

ADMISSIONS TO MEDICINE, DENTISTRY, PHARMACY & PHYSIOTHERAPY PROGRAMS

TOPICS TO PREPARE FOR WRITTEN TEST AND INTERVIEW

BIOLOGY

1. Prokaryotic cell structure and function.

2. Eukaryotic cell structure and function.

3. Cell communication.

Cell junctions. Local and long distant signaling. Chemical messengers. Receptors. The stages of cell signaling.

4. Cell cycle.

Cellular organization of genetic material. Phases of cell cycle. Cellular organization of genetic material. The stages of mitosis and meiosis. A comparison of Mitosis and Meiosis. Origins of genetic variation among offspring.

5. Cellular respiration and fermentation.

Catabolic pathways and production of ATP. The stages of cellular respiration. Anaerobic respiration.

6. Viruses.

Structure of viruses. General features of viral replication cycles. Viral diseases.

7. Bacteria and Archaea.

Cell surface structures. Motility. Internal organization. Reproduction and adaptation.

8. Chromosomal and Molecular Basis of Inheritance.

The chromosomal basis of sex. Inheritance of X- and Y-linked genes. Alternation of chromosome number and structure. Human disorders due to chromosomal alternation. Inheritance of organelle genes. DNA as genetic material. Structural model of DNA. Chromosomes' structure.

9. Genetic mechanisms.

The flow of genetic information. Replication. Transcription. Translation. Genetic code. Type of mutations. Regulation of Gene Expression.

10. Tissues and body membranes.

Structure and physiology of: connective, muscle, epithelial and nervous tissue; serous, mucous, synovial and cutaneous membranes.

11. Senses.

Hearing and equilibrium. Visual perception. Taste. Smell. Types of sensory receptors.

12. Nervous system.

Organization of nervous system. The central nervous system. The organization of human brain. Peripheral nervous system: motor and autonomic nervous system. Glia. Blood-brain barrier. Nervous system disorders.

13. Neurons, synapses and signaling.

Neurons structure and function. Resting and action potential. Conduction of action potentials. Postsynaptic potential. Neurotransmitters.

14. Hormones and endocrine system.

Intercellular communication. Endocrine tissues and organs. Chemical classes of hormones. Multiple effects of hormones. Simple hormone pathways. Feedback regulation.

15. Immune system. Innate and adaptive immunity.

Antigen. Antibody. The humoral immune response. The cell-mediated immune response. Inflammatory response. Immunological memory. Allergies. Immunization (vaccination).

16. Cardiovascular system.

Organization of human circulatory system. Heart and heart's rhythmic beat. Blood vessels structure and function. Blood pressure. Blood composition and function.

17. Respiratory system.

Organization of human respiratory system. Negative pressure breathing. Hemoglobin.

18. Digestive system and nutrition.

Essential nutrients. Dietary deficiencies. Organization of human digestive system. Chemical digestion in the human digestive system. Dental adaptation.

19. Human reproduction and development.

Female and male reproductive anatomy. Hormonal control of reproductive system. Gametogenesis. Conception. Embryonic development. Birth.

20. Osmoregulation and excretion.

Excretory organs. Kidney structure. Nephron organization and function. Kidney function, water balance and blood pressure.

21. Evolution.

Evolution of population. Evolution of human being. The Origin and Evolution of Vertebrates.

22. Genetics of population.

Genetic drift and effective population size, bottleneck effect, adaptation and phenotypic variance, Hardy-Weinberg equilibrium.

CHEMISTRY

1. Atoms

Atomic theory. Elements and atomic number. Isotopes and atomic weight.

2. The Periodic Table

The periodic table and some characteristics of different groups. Electronic structure of atoms and electron configurations. Electron configurations and the periodic table. Electron-dot symbols.

3. Ionic Compounds

The octet rule ions and ionic bonds. Periodic properties, ion formation formulas, naming ionic compounds. Some properties of ionic compounds. H^+ and OH^- ions: an introduction to acids and bases.

4. Molecular Compounds

Covalent bonds and the periodic table. Characteristics of molecular compounds. Molecular formulas and Lewis structures. Polar covalent bonds and electronegativity, polar molecules. Naming binary molecular compounds.

5. Classification and Balancing of Chemical Reactions

Classes of chemical reactions. Chemical equations and balancing chemical equations. Acids, bases, and neutralization reactions. Redox reactions.

6. Mole and Mass Relationships

The mole and Avogadro's number. Gram-mole conversions.

7. Reaction Rates and Chemical Equilibria.

Endothermic and exothermic chemical reactions. Factors that influence chemical reaction rates. Chemical equilibrium. Equilibrium constants.

8. Nuclear Chemistry

Radioactivity. Radioactive half-life.

9. Physical quantities

Metric system of units. Metric units of length. Metric units of mass. Metric units of volume. Significant figures.

10. Fundamental Chemical Laws

Law of conservation of mass. Law of definite proportions. Law of multiple proportions.

11. Chemical Calculations

Mole concept and chemical formulas. Calculations involving chemical equations. Calculations involving volume and concentration.

12. Solutions

Mixtures and solutions. Units of concentration. Dilution. Ions in solution: electrolytes.

13. Acids and Bases

Acids and bases in aqueous solution, some common acids and bases. The Brønsted–Lowry definition of acids and bases. Acid dissociation constants. Acid and base strength. Some common acid–base reactions. Acidity and basicity of salt solutions.

14. Buffers

Measuring acidity in aqueous solution: pH. Buffer solutions.

15. Introduction to Organic Chemistry: Alkanes

The nature of organic molecules. The structure of organic molecules: alkanes and their isomers. Drawing organic structures. The shapes of organic molecules. Naming alkanes. Properties of alkanes. Reactions of alkanes.

16. Alkenes and Alkynes

Alkenes and alkynes. Naming alkenes and alkynes. The structure of alkenes. Properties of alkenes and alkynes. Types of organic reactions. Reactions of alkenes and alkynes.

17. Aromatic Compounds

Alkene polymers. Aromatic compounds and the structure of benzene. Naming aromatic compounds. Reactions of aromatic compounds

18. Alcohols

Some common alcohols. Naming alcohols. Properties of alcohols, acidity of alcohols. Reactions of alcohols

19. Phenols

Some common phenols. Acidity of phenols

20. Some Compounds with Oxygen, Sulfur, or a Halogen

Ethers. Thiols and disulfides. Halogen-containing compounds

21. Amines

Amines. Properties of amines. Heterocyclic nitrogen compounds. Basicity of amines. Amine salts.

22. Aldehydes

The carbonyl group. Naming aldehydes. Properties of aldehydes. Some Common aldehydes. Oxidation of aldehydes. Reduction of aldehydes.

23. Ketones

Naming ketones. Properties of ketones. Some Common ketones. Reduction of ketones.

24. Carboxylic Acids and their Derivatives

Carboxylic acids and their derivatives: properties and names. Some common carboxylic acids.

25. Amino Acids and Proteins

Amino acids structures. Acid–base properties of amino acids. Chemical properties of proteins.

26. Enzymes and Vitamins

Catalysis by enzymes. How enzymes work. Vitamins and minerals.

27. Carbohydrates

Classification of carbohydrates. The D and L families of sugars: drawing sugar molecules. Structure of glucose . Disaccharides. Some important polysaccharides. Properties of carbohydrates.

28. Lipids

Structure and classification of lipids. Fatty acids and their esters. Properties of fats and oils.

29. Nucleic Acids and Protein Synthesis

DNA, chromosomes, and genes. Composition of nucleic acids. The structure of nucleic acid chains. Base pairing in DNA: the Watson–Crick model.

PHYSICS

1. Dynamics

Force, mass, Newton's 1st, 2nd and 3rd law. Free-body diagrams. Contact forces: normal force and friction force. Linear momentum, impulse, conservation of momentum.

2. Electric currents

Electric current. Ohm's law, electrical resistance and resistors. Electric power. EMF and terminal voltage.

3. Electric field

Electric charge, static electricity, induced charge, electric field, field lines, electric potential, equipotential lines, voltage. Coulomb's law. Electric field, conductors and dielectrics, charge distribution. Capacitance, storage of electric energy.

4. Fluids and solids

Mass and weight, specific density and specific gravity. Pascal's principle, pressure, hydraulic lift. Archimedes' principle, buoyancy and buoyant force. Elasticity, stress, strain, Hook's law and Young's modulus.

5. Geometrical optics and wave nature of light

The ray model of light. Reflection of light, formation of image by plane mirrors and spherical mirrors, total internal reflection, fibre optics. Refraction, Snell's law index of refraction. Thin lenses, focal point, focal length, optical power, ray tracing: converging and diverging lenses. Magnifying glass, eye and corrective lenses. Huygens principle, diffraction, diffraction grating, interference, polarization

6. Kinematics

Vectors and scalars, vector components, addition of vectors. Frames of reference and displacement. Velocity and acceleration. Motion at a constant acceleration; falling objects. Projectile motion.

7. Magnetism and electromagnetic induction, electromagnetic waves

Magnets and magnetic fields. Magnetic field of straight wires and coils supplied with electric current. Force on an electric current in a magnetic field and on electric charge moving in a magnetic field Faraday's law of induction. Lenz's law, electric generators, transformers and transmission of power. Electromagnetic waves and the electromagnetic spectrum, production of electromagnetic waves.

8. Nuclear Physics and radioactivity

Structure and properties on the nucleus, nuclear size. Radioactivity: alpha, beta and gamma decay; conservation of nucleon number and charge. The law of radioactive decay; the half-life time. Nuclear reactions and transmutation of elements. Nuclear fission and fusion, nuclear reactors.

9. Sounds

Characteristics of sound. Sound intensity and intensity level, ear, sound loudness. Doppler effect. Sources of sound: vibrating strings and air columns, standing waves.

10. Temperature and kinetic theory of gases

Temperature, kinetic theory of gases and molecular interpretation of temperature. Thermal Equilibrium and the Zero-the Law of Thermodynamics. The Ideal Gas Law. Heat and internal energy. First Law of Thermodynamics. Specific heat and latent heat. Heat engines. Second Law of Thermodynamics.

11. Vibration and waves

Simple harmonic motion (SHL), energy in the SHL, conservation of energy in the SHL. Simple pendulum, resonance, forced vibration. Wave motion, transverse and longitudinal waves. Energy transported by waves. Propagation of waves: reflection, refraction and diffraction.

12. Work, power and energy

Work, kinetic energy, potential energy, power. Conservative and non-conservative forces. Conversion of mechanical energy, energy transformations. Work-energy principle.