

A. PHYSICS

01. Mechanics: Laws of motion. Motion in straight line, projectile motion, Uniform circular motion, Rotational motion. Rigid body rotation. Work, Energy and Power.

Gravitation -Laws of Gravitation, gravitational field and potential.

Kepler's laws of planetary motion.

02. Properties of Matter: Elasticity of solids, surface tension, viscosity.

03. Waves & Oscillations: Periodic and Simple Harmonic Motions, displacement, velocity, acceleration and energy of SHM, motion of a simple pendulum, oscillations of loaded springs

Wave Motion – Longitudinal and transverse waves, Velocity of waves in different media, progressive and stationary waves, superposition of waves, beats, standing waves in strings and pipes, air columns, fundamental mode and harmonics. Doppler effect.

04. Heat and Thermodynamics: Transfer of heat - Thermal conductivity of solids, black-body radiation, Kirchoff's, Wien's, and Stefan's laws, Newton's law of cooling, solar constant.

Thermodynamics - Heat work and internal energy, First and Second Law of thermodynamics, isothermal and adiabatic processes.

05. Optics and electromagnetic waves: Refraction by spherical lenses and prism, dispersion by prism, spectrometer.

Nature of light – Huygen's principles.

Interference – Principles, Young's double slit experiment.

Diffraction – Principles, diffraction grating, grating spectra.

Polarisation – Principles, polarisation by reflection, double refraction, Polaroids.

Characteristics of electromagnetic waves, emission and absorption spectra.

06. Electricity and Magnetism: Electrostatics - Electric Field and potential due to point charge, Coulomb's law, capacitors.

Current electricity - Ohm's Law, Kirchoff's laws, potentiometer, Wheat stone bridge, metre bridge. Heating effects of currents, Seebeck, Peltier and Thompson's effects, thermo emf.

Magnetic effect of current - Magnetic flux, Biot-Savart's Law, force on a current carrying conductor, moving coil galvanometer.

Electromagnetic induction - Induced emf and current, Lenz's Law and Faraday's law, self inductance and mutual inductance, AC and DC generators, transformer, AC circuits, LCR circuit, Phasor diagram, Resonance.

07. Atomic Physics: Properties of Cathode and anode rays, determination of specific charge - Millikan's method. Bohr atom model, energy of electron, spectral series of Hydrogen atom, X-Rays, X-Ray spectra, X-Ray diffraction. Photoelectric effect, matter waves – De Broglie hypothesis.

08. Nuclear Physics: Nuclear properties – Nuclear radius, mass and binding energy, nuclear forces, stability of nucleus. Isotopes, Isobars and Isotones, properties of Neutrons, Nuclear fission and fusion, Nuclear reactor. Natural radioactivity – Alpha, Beta, Gamma rays. Artificial radioactivity - Half life period. Particle accelerator – cyclotron, elementary particles.

09. Electronics: Energy bands in solids, semiconductor diode characteristics, zener diode, Diode as half wave rectifier, Junction transistors, transistor amplifier (common emitter)

MODEL QUESTIONS

1. A person covers half of his journey with a speed of 40 m/sec and other half with a speed of 50 m/sec. His average speed during the whole of the journey is
(A) 45 m/sec (B) 44 m/sec (C) 46 m/sec (D) 44.4 m/sec

Correct answer is (D)

2. A monochromatic light of $\lambda = 5000\text{\AA}$ falls normally on a plane diffraction grating with 5000 lines per cm on it. How many orders of diffraction maximum can be observed on either side of the centre?
(A) 5 (B) 4 (C) 3 (D) 2

Correct answer is (B)

B. CHEMISTRY

01. Fundamental concepts: Atomic mass, equivalent mass, molecular mass, Avagadro hypothesis. Mole concept, Avagadro number, different methods of expression of concentration

02. Atomic structure and periodic classification : Constituents of the atom. Quantum number, Pauli's

exclusion principle, Hund's rule, Aufbau principle, Periodic properties of d-block and s-block elements.

03. Chemical bonding : covalent, ionic and coordinate bonding, hybridization, shapes of some simple molecules, VSEPR theory.

04. Acids and Bases : Theories of acids and bases, theory of oxidation and reduction, oxidation numbers, dissociation constants of acids and bases, pH, acid-base indicators, common ion effect, buffer solution.

05. Chemical equilibrium : Law of mass action – its application (HI and PCl_5 system), Le-chatelier-Braun principle and application to NH_3 and SO_3 synthesis, reaction between K_c & K_p .

06. Chemical thermodynamics : Internal energy and enthalpy, energy changes in chemical reactions, Hess's Law, enthalpy of neutralization and vapourisation.

07. Chemical kinetics : Rate of reaction, factors influencing rate of reaction, rate expression, units of rate and specific rate constants, molecularity and order of reaction (first order reaction only).

08. Surface chemistry : Adsorption-classification, factors affecting adsorption, catalyst – different types of catalysis, theory of catalysis, colloidal state-classification, preparation, properties and application of colloids..

09. Electro chemistry : Different types of conductors, electrolytes, Faraday's law, electrolytic conduction (specific, equivalent and molar conductance), strong and weak electrolytes, Electrochemical cells-cell terminology, cell diagram and representation of electrodes, IUPAC convention-single electrode potential, relation between e.m.f and free energy, Nernst equation, calculation of cell potential.

10. Chemistry of Non-metals : Preparation, properties and uses of phosphorus compounds - phosphine, PCl_3 , PCl_5 , P_2O_3 , P_2O_5 , H_3PO_3 & H_3PO_4 , preparation, properties and uses of fluorine.

11. Chemistry of metals : Occurrence, extraction, properties and uses of gold, silver, copper, zinc, chromium, alloys of Cr, Cu and Zn, preparation, properties and uses of copper sulphate, potassium dichromate and silver nitrate. Co-ordination compounds – IUPAC nomenclature, types of ligands, theories of co-ordination compounds – Werner's theory, VB theory.

12. Organic Chemistry: Preparation & properties of Alcohols: Methanol, ethanol, isomers of propanol and butanol, glycol, classification of alcohols, glycerol and benzyl alcohol.

Phenols: Phenols-classification of phenols, preparations, physical and chemical properties and uses of phenol

Ethers diethylether, phenolic ethers

Aldehydes: formaldehyde, acetaldehyde, benzaldehyde

Ketones: acetone, acetophenone, benzophenone

Acids : formic acid, acetic acid, benzoic acid, salicylic acid, oxalic acid, phthalic Acid.

Nitrogen compounds: Nitromethane, nitrobenzene, methyl amine, dimethylamine, trimethylamine (classification of amines) aniline, benzene, diazonium chloride and its synthetic uses, glycine.

Carbohydrates : mono, di, and polysaccharides

13. Applied Chemistry: Thermosetting and thermoplastic, polythene, synthetic rubber, terylene, nylon, antibiotics, anaesthetics, antipyretics, analgesics, antiseptics, antimalarial and antacids

Environmental chemistry : Environmental terminology, types of pollution, classification of pollutants, effect of pollution-acid rain, green house effect, depletion of ozone layer, prevention of pollution.

MODEL QUESTIONS

1. The number of hydrogen atoms present in 18g of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) is
(A) 7.22×10^{23} (B) 7.22×10^{22} (C) 6.023×10^{22}
(D) None of the above

Correct answer is (A)

2. What is the molarity of methanol, CH_3OH (density = 0.792 gm/mL) if 125.0 mL is dissolved in enough water to make 12.5 L of solution?
(A) 0.4045M (B) 2.472×10^{-4} M (C) 0.247M
(D) 0.2336 M

Correct answer is (C)

BOTANY

01. Biodiversity & Vegetative Morphology:

Algae, Fungi, Bryophytes, Viruses and Bacteria, Pteridophytes, Gymnosperms.

Vegetative Morphology

Root : Introduction to Angiosperms. General characters. General characteristics of roots. types- Taproot, adventitious roots-modifications-Storage (Tap root) conical, fusiform, Napiform, Epiphytic, Proproot.

Stem : General characteristics of normal stem-functions -modifications aerial-twiner (Clitoria)-Sub-aerial (Chrysanthemum) – Underground stem (rhizome - Ginger).

Leaf : Parts of a leaf-venation-parallel-recticulate-simple and compound leaves-phyllotaxy (Alternate, Opp.ternate,whorled) - Modifications. (phyllode-Acacia, Insectivorous Nepenthes).

Inflorescence : Introduction-types.

Racemose: Simple Raceme, head.

Cymose : Simple, Dichasial.

Flower : Terminologies related to description of flower. Floral parts-Floral symmetry-symmetrical, asymmetrical actinomorphic-zygomorphic-aestivation-(Valvate, twisted, and imbricate)-Thalamus and position of pistil-hypogynous and epigynous with one example each Floral diagram-Floral formula.

Fruits : Simple-Berry and Drupe - Aggregate (polyalthia) - Multiple (Jack fruit) - Dry Dehiscent-Legume and Pea - Dry Indehiscent-Caryopsis (Paddy).

02. TAXONOMY Bentham and Hooker's systems of classification up to order level.

Introduction - Classification-Binomials-concept of genus and species-herbarium and its importance.

General family Characters, economic importance: pulses, oil, timber, medicines, and floral formula, floral diagrams for the following families.

Malvaceae, and Fabaceae (Papiilionaceae) (Polypetalae)

Solanaceae (Gamopetalae)

Euphorbiaceae (Monochlamideae)

03. ANATOMY A brief account of meristematic permanent tissues.

Root - dicotyledonous root - Monocotyledonous root - Primary structure of bean root.

Structure of maize root.

Stem - Dicotyledonous stem - Monocotyledonous stem - Primary structure of sunflower stem. Primary structure of maize stem. A brief study on secondary growth of stems (dicot).

Leaf - Dorsiventral leaf (Dicot) - Description - Helianthus leaf.

04. GENETICS AND HUMAN WELFARE.

Introduction Mendel's law of inheritance.

Laws of Mendel- monohybrid and dihybrid cross- incomplete dominance - Test cross.

Gene expression and interaction.

Linkage and crossing over.

Linkage-coupling repulsion, crossing over mechanism and significance.

Chromosomal aberrations -significance of mutations

Breeding experiments, food production, biopesticides, biowar, biopiracy, biopatent.

Genetic Engineering Outline - importance- protoplasmic fusion-gene cloning and splicing and tissue culture.

05. PHYSIOLOGY Absorption of water, Soil-water-availability-Root pressure- experiment-path of water across cortex, diffusion-potato osmoscope and Thistle funnel experiments-Capillary forces-Imbibition.

Transpiration: definition-Types of transpiration-cuticular, Lenticular stomatal mechanism of stomatal movement-significance of guttation-Experiment on transpiration - Ganong's photometer-Transpiration pull.

Photosynthesis: Introduction-Definition, raw materials-Importance of Chlorophyll overall equation - mechanism of photosynthesis - light reaction - Dark reaction – Experimental. (Ganong's light screen, Mohl's half leaf, test tube and funnel experiment, starch test).

Nutrition: Kinds- autotropic, heterotropic: saprophytic, parasitic and insectivorous plants

Respiration : Introduction – Definition – aerobic , anaerobic with equation – mechanism – Glycolysis – kreb's cycle-energy out put. Ganong's Respirascope experiment.

Growth : Introduction – Definition , growth substance – Auxins – Gibberellins – Cytokinins – Role any five practical applications of each hormone. Growth patterns-lever auxanometer exp.

06. ECOLOGY AND ENVIRONMENT

Introduction – Scope – Division of ecology. Ecological Groups.

Hydrophytes – Definition – Types - adaptations – morphological and anatomical.

Free floating – Eichhornia, submerged – Vallisneria, Attached floating (Nymphaea) - Amphibious (Limnophylla heterophylla) -

Xerophytes – Definition – Morphological and anatomical adaptations.

Drought escaping, Drought enduring & Drought resisting - any one eg. each.

Vegetation types : Introduction; Tropical, ever green, deciduous – scrub jungle

Natural resources: inorganic and organic resources. Renewable and non-renewable. Global environmental changes-global warming, greenhouse effect

MODEL QUESTIONS

1. Palmately parallel convergent venation is found in the leaves of

- (A) bamboo (B) cucurbita
(C) zizyphus (D)Palmyra

Correct answer is (A)

2. The epiblema is otherwise known as

- (A) rhizodermis (B)epithelium
(C)endodermis (D) mesodermis

Correct answer is (A)

ZOOLOGY

01 BASICS OF ZOOLOGY AND CELL BIOLOGY: General characters and out line classification of major phyla up to classes. Ultra structure of animal cell, models of plasma membranes. Cell organelles structure and functions. Nucleic acids. Cancer cell-types.

02. HUMAN PHYSIOLOGY-I : Nutrition and digestion: Food constituents protein -carbohydrates - fats - mineral salts - vitamins and water. Digestive system : structure of alimentary canal and physiology of digestion. Respiration : Respiratory organs in Man – Structure - Mechanism of respiration. Circulation : External and internal structure of human heart - working of heart - origin and conduction - heart-beat. Blood : Composition, function, clotting of blood. Blood pressure, Heart attack - stroke – Thrombosis.

03. HUMAN PHYSIOLOGY-II. Excretion : Structure of human urinary system – External and internal structure of human kidney. Functions of kidney – Urine formation. Nervous co-ordination : Central nervous system, structure and function of brain and spinal cord-reflex action – conditioned reflex.

Meninges : Cerebro spinal fluid. Chemical co-ordination (Endocrine glands) Location, origin, structure, secretion, function and malfunctions of pituitary gland, thyroid gland, parathyroid gland, pancreas, thymus, adrenal and sex glands. Reproduction : Structure of male and female reproductive systems. Menstrual cycle. and Birth control.

04. GENETICS AND EVOLUTION. Sex determination : Theories of sex determination – sex determination in Drosophila – Man moth Bonellia and crab. Sex linked inheritance in Drosophila (eye colour) in man (colour-blindness, hemophilia), X-linked and Y-linked inheritance of characters in man. Ploidy : Types of ploidy, human syndrome due to ploidy. Gene Mutation: Characteristics of gene mutation – Mutagenic agents - gene action. Blood Groups : Multiple alleles (blood groups) A, B, O Blood grouping – R_h factor – erythroblastosis foetalis. Gene therapy, cloning, transgenic

organisms, bioinformatics. Theories of organic evolution.

05. EMBRYOLOGY .

Gametogenesis : Gametogenesis – Spermato genesis – Oogenesis in frog. Types of vertebrate eggs : Vertebrate eggs – Amphioxus, frog, chick and mammal. Fertilisation : Fertilisation events, functions, process and significance. Cleavage: Cleavage – holoblastic unequal – Telelecithal. Gastrulation : Gastrulation – Morphogenetic movements in amphioxus and frog. Organogenesis.

06. ENVIRONMENTAL SCIENCES

Population and explosion, issues, environmental pollution – air, water, land, noise and their effects and control. Bio diversity conservation (Biosphere reserves and protected areas).

07. BIOLOGY IN HUMAN WELFARE.

Human health and diseases. Immunity: innate, acquired. Immunization - antigen, antibodies. Immune system disorders: allergy. Immunodeficiency: SCID, AIDS. Vector borne diseases – vectors - Hosts - zoonoses - name of vector borne diseases – symptoms – pathologies - malaria and filaria only. Bacterial and Viral Diseases.

Non-communicable diseases: Introduction to various metabolic disorders – obesity, diabetes, hyper tension, stroke – coronary heart diseases.

MODEL QUESTIONS

1. Sex determination is non genetic in
(A) moth (B) Bonellia (C) Drosophila
(D) Cockroach

Correct answer is (B)

2. A drastic reduction in the distribution of yolk is found in the eggs of

- (A) frog (B) bird (C) Mammals
(D) reptiles

Correct answer is (C)