • Making labelled drawings of observed structures - Discussing the functions of xylem and phloem • Discussing the concept and functions of transpiration • Carrying out experiments to investigate factors affecting the rate of transpiration. • Demonstrating • transpiration • Observing leaves. • Carrying out experiments to investigate the distribution and role of stomata in water loss. • Observing wilting plants. • Explaining wilting and its significance. • Discussing translocation • Explaining the process of bark ringing. • Explaining the effects of ring barking	• Hand lenses • Maize and bean plants • Maize and bean seeds • Microscopes • Bio viewers and bio sets • Prepared slides • Dyes • Celery plants or spinach • Microscope slides • Bioviewers • Leaves • Vaseline • Transparent plastic bags • Potted plants • Print media • Educational touring

8.6 TOPIC 6 ANIMAL SCIENCE

KEY CONCEPT	LEARNING OBJECTIVES Learner should be able to	CONTENT (Attitudes, Knowldeg and Skills)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.6.1 **Nutrition**	• define balanced diet • list components of a balanced diet • list major sources of nutrients • describe the major functions of nutrients • Test food for presence of nutrients • compare energy content of carbohydrates and lipids • relate food intake to age, sex, activity and health requirements • define malnutrition • discuss causes and effects of malnutrition	• components of a balanced diet • Components of nutrients • Sources of nutrients • Functions of nutrients • Food tests • Energy content • Nutrient requirements • Malnutrition as under nourishment or over nourishment • Under nourishment of - Vitamin A - Vitamin C - Vitamin D - Iron - Calcium - Iodine - Protein • Over nourishment - Fats - Carbohydrates	• Discussing balanced diet • Discussing sources and functions of nutrients NB. On lipids include synthesis of cell membranes • Carrying out case study on nutritional values of locally available foods • Carrying out food tests • Carrying out experiments to measure energy content in food • Discussing the relationship between food intake to age, sex, activity and health requirements. • Discussing malnutrition • Discussing diseases linked to malnutrition. • Discussing effects of taking excess fats, carbohydrates.	• Refer to topic 2 • Carbohydrate and fat- rich foods • Resource persons • ICT tools • Braille software/ Jaws • ICT tools • Braille software/ Jaws • Resource person

8.6 TOPIC 6 ANIMAL SCIENCE CONTD..

KEY CONCEPT	LEARNING OBJECTIVES Learner should be able to	CONTENT (Attitudes, Knowldeg and Skills)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
	• Identify the main regions of the human alimentary canal and associated organs • state functions of parts of the alimentary canal • define mechanical digestion • describe peristalsis • explain the importance of chemical digestion • describe the function of amylase, protease and lipase • explain the roles of hydrochloric acid, rennin and bile • describe structural adaption of small intestines to absorption • describe absorption of end products of digestion • state the function of the hepatic portal vein • state the roles of large intestine	• Human digestive system • Ingestion, digestion, absorption, assimilation and egestion • physical breakdown of food by teeth and muscles • Peristalsis • molecule size and solubility • breakdown of starch, protein and fats • Hydrochloric acid – buffer, destruction of bacteria and hydrolysis • Rennin – clotting of milk • Bile – emulsification of fats • Features of - small intestines: - length - folding, - Villi - thin lining - rich blood supply • Diffusion and active uptake • Transportation of products of digestion to the liver	• Drawing and identifying parts of the digestive system • Discussing functions of the parts of the alimentary canal • Discussing mechanical digestion • Describing peristalsis • Discussing chemical digestion • Carrying out experiments with starch and amylase in visking tubing as a model gut to illustrate chemical digestion and absorption (testing for glucose • Carrying out experiments on hydrolysis, clotting of milk and emulsification of fats • Analysing features of the small intestine • Discussing the role of the hepatic portal vein • Describing roles of the large intestine	• Printed media • Model • A ruminant • ICT tools • Braille software/Jaws • Print media • Starch solution • Visking tubing • Amylase • Thermometer • Benedict solution • Hydrochloric acid, bile, starch, fats and rennin • Printed media • Model of villi

8.6 TOPIC 6 ANIMAL SCIENCE CONTD..

KEY CONCEPT	LEARNING OBJECTIVES Learner should be able to	CONTENT (Attitudes, Knowldeg and Skills)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
		• Absorption of water, vitamin B formation and expulsion of faeces		
	• define assimilation • outline the role of the liver in metabolism	• Use of end products of digestion • Regulation of glucose ami-no acids, breakdown of alcohol, toxins storage of fat, glycogen and vitamin A and D	• Discussing the fate of end products of digestion • Discussing the roles of the liver NB. Details of urea formation not required	• ICT tools • Braille software/Jaws • Model of a tooth • Acid
	• describe types and func-tions of teeth • describe the structure of a tooth	• Types of teeth	• Identifying incisors, canines, premolars and molars	• Tooth or any calcium containing material • Tooth paste • Tooth brush
	• identify causes of tooth decay	• Internal and external struc-tures of teeth	• Identifying the crown neck, root, enamel, dentine and pulp cavity	• Floss • Salt
	• describe the proper care of teeth	• Causes of tooth deca - Action of bacteria on sug-ary food producing acid • Care of teeth - Remove plaque - Neutralizing acid - Destroying bacteria	• Describing causes of tooth decay • Experimenting on action of acid on tooth • Describing different ways of preventing tooth decay	• Ash/soda

8.6 TOPIC 6 ANIMAL SCIENCE CONTD..

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.6.3 Gaseous exchange	respiratory system • state the functions of parts of the respiratory system • describe the mechanisms of breathing • describe the structure and role of the alveoli • describe factors which increase the efficiency of gaseous exchange • state the differences between inhaled and exhaled air • explain the effects of physical activity on breathing and blood circulation • describe effects of smoking on the respiratory system	trachea, bronchi, bronchioles, alveoli and capillaries • Inhalation and exhalation • Structure - large surface area - moist - thin - vascularised • Factors - Diffusion gradient - Thinness - Moisture - vascularisation • Differences in temperature, volume of carbon dioxide, oxygen and water vapour • Depth and rate of breathing • Pulse rate • Short term effects - destruction of cilia - increased mucus production - constriction of the bronchioles • Long term effects - lung cancer - bronchitis	• Discussing functions of parts of the respiratory system • Demonstrating breathing mechanisms using models and animations • Discussing factors which increase efficiency of gaseous exchange • Carrying out experiments to show the differences between inhaled and exhaled air • Measuring of pulse and breathing rates before and after physical activity • Evaluating statistical data linking diseases and smoking	• Printed media • ICT tools • Braille software/Jaws • Lime water/ Bicarbonate indicator • Stop watch • ICT tools • Braille software/Jaws • Print media • Resource person

8.6 TOPIC 6 ANIMAL SCIENCE CONTD..

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
		- emphysema		
8.6.4 Respiration	• define aerobic respiration • state the word equation for aerobic respiration • list uses of energy in the body • define anaerobic respiration • state the word equations for anaerobic respiration in plants and animals • describe the production and effects of lactic acids on muscles during exercise	• Aerobic respiration • Word equation • Uses of Energy • Anaerobic respiration in plants and animals • Word equations • Fatigue • Oxygen debt	• Discussing aerobic respiration • Carrying out experiments to show products of aerobic respiration • Discussing uses of energy in the body • Carrying experiments to show fermentation of sugar by yeast • Demonstrating effects of lactic acids on muscle during exercise	• Seeds • Thermos flask • Thermometer • Fermentation apparatus
8.6.5 Transport	• describe the human circulatory system • state functions of the circulatory system • identify parts of the heart • describe the cardiac cycle	• Heart, vessels, blood and valves • Transport of materials, distribution of heat and immunity • Parts of the heart - Auricles/atria - Ventricles - Vessels - Valves • Cardiac cycle	• describing components of the circulatory system • Discussing transportation of materials, distribution of heat and immunity. • Examining a heart model. • Describing the action of heart muscles and movement of blood.	• Printed media • Models • ICT tools • Braille software/Jaws • Models

8.6 TOPIC 6 ANIMAL SCIENCE CONTD..

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
	• explain the importance of heart valves	• Function of heart valves	**NB. Mentioning the terms diastole and systole not necessary**	
	• relate pressure differences in the dual circulatory system to the functions of the two circuits	• Pulmonary and systemic circulation	• Discussing the importance of heart valves. • Comparing pulmonary and systemic circulations.	
	• relate the structure of blood vessels to their function	• Arteries, veins and capillaries	• Examining blood vessels to compare their structures	• Biosets, bioviewers • Microscopes • Prepared slides
	• identify possible causes of high blood pressure	• Genetic predisposition, stress, lack of exercise and diet	• Discussing possible causes of high blood pressure	
	• identify possible causes of coronary heart disease	• Diet, stress, smoking, obesity and high blood pressure	• Discussing possible causes of coronary heart disease. • Analysing statistics showing the link between life style and occurrence of coronary heart diseases.	• Resource person • ICT tools • Braille software/Jaws
	• state components of mammalian blood and their functions disease • describe the movement of materials between capillaries and tissue fluid	• Components - Red blood cells - White blood cells - Platelets - Plasma • Diffusion and pressure filtration	• Identifying red and white blood cells from prepared slides • Discussing movement of materials between capillaries and tissue fluid by diffusion and pressure filtration.	• Print media • Slides/ photomicrographs
8.6.6 Immunity	• explain how the body	• Skin, tears ,clotting of	• Discussing natural defense	• Print media

8.6 TOPIC 6 ANIMAL SCIENCE CONTD..

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
	protects itself against infection	blood, white blood cells (engulfing action and production of antibodies)	mechanisms.	
	• describe events leading to active immunity	• Infection leading to antibody production • Vaccination	• Discussing natural active immunity and artificial active immunity.	
	• describe events leading to passive immunity	• Transfer of antibodies via placenta , breast milk and serum injection (snake bites and rabies)	• Discussing natural passive immunity andartificial passive immunity.	• Print media
	• describe the effects of the human immunodeficiency virus (HIV) on the body	• Destruction of white blood cells leading to inability to resist infections	• Discussing the effects of HIV on the body.	
	• discuss the significance of immunisation	• Extended programme of immunisation	• Studying the immunisation card.	• Immunisation card • Resource persons
8.6.7 Reproduction in humans	• describe the structure and function of the human reproductive system	• Male and female reproductive systems	• Identifying parts of the reproductive systems. • Drawing and labelling the reproductive systems. • Discussing the functions of parts of the reproductive systems.	• Print media • ICT tools • Braille software/Jaws
	• describe gamete formation	• Sperm and ovum formation	• Discussing formation of gametes **NB. Details of meiosis not required**	
	• compare male and female gametes	• Size, mobility and numbers produced	• Discussing the differences between sperm and ovum.	
	• describe the menstrual cycle	• Changes in uterus lining and ovulation. • Fertile and infertile phases of cycle • Role of oestrogen and progesterone	• Describing the menstrual cycle.	

8.6 TOPIC 6 ANIMAL SCIENCE CONTD..

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
	• outline pathway of sperm from testes to ovum	• Pathway of sperm	• Outlining the pathway of sperm	
	• describe fertilisation	• Fusion of male and female nuclei	• Discussing fertilisation	
	• describe the development of a zygote	• Formation of a ball of cells which becomes implanted in uterine wall • Early development - Organ formation later development – mass increase	•Discussing the development of a zygote **NB. Details of mitosis not required**	
	• describe the role of the placenta	• Passage of - antibodies - nutrients - gases and - excretory products	• Discussing the role of the placenta	
	• describe limitations of the placenta	• Separating foetal from maternal blood	• Discussing limitations of the placenta.	• Resource person
	• describe the role of the amniotic fluid	• Reference to passage of toxins and certain viruses including HIV • Functions - Shock absorber - Preventing temperature fluctuation - Lubrication	• Discussing the role of the amniotic fluid.	
	• explain the dangers of taking drugs during pregnancy	• Dangers of taking drugs during pregnancy (Illicit drugs, smoking and alcohol)	• Discussing the dangers of taking drugs during pregnancy.	
	• explain causes of infertility	• Causes - hormonal - sperm quantity and quality - physical damage by	• Discussing causes of infertility.	

8.6 TOPIC 6 ANIMAL SCIENCE CONTD..

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
		STIs - cancers		
	• outline various methods of contraception	• Natural methods - Abstinence - Withdrawal - Rhythm • Chemical: spermicides • Barriers: condom and diaphragm • Intra-uterine devices (IUDs) • Hormonal : injection and pills • Sterilisation - Vasectomy and tubal ligation	• Discussing reliability, limitations and appropriateness of contraceptive methods	• Resource person
	• identify causative agents of sexually transmitted infections (STI's)	• Causative agents - Bacteria - Virus	• Discussing causative agents of STI's.	
	• describe signs, symptoms and effects of STIs	• Signs and symptoms - Gonorrhea, - Syphilis, - Chancroid - HIV/AIDS - Genital warts - Genital herpes	• Discussing effects on health and fertility of STIs.	
	• discuss the methods by which STIs and HIV may be controlled	• Mutual faithfulness, abstinence and the use of condoms • Contact tracing • Treatment with antibiotics for some STI's	• Discussing the spread of STI's and HIV, incurability of AIDS and the social implications. • Visiting the local clinic or hospital for statistical data	

8.7 TOPIC 7 MICROBIOLOGY AND BIOTECHNOLOGY

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.7.1 Characteristics Types and economic importance of microorganisms	• state the main characteristics of microorganisms • outline the economic importance of microorganisms	• Types of micro organisms - Viruses - Bacteria - Fungi • Role of: - microorganisms in decomposition - (Bioremediation) - yeast in the production of bread and alcohol - bacteria in yoghurt , cheese and insulin production - Fungi in production of penicillin	• Observing structures of microorganisms. • Drawing and labelling the structures. • Discussing the economic importance of microorganisms. • Carrying out educational tours to bakeries, breweries, dairy industries and sewage works.	• Print media, • Microscope slides • ICT tools • Bakeries • Breweries • Dairies • Sewage works

8.8 TOPIC 8 GENETICS

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.8.1 Chromosomes and Genes	• define chromosome • define a gene • explain the major genetic terms	• Chromosome as including a long molecule of DNA • A unit of inheritance • Genetic terms - Allele - Dominant - Recessive - Genotype - Phenotype - Homozygous - Heterozygous	• Discussing the structures of chromosomes and genes. • Explaining genetic terms.	• ICT tools • Braille software/Jaws • Print media

8.8 TOPIC 8 GENETICS CONTD..

KEY CONCEPT	LEARNING OBJECTIVES Learner should be able to	CONTENT (Attitudes, Knowldeg and Skills)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.8.2Monohybrid inheritance	• Describe complete dominance • predict possible outcomes of mono-hybrid crosses • explain codominance	• Dominant and recessive alleles • Homozygous and heterozygous • Phenotypes and genotypes • Genetic Crosses F1 and F2 generations monohybrid ratio • Inheritance of ABO blood groups • Phenotypes groups A, B, AB and O • Gene alleles for blood groups IA, IB, I0 • Sex chromosomes X and Y	• Discussing complete dominance. • Constructing genetic crosses and Punnet squares. • Demonstrating monohybrid crosses. • Constructing genetic crosses. • Discussing and illustrating sex determination in humans.	• ICT tools • Braille software/Jaws • Coloured beads/beans • Print media
8.8.3 Mutations	• describe genetic and chromosomal mutations • discuss factors that increase rate of mutation	• Genetic - Sickle cell anemia - Albinism • Chromosomal - Down syndrome • Factors that increase rate of mutation: - Genetic disposition - Radiation (UV, gamma, alpha, X – rays) - Carcinogens	• Discussing the concept and types of mutations. • Discussing factors that increase the rate of mutation.	• Print media • ICT tools • Braille software/Jaws

8.9 TOPIC 9 BIODIVERSITY

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.9.1 Biodiversity	• state the five kingdoms of living organisms • state characteristic features of the five kingdoms	• Five kingdoms - Prokaryotae/Monera - Protoctista/Protista - Fungi - Plantae - Animalia • Diagnostic features	• Classifying organisms into five kingdoms • Discussing characteristic features of each kingdom	• ICT tools • Braille software/Jaws • Samples of organisms • Print media

8.10 TOPIC 10 ECOSYSTEMS

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.10.1 Ecosystems	• define ecosystem	• A self-contained system of interdependent organisms and their physical environment	• Examining an ecosystem such as pond, forest, field, botanical gardens.	• Ponds • Fields • Forests • Botanical gardens
	• list components of an ecosystem	• Physical and biological components such as air, water, soil, light and living organisms	• Classifying components into physical and biological.	
	• identify the role of soil in an ecosystem	• Role of soil	• Discussing the role of soil in an ecosystem.	
	• identify biological components of soil	• Components such as litter, earthworms, nematodes, termites, fungi, bacteria and humus	• Extracting macro organisms in the soil. • Demonstrating that soil contains micro organisms.	• Wire gauze • Lamps • Soil samples • Alcohol • Lime water / bicarbonate indicator
	• state the role of the biological components • compare properties of clay, loam and sandy soils	• Crumb structure, aeration, fertility and pH • Properties - size of particles - Air content - Water holding capacity - Drainage - Leaching - Acidity/alkalinity (pH)	• Discussing the role of biological components • Carrying out experiments to measure air, water, organic content, pH, water retention and drainage	• Soil samples
8.10.2 Natural ecosystem	• describe a natural ecosystem	• Natural ecosystems	• Carrying out educational tours to a natural ecosystem	• Natural ecosystems
	• construct simple food chains and webs	• Trophic levels: • Producers, consumers and decomposers	• Discussing examples from local ecosystems • Constructing simple food chains and webs	
	• interpret food webs	• Inter-relationships between	• Discussing inter-	• Print media

8.10 TOPIC 10 ECOSYSTEMS CONTD..

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
	• explain the loss of energy in food chains • interpret ecological pyramids • describe nutrient cycles	food chains • Respiration and heat loss • Energy input and energy flow • Pyramids of numbers, biomass and energy • Carbon cycle • Nitrogen cycle	relationships between food chains. • Discussing energy losses in food chains. • Constructing and interpreting pyramids. • Discussing nutrient cycles • Drawing nutrient cycles. **NB. Scientific names of bacteria not required**	• ICT tools • Braille software/Jaws
8.10.3 Artificial ecosystem	• describe an artificial ecosystem • compare species biodiversity in natural and artificial ecosystems • state problems caused by limited species diversity	• Artificial ecosystem • Species diversity - Soil fertility - Pest problems	• Studying cultivated piece of land. • Comparing species diversity. • Discussing the problems.	• garden • field

8.11 TOPIC 11 HEALTH AND DISEASE

KEY CONCEPT	LEARNING OBJECTIVES Learner should be able to	CONTENT (Attitudes, Knowldeg and Skills)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.11.1 Health	• define health • discuss levels of hygiene	• Health as a state of physical, mental, emotional and social wellbeing and not just the absence of disease • Personal hygiene • Domestic hygiene • Community hygiene	• Discussing the concept of health • Carrying out cleaning campaigns around communities and in school • Discussing health issues	• Resource persons • Cleaning materials • ICT tools • Braille software/Jaws

8.11 TOPIC 11 HEALTH AND DISEASE CONTD..

KEY CONCEPT	LEARNING OBJECTIVES Learner should be able to	CONTENT (Attitudes, Knowldeg and Skills)	SUGGESTED LEARNING	SUGGESTED RESOURCES
8.11.1 Health		- Waste disposal methods - Provision of clean, safe drinking water - Sanitation - Provision of health facilities such as clinics		
8.11.2 Diseases	• define a disease • state causes of diseases • classify diseases into infectious and non-infectious diseases • state the causative agent, mode of transmission and signs and symptoms of infectious diseases • explain ways of preventing and treating infectious diseases	• Definition of disease • Causes such as: - infection, - Genetic defects - Cemicals - Radiation - malnutrition - degenerative causes • Infectious diseases - Cholera - Malaria - Tuberculosis (TB) - Typhoid - Bilharzia • Non-infectious diseases - Deficiency diseases - Genetic diseases - Cancer • Causative agents, mode of transmission and signs and symptoms of infectious diseases (NB Scientific names of causative agents not required) • Prevention and treatment of infectious diseases	• Discussing the concept of disease • Classifying diseases into infectious and non-infectious. • Discussing causes of diseases. • Researching on causes, mode of transmission, signs and symptoms and ways of treating and preventing infectious diseases. • Discussing research findings.	• ICT tools • Braille software/Jaws • Resource persons

FORM 4

8.12 TOPIC 1 SAFETY, CAREERS AND BRANCHES IN BIOLOGY

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.12.1 Safety labels and symbols	• identify various safety labels and symbols • explain the meaning of various safety labels and symbols	• Labels and symbols	• Identifying various safety labels and symbols • Discussing the meaning of the various labels and symbols	• Containers with labels and symbols • Print media

8.13 TOPIC 2 CHEMICALS OF LIFE

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.13.1 Carbohydrates	• state classes of carbohydrates • state the uses of glucose, sucrose, starch, glycogen and cellulose in living organisms	• Carbohydrates as mono, di-, and poly-saccharides • Glucose, sucrose, starch, glycogen and cellulose in living organism	• Classifying carbohydrates. • Discussing uses of mono -, di- and polysaccharides.	• ICT tools • Braille software/Jaws • Print media
8.13.2 Proteins	• state the functions of proteins in living organisms	• Functions of proteins in living organisms	• Discussing the functions of proteins in living organisms.	• Print media • ICT tools • Braille software/Jaws
8.13.3 Lipids	• state the functions of lipids in living organisms	• Functions of lipids in living organisms	• Discussing the functions of lipids in living organisms.	• ICT tools • Braille software/Jaws
8.13.4 Nucleic acids	• state the functions of nucleic acids in living organisms	• Functions of DNA and RNA	• Discussing the functions of DNA and RNA.	• ICT tools • Braille software/Jaws

8.14 TOPIC 3 ENZYMES

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.14.1 Industrial applications of enzymes	• explain the use of enzymes in the production of washing powders	• Detergents/washing powder - Lipases – fat stains - Proteases – protein stains	• Discussing the uses of lipases and proteases in stain removal. • Carrying out experiments with lipases and proteases to remove stains.	• Washing powder • Lipases and proteases

8.15 TOPIC 4 PLANT SCIENCE

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.15.1 Reproduction	• define asexual reproduction • describe natural and artificial methods of vegetative reproduction in plants	• Asexual reproduction in plants • Vegetative reproduction • Natural methods - Rhizomes, tubers, suckers, runners bulbs • Artificial methods - Cuttings, grafting	• Discussing asexual reproduction in plants. • Observing vegetative structures in plants. • Demonstrating various methods of vegetative reproduction.	• Plant vegetative structures such as: stems, tubers, leaves, bulbs • Gardens
	• state advantages and disadvantages of vegetative reproduction	- Resistance to diseases and pests - genetic variation - survival of offspring - rate of propagation	• Discussing advantages and disadvantages of vegetative reproduction	• ICT tools • Braille software/Jaws • Grass • Irish potatoes • Bananas • Sugar cane • Sweet-potato stems • Onion bulbs • Strawberry plants

8.15 TOPIC 4 PLANT SCIENCE CONTD..

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
	• describe the structure and characteristics of wind and insect pollinated flowers • compare the different structural adaptations of insect pollinated and wind pollinated flowers • outline the process of pollination • distinguish between self- and cross pollination • describe the advantages of self and cross pollination	• Flower as a reproductive structure in plants • Wind pollinated and insect pollinated flowers • Pollination • Self and cross pollination • Advantages and disadvantages of self and cross pollination	• Observing insect and wind • pollinated flowers • Comparing insect and a wind pollinated flower • Examining pollen grains using microscopes or hand lenses • Discussing self and cross pollination • Discussing advantages of self and cross pollination	• Flowers • Hand lenses • Microscopes • Pollen grains
	• outline the process of fertilisation • describe changes that occur after fertilisation in a flower • describe seed dispersal • outline the importance of seed dispersal	• Development of pollen tube **NB. No knowledge of double fertilisation is required** • Formation of seeds and fruits • Various ways of seed dispersal • Importance of seed dispersal - Colonisation of new areas - Reducing overcrowding of plants - Increasing survival chances of plants	• Examining growing pollen tubes • Describing the growth of the pollen tube and its entry into the ovule followed by fertilisation • Observing a variety of fruits and seeds • Relating structure of seed to method of dispersal • Discussing importance of seed dispersal	• Print media • ICT tools • Braille software/Jaws • Fruits • Seeds • Hand lenses

8.15 TOPIC 4 PLANT SCIENCE CONTD..

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
	• describe the structure of a monocot and dicot seed	• Seed structure– - testa/seed coat - embryo (radicle and - plumule) - endosperm - cotyledon - hilum - micropyle - Monocot seeds – maize seeds - Dicot seeds – bean / pea/groundnut	• Identifying different parts external and internal of seeds. • Making labelled drawings of seeds.	• ICT tools • Braille software/Jaws • Variety of fruits and seeds • Scalpel blades • Hand lenses • Bean seeds • Maize seeds
	• describe the conditions necessary for germination	• Germination - Oxygen - Suitable temperature - Water • Functions of enzymes - Respiration - Hydrolysis of stored food	• Carrying out controlled experiments to investigate conditions necessary for germination	• Pyrogallic acid • Drying agents such as calcium chloride • Refrigerator • Incubator
8.15.2 Coordination and response	• define phototropism and geotropism • illustrate phototropism and geotropism in plants	• response by plants to light and gravity	• Carrying out experiments to illustrate phototropism and geotropism	• Potted plants • Germinating seeds • Cardboard boxes • Blades • ICT tools • Braille software/Jaws • Petri-dishes • Cotton wool • Clinostat

8.15 TOPIC 4 PLANT SCIENCE CONTD..

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
	• Define a plant hormone • describe the application of hormones to growth and development of plants	• Plant hormone as a chemical substance produced in one part of a plant and transported to other parts where it initiates a response • Uses of - Ethylene - Gibberellins - Auxins - Cytokinins	• Discussing commercial application of plant hormones	• Plant hormones • Fruits • Young plants

8.16 TOPIC 5 ANIMAL SCIENCE

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.16.1 Productivity	• define food intake in relation to increase in mass • identify animal pests and related diseases • describe how animal pests and diseases affect productivity • describe ways of preventing plant pests and diseases	• Food conversion efficiency • Animal pests and diseases - Anthrax – bacteria - Foot and mouth – virus - Liver damage – fluke - Red water – tick (vector) • Reduced yields • Mechanisms - Dosing - Vaccination - Dipping - quarantine	• Analysing data from the agriculture department • Constructing and interpreting growth curves • Observing animal pests. • Discussing animal diseases. • Discussing how pests and diseases affect productivity • Discussing prevention mechanisms	• Resource persons • Pest specimens

8.16 TOPIC 5 ANIMAL SCIENCE CONTD..

KEY CONCEPT	LEARNING OBJECTIVES Learner should be able to	CONTENT (Attitudes, Knowldeg and Skills)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.16.2 Homeostasis	• define homeostasis • identify and label parts of the skin • relate the functions of parts of the skin to temperature regulation • describe the function of the brain in homeostasis • define excretion • list substances that must be excreted and organs involved • describe the structure of the urinary system • state the functions of the parts of the urinary system • describe the structure of the kidney • state the functions of the kidney • describe how the kidney dialysis machine works	• The maintenance of a constant internal environment • Skin structure and functions of its parts • Temperature sensitivity, shivering, sweating, vaso-dilation and vasoconstriction • The hypothalamus • Negative feedback • Excretion as removal of toxic materials and waste products of metabolism • Kidney – urea, excess salt, excess water and toxins • Lungs – carbon dioxide and excess water • Skin – excess salts, urea and excess water • Structure of the urinary system • Functions of- kidney - renal artery - urethra - ureter - bladder • Kidney structure - Cortex - medulla - pelvis	• Discussing regulation of water, pH, ions, glucose concentration and temperature • Drawing and labelling parts of the skin • Discussing the functions of parts of the skin • Discussing the roles of parts of the skin in relation to temperature regulation • Discussing the role of the hypothalamus in temperature regulation • Discussing excretion • Discussing the excretory organs and the wastes they excrete • Drawing and labelling the urinary system • Discussing functions of parts of the urinary system • Discussing kidney structure and functions. NB. No detailed structure of the nephron required • Discussing how the dialysis machine works.	• Print media • Print media • ICT tools • Braille software/Jaws • Print media • Resource person • Resource person

8.16 TOPIC 5 ANIMAL SCIENCE CONTD..

KEY CONCEPT	LEARNING OBJECTIVES Learner should be able to	CONTENT (Attitudes, Knowldeg and Skills)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
		• Functions - urine formation, - osmo-regulation, - pH regulation • Kidney failure and the use of dialysis machine		
8.16.3 Coordination and Response	• describe the structure of a neurone • describe a simple spinal reflex arc • outline functions of the main parts of the brain • describe the structure of the eye • describe the functions of parts of the eye • describe how the eye focuses images on the retina • Describe eye defects and their correction • Describe the structure and functions of parts of the ear	• Structure of sensory, relay and motor neurones • Receptor, sensory neurone, relay neurone, motor neurone, effector and spinal cord • Cerebrum, cerebellum, pituitary gland, hypothalamus and medulla oblongata • Eye - Front view - horizontal section • Parts of the eye • Refraction, accommodation and image formation • Short and long sightedness • Parts of the ear • Sound conduction • Balance	• Drawing and labeling the structure of neurons. • Demonstrating reflex actions such as knee jerk and blinking. • Drawing the reflex arc. • Identifying parts of the brain and discussing their functions. • Drawing and labelling the front view and horizontal section of the eye • Discussing functions of parts of the eye • Demonstrating the refraction of light • Discussing eye defects and their correction • Drawing and labeling parts of the ear • Discussing functions of parts of the ear	• Print media • Bioviewers and biosets • ICT • Braille software/Jaws • Model

8.16 TOPIC 5 ANIMAL SCIENCE CONTD..

KEY CONCEPT	LEARNING OBJECTIVES Learner should be able to	CONTENT (Attitudes, Knowldeg and Skills)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.16.4 Endocrine system	• define hormone • describe the effects of adrenaline • outline the role of insulin and glucagon • state the signs and symptoms of diabetes mellitus • explain how Diabetes mellitus can be managed	• Hormone as a chemical substance produced by a gland and carried by blood, which affects the activities of a target organ • Adrenal gland, fright fight and flight responses • Regulation of blood glucose level • Diabetes mellitus • signs and symptoms: - frequent urination - tiredness - thirst - increased blood glucose level - glucose in urine • Management of Diabetes mellitus	• Discussing the production, transport and of hormones • Discussing effects of adrenaline • Discussing regulation of blood sugar • Discussing signs of diabetes mellitus • Discussing the management of Diabetes mellitus.	• ICT tools • Braille software/Jaws • Resource person
8.16.5 Skeletal system	• outline functions of the skeleton • identify the main bones of the fore and hind limb of a mammal • describe types of joints • describe the types of movement permitted by joints • describe the action of muscles at a hinge joint	• Functions - Support, - Protection - movement • Scapula, humerus, radius ulna, pelvis femur, tibia and fibula • Hinge joint, ball and socket joint • Hinge joint – one plane • Ball and socket joint – all planes • Antagonistic muscles (extensor and flexor muscles)	• Observing the human skeleton • Discussing functions of the skeleton • Identifying the bones on the skeleton • Observing joints • demonstrating movement permitted by joints • Demonstrating the action of extensor and flexor muscles	• Model of the skeleton • Model of antagonistic muscles

8.17 TOPIC 6 MICROBIOLOGY AND BIOTECHNOLOGY

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.17.1 Recombinant Gene Technology	• define the term recombinant DNA • explain that genes may be transferred between cells of different species • Outline production of insulin using recombinant DNA technology • discuss potential benefits and hazards of recombinant DNA technology	• Recombinant DNA as a DNA molecule incorporating DNA from more than one species of organism • Production of insulin using recombinant DNA technology - Gene coding for human insulin recovered for bacteria - Transformed bacteria allowed to multiply producing insulin - Insulin then recovered from bacteria • Benefits and hazards of recombinant DNA technology	• Discussing formation of recombinant DNA • Discussing insulin production **NB. Only simplified outline of insulin production using recombinant DNA technology** • Debating on benefits and hazards of recombinant DNA technology	• ICT tools • Braille software/Jaws • Print media

8.18 TOPIC 7 GENETICS

KEY CONCEPT	LEARNING OBJECTIVES Learner should be able to	CONTENT (Attitudes, Knowldeg and Skills)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.18.1 Variation	• identify variable features in plants and animals • draw graphs to show continuous and discontinuous distribution of characteristics • distinguish between continuous and discontinuous variation	• Variation - Features such as: leaf size, size of pods, height, coat colour, mass, tongue rolling, sex - Tables and graphs • Continuous and discontinuous variation	• Carrying out activities such as: - measuring pupils' heights/masses in class - counting number of boys and girls in class - collecting leaves of the same plant and measuring length - to show variables in plants and animals	• Leaves • Balances • Rulers • Graph papers

8.18 TOPIC 7 GENETICS CONTD..

KEY CONCEPT	LEARNING OBJECTIVES Learner should be able to	CONTENT (Attitudes, Knowldeg and Skills)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.18.1 Variation			• Constructing tables and graphs to show continuous and discontinuous variation	• Leaves • Balances • Rulers • Graph papers
8.18.2 Selection	• define evolution • outline natural selection as a possible mechanism for evolution • describe the applications of artificial selection • state the reasons for plant and animal breeding	• Evolution • Variation, competition, selective survival and reproduction • Application of artificial selection in plants and animal breeding • Productivity - quality of breed, - resistance to drought and disease	• Discussing how evolution occurs in natural communities. • Investigating application of artificial selection in plant and animal breeding in local communities and commercial farms.	• Local communities • Commercial farms

8.19 TOPIC 8 BIODIVERSITY

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.19.1 Threats and Conservation measures	• explain threats to biodiversity • describe conservation measures	• Threats to biodiversity - Deforestation - Invasive species - Habitat destruction - Climate change - Pollution • Measures - Afforestation - Uses of alternative sources of energy - Preservation of endangered species and agents	• discussing threats to biodiversity • Discussing conservation measures • Participating in tree planting activities	• ICT tools • Braille software/Jaws

8.20 TOPIC 9 ECOSYSTEMS

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.20.1 Management of Ecosystems	• describe advantages of ground cover	• Advantages - Top soil preservation - water retention - reduced evaporation	• Investigating effects of soil cover.	• Agricultural plots
	• describe the harmful human activities on the ecosystems	• Human activities: Agricultural - Mining - industrial - social activities	• Carrying out case studies of environmental problems in the local communities	
	• suggest corrective measures to harmful human activity	• Corrective measures	• discussing and implementing corrective measures	• Print media • Local ecosystems
	• explain the concept of carrying capacity	• Limiting factors: - Water - Food - Oxygen - Space and shelter	• Discussing the concept of carrying capacity • Field trip	
	• describe the effects of exceeding the carrying capacity	• Effects: - Degradation of - ecosystem - overgrazing - diseases - pollution	• Discussing the effects of exceeding the carrying capacity	

8.21 TOPIC 10 HEALTH AND DISEASE

KEY CONCEPT	OBJECTIVES Learners should be able to:	CONTENT (ATTITUDES, SKILLS AND KNOWLEDGE)	SUGGESTED LEARNING ACTIVITIES AND NOTES	SUGGESTED RESOURCES
8.21.1 Drug use and abuse	• define drug	• Drug as any substance administered into the body and modifies or affects chemical reactions	• Discussing the meaning of drug	• ICT tools • Braille software/Jaws
	• describe medical uses of drugs	• Antibiotics – penicillin • Analgesics – paracetamol, asprin • Anti-malaria – chloroquine and paludrine	• Discussing the importance of proper administration and use of medicinal drugs. • Discussing allergic reactions to drugs in some individuals	
	• describe the abuse of alcohol, tobacco, cannabis and solvents	• Physical, mental and social ill-effects - Alcohol - Tobacco - Cannabis - Solvents	• Discussing the effects of drug abuse • Carrying out campaigns against drug abuse	• Resource persons • Specimens

9.0 ASSESSMENT

9.1 Scheme of Assessment

Forms 3 to 4 Biology assessment will be based on 40% continuous assessment and 60% 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 assessment procedure booklet.

9.1.1 Continuous assessment

Continuous assessment for Forms 3-4 will consist of practical tests, theory tests and end of term examinations:

9.2.1 Practical tests

These are practical tests that teachers give to learners twice a term. These may be individual or group activities. The tests should cover manipulation of apparatus, following procedures, results collection, presentation, analysis and evaluation.

9.2.2 Theory Tests

These are tests set by the teacher to assess the concepts covered during the term. The tests should consist of multiple choice, structured and free response questions. Two tests shall be given in a term

9.2.3 End of term examinations

These are comprehensive tests of the whole term work. These can be set at school/district/provincial level.
Summary of Continuous Assessment Tasks
In 5 terms (Form 3 to 4) candidates are expected to have done at least the following recorded tasks per term:

- 2 Practical tests
- 2 theory tests
- 1 End of term test

Detailed Continuous Assessment Tasks Table

Term	Practical tests	Theory Tests	End Of Term Test	Total
1	2	2	1	
2	2	2	1	
3	2	2	1	
4	2	2	1	
5	2	2	1	
6	National Examinations			
Weighting	20%	10%	10%	405

9.3 SUMMATIVE ASSESSMENT

ASSESSMENT OBJECTIVES

The following objectives reflect those aspects of the aims that will be assessed. Specific behavioural learning objectives are stated in each section of the syllabus.

9.3.1 KNOWLEDGE AND COMPREHENSION

Learners should be able to demonstrate knowledge and understanding of:

1.1 scientific instruments and apparatus, techniques and aspects of safety;
1.2 scientific units, terminology, symbols and conventions;
1.3 scientific quantities and how they are determined;
1.4 scientific phenomena, facts and laws, definitions, concepts, theories and models;
1.5 personal, social, economic and environmental implications of science applications.

9.3.2 HANDLING INFORMATION AND SOLVING PROBLEMS

Learners should be able to demonstrate, in familiar and unfamiliar situations, their ability to:

2.1 extract information relevant to a particular context from data presented in diagrammatic, symbolic, graphical, numerical or verbal form;
2.2 use data to recognize patterns, formulate hypotheses and draw conclusions;
2.3 translate information from one form to another;
2.4 communicate logically and concisely;
2.5 explain facts, observations and phenomena in terms of scientific laws, theories and models;
2.6 explain technological applications of science and evaluate their associated personal, social, economic, and environmental implications;
2.7 make logical decisions based on the examination of evidence and arguments;
2.8 apply scientific principles, formulae and methods to solve qualitative and quantitative problems;
2.9 suggest explanations of unfamiliar facts, observations and phenomena;

9.3.3 EXPERIMENTAL SKILLS

Learners should be able to:

3.1 follow instructions for practical work;
3.2 plan, organise and carry out experimental investigations;
3.3 select appropriate apparatus and materials for experimental work;
3.4 use apparatus and materials effectively and safely;
3.5 make accurate, systematic observations and measurements, recognising the variability of experimental measurements;
3.6 observe, measure and record results of experimental procedures;
3.7 identify possible sources of error in experimental procedures;
3.8 draw conclusions and make generalisations from experiments;
3.9 extract information from data presented in diagrammatic, graphical or numerical form.

WEIGHTING OF ASSESSMENT OBJECTIVES

	ASSESSMENT OBJECTIVES	WEIGHTING
Paper 1 and 2		
Knowledge and comprehension	1.0	60%
Handling information and solving problems	2.0	40%
Paper 3		
Experimental skills	3.0	100%

PAPER	TYPES OF PAPER	DURATION	MARKS	WEIGHTING
1	Multiple Choice	1 hour	40	30%
2	Theory	2 hours	100	40%
3	Practical	1 hour 30 minutes	40	30%

Paper 1 Theory (1 hour, 40 marks)
This paper will consist of 40 compulsory multiple-choice items

Paper 2 Theory (2 hours, 100 marks)

This paper is composed of two sections, A and B

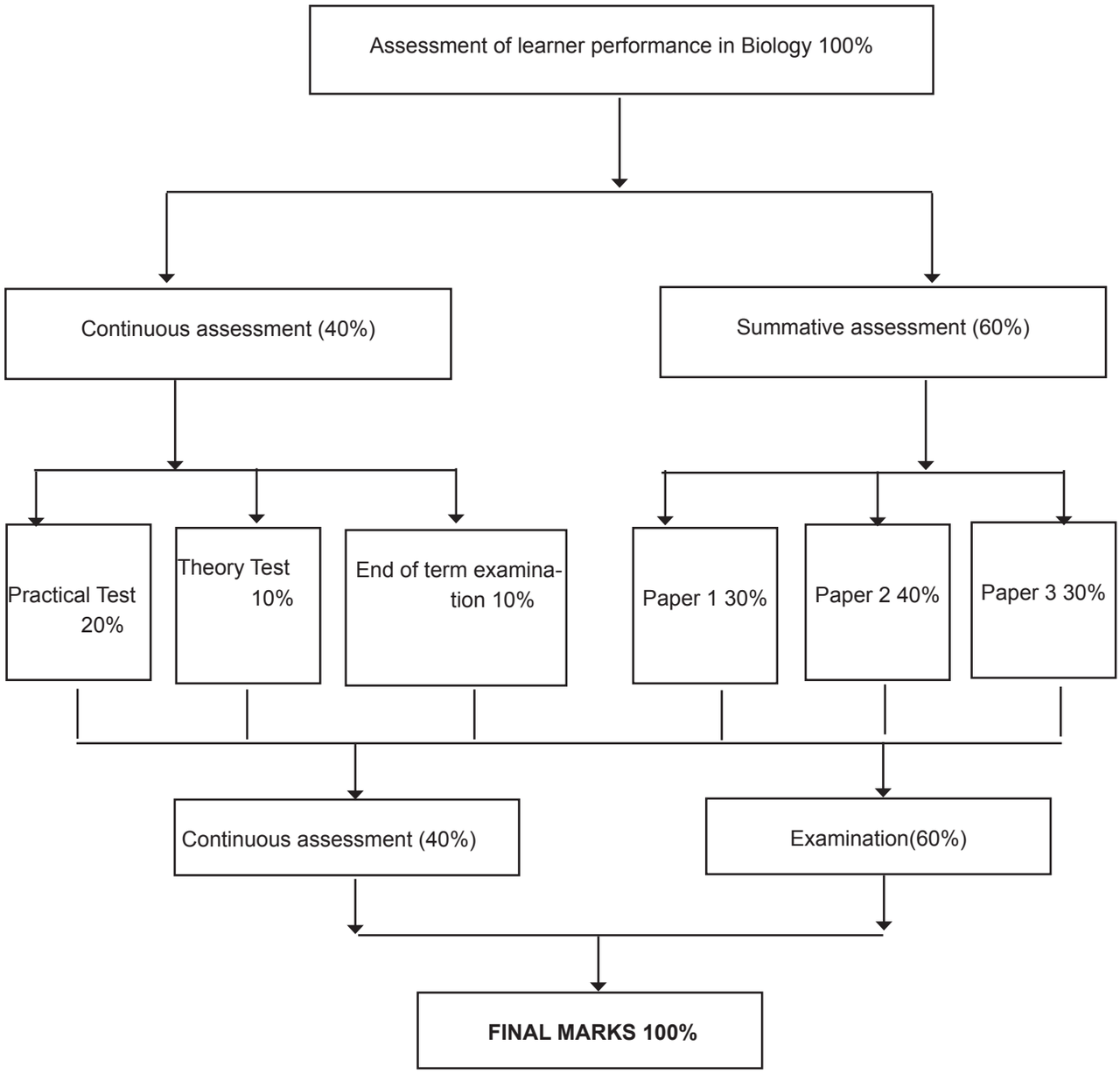
- Section A – made up of 6 compulsory structured questions of 10 marks each which add up to 60 marks.
- Section B- made up of 6 optional questions of 10 marks each. Candidates will be required to answer any 4 questions to give a total of 40 marks.

Paper 3 Practical Examination (1 hour 30 minutes, 40 marks)

This is a practical test consisting of two compulsory questions of 20 marks each

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

ASSESSMENT MODEL



10.0 GLOSSARY OF TERMS USED IN SYLLABUS/SCIENCE PAPERS

It is hoped that the glossary (which is relevant only to science subjects) will prove helpful to candidates as a guide, i.e. it is neither exhaustive nor definitive. The glossary has been deliberately kept brief not only with respect to the number of terms included but also to the descriptions of their meanings. Candidates should appreciate that the meaning of a term must depend in part on its context.

10.1 Define (the term(s)…) is intended literally. Only a formal statement or equivalent paraphrase being required.

10.2 What do you understand by/What is meant by (the term(s)…) normally implies that a definition should be given, together with some relevant comment on the significance or context of the term(s) concerned, especially where two or more terms are included in the question. The amount of supplementary comment intended should be interpreted in the light of the indicated mark value.

10.3 State implies a concise answer, with little or no supporting argument, e.g. a numerical answer that can be obtained 'by inspection'.

10.4 List requires a number of points, generally each of one word, with no elaboration. Where a given number of points is specified, this should not be exceeded.

10.5 Explain may imply reasoning or some reference to theory, depending on the context.

10.6 Describe requires candidates to state in words (using diagrams where appropriate) the main points of the topics. It is often used with reference either to particular phnomena or to a particular experiment. In the former instance the term usually implies that the answer should include reference to (visual) observations associated with the phenomena.

10.7 Calculate is used when a numerical answer is required. Working should be show

10.8 Deduce means that the candidate is expected to draw logical and valid conclusion from given information.

10.9 Determine implies that the quantity concerned cannot be measured directly but is obtained by calculation, substituting measured or known values of other quantities into a standard formula.

10.10 Estimate implies an approximate calculation of the magnitude or quantity concern

10.11 Find means that the candidate is expected to calculate measure or determine.

10.12 Measure means to establish the quantity concerned using a suitable measuring instrument.

10.13 Outline means to give the essential points.

10.14 Predict implies that the candidate is expected to state what as likely to happen by analysing given information

10.15 Sketch, when applied to graph work, implies that the shape and/or position of the curve need only be qualitatively correct.