

TEACHING SEQUENCE

Topic	Sub-topic
1. DIVERSITY OF LIVING THINGS	1.1 Introduction to Biology. 1.2 Classification. 1.3 Hand lenses and microscopes. 1.4 Animal and plant cells. 1.5 External features and internal structures of flowering plants. 1.6 External features, life cycles and economic importance of insects.
2. SOIL	2.1 Soil formation, composition and profile. 2.2 Physical and chemical properties of soil. 2.3 Soil erosion, fertility and conservation. 2.4 Living components of soil, carbon nitrogen and water cycles.
3. NUTRITION	3.1 Nutrient compounds. 3.2 Nutrition in animals. 3.3 Nutrition in a mould. 3.4 Nutrition in green plants.
4. TRANSPORT	4.1 Transport in animals. 4.2 Transport in plants.
5. RESPIRATION	5.1 Gaseous exchange. 5.2 Tissue respiration. 5.2.1 Aerobic respiration. 5.2.2 Anaerobic respiration.
6. EXCRETION AND HOMEOSTASIS	6.1 Excretion in lower organisms. 6.2 Excretion in plants. 6.3 Excretion in animals.

7.	CO-ORDINATION IN PLANTS AND ANIMALS	7.1 Reception and response in plants. 7.2 Reception, response and behavior in animals. 7.3 Chemical co-ordination in vertebrates. 7.4 Nervous co-ordination in a mammal. 7.5 Receptor organs in mammals.
8.	LOCOTION IN ANIMALS	8.1 Locomotion in a mammal. 8.2 Locomotion in an insect, bony fish and birds.
9.	GROWTH AND DEVELOPMENT IN PLANTS AND ANIMALS	9.1 Growth in plants and animals. 9.2 Development in plants and animals.
10.	REPRODUCTION IN PLANTS AND ANIMALS	10.1 Asexual reproduction in lower organisms 10.2 Vegetative reproduction in plants. 10.3 Sexual reproduction in lower organisms 10.4 Sexual reproduction in animals. 10.5 Sexual reproduction in plants.
11.	GENETICS AND EVOLUTION	11.1 Mitosis and meiosis and their importance. 11.2 Genetics and monohybrid inheritance. 11.3 Sex determination and hereditary diseases. 11.4 Mutation and evolution
12.	INTER-RELATIONSHIPS	12.1 Food chains and food webs 12.2 Changes population 12.3 Associations in organisms 12.4 Humans and natural environment.

TIME ALLOCATION

Adequate time has been allocated to the topics and sub-topics to be covered in a per term. However, inevitable spill over may occur. There are three (3) periods of 40 minutes each allocated to the subject per week. You are advised to use the double periods for practical work at periods for theory.

HOW TO USE THE TEACHING SYLLABUS

Each main topic has the following components:

- General objective(s)
- Sub-topics
- Specific objectives
- Periods
- Content
- Teaching and Learning strategies

Each sub-topic is allocated a specific number of periods to enable the teacher plan the teaching properly. Specific objectives are provided but the teacher is free to formulate others as long as the principles / concepts are not changed. Topics that may spill over to the following term should be handled cautiously so that they do not interfere with completion of other topics.

The teacher is advised to use the available time (3 periods per week) to cover the subject content before the final examination at S.4. Learners can be assigned to make drawings of body systems and other features of organisms outside class time. However, for practicals, the learners are required to draw as they observe the specimens and record the experimental results there and then.

The teaching of Biology is expected to develop competences like drawing, labelling, observing, recording correctly and making the correct deductions. On completion of this syllabus, the teachers and learners will be able to support their arguments with scientific facts and help to educate other people on basic concepts of life processes.

MODE OF ASSESSMENT

There are two forms of assessment namely continuous assessment and external (summative) assessment. You are required to assess all learners continuously especially after each sub-topic has been covered. Keep all the marks records and use them to evaluate the achievement of the learners at all levels (S I-V).

a) Continuous assessment can be done using the following methods:

- Tests
- Quizzes
- Practical activities and experiments
- Assignments
- Projects and field work reports.

You are therefore, very much encouraged to do a lot of teaching and assess the learners as often as possible in order to ascertain whether learning has taken place. The aim here is to capture the achievements of the learners based on all the learning experiences they have gone through. The assessment should be done in the periods allocated to the subject.

- b) The external assessment by UNEB, the examination body, takes place at end of Senior Four in Term Three.

EXAMINATION FORMAT

1. The syllabus covers a four-year course and will be examined in two papers i.e. Paper 1 and 2 or Paper 1 and 3.

Structure of the Papers

Paper 1 (2½ hours) consists of three sections A, B, and C.

Section A: consists of compulsory multiple choice questions (30 marks)

Section B: consists of three compulsory structured questions (40 marks)

Section C: consists of four essay questions. Candidates are required to answer two questions only (30 marks).

Paper 2/3 (2 hours) consists of three compulsory questions (60 marks)

Questions may be set on interpretation of new / unfamiliar biological data which may include photographs. One question requires carrying out laboratory practical procedures.

2. Any learning area of the syllabus may be examined in any of the sections of the papers.
3. The practical examination (Paper 2/3) is designed to test the following abilities in the learners:
 - following a sequence of instruction within a given time.
 - use of familiar and unfamiliar techniques, recording of observations and making conclusions there from.
 - making observations and recognizing features of familiar and unfamiliar biological specimens, make a record of such observations and draw conclusion on functions of part or whole specimen.
 - making clear line drawings of specimens provided indicating the magnification and labels of the specimen's structures.
 - interpreting of unfamiliar data and drawing conclusions.
 - exhibiting manual skills in assembling apparatus as required, using chemical reagents for the correct experiment, and using any other apparatus/instruments such as scalpels, scissors, forceps etc.
 - making observations of reactions, correct reading of measuring instruments and performing simple arithmetic calculations.

4. The food tests expected are as follows:

• Food sample	Reagent
• Reducing sugars	Fehling's and Benedict's solution
• Non-reducing sugars	Fehling's and Benedict's solution after hydrolysing with dilute HCL
• Starch	Iodine solution
• Fats	Ethanol emulsion test and Grease Spot
• Protein	Millon's Reagent and Biuret Test
• Vitamin C	DCPIP (Dichloro-phenol-indo-phenol)

SECTION II

SENIOR ONE TERM I

Duration: 36 Periods

TOPIC 1: Diversity of Living things

General Objective:

By the end of the topic the learner should be able to understand the biodiversity and be able to preserve and protect living organisms.

SUB-TOPIC	NO. OF PERIODS	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
1.1 Introduction to Biology	2	The learner should be able to; <ul style="list-style-type: none"> • Define Biology • Name branches of Biology • State the importance of Biology in everyday life. 	<ul style="list-style-type: none"> • Definition of Biology • Branches of Biology • Importance of Biology in relation to its application. 	<ul style="list-style-type: none"> • Brain storm on branches of Biology. • Discuss the importance and application of Biology in everyday life.
1.2 Classification	4	<ul style="list-style-type: none"> • State characteristics of living and non-living things. • List the taxonomic categories of organisms. • Describe types of classification 	<ul style="list-style-type: none"> • Characteristics of living things • Distinction between living and non-living things. • Need to classify organisms • Types of classification 	<ul style="list-style-type: none"> • Brain storm on characteristics of living things. • Group discussion on differences between living and non-living things, the need to classify organisms, methods of collecting living things. • Demonstrate the various taxonomic groups giving examples.
	9	<ul style="list-style-type: none"> • Construct and use a dichotomous key to classify organisms into groups. 	<ul style="list-style-type: none"> • Classification of living things into groups: monera, protocista, fungi, plants and animals. 	
	4	<ul style="list-style-type: none"> • Use an identification key to classify organisms. 	<ul style="list-style-type: none"> • Simple identification key 	

SUB-TOPIC	NO. OF PERIODS	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
	6	<ul style="list-style-type: none"> Name and use different methods of sampling and collecting organisms. Collect living organisms using the appropriate methods. 	<ul style="list-style-type: none"> Quantitative sampling and methods of collecting living things: quadrat, line transect, direct count, capture – recapture, trapping. 	<ul style="list-style-type: none"> Practical on classification and use of identification key.
	1	<ul style="list-style-type: none"> Explain what a virus is. 	<ul style="list-style-type: none"> Nature of virus – no details required. 	
1.3 Hand lenses and microscopes	10	<ul style="list-style-type: none"> Use hand lens and microscope correctly. List parts of a light microscope Demonstrate care of hand lens and microscope List differences between plant and animal cells. Calculate the magnification of an object using a microscope. 	<ul style="list-style-type: none"> Hand lens and its function Parts of a microscope and their functions Examination of plant cells e.g. leaf epidermis and animal cell (cheek cell). Difference between plant and animal cells. Magnification of microscope and its calculation. 	<ul style="list-style-type: none"> Practical approach on examination of cells. Group work on observing parts of microscope and hand lens and their use. Demonstrate care of hand lens and microscope. Discussion on differences between plant and animal cells. Demonstrate how to calculate the magnification of an object using a microscope.



Term II

Duration: 36 Periods

SUB-TOPIC	NO.OF PERIODS	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
1.4 Animal and Plant cells	6	<ul style="list-style-type: none">Observe plant and animal cells using microscope.Draw and label parts of animal and plant cells.State the difference between plant and animal cells.State the functions of the parts of plant and animal cell.Describe tissues, organs and systems.	<ul style="list-style-type: none">Structure of plant and animal cells.Comparison between plant and animal cells.Functions of different parts of plant and animal cells.Organisation of cells into tissues, organs and systems.	<ul style="list-style-type: none">Practical approach on parts of plant and animal cell.Discussion on functions of plant and animal cells, tissues, organs and systems.Brain storming on structural differences between plant and animal cells.
1.5 External features and internal structures of flowering plants	9	<ul style="list-style-type: none">Draw a flowering plant and label its parts.State types of leaves.Describe leaf arrangement	<ul style="list-style-type: none">External features and internal structures and functions of roots, stems and leaves.Types of leaves and leaf arrangement.	<ul style="list-style-type: none">Discussions on external features and internal structures of roots, stems and leaves.Demonstration of leave arrangements in plants.Practical approach on types of flowers, drawing and labeling of different types of flowers.
	9	<ul style="list-style-type: none">Name and describe functions of modified roots, stems and leaves.	<ul style="list-style-type: none">Modified roots and their functions.Modified stems and their functions.Modified leaves and their functions.	<ul style="list-style-type: none">Group discussion on modified roots, stems and leaves and their functions.
	5	<ul style="list-style-type: none">Draw and label the parts of a flower.Explain the functions of each part of a flower.Describe an inflorescence.	<ul style="list-style-type: none">Parts of a typical flower.Dicot and monocot flowers.Types of inflorescence	<ul style="list-style-type: none">Brain storming on types of inflorescence.

	7	<ul style="list-style-type: none"> Construct a dichotomous key using leaves and flowers. State types of flowers. 	<ul style="list-style-type: none"> Use of dichotomous key Types of flowers – free petals (hibiscus), fused petals (morning glory), keel and standard wing (pea or bean family), grass flower. 	
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TERM III

Duration: 36 Periods

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
1.5 (Contd.)	8	<p>The learner should be able to;</p> <ul style="list-style-type: none"> Draw and label the external and internal parts of fruits and seeds. 	<ul style="list-style-type: none"> External and internal structures of fruits and seeds. 	<ul style="list-style-type: none"> Brain storm on external and internal structures of fruits and seeds. Group discussion on differences between fruits and seeds. Practical approach on types of fruits.
	9	<ul style="list-style-type: none"> List the differences between fruits and seeds. List the types of fruits giving an example of each. 	<ul style="list-style-type: none"> Differences between fruits and seeds. Types of fruits; succulent (pome berry, drupe, dry dehiscent (legume and capsule); dry indehiscent (caryopsis and schizocarp) 	

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
1.6 External features, life cycles and economic importance of insects	10	<ul style="list-style-type: none"> • Draw and label the external features of a housefly, bee, cockroach, mosquito and butterfly. • Describe the life cycle of each insect. 	<ul style="list-style-type: none"> • External features and life cycles of housefly, cockroach, mosquito, bee and butterfly. 	<ul style="list-style-type: none"> • Discussion on external features and life cycles of insects.
	9	<ul style="list-style-type: none"> • Explain the economic importance of each insect. • Name insect activities and products useful to humans. 	<ul style="list-style-type: none"> • Explain the economic importance of each insect. • Harmful and useful insects. • Role of useful insects in improving family income. • Control of insect pests. 	<ul style="list-style-type: none"> • Group discussion on useful and harmful insects. • Practical work on drawing of external features of the named insects.

TOPIC 2:**Soil****Duration:** 36 Periods

General Objective: By the end of the topic the learner should be able to understand the components of soil, their contribution to the life of plants and animals and the necessity to conserve soil.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
2.1 Soil formation, composition and profile	6	The learner should be able to; <ul style="list-style-type: none"> • Define soil • Describe ways in which soil is formed. • Name main agents in soil formation. 	<ul style="list-style-type: none"> • Definition of soil • Soil formation, composition and types. 	<ul style="list-style-type: none"> • Practical approach on soil profile • Discussion on functions of soil constituents
	3	<ul style="list-style-type: none"> • List soil constituents and their functions. • Describe a soil profile. • Explain factors that affect the quality of the soil. 	<ul style="list-style-type: none"> • Functions of each soil constituent • Soil profile • Factors that affect the quality of soil. 	<ul style="list-style-type: none"> • Brain storming on factors that affect soil quality. • Field study on different types of soils in the locality.
2.2 Physical and chemical properties of soil	6	<ul style="list-style-type: none"> • State physical and chemical properties of soil. • Explain the importance of air and water to plants and animals. • Demonstrate porosity and soil drainage in different soil samples. • Conduct a test to find the pH of a soil sample. 	<ul style="list-style-type: none"> • Physical and chemical properties of soil. • Importance of soil crumb structure, air and water to plants and animals. • Air and water holding capacities of soils. • Capillarity, porosity and drainage of soils. 	<ul style="list-style-type: none"> • Practical work on determination of soil pH, and water retention, and properties of soils. • Discussion on physical and chemical properties of soil. • Field visit to Agricultural

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
2.2 Soil properties and composition	3	<ul style="list-style-type: none"> Compare water retention in two or three soil samples. 	<ul style="list-style-type: none"> Water retaining properties of soil. 	Colleges to study soil requirements for plant/crop growth.
		<ul style="list-style-type: none"> Carry out experiments to find the percentage of air, water and humus in a soil sample. List the essential elements in a complete culture solution. Demonstrate flocculation of clay. 	<ul style="list-style-type: none"> Practicals on percentage of water & humus in soil sample. Components of a culture solution, use of culture solution. Flocculation of clay. 	<ul style="list-style-type: none"> Experimentation on percentage of air, water and humus in soil sample and flocculation of clay.
2.3 Soil erosion and conservation; causes, effects and prevention.	9	The learner should be able to: <ul style="list-style-type: none"> Outline features of a fertile soil. Explain soil erosion. Name the types of soil erosion. Explain soil exhaustion and leaching. Name and describe methods of soil conservation. 	<ul style="list-style-type: none"> Features of a fertile soil. What soil erosion is Types and effects of soil erosion on soil fertility. Soil exhaustion and leaching. Methods of soil conservation: good farming practices, mixed cropping, mulching, contour farming, terracing, strip cropping and application of fertilizers. 	<ul style="list-style-type: none"> Discussion on soil erosion, types, effects and prevention. Field work to observe areas affected by soil erosion. Discussion and demonstration of soil conservation methods.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
2.4 Living components of soil, carbon and nitrogen cycle and water cycle.	9	<ul style="list-style-type: none"> • Describe the role of plants and animals in conserving soil. • Explain the role of bacteria in soil fertility. • Draw and describe the nitrogen cycle. • Draw and explain the carbon cycle. • Explain the steps in the water cycle or hydrological cycle. • Conduct experiments to find out the living organisms in a soil sample. 	<ul style="list-style-type: none"> • Plant and animal life in soil. • Role of soil organisms in the soil. • Role of bacteria in the nitrogen cycle. • Carbon cycle. • Water cycle / hydro cycle. • Practicals on soil organisms. 	<ul style="list-style-type: none"> • Discussion on plant and animal life in soil and role of soil organisms in the soil. • Demonstrate presence of soil organisms. • Discussion on role of bacteria in nitrogen cycle. • Illustrate carbon and water cycles.

TERM II

Duration: 36 Periods

Topic 3:

Nutrition in Plants and Animals

General Objective:

By the end of the topic the learner should be able to understand types of food nutrients, their role in the maintenance of life in living organisms, their deficiency effects and prevention.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
3.1 Nutrient Compounds	4	<p>The learner should be able to;</p> <ul style="list-style-type: none"> • Name food nutrients and their uses in the body. • Classify food stuffs available in their locality • Describe food deficiencies and their prevention. 	<ul style="list-style-type: none"> • Food nutrients, their uses, sources, deficiencies and their prevention. • Food nutrients: proteins, carbohydrates, fats, vitamins, mineral salts. • Importance of water 	<ul style="list-style-type: none"> • Brain storming on classes of food stuffs and they nutrients they contain. • Discussion on uses of different nutrients, their deficiencies and prevention.
	9	<ul style="list-style-type: none"> • Conduct food tests for various nutrients. • Define an enzyme. • List the properties of an enzyme. • Name factors that affect enzyme activity. • Explain effect of pH and temperature on enzyme activity using a graph. • Conduct experiments on enzyme activity. 	<ul style="list-style-type: none"> • Food tests for: proteins, fats, starch, vitamin C, reducing and non-reducing sugars. • Definition of an enzyme • Properties of enzymes • Factors that affect enzyme activity. 	<ul style="list-style-type: none"> • Practical on food tests. • Discussion on enzyme properties and factors that affect them. • Practical on enzyme reactions.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
3.2 Nutrition in Animals	2	<ul style="list-style-type: none"> • Describe feeding methods in various organisms. 	<ul style="list-style-type: none"> • Feeding methods in amoeba, insects, frog/toad, birds, 	
	3	<ul style="list-style-type: none"> • Describe the structure and function of teeth. • Draw and label teeth. • State the dental formula of herbivore, carnivore and humans. • Describe the care for teeth in humans. 	<ul style="list-style-type: none"> • Herbivore, carnivores and omnivores. • Structure, type and arrangement of teeth / dental formula. • Structure and shape of mammalian teeth. • Care of teeth in humans 	<ul style="list-style-type: none"> • Demonstration of different types of teeth and care. • Discussion on functions of different types of teeth in different animals. • Practicals on drawings of teeth • Field work to study feeding habits / methods in various organism.
	6	<ul style="list-style-type: none"> • List the parts of the alimentary canal. • Name the organs associated with the canal and give their functions. • Explain the role of caecum and rumen in a herbivore. • Describe the process of digestion and its products. • Explain how the end products of digestion are absorbed and assimilated. 	<ul style="list-style-type: none"> • Alimentary tract of a mammal. • Function of each part of the alimentary canal/tract. • Function of caecum and rumen in herbivores. • Processes of ingestion, digestion, absorption, assimilation and egestion. 	<ul style="list-style-type: none"> • Illustration of alimentary canal and functions • Discussion on digestion, absorption and assimilation

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
3.3 Nutrition in a mould	3	<ul style="list-style-type: none"> Describe the structure of a common mould. Explain the mode of nutrition in a mould. List the differences between internal and external digestion. Examine a mould under a microscope. 	<ul style="list-style-type: none"> Structure of a common mould e.g. Rhizopus or mucor. Nutrition in a mould. Comparison of internal and external digestion. 	<ul style="list-style-type: none"> Discussion Practical approach
3.4 Nutrition in green plants	9	<ul style="list-style-type: none"> Define photosynthesis. List factors that affect photosynthesis. State the site of photosynthesis in a leaf. List adaptations of a leaf to carry out the process of photosynthesis. State products of photosynthesis and their importance. Name major plant nutrients for normal growth. Demonstrate the necessity for carbon dioxide, light and chlorophyll for photosynthesis. Demonstrate that oxygen is given off during photosynthesis. 	<ul style="list-style-type: none"> Definition of photosynthesis Factors that affect the rate of photosynthesis. Leaf adaptations for photosynthesis. Products of photosynthesis and their importance to plants and animals. Major plant nutrient elements (culture experiment). Experiments on factors affecting rate of photosynthesis; light, carbon dioxide (CO_2) and chlorophyll. 	<ul style="list-style-type: none"> Discussion on the process of photosynthesis, its products and their importance, and leaf adaptations. Guided discussion on plant nutrients. Practical on factors that affect the process of photosynthesis.

TERM III

Topic 4:
Transport
Duration: 36 Periods
General Objective:

By the end of the topic the learner should be able to understand and appreciate the mechanisms by which materials move within an organism.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
4.1 Transport in animals	2	<p>The learner should be able to;</p> <ul style="list-style-type: none"> • Explain the need for a transport system • List structures involved in transport in animals. 	<ul style="list-style-type: none"> • Need for transport system. • Use of surface area to volume ratio. 	<ul style="list-style-type: none"> • Discussion on the need for transport system, structures involved in transport in animals and their functions • Use of surface area to volume ratio in relation to transport.
	9	<ul style="list-style-type: none"> • Describe the structure of the heart and how it functions. • Explain the differences between arteries, veins and capillaries. • Describe the major functions of blood. • State components of blood and their function. • Demonstrate blood flow in a tail of tadpole. 	<ul style="list-style-type: none"> • Heart structure and function. • Types of blood vessels. • Blood circulation and its functions. • Practicals on blood flow in the wing of cockroach or tail of a tadpole. 	
	4	<ul style="list-style-type: none"> • Explain the importance of knowledge of blood groups for blood transfusion. • Define immunity. • State the types of immunity. • Explain how immunity is weakened by various infections including HIV. 	<ul style="list-style-type: none"> • Blood groups and blood transfusion. • Immunity and HIV. 	<ul style="list-style-type: none"> • Discussion on blood groups, Immunity and HIV. • Brain storm on the importance of the different types of immunity.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
	3	<ul style="list-style-type: none"> Explain the function of lymph in a mammalian body. Explain cause, signs and symptoms of elephantiasis. 	<ul style="list-style-type: none"> Lymphatic system Elephantiasis – cause, signs and symptoms. 	<ul style="list-style-type: none"> Discussion on lymph and its functions
4.2 Transport in plants	5	<ul style="list-style-type: none"> Describe the internal structure of a root hair. Explain how the root hair is adapted for absorption of water and mineral salts. Describe the internal structure of a monocot and dicot root. 	<ul style="list-style-type: none"> Internal structures of root hairs and stems. Adaptations of the root hair for absorption of water and mineral salts. 	<ul style="list-style-type: none"> Demonstration on root structure. Discussion on osmosis, diffusion and turgor pressure and their importance.
	6	<ul style="list-style-type: none"> Describe the internal structure of a monocot and dicot stem. Explain what active transport is and its importance. Define the terms; osmosis, diffusion and turgot pressure. Explain the terms; flaccid, turgid, wilting and shriveling. Explain how materials move into and within the whole plant. Conduct an experiment on osmosis and diffusion. 	<ul style="list-style-type: none"> Active transport. Diffusion, osmosis and turgor pressure. Experiments on osmosis and diffusion. Movement of materials within a plant. 	<ul style="list-style-type: none"> Guided discussion on active transport. Demonstration of osmosis and diffusion using experiments.
	7	<ul style="list-style-type: none"> Define transpiration. Describe the various factors that affect the rate of transpiration. Conduct experiments on transpiration. Describe storage of food in a plant. Identify the different storage organs. 	<ul style="list-style-type: none"> Transpiration and factors affecting it. Experiment on transpiration Storage of food in plants. Observation of storage organs. 	<ul style="list-style-type: none"> Discussion on transpiration and its importance. Guided discussion on factors that affect transpiration Experiments on transpiration. Discussion on plant storage organs and their importance.

SENIOR THREE

TERM I

Topic 5:

Respiration

Duration: 36 Periods

General Objectives: By the end of the topic the learner should be able to:

1. understand the processes by which food is broken down to release energy needed for chemical processes.
2. understand how organism exchange gases with their respiratory medium.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
5.1 Gaseous exchange	4	The learner should be able to; <ul style="list-style-type: none">• Explain the need for gaseous exchange systems in different animals.• Describe essential features of an efficient respiratory surface.	<ul style="list-style-type: none">• Structure and functions of respiratory organs in insects, bony fish, amphibians and mammals.• Properties of gaseous exchange surfaces.	<ul style="list-style-type: none">• Discussion on need for gaseous exchange surfaces and their characteristic features in different organisms.• Demonstration of some of the respiratory organs such as gills in fish, tracheal system in insects.
	6	<ul style="list-style-type: none">• Explain the mechanism of gaseous exchange in amoeba, insect, bony fish, and frog/toad.	<ul style="list-style-type: none">• Gaseous exchange in amoeba, insect, bony fish and frog / toad.	
	8	<ul style="list-style-type: none">• Explain the mechanism of gaseous exchange in mammals.• Demonstrate how to carry out artificial respiration.• Conduct experiments on mechanism of breathing	<ul style="list-style-type: none">• Breathing mechanism and artificial respiration in humans.• Analyze the nature of inhaled and exhaled air.	<ul style="list-style-type: none">• Discussion on breathing mechanism in humans.• Practical work on analysis of inhaled and exhaled air.
		<ul style="list-style-type: none">• Explain how the stomata allow gaseous exchange in a leaf.	<ul style="list-style-type: none">• Role of stomata in gaseous exchange.	

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
	3	<ul style="list-style-type: none"> Describe the function of lenticels and breathing roots in relation to gaseous exchange. 	<ul style="list-style-type: none"> Role of lenticels and breathing roots in gaseous exchange. 	<ul style="list-style-type: none"> Discussion on adaptations of aquatic organisms for gaseous exchange.
	2	<ul style="list-style-type: none"> Describe the adaptations exhibited by aquatic plants and animals for gaseous exchange. 	<ul style="list-style-type: none"> Adaptation of aquatic plants and animals for gaseous exchange. 	
	2	<ul style="list-style-type: none"> Explain the relationship between plants and animals in relation to respiration and photosynthesis. 	<ul style="list-style-type: none"> Gas relationship between plants and animals. 	
5.2. Tissue respiration	5	<ul style="list-style-type: none"> State the substrate and products of chemical oxidation of food in a cell. 	<ul style="list-style-type: none"> Chemical oxidation in the cell. 	<ul style="list-style-type: none"> Discussion on aerobic respiration.
5.2.1 Aerobic respiration		<ul style="list-style-type: none"> Show the process of respiration in an equation form. Define aerobic respiration. State the site and importance of aerobic respiration in living organisms. Name the products of aerobic respiration. Demonstrate heat generation during aerobic respiration. Conduct an experiment of analysis of inhaled and exhaled air. 	<ul style="list-style-type: none"> Difference between aerobic and anaerobic respiration. Role of adenosine triphosphate (ATP). Practical activities – heat generation during respiration, analysis of breathed in and exhaled air. 	<ul style="list-style-type: none"> Guided discussion on site and products of aerobic respiration. Experimentation on heat generation and nature of inhaled and exhaled air.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
5.2.2 Anaerobic respiration	6	<ul style="list-style-type: none"> • Define anaerobic respiration • State where anaerobic respiration occurs in plants and animals. • State the importance of anaerobic respiration. • Explain what ATP is. • Explain the importance of ATP in cells. • Demonstrate anaerobic respiration in germinating seeds. • Demonstrate fermentation in yeast. 	<ul style="list-style-type: none"> • Definition of anaerobic respiration. • Anaerobic respiration in germinating seeds, fermentation in yeast. • Adenosine triphosphate (ATP) and its importance. • Practicals on anaerobic respiration 	<ul style="list-style-type: none"> • Discuss anaerobic respiration, where it takes place and its importance. • Guided discussion on the role of ATP • Practical work on germinating seeds and fermentation in yeast.

TERM II

Duration: 12 Periods

Topic 6:

Excretion and Homeostasis

General Objective: By the end of the topic learners will be able to understand how living organisms eliminate waste products from their bodies and also maintain a constant internal environment.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
6.1 Excretion in lower organisms	1	The learner should be able to; <ul style="list-style-type: none">• Define excretion.• Explain the concept of osmoregulation.• Describe the process of excretion in amoeba.	<ul style="list-style-type: none">• Definition of excretion.• Concept of osmoregulation.• Excretion and osmoregulation in amoeba or paramecium.	<ul style="list-style-type: none">• Discussion on excretion and osmoregulation in lower organisms
6.2 Excretion in Plants	1	<ul style="list-style-type: none">• Name plant waste products.• Explain the role of stomata in getting rid of water vapour and carbon dioxide.• Explain how plants get rid of other waste products.• Explain how some waste products of plants are useful to humans.	<ul style="list-style-type: none">• Plant waste products: Carbon dioxide (CO_2), Oxygen (O_2), water, resins, tannins, latex.• Special methods of getting rid of waste products by plants.• Useful plant waste products.	<ul style="list-style-type: none">• Discussion on excretion in plants; waste products and forms in which they are eliminated.• Guided discussion on useful plant waste products.
6.3 Excretion in animals	2	<ul style="list-style-type: none">• List the parts of a mammalian skin.• Describe the functions of the skin.	<ul style="list-style-type: none">• Structure and function of a mammalian skin.	<ul style="list-style-type: none">• Discussion on structure and function of a mammalian skin.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
	4	<ul style="list-style-type: none"> Draw and label the parts of the urinary system. Locate the position of the kidneys in a mammal. Describe the structure of mammalian kidneys. Explain how kidneys function in getting rid of waste products from the body. 	<ul style="list-style-type: none"> Urinary system. Structure and function of a mammalian kidney. Role of the kidney in osmoregulation. 	<ul style="list-style-type: none"> Demonstration on position / location of kidneys in a mammal. Discuss role of kidneys in osmoregulation.
	1	<ul style="list-style-type: none"> Describe how the lungs get rid of excess heat, water and carbon dioxide from the body. 	<ul style="list-style-type: none"> Lungs and their role in temperature regulation and excretion of water and carbon dioxide. 	<ul style="list-style-type: none"> Guided discussion on excretory wastes by the lungs, and their elimination from the body. Practical approach
	3	<ul style="list-style-type: none"> Explain how urea is formed in the liver and eliminated. Define homeostasis. Explain the role of the kidney in osmoregulation. Explain how the liver regulates blood sugar level in the human body. List other functions of the liver. Conduct an experiment to find out presence of sugar and albumen in urine sample. Identify and draw the mammalian kidneys in a dissected rabbit or white mice. 	<ul style="list-style-type: none"> Role of the liver in formation and elimination of urea. Role of the liver in maintaining internal environment. Practical – test for glucose and albumen and dissection of a mammal to show position of kidneys (by teacher). 	<ul style="list-style-type: none"> Discussion on formation of urea and its elimination. Guided discussion on the importance of maintaining internal environment. Practical: test for components of urine e.g. glucose and albumen

Duration: 24 Periods

Topic 7:

Co-ordination in Plants and Animals

General Objective:

By the end of the topic the learner should be able to understand how living organisms respond to stimuli (changes) in the environment and how their behavior is influenced by the environment.

SUB-TOPIC	NO. OF PERIODS	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
7.1 Reception and Response in plants	4	<p>The learner should be able to;</p> <ul style="list-style-type: none"> • Explain the term irritability, stimulus and response. • Name the different types of stimuli and the corresponding receptor organs. • Explain what a nastic response is and its importance in organisms. • Define a tropism. • List the types of tropisms. • Explain phototropism, geotropism and hydrotropism using real life examples. • Explain what auxins are and their role in plant growth. • Describe an experiment on the effects of Indole Acetic Acid (IAA) on decapitated coleoptiles tips. • Explain how auxins are used on plant growth as weedicides / herbicides. 	<ul style="list-style-type: none"> • Definition of irritability, stimulus and response. • Nastic response. • Tropic responses. • Chemical control of responses in plants. • Experiments on nastic and tropic responses. • Experiment using IAA. • Use of other plant hormones e.g. Gibberellins. • Comparison of auxins and gibberellins. 	<ul style="list-style-type: none"> • Discussion on different types of stimuli and responses. • Guided discussion on the importance of irritability. • Practical work on effects of IAA on decapitated coleoptiles tips. • Field work to study nastic responses. • Guided discussion on gibberellins.

SUB-TOPIC	NO. OF PERIODS	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
		<ul style="list-style-type: none"> Demonstrate experiments on nastic and tropic responses. Conduct an experiment on effect of auxins on plant growth. Give the uses of other plant hormones such as gibberellins. Compare auxins and gibberellins. 		
7.2 Reception, response and behaviour in animals	2	<ul style="list-style-type: none"> Define a tactic response. List the types of tactic responses using suitable examples. Explain the importance of tactic responses to the organism. Demonstrate tactic responses using on earthworm or fly larvae/maggot / wood louse. 	<ul style="list-style-type: none"> Tactic response in animals. Types of tactic responses (photo, chemo, moisture, temperature, touch). Importance of tactic responses. Practical activity. 	<ul style="list-style-type: none"> Discussion on nature of tactic responses and their importance. Experiment on tactic responses.
7.3 Chemical Coordination in vertebrates	3	<p>The learner should be able to;</p> <ul style="list-style-type: none"> Define a hormone. List the names and locations of endocrine glands. Name the hormones produced by the endocrine glands. Explain the effects of the various hormones in the human body. 	<ul style="list-style-type: none"> Definition of a hormone. Endocrine glands – names, location and functions. Hormones produced by endocrine glands Role of pituitary gland. 	<ul style="list-style-type: none"> Discussion on endocrine glands their location, the hormones they secrete and the different functions of the hormones. Guided discussion on role of pituitary gland.

SUB-TOPIC	NO. OF PERIODS	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
		<ul style="list-style-type: none"> Explain how the pituitary gland controls the other endocrine glands. Describe the effects of the hormones produced by the pituitary gland on the target organs. Explain the differences between hormones and enzymes. 	<ul style="list-style-type: none"> Comparison of hormones and enzymes. 	
7.4 Nervous coordination in a mammal	2	<ul style="list-style-type: none"> Define a neurone. Define the term stimulus, effector and receptor. Describe the structure and function of a nerve cell. Describe the different types of nerve cells. Describe the direction of the nerve impulse from receptor to effector. 	<ul style="list-style-type: none"> Nerve Cell (neurone) structure, function and types. Structure and function of nerve. 	<ul style="list-style-type: none"> Discussion on nerve cells, receptors and effectors. Discussion on parts of the nervous system and their functions.
	3	<ul style="list-style-type: none"> Describe the parts/divisions of the nervous system and the organs associated with each division. Describe the structure and general functions of the brain and spinal cord. Explain the functions of the peripheral nervous system. 	<ul style="list-style-type: none"> Parts of nervous system (central and peripheral nervous system). Parts and function of peripheral nervous system. 	<ul style="list-style-type: none"> Guided discussion on peripheral nervous system

SUB-TOPIC	NO. OF PERIODS	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
	3	<ul style="list-style-type: none"> Describe the path of a reflex arc. Describe the structure and function of a synapse. Explain the difference between simple and conditioned reflexes. Demonstrate a knee jerk, blinking of eye as examples of reflex actions. Describe Pavlov's experiment on conditioned reflex. 	<ul style="list-style-type: none"> Types of reflex actions (simple and conditioned reflexes). Reflex arc. Structure and function of synapses. Practical activity – knee jerk, blinking of eye, and Pavlov experiment. 	<ul style="list-style-type: none"> Discussion on reflex action, reflex arc and function of synapse. Practical work on reflex actions
7.5 Receptor organs in mammals	1	<ul style="list-style-type: none"> List the physical and chemical stimuli. List the various receptor organs. 	<ul style="list-style-type: none"> Types of stimuli (physical and chemical). Receptor organs in a mammal 	<ul style="list-style-type: none"> Guided discussion on physical and chemical stimuli, and receptor organs in a mammalian body.
	3	<ul style="list-style-type: none"> Name the various parts of the human eye. Explain the function of each part of the human eye. Explain how the eye views near and far objects. Name the eye defects and their causes. Explain how the eye defects can be corrected. 	<ul style="list-style-type: none"> Structure and function of the mammalian eye. Accommodation of the eye, eye defects and their corrections. 	<ul style="list-style-type: none"> Discussion on structure and function of the mammalian eye, accommodation, eye defects and correction.

SUB-TOPIC	NO. OF PERIODS	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
	3	<ul style="list-style-type: none"> • List the various parts of the human ear. • Explain the function each part of the human ear. • Explain the process of hearing. • Explain causes of deafness. 	<ul style="list-style-type: none"> • Structure and function of a mammalian ear. • Process of hearing. • Causes of deafness 	<ul style="list-style-type: none"> • Discussion on structure and function of the ear. • Illustrate the process of hearing.
	1	<ul style="list-style-type: none"> • Name various parts of human skin and their function. • Explain the role of the skin in regulating body temperature and sensing of pressure. 	<ul style="list-style-type: none"> • Structure and functions of the skin. • Role of skin in regulation of body temperature and sensing of pressure. 	<ul style="list-style-type: none"> • Discuss structure and function of the skin in relation to sensitivity.
	2	<ul style="list-style-type: none"> • Identify areas in the tongue responsible for sensing sour, sweet, bitter and salty. • Explain the role of the nose in sensing different types of odours. • Describe the different ways of caring for sensory organs. 	<ul style="list-style-type: none"> • Role of tongue and nose • Care of sensory organs. • Practical activity – experiment to locate various taste buds / areas on the tongue, sensitive to sour, salty, bitter and sweet. 	<ul style="list-style-type: none"> • Discussion on areas of tongue sensitive to sour, bitter, sweet and salty. • Demonstration of such areas using different chemicals solutions / materials such as sugar, salt, lemon and chloroquine tablets.

TERM III

Topic 8:**Locomotion in Animals****Duration:** 36 Periods**General Objective:**

By the end of the topic the learner should be able to understand mechanisms by which organisms move in search of food, protection, mates and suitable conditions.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
8.1 Locomotion in a mammal	1	<ul style="list-style-type: none">• Define locomotion.• Explain the need for locomotion.	<ul style="list-style-type: none">• Definition of locomotion• Need for locomotion	<ul style="list-style-type: none">• Discussion on the need for locomotion in animals.• Guided discussion on types of skeletons and their functions.• Demonstration of the various types of skeletons.
	9	<ul style="list-style-type: none">• State the types of skeletons and their function.• State the two divisions of the skeleton.• List the bones that form each of the divisions.• List the functions of the mammalian skeleton.	<ul style="list-style-type: none">• Types of skeletons.• Axial and Appendicular skeletons and their functions.	
	4	<ul style="list-style-type: none">• Define a joint.• Describe the structure of a joint.• Describe the different types of joints.• Explain the functions of the joints.	<ul style="list-style-type: none">• Definition of a joint• Types of joints and their functions	<ul style="list-style-type: none">• Discussion on types of joints, their location and functions.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
	2	<ul style="list-style-type: none"> Explain what antagonistic muscles are. Explain the functioning of antagonistic muscles. 	<ul style="list-style-type: none"> Antagonistic muscles and their function. 	<ul style="list-style-type: none"> Guided discussion on antagonistic muscles and their importance.
	4	<ul style="list-style-type: none"> Identify, draw and label different types of vertebrae and limb bones. 	<ul style="list-style-type: none"> Practical activity – <ul style="list-style-type: none"> - movements of muscles in the forearm, - drawing and labeling parts of a mammalian skeleton. 	<ul style="list-style-type: none"> Practicals: drawing of various bones of the skeletal structure especially those of the vertebral column and limbs.
8.2 Locomotion in insect, bony fish and birds	6	<ul style="list-style-type: none"> Name the parts of a grasshopper that enable it to move. Explain how movement is brought about in a grasshopper. Draw and label the hind legs of a grasshopper. State differences in structure between inner and outer wings of a grasshopper. 	<ul style="list-style-type: none"> Locomotion in an insect e.g. grasshopper <ul style="list-style-type: none"> - Parts that help it to move. - Mechanism of movement – flight and hopping. Practical activity on observation of movement in a grasshopper. 	<ul style="list-style-type: none"> Discussion of main parts of a grasshopper used in movement. Guided discussion on mechanism of movement Observation of grass hopper movements.
	4	<ul style="list-style-type: none"> Name external features of a bony fish Explain the function of each feature. List the various adaptations that enable a bony fish to move. 	<ul style="list-style-type: none"> Locomotion in a bony fish: <ul style="list-style-type: none"> - external features of a bony fish - mechanism of movement Practical activity on fish movement in an aquarium. 	<ul style="list-style-type: none"> Discussion on external features of bony fish Demonstration on how a bony fish moves. Practical approach – observation on fish movements.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
		<ul style="list-style-type: none"> Explain briefly how movement is brought about in a bony fish. 		
	6	<ul style="list-style-type: none"> List parts of the bird that enables it to move. Identify, draw and label the different types of feathers. List the various adaptations that enable the bird to fly. Name types of movements a bird makes while flying. 	<ul style="list-style-type: none"> Parts of a bird that help it to move. Types of feathers. Adaptations for flight. Types of bird movements (gliding, flapping, soaring). Bird's skeleton adaptation to flight. Practical activity – drawing and labeling of bird's feathers. 	<ul style="list-style-type: none"> Brainstorm on parts of a bird that help it to move. Discussion on adaptation and types of bird movements. Field study on movements in different birds. Practical work on drawing of flight bones and feathers.

SENIOR FOUR TERM I

Topic 9:

Growth and Development in Plants and Animals

Duration: 14 Periods

General Objective: By the end of the topic the learner should be able to understand processes by which living organisms increase in size and change in form, becoming more complex as they grow.

SUB-TOPIC	NO. OF PERIODS	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
9.1 Growth in plants and animals	2	<ul style="list-style-type: none">• Define the terms: growth and development.• Describe the stages of mitosis.• Explain the importance of mitotic cell division in living organisms.	<ul style="list-style-type: none">• Definition of growth and cell division.• Mitotic cell division, stages and its importance.	<ul style="list-style-type: none">• Discussion on growth and role of mitosis
	3	<ul style="list-style-type: none">• Describe internal and external structure of a seed.• Draw and label the internal and external parts of a seed.• Explain seed dormancy.• List the factors / conditions necessary for seed germination.• Conduct experiments on conditions necessary for seed germination• Name the type of seed germination in monocots and dicots.• List causes of seed dormancy.	<ul style="list-style-type: none">• Seed structure• Stages of germination• Conditions necessary for germination.• Seed dormancy, causes and how to break it.• Meristems and their importance.• Regions of elongation in roots and stems.	<ul style="list-style-type: none">• Guided discussion on seed structure and stages of germination.• Practical on germination.• Explanation on seed dormancy and its causes.• Discussion on the importance of meristems and their location in plants.• Explanation on cell division and enlargement.

SUB-TOPIC	NO. OF PERIODS	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
		<ul style="list-style-type: none"> Explain how seed dormancy can be broken. State the importance of seed dormancy. Explain the importance of meristems in plants. Identify regions of greatest cell elongation in roots and shoots. 		
	3	<ul style="list-style-type: none"> Explain the growth patterns in insects, amphibians and mammals. Explain how growth is brought about by cell division and cell enlargement in organisms Conduct experiment on plant growth over time and plot a growth-time graph on the growth observed. 	<ul style="list-style-type: none"> Growth patterns in various animals. Growth as a result of cell division and cell enlargement. Growth curves in humans. 	<ul style="list-style-type: none"> Guided discussion on growth patterns.
9.2 Development in plants and animals	1	<ul style="list-style-type: none"> Explain the increase in complexity and form in plants and animals. Explain the development of a simple seed into a huge plant. 	<ul style="list-style-type: none"> Differentiation of cells to form tissues. Change form of organisms. 	<ul style="list-style-type: none"> Discussion on cell differentiation and change of form of organisms. Observation of a growing plant.
		<ul style="list-style-type: none"> List the differences between endospermic seeds and non-endospermic seeds. 	<ul style="list-style-type: none"> Secondary growth of stem in dicot plants. 	<ul style="list-style-type: none"> Discussion on secondary growth and how it is brought about.

SUB-TOPIC	NO. OF PERIODS	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
	5	<ul style="list-style-type: none"> • Describe epigeal and hypogea germination. • Explain the process of secondary growth of stem in dicot-plants. • Define the term metamorphosis. • Explain the difference between complete and incomplete metamorphosis. • Describe the stages of development in an insect. • Describe the stages of development in an amphibian and a mammal. • Explain metamorphosis in a frog. • Conduct experiments on growth of a frog. • Record observations on growth of human baby by weight for a period of 4 months using a health card. 	<ul style="list-style-type: none"> • Germination in a monocot and dicot seeds. • Metamorphosis in insects (cockroach and butterfly). • Stages of development in amphibians and mammals. • Measurement of weight of human baby for a given period of time. • Practical activities <ul style="list-style-type: none"> - Growth in a frog - Growth in a baby • Use of health card. 	<ul style="list-style-type: none"> • Observe and record stages of germination in dicot and monocot seeds. • Projects on stages of insects growth and development.

Topic 10:**Reproduction in Plants and Animals****Duration:** 22 Periods**General Objective:**

By the end of the topic the learner should be able to understand the mechanism by which living organisms produce their off-springs and sustain their life on earth.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
10.1 Asexual Reproduction in lower organisms	2	<ul style="list-style-type: none"> • Define asexual reproduction. • Describe binary fission in amoeba • Describe the structure of mucor. • Explain how mucor reproduces through sporulation. • Describe budding in yeast. • Explain how spirogyra reproduces by fragmentation. • Conduct a practical on growth of mucor / rhizopus on moist bread. 	<ul style="list-style-type: none"> • Asexual reproduction in amoeba and mucor/rhizopus. • Budding in yeast • Fragmentation in spirogyra. • Practical activity on growth of mucor or rhizopus. 	<ul style="list-style-type: none"> • Discussion on asexual reproduction in lower organisms. • Demonstration on budding in yeast and fragmentation in spirogyra. • Practical on growth of mucor or rhizopus using moist bread.
10.2 Asexual Reproduction in plants (vegetative reproduction)	4	<ul style="list-style-type: none"> • Define vegetative reproduction • List plant structures used in vegetative reproduction. • Explain vegetative reproduction using leaves of Bryophyllum. • Describe structure of a stem tuber and a bulb. • Draw and label parts of a sucker and rhizome. 	<ul style="list-style-type: none"> • Concept of vegetative reproduction in plants • Stem tubers and bulbs • Suckers and rhizomes and their parts. • Corms and its parts. • Differences between a rhizome and corm • Practical activity on drawing and labeling of vegetative parts. 	<ul style="list-style-type: none"> • Discuss vegetative reproduction in plants. • Guided discussion and explanation on stem tubes, bulbs, suckers, rhizomes and corms. • Brain storm on advantages and disadvantages of vegetative reproduction.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
		<ul style="list-style-type: none"> • Describe parts of a corm. • List differences between a rhizome and a corm. • Draw and label vegetative reproductive organs. • Explain how stem cuttings are used to produce new plants. • Describe the procedures used in budding, marcotting, layering and grafting to produce new plants. • Explain the importance of artificial propagation with regard to crop production. 	<ul style="list-style-type: none"> • Artificial propagation – use of stem cutting, budding, layering and grafting marcotting. • Importance of artificial propagation in plant growth. 	<ul style="list-style-type: none"> • Discuss methods used in artificial propagation and advantages of such methods.
10.3 Sexual Reproduction in lower organisms	2	<ul style="list-style-type: none"> • Define sexual reproduction. • Describe sexual reproduction in mucor / rhizopus and spirogyra. • Observe slides of sexual reproduction in spirogyra and mucor. 	<ul style="list-style-type: none"> • Definition of sexual reproduction. • Sexual reproduction in lower organisms e.g. mucor and spirogyra. 	<ul style="list-style-type: none"> • Discussion on sexual reproduction in lower organisms. • Practical approach using mucor / rhizopus.
10.4 Sexual reproduction in animals.		<ul style="list-style-type: none"> • Describe sexual reproduction in bony fish, amphibians and birds. • Draw and label male reproductive parts in humans. • Draw and label female reproductive parts. 	<ul style="list-style-type: none"> • Sexual reproduction in bony fish, amphibians and insects. • Sexual reproduction in birds. • Sexual reproduction in a mammal: 	<ul style="list-style-type: none"> • Discussion and explanation on sexual reproduction in fish, frog and bird. • Illustration on male and female reproductive parts and explanation on their functions.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
	6	<ul style="list-style-type: none"> • Describe the menstruation cycle. • Describe the process of fertilization of an ovum and the developments up to birth. • State the role of the placenta during pregnancy. • Describe birth and parental care of the young. • List birth control methods • Describe the use of each birth control method, its side effects and effectiveness. • State what STDs are. • Name the types of STDs and STIs . • State the causes of STDs and STIs. • State the cause of HIV/AIDS. • Explain the mode of transmission of STDs and STIs. • Describe signs and symptoms of each STD. • List preventive measures for each disease (STD). 	<ul style="list-style-type: none"> ▪ Male reproductive organs. ▪ Female reproductive organs ▪ Menstruation cycle. • Fertilization and development of embryo in humans. • Role of the placenta during pregnancy. • Role of hormones in maintenance of pregnancy. • Birth of the young and parental care. • Method of birth control. • What STDs, STIs, HIV/AIDS are • Causes and mode of transmission. • Signs and symptoms of each STDs. • Prevention of STDs and HIV/AIDS. • Practical activity on reproduction e.g. stages of insects, amphibians and birds. 	<ul style="list-style-type: none"> • Guided discussion on menstrual cycle and secondary sexual characteristics. • Discussion and explanation on fertilization and development of embryo in humans. • Guided discussion on role of hormones during pregnancy. • Brain storm on methods of birth control. • Discuss the different types of STDs, causes, prevention and control. • Observations on stages of an insect in laboratory.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
10.5 Sexual Reproduction in Plants	6	<ul style="list-style-type: none"> • List the parts of a flower. • Explain the function of each part of a flower. • Define pollination. • Name types of pollination. • List the agents of pollination. • Outline characteristics of insect and wind pollinated flowers. • Describe the process of fertilization. • Explain the formation of fruit and seeds. • Explain how a fruit differs from a seed. • Explain the economic importance of flowers. 	<ul style="list-style-type: none"> • Structure of a flower. • Flower parts and their function. • Economic importance of flowers . • Definition of pollination. • Types of pollination. • Agents of pollination. • Adaptations of wind and insect pollinated flowers. • Fertilization and formation of fruit and seeds. • Differences between fruits and seeds. 	<ul style="list-style-type: none"> • Brain storming on parts of a flower and their functions. • Discussion on pollination, agents of pollination and adaptations of the different flowers to wind and insect pollination. • Explanation on formation of fruits and seeds.
	2	<ul style="list-style-type: none"> • Explain fruit and seed dispersal. • Describe methods of fruit and seed dispersal • List the agents of fruit and seed dispersal. • State the adaptations of fruits and seeds that aids their dispersal. • Explain the importance of fruit and seed dispersal. • Examine, dissect and label the various parts of a flower. 	<ul style="list-style-type: none"> • Definition of fruit and seed dispersal • Methods of fruit and seed dispersal. • Importance of fruit and seed dispersal. • Agents of fruit and seed dispersal. • Adaptations of fruit and seeds for dispersal by various agents. 	<ul style="list-style-type: none"> • Discussion on the fruit and seed dispersal, agents involved and its importance. • Brainstorm on the adaptations of fruit and seed for dispersal • Practical on drawing of fruits and seeds to show the adaptations they have for dispersal.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
		<ul style="list-style-type: none"> • Observe and record the differences between wind pollinated and insect pollinated flowers. • Draw and label fruits and seeds showing their adaptations for dispersal. 	<ul style="list-style-type: none"> • Practical activity on flowers, fruits and seeds. 	

TERM II

Topic 11:
Genetics and Evolution
Duration: 30 Periods
General Objective:

By the end of the topic the learner should be able to understand the role of cell division in living organisms and how variation occurs among various species.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
11.1 Mitosis and meiosis and their importance	4	<ul style="list-style-type: none"> • Describe the process of mitosis • Describe the process of meiosis. • Explain the significance of both types of cell division. 	<ul style="list-style-type: none"> • Mitosis and meiosis • Comparison of mitosis and meiosis. • Significance of mitosis and meiosis. 	<ul style="list-style-type: none"> • Discussion on differences between mitosis and meiosis. • Brain storm on the importance of each type of cell division.
11.2 Genetics and Monohybrid inheritance	6	<ul style="list-style-type: none"> • Define genetics. • Explain Mendel's Monohybrid ratio. • Work out Mendel's Monohybrid ratio. • Explain the mechanism of heredity. • Explain the terms dominance, recessive, homozygous, heterozygous, phenotype and genotype, hybrid, test cross. • Construct a punnet square (crosses) to explain genotypes of offsprings. 	<ul style="list-style-type: none"> • Definition of genetics. • Mendel's Monohybrid ratio. • Heredity through Mendel's law of independent segregation. • Definitions of dominance, recessive, homozygous, heterozygous, phenotype, genotype and their respective ratios. 	<ul style="list-style-type: none"> • Discussion and explanation on genetics and Mendel's work. • Demonstration on how to arrive at monohybrid ratio. • Explanation of the genetic terms.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
	6	<ul style="list-style-type: none"> • Explain co-dominance. • Explain co-dominance in blood groups, sickle cell anaemia. • Explain the role of heredity in producing the desired varieties of plants and animals. • Demonstrate how the production of the desired plants and animal species can be achieved. • Carry out selective breeding in goats, chicken and cattle. • Explain the advantage of hybridization (cross breeding). 	<ul style="list-style-type: none"> • Incomplete dominance or co-dominance and its cause. • Co-dominance in blood groups, sickle cell trait. • Role of principles of heredity in plant and animal breeding. • Hybridization and its importance. 	<ul style="list-style-type: none"> • Discussion on dominance and co-dominance • Field trips to Agricultural Colleges / Institutions. • Discuss the advantages of hybridization.
11.3 Sex determination and hereditary diseases	6	<ul style="list-style-type: none"> • List the differences between autosomes and sex chromosomes. • Explain the terms chromosome, gene and DNA. • Compare the chromosome number of a body cell, a sperm and an egg (ovum). • Name the types of sex cells produced by a male and female. • Explain the 50:50 ratio of male: female in a population. • State the heredity diseases and sex linked traits. 	<ul style="list-style-type: none"> • Chromosome, Genes and DNA. • Sex chromosomes. • Sex determination in humans. • Sex linked traits. • Hereditary diseases e.g. hemophilia, sickle cell. 	<ul style="list-style-type: none"> • Discussion on chromosomes, genes and DNA. • Explanation on sex determination in humans. • Brainstorm hereditary sex linked traits.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
11.4 Mutation, variation and evolution	8	<ul style="list-style-type: none"> • Define the term mutation. • List the types of mutation. • Explain the causes of mutation. • Explain the term variation. • Explain continuous and discontinuous variation. • Name types of variation. • Explain the causes of variation. • Define evolution. • Explain some theories of the origin of life. • Explain natural selection and factors that favour it. • Demonstrate continuous and discontinuous variation using plotted graphs based on certain characteristics such as height and sex. • State different types of evidence for evolution. • Explain each type of evidence for evolution 	<ul style="list-style-type: none"> • Definition of mutation • Types of mutation. • Causes of mutation. • Definition of variation. • Types of variations. • Causes of variations. • Definition of evolution • Theory on origin of life. • Natural selection. • Factors that cause natural selection. • Role of mutation, natural selection and adaptive changes in evolutionary changes. • Practical on continuous and discontinuous variation in class e.g. height, weight, sex, tongue rolling etc. • Evidence of evolution 	<ul style="list-style-type: none"> • Discussion on mutation, types and causes • Brain storm on variation, types and causes. • Experimentation on variation <ul style="list-style-type: none"> • Discussion on origin of life and natural selection. • Explanation on the role of mutation, natural selection in evolutionary changes.

TERM III

Topic 12:
Inter-Relationships
Duration: 20 Periods

General Objective:

By the end of the topic the learner should be able to understand how living organisms relate to one another and how human activities affect the environment.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
12.1 Food chains and food webs	3	<ul style="list-style-type: none"> • Define ecology. • Explain the terms inter-relationship, population, producer, consumer, decomposer and community. • Explain the terms habitat, niche, prey, predator, carrying capacity and ecosystem. • State the different types of ecosystems. 	<ul style="list-style-type: none"> • Definition of ecology • Concept of inter-relationship. • Components of the ecosystem. • Types of ecosystems 	<ul style="list-style-type: none"> • Explanation of ecology and ecosystem • Brain storm on types of ecosystems. • Explanation of concept of inter-relationship in ecosystems. • Field work and observation of the different ecosystems.
	3	<ul style="list-style-type: none"> • Explain what a food chain is. • Explain what a food web is. • Give an example of food web in illustrated diagrams. • Explain the various trophic levels in a food chain. 	<ul style="list-style-type: none"> • Food chain and food web. • Ecological pyramids: pyramids of numbers, biomass and energy. 	<ul style="list-style-type: none"> • Discussion on food webs, food chains and ecological pyramids.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
12.1 Energy flow in a habitat	1	<ul style="list-style-type: none"> Explain the pyramid of numbers, pyramid of biomass and energy. Explain the process of energy flow in the food chain and food web. Use the methods to collect and identify organisms in a habitat. 		
		<ul style="list-style-type: none"> List the appropriate methods used to collect plants and animals in a habitat. Use the methods to collect and identify organisms in habitat. 	<ul style="list-style-type: none"> Methods of quantitative sampling. When and how to use such methods 	<ul style="list-style-type: none"> Review methods of quantitative sampling and their use.
12.2 Changes in population	3	<ul style="list-style-type: none"> Define the term population. Describe characteristics of a population. State factors that affect population growth. Interpret population growth curves. List factors that affect human population growth. 	<ul style="list-style-type: none"> Definition of population Characteristics of a population. Factors that affect human population growth. Population growth and growth curves. 	<ul style="list-style-type: none"> Discussion on population, its characteristics and factors that affect its growth.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
	2	<ul style="list-style-type: none"> • State what a microbe is. • Describe the effects of microbes to plants and animals. • Outline methods of controlling microbial growth. • Explain how plants and animals are adapted for the different types of ecosystems • Explain the term competition. • Distinguish between inter-specific and intra – specific competition. 	<ul style="list-style-type: none"> • Definition of a microbe and examples. • Effects of microbial growth to plants and animals. • Methods of controlling microbial growth. 	<ul style="list-style-type: none"> • Explanation on microbial growth and effects. • Observations of microbial growth.
	4	<ul style="list-style-type: none"> • Explain what makes certain organisms compete better than others. • State factors that enable plants and animal to colonize new areas. • Explain what succession means. • Study and report the succession of a well cleared piece of land. 	<ul style="list-style-type: none"> • Competition. • Types of competition. • Adaptations of plants and animals for various ecosystems. • Factors that enable plants and animals to inhabit new areas. • Succession and its stages. • Practical activity. 	<ul style="list-style-type: none"> • Discussion on competition and types. • Explanation on adaptations of plants for various ecosystems. • Brain storm on succession and its stages. • Practical work on succession on a cleared piece of land.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
12.3 Associations in organisms	3	<ul style="list-style-type: none"> • Explain symbiosis. • Name organisms that exhibit symbiosis. • Explain parasitism. • List characteristics of parasites and types. • List adaptations of parasites and methods of controlling them. • Explain what schistosomiasis is and measures to control it. • Describe the life cycle of a tapeworm. • Outline measures to control tapeworm infestation. 	<ul style="list-style-type: none"> • Definition of Symbiosis and examples • Parasitism, parasites and types. • Characteristics of parasites. • Adaptations of parasites to various environments. • Methods of parasite control. • Schistosomiasis (Bilharzia) and mode of spread. • Tapeworm, its life cycle and effects on the host. 	<ul style="list-style-type: none"> • Discussion on symbiosis and types. • Explanation on parasitism. • Brain storm on parasites, types and their characteristics.
	3	<ul style="list-style-type: none"> • State the cause of malaria. • Describe mode of transmission of malaria parasite. • Name signs and symptoms of malaria • Outline control measures for malaria. • Describe the cause and mode of spread of trypanosomaisis. 	<ul style="list-style-type: none"> • Malaria, cause, mode of transmission, signs and symptoms and control measures. • Trypanosomaisis, causes and mode of spread. • Signs and symptoms of trypanosomaisis. 	<ul style="list-style-type: none"> • Discussion on cause, mode of transmism signs and symptoms and control of malaria. • Explanation on cause, mode of spread and control of tryponosomaisis • Discuss control measures for tyrponosomaisis.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
		<ul style="list-style-type: none"> • List the signs and symptoms of trypanosomiasis. • Describe control measures for trypanosomiasis. • List the adaptations of a tick 	<ul style="list-style-type: none"> • Control measures of the disease. • Adaptations of a tick 	<ul style="list-style-type: none"> • Brain storm on adaptations of a tick.
	8	<ul style="list-style-type: none"> • Explain the term commensalism. • State examples of organisms that are commensals. • List signs of presence of tomato blight fungus • Explain how the tomato blight is controlled • Identify and classify different types of associations among living organisms. 	<ul style="list-style-type: none"> • Commensalism, its meaning and examples. • Tomato blight fungus and its effects. • Practical activity – <ul style="list-style-type: none"> - field study to find out some of the associations between living organisms. 	<ul style="list-style-type: none"> • Explanation of the term commensalism. • Discuss infection of the tomatoes by the blight fungus. • Practical work to study associations between organisms in the locality
12.4 Humans and natural environment	6	<ul style="list-style-type: none"> • List human activities that adversely affect the natural environment. • Name the natural resources. • Describe conservation methods for natural resources. • State what pollution is? • State types of pollution. 	<ul style="list-style-type: none"> • Human activities – agriculture, lumbering, stone quarrying, swamp reclamation, charcoal making and fuel wood collection. • Natural resources 	<ul style="list-style-type: none"> • Group discussions on human activities • Discussion on natural resources • Brainstorm on methods of conserving natural resources. • Discussion on pollution, pollutants and effects on living organisms and environment.

SUB-TOPIC	PERIOD	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
		<ul style="list-style-type: none"> • List different types of pollutants. • Describe the effects of pollutants on the environment. • Explain methods of pollution control. 	<ul style="list-style-type: none"> • Methods of conservation of natural resources. • Importance of conservation of natural resources such as water, land, water forest and wild life. • Pollution and examples of pollutants. • Effects of pollutants to human life and the environment. 	<ul style="list-style-type: none"> • Field study to identify polluted areas in the locality.

Appendix I:

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Appendix II:

Biology Teaching Equipment

Apparatus

1. Aquarium
2. A pump
3. Aspirator
4. Asbestos cement mats
5. Gauze iron (12.5 cm)
6. Tripod triangular stands
7. Thermometers
8. Stop clocks
9. Balance (direct weighing)
10. Balance (chemical)
11. Plasticine of various colours
12. Evaporating basins
13. Crucibles
14. Tongs of wrought iron
15. Mortars and Pestles
16. Filter Papers (what man No.1) of various sizes
17. Filter Funnels (7.5 cm)
18. Blotting paper
19. Hand lenses
20. Microscopes
21. Cover slips
22. Glass slides
23. Microscope lamps
24. Razors
25. Petri dishes
31. Dissecting dish
32. Blocks of wood
33. Wax
34. Visking tube
35. Cellophane sheets
36. Oven
37. J-Tube for gas analysis
38. Klinostat
39. Potometer
40. Balloons
41. Beakers (100 ml) capacity
42. Beakers (1000 ml)
43. Bottles
44. Brushes for cleaning
45. Bungs of rubber
46. Cork bungs
47. Cork borer
48. Cage
49. Cans
50. Centrifuge
51. Clips for rubber tubing
52. Crocodile clips
53. Cooling system
54. Cotton wool
55. Desicators
56. Droppers
61. Glass tubing
62. Glass tubes
63. Bunsen burners
64. Jars
65. Cylinders (10 ml)
66. Pipettes
67. Test tubes
68. Boiling tubes
69. Glue
70. Tape
71. Cobalt chloride paper
72. Meter rules
73. Nets
74. Oven
75. Graph paper
76. Pins
77. Test tubes racks
78. Pots
79. Polythene bags
80. Plastic bottles
81. Spatulas
82. Strings (strong and light)
83. Syringes
84. Thermos flasks
85. Litmus papers (blue and red)
86. Plasticine

- 26. Watch glasses
- 27. Scalpels
- 28. Scissors
- 29. Needles
- 30. Dissecting kit
- 57. Electric supply e.g. dry cells, lead accumulators
- 58. Flask (500 ml)
- 59. Flasks (250 ml, 1000 ml)
- 60. Glass rods

CHEMICALS	REAGENTS AND CHEMICALS
<ul style="list-style-type: none"> 1. Methylene blue 2. Hydrochloric acid 3. Nitric acid 4. Sulphuric acid 5. Sodium chloride 6. Calcium oxide 7. Hydrogen peroxide 8. Glycerol / glycerin 9. Glacial acetic acid 10. Magnesium chloride 11. Sodium hydrogen carbonate 	<ul style="list-style-type: none"> 1. IAA 2. Agar powder 3. Glucose 4. Starch (soluble) 5. Sucrose 6. Millon's Reagent 7. Benedict's solution 8. Iodine 9. Ethanol (absolute) 10. DCPIP 11. Pepsin 12. Diastase 13. Bicarbonate Indicator, Thymol blue or Cresol red 14. Formaldehyde (methanol) 15. Chloroform 16. Ringer 's solution 17. Universal indicator 18. Eosin 19. Methylene blue 20. Leishman's Stain 21. Safranin Powder 22. Iodine solution 23. Copper sulphate 24. Calcium chloride

Useful materials and Specimens

1. Onion, beet root for study of cell structure.
2. Leguminous plants for epigeal germination.
3. Flower buds for study of meiosis
4. Zea mays (maize) for hypogea germination
5. Helianthus annus (sun flower) for germination.
6. Hibiscus sinensis – useful for transpiration.
7. Aloe specimen – for succulent leaves.
8. Bryophyllum specimen – for succulent leaves with buds.
9. Bougainvillea specimen – coloured bracteoles.
10. Crotalaria sp. – bee pollinated flowers and pod fruits.
11. Cassia siamea – a legume with cymose inflorescence and fruit (capsule).
12. Imperator cylindrical – rhizome and perennial weed.
13. Tridax procumbens – composite, achene fruits with parachute hairs.
14. Vernonia sp. – (Black jack) composite, achene fruits with hooks.
15. Sild specimen – malvaceae with schizocarp fruit.
16. Zebriana sp. – (*Tradescantia*) – useful for study of cytoplasmic streaming and plasmolysis.