BIOLOGY

GRADE 9

SLOs for Assessment Key:

1.Assessible / Attainable - (Not included in drop down list)
2. Ambiguous (assessable in longer run) - (Grey)
3. Not assessable in Summitive - (Grey)
4. Repetitive (with in same grade) - (Grey)
5. Repetitive (with in same learning level) - (Grey)

Domains	Standards	Benchmarks	Topic/Title	NCP SLO #	SLO	SLOs for Assessment	Cognitive Domain
Domain A: Nature of Science in Biology	**Standard:** **Students should be able to** explain and evaluate with examples that science operates in a historical context that affects its current practices and paradigms Note: In the Nature of Science domain SLOs, unless explicitly stated, where the SLO begins with the phrase 'explain with examples' it is enough that students study 2-3 examples and can use them in their answers for examination questions. There is no need to extensively or comprehensively study the history of science or its applications in other fields. The purpose here is that students are able to develop an appreciation of these aspects of the field of biology with some rigor (hence these SLOs are expected to be assessed), but not to become so extensive that it take a lot of time out from building competence in rest of the domains on biology skills and knowledge. Assessment of Nature of Science in standardized board exams will be kept to objective knowledge; students will not be expected to write argumentative essays or express subjective perspectives. Rather	**Benchmark 1:** Critically analyze claims made about the relationship of biology with society	The Science of Biology:	[SLO: B-09-A-01]	Define biology		Remember
				[SLO:B-09-A-02]	State Quran instructs to reveal the study of Life		Remember
				[SLO:B-09-A-03]	Define major fields of biology as Botany, zoology and Microbiology		Remember
				[SLO:B-09-A-04]	Define with examples that biology has many sub-fields. (-Cytology) (-Embryology) (-Genetics) (-Molecular Biology) (-Pathology) (-Ecology) (-Marine Biology) (-Immunology) (-Morphology) (-Anatomy) (-Histology) (- Physiology) (-Taxonomy) (-Paleontology) (-Pharmacology)		Remember
				[SLO:B-09-A-05]	Relate that biology connects with other natural sciences.Students should be able to distinguish in terms of the broad subject matter the below fields: (-Biophysic) (-Biochemistry) (-Computational Biology) (-Biogeography) (-Biostatistics) (-Biotechnology) (-Bioeconomics)		Understand
				[SLO:B-09-A-06]	Identify the careers in Biology and Explain with examples how biology is a subset of the natural sciences and of the life scienes.		Understand
				[SLO: B-09-A-07]	Justify with examples that science is a collaborative field that requires interdisciplinary researchers working together to share knowledge and critique ideas		Understand
				[SLO: B-09-A-08]	Describe the steps of the scientific method thatis: Recognition Observation Hypothesis Deduction Experiments Results		Understand

	assessment in the standardised exams will occur through multiple choice questions and/or through short answer			[SLO: B-09-A-09]	Evaluate the terms 'hypothesis', 'theory' and 'law' in the context of research in the natural sciences		Analyse
Domain B: Evolution and Biodiversity Classification	**Standard** **Students should be able to:** Define evolution and natural selection. Explain the mechanisms of genetic variation and inheritance. Describe how populations change over time and how speciation occurs. Explain the evidence for common ancestry and the history of ife on Earth. Describe the major taxonomic categories and their characteristics, including the classification of organisms into species, genus, family, order, class, phylum, and kingdom.	**Benchmark 1:** Students will be able to explain the theory of evolution by natural selection and provide evidence for its occurrence.		[SLO:B-09-B-01]	Explain the theory of evalution by natural selection with example		Understand
				[SLO:B-09-B-02]	Define Species		Remember
				[SLO:B-09-B-03]	Describe speciation		Understand
				[SLO: B-09-B-04]	Discuss briefly the observations Darwin made during his voyage on HMS Beagle.		Remember
				[SLO: B-09-B-05]	Describe sources of variation which can lead to speciation and evolution.		Understand
				[SLO: B-09-B-06]	Describe evidence of evolution with regards to the following - Paleontology (fossil record) - Comparative anatomy (homologous structures, vestigial structures) - Selective breeding		Understand
		Benchmark 2: Students will be able to describe the process of classification and explain how taxonomy helps us understand the diversity of life on Earth.		[SLO:B-09-B-07]	Define biodiversity and classification.		Remember
				[SLO:B-09-B-08]	Describe advantages of classification		Understand
				[SLO:B-09-B-09]	Discuss the history of classification schemes		Understand
				[SLO:B-09-B-10]	List the three distinct domains into which living organisms are broadly classified into		Understand
				[SLO:B-09-B-11]	List the taxonomic ranks of classification		Understand
				[SLO:B-09-B-12]	Outline the binomial nomenclature system		Remember
				[SLO:B-09-B-13]	Describe the complications of classifying viruses		Understand
				[SLO:B-09-C-1]	Define Biochemistry/molecular biology		Remember

Domain C: Molecular Biology	**Standard:** **Students should be able to:** Describe the structure and function of the four main biomolecules: carbohydrates, lipids, proteins, and nucleic acids. Explain the role of DNA as the genetic material and its role in heredity. Describe the structure of DNA, including the double helix and the four nitrogenous bases. Explain the process of DNA replication and its importance in cell division. Describe the process of transcription and translation, including the role of RNA and ribosomes.	**Benchmark 1**: Students will be able to describe the chemical structure, properties and roles of the four major classes of biomolecules (carbohydrates, lipids, proteins, and nucleic acids).		[SLO:B-09-C-2]	Outline the various types of common biomolecules (DNA,RNA,Proteins,Lipids,Carbohydrates) including their locations inside the cell and main roles		Remember
				[SLO:B-09-C-3]	Outline the structure and function and sources of proteins with structure of amino acids		Remember
				[SLO:B-09-C-4]	Outline the structure, function and sources of lipids		Remember
				[SLO: B-09-C-05]	Define Carbohydrates and Outline the structure, function and sources of Carbohydrates.		Remember
				[SLO:B-09-C-06]	Identify carbohydrates as monosaccharides, disaccharides and polysaccharides.		Understand
		Benchmark 2: Students will be able to explain the role of DNA in genetic information storage and transfer, including the structure of DNA, DNA N/A replication, and the central dogma of molecular biology.		[SLO: B-09-C-07]	Describe briefly the structure of DNA as a double helix macromolecule made of nucleotides with base pairing in between the two helices through complementary base pairing.		Understand
				[SLO: B-09-C-08]	Outline function of DNA as carrier of , hereditary information		Remember
				[SLO: B-09-C-09]	Describe briefly the structure of RNA as single stranded macromolecule made of nucleotides with nitrogenous base overhangs		Understand
				[SLO: B-09-C-10]	Outline the function of RNA as aid in converting hereditary information into useful proteins		Remember
				[SLO: B-09-C-11]	Outline how information in the DNA is converted to information on RNA and then into proteins		Understand
ular Organelles	**Standard:** **Students should be able to:** Describe the structure and function of cells, including prokaryotic and eukaryotic cells. Identify and describe the main subcellular organelles, including the nucleus	**Benchmark 1:** Students will be able to describe the structure of animal and plant cells and the structure and roles of different organelles inside the cells.		[SLO: B-09-D-1]	Describe cell as the basic unit of life		Understand
				[SLO: B-09-D-2]	Compare with diagrams the structure of animal and plant cells		Understand
				[SLO: B-09-D-3]	Sketch different sub-cellular organelles (nucleus, mitochodria,cell membranes, etc) and outline their roles		Remember
				[SLO: B-09-D-4]	Outline structural advantages of plant and animal cells		Understand
				[SLO: B-09-D-05]	Identify different types of cells (mesophyll cell, epidermal cell, neurons, muscle, red blood cell, liver cell) and sketch their structures		Remember

Domain D: Cells and Subcell	including the nucleus, mitochondria, ribosomes, endoplasmic reticulum, Golgi apparatus, lysosomes, and peroxisomes. Explain the role of the cell membrane and describe its structure. Explain the process of cellular respiration and its role in producing energy. Describe the process of cellular division, including mitosis and meiosis.			[SLO: B-09-D-06]	Describe the concept of division of labor and how it applies to - within cells (across sub-cellular organelles) - multicellular organisms (across cells)		Understand
				[SLO: B-09-D-07]	Describe Cell Specialization.		Understand
		Benchmark 2: Students will be able to describe the different stages of cell division and the roles organelles have in this process.		[SLO: B-09-D-08]	Describe Cell cycle		Understand
				[SLO: B-09-D-09]	Explain mitosis, meiosis and stages of mitosis, meiosis (by use of sketch and diagrams)		Understand
				[SLO: B-09-D-11]	Compare the procsses of mitosis and meiosis		Understand
				[SLO: B-09-D-12]	Outline the significance of mitosis and meiosis		Remember
				[SLO: B-09-D-13]	Define stem cells as unspecialized cell		Remember
				[SLO: B-09-E-1]	Distinguish between tissues, organs and system with examples from animals and plants		Understand
Domain E: Tissue, Organ and Systems	**Standard:** **Students should be able to:** Describe the structure and function of tissues, including epithelial, connective, muscle, and nervous tissue. Explain the role of organs in maintaining homeostasis. Describe the structure and function of the major organ systems, including the circulatory, digestive, respiratory, nervous, endocrine, muscular, and skeletal systems. Explain how the different organ systems interact to maintain homeostasis in the body. o Describe how diseases can affect the functioning of organ systems.	**Benchmark 1:** Students will be able to describe the four basic types of tissues (epithelial, connective, muscle, and nervous), their constituent cells and N/A explain their structure and functions.		[SLO: B-09-E-2]	Describe the concept of emergent properties as gain in functionalities and how it applies to the following going from sub-cellular organelles to cells - going from cells to tissues - going from tissues to organs - going from organs to systems - going from systems to living organisms		Understand
				[SLO: B-09-E-3]	Enlist the different types of tissue come together to form the stomach organ in the human body		Understand
				[SLO: B-09-E-4]	Discuss the different types of tissue come together to form the leaf		Understand
				[SLO: B-09-E-5]	Discuss the organ system come together to form the human body		Understand
		Benchmark 2: Students will be able to explain the structure and function of major organ systems in animals, including the digestive, respiratory, cardiovascular, nervous, endocrine, and reproductive systems and their disorders		[SLO: B-09-E-06]	Describe the advantages of homeostasis		Understand
		Benchmark 3:		[SLO: B-09-E-07]	Discuss the various organs and systems of the human body work to maintain homeostasis.		Understand

		Understand what homeostasis means and describe major plant organs.		[SLO: B-09-E-08]	Explain plant physiology in terms of structures and roles of various plant organs.		Understand
				[SLO: B-09-F-01]	Define metabolism, catabolism and anabolism with examples		Remember
Domain F: Metabolism	**Standard:** **Student willbe able to** Define metabolism and describe how it is related to cellular respiration and photosynthesis. Explain the role of enzymes in metabolic reactions and describe the process of enzyme-catalyzed reactions. Define enzymes and explain their role in metabolic reactions. Describe the factors that affect enzyme activity, including temperature, pH, and substrate concentration. [Explain the importance of enzymes in maintaining homeostasis and how disturbances can lead to disease.	**Benchmark 1:** Students will be able to describe the concepts of metabolism, anabolism and catabolism, and explain how enzymes help in metabolism.		[SLO: B-09-F-02]	Define Enzymes and describe their characteristics		Remember
				[SLO: B:09-F-03]	Show the mechanism of enzyme action		Understand
				[SLO: B-09-F-04]	Assess the factors which could influence enzyme activity.		Understand
				[SLO: B-09-F-05]	Describe competitive, and non-competitive inhibition.		Understand
				[SLO: B-09-F-06]	Discuss the role of ATP as energy currency.		Remember
		Benchmark 2: Students will be able to explain the processes of cellular and Respiration occurs and understand the respiration and photosynthesis and the energy conversions.		[SLO: B-09-F-07]	Describe photosynthesis in plants.		Understand
				[SLO: B-09-F-08]	Explain aerobic respiration and anaerobic respiration		Understand
				[SLO: B-09-Q-01]	Define mineral nutrition in plants.		Remember
				[SLO: B-09-Q-02]	Categorize minerals nutrients of plants into macronutrients and micronutrients.		Understand
				[SLO: B-09-Q-03]	State that nitrogen is important in protein synthesis and magnesium for chlorophyll formation.		Remember
				[SLO: B-09-Q-04]	Conceptualize transport and its needs		Understand
				[SLO: B-09-Q-05]	Explain the internal structure of root and root hair		Understand
				[SLO: B-09-Q-06]	Describe how roots take up water and mineral salts by active and passive absorption		Understand
				[SLO: B-09-Q-07]	Describe transpiration and relate this process with cell surface and stomatal opening and closing		Understand
	Standard:			[SLO: B-09-Q-08]	Describe temperature, wind and humidity as the factors affecting the rate of transpiration.		Understand

Domain Q: Plants	**Standard:** **Students will be able to:** Describe the basic structure and anatomy of plant cells and organs, including stems, roots, leaves, and flowers. Explain the process of photosynthesis, including the role of chlorophyll and other pigments. Discuss the significance of seeds and the different methods of seed dispersal. Describe the basic processes of plant growth and development, including germination, shoot and root development, and the role of hormones. Outline the adaptations that allow plants to survive in different environments, including ways to conserve water, regulate temperature, and defend against herbivores.			[SLO: B-09-Q-09]	Describe the mechanism of transport of water and salt in plants.		Understand
				[SLO: B-09-Q-10]	Explain the mechanism of food translocation by , the theory of Pressure Flow Mechanism.		Understand
				SLO: B-09-Q-11]	Describe the process of gaseous exchange in plants		Understand
				SLO: B-09-Q-12]	Define homeotasis and describe its importance		Remember
				SLO: B-09-Q-13]	Describe the mechanism adaptations in plants for the excretion		Understand
				SLO: B-09-Q-14]	Explain osmotic adjustments in plants		Understand
				SLO: B-09-Q-15]	Describe different types of asexual reproduction i.e. binary fission, budding, spore formation and vegetative propagation.		Understand
				[SLO: B-09-Q-16]	Distinguish between vegetative propagation and artificial propagation.		Understand
				[SLO: B-09-Q-17]	Explain vegetative propagation in plants (through stem, suckers and leaves).		Understand
				[SLO: B-09-Q-18]	Describe the two methods of artificial vegetative propagation (stem cuttings and grafting).		Understand
				[SLO: B-09-Q-19]	Rationalize how parthenogenesis is a type of asexual reproduction		Understand
				[SLO: B-09-Q-20]	Define cloning		Remember
				[SLO: B-09-Q-21]	Explain sexual reproduction in plants		Understand