



آغا خان یونیورسٹی ایگزامینیشن بورڈ

AGA KHAN UNIVERSITY EXAMINATION BOARD

Secondary School Certificate
Examination Syllabus

Biology

Grades IX - X

(Based on New National Curriculum 2022-2023)

Part II (Grade X)

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level ¹		
		R	U	A and beyond
10. Biostatistics	Students should be able to:			
10.1 Introduction	10.1.1 define 'biostatistics'; 10.1.2 describe the significance of biostatistics in biological research and data analysis; 10.1.3 differentiate between measures of central tendency (mean, median, mode) with their importance in summarising biological data; 10.1.4 calculate mean, median and mode for a given set of biological data;	*	*	A
10.2 Data handling	10.2.1 analyse trends or patterns in a biological data by plotting graph/ histogram; 10.2.2 interpret graphical representations of data, i.e., line graphs, bar charts, histograms and pie charts, used in biological studies; 10.2.3 analyse biological data using statistical methods to make meaningful conclusions.			An E An

¹R = Remember, U = Understand, A = Apply and beyond [Apply (A), Analyse (An), Evaluate (E), Create (C)]

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
11. Cell Cycle	Students should be able to:			
11.1 Cell Cycle (Interphase and Mitotic Phase)	11.1.1 define 'cell cycle'; 11.1.2 illustrate different phases (interphase and mitotic phase) of cell cycle; 11.1.3 describe the key events of different sub-phases of interphase, i.e., G1 phase, S phase and G2 phase;	*		A
11.2 Mitosis	11.2.1 define 'mitosis'; 11.2.2 describe the different stages of mitosis; 11.2.3 compare the processes of cytokinesis in animal and plant cells; 11.2.4 differentiate between: a. chromosome and chromatid, b. haploid and diploid cells with examples; 11.2.5 analyse changes in the amount of DNA during different stages of cell cycle through graph; 11.2.6 explain the significance of mitosis in cell replacement, development and growth, regeneration and asexual reproduction in living organisms; 11.2.7 predict the consequences of spindle fibre malfunction during prophase on chromosome segregation in later stages of mitosis; 11.2.8 describe that errors in the control of mitosis lead to benign tumor and enable cancer cells to invade other tissues and form metastases;	*	* * *	An E
11.3 Meiosis	11.3.1 define the terms: 'meiosis', 'homologous chromosomes', 'sister and non-sister chromatids', 'synapsis' and 'crossing over'; 11.3.2 describe the stages of meiosis I and meiosis II; 11.3.3 illustrate homologous chromosome pairs, haploid/ diploid cells in diagrams or micrographs of different stages of meiosis;	*	*	A

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
	11.3.4 describe that meiosis contributes to genetic variation through processes such as crossing over and independent assortment; 11.3.5 differentiate between meiosis and mitosis in terms of process, purpose, and outcomes; 11.3.6 explain the significance of meiosis in generating genetic diversity, preserving species-specific chromosome numbers and producing gametes; 11.3.7 predict the changes in number of chromosomes, chromatids and DNA molecules during different stages of the cell cycle in various conditions, i.e., normal cell division, errors in mitosis or meiosis and exposure to mutagens;		*	E
11.4 Necrosis and Apoptosis	11.4.1 define 'apoptosis' as programmed cell death and 'necrosis' as uncontrolled cell death; 11.4.2 compare apoptosis and necrosis with respect to their causes and processes.	*	*	

FOR ANNUAL EXAMINATION

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
12. Homeostasis	Students should be able to:			
12.1 Introduction	12.1.1 define 'homeostasis'; 12.1.2 explain the importance of homeostasis; 12.1.3 describe the key components of a negative feedback loop, i.e., stimulus, sensor (receptor), control centre and effector; 12.1.4 explain how homeostasis works in terms of negative feedback mechanisms; 12.1.5 describe the three main aspects of homeostasis, i.e., osmoregulation, thermoregulation and excretion; 12.1.6 differentiate between: a. excretion and secretion, b. egestion and excretion;	*	*	
12.2 Homeostasis in Plants	12.2.1 describe the mechanism of excretion in plants for carbon dioxide, water, oxygen, latex, resins and gums; 12.2.2 compare the adaptations of hydrophytes, halophytes, mesophytes and xerophytes in relation to their osmotic adjustments and environmental conditions;		*	
12.3 Homeostasis in Human Beings	12.3.1 identify skin, lungs and kidneys as major organs involved in homeostasis; 12.3.2 relate the internal structure of skin with its function to regulate body temperature; 12.3.3 explain temperature regulation as an example of negative feedback mechanisms in the human body; 12.3.4 describe the role of lungs in keeping carbon dioxide concentration down to a certain level;		*	

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
	12.3.5 explain the negative feedback loop of antidiuretic hormone (ADH)/ vasopressin in osmoregulation, including the roles of osmoreceptors as sensors, hypothalamus as the control centre and kidneys as effectors; 12.3.6 describe homeostatic control of blood glucose level; 12.3.7 analyse trends in blood glucose fluctuations due to diet and physical activity; 12.3.8 identify normal and abnormal blood glucose ranges for fasting, before meals and after meals;		* * FA ²	An
12.4 Urinary System of Human Beings	12.4.1 describe the functions of different organs of urinary system; 12.4.2 describe the internal structure of the human kidney; 12.4.3 define 'nephron' as an excretory unit of kidney; 12.4.4 explain the structure and function of following parts of nephron: a. renal or malpighian corpuscle (Bowman's capsule and glomerulus), b. proximal convoluted tube, c. loop of Henle, d. distal convoluted tube, e. collecting duct, f. associated blood vessels; 12.4.5 describe the processes involved in urine formation, i.e., ultrafiltration, reabsorption and secretion; 12.4.6 predict the consequences if a specific part of the nephron fails to function properly; 12.4.7 analyse the impact of functional impairments of nephron using the case study of glomerulonephritis and diabetic nephropathy;	*	* * * *	E FA

²FA= Formative Assessment, not to be assessed under examination conditions

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
12.5 Disorders of Kidney	12.5.1		*	
	12.5.2		*	
	12.5.3		*	
	12.5.4		*	
	12.5.5		*	
	12.5.6			An
	12.5.7			FA

FOR ANNUAL EXAMINATIONS

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
13. Coordination and Control	Students should be able to:			
13.1 Introduction	13.1.1 define the term 'coordination'; 13.1.2 explain the significance of coordination in living organisms; 13.1.3 identify the two main systems involved in coordination and control: the nervous system and the endocrine system; 13.1.4 illustrate the process and main components of a coordinated action (response activity) as stimulus, receptor, coordinator, effector and response;	*	*	A
13.2 Types of Coordination (Nervous and Chemical Coordination)	13.2.1 differentiate between two main types of coordination in living organisms, i.e., nervous (electrical) and chemical (hormonal); 13.2.2 classify the human nervous system in terms of: a. the central nervous system (CNS) consisting of the brain and the spinal cord, b. the peripheral nervous system (PNS) consisting of the nerves outside of the brain and spinal cord, i.e., the nerves consisting of the sensory and motor division: I. the motor division consisting of the autonomic and somatic nervous system, II. the autonomic nervous system consisting of the sympathetic and parasympathetic nervous system; 13.2.3 differentiate between: a. autonomic and somatic nervous system b. sympathetic and parasympathetic nervous system;		*	
13.3 Human Nervous System	13.3.1 describe the key structural components of a neuron with their respective functions, i.e., neurilemma, cell body (soma), dendrites, axon, myelin sheath, nodes of Ranvier and Schwann cells; 13.3.2 differentiate between the structure and functions of sensory, relay (intermediate) and motor neurons; 13.3.3 differentiate between neuron, nerve fibre and nerve;		*	

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
	13.3.4 classify nerves as sensory, motor and mixed nerves;		*	
	13.3.5 identify parts of the brain as forebrain, midbrain and hindbrain;		*	
	13.3.6 explain functions of the different parts of brain, i.e., cerebrum, thalamus, hypothalamus, pituitary gland, midbrain (optic lobes), cerebellum, medulla oblongata and pons;		*	
	13.3.7 evaluate the effects of injuries or diseases on the functions of specific brain areas;			E
	13.3.8 differentiate between cross-sectional views of brain and spinal cord with reference to white and grey matter;		*	
	13.3.9 identify the structures visible in the cross-sectional view of spinal cord, i.e., white and grey matter, spinal nerves, dorsal root, ventral root, central canal and the associated neurons;		*	
	13.3.10 rectify the diagram of cross-section of spinal cord for common mistakes such as misplaced structures or incorrect labellings;			A
	13.3.11 differentiate between voluntary and involuntary actions;		*	
	13.3.12 define 'reflex action' and 'reflex arc';	*		
	13.3.13 trace the sequence of events in a reflex arc during common reflex actions;		*	
	13.3.14 explain the significance of reflex actions in everyday safety;		*	
	13.3.15 state that nerve impulses are electrical signals that travel across neurons;	*		
	13.3.16 define 'neurotransmitters' with examples, i.e., dopamine, acetylcholine, norepinephrine and epinephrine;	*		
	13.3.17 describe synapse as a junction between two neurons or a neuron and a target or effector cell such as a muscle cell;		*	
	13.3.18 describe the key components of a synapse, i.e., neurotransmitter, presynaptic neuron, synaptic cleft and postsynaptic neuron;		*	

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level			
		R	U	A and beyond	
13.4 Human Sensory Organs (Ear and Eye)	13.4.1	explain the structure and functions of each part of human auditory (ear) and visual (eye) receptors;		*	
	13.4.2	differentiate between pupil reflex in dim and bright light;		*	
	13.4.3	relate image formation in the human eye with image formation in the dark chamber used by <i>Ibn-al-Haitham</i> in his experiment;		FA	
	13.4.4	explain accommodation to view near and distant objects in terms of the contraction and relaxation of the ciliary muscles, tension in the suspensory ligaments, shape of the lens and refraction of light;		*	
	13.4.5	differentiate between defects of eye, i.e., short sightedness and long sightedness;		*	
	13.4.6	illustrate the treatment of short and long sightedness using ray diagrams;			A
	13.4.7	differentiate between rod cells and cone cells based on their structure, function and role in vision;		*	
	13.4.8	describe the role of vitamin A in vision and the impact of its deficiency on retina;		*	
13.5 Endocrine System	13.5.1	define the terms 'hormone' and 'endocrine system';	*		
	13.5.2	describe the location and functions of major glands of the endocrine system, i.e., pituitary, parathyroid, thyroid, pancreas, adrenal, testes and ovary;		*	
	13.5.3	assess the problems associated with the hyper or hypo secretion of somatotrophin, thyroid-stimulating hormone, vasopressin/ADH, thyroxin, calcitonin, adrenaline, insulin, glucagon, testosterone, estrogen and progesterone;			E
	13.5.4	describe diabetes and its subtypes (type 1 and type II) in terms of insulin production and utilisation, affected age group and treatment strategies;		*	

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			R	U	A and beyond
	13.5.5	explain the roles of adrenaline (epinephrine) during emergency (fight or flight) and acetylcholine during rest and digest (parasympathetic nervous system) conditions;		*	
13.6 Nervous Disorders	13.6.1	explain the causes, symptoms and treatment of paralysis and epilepsy.		*	

FOR ANNUAL EXAMINATION 2026 ANL

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
14. Support and Movement	Students should be able to:			
14.1 Human Skeleton (Axial and Appendicular Skeleton)	14.1.1 define 'skeleton'; 14.1.2 explain the functions of skeleton in human body; 14.1.3 relate the main components of the axial skeleton (skull, middle ear ossicles, hyoid bone, vertebral column and ribcage) and the appendicular skeleton (upper limbs, lower limbs, pectoral girdle and pelvic girdle) with their functions; 14.1.4 differentiate between cartilage and bone; 14.1.5 differentiate between tendons and ligaments in terms of their function and flexibility;	*	* * * *	
14.2 Types of Joints	14.2.1 define 'joint/ articulation'; 14.2.2 differentiate among different types of joints (i.e., immovable, slightly moveable and freely moveable joints) with examples; 14.2.3 compare hinge joints and ball-and-socket joints on the basis of their locations and working; 14.2.4 relate the key structures of hinge and ball-and-socket joints, i.e., joint capsule, ligaments, tendons, articular cartilage, synovial fluid and synovial membrane with their functions; 14.2.5 analyse that injuries to hinge and ball-and-socket joints can limit movement;	*	* * *	An
14.3 Antagonistic Muscles	14.3.1 differentiate between locomotion and movement; 14.3.2 define 'antagonism'; 14.3.3 describe action of flexors (biceps) and extensors (triceps) as a pair of opposing (antagonistic) muscles;	*	* *	

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level			
		R	U	A and beyond	
14.4 Disorders of Skeletal System	14.4.1	describe osteoporosis as a condition characterised by weakened bones and increased risk of fractures and arthritis as inflammation of one or more joints, causing pain and stiffness; assess the causes, common symptoms, risk factors and treatments of osteoporosis and arthritis; evaluate the impact of nutrition (e.g. calcium, vitamin D) on bone health and the role of hydration and collagen in maintaining cartilage function;			E
	14.4.2				
	14.4.3				
	14.4.4				

FOR ANNUAL EXAMINATION

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			R	U	A and beyond
15. Reproduction	Students should be able to:				
15.1 Introduction	15.1.1	state the importance of reproduction;	*		
	15.1.2	differentiate between asexual and sexual reproduction;		*	
15.2 Asexual Reproduction in Bacteria, Protists, Fungi and Plants	15.2.1	describe different types of asexual reproduction, i.e., binary fission, multiple fission, budding, fragmentation, spore formation, parthenogenesis, apomixis and vegetative propagation with examples;		*	
	15.2.2	distinguish between natural and artificial vegetative propagation;		*	
	15.2.3	explain natural vegetative propagation in plants through underground stems (i.e., runners, bulbs, rhizome, tuber and suckers) and leaves (e.g. <i>Bryophyllum</i>);		*	
	15.2.4	explain methods of artificial vegetative propagation (i.e., stem cutting, layering, grafting and tissue culture);		*	
15.3 Sexual Reproduction in Flowering Plants	15.3.1	describe structure and function of each whorl of a flower;		*	
	15.3.2	differentiate between self and cross pollination;		*	
	15.3.3	assess the role of biotic and abiotic agents (such as wind and insects) in aiding cross-pollination and their potential response to environmental changes;			FA
	15.3.4	explain the events that occur during the life cycle of a flowering plant;		*	
	15.3.5	evaluate the role of meiosis and mitosis in the formation of the male and female gametophytes (pollen grains and embryo sac);			E
	15.3.6	differentiate between the structural adaptations of wind-pollinated and insect-pollinated flowers;		*	
	15.3.7	analyse the impact of compromised structural adaptations in insect-pollinated and wind-pollinated flowers on the efficiency of pollen dispersal and the likelihood of successful pollination;			An

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			R	U	A and beyond
15.4 Germination of Seed	15.4.1 15.4.2 15.4.3 15.4.4	differentiate between structure of monocot and dicot seeds; differentiate between epigeal and hypogeal germination; describe conditions necessary for germination of seeds; analyse the outcomes of seeds exposed to varying conditions, i.e., stressful environments or conditions outside the optimal range;		* * *	An
15.5 Reproduction in Animals (Asexual and Sexual)	15.5.1 15.5.2 15.5.3 15.5.4 15.5.5	describe methods of asexual reproduction in animals, i.e., binary and multiple fission, budding, fragmentation and parthenogenesis with examples; define 'fertilisation' and 'gametogenesis' (spermatogenesis and oogenesis); differentiate between external and internal fertilisation; explain male and female reproductive systems of rabbit; compare processes of gametogenesis in male and female rabbit;	*	* * *	
15.6 Sexually Transmitted Diseases (STDs)	15.6.1	explain the cause, symptoms and prevention of Acquired Immunodeficiency Syndrome (AIDS).		*	

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			R	U	A and beyond
16. Inheritance	Students should be able to:				
16.1 Introduction	16.1.1	define 'genetics';	*		
	16.1.2	describe genes as the units of inheritance;		*	
16.2 Chromosomes, DNA and Genes	16.2.1	describe the chemical composition of a chromosome;		*	
	16.2.2	sketch the general structure of a nucleotide;			A
	16.2.3	illustrate the double helical structure of deoxyribonucleic acid (DNA);			A
	16.2.4	determine the percentages of each nitrogenous base in a specified DNA fragment, using the principle of complementary base pairing (Chargaff's rule);			E
	16.2.4	differentiate between a gene and an allele;		*	
	16.2.5	describe the process of DNA replication, including the key steps involved such as unwinding of the DNA, adding of nucleotides and the formation of two identical DNA molecules;		*	
16.3 Central Dogma of Protein synthesis	16.3.1	describe the structure of RNA;		*	
	16.3.2	differentiate between RNA and DNA;		*	
	16.3.3	compare the types of RNA, i.e., messenger RNA (mRNA), ribosomal RNA (rRNA) and transfer RNA (tRNA);		*	
	16.3.4	differentiate between codons and anticodons;		*	
	16.3.5	describe the processes of transcription and translation;		*	
	16.3.6	convert the mRNA sequence (codons) to DNA and tRNA anticodons and vice versa;			A

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level			
		R	U	A and beyond	
16.4 Mendel's Law of Segregation and Independent Assortment	16.4.1	define the terms: dominant, recessive, phenotype, genotype, homozygous, heterozygous, parental generation (P1), filial one and second (F1 and F2) generations and pedigree;	*		
	16.4.2	state Mendel's Law of Segregation and Law of Independent Assortment;	*		
	16.4.3	determine that 3:1 monohybrid F2 phenotypic ratio is evidence of segregation of alleles;			A
	16.4.4	determine that 9:3:3:1 dihybrid F-2 phenotypic ratio is evidence of independent assortment;			A
	16.4.5	determine the genotypic and phenotypic ratios of co-dominance using examples (e.g. ABO blood group system, roan coat colour in animals, checkered chicken, variegated flower and sickle cell anaemia);			A
	16.4.6	determine the genotypic and phenotypic ratios of incomplete dominance using examples (e.g. flower colour in Japanese 4 O' clock plant, hair texture, skin colour, hair colour, eye colour in animals and humans);			A
	16.4.7	predict the phenotypic and genotypic outcomes of offspring based on the genotype of parents and ancestral lineage using pedigree charts;			E
	16.4.8	define 'autosomes' and 'sex chromosomes';	*		
	16.4.9	describe the roles of the X and Y chromosomes in gender determination in humans;		*	
16.5 Variation and Evolution	16.5.1	define 'species', 'speciation' and 'evolution';	*		
	16.5.2	describe sources of variation, i.e., mutation, crossing over, environmental factors, independent assortment of chromosomes and fertilisation that leads to speciation and evolution;		*	
	16.5.3	differentiate between continuous and discontinuous variation;		*	

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
	16.5.4 construct histograms using biostatistical methods to show continuous variation in different human traits (i.e., height, weight, skin/ eye/ hair colour, intelligence, finger length and foot size);			An
	16.5.5 analyse frequencies of discontinuous variation in categorical traits across human populations, i.e., blood groups, earlobe attachment, polydactyly/ extra fingers or toes, tongue rolling, cleft chin, presence or absence of dimples, gender, widow's peak and Hitchhiker's thumb by using bar chart and pie chart;			An
	16.5.6 explain the observations Darwin made during his voyage on HMS Beagle;		FA	
	16.5.7 explain the main points of the theory of natural selection (Darwinism), i.e., over production, struggle for existence, heritable variation and survival of the fittest;		*	
	16.5.8 describe artificial selection as a means of improvement of yield in economically important plants and animals;		*	
	16.5.9 describe evidence of evolution from palaeontology (fossil record), comparative anatomy (homologous and analogous structures, vestigial structures) and selective breeding.		*	

FOR ANNUAL EX

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
17. Man and His Environment	Students should be able to:			
17.1 The Ecosystem: Levels of Ecological Organisation; Components	17.1.1 describe the levels of ecological organisation, i.e., species, population, community, habitat, ecosystem and biosphere with examples;		*	
	17.1.2 differentiate between biotic and abiotic components of the ecosystem with examples;		*	
17.2 Flow of Energy in the Ecosystem	17.2.1 describe trophic levels (producer, primary consumer, secondary consumer and tertiary consumer) of an ecosystem;		*	
	17.2.2 compare flow of materials (cyclic) and flow of energy (non-cyclic) in the ecosystem;		*	
	17.2.3 construct food chains and food webs of different ecosystems;			An
	17.2.4 infer that the transfer of energy from one trophic level to another is inefficient;			An
	17.2.5 analyse the impact of an increase or decrease in the population of a certain species on other species' population within a food web;			An
	17.2.6 illustrate pyramids of numbers, energy and biomass for the given food chains;			A
17.3 Biogeochemical Cycles (Carbon and Nitrogen Cycle)	17.3.1 illustrate different stages of carbon cycle and nitrogen cycle;			A
	17.3.2 relate biogeochemical cycles with flow of energy and ecological balance;		*	
17.4 Interactions in the Ecosystem (Competition, Predation, Symbiosis)	17.4.1 define 'population growth';	*		
	17.4.2 analyse the factors affecting the rate of population growth including competition, predation, symbiosis (parasitism, mutualism, commensalisms);			An

Topics and Sub-topics	Student Learning Outcomes		Cognitive Level		
			R	U	A and beyond
17.5 Human Impact on the Environment	17.5.1	explain that anthropogenic (human activities) in the environment, i.e., deforestation, pollution, overuse of fossil fuels, agricultural practices, introduction of new species, overhunting, mining and urbanisation can disrupt an ecosystem and threaten the survival of some species;		*	
17.6 Pollution, its Consequences and Control	17.6.1 17.6.2	explain causes of air, water and land pollution; suggest possible actions to control each kind of pollution;		*	E
17.7 Conservation of Resources	17.7.1 17.7.2	apply the concept of environmental care through acting upon the principle of 'The 3Rs' (reduce, reuse and recycle); evaluate the effectiveness of a designed solution for reducing the impact of human activities on the environment.			A FA

FOR ANNUAL EXAMINATION

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
18. Biotechnology	Students should be able to:			
18.1 Introduction	18.1.1 define 'biotechnology'; 18.1.2 describe the importance of biotechnology; 18.1.3 state the contributions of Paul Berg in the field of genetic engineering;	* FA	* 	
18.2 Industrial Fermentation	18.2.1 compare the methods of fermentation in yeast and bacteria; 18.2.2 describe functions of different parts of a fermenter; 18.2.3 describe methods of producing different products, i.e., yogurt, bread, cheese, antibiotics and alcohol in fermenters; 18.2.4 describe the advantages of using fermenters in preparing food products;		* * * *	
18.3 Genetic Engineering	18.3.1 describe objectives of genetic engineering; 18.3.2 illustrate the steps of recombinant DNA technology in the production of human insulin/ growth hormone; 18.3.3 describe major achievements of genetic engineering with reference to improvement in the traits of agricultural crops, i.e., herbicide resistance, virus resistance and insect resistance; 18.3.4 describe major achievements of genetic engineering in health and medicine, i.e., production of insulin, human growth hormone, vaccine against hepatitis B and interferon; 18.3.5 define 'bioremediation'; 18.3.6 infer that bioremediation can help us in taking better care of our environment.		* * *	A An

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Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
19. Pharmacology	Students should be able to:			
19.1 Introduction	19.1.1 define 'pharmacology'; 19.1.2 define the term 'drug'; 19.1.3 identify various sources of drugs, i.e., minerals, animals, plants, synthetics and microorganisms; 19.1.4 describe main usages of painkillers, antibiotics, vaccines and sedatives; 19.1.5 state the contribution of Joseph Lister in the discovery of antiseptics; 19.1.6 describe the discovery of penicillin by Alexander Fleming;	* * FA	* *	
19.2 Medicinal and Addictive Drugs	19.2.1 describe addictive drugs, including sedatives, narcotics (e.g. morphine and heroin) and hallucinogens (e.g. marijuana), focusing on their effects; 19.2.2 describe associated social problems of drug addiction, i.e., severe social abandonment and crimes; 19.2.3 list withdrawal symptoms of addiction to heroine; 19.2.4 list different plants which are common in Pakistan and used for getting hallucinogens and narcotics;	 * FA	* *	
19.3 Antibiotics and Vaccines	19.3.1 describe sulphonamides, tetracyclines and cephalosporins as the major groups of antibiotics being used; 19.3.2 differentiate between bactericidal and bacteriostatic effects of antibiotics with examples; 19.3.3 compare broad-spectrum antibiotics (e.g. amoxicillin) with narrow-spectrum antibiotics (e.g. penicillin), including their applications and effectiveness against different bacterial infections;		* *	FA

Topics and Sub-topics	Student Learning Outcomes	Cognitive Level		
		R	U	A and beyond
	19.3.4 describe the development of antibiotic resistance in bacteria and the mechanisms involved;		*	
	19.3.5 differentiate between antibiotics and vaccines in terms of their mode of action, time and method of administration, effectiveness against types of pathogens, duration of effectiveness and impact on the immune system;		*	
	19.3.6 assess the role of antibiotics and vaccines in public health, considering issues such as antibiotic resistance and vaccine coverage rates.			FA

FOR ANNUAL EXAMINATION 20

Part II (Grade X)

S. No.	Topic-Wise Practical Activities	Apparatus/ Slide/ MPDEL	Chemical/ Material
Topic 11: Cell Cycle			
1.	Observe the prepared slides/ charts/ photomicrographs of different stages of mitosis	Prepared slides/ charts/ photomicrographs of different stages of mitosis, microscope	
2.	Sketch key features of the different stages of mitosis observed under the microscope		
3.	Observe the prepared slides/ charts/ photomicrographs of different stages of meiosis	Prepared slides/ charts/ photomicrographs of different stages of meiosis, microscope	
4.	Sketch key features of the different stages of meiosis observed under the microscope		
5.	Take precise notes on the observed structural changes during each stage of mitosis and meiosis		
Topic 12: Homeostasis			
6.	Disassemble and reassemble the kidney model (if it comes in parts), ensuring the accurate placement of all internal structures in the correct anatomical order	Model/ chart of kidney	
7.	Use the kidney model to label the key components with their specific functions		
8.	Use the kidney model to trace the path of blood through the kidney		
Topic 13: Coordination and Control			
9.	Disassemble and reassemble a brain model to show the sections of brain in the correct anatomical order	Model/ chart of brain	
10.	Use brain model/ chart to label each part with its specific functions		

11.	Demonstrate proper techniques for disassembling and reassembling the eye model, i.e., removing the lens, cornea or retina	Model/ chart of eye	
12.	Use the model of eye/ chart to label the key structures with its specific functions		
13.	Use the model/ chart of eye to trace the path of light through the eye		
14.	Manipulate the model to demonstrate the separate pathways of sound perception (through the cochlea) and balance regulation (through the semicircular canals and vestibular system).	Model/ chart of ear	
15.	Use the model of ear/ chart to label the key structures with its specific functions		

FOR ANNUAL EXAMINATION 2026 AND ONWARDS

S. No.	Topic-Wise Practical Activities	Apparatus/ Slide/ MPDEL	Chemical/ Material
Topic 14: Support and Movement			
16.	Use the model/ chart of human skeleton to label the key divisions (i.e., axial and appendicular) and bones with their specific functions	Model/ chart of human skeleton	
17.	Demonstrate various joint types on the skeleton model (e.g. hinge joints, ball-and-socket joints, pivot joints), showing the types of movements, they allow (e.g. flexion, extension, rotation)		
18.	Use the model/ chart of human skeleton to compare the articulations of different joints		
Topic 15: Reproduction			
19.	Use the specimens to identify the main features of bulb (onion), rhizome (ginger) and tuber (potato)	Petri dish, pointer/ needle	Onion, ginger, potato
20.	Point out the growth points on the specimens to highlight their function in vegetative reproduction		
21.	Draw labelled diagrams of bulb (onion), rhizome (ginger) and tuber (potato)		
22.	Dissect a flower to expose the internal structures (e.g. stamens, pistils, petals, sepals)	Petri dish, pointer/ needle, scalpels, forceps, magnifying glasses, microscope	Dicotyledonous plant
23.	Observe pollen grains and ovules under a microscope		
24.	Draw labelled diagrams to highlight the functions of vegetative and reproductive parts of a dicotyledonous plant		
25.	Dissect maize and gram seeds to examine their internal structures	Petri dish, pointer/ needle, scalpels, forceps, magnifying glass	Maize and gram seeds
26.	Sketch labelled diagrams of maize and gram seeds to represent their external and internal structures		

27.	Perform experiments to investigate seed germination in maize and gram seeds	Petri dish, beaker, filter paper, cotton, water, refrigerator	Seeds of maize/ wheat/ gram/ pea
28. 29.	Focus the prepared slide/ chart/ photomicrograph to observe binary fission in amoeba Sketch binary fission in amoeba observed under the microscope	Prepared slide/ chart/ photomicrograph of binary fission in amoeba, microscope	
30. 31.	Focus the prepared slide/ chart/ photomicrograph to observe budding in yeast Sketch budding in yeast observed under the microscope	Prepared slide/ chart/ photomicrograph of budding in yeast, microscope	

FOR ANNUAL EXAMINATION 2026 AND ONWARDS

S. No.	Topic –Wise Practical Activity	Apparatus/ Slide/ MPDEL	Chemical/ Material
Topic 10: Biostatistics			
32.	Record the heights of class fellows to predict the type of variation and present the data in graphical form (histogram).	Pencil, eraser, meter scale, graph paper	
Topic 16: Inheritance			
33.	Use the model/ chart of DNA to identify the key features of DNA	Model/ chart of DNA	
34.	Disassemble and reassemble the model of DNA to show complementary base pairing, DNA replication and unwinding of DNA strands		
Topic 17: Man and His Environment			
35.	Construct food chains and food webs of aquarium/ pond	Notebook, pencil, magnifying glass, aquarium/ pond	
Topic 18: Biotechnology			
36.	Perform experiments to investigate the role of yeast and bacteria in the fermentation of flour and milk	Beaker, water, glass lid	Flour, instant yeast, sugar, milk, yogurt (for bacterial strain)

Grade X

Table 2: Exam Specifications

Topic No.	Topics	Marks Distribution			Total Marks
		MCQs	CRQs	ERQs	
10.	Biostatistics	1			1
11.	Cell Cycle	4	Total 3 Marks (1 CRQ)	6 marks Choose any one from Two	22
13.	Coordination and Control	6	Total 3 Marks (1 CRQ)		
12.	Homeostasis	3	Total 2 marks (1 CRQ)		5
14.	Support and Movement	2	Total 3 mark (1 CRQ)		5
15.	Reproduction	7		6 Marks Choose any ONE from TWO	21
16.	Inheritance	8			
17.	Man and His Environment	3	Total 2 marks (1 CRQ)		5
18.	Biotechnology	3			3
19.	Pharmacology	3			3
Total		40	13	12	65
Practical *					10
Total					75

Examination Structure and Practical Requirements for Grades IX and X

Theory:

- Multiple Choice Question (MCQ) requires candidates to choose one best/ correct answer from four options for each question. Each MCQ carries ONE mark.
- Constructed Response Question (CRQ) requires students to respond with a short text (few phrases/ sentences), calculations or diagrams.
- Extended Response Question (ERQ) requires students to answer in a more descriptive form. The answer should be in paragraph form, with diagrams where needed, and address all parts of the question.
- Table 1 and 2 contains the mark distribution for each topic.
- There will be two examinations, one at the end of grade IX and one at the end of grade X.
- In each grade, the theory paper will be of 3 hours and will consist of two parts: paper I and paper II.
- Paper I theory will consist of 40 compulsory, multiple choice items. These questions will involve four responses options. The OMR (Optical Mark Recognition) sheet for paper I will be provided separately.
- Paper II theory will carry 25 marks and consist of Constructed Response Questions (CRQs) and Extended Response Questions (ERQs). Each extended response question will be presented in an either/ or form.
- The booklet for paper II will serve as an answer script.

Practical:

- In each grade, practical examination (Paper III) will be conducted separate from the theory paper and will consist of 10 marks.
- Practical examination (Paper III) will be based on the list of practical activities given in the examination syllabus. Schools may design their own practical manuals based on these activities for teaching and learning purpose.
- Practical journal/ portfolio should be developed by students and endorsed by a figure of authority, such as a teacher or principal, and submitted at the time of the practical examination (Paper III).
- It is essential for each school to equip its laboratories with chemicals, instruments, apparatus, specimens etc. according to the requirements of the practical activities. Each school will be responsible to make sure that each student is provided the opportunity to do the practical activities.