Topics and Student Learning Outcomes of the Examination Syllabus

Part I (Class XI)

Section – I: Introduction

Topics		Student Learning Outcomes		Cognitive Level[2]		
				K	U	A
1. The Biology		**Candidates should be able to:**				
1.1	Major fields of specialization in biology	1.1.1	define and recognize the major fields of specialization in biology (molecular biology, environmental biology, microbiology, fresh water biology, marine biology, parasitology, human biology, social biology, biotechnology);	*		
1.2	Levels of biological organization	1.2.1	identify different levels of biological organization from subatomic particles to biosphere;		*	
1.3	Biological method	1.3.1	compare deductive and inductive reasoning;			*
		1.3.2	recall hypothesis, theory and scientific law;	*		
1.4	Biology and the services of mankind	1.4.1	give an account on the services of biology for mankind (disease control such as preventive measures, vaccination, drug treatment etc;			*
1.5	Protection and conservation of environment	1.5.1	list out different factors affecting on environment and different ways of their remediation.	*		*

[2] K = Knowledge, U = Understanding, A= Application (for explanation see section 8: Definition of command words used in Student Learning Outcomes and in Examination Questions).

Section – II: Unity of Life

2. Biological Molecules	**Candidates should be able to:**	**K**	**U**	**A**
2.1 Introduction to biochemistry	2.1.1 define biochemistry, protoplasm and biological molecule;	*		
	2.1.2 differentiate between micro and macro molecules;		*	
	2.1.3 compare atom and molecules, organic and inorganic molecules, covalent , ionic bond and hydrogen bond;			*
2.2 Importance of carbon	2.2.1 explain the properties of carbon;		*	
	2.2.2 differentiate between condensation & hydrolysis;		*	
	2.2.3 explain chemical composition of protoplasm;		*	*
2.3 Importance of water	2.3.1 explain the properties of water (polarity, hydrogen bonding, specific heat, heat of vaporization, cohesion, hydrophobic nature, ionization, low density of ice, amphoteric nature);		*	
2.4 Carbohydrates	2.4.1 define carbohydrates and classify into groups.(monosaccharides, disaccharides, poly saccharides);	*		
	2.4.2 give properties of monosaccharides, disaccharides and poly saccharides with examples;		*	
	2.4.3 compare isomers and stereoisomers of glucose;		*	
	2.4.4 illustrate the formation and breakage of distinguished disaccharides i.e. maltose, sucrose and lactose;			*
	2.4.5 compare the structure and function of starch, cellulose, glycogen and chitin;		*	
	2.4.6 perform Benedict's test for reducing sugars;			P
	2.4.7 examine the presence of starch through iodine test;			P

			K	U	A
2.5 Lipids	2.5.1	define lipids and classify into groups;	*		
	2.5.2	describe the properties of acylglycerol, phospholipids, terpenoids and waxes;		*	
	2.5.3	illustrate the molecular structure of acylglycerol , (triglycerides), phospholipids, steroids, caretenoids and terpenes;			*
	2.5.4	describe the roles of steroids and prostaglandins in living organisms;		*	
2.6 Proteins	2.6.1	define proteins and amino acids;	*		
	2.6.2	differentiate between essential and non-essential amino acids, acidic and basic amino acids, polar and non-polar amino acids;			*
	2.6.3	explain amphoteric property of aminoacids;		*	
	2.6.4	differentiate between di-peptides and poly-peptides;			*
	2.6.5	describe various levels of organization of proteins (primary, secondary, tertiary and quaternary);		*	
	2.6.6	define fibrous and globular proteins;	*		
	2.6.7	discuss significance of sequence of amino acid in poly peptide chain through sickle cell anaemia;		*	
	2.6.8	enlist the names and functions of protein in the body;		*	
2.7 Nucleic acid	2.7.1	define nucleic acid and describe the structure of DNA;	*	*	
	2.7.2	differentiate between nucleotide and nucleoside;			*
	2.7.3	classify nucleotides according to their sugar molecules and nitrogen bases;		*	
	2.7.4	differentiate between mononucleotide (ATP) and di-nucleotide;			*
	2.7.5	define genetic code;	*		
	2.7.6	differentiate between DNA and RNA;			*
	2.7.7	discuss various types of RNA molecules with reference to protein synthesis;		*	

		K	U	A
2.8 Conjugated molecules	2.8.1 define conjugated molecules; 2.8.2 discuss the roles of glycolipids, glycoproteins, lipoproteins and nucleoproteins.	*	 *	
3. Enzymes	**Candidates should be able to:**			
3.1 Structure of enzyme	3.1.1 define enzyme, apoenzyme, cofactor, prosthetic group, co-enzyme and holoenzyme;	*		
3.2 Characteristics of enzymes	3.2.1 describe the characteristics of enzymes;		*	
3.3 Mechanism of enzyme action	3.3.1 explain the mechanism of enzyme action through induced fit model, comparing it with lock and key model; 3.3.2 show with the help of diagram how an enzyme catalyzes specific reactions; 3.3.3 define energy of activation and explain through graph how an enzyme speeds up a chemical reaction by lowering the energy of activation;		* *	 *
3.4 Factors affecting enzyme action	3.4.1 explain different factors affecting the rate of enzyme action (graphic presentation); 3.4.2 examine the effect of temperature, pH, substrate concentration enzyme concentration on the rate of reaction; 3.4.3 compare the optimum temperature of human body enzymes and thermophilic bacteria; 3.4.4 compare the optimum pH of different enzymes like trypsin, pepsin;		* * *	 P

			K	U	A
3.5 Enzyme inhibition	3.5.1	compare inhibitor and activator and discuss their significance;		*	
	3.5.2	categorize inhibitors into competitive and non competitive inhibitors;		*	
	3.5.3	explain feed back inhibition;		*	
3.6 Classification of enzymes	3.6.1	recognize different enzymes on the basis of reactions they catalyze and nature of substrate.		*	
4. The Cell	**Candidates should be able to:**				
4.1 Cell as basic unit of life	4.1.1	recall the history of cell;	*		
4.2 Microscope	4.2.1	compare resolution vs. magnification of microscope;		*	
4.3 Techniques used in cell biology	4.3.1	discuss cell fractionation, differential staining, centrifugation, micro dissection, tissue culture, chromatography, electrophoresis, spectrophotometry;	*		
4.4 Structure of cell	4.4.1	describe in detail the structure, chemical composition and functions of different cellular organelles (cell wall, cell membrane with reference to Fluid Mosaic Model, cytoplasm, endoplasmic reticulum, ribosomes, mitochondria, nucleus, Golgi apparatus, lysosomes, vacuoles, cytoskeleton, centriole, plastids) revealed from the electron microscope;		*	
	4.4.2	compare glyoxisome vs. peroxisome; cell wall vs cell membrane chloroplast vs chromoplast animal cell vs plant cell prokaryotic and eukaryotic cell.		*	

Section – III: Biodiversity

5. Variety of Life		Candidates should be able to:		K	U	A
5.1	Classification	5.1.1	recall the need and basis of classification (homology, bio-chemistry, cytology and genetics);	*		
		5.1.2	explain the concept of species and hierarchy of biological classification (species, genera, family, order, class, phylum/division and kingdom);		*	
5.2	Nomenclature	5.2.1	briefly describe binomial nomenclature;	*		
5.3	Two to five kingdom classification system	5.3.1	describe kingdoms of biology (two kingdom system, five kingdom system of Whittaker, five kingdom system of Marguillis and Schwartz);		*	
5.4	Characteristics of viruses	5.4.1	give an account of history of viruses;	*		
		5.4.2	state the characteristic features of viruses;	*		
		5.4.3	explain how viruses survive inside a host cell;		*	
		5.4.4	explain the survival of viruses outside the host;		*	
5.5	Classification of viruses	5.5.1	classify viruses on the basis of their structure ,type of nucleic acid and host;			*
		5.5.2	make a list of diseases caused by viruses in animals and plants;	*		
5.6	Life cycle of a bacteriophage	5.6.1	describe lytic and lysogenic life cycles of a bacteriophage;		*	
		5.6.2	discuss the use of a bacteriophage in genetic engineering;			*
5.7	Viral diseases	5.7.1	describe the causative agent, symptoms, treatment and preventive measures of hepatitis, herpes, polio, AIDS, leaf curl and bird flu;		*	
5.8	Prions and viroids	5.8.1	define prions and viroids;	*		
		5.8.2	list the names of diseases caused by prions and viroids;	*		
5.9	Economic loss by viruses	5.9.1	interpret how viral infections cause global economic loss.		*	

6. Kingdom Prokaryotae		Candidates should be able to:		K	U	A
6.1	Characteristic features of Kingdom Prokaryotae	6.1.1	list characteristic features of Kingdom Prokaryotae;	*		
6.2	Morphology of bacteria	6.2.1	state characteristic features of archae bacteria (thermophilic, acidophilic, hallophilic);	*		
		6.2.2	discuss the discovery, occurrence and habitat of bacteria;		*	
		6.2.3	describe morphological diversity (shapes) of bacteria;		*	
		6.2.4	differentiate between gram positive and gram negative bacteria;		*	*
		6.2.5	discuss structure of bacteria (cell wall, cell membrane, flagella, cytoplasm, mesosome and chromatin);		*	
6.3	Nutrition in bacteria	6.3.1	describe autotrophic, heterotrophic, symbiotic and parasitic bacteria;		*	
		6.3.2	differentiate between the chlorophyll present in bacteria and plant;		*	
6.4	Respiration in bacteria	6.4.1	describe facultative and obligatory aerobes, micro aerobes, facultative and obligatory anaerobes;		*	
6.5	Locomotion in bacteria	6.5.1	give the methods of locomotion in bacteria (chemotaxis, magnetotaxis);	*		
6.6	Growth in bacteria	6.6.1	explain different phases of growth in bacteria;		*	
6.7	Reproduction in bacteria	6.7.1	describe the different modes of reproduction in bacteria (binary fission, endospore formation and genetic recombination; conjugation, transduction and transformation);		*	

		K	U	A
6.8 Economic importance of bacteria	6.8.1 describe the role of beneficial bacteria in terms of medicine, agriculture, industry, symbiosis, research and harmful bacteria (pathogens, food spoiling);		*	
6.9 Control and prevention of bacteria	6.9.1 describe different physical and chemical methods to control bacteria;		*	
	6.9.2 describe immunization and vaccination;		*	
	6.9.3 discuss about uses and misuses of antibiotics;		*	
6.10 Cyanobacteria	6.10.1 enlist general characteristics of cyanobacteria;		*	
	6.10.2 describe the habitat, structure, nutrition and reproduction of nostoc;		*	
	6.10.3 describe the importance of cyanobacteria in terms of nitrogen fixation.		*	
7. Kingdom Protista (Protoctista)	**Candidates should be able to:**	*		
7.1 Unifying features	7.1.1 identify protoctists on the basis of their characters;			
7.2 Diversity among Protoctista	7.2.1 discuss evolutionary relationship among protoctista;		*	
7.3 Animal like Protoctist	7.3.1 describe the salient features of animal like protoctist;		*	
	7.3.2 classify these animals on the basis of their locomotary organelles and give examples;		*	
	7.3.3 list the pathogenic protozoan, apicomplexans and diseases caused by them;	*		
7.4 Algae (Plant like Protoctist)	7.4.1 describe the salient features of plant like protoctist;		*	
	7.4.2 classify the photosynthetic protist (preferably in tablular form);			*
	7.4.3 differentiate between brown, red and green algae;			*

			K	U	A
7.5 Fungi like Protoctist	7.5.1	compare the salient features of myxomycota and oomycota;		*	
	7.5.2	give the importance of phytophthora infestance.		*	
8. FUNGI "The Kingdom of Recyclers"	**Candidates should be able to:**				
	8.1.1	list the characteristics of fungi which distinguish them from other groups;	*		
8.1 General characteristics	8.1.2	describe the structure and nutrition in fungi;		*	
	8.1.3	compare lichens with mycorrhizae;		*	
	8.1.4	explain different methods of asexual and sexual reproduction in fungi;		*	
8.2 Classification of fungi	8.2.1	describe four main groups of fungi based on reproductive structures and methods of reproduction;		*	
8.3 Land adaptations	8.3.1	give a brief account on land adaptations in fungi;	*		
8.4 Importance of fungi	8.4.1	discuss ecological, commercial importance and economic losses due to fungi.	*		
9. Kingdom Plantae	**Candidates should be able to:**				
9.1 Diversity among plants	9.1.1	give the general characteristics of plants;	*		
	9.1.2	give phylogeny of kingdom plantae;	*		
	9.1.3	classify the kingdom plantae;		*	
	9.1.4	give the general characteristic features of bryophytes;	*		
	9.1.5	classify the bryophytes (musci, hepaticae, anthocerotae);		*	
	9.1.6	give the general account of life cycle of moss;		*	
	9.1.7	give significance of alternation of generation;	*		

				K	U	A
9.2	Adaptation to the land habitat	9.2.1	explain the land adaptation of plants absorption of water, CO_2, heterogamy, formation of embryo;		*	
9.3	Tracheophyta	9.3.1	give the general account and major groups of tracheophyta (psilopsida, lycopsida, pteropsida, sphenopsida, spermopsida);	*		
		9.3.2	explain the evolution of single veined (microphyllus) and multiveined (megaphyllus) leaf ;		*	
		9.3.3	differentiate between homospory and heterospory;			*
		9.3.4	explain the evolution of seed;		*	
9.4	Seed plants	9.4.1	give the general characteristics of gymnosperms and angiosperms;		*	
		9.4.2	explain the life cycle of pinus (gymnosperm) with diagram;		*	P
		9.4.3	explain the life cycle of an angiosperm with diagram;		*	P
		9.4.4	compare dicot and monocot seed;		*	P
		9.4.5	state why vascular plants became the most successful group of land plants;	*		
9.5	Angiospermic families	9.5.1	give the vegetative characters, floral characters, floral formula, economic importance and familiar plants of rosaceae, solanaceae, fabaceae, caesalpiniaceae, mimosaceae and poaceae.		*	P

		K	U	A
10. Kingdom Animalia	**Candidates should be able to:**			
10.1 Introduction	10.1.1 describe the general characters of animals;	*		
10.2 Criteria for animal classification	10.2.1 classify animals on the base of presence or absence of tissue;		*	
	10.2.2 differentiate the diploblastic and triploblastic level of organization;		*	
	10.2.3 describe different types of symmetry found in animals;		*	
	10.2.4 differentiate pseudocoelomates and coelomate;		*	
	10.2.5 classify coelomates into protostomes and deuterostomes;		*	
10.3 Invertebrates	10.3.1 explain general characters and classification of non chordate;		*	
10.4 Parazoa Phylum Porifera	10.4.1 describe the salient features, economic importance of phylum porifera;		*	
10.5 Grade Radiata Phylum Coelenterate	10.5.1 explain general characteristics, origin of diploblastic organization, radial symmetry, polymorphism, alternation of generation, coral reefs;		*	
10.6 Grade Bilateria Acoelomate Phylum Platyhelminthes	10.6.1 explain the general characters, triploblastic, acoelomate organization, adaptations, parasitic mode of life common examples, importance of tapeworm infestation and disinfestations;		*	
10.7 Triploblastic animals Pseudocoelomates Phylum Nematode	10.7.1 describe the salient features, importance and parasitic adaptations of nematodes (aschelminthes);		*	

		K	U	A
10.8 Triploblastic animals (Coelomates)	10.8.1 explain general characters, segmentation and its advantages, coelom and its advantages in annelida;		*	
	10.8.2 classify the phylum annelida upto classes;		*	
	10.8.3 describe the importance of phylum annelida;		*	
10.9 Phylum Arthropada	10.9.1 give the salient features, diversity, major groups (merostomata, arachnida, crustaceae, insecta, myriapoda), give economic importance of insects (beneficial and harmful), metamorphosis in insects, insects as the successful group of animals;		*	
10.10 Phylum Mollusca	10.10.1 explain the general characters, classification (gastropoda, bivalvia, cephalopoda) and economic importance of phylum mollusca;		*	
10.11 Phylum Echinodermata	10.11.1 discuss the important characters of spiny skinned animals (echinodermata) and their affinities;		*	
10.12 Phylum Hemichordata	10.12.1 describe basic characters of hemichordate;	*		
10.13 Phylum Chordata	10.13.1 discuss fundamental characters of chordate;	*		
	10.13.2 classify the phylum chordate;		*	
	10.13.3 distinguish between acraniata vs. craniata, urochordata Vs cephalochordate;		*	

		K	U	A
10.14 Sub Phylum Vertebrata	10.14.1 explain the general characters of super class pisces and their sub classes, aquatic adaptations;	*		
	10.14.2 distinguish between cartilaginous (chondricthyes) and bony fishes (osteicthyes);		*	
	10.14.3 discuss some familiar edible fishes in Pakistan;	*		
	10.14.4 explain the origin general characteristics of amphibian and briefly describe trends for land habitat;	*		
	10.14.5 discuss amphibians as unsuccessful land vertebrate;		*	
	10.14.6 give salient features of reptiles and their brief history;	*		
	10.14.7 explain why reptiles are considered as successful land vertebrates;		*	
	10.14.8 give an account on characteristics of birds and adaptations for aerial mode of life (flight adaptations);	*		
	10.14.9 distinguish between flightless and flying birds with examples;		*	
	10.14.10 describe evolutionary origin of birds with reference to archaeopteryx ;	*		
	10.14.11 explain the characteristic features, diversity and classification of mammalian (prototheria, metatheria and eutheria; aquatic mammals);		*	
	10.14.12 describe the evolutionary origin of class mammalian.	*		

Section – IV: Functional Biology

			K	U	A
11. Bioenergetics	**Candidates should be able to:**				
11.1 Role of ATP	11.1.1	define bioenergetics;	*		
	11.1.2	describe the role of ATP as currency of energy in metabolism;		*	
11.2 Photosynthesis	11.2.1	define photosynthesis, state its reactants and products;	*	*	
	11.2.2	explain the role of chlorophyll and other photosynthetic pigments, light, carbon-dioxide and water in photosynthesis;		*	P
	11.2.3	give an account on light dependent and light independent reactions (carbon dioxide fixation) of photosynthesis;		*	
	11.2.4	distinguish between light and dark reactions;		*	
11.3 Respiration	11.3.1	define respiration, cellular respiration, oxidative phosphorylation, aerobic respiration and fermentation;	*		
	11.3.2	distinguish between alcoholic and lactic acid fermentation;		*	
	11.3.3	state the role of mitochondria in respiration;	*		
	11.3.4	give different stages of cellular respiration;	*		
	11.3.5	describe the reactions of glycolysis;		*	
	11.3.6	explain the pyruvic acid oxidation (formation of acetyl COA);		*	
	11.3.7	explain the reactions of Kerb cycle (citric acid cycle);		*	
	11.3.8	draw and explain respiratory chain;		*	
11.4 Photorespiration	11.4.1	explain alternative mechanism of carbon fixation in hot, arid climate (CAM plants).		*	

12. Nutrition		**Candidates should be able to:**	**K**	**U**	**A**
12.1	Nutrition in plants	12.1.1 define nutrition;	*		
		12.1.2 differentiate between autotrophic and heterotrophic nutrition;			*
		12.1.3 differentiate between phototrophic and chemotropic nutrition;			*
		12.1.4 describe various conditions caused by the deficiency of minerals (N,P,K,Mg);		*	
		12.1.5 describe various modes of heterotrophic nutrition in plants with example (saprophytic, parasitic, symbiotic and insectivorous plants);		*	
12.2	Nutrition in animals	12.2.1 describe heterotrophic nutrition in animals (holozoic, saprotrophic, parasitic, detritivores, predators, herbivores, carnivores and omnivores);		*	
		12.2.2 differentiate between macrophagous and microphagous feeders, fluid feeders and filter feeders;			*
		12.2.3 describe steps of holozoic nutrition;		*	
		12.2.4 describe different type of digestion in animals;		*	
		12.2.5 differentiate between intercellular and intracellular digestion;			*
		12.2.6 describe different mode of ingestion in animals with example;		*	
12.3	Nutrition in non chordate	12.3.1 describe nutrition in amoeba, hydra, planaria and cockroach;		*	
		12.3.2 differentiate between complete and incomplete alimentary canal;			*

		K	U	A
12.4 Digestion in man	12.4.1 briefly describe gastrointestinal tract (dentitions, salivary glands, function of tongue, swallowing, peristalsis, ant peristalsis, non directional peristalsis, bile)		*	
	12.4.2 describe the process of digestion in man;			
	12.4.3 describe different types of dental diseases, their causes, prevention and control;		*	
	12.4.4 describe the disorders of GIT (diarrhoea, dysentery, constipation, piles, dyspepsia, peptic ulcer, food poisoning, malnutrition, over nutrition, under nutrition, anorexia and bulimia nervosa);		*	
	12.4.5 describe parasitic nutrition in animals;		*	
	12.4.6 differentiate between ectoparasite and endoparasite.			*
13. Gaseous Exchange	**Candidates should be able to:**			
13.1 Gaseous exchange in plants	13.1.1 define respiration;	*		
	13.1.2 describe the conditions necessary for gaseous exchange;		*	
	13.1.3 describe gaseous exchange in plants (through stomata and lenticels);		*	
	13.1.4 describe the process and importance of photorespiration;		*	
13.2 Gaseous exchange in animals	13.2.1 give the properties of respiratory surface;	*		
	13.2.2 briefly describe the process of respiration (gaseous exchange) in hydra earthworm, cockroach;		*	
	13.2.3 describe the process of respiration in fishes;		*	
	13.2.4 give the different types of respiration in amphibia and explain pulmonary respiration;	*		
	13.2.5 describe the respiration in birds;		*	
	13.2.6 differentiate between complete and incomplete ventilation;			*

			K	U	A
13.3 Respiratory system of man	13.3.1	describe the respiratory system of man (organs of respiration, route of lungs);		*	
	13.3.2	describe the mechanism of breathing in man;			
	13.3.3	describe voluntary and involuntary control in breathing rate;		*	
	13.3.4	describe the transportation of CO_2 and O_2 by the blood;		*	
				*	
13.4 Respiratory disorders	13.4.1	give causes, symptoms and control of upper respiratory tract infection (sinusitis, otitis) lower respiratory tract infection (pneumonia, tuberculosis);	*		
	13.4.2	describe the disorders of lungs (emphysema, lung cancer);			
	13.4.3	give the effects of smoking on respiratory system.		*	
			*		
14. Transport	**Candidates should be able to:**				
14.1 Introduction	14.1.1	define transport;	*		
	14.1.2	state why transport of material is needed in living organism;	*		
14.2 Transport in plants	14.2.1	explain uptake of water and minerals by roots and processes involved in it;		*	
	14.2.2	define water potential, osmotic potential, pressure potential;			
	14.2.3	distinguish between plasmolysis and deplasmolysis;		*	
			*		
14.3 Ascent of sap	14.3.1	define ascent of sap, what is the path of ascent of sap;	*		
	14.3.2	explain the factors of ascent of sap(cohesive and adhesive forces and xylem vessels) involved in the process;		*	
	14.3.3	describe the mechanism of transpiration pull in cohesion, tension theory and root pressure;		*	
	14.3.4	define imbibitions and bleeding;	*		

		K	U	A
14.4 Transpiration	14.4.1 define transpiration;	*		
	14.4.2 describe different types of transpiration (cuticular, lenticular, stomatal);		*	
	14.4.3 explain the mechanism involved in opening and closing of stomata;		*	
	14.4.4 describe the factors affecting rate of transpiration;	*		
	14.4.5 explain why transpiration is considered as a necessary event;		*	
14.5 Translocation	14.5.1 define translocation;	*		
	14.5.2 explain the phloem transport and patterns of transport;		*	
	14.5.3 describe the mechanism of phloem translocation (diffusion and pressure flow theory);		*	
14.6 Transportation in animals	14.6.1 describe transportation in animals;		*	
	14.6.2 describe need of transportation;		*	
	14.6.3 describe the process of transportation in amoeba, hydra and planaria;		*	
	14.6.4 define circulatory system;	*		
	14.6.5 give the characteristics of circulatory system;	*		
	14.6.6 differentiate between open and closed type circulatory system, single circuit and double circuit circulation ;			*
	14.6.7 describe evolution of vertebrates heart (fish, amphibians, reptiles, birds and mammals);		*	
	14.6.8 give a comparative account of circulatory system among fishes, amphibians, reptiles, birds and mammals;	*		

			K	U	A
14.7	Circulatory system of man	14.7.1 describe the composition and functions of blood;		*	
		14.7.2 describe disorder of blood, leukaemia, thalassemia, oedema;		*	
		14.7.3 describe structure and function of heart (cardiac cycle, heart beat. S.A node, A.V. node, artificial pace maker);		*	
		14.7.4 describe the causes of blue babies;		*	
		14.7.5 differentiate between artery, veins and capillaries;			*
		14.7.6 define blood pressure and describe the measurement of blood pressure;	*	*	
		14.7.7 differentiate between blood pressure and pulse pressure;			*
		14.7.8 describe lymphatic system, lymph vessels and lymph node;		*	
		14.7.9 give the function of lymphatic system;	*		
14.8	Cardiovascular disorder	14.8.1 describe the causes, effect and prevention of atherosclerosis, hypertension, thrombus formation, coronary thrombosis, embolus, myocardial infarction and stroke;		*	
		14.8.2 differentiate between haemorrhage and haematoma;			*
14.9	Immune system	14.9.1 define immunity;	*		
		14.9.2 describe innate and adaptive immune system in details;		*	
		14.9.3 differentiate between primary and secondary immune responses, active and passive immunity.			*

Part II (Class XII)
Section – I: Functional Biology

15. Homeostasis	**Candidates should be able to:**	**K**	**U**	**A**
15.1 Introduction	15.1.1 define homeostasis;	*		
	15.1.2 explain in various aspects and need for homeostasis;		*	
15.2 Feed back system	15.2.1 describe feedback system;		*	
	15.2.2 describe components of feed back system;		*	
	15.2.3 compare positive and negative feed back with examples;		*	
15.3 Osmoregulation	15.3.1 define osmosis, water potential and solute potential, specify the term use for plant and animals;	*		
	15.3.2 give an account on osmoregulation in plants (hydrophytes, halophytes, mesophytes, xerophytes);	*		
	15.3.3 define hypotonic, isotonic and hypertonic solution;	*		
	15.3.4 explain osmoregulation in aquatic (fresh water and marine) and terrestrial animals;		*	
15.4 Excretion in plants	15.4.1 define excretion;	*		
	15.4.2 explain different excretory product in plants and methods by which they are stored and removed from the plant body;		*	
15.5 Excretion in animals	15.5.1 describe different types of excretory products and relationship of these wastes to the habitat of animals;		*	
	15.5.2 explain the process of excretion in hydra, planaria, earthworm and cockroach;		*	

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15.6 Excretion in man	15.6.1 give an account on metabolic waste and excretory organs in man (kidney, liver, skin);	*		
	15.6.2 describe the role of liver in urea formation (urea cycle or ornithine cycle);		*	
	15.6.3 explain the liver as a homeostatic organ;			
	15.6.4 give an account on urinary system of man;		*	
	15.6.5 explain the mechanism of excretion through kidney (simple filtration, reabsorption, secretion, counter current);	*	*	
	15.6.6 describe adaptation of kidney and effect of hormones on the working of kidney, composition of urine and variation in the composition of urine and its significance;		*	
15.7 Kidney problems	15.7.1 explain the kidney problems (kidney stone, renal failure) and their cures (lithotripsy, dialysis and kidney transplantation);		*	
15.8 Thermoregulation in plants	15.8.1 give an account on adaptations of plants to low and high temperature;	*		
15.9 Thermoregulation in animals	15.9.1 classify animals on the basis of thermoregulation;	*		
	15.9.2 describe adaptations in animals for temperature regulation (structural, physiological, behavioural);		*	
	15.9.3 explain thermoregulation in mammals (human) in cold and hot environment;		*	
	15.9.4 describe thermostatic function of brain and feedback control in human;			
	15.9.5 define pyrexia (fever).	*	*	

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16. Support and Movement		**Candidates should be able to:**			
16.1	Support in plants	16.1.1 describe in detail the supporting structures in plants (parenchyma, collenchyma and sclerenchyma), secondary growth and significance of secondary growth;		*	
16.2	Movement in plants	16.2.1 differentiate between autonomic and paratonic movement;			*
		16.2.2 describe autonomic movement with examples (locomotory, tactic movement , growth and curvature and turgor movement);		*	
		16.2.3 differentiate between tropic movement and nastic movement;			*
		16.2.4 describe paratonic movement with examples(phototropism, geotropism, chemotropism, hydrotropism, thigmotropism, photonastic and hyponastic);		*	
		16.2.5 describe the role of growth substances (plant hormone) in plant movement;		*	
16.3	Support and locomotion in animals	16.3.1 define skeleton;	*		
		16.3.2 describe types of skeleton with examples (hydrostatic skeleton, exoskeleton, disadvantages of exoskeleton, moulting or ecdysis and endoskeleton;		*	

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16.4	Human skeleton	16.4.1 differentiate between bones and cartilage;			*
		16.4.2 describe human skeletal system (axial and appendicular skeleton);		*	
		16.4.3 give the functions of skeleton;	*		
		16.4.4 describe joints (articulation) and its type with examples;		*	
		16.4.5 briefly describe the structure of synovial joint with diagram;		*	
		16.4.6 differentiate between tendon and ligament, origin and insertion;			*
		16.4.7 describe deformities of skeleton (cleft palate, microcephaly, osteoarthritis, rickets);		*	
		16.4.8 describe skeleton related diseases and their control (disc slip, spondylitis, sciatica, osteoarthritis);		*	
		16.4.9 briefly describe the repairing of broken bones;		*	
16.5	Muscular system	16.5.1 describe muscular tissue;		*	
		16.5.2 differentiate between voluntary and involuntary muscles;			*
		16.5.3 describe different types of muscles and their occurrence (skeletal, smooth and cardiac muscles);		*	
		16.5.4 describe in detail the structure of skeletal muscles;		*	
		16.5.5 describe the process of muscle contraction (sliding filament theory of Huxley, control of muscle contraction, all or no response of muscles, muscle fatigue)		*	
		16.5.6 briefly describe abnormal muscle contraction (tetany and cramps);			
		16.5.7 define antagonistic muscles;		*	
		16.5.8 describe different types of antagonistic muscles which help to move shoulder in man;	*	*	

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16.6 Locomotion in animals	16.6.1 define locomotion;	*		
	16.6.2 describe locomotion in protozoa (amoeboid movement, flagellary and cilliary movement);		*	
	16.6.3 describe locomotion in non chordates (jelly fish, earth worm, snail, starfish and cockroach);		*	
	16.6.4 briefly describe locomotion with examples among vertebrates (fishes, tetra pods, bipedal locomotion, brachiation);		*	
17. Coordination and control	**Candidates should be able to:**			
	17.1.1 define coordination and control;	*		
17.1 Need for coordination	17.1.2 explain the need of coordination;		*	
17.2 Coordination in plants	17.2.1 describe control through hormones in plants;		*	
	17.2.2 give a brief account on responses to environmental stresses in plants;	*		
	17.2.3 describe defence against pathogens in plants;		*	
	17.2.4 explain biological clock and circadian rhythm;		*	
	17.2.5 give an account on different plant hormones and their commercial application;	*		

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17.3	Co ordination in animals	17.3.1 define nervous co ordination , receptors, neurons;	*		
		17.3.2 classify receptors with examples;		*	
		17.3.3 explain working of sensory receptors with special reference to skin;		*	
		17.3.4 describe the structure and types of neurons;	*		
		17.3.5 explain reflex arc, types of reflex arcs and reflex action by giving examples;		*	
		17.3.6 define nerve impulse;	*		
		17.3.7 explain different steps involved in initiation and propagation of nerve impulse;		*	
		17.3.8 define synapse, pre synapse, post synapse, neurotransmitter;	*		
17.4	Evolution of nervous system	17.4.1 differentiate between diffused and centralized nervous system;			*
		17.4.2 explain the nervous system of hydra and planaria;		*	
		17.4.3 classify the human nervous system;		*	
		17.4.4 describe different parts and functions of human brain;		*	
		17.4.5 explain the structure of spinal cord;		*	
		17.4.6 give an account on peripheral nervous system;		*	
		17.4.7 differentiate between sympathetic and parasympathetic nervous system;			*
		17.4.8 describe nervous disorders (Parkinsons disease, Epilepsy and Alzheimers disease);	*		
		17.4.9 give an account on effects of drugs on coordination;	*		

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17.5 Chemical coordination	17.5.1 differentiate between nervous and chemical coordination;			*
	17.5.2 describe the chemical nature of hormones and hormone action;		*	
	17.5.3 explain endocrine gland of mammals (man), hormones secreted from them and their disorders;		*	
	17.5.4 give an account on feedback mechanism with reference to endocrine gland (Thyroid gland);		*	
	17.5.5 explain disorders caused by endocrine glands which leads to infertility in males and females;		*	
17.6 Behaviour	17.6.1 define behaviours;	*		
	17.6.2 differentiate between innate and learning behaviours;			*
	17.6.3 describe different types of innate behaviour with examples;		*	
	17.6.4 give an account on types of learning behaviour by giving examples and experiments performed on them;		*	
	17.6.5 differentiate between instincts and learning behaviour.			*
18. Reproduction	**Candidates should be able to:**			
18.1 Asexual reproduction in plants	18.1.1 define asexual reproduction, sexual reproduction and parthenocarpy in plants;	*		
	18.1.2 describe the process of fruit ripening in plants;	*		
	18.1.3 state advantages and disadvantages of asexual reproduction;		*	
	18.1.4 explain the role of mitosis and meiosis of reproduction;		*	
	18.1.5 describe natural and artificial methods of reproduction (spores, vegetative reproduction and apomixis) in plants;		*	
	18.1.6 describe a brief account on importance and application of asexual reproduction;		*	

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18.2 Photoperiodism	18.2.1 define photoperiodism, long day, short day and day neutral plants;	*		
	18.2.2 describe discovery, day length/night length and mechanism involved in light quality;		*	
	18.2.3 describe salient features in the life cycle of gymnosperms;		*	
	18.2.4 explain structure of flower, pollination, inflorescence and its different types;		*	
	18.2.5 give a brief account on sporophyte and gametophyte generations;	*		
	18.2.6 explain the process of sexual reproduction in angiosperms (development of male and female gametophyte, double fertilization, mature seeds);		*	
	18.2.7 briefly describe seed dormancy ;	*		
	18.2.8 define germination and its types (epigeal, hypogeal and viviparous germination);	*		
	18.2.9 describe the process of vernalization;		*	
	18.2.10 differentiate between florigan and phytochromes;			*
18.3 Asexual reproduction in animals	18.3.1 describe asexual reproduction in animals, (fission, budding, regeneration, parenthogenesis);		*	
	18.3.1 describe identical and faternal twins;		*	
	18.3.2 define cloning and explain its socio-cultural and moral implications;	*		

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18.4	Sexual reproduction in animals	18.4.1 differentiate between asexual and sexual reproduction;			*
		18.4.2 state three basic steps of sexual reproduction (gametogenesis, mating, fertilization);	*		
		18.4.3 differentiate spermatogenesis and oogenesis;			*
		18.4.4 differentiate between sexual, bisexual animals;			*
		18.4.5 describe external and internal fertilization and their relation to habitat of animals;		*	
		18.4.6 briefly describe oviparity, viviparity and placenta;		*	
		18.4.7 describe female reproductive system;		*	
		18.4.8 explain different stages of reproduction cycle/and its hormonal control in human female;		*	
		18.4.9 differentiate between menstrual cycle and oestrous cycle;			*
		18.4.10 define conception, implantation, pregnancy, gestation, misconception, placenta, umbilical cord;	*		
		18.4.11 describe extra-embryonic coats;		*	
		18.4.12 explain the role of different hormones in birth;		*	
		18.4.13 explain the changes in uterus, vagina and mammary glands which take place after birth;		*	
		18.4.14 define lactation;	*		
		18.4.15 give an account on test tube baby;	*		
		18.4.16 describe sexually transmitted diseases (gonorrhoea, syphilis, genital herpes and AIDS);		*	
		18.4.17 differentiate between miscarriage and abortion.			*

19. Growth and Development	Candidates should be able to:	K	U	A
19.1 Introduction	19.1.1 differentiate between growth and development; embryo and larva;			*
19.2 Growth and development in plants	19.2.1 define growth in plants;	*		
	19.2.2 state what is meristem;	*		
	19.2.3 describe the types of meristems;		*	
	19.2.4 state the roles of meristems in the development of plants;	*		
19.3 Phases of growth in plants	19.3.1 explain primary and secondary growth in plants;		*	
	19.3.2 describe phases of growth in plants;		*	
	19.3.3 describe the external and internal factors affecting the growth rate in plants;		*	
	19.3.4 define differentiation and correlations;	*		
	19.3.5 explain growth correlation effects in plants;		*	
19.4 Growth and development in animals	19.4.1 briefly outline the process of development in vertebrates;	*		
	19.4.2 draw key events which occur during development of animals;		*	
19.5 Development of chick	19.5.1 describe development of chick up to three germinal layers;		*	P
	19.5.2 explain notochord formation, neurulation, differentiation of mesoderm and coelom in chick embryo;		*	
	19.5.3 explain the role of cytoplasm in development;		*	
	19.5.4 describe the role of nucleus in development;		*	

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19.6	Cell differentiation and its mechanism	19.6.1 explain cell differentiation with examples;		*	
		19.6.2 explain embryonic induction;		*	
		19.6.3 differentiate between aging and regeneration;			*
		19.6.4 describe the process of regeneration in invertebrates and vertebrates;		*	
19.7	Abnormal development	19.7.1 state the abnormalities inherited from parent to offspring;	*		
		19.7.2 describe different environmental and metabolic factors involve in abnormal development.		*	

Section – II: Continuity of Life

20. Chromosomes and DNA		**Candidates should be able to:**			
20.1	Structure and types of chromosomes	20.1.1 define chromosomes, give examples of some organism with different number of chromosomes;	*		
		20.1.2 describe types of chromosomes (autosomes, sex chromosomes, homologous, telocentric, acrocentric, metacentric and submetacentric chromosome);		*	
		20.1.3 describe the ultra structure and chemical composition of chromosome;		*	
		20.1.4 describe chromosome karyotype;		*	
		20.1.5 differentiate between heterochromatin and euchromatin;			*
20.2	Chromosomal theory of inheritance	20.2.1 describe the chromosomal theory of inheritance (Karl Corren 1900,Walter Sutton 1902, and TH Morgin 1910);		*	

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20.3 DNA as the hereditary material	20.3.1 explain DNA as a heredity material (Griffith experiment, Macleod and Mc Cartay and Hershey and Martha Chase experiment);		*	
	20.3.2 describe structure of DNA (Watson and Crick model);		*	
20.4 DNA replication	20.4.1 describe the replication of DNA;		*	
	20.4.2 prove that replication is a semi-conservative process;		*	
20.5 Gene expression	20.5.1 describe gene and genetic code;		*	
	20.5.2 discuss one gene-one enzyme hypothesis;		*	
	20.5.3 describe the mechanism of protein synthesis by means of DNA and RNA;		*	
20.6 Mutations	20.6.1 define mutation, describe types of mutation;	*		
	20.6.2 differentiate between chromosomal aberration and gene mutation;			*
	20.6.3 briefly describe chromosomal aberration and their effects;		*	
	20.6.4 briefly describe gene mutation and causes of mutations (ionization radiation, ultraviolet radiation, chemical mutagens);		*	
	20.6.5 describe sickle cell anaemia and phenylketonuria (PKT).		*	
21. Cell Cycle	**Candidates should be able to:**			
21.1 Phases of cell cycle	21.1.1 define cell cycle;	*		
	21.1.2 differentiate between interphase and m phase;			*
	21.1.3 describe the changes occurs during G-phase, Go phase, S-phase and G_2-phase;	*		
	21.1.4 briefly describe amitotic cell division, cell death, necrosis and apoptosis;	*		
	21.1.5 distinguish between Karyokinesis and Cytokinesis;			*

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21.2 Mitosis	21.2.1 define mitosis;	*		
	21.2.2 describe different stages of mitosis;		*	
	21.2.3 give the significance of mitosis;	*		
	21.2.4 describe cancer as uncontrolled cell division;		*	
21.3 Meiosis	21.3.1 define meiosis;	*		
	21.3.2 explain different stages of meiosis;		*	
	21.3.3 give the significance of meiosis;		*	
21.4 Meiotic errors (non-disjunction)	21.4.1 define meiotic errors (non-disjunction) and its types;	*		
	21.4.2 describe Down's syndrome, Kline felter's syndrome and Turner's syndrome.		*	
22. Variation and Genetics	**Candidates should be able to:**			
22.1 Gene and allele	22.1.1 define the following terms gene, loci, alleles, gene pool, phenotype, genotype, homozygous, heterozygous, dominant, recessive;	*		
	22.1.2 describe the measurement of gene pool with suitable example;		*	
22.2 Mendel's law of inheritance	22.2.1 give the characteristics of plant used by Gregor Mendel in his experiment;	*		
	22.2.2 describe Mendel's law of dominance, segregation and independent assortment, law of inheritances by considering tongue rolling, ear lobe types, eyes and hair colour;		*	*
22.3 Incomplete dominance and co dominance	22.3.1 briefly describe test cross, incomplete dominance, co-dominance with suitable examples;		*	

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22.4 Multiple allele	22.4.1 describe multiple allele with reference to ABO blood group system;		*	*
	22.4.2 describe Rh factor in blood group;		*	
	22.4.3 describe the effect of Rh-ve mother to her Rh+ve baby;		*	
	22.4.4 define epistalsis, describe the dominant and recessive epistalsis;	*	*	
	22.4.5 define pleiotropy with examples;	*		
	22.4.6 describe polygenic inheritance with suitable example;		*	
22.5 Linkage and crossing over	22.5.1 describe linkage and crossing over with suitable examples of Drosophila;		*	
22.6 Sex determination and sex linkage	22.6.1 describe sex determination mechanism with example (variation in numbers of chromosome, XY system, ZW system of birds and fish);		*	
	22.6.2 describe in detail sex determination in drosophila ;		*	
	22.6.3 describe the sex linked inheritance in drosophila;		*	
	22.6.4 describe sex linked inheritance in man (colour blindness and haemophilia);		*	
	22.6.5 describe diabetes mellitus and differentiate between type I and type II.		*	
23. Biotechnology	**Candidates should be able to:**			
23.1 Importance of biotechnology	23.1.1 define biotechnology and describe its importance;	*	*	
23.2 Genetic engineering	23.2.1 describe steps of genetic engineering through recombinant DNA technology;		*	
	23.2.2 describe the applications of genetically engineered bacteria;			*
	23.2.3 describe transgenic plants and animals;		*	
	23.2.4 describe the isolations of eukaryotic gene for transgenesis;		*	

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23.3	Gene sequencing	23.3.1 describe gene sequencing;		*	
		23.3.2 briefly describe polymerase chain reaction;		*	
		23.3.3 describe the importance of DNA fingerprinting;			*
		23.3.4 describe human genome project;			*
23.4	Detection and treatment of genetic diseases	23.4.1 explain genetic diseases (Huntington disease and cystic fibrosis);		*	
23.5	Biotechnology and health	23.5.1 describe the role of biotechnology in diagnosis of disease, gene therapy, amniocenteses;			*
		23.5.2 apply the knowledge for genetic counselling, tissue culture, cloning;			*
23.6	Applications of biotechnology	23.6.1 use the applications of biotechnology in agriculture and medicine (improve agriculture traits, drought tolerant, improved food quality trait, increased plant productivity;			*
		23.6.2 discuss the hazardous effect of biotechnology.		*	

24. Evolution		**Candidates should be able to:**	**K**	**U**	**A**
24.1	Introduction	24.1.1 define organic evolution, give reference of Quranic verses with reference to evolution (Al-Quran- 6:98, 21:30, 37:11, 4:1, 29:19, 51:49, 6:39, 88:17, 67:19, 24:45, 80:24-32);	*		
		24.1.2 compare evolution Vs special creation;		*	
		24.1.3 explain evolution from prokaryotes to eukaryotes;	*		
24.2	Theories of evolution	24.2.1 describe inheritance of acquired characters as proposed by Lamarck	*		
		24.2.2 describe Darwin's theory and the modern theory of evolution and the objections put forward on Darwin's theory;		*	
24.3	Evidences of evolution	24.3.1 give an account on evidences of organic evolution (biogeographical, paleontological, from classification, domestication, vestigial organs, comparative anatomy, comparative embryology and biochemistry);		*	
24.4	Mechanism of evolution	24.4.1 compare artificial selection Vs natural selection;		*	
		24.4.2 explain natural selection as a possible mechanism for evolution;	*		
		24.4.3 describe the role of artificial selection in the production of economically important plants and animals, controlled breeding;		*	
		24.4.4 define gene pool, allele, genotype and gene frequency;	*		
		24.4.5 describe gene frequency and their role in evolution;		*	
		24.4.6 explain hard-Weinberg law and its implication;		*	
		24.4.7 give an account on factors affecting gene frequency;		*	
		24.4.8 explain endangered species, their causes and risk for extinction.	*		

Section – III: Environmental Biology

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25. Ecosystem	**Candidates should be able to:**			
25.1 Introduction	25.1.1 define ecosystem;	*		
	25.1.2 define population, community, environment, habitat, ecology niche, biome and biosphere;	*		
	25.1.3 describe different types of approaches to ecology;		*	
25.2 Components of ecosystem	25.2.1 distinguish between abiotic and biotic components;		*	
	25.2.2 state climatic, topographic and edaphic factors;		*	
	25.2.3 define producers, consumers and decomposers in an ecosystem;	*		
	25.2.4 differentiate between positive and negative interactions with examples;			*
	25.2.5 define parasitism, symbiosis, predation and grazing with examples;	*		
25.3 Biogeochemical cycles	25.3.1 describe nitrogen cycle, nitrogen depletion and its remedies;		*	
	25.3.2 give brief account on energy flow through an ecosystem;		*	
	25.3.3 describe pyramids of energy;		*	
	25.3.4 define primary productivity, gross primary and net primary productivity;	*		
	25.3.5 define food chain, describe advantages of short food chain;	*		
25.4 Ecological succession	25.4.1 define succession;	*		
	25.4.2 differentiate between primary and secondary succession;			*
	25.4.3 describe main stages involved in hydrarch and xerarch;		*	
	25.4.4 give brief account on concept of climax.		*	

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26. Some Major Ecosystems	**Candidates should be able to:**			
26.1 Fresh water ecosystem	26.1.1 explain abiotic and biotic components of lake ecosystem;		*	
26.2 Marine ecosystem	26.2.1 describe zonation in fresh water and their abiotic and biotic components;		*	
26.3 Terrestrial ecosystem	26.3.1 describe abiotic and biotic components of terrestrial ecosystems i.e. tropical rain forest, coniferous forest and temperate deciduous forest;		*	
	26.3.2 explain grass land ecosystem;		*	
	26.3.3 give an account of biotic and abiotic components of savannah;		*	
	26.3.4 explain desert ecosystem (desert biome);		*	
	26.3.5 give an account on tundra;	*		
	26.3.6 explain the role of man in ecosystem.		*	
27. Man and his Environment	**Candidates should be able to:**			
27.1 Resources	27.1.1 define renewable and non-renewable resources;	*		
	27.1.2 explain different types of renewable resources;		*	
	27.1.3 define energy;	*		
	27.1.4 describe the main sources of energy (renewable and non-renewable) and its conservation;		*	

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27.2	Man's impact on environment	27.2.1 discuss degradation and depletion of resources;		*	
		27.2.2 discuss the effect of rising population on food resources and need of population control;		*	
		27.2.3 briefly describe the effect of human population on agriculture;	*		
		27.2.4 differentiate between deforestation and aforestation;			*
27.3	Pollution	27.3.1 define pollution;	*		
		27.3.2 classify different types of pollution (air pollution with reference to green house effect, acid rain, ozone depletion, land pollution, water pollution including eutrophication and non-material pollution);		*	
27.4	Protection and conservation of environment	27.4.1 point out importance and awareness about management of natural resources, pollution control and recycling of waste;		*	
27.5	Conservation of organism and their habitat	27.5.1 briefly describe the conservation of organism and their habitat;		*	
27.6	Health and disease	27.6.1 classify diseases as infections, parasitic, nutritional, genetic and disease related to aging (discuss cause, transmission and control).		*	