MDCAT Helper - AMC & AFNS Test Syllabus

Dear Aspirants,

We are thrilled to announce that our new session for AMC and AFNS test preparation has officially started! MDCAT Helper is here to guide you through your journey to success. Below is a comprehensive and elaborative syllabus designed to help you prepare effectively for the Biology, Physics, and Chemistry sections of the AMC and AFNS entrance examinations.

For any queries or to join our sessions, please contact us at: **03145367050**

Biology Syllabus

I. Cell Biology and Biochemistry

- **Cell Structure and Function:** Prokaryotic vs. Eukaryotic cells, cell organelles (nucleus, mitochondria, chloroplasts, ER, Golgi, ribosomes, lysosomes, vacuoles), plasma membrane structure and transport mechanisms (diffusion, osmosis, active transport).
- **Cell Division:** Mitosis (phases, significance) and Meiosis (phases, significance, genetic variation).
- **Biomolecules:** Structure and function of carbohydrates (monosaccharides, disaccharides, polysaccharides), lipids (fats, phospholipids, steroids), proteins (amino acids, peptide bonds, primary to quaternary structure, denaturation), and nucleic acids (DNA, RNA, nucleotides, replication, transcription, translation).
- **Enzymes:** Characteristics, mechanism of action, factors affecting enzyme activity (temperature, pH, substrate concentration, inhibitors).

II. Genetics and Evolution

- **Mendelian Genetics:** Laws of inheritance (segregation, independent assortment), monohybrid and dihybrid crosses, dominant/recessive alleles, genotype/phenotype.
- **Non-Mendelian Inheritance:** Incomplete dominance, codominance, multiple alleles, polygenic inheritance, sex-linked inheritance.
- **Molecular Genetics:** DNA replication (semiconservative model), RNA types (mRNA, tRNA, rRNA), genetic code, protein synthesis, gene expression regulation (operons).
- **Mutations:** Types of mutations (point, chromosomal), causes, effects.
- **Biotechnology:** Recombinant DNA technology, PCR, gel electrophoresis, gene cloning, genetic engineering applications.
- **Evolutionary Biology:** Theories of evolution (Lamarckism, Darwin's natural selection), evidence for evolution (fossil record, comparative anatomy, embryology, molecular biology), speciation, adaptive radiation, Hardy-Weinberg principle.

III. Human Physiology

- **Digestive System:** Organs, digestion process, absorption, enzymes.
- **Respiratory System:** Anatomy of respiratory tract, mechanism of breathing, gas exchange, transport of gases.
- **Circulatory System:** Heart structure and function, blood vessels (arteries, veins, capillaries), blood composition, blood groups, circulation (pulmonary, systemic).
- **Excretory System:** Kidney structure and function, urine formation, osmoregulation.
- **Nervous System:** Central nervous system (brain, spinal cord), peripheral nervous system, neurons, nerve impulse transmission, reflexes, sensory organs.
- **Endocrine System:** Endocrine glands, hormones, their functions and regulation.
- **Reproductive System:** Male and female reproductive organs, gametogenesis, menstrual cycle, fertilization, embryonic development.
- **Immune System:** Innate and adaptive immunity, types of immune responses, vaccines, allergies, autoimmune diseases.

IV. Ecology and Environment

- **Ecosystems:** Components (biotic, abiotic), energy flow (food chains, food webs, trophic levels), nutrient cycling (carbon, nitrogen, water cycles).
- **Population Ecology:** Population characteristics, growth curves, limiting factors.
- **Community Ecology:** Interspecific interactions (competition, predation, symbiosis).
- **Biodiversity and Conservation:** Importance of biodiversity, threats to biodiversity, conservation strategies.

Physics Syllabus

I. Mechanics

- **Kinematics:** Displacement, velocity, acceleration, equations of motion (uniform and non-uniform acceleration), projectile motion, relative velocity.
- **Dynamics:** Newton's Laws of Motion (inertia, F=ma, action-reaction), momentum, impulse, conservation of momentum, friction, centripetal force.
- **Work, Energy, and Power:** Work done by constant and variable forces, kinetic energy, potential energy (gravitational, elastic), conservation of mechanical energy, power.
- **Rotational Motion:** Angular displacement, velocity, acceleration, torque, moment of inertia, angular momentum, conservation of angular momentum.
- **Simple Harmonic Motion (SHM):** Characteristics of SHM, mass-spring system, simple pendulum, energy in SHM.
- **Fluid Mechanics:** Density, pressure, Pascal's principle, Archimedes' principle, buoyancy, fluid flow (Bernoulli's principle, continuity equation).

II. Waves and Optics

- **Wave Motion:** Types of waves (transverse, longitudinal), wave characteristics (amplitude, wavelength, frequency, period, speed), superposition principle, standing waves.

- **Sound Waves:** Production, propagation, speed of sound, intensity, loudness, pitch, Doppler effect.
- **Light Waves:** Nature of light, reflection (plane and spherical mirrors), refraction (lenses, Snell's law), total internal reflection.
- **Wave Optics:** Interference (Young's double-slit experiment), diffraction (single-slit), polarization.
- **Optical Instruments:** Human eye, microscope, telescope.

III. Thermodynamics

- **Temperature and Heat:** Temperature scales, thermal expansion, specific heat capacity, latent heat.
- **Laws of Thermodynamics:** First Law (conservation of energy), Second Law (entropy, heat engines, refrigerators), Third Law.
- **Kinetic Theory of Gases:** Ideal gas law, molecular interpretation of temperature and pressure.

IV. Electricity and Magnetism

- **Electrostatics:** Electric charge, Coulomb's law, electric field, electric potential, capacitance, dielectrics.
- **Current Electricity:** Electric current, Ohm's law, resistance, resistivity, series and parallel circuits, Kirchhoff's laws, electrical power.
- **Magnetism:** Magnetic field, magnetic force on current-carrying conductors and moving charges, Biot-Savart law, Ampere's law, solenoids, toroids.
- **Electromagnetic Induction:** Faraday's law of induction, Lenz's law, self-induction, mutual induction, transformers.
- **Alternating Current (AC):** AC circuits (resistors, inductors, capacitors), impedance, resonance, power in AC circuits.

V. Modern Physics

- **Atomic Structure:** Bohr model, quantum numbers, atomic spectra, X-rays.
- **Nuclear Physics:** Nucleus composition, isotopes, radioactivity (alpha, beta, gamma decay), half-life, nuclear fission, nuclear fusion.

- **Quantum Mechanics:** Wave-particle duality, photoelectric effect, Compton effect, de Broglie wavelength.

Chemistry Syllabus

I. General Chemistry

- **Basic Concepts:** Atoms, molecules, ions, moles, molar mass, chemical formulas, chemical equations, stoichiometry (mole-mole, mass-mass, limiting reactants).
- **Atomic Structure:** Subatomic particles, atomic number, mass number, isotopes, electronic configuration, quantum numbers, Aufbau principle, Hund's rule, Pauli exclusion principle.
- **Periodic Table:** Classification of elements, periodic trends (atomic radius, ionization energy, electron affinity, electronegativity).
- **Chemical Bonding:** Ionic bonding, covalent bonding (Lewis structures, VSEPR theory, hybridization), metallic bonding, intermolecular forces (hydrogen bonding, dipole-dipole, London dispersion forces).
- **States of Matter:** Gases (gas laws: Boyle's, Charles's, Gay-Lussac's, ideal gas equation), liquids (vapor pressure, surface tension, viscosity), solids (types of solids, crystal structures).
- **Solutions:** Types of solutions, solubility, concentration units (molarity, molality, percentage), colligative properties (vapor pressure lowering, boiling point elevation, freezing point depression, osmotic pressure).
- **Acids and Bases:** Arrhenius, Brønsted-Lowry, and Lewis concepts, pH, pOH, strong and weak acids/bases, neutralization reactions, buffers.
- **Chemical Equilibrium:** Reversible reactions, equilibrium constant (Kc, Kp), Le Chatelier's principle.
- **Thermochemistry:** Enthalpy, Hess's law, standard heats of formation, bond energies, spontaneity, Gibbs free energy.
- **Electrochemistry:** Oxidation and reduction, electrochemical cells (voltaic, electrolytic), standard electrode potentials, Nernst equation, corrosion.
- **Chemical Kinetics:** Reaction rates, factors affecting reaction rates, rate laws, reaction order, activation energy, collision theory.

II. Organic Chemistry

- **Basic Principles:** Hybridization (sp, sp2, sp3), functional groups, isomerism (structural, geometric, optical).
- **Hydrocarbons:** Alkanes (nomenclature, reactions: halogenation, combustion), Alkenes (nomenclature, reactions: addition, polymerization), Alkynes (nomenclature, reactions), Aromatic compounds (benzene structure, electrophilic substitution).
- **Alkyl Halides:** Nomenclature, nucleophilic substitution (SN1, SN2) and elimination (E1, E2) reactions.
- **Alcohols, Phenols, and Ethers:** Nomenclature, properties, reactions (oxidation, dehydration).
- **Aldehydes and Ketones:** Nomenclature, properties, nucleophilic addition reactions.
- **Carboxylic Acids and Derivatives:** Nomenclature, acidity, reactions (esterification, amide formation).
- **Amines:** Nomenclature, basicity, reactions.
- **Polymers:** Types of polymerization (addition, condensation), common synthetic polymers.

III. Inorganic Chemistry

- **Coordination Compounds:** Ligands, coordination number, nomenclature, isomerism, crystal field theory (basic).
- **Transition Elements:** General characteristics, electronic configuration, variable oxidation states, catalytic properties, complex formation.
- **Main Group Elements:** General properties and important compounds of s-block and p-block elements.

IV. Basic Biochemistry

- **Introduction to Biomolecules:** Overview of carbohydrates, lipids, proteins, and nucleic acids.
- **Enzymes:** Basic understanding of enzyme function and importance in biological systems.

- **Metabolic Pathways:** Brief introduction to glycolysis, Krebs cycle, and oxidative phosphorylation.

We wish you the best of luck in your preparations!

Sincerely, **The MDCAT Helper Team**