5: Student Learning Outcomes for Grade X

Unit 9: Gaseous exchange

Gaseous exchange in plants		1 Lecture
Understand Analysis→	*After reading this topic the student will be able to:* • Differentiate among cellular respiration, gaseous exchange and breathing. • Describe the process of gaseous exchange in plants by comparing photosynthesis and respiration. • Draw diagram of stomata of a leaf indicating the movement of gases	
Human respiratory system		2 Lectures
Understand Analysis→	*After reading this topic the student will be able to:* • Draw diagram of organs of human respiratory system from model/chart • Name and describe, role of the parts of human air passageway and lungs • Describe the mechanism of breathing in terms of movements of ribs and diaphragm. • Differentiate between the composition of inhaled and exhaled air.	
Respiratory Disorders / Diseases		4 Lectures
Understand Analysis→	*After reading this topic the student will be able to:* • Differentiate between disorder and disease. • Describe briefly diseases related to respiratory system like bronchitis, emphysema, pneumonia, asthma, and lung cancer. • Describe smoking in terms of lungs and respiratory system. • Establish the importance of breathing in fresh air, nasal and oral cavity cleanliness	
STS Connections	*After reading this topic the student will be able to:* • Evaluate the effects of tilling on roots for better exchange of gases with the soil air. • Compare the concepts of artificial ventilator and artificial breathing. • Understand effect of breathing in exhausts of fossil fuels (petrol and others). • Know the importance of cross ventilation in homes.	

Unit 10: Homeostasis

Homeostasis: Metabolic equilibrium		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Understand homeostasis and describe its importance.	
Adaptations in plants for equilibrium		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Recall the mechanisms / adaptations in plants for the excretion / storage of CO2, H2O, O2, latex, resins and gums. • Recognize osmotic adjustments in plants.	
Major organs involved in homeostasis		2 Lectures
Understand →	*After reading this topic the student will be able to:* • Recognize skin, lungs, liver and kidneys as the major organs involved in homeostasis. • Explain the role of skin in regulating body temperature. • Describe how lungs keep the carbon dioxide concentration down to certain level.	
Role of kidneys and liver		2 Lectures
Understand →	*After reading this topic the student will be able to:* • Recognize the role of kidneys and liver to control blood composition.	
Human urinary system		2 Lectures
Understand →	*After reading this topic the student will be able to:* • Identify the different organs of urinary system. • Relate the structure of kidney with its function. • Locate the different parts of nephrons and relate them with their function.	
Urine formation and osmoregulation		2 Lectures
Understand →	*After reading this topic the student will be able to:* • Describe urine formation as major function of kidneys which involves three processes i.e. filtration, reabsorption and secretion. • Recognize role of kidney in osmoregulation.	
Kidney disorders		2 Lectures
Understand →	*After reading this topic the student will be able to:* • Identify the causes of kidney stones • Recognize lithotripsy and surgery as the methods to remove kidney stones.	

	• Identify causes of kidney failure and explain that dialysis is one of the treatments in kidney failure. • Describe the contributions of Al-Farabi and Abu-al-Qasim in introducing the method of removing stones from the urinary bladder.	
Analysis and interpreting	*After reading this topic the student will be able to:* • Recognize the right treatments of kidney problems and will refuse to accept the myths. • Rationalize why dialysis machine is considered as artificial kidney. • Design dialysis apparatus by cellophane paper and empty photographic film case	

Unit 11: Coordination and Control

Coordination: types in living organism		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Introduce coordination and Identify the two main types of coordination in living organisms, i.e., Nervous (electrical) and Hormonal (chemical).	
Organs for Coordination and control		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Identify the main organs responsible for coordination and control. • Analyse why plants (like sunflower) have a very slow response to stimuli.	
Human nervous system		1 Lecture
Understand Aanalysis→	*After reading this topic the student will be able to:* • Simplify the structure of human nervous system and relate to its function • Differentiate between the cross-sectional views of brain and spinal cord, with reference to white and grey matter.	
Neuron and its types		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Introduce neurons and differentiate its types. • Describe the general structure of a Motor neuron.	
Reflex action and reflex arc		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Explain reflex action and reflex arc with help of knee jerk.	
Disorders of the Nervous System		1 Lecture
Understand →	*After reading this topic the student will be able to:*	

	• Explain the causes, symptoms and control of two nervous disorders i.e. vascular paralysis and functional epilepsy.	
Short and long sightedness and its remedial measures		2 Lectures
Understand Application→	*After reading this topic the student will be able to:* • Relate the working of lenses for the treatment of short and long sightedness and nominate Lens replacement surgery as latest method.	
Role of Vitamin A in vision		3 Lectures
Understand Application→	*After reading this topic the student will be able to:* • Associate the role of Vitamin A in vision. • Explain the role of ear and eye in balance and accommodation. • Relate the contribution of Ibn-al-Haitham and Al-Ibn-Isa with knowledge about the structure of eye and treatment of various ophthalmic diseases.	
Endocrine system		5 Lectures
Understand →	*After reading this topic the student will be able to:* • Define the terms hormone and endocrine system and their major role in metabolism. • Outline the parts and role of endocrine glands in body activities; major glands of this system (Pituitary, Thyroid, Pancreas, Adrenal, Gonads) and names of their respective hormones.	
Concept of negative feedback		1 Lecture
Understand Analysis→	*After reading this topic the student will be able to:* • Describe how the negative feedback regulates the secretion of hormones. • Associate adrenaline involvement in exercise and emergency conditions. • Compare the BGC (blood glucose concentration) of healthy person with a patient suffering from Diabetes mellitus (Data/ graph to be given in the textbook)	
STS Connections	• Explain the way nervous system helps to coordinate complex and intricate movements of hand to play a piano, or write alphabets. • Analyse the way this knowledge has helped humans to train dogs and domesticated animals to perform specific tasks. • Justify the time difference between seeing the flash of lightning and hearing the roar of a thunderstorm.	

	• Explain how colour blindness could be a hurdle for aircraft pilots and drivers. • Relate how the knowledge of nervous system has helped humans to treat diseases like epilepsy, paralysis.	

Unit 12: Support and Movement

Role of skeleton in Support and movement		2 Lectures
Understand →	*After reading this topic the student will be able to:* • Justify the need of skeleton. • Differentiate between cartilage and bone. • Explain that skeletal system is actually a dynamic, living tissue that is capable of growth, adapts to stress and repairs itself after injury.	
Main components of Human skeleton		1 Lecture
Understand Application→	*After reading this topic the student will be able to:* • Differentiate and enumerate bones of axial skeleton and appendicular skeleton and draw labelled diagrams. • Describe the contribution of Vesalius in describing the bones and muscles in human.	
Movable and immovable joints		2 Lectures
Understand Analysis→	*After reading this topic the student will be able to:* • Differentiate between movable joints (ball and socket, hinge joint) and immovable joints (sutures), ligaments and tendons. • Identify ball-n-socket and hinge joints in human body.	
Muscles and Movement		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Discuss how the action of flexor and extensor muscles explains antagonism.	
Disorders of Skeletal System		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Relate low intake of calcium/milk, hormonal imbalance with osteoporosis.	
Causes, symptoms and treatment of arthritis		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Discuss the causes, symptoms, and treatment of arthritis. • Relate the onset of arthritis with age and weight-bearing joints.	
STS Connections	• Relate the principle of leverage to the action of elbow joint.	

	• State the principles of arthroplasty for the replacement of joints.	

Unit 13: Reproduction

Introduction		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Introduce reproduction and describe its various types.	
Types of asexual reproduction in plants		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Describe different types of asexual reproduction i.e. budding, spore formation and vegetative propagation.	
Vegetative and artificial reproduction		2 Lectures
Understand →	*After reading this topic the student will be able to:* • Distinguish between vegetative propagation and artificial propagation. • Explain vegetative propagation in plants (through stem, suckers and leaves). • Describe stem cuttings and grafting.	
Life cycle of flowering plants		2 Lectures
Understand →	*After reading this topic the student will be able to:* • Illustrate sexual reproduction in plants by explaining the life cycle of a flowering plant distinguishing between seed and fruit. • Differentiate between wind-pollination and insect-pollination.	
Structure of seed		2 Lecture
Understand →	*After reading this topic the student will be able to:* • Describe the structure of seed and differentiate between epigeal and hypogeal germination indicating epicotyl and hypocotyl.	
Germination of seed		1 Lecture
Initiate and Plan	*After reading this topic the student will be able to:* • Describe the conditions necessary for germination of seeds • List some of the ripened ovaries and ovules, which are eaten in daily life.	
Types of asexual reproduction in animals		1 Lecture
Understand →	*After reading this topic the student will be able to:*	

	• Outline the binary fission, multiple fission, budding and fragmentation as asexual methods of reproduction in animals. • Draw different stages of binary fission in Amoeba after observing them through slides or charts.	
Sexual Reproduction in animals		2 Lectures
Understand →	*After reading this topic the student will be able to:* • Describe the male and female reproductive systems of rabbit. • Locate the different organs of rabbit's male and female reproductive systems on a chart	
Gametogenesis and types of fertilization		2 Lectures
Understand →	*After reading this topic the student will be able to:* • Describe the processes of gametogenesis in rabbit. • Define fertilization and differentiate between external and internal fertilization.	
Overpopulation		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Appreciate that Why population control is required? • Rationalize the need for population planning.	
STS Connections	• Enlist STDs and explain AIDS as an example of sexually transmitted diseases. • Grow plants at home using asexual reproduction methods. • Describe commercially important applications of asexual reproduction in plants.	

Unit 14: Inheritance

Composition of genetic material		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Introduce genetics and relate role of genes in inheritance. • Describe the composition of chromatin material	
Gene and allele		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Clarify the difference between a gene and an allele.	
Mendel's Principles of Segregation and Independent Assortment		6 Lectures
Understand Application Analysis→	*After reading this topic the student will be able to:* • State and explain Mendel's Principle of Segregation emphasizing the terms related to genetics i.e. dominant,	

	recessive, phenotype, genotype, homozygous, heterozygous, P1, F1, F2 generation, complete and incomplete dominance, cross and back cross • State and explain Mendel's Principle of Independent Assortment. • Differentiate between complete and partial dominance. • Explain co-dominance by selecting the example of ABO blood group system. • Solve basic genetic problems, involving monohybrid crosses, incomplete dominance and codominance, using the Punnet Square.	
Variation leads to evolution and competition		2 Lectures
Understand →	*After reading this topic the student will be able to:* • Describe mutation as a source of variation. • Differentiate between continuous and discontinuous variation by giving examples like height, weight, IQ, gender and blood groups in population. • Introduce organic evolution as a result of variation. • Describe how variation leads to competition in a population and differential survival by best fitting to the environment.	
Selection as a possible means of evolution		
Understand Assess→	*After reading this topic the student will be able to:* • Assess selection as a possible means of evolution. • Develop an understanding of artificial selection as a means of improvement of yield in economically important plants (wheat, rice etc.) and animals • Plan an experiment (performance is not required) in which pure breeding tall plants can be crossed to pure breeding short plants to get tall variants predominantly, which are selected by environment • Analyse a case study of variation and selection, e.g., Peppered Moth.	
STS Connections	• Prepare a report using newspaper clippings of the recent advances and future possibilities in genetics. • Rationalize life as a product of the diversity brought about by chromosomes, genes and DNA molecule. • Explain how genetics can help predict the progeny of two individuals, which are crossed.	

	• Describe the effects of environment that lead to the selection of a variant which is more adapted to it.	

Unit 15: Men and Environment

The Ecosystem: Levels of Ecological Organization		2 Lectures
Understand →	*After reading this topic the student will be able to:* • Introduce ecology and describe levels of ecological organization.	
Sun is the main source of energy for all organisms		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Explain that the sun is the principal source of energy for all biological systems. • Compare and contrast the flow of materials (cyclic) and the flow of energy (non-cyclic) in the ecosystem.	
Flow of Materials and Energy in the Ecosystem		3 Lectures
Understand →	*After reading this topic the student will be able to:* • Conceptualize food chains and food webs. • Describe and compare energy relations between different trophic levels. • Construct food chains, food webs through observation of the local pond or grassland ecosystem.	
Pyramid of numbers and biomass		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Interpret pyramids of numbers and biomass	
Carbon and nitrogen cycles		2 Lectures
Understand →	*After reading this topic the student will be able to:* • Describe carbon and nitrogen cycles.	
Competition, Predation and Symbiosis		3 Lectures
Understand →	*After reading this topic the student will be able to:* • Recognize competition, predation and symbiosis (parasitism, mutualism, commensalisms) • Prepare lists showing predators and their prey, parasites and their hosts.	
Global and regional environment		2 Lectures
Understand →	*After reading this topic the student will be able to:* • Recall the importance of balance in nature. • Recognize the human impact on environment. • Introduce some global and regional environmental problems (population growth, urbanization, global warming, deforestation, acid rain).	

Causes, consequences and preventions of air, water and land pollution		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Explain causes of air, water, and land pollution. • Describe effects of pollution on plants, animals and human beings. • Describe possible actions to control pollution	
Analyse and Interpret	• Interpret the data about local environmental problems. (Data may be collected through surveys or literature search) • Plan and carry out simple investigations to determine the nature and effects of pollutants • Prepare lists showing predators and their prey, and parasites and their hosts.	
Conservation of nature and 3Rs		2 Lectures
Understand →	*After reading this topic the student will be able to:* • Explain conservation of nature and 3R strategic formula.	
Analyse and Interpret	• State the names of endangered and threatened species of Pakistan (data may be collected)	
STS Connections	• Interpret population growth trends and their possible consequences on our society, through data from internet and literature search on population growth in Pakistan from 2000 to 2020. • Identify environmental problems in your community. What are possible causes? Suggest measures to solve the problems. • Participate in the community efforts for conservation of nature.	

Unit 16: Biotechnology

Introduction and importance		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Define biotechnology and explain its importance.	
Biotechnology and genetic engineering		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Relate biotechnology with genetic engineering.	
Fermentation		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Introduce fermentation and explain the method of fermentation by yeast and bacteria.	

Uses of fermentation in daily life		3 Lectures
Understand →	*After reading this topic the student will be able to:* • Identify different fermentation products and their importance in daily life i.e. production of yogurt, bread, cheese and production of alcohol. • Describe the advantages / profitability of using fermenters in preparing medical products.	
Genetic Engineering and its Uses		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Define genetic engineering and describe its objectives.	
Gene transplantation		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Describe how a gene is transplanted?	
Achievements of genetic engineering		2 Lectures
Understand →	*After reading this topic the student will be able to:* • Describe major achievements of genetic engineering with reference to improvement in agricultural crops (herbicide resistance, virus resistance and insect resistance) • Describe major achievements of genetic engineering in curing animal diseases (foot and mouth disease, Coccidiosis, Trypanosomiasis) and in animal propagation (animal cloning).	
Applications of genetic engineering		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Describe the application of genetic engineering in the production of human insulin and growth hormones.	
Single cell protein and its importance		2 Lectures
Understand →	*After reading this topic the student will be able to:* • Describe single cell protein and its importance in animal feed and human food.	
STS Connections	• Describe the ways in which society benefits from the knowledge of genetics and genetic engineering. • Interpret data (collected from internet) on some viral resistant, insect resistant and high yielding varieties of agriculture crops in Pakistan.	

Unit 17: The use and abuse of drugs

Drug and medicinal drug		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Introduce the term drug (the substance or product that is used to modify physiological systems of the body) and differentiate it from medicinal drug concluding "All medicines are drugs whereas all drugs are not medicines" • List various steps in the clinical trials of drugs. • Signify importance of prescription abuse.	
Sources of drugs		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Enlist the various sources of drugs i.e. minerals, animals, plants, synthetics, microorganisms. • Describe the principle usages of painkillers, antibiotics, vaccines and sedatives. • State the contributions of Joseph Lister in the discovery of antiseptics and of Alexander Fleming in the discovery of penicillin.	
Effects of addictive drugs		2 Lectures
Understand →	*After reading this topic the student will be able to:* • Categorize and describe the effects of addictive drugs (sedatives, narcotics and hallucinogens). • Define hallucinogen (drugs that alter ordinary mental and emotional processes) and relate it with Marijuana. • Define narcotics (drugs that produce semi-consciousness and sleep to get relief from pain) and relate it with Morphine and Heroine (as the most widely used / abused).	
Symptoms and problems of addiction		1 Lecture
Understand →	*After reading this topic the student will be able to:* • State the associated problems of drugs addictions i.e. severe social abandonment and crimes. • Identify the symptoms of addiction. • Name different plants which are common in Pakistan and used for getting hallucinogens and narcotics	
Major groups of antibiotics		1 Lecture
Understand Application→	*After reading this topic the student will be able to:*	

	• Categorize Penicillin's, Tetracyclines and Cephalosporins as the major groups of antibiotics being used.	
Antibiotics with their bactericidal and bacteriostatic effects		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Categorize major antibiotics as per their bactericidal and bacteriostatic effects.	
Resistance developed in bacteria against widely used antibiotics		1 Lecture
Understand →	• Rationalize the resistance developed in bacteria against the widely used antibiotics and relate enzyme penicillinase for resistance in bacteria against penicillin.	
Role of vaccines		1 Lecture
Understand →	*After reading this topic the student will be able to:* • Describe the role of vaccines in producing immunity against specific diseases.	
STS Connections	• Compile a list of various painkillers, antibiotics and sedatives being used in daily life. • Summarize the antisocial effects of the usage of hallucinogens and narcotics. • Justify the effects of probable over-dosage, under-dosage and drug interactions when using antibiotics without doctor's consultation.	