NCDC
NATIONAL CURRICULUM
DEVELOPMENT CENTRE

ADVANCED LEVEL

S.6 BIOLOGY –

Abridged curriculum

BIOLOGY

SENIOR 6

KEY CHANGES	JUSTIFICATION
All S.5 topics moved to S.6 except cell biology.	These topics had not been covered before students went for lock down except cell biology.
All topics were maintained	
Some objectives from all A'level topics were left out.	Content/concepts from these objectives is; • Embedded in other objectives. • Already known from primary level. • Not relevant to the abridged curriculum.

A-level Biology abridged curriculum

Topic	Sub-topic	Objectives *The learner should be able to*	Content
Chemicals of life **(30 Periods)**	Acids, bases and salts	• describe properties of acids bases and salts • explain the role of acids, bases and salts in maintaining a stable internal environment for physiological processes.	• Properties of acids, bases and salts • Functions of acids, bases and salts in organisms
		Practical • The learner should be able to identify salts using quantitative and qualitative analysis.	• Test for presence of mineral salts in food samples /extracts (refer to inorganic analysis in Chemistry practical).

Topic	Sub-topic	Objectives *The learner should be able to*	Content
	Water	• Relate the water properties to its role in the life of organisms.	• Role / significance of water in the life of organisms in relation to its properties
		(Practical) The learner should be able to: • test for water. • determine water content in tissues by using dry weigh method. • investigate the natural relationship of water and organisms in a habitat (including humans).	• Testing for water • Measuring water content in tissues • Field study on water habitats. (The • natural relationship of water and • organisms)
	Structure of carbohydrates	• describe the structure and components of various carbohydrates. • explain the properties of carbohydrates. • explain the functions of carbohydrates in organisms. • describe the condensation of	• Structure and components of carbohydrates • Properties of carbohydrates • Importance of carbohydrates: monosaccharide's, disaccharides, polysaccharides

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		carbohydrates. • describe the hydrolysis of carbohydrates.	• Condensation of carbohydrates • Hydrolysis of carbohydrates
		(Practical) The learner should be able to: • carry out food test for • carbohydrates on food samples / extracts. • demonstrate hydrolysis of nonreducing sugars.	• Testing for carbohydrates • Hydrolysis of non- reducing sugars • to reducing sugars.
	Structure of lipids	• describe the structure and components of lipid molecules. • state properties of lipids. • explain the functions of lipids in organisms. • explain effects of lipids and steroids to organisms • state the importance of cholesterol in	• components of lipids molecules • Properties of lipids Importance of lipids in organisms • Effects of lipids and steroids to organisms • Importance of cholesterol in organisms

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		organisms.	
		(Practical) The learner should be able to; • Carry out food tests for lipids on food samples / extracts.	• Tests for lipids
	Structure of proteins	• describe the structure and components of proteins. • describe the properties of proteins. • explain the functions of proteins in organisms. • explain effects of heat / temperature changes on proteins.	• Structure and components of proteins • Properties of proteins • Functions of proteins in organisms: buffer, enzymes/catalytic, hormones, structural, growth, carriers etc • Effects of heat/temperature on proteins

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		(Practical) The learner should be able to: • Carry out food tests for proteins on food samples / extracts.	• Test for proteins
	Vitamins	• state types of vitamins. • state the importance of vitamins in organisms.	• Types of vitamins: water soluble and fat soluble, essential and non-essential • Importance of vitamins in the life of organisms: protection against diseases, formation of • Co-enzymes role in blood clotting and component of visual pigment
		(Practical) The learner should be able to: • test for vitamin C. demonstrate effect of over boiling vegetables. • demonstrate the effect of storage on quality of fresh foods.	• Test for vitamin C • Effect of over boiling vegetables • Effects of storage on quality of fresh foods.

Topic	Sub-topic	Objectives *The learner should be able to*	Content
	Enzymes	• describe the criteria for naming enzymes. • explain the characteristics /properties of enzymes. • state factors that affect enzyme action. • explain the mechanism of • enzyme action using the lock and key mechanism and induced fit. • explain the role of enzymes in the organism's life.	• Criteria for naming enzymes: Use type of substrate, type of reaction • Characteristics/ Properties of enzymes relating to factors • affecting enzyme activities: Protein in nature, can be denatured, catalytic /change rates of reactions, work in small amounts, specific to reactions they catalyse, catalyse reversible reactions, can be inhibited, affected by temperature, pH, concentration of substrate and some require coenzymes/ cofactors • Factors affecting enzyme action: pH, temperature, inhibitors, substrate concentration • The enzyme action: lock and key mechanism, induced fit • Role of enzymes in living organisms

Topic	Sub-topic	Objectives *The learner should be able to*	Content
			including inhibition, competitive/non competitive, reversible/non reversible
		(Practical) The learner should be able to: • demonstrate properties of enzyme action in specific temperature, pH range, substrate concentration. • identify enzymes in the different parts of the gut based • on their actions on different • food substances. • carry out food tests on gut • Contents.	• Enzyme properties relating to factors (temperature and pH, concentration of substrate) affecting enzymes' activities • Enzymes in the different parts of the gut based on their actions on different food substances • Food tests using the animal gut contents and enzymes.
Cell physiology **(12 Periods)**	Movement in and out of cells	• describe the processes • osmosis.	• Process of osmosis: including; turgidity, plasmolysis, water • potential, osmotic potential, wall pressure.
		• **(Practical)** • The learner should be able to:	• Habitats with suitable media for organisms' survival

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		• identify habitats with suitable media for organisms' survival. • demonstrate use of salt in food preservation. • demonstrate use of visking tubing, glass columns, microscope in diffusion and osmosis experiments. • Demonstrate conditions affecting the rate of diffusion. • demonstrate effects of osmosis on the cells/ tissues.	• Use of salt in food preservation • Use of visking tubing, glass columns and microscope in • diffusion and osmosis • experiments • Conditions affecting the rate • of diffusion • Effect of osmosis in living • cells/tissues
Levels of organization and diversity of life **(32 periods)**	Diversity of Living Things	• list 3 criteria for classifying organisms. • state the hierarchy of classification according to Carl Linnaeus. • distinguish between scientific and local names.	• 3 Criteria for classifying organisms: morphology, anatomy, physiology • Hierarchy of classification according to Carl Linnaeus (kingdom-phylum/ division -class-order-family-genus-species) • Scientific /binomial nomenclature and local names

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		(Practical) The learner should be able to: • identify organisms using observable features. • construct simple biological keys.	• Identification of organisms using • observable features • Construction and use of simple biological keys.
	Viruses	• explain characteristics of viruses.	• Characteristics of viruses
	Kingdom Monera	• describe characteristics of bacteria. • differentiate between bacteria and viruses.	• Characteristics of bacteria: shape, cell wall, reproduction, movement • Differences between bacteria and viruses
		• **(Practical)** • The learner should be able to: • draw, label and state the types of bacteria • demonstrate the role of bacteria in the production of dairy products. • identify common bacterial diseases in plants and animals. • demonstrate methods of preventing the common bacterial diseases.	• Types of bacteria • Role of bacteria in production of dairy products • Common bacterial diseases in plants and animals • Methods of preventing common bacterial diseases.

Topic	Sub-topic	Objectives *The learner should be able to*	Content
	Kingdom Protoctista	• State characteristics of Protoctista. • outline the role of protozoa and algae in the environment. • Name common diseases caused by Protozoa.	• Characteristics of Protoctista • Economic importance of protozoa and algae e.g. *Amoeba, Euglena, Entamoeba, Paramecium, Trypanosoma, Plasmodium* • Common diseases caused by protozoa
		(Practical) The learner should be able to: • prepare temporary mount of *Spirogyra* filaments. • draw and label structure of *Spirogyra* as seen under a light microscope. • identify and draw protozoa from prepared slides.	• Structure of the *Spirogy* • Structure of protozoa
	Kingdom Fungi	• State characteristics of fungi. mushroom. • state the economic importance of fungi. • describe the methods of preventing the spread of fungal diseases.	• Characteristics of fungi (feeding, reproduction). • Economic importance of fungi • Methods of preventing the spread of fungal diseases

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		(Practical) The learner should be able to: • prepare temporary mount of yeast, *Mucor/Rhizopus*. • draw and label structure of *Rhizopus* or *Mucor,* y east and t he Mushroom.	• Structures of yeast, *Mucor*/*Rhizopus* as seen under the light microscope • Structure of the mushroom.
	Kingdom Plantae	• identify lower plants and higher plants using structural features. • name the plant groups to phyla. • outline the characteristics and structures of the named plant groups.	• Structural features of lower plants and higher plants • Lower plants: Bryophyta and Pteridophyta (Ferns)/Filicinophyta Higher plants: Coniferophyta, Spermatophyta • Characteristics and structures of named plant groups: Bryophyta, Filicinophyta, Coniferophyta, Spermatophyta: gymnosperms and angiosperms to class level

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		(Practical) The learner should be able to: - Identify distinguishing structural features of plant groups in lower plants. - identify distinguishing structural features of plant groups in higher plants.	- Structural features of lower plants: Bryophyta, Pteridophytes/ Filicinophyta - Structural features of higher plants: Coniferophyta, Spermatophyta:(gymnosperms, angiosperms)
	Kingdom Animalia	- state characteristics of invertebrates and vertebrates. - state the distinguishing structural features of organisms in different animal phyla.	- Characteristics of invertebrates and vertebrates - Distinguishing structural features of various animal phyla: - arthropoda down to classes. consider class insecta down to order. - chordata down to vertebrate classes.
		(Practical)	- Structural features of

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		The learner should be able to: classify phylum Arthropoda to class level using structural features. identify structural features of class Insecta down to order level. state distinguishing structural features of animals other than Arthropoda.	Arthropoda down to class level Structural features of class Insecta down to order level Structural features of animals other than arthropods.
Ecology **(18 Periods)**	Components of the Environment	• state abiotic and biotic factors • explain how Components of the Environment w the components and environmental factors influence the distribution and abundance of organisms in an ecosystem.	Abiotic components: air, water, Soil Biotic components: living things Influence of abiotic and biotic components and factors of the environment on distribution and abundance of organisms
		(Practical) The learner should be able to: collection of data from field	Collection of data on ecological components and factors of an ecosystem Analysis and interpretation of data or

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		studies. • analyse and interpret data or literature on ecological principles.	literature on ecological principles
	Concept of Ecosystem	• describe an ecosystem. • state the types and properties of an ecosystem. • explain changes in an ecosystem. • describe feeding relations in an ecosystem. • explain energy flow and recycling of nutrients in an ecosystem.	• Ecosystem: definition • Aquatic and terrestrial ecosystems and properties of an ecosystem: feeding relations, cycling of materials, succession, climax, and homeostasis of an ecosystem/balance of nature • Changes in an ecosystem: ecosystem productivity, succession and climax • Feeding relations: food chains, food webs, ecological pyramids • Recycling of nutrients and energy flow in ecosystems

Topic	Sub-topic	Objectives *The learner should be able to*	Content
	Population and Natural resources	• explain factors affecting population density. • explain population growth patterns. • explain the terms renewable and non-renewable resources • discuss environmental resistance and “balance of nature”.	Population density dependent factors and density independent factors Population growth patterns Natural resources types: renewable and non-renewable, importance, conservation Environmental resistance: density dependent factors affecting “balance of nature”
	Interdepence	explain the various interactions of organisms in nature.	Interactions among organisms and their effects: interspecific and intraspecific relationships between organisms:

Topic	Sub-topic	Objectives *The learner should be able to*	Content
			competition, parasitism, predation, saprophytism, mutualism, commensalism
	Effects of Human Activities on Ecosystem	⁃ explain the effects of human activities on ecological components and factors in a habitat. ⁃ discuss natural resource utilisation and sustainable development.	⁃ Effects of human activities on ecosystem components and factors in a habitat: - interruption of biogeochemical cycles, natural resources imbalances, population imbalances, soil erosion, soil exhaustion, extinction, pollution, speciation. ⁃ Natural resources utilisation and sustainable development
		(Practical) The learner should be able to: ⁃ demonstrate conservation practices.	⁃ Natural resource conservation practices: mulching, terracing, crop rotation, afforestation, reforestation, mixed farming,

Topic	Sub-topic	Objectives *The learner should be able to*	Content
			agro forestry, wise use of resources, etc.
Inheritance and Evolution **(19 Periods)**	Genetics	▯ explain the concept of inheritance. ▯ define genetics terms. ▯ describe Mendel's investigations on heredity. ▯ explain inheritance of traits using the monohybrid and dihybrid crosses. ▯ explain the two Mendel's laws of inheritance. ▯ discuss the challenges of inheritable disorders.	▯ Concept of inheritance ▯ Definition of genetics terms e.g. inheritance, gene, allele, chromosome, DNA, trait, etc ▯ Mendel's work on heredity ▯ Monohybrid inheritance and dihybrid inheritance. ▯ Mendel's laws of inheritance: law of independent assortment and law of segregation ▯ Challenges of inheritable disorders
		(Practical) The learner should be able to: ▯ demonstrate monohybrid and dihybrid inheritance. ▯ illustrate a pedigree.	▯ Monohybrid inheritance dominant and recessive traits: using uniform money coins/ beads/seeds. ▯ Pedigree study: baldness, early greying of

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			hair, haemophilia, eye colour, sickle cell, albinism
	Chromosomes and genes	⍰ The learner should be able to explain the terms: gene interactions, sex linkage, sex determination, sex limitation, lethal genes and polygenes.	⍰ Terms: - gene interactions: definition and examples: linkage, multiple alleles, codominance, incomplete dominance, dominant and recessive traits, epitasis and complementary genes - sex linkage definition, examples and inheritance - sex determination: definition and examples in humans - sex limitation: definition and examples - lethal genes: definition and examples: phenyl ketonuria,

Topic	Sub-topic	Objectives *The learner should be able to*	Content
			neurospora, etc - polygene: definition and Examples.
	Variation	explain population traits and types of variation. describe the causes of variation. define mutation. describe types and causes of explain the significance of mutations.	Population traits and types of variations: continuous (quantitative) and discontinuous (qualitative) Causes of variation: genetic and environmental factors Definition of mutation Types of mutations: gene and chromosomal mutation Causes of mutation: chance, radiation, chemicals Significance of mutations
		(Practical) The learner should be able to: identify variations in organisms. collect data on variations among	Variations among organisms Data on variations among organisms (e.g. sex, height, tongue rolling).

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		themselves.	
	Mechanisms of Evolution	⁃ explain Darwin's theory of natural selection. ⁃ explain the importance of variation in evolution. ⁃ discuss Neo-Darwinism. ⁃ explain the causes of present day evolution.	⁃ Darwin's theory of natural selection: observations and deductions ⁃ Importance of variation in evolution ⁃ Neo- Darwinism (present day theory of evolution) ⁃ Causes of present day evolution: competition, changes in the environment, sexual reproduction, mutations, gene recombination, industrialisation, effects of drug / chemical resistance, artificial selection, polyploidy
	Evidence of evolution	⁃ discuss evidence of evolution.	⁃ Evolution evidence based on: fossilization, comparative study of anatomy, embryology, cytology, biochemistry,

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			taxonomy, geographical distribution, vestigial structures, analogous structures, homologous structures
	Selection and Speciation	- explain natural selection and artificial selection. - state the roles of natural selection and artificial selection in speciation. - explain extinction.	- Natural selection and artificial selection. - Role of natural selection and artificial selection in speciation. - Extinction: meaning, causes and Effect.
	Circulatory system in animals	- describe types of circulatory systems. - explain the advantages and disadvantages of open and closed systems in animals. - describe the functioning of the mammalian heart. explain the response of the heart to body activities. relate the action of adrenalin and acetylcholine to the innervation of the heart. - interpret information on the effects of	- Types of circulatory systems: open and closed, single and double. - Advantages and disadvantages of open and closed systems in animals. - Functioning of the mammalian heart: cardiac cycle, blood pressure changes, myogenic property, control of the heart beat.

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		drugs and variation of temperature on the cardiac frequency. describe the role of blood components in the transport process. explain the diseases related to the circulatory system.	Response of heart to body activities Action of adrenalin and acetylcholine on the innervation of the heart Effects of drugs and temperature variations on the cardiac frequency Blood constituents and functions Common diseases of the blood and heart, including, sickle cell anaemia and coronary artery disease.
		(Practical) The learner should be able to: identify structural features of blood vessels. display and draw major structures of the circulatory systems in insects,	Structure of blood vessels (veins, arteries, capillaries) Circulatory systems in insects, toads and mammals: gross structure and fine structure

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		toads, and mammals. describe the insects', toads' and mammals' circulatory system in relation to their functions. describe the structural adaptations of the muscles of the circulatory system of mammals.	Insects, toads and mammals circulatory systems in relation to functions Structural adaptation of cardiac muscle and smooth muscle of the circulatory system of mammals.
	Defence against Diseases	describe the mechanism of blood clotting. describe immune responses in humans. describe the effects of the Rhesus factor during pregnancy.	Mechanism of blood clotting Immune responses in humans: definition, primary, secondary Effects of the Rhesus factor during pregnancy
	Vascular System of Flowering Plants	describe the structural and functional adaptations of the vascular tissues to the transport process of materials in monocotyledonous and dicotyledonous plants.	Structure and functional adaptations of vascular tissues in monocotyledonous and dicotyledonous plants Mechanism of transporting

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		▯ explain the mechanism of transporting materials in plants. ▯ describe the evidence for the path of materials in plants. ▯ describe translocation and uptake of water and mineral salts in plants.	materials in plants ▯ Evidence for the path of materials in plants ▯ Uptake of water and mineral salts in plants.
		(Practical) ▯ interpret data related to transport of materials. ▯ identify types and the pattern of distribution of vascular bundles in plant organs. ▯ stain and make temporary mounts of transverse sections (T.S) and longitudinal sections (L.S) o f: stems, roots and T .S o f leaves from herbaceous plant organs.	▯ Structure and distribution pattern of the vascular tissues in monocotyledonous and dicotyledonous plants ▯ Transverse (T.S) and longitudinal sections (L.S) of: stems, roots and, T.S of leaves of monocotyledonous and herbaceous dicotyledonous plants ▯ Labelled diagrams of T.S and

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		- interpret T.S and L.S of stems, roots and T.S of leaves. - draw and label low power plans to show distribution of tissues in T.S and L.S of stems, roots and T.S of leaves. - make high power labelled drawings of vascular tissues in T.S and L.S of stems, roots and T.S of leaves	L.S of stems, roots and T.S of Leaves.
Nutrition **(27 Periods)**	Autotrophic nutrition	describe photosynthesis. - describe the structure of chloroplasts. - describe the absorption and action spectrum of chlorophyll.	Photosynthesis including adaptations of C3, C4 and CAM to different environmental conditions - Structure of chloroplasts - Absorption and action spectrum of chlorophyll
		(Practical) The learner should be able to:	- Experiments to investigate factors affecting photosynthesis: light,

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		▯ design and carry out experiments to investigate factors affecting the rate of photosynthesis. ▯ carry out experiments to test for starch production in terrestrial plants and oxygen in aquatic plants.	carbon dioxide, availability of water, chlorophyll, temperature. ▯ Tests for starch in terrestrial plants and tests for oxygen in aquatic plants.
	Holozoic Nutrition	Explain the role of the nervous and hormonal systems in digestion.	The role of the nervous and hormonal systems in the regulation/ control of digestion
		(*Practical*) The learner should be able to: ▯ open up the animal and display the digestive system. ▯ examine, draw and label the major parts of the animals' digestive systems. ▯ observe and state structural adaptations of the parts of the	▯ The digestive system of cockroach, toad/frog, birds, rat/rabbit/cow/goat ▯ Parts of the digestive system ▯ Function and structural adaptations of the digestive system parts. ▯ Food tests on gut content

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		digestive system. • identify food substances in the different parts of the gut. • Identify enzymes in the different parts of the gut. • identify, draw the different parts that make up the mouth of insects, mammals and toad. • state the functions of mouth parts of insects, mammals and toad. • compare dentition in the animals.	• Gut extracts actions on different foods • Structure of mouth parts of insects, mammals and toad • Functions of mouth parts of insects, mammals and toad • Dentition in animals
	Mutualism	define mutualism. • describe the role of mutualistic organisms in the nitrogen cycle. • explain the relationships of mutualistic associations in an ecosystem. • discuss the economic importance of mutualistic associations.	Definition of mutualism • Role of mutualistic organisms in the nitrogen cycle • Mutualistic associations between organisms • Economic importance of mutualistic associations

Topic	Sub-topic	Objectives *The learner should be able to*	Content
	Parasitism	explain adaptation of disease causing organisms in plants and animals. explain the effect of host-parasite relations.	Adaptations of disease causing organisms in plants and animals Interrelationship between parasites and hosts of the following: intestinal worms, a tick and one plant parasite
Gaseous Exchange **(19 Periods)**	Gaseous Exchange in plants	explain the mechanism of opening and closure of a stoma. explain conditions affecting the functioning of stomata. explain how stomata, lenticels and breathing roots are adapted to their function. relate the differences between the structure of aquatic and aerial leaves to a habitat.	Mechanism of opening and closure of stoma Conditions affecting functioning of stomata Structural adaptation and function of the stomata, lenticels and breathing roots Structural adaptation of aquatic and aerial leaves to a habitat
		(Practical) The learner should be able to:	Structures of stomata Principles related to control of

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		identify, draw and label stomata. examine principles related to control of gaseous exchange in plants. determine surface area to volume ratio in large and small objects.	gaseous exchange in plants Surface area to volume ratio in large and small pieces of plant organs.
	Gaseous Exchange in Animals	explain the efficiency of gaseous exchange surfaces and structures. explain the significance of the counter current flow system. describe the role of the brain in controlling breathing.	Structural adaptation of gaseous exchange surfaces in protozoa, worms, insects, fish, amphibians and mammals Significance of the counter current flow system The role of the brain in controlling breathing
		(Practical) The learner should be able to: dissect, display and draw	Structure of gaseous exchange systems in tadpoles, toad, fish, insect, and mammal

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		gaseous exchange systems in animals. collect and analyse data on factors affecting breathing rate in animals.	Factors affecting rate of breathing in animals.
Respiration **(6 Periods)**	Respiration	explain the relationship between gaseous exchange and respiration. describe the structure and function of the mitochondrion. describe the role of electron transport system, hydrogen acceptors, acetyl coenzyme A and pyruvic acid. explain the role of acetyl coenzyme A in the carbohydrate, lipid and protein metabolism.	Relationship between gaseous exchange and respiration Structure and function of mitochondrion Role of electron transport system, hydrogen acceptors, acetyl coenzyme A and pyruvic acid Role of acetyl coenzyme A in the metabolism of: carbohydrates, lipids, proteins
		(Practical)	Products of respiration:

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		The learner should be able to: carry out experiments to demonstrate products of respiration. carry out experiments to show the effect of temperature and activity on rate of respiration. carry out experiments and analyse data on factors affecting aerobic and anaerobic respiration processes. demonstrate fermentation process in yeast cells.	carbon dioxide, energy, ethanol, water, lactic acid Factors affecting the rate of respiration: temperature and activity Factors affecting aerobic and anaerobic respiration processes Fermentation process: use in yeast cells.
Homeostasis **(25 Periods)**	General principles of Homeostasis	explain the significance of a constant internal environment. state the factors which must be kept constant in the internal environment of the body. discuss the role of negative	Significance of a constant internal environment Factors which must be kept constant in the body: glucose, temperature, pH, water, ions, respiratory gases, osmotic

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		feedback mechanism. - explain the feedback mechanism related to the endocrine and nervous systems. - identify the main internal and external causes of changes in the internal environment.	pressure of body fluids - Role of negative feedback mechanism - Feedback mechanism related to the endocrine and nervous systems in homeostatic activities - Causes of changes in the internal environment
		(Practical) - The learner should be able to relate organisms' ways of life to their environmental conditions.	- Adaptation of organisms to different environmental conditions.
	Regulation of Glucose	describe the role of hormones in sugar regulation. - explain the negative feedback mechanism in the process of blood glucose control. - discuss the causes and effects of	Action of insulin, glucagon and adrenalin in blood sugar control. - The negative feedback mechanism in the process of blood glucose control - Causes and effects of blood sugar

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		blood sugar imbalances in the body. discuss the functions of the liver and the pancreas in regulation of glucose in the body.	imbalances in the body Role of the liver and the pancreas in glucose regulation
		(Practical) The learner should be able to: test urine samples for sugar. relate structure of liver and pancreas to their function.	Identification of sugar in urine Histology of liver and pancreas: microstructure and their function.
	Regulation of respiratory gas	describe the regulation of respiratory gases. discuss the role of feedback mechanism in response to oxygen deprivation. explain the effects of fluctuations of respiratory gases on the rate of breathing. explain the role of respiratory	Control of respiratory gases Role of feedback mechanism in response to oxygen deprivation Effects of fluctuations in oxygen and carbon dioxide gases on the rate of breathing Role of medullary centres in controlling respiration and blood circulation

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		centre in the brain in controlling respiration and blood circulation. • describe the different physiological changes that take place during exercise and at high altitude.	• Physiological changes that take place during exercise and at high altitude
		(Practical) • The learner should be able to determine the rate of breathing at different levels of activity.	• Effect of different levels of activity on the rate of breathing.
	Excretion	describe the formation of urea and urine.	Formation of urea and urine
		(Practical) The learner should be able to: • identify and draw sections of parts of kidney. • dissect, display, draw and label the urinary system.	• Histology of the kidney: cortex, medulla, different regions of the nephron • Urinary system of a toad, rat/ rabbit/goat/cattle.

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	Osmoregulation	describe the role of the brain, endocrine glands and nephrons in osmoregulation. - explain the negative feedback mechanism involving antidiuretic hormone (ADH). - discuss principles of osmoregulation in organisms living in marine, fresh water and terrestrial habitats. - explain animals' adaptations to varying water availability in their habitats. - explain osmoregulation in plants and how plants are adapted to varying water availability in their habitats.	Role of the hypothalamus, pituitary gland, adrenal gland and nephrons in varying osmotic pressure of blood - Role of negative feedback mechanism involving anti-diuretic hormone (ADH) - Principles of osmoregulation in marine, fresh water and terrestrial organisms - Adaptations of animals to varying water availability in habitats - Osmoregulation in plants (xerophytes, hydrophytes, mesophytes, halophytes)
Coordination **(30 Periods)**	Concept of Reception and Response in Plants	interpret data from experiments on how day length affects the	Effects of day length on flowering process

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		flowering process.	
	Plant Hormones	discuss the influence of hormones on plant growth and related processes. explain the economic importance of plant hormones.	Influence of hormones on plant growth: Role and effects of plant hormones (e.g. auxins, cytokinins, gibberellins, abscisic acid, and ethane) in regulating processes Economic importance of plant hormones
		(Practical) The learner should be able to: design and perform experiments on effects of plant hormones on plant growth processes. demonstrate the economic importance of plant hormones.	Effects of plant hormones e.g. Auxins / Indole acetic acid (IAA), gibberellic acid on different plant growth process: dormancy, weed control, flowering, fruiting etc Economic importance of plant Hormones.
	Response and behaviour in Animals	explain how types of behaviour result from sequential responses.	Types of behaviour: orientation (kinesis, taxis, territorial, breeding, instinct and migration) learning (habitual,

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			conditioned reflex, imprinting exploration, insight, trial and error
		(Practical) The learner should be able to: - demonstrate the welfare of animals. - design and perform experiments on orientation behaviour.	- Practices of animal welfare - Orientation behaviour
	General Principles of Reception and Response in Animals	describe the types of stimuli. - describe the structure and role of receptor organs in relation to the environmental stimuli. - state the importance of different effectors in organisms.	Types of chemical and physical stimuli - Role of simple and complex receptors (including reception mechanisms) in relation to the environmental stimuli - Importance of effectors in organisms
		(Practical) **The learner should be able to:** - identify sections of: skin, eye,	

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		retina, cochlea from prepared slides. - identify locations of different taste buds on the tongue.	- Structure of: skin, eye, retina, cochlea from prepared slides - Location of taste buds on the tongue.
	Nervous Coordination in Animals	distinguish between the roles of the autonomic and other peripheral nerves. • explain the events of generating and transmitting impulses. - describe the structure and functioning of the synapse and neuromuscular junction. - explain the importance of transmitter substances. • explain summation, facilitation and inhibition.	Role of the autonomic and peripheral nerves - Events of generating and transmitting impulses - Synapse and neuromuscular junction structure and functioning - Importance of transmitter Substances System functions: summation, facilitation and inhibition
		(Practical) The learner should be able to: - observe and record human	- Reflex actions in human

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		responses to different stimuli. dissect, display, draw and label the major parts of the insect's /toad's/ frog's, mammal's nervous system below the head.	beings Nervous system of a cockroach/toad /frog/rat/ rabbit/Guinea pig.
	Hormonal Coordination in Animals	explain the principle of negative feedback mechanism of hormonal action. explain why hormonal balance is necessary for coordinating functions in the body. explain effects of hormonal imbalances.	Principles of negative feedback mechanism of hormonal action: between pituitary and thyroid Necessity of hormonal balances Hormonal imbalances effects: diabetes, goitre, dwarfism, gigantism
Support and Movement **(24 Periods)**	Support systems in plants and animals	• explain the role of modified roots, leaves and stems in support. • describe the role of secondary growth /thickening in support. • describe the micro structure of cartilage and bone and relate their structure to function.	Importance of plant organs modifications of: tendrils, prop roots, clasping roots, buttress roots Role of secondary growth/ thickening in support • Micro structure and function

Topic	Sub-topic	Objectives *The learner should be able to*	Content
			of cartilage and bone
		Support Systems in Organisms (Practical) The learner should be able to: - observe organisms of different sizes and relate their support systems to their sizes. - identify and draw support structures and tissues in plants and animals.	- Supporting systems and organism's size - Support structures and tissues in plants and animals.
	Muscles	describe the arrangement and function of muscles and joints. - explain the sliding hypothesis of muscular contraction.	Arrangement and function of muscles and joints - The sliding filament hypothesis of muscle contraction
	Movement/Locomotion.	- describe support and movement on land.	Support and movement on land/ muscular skeletal basis of locomotion, propulsion in the: walking tetrapods (mammals), birds and annelids - Flight /movement in air in birds and insects

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		(Practical) The learner should be able to: • observe and explain the relationship between muscles, joints and musculo-skeletal attachments. • observe and describe skeletal modifications in birds. • observe and explain how the support structures are related to the environment of the animal.	• Relationship between muscles, joints and musculo-skeletal attachments: Antagonistic muscles in animals: fish myotomes, pectoral muscles in birds, hind limb muscles and muscles in the pelvic region of amphibians and mammals • Fore limb and sternum modification in birds • Support structures in relation to the environment of the animal
Reproduction, Growth and Development	Sexual Reproduction in Animals	state the functions of reproductive system structures/parts in animals.	Reproductive system in animals: structure and function(s) of parts

Topic	Sub-topic	Objectives *The learner should be able to*	Content
(27 Periods)		describe the structure and function of gametes. describe the stages of oogenesis and spermatogenesis processes. describe the relationship between stages of gametogenesis and meiosis. explain the significance of gametogenesis. describe copulation, fertilisation and implantation. explain the role of the placenta in the development of an embryo. explain the physiological changes in females during pregnancy. explain gestation period and birth.	Gamete structure and function Stages of oogenesis and spermatogenesis processes Relationship between gametogenesis to meiosis Significance of gametogenesis Copulation, fertilisation and implantation Role of placenta in the development of an embryo Physiological changes in females during pregnancy Gestation period and birth Events and role of hormones in the menstrual cycle: menstruation, follicular development, ovulation, corpus lutetium. And FSH, LH, oestrogen and progesterone.

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		discuss the events and role of hormones in menstrual cycle. discuss birth control methods and their limitations. state the causes and ways of prevention of STDs.	Mention the oestrous cycle Birth control methods and limitations Causes and prevention of Sexually Transmitted Diseases (STDs) .e.g. infections by fungal bacterial and viral (HIV and AIDS).
		(Practical) The learner should be able to: prepare or use prepared slides to study structure of gametes. identify and draw the external features of the cockroach for sex identification. dissect, observe, draw and label the major parts of the insect's reproductive system identify and draw the external	Structure of gametes Cockroach external features for sex identification Reproductive system of a cockroach External features of a toad or frog for sex identification Reproductive system of a toad/frog.

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		features of the toad/ frog for sex identification. • dissect, examine, draw and label the major parts of the toad's reproductive system. • relate the structure of reproductive parts to their functions. • identify and draw the external features of the rat /rabbit/Guinea pig for sex identification. • dissect, examine, draw and label the major parts of the rat's reproductive system. • relate the structure of reproductive parts to their functions.	• Rat/ rabbit/guinea pig external/features for sex identification • Reproductive system of a rat/rabbit/Guinea pig.
	Sexual reproduction in Lower Organisms and plants	describe the types and structure of flowers. describe the types and structure of seeds and fruits.	Types and structure of flowers : (insect and wind pollinated flowers) Types and structure of seeds and fruits
		(Practical) The learner should be able to:	• Structures of a flower and inflorescence in relation to

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		relate floral structures to the mode of pollination. observe and draw pollen grain. describe floral parts. Write floral formulae of different flowers. draw floral diagrams of different flowers. draw and label structures of different fruits and seeds. dissect fruits to display and draw arrangement of seeds. describe the mechanisms of fruit and seed dispersal. distinguish between endospermic and non endospermic seeds.	pollination Pollen grain structure in relation to pollination Arrangement of floral parts in flowers with free petals, fused petals, keel and standard wing, and a grass flower Floral formulae Floral diagrams Types and structure of fruits and seeds Placentation Mechanisms of fruit and seed dispersal Endospermic and non endospermic seeds
	Growth and Development	distinguish between growth and development.	Differences between growth and development

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		⁃ explain factors affecting growth. ⁃ discuss the parameters of measuring growth in plants / animals. ⁃ distinguish between primary and secondary meristems. ⁃ discuss the role of meristems in plant growth.	⁃ Factors affecting growth: internal and external ⁃ Parameters used in measurement of growth in an individual plant /animal: weight, length, height, volume, area • Primary and secondary meristems in plants ⁃ Primary and secondary growth in plants ⁃ Role of meristems in plant growth
		(Practical) The learner should be able to: ⁃ Carry out germination of seeds that exhibit epigeal and hypogeal germination. ⁃ Demonstrate factors affecting	⁃ Epigeal and hypogeal seed germination ⁃ Factors affecting growth e.g. temperature, light, water, etc

Topic	Sub-topic	Objectives *The learner should be able to*	Content
		growth. • Examine and draw sections showing apical meristems and secondary thickening in dicotyledonous stems. • Make accurate measurements of growth in an organism and record. • Demonstrate hormonal control of plant growth.	• Apical growth, secondary growth • Parameters of measuring growth • Hormonal control of plant Growth.