NCDC
NATIONAL CURRICULUM
DEVELOPMENT CENTRE

ORDINARY LEVEL

S.2, S.3 & S.4 BIOLOGY - Abridged curriculum

BIOLOGY

KEY CHANGES	JUSTIFICATION
SENIOR 2	
All S.1 topics moved to S.2 except introduction to biology	These topics had not been covered before students went for lock down except Introduction to biology.
All topics S.2 topics were maintained	
Some learning outcomes from topics like Cells, Flowering plants, Five Kingdom System of Living Organisms, insects, Soil, Nutrition and Transport were left out.	concepts from these learning outcomes is; • Embedded in other learning outcomes. • Already known from primary level. • Not relevant to the abridged curriculum.
SENIOR 3	
All S.2 topics moved to S.3 except soil.	These topics had not been covered before students went for lock down except soil.
All S.3 topics were maintained	
Some objectives from topics like nutrition, transport, gaseous exchange, respiration and locomotion, were left out.	Content/concepts from these objectives is; • Embedded in other objectives. • Already known from primary level.

	• Not relevant to the abridged curriculum.
SENIOR 4	
All S.3 topics moved to S.4 except gaseous exchange.	These topics had not been covered before students went for lock down except gaseous exchange.
All S.4 topics were maintained	
Some objectives from topics like transport, locomotion, growth and development, genetics and evolution, reproduction and interrelationships were left out.	Content/concepts from these objectives is; • Embedded in other objectives. • Already known from primary level. • Not relevant to the abridged curriculum.

SENIOR TWO BIOLOGY - ABRIDGED CURRICULUM

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
S2	**Cells** **(10 periods)**	a. life processes are common to all living things, but they are manifested differently in different organisms b. know and understand the structure and functions of a typical animal cell and plant cell c. understand the structure of specialized cells in terms of their functions in an organism d. understand levels of organization in organisms (cell, tissue, organ, system, organism)	· In pairs, learners observe plants and animals, and identify characteristics that show that organisms are living. Identify, research on and record the seven characteristics of living things. · Observe prepared slides of plant and animal cells, draw cells and identify similarities and differences. · Draw and label the animal and plant cell as seen under a light microscope. · Research on the functions of the parts in a plant and animal cell, and annotate labels on cell diagrams accordingly. · Draw examples of specialised cells in animals and plants. Identify and explain the similarities and	· Listen and observe as learners demonstrate orally or by completing a comparison table that they understand how animals and plants carry out nutrition, respiration, movement, excretion, growth and reproduction, and how they show sensitivity. · Listen to learners explaining why a machine such as a moving vehicle is a not a living organism. • Listen and observe as learners explain orally or

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
			differences between the cells. In groups, learners brainstorm, research on and list the different types of cells, tissues, organs and systems in the human body. Devise creative ways of explaining the five levels of organization (from simple to complex) to the class.	in writing: • similarities and differences between plant and animal cells • structure and functions of cells, parts of cells and some specialised cells • different levels of organisation and their importance in large organisms • Observe group simulations showing the organ systems that need to work together when a person is: • dancing • eating

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
				• writing a story • Teacher involves class members in peer assessment and discussion of how groups could improve the quality of simulations. • Evaluate quality of learners' illustrations relating to each activity mentioned above.
	Five Kingdom System of Living Organisms **(15 periods)**	a) know examples of organisms belonging to Kingdom Monera, Kingdom Protoctista and Kingdom Fungi b) understand the value of microorganisms in food-making processes c) identify three characteristics (cell structure, mode of feeding, and	• Learners use pictures (and possibly microscope slides) as well as lists of group characteristics to identify organisms as belonging to the following groups: Monera/bacteria, Protoctista, Fungi, Plantae, and Animalia. • In groups, learners construct simple	• Observe learners in groups as they develop and use identification keys. • Listen to learners' conversations and ask probing questions to check their

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
		photosynthetic pigment) of organisms in Kingdom Plantae d) know examples of organisms from each of the following categories: vascular & non-vascular, angiosperms & gymnosperms, monocots & dicots in Kingdom Plantae (No drawings required) e) identify and describe the common observable characteristics and give examples of organisms from phylum Arthropoda including its classes (No drawings required) f) Identify and describe the common observable characteristics (types of teeth, temperature regulation, habitat, reproduction, and gas exchange) and give examples of organisms from the phylum Chordata and its classes. No	identification keys for grouping the organisms in the pictures, share their keys with other groups, and then use them to identify other examples of organisms belonging to the same groups. · In groups, learners research on and make summary write- ups on the use of bacteria and fungi in the production of yoghurt, cheese, bread and alcohol. · In groups, learners research on the common characteristics and differences between examples of members of the kingdom Plantae belonging to the following categories: vascular/non-vascular, angiosperms/gymnosperms, monocots/ dicots. Groups choose	understanding. · Observe and listen to group presentations. Evaluate quality of products such as keys, tables, experiment reports, diagrams, and drawings.

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
		details of the reproduction process should be given	the format to use to present their findings (tables, drawings or more creative methods) · Groups construct simple keys to place plants in the correct category. · In groups, learners research the common characteristics of arthropods and differences between members of the classes of arthropods. Groups choose the format to use to present their findings (tables, drawings or more creative methods) · Groups construct simple keys to place animals in the correct category. · In groups, learners research the common characteristics (see list in learning outcomes) and differences	

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
			between examples of members of the five main classes of the phylum Chordata: fish, amphibians, reptiles, birds, and mammals. Groups choose the format to use to present their findings (tables, drawings or more creative methods)	
	Insects **(08 periods)**	a. Identify the observable external features of a housefly, cockroach, bee, and butterfly (No details of mouth parts required) b. Appreciate the useful and harmful effects of a housefly, cockroach, bee, and butterfly c. Know the different methods of controlling the harmful stages of a housefly, cockroach, and butterfly	• In pairs, use a hand lens to observe a housefly, cockroach, bee, and butterfly; paying specific attention to the following structures: • head (mouth parts, antennae, eyes, hair) • thorax (wings, halters, hairs, strips, legs and the different segments) • abdomen	· Observe pairs carrying out activities and check that they identify the parts listed; create an appropriate comparison table; draw and label correctly; construct keys that work. · Listen to pairs' conversations and monitor understanding

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
			• Pairs create a suitable table and record observations; comparing each of the insects. • Draw the insects provided, label the structures listed above and annotate drawings to explain the functions of the structures. • Pairs construct a dichotomous key for any four of the insects listed above. • Pairs research on the different methods of controlling the harmful stages of a housefly, cockroach, mosquito, and butterfly. They produce a presentation advising the class on how to control these populations.	and progress towards learning outcomes. Evaluate quality of products of each activity.

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
	Flowering Plants **(10 periods)**	a. Know the external parts of a typical flowering plant. b. understand how the structures of monocotyledonous and dicotyledonous roots, stems, leaves, flowers, and fruits suit their functions c. Classify leaves	• In pairs, learners draw and label the parts of a whole mature dicotyledonous and monocotyledonous plant. • In groups, learners compare the structural features (root system, leaf venation, leaf shape, leaf attachment to stem, and flower colour) of a whole herbaceous dicotyledonous plant and whole monocotyledonous plant. Learners record their observations and present them to the class • In groups or as a whole class, learners discuss how the structures observed in the two plants carry out their functions. Annotate the drawings made above to explain how each structure is suited to its	· Observe pairs carrying out activities, and check that they interpret specimens and identify functions correctly. · Listen to pairs' conversations and monitor understanding and progress towards learning outcomes. · Monitor individuals' and groups' contributions to whole class discussion. Evaluate quality of products from activities.

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
			function. • In pairs, learners draw and label the parts of the flower. • In groups or as a whole class, learners discuss how each part of the flower is suited to its function, and annotate the drawing made above to explain how. • In groups learners classify leaves using observable characteristics and construct a dichotomous key for not more than four leaves. • Pairs observe a bean seed and a tomato or other fruit, and write down the similarities and differences. Learners present their findings.	

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
	PHYSICAL AND CHEMICAL PROPERTIES OF SOIL **(12 periods)**	a) determine soil constituents and identify their properties (u, s) b) understand that different soil samples have different properties: water retention, drainage, capillarity and pH; learners conduct experiments to investigate these properties (u, s) c) understand the importance of air and water in soil to other living organisms (u)	· In pairs or groups, learners observe three different soil samples – clay, sand and loam, and: - examine the dry soil samples - shake the samples in water and allow them to settle to show different layers/ particle sizes. Pairs/groups record their observations relating to the following characteristics: - the colour of each soil sample - the texture of each soil sample - the size of particles in each soil sample · Task groups of learners to design, perform and report on investigations to show: retention, drainage and capillarity in loam, clay, and sandy soils. The report for each experiment	· Observe pairs/groups as they examine soil samples. · Listen to conversations and ask questions to gauge and deepen learning. · Evaluate products: records of characteristics of each soil type. · Observe groups and pairs carrying out activities. Check that they plan investigations that will give meaningful results. · Listen to pairs' discussions and monitor

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
			should follow scientific methods. • In pairs, learners determine the pH of a soil sample and discuss the significance of their findings. **Group Project** **Aim:** To investigate whether crop growth is different in different soil types. Design and carry out an experiment using 20 annual plants (fast growing legumes) in soils with different percentages of contents; e.g. high clay content or high sand content. Remember to make sure to design a fair test, controlling variables; e.g. the amount of water and light the plants receive. Observe the plants and record their appearance and the yield of the crop. From your observations deduce	understanding and their progress towards learning outcomes. Ask probing questions to promote critical thinking and deepen learning. • Evaluate quality of products from activities: reports of investigations; conclusions relating to impact of different properties on quality of soil; explanations of the impact of soil types on crop yield and reasons for it.

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
			which type of soil is best for the chosen plants, and suggest why. Record conclusions.	
	SOIL EROSION AND CONSERVATION: CAUSES, EFFECTS, AND PREVENTION (10 periods)	a) know the features of fertile soil (k) b) understand the process of and factors leading to soil erosion (u) c) understand the causes of reduced soil fertility and describe methods of soil conservation (u, v) d) outline the processes involved in the nitrogen cycle (u)	• In groups, learners discuss conclusions from Topic 2 and agree on a list of the features of fertile soil. Present their conclusions to the class. • In groups, learner's research on the causes of soil erosion and the impact erosion has on communities. Produce a short presentation to show the types and the possible impact. • In groups, learners discuss what steps farmers and gardeners in their locality take to maintain the fertility of their soils. Then research and	• Through listening to group discussions, or through whole class discussion, gauge whether all learners understand the features of fertile soils, the causes and impact of soil erosion, and the steps taken to increase fertility and reduce erosion • Observe groups carrying out activities and check they communicate

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
			write a report on the different methods used to maintain soil fertility and conserve soil in the following regions of Uganda: - Lake Victoria basin - Kigezi highlands - Karamoja region • In groups, learners carry out research into soil organisms that are called decomposers. Produce a short presentation/drama to explain why they are so important. • In groups, learners use labelled cards to role play and explain the nitrogen cycle. • In groups, learners design and carry out an investigation to show the presence of microorganisms in root nodules, soils and compost. Present	effectively and work as teams so that everyone is learning and developing skills • Listen to pairs' conversations and monitor their progress towards learning outcomes. Intervene as appropriate to deepen learning • Observe groups interacting and intervene as appropriate to steer research and project planning so that learning outcomes are achieved Evaluate quality of products: presentations

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
			their findings to the whole class and compare with other groups **Group Project**: Design, perform and write a report on an investigation into the formation of compost in a compost bin. Report on the process of composting, how fast different materials decompose, any organisms (decomposers) that seem to be involved in the process, and anything else significant or interesting.	and reports
	NUTRITION TYPES AND NUTRIENT COMPOUNDS (06 periods)	a) identify the food nutrients, their sources, and importance to humans (u) b) perform food tests for various nutrients (only quality testing required) (s) c) appreciate the concept of balanced	• In groups or pairs, learners carry out tests on foods such as potato, egg yolk, milk, groundnuts, and pineapple to determine what main food nutrients they contain. • In groups or as a whole class, learners discuss, research and	· Observe groups and pairs carrying out activities. Check they carry out tests and research effectively, and plan experiments that will give valid results.

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
		diet in relation to age, sex, and an individual's activity (u, v) d) appreciate the causes and effects of nutrient deficiency in humans including diseases related to malnutrition (u, s) e) identify the major plant mineral nutrients (N, P, K, Mg, Ca, S, Mg), their role, and the symptoms of deficiencies (u)	report on: - the meaning of the term 'balanced diet' and what this might mean for a baby, a child, an adult woman and adult, an athlete, and an inactive person. They record their conclusions. - the likely effects of an imbalanced diet • In groups, learners design and perform an experiment to compare the growth of a plant in distilled water and pond water and/or other water rich in nutrients. Learners use scientific method to write a report. In groups, learners research on the uses of N, P, K, Mg, Ca, S and Mg to plants and the effects of deficiencies.	· Listen to pairs' discussions and monitor understanding and progress towards learning outcomes. Ask probing questions to deepen learning · Evaluate quality of products from activities: reports and conclusions from tests and investigations; presentations, and explanations.

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
			Groups present their findings to the class (illustrated, if possible), with examples of leaves in good health, and showing deficiencies found in the locality.	
	NUTRITION IN GREEN PLANTS (08 periods)	a) understand the meaning of autotrophic and heterotrophic nutrition (k) b) derive the meaning of the term photosynthesis and understand the process (u, s) c) perform experiments to investigate the factors that affect the rate of photosynthesis (s, gs) d) appreciate the structures and adaptations that enable a leaf to carry out the process of photosynthesis (k, u)	• In pairs or groups, learners discuss, research on and document: - the meaning of autotrophic and heterotrophic nutrition - why autotrophs are the providers of all food - the origin and meaning of the term photosynthesis - the equation for photosynthesis and its implications regarding what plants need for photosynthesis • In groups, learners design and carry out experiments to show the	• Listen to discussion and ask probing questions to promote critical thinking and guide learners towards learning outcomes. • Observe pair and group activities to monitor development of practical skills, effectiveness of experiment designs, and accuracy of models. • Evaluate products:

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
			need for carbon dioxide, light and chlorophyll, during photosynthesis. Learners produce a formal report at the end of the experiments that includes the following: title, question, prediction, materials, procedure, record/analysis of results, and conclusion. Groups present their report to the rest of the class • In groups learners examine diagrams, photographs or microscope slides of sections through a leaf and discuss how the structure is adapted so that cells can obtain the water, carbon dioxide, light, and energy they need. • Groups share findings and through whole class discussion	conclusions from discussion and research; reports on experiments, findings about leaf structure, and 3D leaf models.

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
			agree on conclusions Group Project: Develop a simple 3D model of the internal structure of a leaf using locally available materials	
	NUTRITION IN MAMMALS (11 periods)	a) understand the role of enzymes in influencing life processes; and appreciate that the working of enzymes may be affected by different factors (No details of lock and key mechanism required) (u, s) b) conduct experiments on and explain the effects of pH and temperature on enzyme activity (s, gs) c) know and identify different types of mammalian teeth, and relate their structure and position in the jaw to diet (k, u, s) d) understand the importance of oral hygiene, and describe good practice	• In groups, learners research on and discuss the effects of enzymes on chemical reactions, list the properties of enzymes, and the names and functions of some enzymes, that work in the human digestive system. Produce a presentation to explain findings. • In groups, learners design and carry out an experiment to determine the effect of one factor (pH or temperature) on enzyme activity. Share findings with other groups and develop understanding	• Observe groups carrying out research and experiments to check that engagement in skills development and experiment designs is appropriate for achieving learning outcomes. Steer learners towards learning outcomes if necessary • Listen to, and engage in group conversations and ask probing questions to check and

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
		in caring for teeth and gums in humans (u, v) e) appreciate the structure of the different parts of the mammalian alimentary canal, and its role in the digestion of food (k, u) f) understand how the end products of digestion are absorbed and assimilated (u)	of the effect of pH and temperature on enzyme activity. Check findings against established science theory. • In pairs, learners observe a molar, canine, pre-molar and incisor tooth and identify: • the common structural features of each of the teeth in a mammal • the adaptations of each type of tooth to its function • Learners make an accurate labelled drawing of each tooth and state the magnification. • In pairs, learners share experience and research on reasons for, and methods of ensuring dental hygiene as well as consequences of poor hygiene. Produce a short good practice guide.	guide progress towards learning outcomes. • Evaluate quality of products: findings on role of enzymes; explanation of effect of pH and temperature on the rate of reaction; clarity of drawings; accuracy and creativity of presentations; drawings; guide and dental formulae; experiment reports, simulations, mind maps/spider diagrams, descriptive reports

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
			• In pairs, learners research on and write the dental formula for a herbivore, a carnivore and an omnivore. • In pairs, learners observe an unlabelled chart and, through discussion and research, identify and name the parts of the alimentary canal and associated organs, labelling the parts and adding their functions • Guide groups of learners to design a controlled experiment to determine what substances are digested in the mouth: • include the hypothesis • describe the experimental design • indicate the control group(s)	

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
			• describe the results of the test • In groups, learners simulate the process of digestion, its products and their absorption using either: • labelled cards with names of parts of the alimentary canal and different food types • strings of beads that can be linked and unlinked • role play (holding hands to form long chain molecules,	
	TRANSPORT IN PLANTS **(13 periods)**	a) investigate the different ways in which materials move into, though, and out of cells (s b) know how the root hair is adopted for absorption of water and mineral salts (u) c) understand the processes of transpiration and translocation (u)	· In pairs, learners observe a tea bag in a clear glass container of still warm water for a period of five minutes, then discuss and explain their observations. Whole class discussion leads to understanding of the process of diffusion. · In groups, learners use scientific	• Observe pairs and groups carrying out activities. Check that they understand how to use resources effectively, take due account of prior learning, use research skills well, and plan valid

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
		d) conduct experiments on and understand the factors that affect transpiration (s, u)	process skills to design and carry out an experiment to show the effect of solutions of different concentrations on raw unshelled eggs and raw potatoes. Groups discuss and draw conclusions to explain their results. Individuals write reports at the end of the experiment that include the following: title, question, prediction, materials, procedure, record / analysis of results and conclusion. Groups present their work to the rest of the class. • In groups, learners discuss and research the meanings of diffusion, osmosis and active transport, as well as the circumstances in which each is involved in the entry and exit of	experiments. • Listen to pair and group discussions, monitor progress towards learning outcomes and ask questions to help learners develop skills and deepen understanding. • Evaluate quality of products from activities: report on root hairs; transpiration diagram; Translocation, and investigations of conditions affecting transpiration rates

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
			substances to and from cells. Groups present conclusions in a comparison table · In pairs, learners use a drawing and look at germinated seedlings to explain how the root hair is adopted for absorption of water and mineral salts. Pairs prepare a report to share with the class. Through whole class discussion, learners agree on the correct explanation, and record it in notes and or diagrams. · In pairs, learners consider what they know about leaf structure, transport vessels in stems, roots and root hairs, and connect their learning to explain how the process of transpiration takes place. Individuals produce an	

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
			annotated diagram to explain the process. • In pairs or groups, learners research on the need for, and the meaning of, translocation in plants. Share findings with the class before learners go on to explain in notes and diagrams. In groups, learners use scientific process skills to design and carry out experiments to investigate how wind, temperature, and light intensity affect the rate of transpiration. Groups consider the significance of their findings for farmers and growers, and report their findings and conclusions to the class.	

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
	TRANSPORT IN ANIMALS **(14 periods)**	a) understand the principle of the surface area to volume ratio (s) b) know the need for a transport system, and identify the components involved in the transport system in mammals (k) c) describe the structure of the heart and how it functions (u, s) d) understand how structure of blood vessels are related to their function by comparing arteries, veins and capillaries (u, s) e) identify the major functions of blood, and relate the functions to the components of blood (u, s) f) understand the causes and prevention of diseases associated with the heart (high blood pressure, coronary heart disease and stroke)	• In pairs, learners use cubes of different dimensions to calculate the surface area to volume ratios of the cubes, then discuss and explain the biological significance of calculated ratios. • In pairs, learners discuss what they already know about the components of their circulatory systems. • In pairs, learners discuss the structure and function of the heart, referring to diagrams and a model. Pairs share their thoughts in groups or whole class discussion. Learners draw and label the parts of a mammalian heart adding clear notes relating to function. • In groups, learners design a	

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
		(u, v) g) understand the importance of knowledge of blood groups for blood transfusion (k, u) h) appreciate the role of blood in the defence of the human body (u) k) appreciate the function of the lymphatic system in maintaining a healthy body (u)	model, visual aid, animation or drama to illustrate blood flow/circulation in the human body and present to the class. • In pairs, learners research on structures of arteries, capillaries and veins, and produce tables, models or diagrams to show how structure is related to function in each case. • In pairs, learners research on components of blood and their functions and produce a table summarising their findings to share with the class. · Organise learners to visit a health facility to find out about the causes and prevention of high blood pressure, coronary heart disease, and stroke. Learners write a report	

Class	Topic	LEARNING OUTCOMES The learner should be able to:	SUGGESTED LEARNING ACTIVITIES	SAMPLE ASSESSMENT STRATEGY
			on the causes and their prevention. • Learners watch a video clip or listen to a talk from blood bank personnel to find out the importance of blood transfusion and the possible risks involved. In pairs, learners complete a short report on the benefits and risks of transfusions, including compatible blood groups.	

Class	Sub-Topic	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
S3	**Topic: Soil**			
	Soil erosion and conservation; causes, effects and prevention. (09 periods)	• 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.	• 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.	• Discussion on soil erosion, types, effects and prevention. • Field work to observe areas affected by soil erosion. • Discussion and demonstration of soil conservation methods.
	Living components of soil, carbon and nitrogen cycle and water cycle.	• Draw and describe the nitrogen cycle. • Draw and explain the carbon cycle.	· Role of bacteria in the nitrogen cycle · Carbon cycle.	• Discussion on role of bacteria in nitrogen cycle. • Illustrate carbon cycle

	(04 periods)			
	Topic: Nutrition in Plants and Animals .			
	Nutrient Compounds (07 periods)	· Name food nutrients and their uses in the body. · Describe food deficiencies and their prevention · Conduct food tests for various nutrients. · List the properties of an enzyme. · Name factors that affect enzyme activity. · Conduct experiments on enzyme activity.	· Food nutrients, their uses, sources, deficiencies and their prevention. · Food tests for: proteins, fats, starch, Vitamin C, reducing and non-reducing sugars. · Properties of enzymes · Factors that affect enzyme activity.	Discussion on uses of different nutrients, their deficiencies and prevention. • Practical on food tests. • Discussion on enzyme properties and factors that affect them. • Discussion on enzyme properties and factors that affect them. • Practical on enzyme reactions.
	Nutrition in Animals (06	• Describe the structure and function of teeth. • Describe the care for teeth in humans.	• Structure and shape of mammalian teeth • Care of teeth in humans	• Demonstration of different types of teeth and care.

	Periods)	• List the parts of the alimentary canal. • Name the organs associated with the canal and give their functions. • Describe the process of digestion and its products. • Explain how the end products of digestion are absorbed and assimilated.	• Alimentary tract of a mammal • .Function of each part of the alimentary canal/tract. • Processes of ingestion, digestion, absorption, assimilation	• Discussion on functions of different types of teeth in different animals. • Practicals on drawings of teeth • Illustration of alimentary canal and functions • Discussion on digestion, absorption and assimilation
	Nutrition in green plants (09 periods)	• 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	• 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.	• 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.

		photosynthesis. • Demonstrate that oxygen is given off during photosynthesis.		
	Topic: Transport			
	Transport in Animals (12 periods)	• Explain the need for a transport system • List structures involved in transport in animals. • 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. • Explain the importance of knowledge of blood groups for blood transfusion. • Define immunity. • State the types of immunity.	• Need for transport system. • Use of surface area to volume ratio. • Heart structure and function. • Types of blood vessels. • Blood circulation and its functions. • Blood groups and blood transfusion.	• Discussion on the need for transport system, structures involved in transport in animals and their functions • Use of surface area to volume ration in relation to transport. • Discussion on blood groups, Immunity and HIV. • Brain storm on the importance of the different types of immunity.

	Transport in Plants (12 periods)	• Explain how the root hair is adopted for absorption of water and mineral salts. • Explain what active transport is and its importance. • Define the terms; osmosis, diffusion and turgor 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. • Define transpiration. • Describe the various factors that affect the rate of transpiration.	• Adaptations of the root hair for absorption of water and mineral salts. • Active transport. • Diffusion, osmosis and turgor pressure. • Experiments on osmosis and diffusion. • Movement of materials within a plant. • Transpiration and factors affecting it.	• Discussion on osmosis, diffusion and turgor pressure and their importance. • Guided discussion on active transport. • Demonstration of osmosis and diffusion using experiments. Discussion on transpiration and its importance. • Guided discussion on factors that affect transpiration • Experiments on transpiration. • Discussion on plant storage organs and their importance.
	Topic: Respiration			

	Gaseous Exchange (12 periods)	• Explain the need for gaseous exchange systems in different animals. • Describe essential features of an efficient respiratory surface. • Explain the mechanism of gaseous exchange in mammals. • Conduct experiments on mechanism of breathing • Explain the relationship between plants and animals in relation to respiration and photosynthesis.	• Properties of gaseous exchange surfaces. • Breathing mechanism in humans. • Analyse the nature of inhaled and exhaled air. • Role of stomata in gaseous exchange.	• 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. • Discussion on breathing mechanism in humans • Practical work on analysis of inhaled and exhaled air
	Aerobic Respiration (03 periods)	• State the substrate and products of chemical oxidation of food in a cell. • Show the process of respiration in an equation form. • Define aerobic respiration.	• Chemical oxidation in the cell. • Practical activities – heat generation during respiration, analysis of breathed in and exhaled air.	• Discussion on aerobic respiration. • Guided discussion on site and products of aerobic respiration.

		• State the site and importance of aerobic respiration in living organisms. • Demonstrate heat generation during aerobic respiration.		• Experimentation on heat generation and nature of inhaled and exhaled air.
	Anaerobic Respiration (04 periods)	• Define anaerobic respiration • State the importance of anaerobic respiration. • Demonstrate fermentation in yeast.	• Definition of anaerobic respiration. • Practical on anaerobic respiration	• Discuss anaerobic respiration, where it takes place and its importance. • Practical on fermentation in yeast.
	Topic: Excretion and Homeostasis			
	Excretion in Lower organisms (01 period)	• Define excretion. • Explain the concept of osmoregulation.	• Definition of excretion. • Concept of osmoregulation.	Discussion on excretion and osmoregulation.
	Excretion in Plants (01 period)	• 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.	• Plant waste products: Carbon dioxide (CO2), Oxygen (O2), water, resins, tannins, latex • Special methods of getting rid of waste products by plants. • Useful plant waste products	• Discussion on excretion in plants; waste products and forms in which they are eliminated. • Guided discussion on useful plant waste products

	Excretion in Animals (07 periods)	• Draw and label the parts of the urinary system. • Describe the structure of mammalian kidneys. • Explain how kidneys function in getting rid of waste products from the body. • Describe how the lungs get rid of excess heat, water and carbon dioxide from the body. • 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.	• Urinary system. • Structure and function of a mammalian kidney. • Role of the kidney in osmoregulation • Lungs and their role in temperature regulation and excretion of water and carbon dioxide. • 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)	• Demonstration on position / location of kidneys in a mammal. • Discuss role of kidneys in osmoregulation. • Guided discussion on excretory wastes by the lungs, and their elimination from the body. • Practical approach • 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

	Topic: Co-ordination in Plants and Animals			
	Reception and Response in Plants (03 periods)	• 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. • Conduct an experiment on effect of auxins on plant growth. • Give the uses of other plant hormones such as gibberellins.	• Definition of irritability, stimulus and response. • Nastic response. • Tropic responses. • Chemical control of responses in plants. • Experiments on nastic and tropic responses. • Use of other plant hormones e.g. Gibberellins. • • Comparison of auxins and gibberellins.	• Discussion on different types of stimuli and responses. • Guided discussion on the importance of irritability. • Field work to study nastic responses. • Guided discussion on gibberellins.
	Reception, response and behavior in animals	• Define a tactic response. • List the types of tactic responses using suitable examples. • Explain the importance of tactic	• Tactic response in animals. • Types of tactic responses (photo, chemo, moisture, temperature, touch)	• Discussion on nature of tactic responses and their importance. • Experiment on tactic

	(02 periods)	responses to the organism. • Demonstrate tactic responses using on earthworm or fly larvae/maggot / wood louse.	• Importance of tactic responses. • Practical activity.	responses.
	Chemical Coordination in vertebrates (02 periods)	• 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. • Explain how the pituitary gland controls the other endocrine glands.	• Definition of a hormone. • Endocrine glands – names, location and functions. • Hormones produced by endocrine glands • Role of pituitary gland. • Comparison of hormones and enzymes	• Discussion on endocrine glands their location, the hormones they secrete and the different functions of the hormones. • Guided discussion on role of pituitary gland.
	Nervous coordination in a mammal (06 periods)	• 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	• Nerve Cell (neurone) structure, function and types. • Structure and function of nerve. • Parts of nervous system (central and peripheral nervous system) • Types of reflex actions (simple and conditioned reflexes) • Reflex arc.	• Discussion on nerve cells, receptors and effectors. • Discussion on parts of the nervous system and their functions.

		impulse from receptor to effector. • 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. • Describe the path of a reflex arc.. • 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.	• Practical activity – knee jerk, blinking of eye, and Pavlov experiment.	
	Receptor organs in mammals (06 periods)	• List the physical and chemical stimuli. • List the various receptor organs. • 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.	• Types of stimuli (physical and chemical) • Receptor organs in a mammal • Structure and function of the mammalian eye. • Accommodation of the eye, eye defects and their corrections. • Structure and function of a	• Guided discussion on physical and chemical stimuli, and receptor organs in a mammalian body • Discussion on structure and function of the mammalian eye,

		• Name the eye defects and their causes. • Explain how the eye defects can be corrected. • List the various parts of the human ear. • Explain the function each part of the human ear. • Explain causes of deafness. • Name various parts of human skin and their function. • Explain the role of the skin in regulating body temperature and sensing of pressure.	mammalian ear. • Causes of deafness • Structure and functions of the skin. • Role of skin in regulation of body temperature and sensing of pressure.	accommodation, eye defects and correction • Discussion on structure and function of the ear. • Discuss structure and function of the skin in relation to sensitivity.
Topic: Locomotion in Animals				
	Locomotion in a mammal (15 periods)	• Define locomotion. • State the types of skeletons and their function. • List the functions of the mammalian skeleton.	• Definition of locomotion • Need for locomotion • Types of skeletons. • Definition of a joint • Types of joints and their	• Discussion on the need for locomotion in animals. • Guided discussion on types of skeletons and their functions.

		• Define a joint. • Describe the structure of a joint. • Describe the different types of joints. • Explain the functions of the joints. • Explain what antagonistic muscles are. • Explain the functioning of antagonistic muscles.	functions • Antagonistic muscles and their function	• Demonstration of the various types of skeletons. • Discussion on types of joints, their location and functions.

SENIOR FOUR BIOLOGY – ABRIDGED CURRICULUM

CLASS	SUB-TOPIC	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
	Topic: respiration			
S.4	**Aerobic Respiration (03 periods)**	• State the substrate and products of chemical oxidation of food in a cell. • Show the process of respiration in an equation form. • Define aerobic respiration. • State the site and importance of	• Chemical oxidation in the cell. • Practical activities – heat generation during respiration, analysis of breathed in and exhaled air.	• Discussion on aerobic respiration. • Guided discussion on site and products of aerobic respiration. • Experimentation on

		aerobic respiration in living organisms. • Demonstrate heat generation during aerobic respiration.		heat generation and nature of inhaled and exhaled air.
	Anaerobic Respiration (04 periods)	• Define anaerobic respiration • State the importance of anaerobic respiration. • Demonstrate fermentation in yeast.	• Definition of anaerobic respiration. • Practical on anaerobic respiration	• Discuss anaerobic respiration, where it takes place and its importance. • Practical on fermentation in yeast.
	Topic: Excretion and Homeostasis			
	Excretion in Lower organisms (01 period)	• Define excretion. • Explain the concept of osmoregulation	• Definition of excretion. • Concept of osmoregulation.	Discussion on excretion and osmoregulation.
	Excretion in Plants (01 period)	• 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	• Plant waste products: Carbon dioxide (CO2), Oxygen (O2), water, resins, tannins, latex • Special methods of getting rid of waste products by plants.	• Discussion on excretion in plants; waste products and forms in which

		waste products. • Explain how some waste products of plants are useful to humans.	• Useful plant waste products	they are eliminated. • Guided discussion on useful plant waste products.
	Excretion in Animals (07 periods)	• Draw and label the parts of the urinary system. • Describe the structure of mammalian kidneys. • Explain how kidneys function in getting rid of waste products from the body. • Describe how the lungs get rid of excess heat, water and carbon dioxide from the body. • Explain how urea is formed in the liver and eliminated. • Define homeostasis.	• Urinary system. • Structure and function of a mammalian kidney. • Role of the kidney in osmoregulation • Lungs and their role in temperature regulation and excretion of water and carbon dioxide. • Role of the liver in formation and elimination of urea. • Role of the liver in	• Demonstration on position / location of kidneys in a mammal. • Discuss role of kidneys in osmoregulation. • Guided discussion on excretory wastes by the lungs, and their elimination from the body.

		• 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.	maintaining internal environment. • Practical – test for glucose and albumen and dissection of a mammal to show position of kidneys (by teacher)	• Practical approach • 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
	Topic: Co-ordination in Plants and Animals			
	Reception and Response in Plants (03 periods)	• 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.	• Definition of irritability, stimulus and response. • Nastic response. • Tropic responses. • Chemical control of responses in plants. • Experiments on nastic and	• Discussion on different types of stimuli and responses. • Guided discussion on the importance of irritability.

		• 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. • Conduct an experiment on effect of auxins on plant growth. • Give the uses of other plant hormones such as gibberellins.	tropic responses. • Use of other plant hormones e.g. Gibberellins. • Comparison of auxins and gibberellins.	• Field work to study nastic responses. • Guided discussion on gibberellins.
	Reception, response and behavior in animals (02 periods)	• 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.	• Tactic response in animals. • Types of tactic responses (photo, chemo, moisture, temperature, touch) • Importance of tactic responses. • Practical activity.	• Discussion on nature of tactic responses and their importance. • Experiment on tactic responses.

	Chemical Coordination in vertebrates (02 periods)	• 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. • Explain how the pituitary gland controls the other endocrine glands.	• Definition of a hormone. • Endocrine glands – names, location and functions. • Hormones produced by endocrine glands • Role of pituitary gland. • Comparison of hormones and enzymes	• Discussion on endocrine glands their location, the hormones they secrete and the different functions of the hormones. • Guided discussion on role of pituitary gland.
	Nervous coordination in a mammal (06 periods)	• 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. • Describe the parts/divisions of	• Nerve Cell (neurone) structure, function and types. • Structure and function of nerve. • Parts of nervous system (central and peripheral nervous system) • Types of reflex actions (simple and conditioned reflexes) • Reflex arc.	• Discussion on nerve cells, receptors and effectors. • Discussion on parts of the nervous system and their functions.

		the nervous system and the organs associated with each division. • Describe the structure and general functions of the brain and spinal cord. • Describe the path of a reflex arc.. • 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.	• Practical activity – knee jerk, blinking of eye, and Pavlov experiment.	
	Receptor organs in mammals (06 periods)	• List the physical and chemical stimuli. • List the various receptor organs. • Name the various parts of the human eye. • Explain the function of each	• Types of stimuli (physical and chemical) • Receptor organs in a mammal • Structure and function of the mammalian eye. • Accommodation of the eye,	• Guided discussion on physical and chemical stimuli, and receptor organs in a mammalian body • Discussion on

		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. • List the various parts of the human ear. • Explain the function each part of the human ear. • Explain causes of deafness. • Name various parts of human skin and their function. • Explain the role of the skin in regulating body temperature and sensing of pressure.	eye defects and their corrections. • Structure and function of a mammalian ear. • Causes of deafness • Structure and functions of the skin. • Role of skin in regulation of body temperature and sensing of pressure.	structure and function of the mammalian eye, accommodation, eye defects and correction • Discussion on structure and function of the ear. • Discuss structure and function of the skin in relation to sensitivity.
	Topic: Locomotion in Animals			

	Locomotion in a mammal (15 periods)	• Define locomotion. • State the types of skeletons and their function.. • List the functions of the mammalian skeleton. • Define a joint. • Describe the structure of a joint. • Describe the different types of joints. • Explain the functions of the joints. • Explain what antagonistic muscles are. • Explain the functioning of antagonistic muscles.	• Definition of locomotion • Need for locomotion • Types of skeletons. • Definition of a joint • Types of joints and their functions • Antagonistic muscles and their function	• Discussion on the need for locomotion in animals. • Guided discussion on types of skeletons and their functions. • Demonstration of the various types of skeletons. • Discussion on types of joints, their location and functions.
	Topic: Growth and Development in Plants and Animals			
	Growth in plants and animals (06 periods)	• Define the terms: growth and development. • Draw and label the internal and external parts of a seed.	• Definition of growth and cell division. • Seed structure • Conditions necessary for	• Discussion on growth and role of mitosis. • Practical on

		• Explain seed dormancy. • List the factors / conditions necessary for seed germination. • Conduct experiments on for conditions necessary for seed germination • List causes of seed dormancy. • Explain how seed dormancy can be broken. • State the importance of seed dormancy. • 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.	germination. • Seed dormancy, causes and how to break it. • Regions of elongation in roots and stems.	germination. • Explanation on seed dormancy and its causes. • Explanation on cell division and enlargement

	Development in plants and animals (05 periods)	• Explain the process of secondary growth of stems in dicot-plants. • Define the term metamorphosis. • Explain the difference between complete and incomplete metamorphosis. • Describe the stages of development in an amphibian and a mammal. • Record observations on growth of human baby by weight for a period of 4 months using a health card.	• Secondary growth of stem in dicot plants. • 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 Growth in a baby Use of health card.	• Discussion on secondary • growth and how it is brought about. • Observe and record stages of • germination in dicot and • monocot seeds. • Projects on stages of insects growth and development.
	Topic: Reproduction in Plants and Animals			
	Asexual Reproduction in lower organisms	• Define asexual reproduction.	• Asexual reproduction.	• Discussion on a sexual reproduction in lower organisms.

	(01 periods)			
	Asexual Reproduction in plants (vegetative reproduction) (04 periods)	• Define vegetative reproduction • List plant structures used in vegetative reproduction. • Explain vegetative reproduction using leaves of Bryophyllum.. • Draw and label vegetative reproductive organs. • Explain how stem cuttings are used to produce new plants. • Describe the procedures used in budding, marcoting, layering and grafting to produce new plants. • Explain the importance of artificial propagation with regard to crop production.	• Concept of vegetative reproduction in plants Stem tubers and bulbs • Suckers and rhizomes and their parts. • Corms and its parts. • Practical activity on drawing and labelling of vegetative parts.	• 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

	Sexual Reproduction in lower organisms (01 period)	• Define sexual reproduction.	• Definition of sexual reproduction.	• Discussion on sexual reproduction in lower organisms
	Sexual reproduction in animals. (05 Periods)	• Draw and label male reproductive parts in humans. • Draw and label female reproductive parts • 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	• Sexual reproduction in a mammal: Male reproductive organs. Female reproductive organs. Menstruation cycle. • Fertilization and development of embryo in humans. • Role of the placenta during pregnancy. • Birth of the young and parental care. • Method of birth control. • What STDs, STIs, HIV/AIDS are	• Illustration on male and female reproductive parts and explanation on their functions. • Guided discussion on menstrual cycle and secondary sexual characteristics. • Discussion and explanation on fertilization and development of embryo in humans. • Brain storm on

		and effectiveness. • State what STDs are. • 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)	• Causes and mode of transmission. • Signs and symptoms of each STDs. • Prevention of STDs and HIV/AIDS.	methods of birth control. • Discuss the different types of STDs, causes, prevention and control. • Observations on stages of an insect in laboratory.
	Sexual Reproduction in Plants (05 periods)	• 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. • Explain fruit and seed dispersal. • Describe methods of fruit and	• Fertilization and formation of fruit and seeds. • Differences between fruits and seeds • Definition of fruit and seed dispersal • Methods of fruit and seed dispersal. • Importance of fruit and seed dispersal. • Agents of fruit and seed	• Explanation on formation of fruits and seeds. • Discussion on the fruit and seed • dispersal, agents involved and its importance. • Brainstorm on the adaptations of fruit and seed for dispersal

		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. • Draw and label fruits and seeds showing their adaptations for dispersal.	dispersal. • Adaptations of fruit and seeds for dispersal by various agents. • Practical activity on flowers, fruits and seeds.	• Practical on drawing of fruits and seeds to show the adaptations they have for dispersal.
	Topic 11: Genetics and Evolution			
	Mitosis and meiosis and their importance (04 periods)	• Describe the process of mitosis • Describe the process of meiosis. • Explain the significance of both types of cell division.	• Mitosis and meiosis • Comparison of mitosis and meiosis. • Significance of mitosis and meiosis.	• Discussion on differences between mitosis and meiosis. • Brain storm on the importance of each type of cell division

	Genetics and Monohybrid Inheritance (04 periods)	• 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. • 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. • Explain the advantage of	• 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. • 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.	• Discussion and explanation on genetics and Mendel's work. • Demonstration on how to arrive at monohybrid ratio. • Explanation of the genetic terms. • Discussion on dominance and co-dominance • Field trips to Agricultural Colleges / Institutions. • Discuss the advantages of hybridization.

		hybridization (cross breeding)		
	Sex determination and hereditary diseases (06 periods)	• 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 inked traits.	• Chromosome, • Genes and DNA. • Sex chromosomes. • Sex determination in humans. • Sex linked traits. • Hereditary diseases e.g. hemophilia, sickle cell.	• Discussion on chromosomes, genes and DNA. • Explanation on sex determination in humans. • Brainstorm hereditary sex linked traits
	Mutation, variation and evolution	• Define the term mutation. • Explain the causes of mutation. • Explain the term variation.	• Definition of mutation • Causes of mutation. • Definition of variation.	• Discussion on mutation, types and causes

	(06 periods)	• Explain continuous and discontinuous variation. • Name types of variation. • Explain the causes of variation. • Define evolution. • 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.	• 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	• Brain storm on variation, types and causes. • Experimentation on variation • Discussion on origin of life and natural selection. • Explanation on the role of mutation, natural selection in evolutionary changes
	Topic 12: Inter-Relationships			
	Food chains and food webs (08)	• Define ecology. • Explain the terms	• Definition of ecology • Concept of	• Explanation of ecology and ecosystem

		interrelationship, • population, producer, consumer, decomposer and community. • Explain the terms habitat, niche, prey, predator, carrying capacity and ecosystem. • State the different types of ecosystems. 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. • Explain the pyramid of numbers, pyramid of biomass and energy. • Explain the process of energy flow in the food chain and food web.	interrelationship. • Components of the ecosystem. • Food chain and food web. • Ecological pyramids: pyramids of Numbers, biomass and energy. • Methods of quantitative sampling; • When and how to use such methods	• Explanation of concept of interrelationship in ecosystems. • Field work and observation of the different ecosystems. • Discussion on food webs, food chains and ecological pyramids. • Review methods of quantitative sampling and their use.

		• List the appropriate methods used to collect plants and animals in a habitat. • Use the methods to collect and identify organisms in habitat.		
	Changes in Population (09 periods)	• 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. • Explain how plants and animals are adapted for the different types of ecosystems • Explain the term competition • Distinguish between interspecific and intra – specific competition.	• Definition of population • Characteristics of a population. • Factors that affect human population growth. • Population growth and growth curves. • 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.	• Discussion on population, its characteristics and factors that affect its growth. • Discussion on competition and types. • Explanation on adaptations of plants for various ecosystems. • Brain storm on succession and its stages. • Practical work on

		• 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.	• Practical activity.	succession on a cleared piece of land.
	Associations in organisms (09 periods)	• Explain symbiosis. • Name organisms that exhibit symbiosis. • Explain parasitism. • List characteristics of parasites and types. • List adaptations of parasites and methods of controlling them. • Outline measures to control tapeworm • Infestation.	• Definition of Symbiosis and examples • Parasitism, parasites and types. • Characteristics of parasites. • Adaptations of parasites to various environments. • Methods of parasite control. • Tapeworm, its life cycle and effects on the host. • Malaria, cause, mode of transmission, signs and	• Discussion on symbiosis and types. • Explanation on parasitism. • Brain storm on parasites, types and their characteristics. • Discussion on cause, mode of transmism signs and symptoms and control of malaria. • Explanation of the

		• mode of transmission of malaria parasite. • Name signs and symptoms of malaria • Outline control measures for malaria. • List signs of presence of tomato blight fungus • Explain how the tomato blight is controlled.	symptoms and control measures. • Commensalism, its meaning and examples. • Tomato blight fungus and its effects. • Practical activity – field study to find out some of the associations between living organisms.	term commensalism. • Discuss infection of the tomatoes by the blight fungus. • Practical work to study associations between organisms in the locality
	Humans and natural environment (06 periods)	• 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. • List different types of pollutants.	• Human activities – agriculture, lumbering, stone quarrying, swamp reclamation, charcoal making and fuel wood collection. • Natural resources • Methods of conservation of natural resources. • Importance of conservation of natural	• Group discussions on human activities • Discussion on natural resources • Brainstorm on methods of conserving natural resources. • Discussion on pollution,

		• Describe the effects of pollutants on the environment. • Explain methods of pollution control.	resources such as water, land, water forest and wild life. • Pollution and examples of pollutants. • Effects of pollutants to human life and the environment.	pollutants and effects on living organisms and environment. • Field study to identify polluted areas in the locality.