



## ACHIEVER PLUS COURSE HIGHLIGHTS

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- The ACHIEVER PLUS COURSE, is best suitable for NEET (UG) qualified students.
- The topics from the syllabus given in this document will be covered in classes.
- Certainly all remaining topics, which are not discussed in the class, will be covered through Tests and all problems from those topics can be discussed on doubt counters.
- After completion of classes, full syllabus tests will be conducted with all students of other Achiever Batches.
- Full syllabus study materials will be provided to every student.

## SYLLABUS TO BE COVERED IN ACHIEVER PLUS COURSE

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### PHYSICS

#### CONTENT OF CLASS XI SYLLABUS

##### Kinematics

- Frame of reference, Motion in a straight line; Position-time graph, speed and velocity. Uniform and non-uniform motion, average speed and instantaneous velocity. Uniformly accelerated motion, velocity-time and position-time graphs, for uniformly accelerated motion (graphical treatment).
- Elementary concepts of differentiation and integration for describing motion. Scalar and vector quantities: Position and displacement vectors, general vectors, general vectors and notation, equality of vectors, multiplication of vectors by a real number; addition and subtraction of vectors. Relative velocity.
- Unit vectors. Resolution of a vector in a plane-rectangular component.
- Scalar and Vector products of Vectors. Motion in a plane. Cases of uniform velocity and uniform acceleration-projectile motion. Uniform circular motion.

##### Laws of Motion

- Intuitive concept of force. Inertia, Newton's first law of motion; momentum and Newton's second law of motion; impulse; Newton's third law of motion. Law of conservation of linear momentum and its applications.
- Equilibrium of concurrent forces. Static and Kinetic friction, laws of friction, rolling friction, lubrication.
- Dynamics of uniform circular motion. Centripetal force, examples of circular motion (vehicle on level circular road, vehicle on banked road).

## Work, Energy and Power

- Work done by a constant force and variable force; kinetic energy, work-energy theorem, power.
- Notion of potential energy, potential energy of a spring, conservative forces; conservation of mechanical energy (kinetic and potential energies); non-conservative forces; motion in a vertical circle, elastic and inelastic collisions in one and two dimensions.

## Motion of System of Particles and Rigid Body

- Centre of mass of a two-particle system, momentum conservation and centre of mass motion. Centre of mass of a rigid body; centre of mass of uniform rod.  $\square$
- Moment of a force, torque, angular momentum, conservation of angular momentum with some examples.
- Equilibrium of rigid bodies, rigid body rotation and equation of rotational motion, comparison of linear and rotational motions; moment of inertia, radius of gyration. Values of M.I. for simple geometrical objects (no derivation). Statement of parallel and perpendicular axes theorems and their applications.

## Gravitation

- Kepler's laws of planetary motion. The universal law of gravitation. Acceleration due to gravity and its variation with altitude and depth.
- Gravitational potential energy; gravitational potential. Escape velocity, orbital velocity of a satellite. Geostationary satellites.

## Properties of Bulk Matter

- Elastic behavior, Stress-strain relationship. Hooke's law, Young's modulus, bulk modulus, shear, modulus of rigidity, Poisson's ratio; elastic energy.
- Viscosity, Stokes' law, terminal velocity, Reynold's number, streamline and turbulent flow. Critical velocity, Bernoulli's theorem and its applications.
- Surface energy and surface tension, angle of contact, excess of pressure, application of surface tension ideas to drops, bubbles and capillary rise.
- Heat, temperature, thermal expansion; thermal expansion of solids, liquids, and gases. Anomalous expansion. Specific heat capacity:  $C_p$ ,  $C_v$ -calorimetry; change of state-latent heat.
- Heat transfer-conduction and thermal conductivity, convection and radiation. Qualitative ideas of Black Body Radiation, Wein's displacement law, and Green House effect.  $\square$
- Newton's law of cooling and Stefan's law.

### **Thermodynamics**

- Thermal equilibrium and definition of temperature (zeroth law of Thermodynamics). Heat, work and internal energy. First law of thermodynamics. Isothermal and adiabatic processes.
- Second law of the thermodynamics: Reversible and irreversible processes. Heat engines and refrigerators.

### **Behaviour of Perfect Gas and Kinetic Theory**

- Equation of state of a perfect gas, work done on compressing a gas.
- Kinetic theory of gases: Assumptions, concept of pressure. Kinetic energy and temperature; degrees of freedom, law of equipartition of energy (statement only) and application to specific heat capacities of gases; concept of mean free path.

### **Oscillations and Waves**

- Periodic motion-period, frequency, displacement as a function of time. Periodic functions. Simple harmonic motion (SHM) and its equation; phase; oscillations of a spring-restoring force and force constant; energy in SHM –Kinetic and potential energies; simple pendulum-derivation of expression for its time period; free, forced and damped oscillations (qualitative ideas only), resonance.
- Wave motion. Longitudinal and transverse waves, speed of wave motion. Displacement relation for a progressive wave. Principle of superposition of waves, reflection of waves, standing waves in strings and organ pipes, fundamental mode and harmonics. Beats. Doppler effect.

## **CONTENTS OF CLASS XII SYLLABUS**

### **Capacitors**

- Capacitors, Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarization, capacitors and capacitance, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor with and without dielectric medium between the plates, energy stored in a capacitor, Van de Graaff generator.

### **Current Electricity**

- Electric current, flow of electric charges in a metallic conductor, drift velocity and mobility, and their relation with electric current; Ohm's law, electrical resistance, V-I characteristics (linear and non-linear), electrical energy and power, electrical resistivity and conductivity.
- Carbon resistors, Colour code for carbon resistors; series and parallel combinations of resistors; temperature dependence of resistance.
- Internal resistance of a cell, potential difference and emf of a cell, combination of cells in series and in parallel.
- Kirchhoff's laws and simple applications. Wheatstone bridge, metre bridge.
- Potentiometer-principle and applications to measure potential difference, and for comparing emf of two cells; measurement of internal resistance of a cell.

## Magnetic Effects of Current and Magnetism

- Concept of magnetic field, Oersted's experiment. Biot-Savart law and its application to current carrying circular loop.
- Ampere's law and its applications to infinitely long straight wire, straight and toroidal solenoids. Force on a moving charge in uniform magnetic and electric fields. Cyclotron.
- Force on a current-carrying conductor in a uniform magnetic field. Force between two parallel current-carrying conductors-definition of ampere. Torque experienced by a current loop in a magnetic field; moving coil galvanometer-its current sensitivity and conversion to ammeter and voltmeter.
- Current loop as a magnetic dipole and its magnetic dipole moment. Magnetic dipole moment of a revolving electron. Magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to its axis. Torque on a magnetic dipole (bar magnet) in a uniform magnetic field; bar magnet as an equivalent solenoid, magnetic field lines; Earth's magnetic field and magnetic elements.
- Para-, dia- and ferro-magnetic substances, with examples.
- Electromagnetic and factors affecting their strengths. Permanent magnets.

## Electromagnetic Induction and Alternating Currents

- Electromagnetic induction; Faraday's law, induced emf and current; Lenz's Law, Eddy currents. Self and mutual inductance.
- Alternating currents, peak and rms value of alternating current/ voltage; reactance and impedance; LC oscillations (qualitative treatment only), LCR series circuit, resonance; power in AC circuits, wattless current.
- AC generator and transformer.

## Optics

- Reflection of light, spherical mirrors, mirror formula. Refraction of light, total internal reflection and its applications optical fibres, refraction at spherical surfaces, lenses, thin lens formula, lens-maker's formula. Magnification, power of a lens, combination of thin lenses in contact combination of a lens and a mirror. Refraction and dispersion of light through a prism.
- Scattering of light-blue colour of the sky and reddish appearance of the sun at sunrise and sunset.
- Optical instruments: Human eye, image formation and accommodation, correction of eye defects (myopia and hypermetropia) using lenses.
- Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers.
- Wave optics: Wavefront and Huygens' principle, reflection and refraction of plane wave at a plane surface using wavefronts.
- Proof of laws of reflection and refraction using Huygens' principle.

- Interference, Young's double hole experiment and expression for fringe width, coherent sources and sustained interference of light.
- Diffraction due to a single slit, width of central maximum.
- Resolving power of microscopes and astronomical telescopes. Polarisation, plane polarized light; Brewster's law, uses of plane polarized light and Polaroids.

### **Dual Nature of Matter and Radiation**

- Photoelectric effect, Hertz and Lenard's observations; Einstein's photoelectric equation-particle nature of light.
- Matter waves- wave nature of particles, de Broglie relation. Davisson-Germer experiment (experimental details should be omitted; only conclusion should be explained).

### **Nuclei**

- Radioactivity- alpha, beta and gamma particles/ rays and their properties decay law. Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number, nuclear fission and fusion.

### **Electronic Devices**

- Energy bands in solids (qualitative ideas only), conductors, insulators and semiconductors; semiconductor diode- I-V characteristics in forward and reverse bias, diode as a rectifier; I-V characteristics of LED, photodiode, solar cell, and Zener diode; Zener diode as a voltage regulator. Junction transistor, transistor action, characteristics of a transistor; transistor as an amplifier (common emitter configuration) and oscillator. Logic gates (OR, AND, NOT, NAND and NOR). Transistor as a switch.

## CHEMISTRY

### Chemical Bonding and Molecular Structure

- Valence electrons, ionic bond, covalent bond, bond parameters, Lewis structure, polar character of covalent bond, valence bond theory, resonance, geometry of molecules, VSEPR theory, concept of hybridization involving s, p and d orbitals and shapes of some simple molecules, molecular orbital theory of homonuclear diatomic molecules (qualitative idea only). Hydrogen bond.

### Some p-Block Elements

- General Introduction to p-Block Elements.
- Group 13 elements: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous properties of first element of the group; Boron, some important compounds: borax, boric acids, boron hydrides. Aluminium: uses, reactions with acids and alkalies.
- General 14 elements: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous behaviour of first element. Carbon, allotropic forms, physical and chemical properties: uses of some important compounds: oxides.
- Important compounds of silicon and a few uses: silicon tetrachloride, silicones, silicates and zeolites, their uses.
- Group 15 elements: General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; preparation and properties of ammonia and nitric acid, oxides of nitrogen (structure only); Phosphorous-allotropic forms; compounds of phosphorous: preparation and properties of phosphine, halides ( $\text{PCl}_3$ ,  $\text{PCl}_5$ ) and oxoacids (elementary idea only).
- Group 16 elements: General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; dioxygen: preparation, properties and uses; classification of oxides; ozone. Sulphur – allotropic forms; compounds of sulphur: preparation, preparation, properties and uses of sulphur dioxide; sulphuric acid: industrial process of manufacture, properties and uses, oxoacids of sulphur (structures only).
- Group 17 elements: General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; compounds of halogens: preparation, properties and uses of chlorine and hydrochloric acid, interhalogen compounds, oxoacids of halogens (structures only).
- Group 18 elements: General introduction, electronic configuration, occurrence, trends in physical and chemical properties, uses.

## Coordination Compounds

- Coordination compounds: Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds, isomerism (structural and stereo) bonding, Werner's theory VBT, CFT; importance of coordination compounds (in qualitative analysis, biological systems).

## d and f Block Elements

- General introduction, electronic configuration, characteristics of transition metals, general trends in properties of the first row transition metals-metallic character, ionization enthalpy, oxidation states, ionic radii, colour, catalytic property, magnetic properties, interstitial compounds, alloy formation. Preparation and properties of  $K_2Cr_2O_7$  and  $KMnO_4$ .
- Lanthanoids- electronic configuration, oxidation states, chemical reactivity, and lanthanoid contraction and its consequences.
- Actinoids: Electronic configuration, oxidation states and comparison with lanthanoids.

## Ionic Equilibrium

- Ionization of acids and bases , Strong and weak electrolytes , Degree of ionization, Ionization of polybasic acids, Acid strength, Concept of pH, Hydrolysis of salts(elementary idea), Buffer solutions, Henderson Equation , Solubility product, Common ion Effect( with illustrative example)

## Thermodynamics

- First law of thermodynamics-internal energy and enthalpy, heat capacity and specific heat, measurement of U and H, Hess's law of constant heat summation, enthalpy of : bond dissociation, combustion, formation, atomization, sublimation, phase transition, ionization, solution and dilution.
- Introduction of entropy as state function, Second law of thermodynamics, Gibbs energy change for spontaneous and non-spontaneous process, criteria for equilibrium and spontaneity.
- Third law of thermodynamics-Brief introduction.

## Solutions

- Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, colligative properties- relative lowering of vapour pressure, Raoult's law, elevation of boiling point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties abnormal molecular mass, Van't Hoff factor.

## Electrochemistry

- Redox reactions, conductance in electrolytic solutions, specific and molar conductivity, variation of conductivity with concentration, Kohlrausch's Law, electrolysis and Laws of electrolysis

(elementary idea), dry cell, electrolytic cells and Galvanic cells, lead accumulator, EMF of a cell, standard electrode potential, Relation between Gibbs energy change and EMF of a cell, fuel cells; corrosion.

## Chemical Kinetics

- Rate of a reaction (average and instantaneous), factors affecting rates of reaction; concentration, temperature, catalyst; order and molecularity of a reaction; rate law and specific rate constant, integrated rate equations and half life (only for zero and first order reactions); concept of collision theory (elementary idea, no mathematical treatment), Activation energy, Arrhenius equation.

## Organic Chemistry : Some Basic Principles and Techniques

- Electronic displacements in a covalent bond: inductive effect, electromeric effect, resonance and hyperconjugation.
- Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbanions; electrophiles and nucleophiles, types of organic reactions.

## Hydrocarbons

- Alkanes- Chemical reactions including free radical mechanism of halogenation, combustion and pyrolysis.
- Alkenes- Structure of double bond (ethene), physical properties, methods of preparation, chemical reactions (mechanism of electrophilic addition, addition of hydrogen, halogen, water, hydrogen halides (Markovnikov's addition and peroxide effect)), ozonolysis, oxidation.
- Alkynes- Structure of triple bond (ethyne), methods of preparation, chemical reactions (acidic character of alkynes, addition reaction of hydrogen, halogens, hydrogen halides and water).
- Aromatic hydrocarbons- Benzene, resonance, aromaticity, chemical properties (mechanism of electrophilic substitution, Nitration, sulphonation, halogenation, Friedel Craft's alkylation and acylation), directive influence of functional group in mono-substituted benzene; carcinogenicity and toxicity.

## Haloalkanes and Haloarenes

- Haloalkanes: Chemical properties, mechanism of substitution reactions, Optical rotation.
- Haloarenes: Nature of C-X bond, substitution reactions (directive influence of halogen for monosubstituted compounds only).
- Uses and environment effects of dichloromethane, trichloromethane, tetrachloromethane, iodoform, DDT.

### **Alcohols, Phenols and Ethers**

- Alcohols: Methods of preparation, physical and chemical properties (of primary alcohols only), identification of primary, secondary and tertiary alcohols, mechanism of dehydration, uses with special reference to methanol and ethanol.
- Phenols: Methods of preparation, physical and chemical properties, acidic nature of phenol, electrophilic substitution reactions, uses of phenols.
- Ethers: Nomenclature, methods of preparation, physical and chemical properties use.

### **Aldehydes, Ketones and Carboxylic Acids**

- Aldehydes and Ketones: Nature of carbonyl group, methods of preparation, physical and chemical properties, and mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes, uses.
- Carboxylic Acids: Nomenclature, acidic nature, methods of preparation, physical and chemical properties, uses.

### **Organic Compounds Containing Nitrogen**

- Amines: Classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary, secondary and tertiary amines, Cyanides and Isocyanides will be mentioned at relevant places.
- Diazonium salts: Preparation, chemical reactions and importance in synthetic organic chemistry.

### **Polymers**

## BIOLOGY

### CONTENTS OF CLASS XI SYLLABUS

#### Diversity in Living World

- Biodiversity; Need for classification; Three domains of life; Taxonomy & Systematics; Concept of species and taxonomical hierarchy; Binomial nomenclature; Tools for study of Taxonomy – Museums, Zoos, Herbaria, Botanical gardens.
- Five kingdom classification; salient features and classification of Monera; Protista and Fungi into major groups; Lichens; Viruses and Viroids.
- Salient features and classification of plants into major groups-Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms (three to five salient and distinguishing features and at least two examples of each category); Angiosperms classification up to class, characteristic features and examples).
- Salient features and classification of animals-no chordate up to phyla level and chordate up to classes level (three to five salient features and at least two examples).
- Morphology and modifications; and functions of different parts of flowering plants: Root, stem, leaf, Anatomy of flowering Plant.
- B Cell division: Cell cycle, mitosis, meiosis and their significance

#### Plant Physiology

- Transport in plants: Movement of water, gases and nutrients; Cell to cell transport-Diffusion, facilitated diffusion, active transport; Plant – water relations – Imbibition, water potential, osmosis, plasmolysis; Long distance transport of water – Absorption, apoplast, symplast, transpiration pull, root pressure and guttation; Transpiration-Opening and closing of stomata; Uptake and translocation of mineral nutrients-Transport of food, phloem transport, Mass flow hypothesis; Diffusion of gases (brief mention).
- Mineral nutrition: Essential minerals, macro and micronutrients and their role; Deficiency symptoms; Mineral toxicity; Elementary idea of Hydroponics as a method to study mineral nutrition; Nitrogen metabolism-Nitrogen cycle, biological nitrogen fixation.
- Photosynthesis: Photosynthesis as a means of Autotrophic nutrition; Site of photosynthesis take place; pigments involved in Photosynthesis (Elementary idea); Photochemical and biosynthetic phases of photosynthesis; Cyclic and noncyclic and photophosphorylation; Chemiosmotic hypothesis; Photorespiration C<sub>3</sub> and C<sub>4</sub> pathways; Factors affecting photosynthesis.
- Respiration: Exchange gases; Cellular respiration-glycolysis, fermentation (anaerobic), TCA cycle and electron transport system (aerobic); Energy relations-Number of ATP molecules generated; Amphibolic pathways; Respiratory quotient.
- Plant growth : Photoperiodism and vernalisation.

## CONTENTS OF CLASS XII SYLLABUS

### Reproduction

- Human Reproduction: Male and female reproductive systems; Microscopic anatomy of testis and ovary; Gametogenesis spermatogenesis & oogenesis; Menstrual cycle; Fertilisation, embryo development upto blastocyst formation, implantation; Pregnancy and placenta formation (Elementary idea); Parturition (Elementary idea); Lactation (Elementary idea).
- Reproductive health: Need for reproductive health and prevention of sexually transmitted diseases (STD); Birth control Need and Methods, Contraception and Medical Termination of Pregnancy (MTP); Amniocentesis; Infertility and assisted reproductive technologies – IVF, ZIFT, GIFT (Elementary idea for general awareness).

### Genetics and Evolution

- Heredity and variation: Mendelian Inheritance; Deviations from Mendelism-Incomplete dominance, Co-dominance, Multiple alleles and Inheritance of blood groups, Pleiotropy; Elementary idea of polygenic inheritance; Chromosome theory of inheritance; Chromosomes and genes; Sex determination-In humans, birds, honey bee; Linkage and crossing over; Sex linked inheritance-Haemophilia, Colour blindness; Mendelian disorders in humans-Thalassemia; Chromosomal disorders in humans; Down's syndrome, Turner's and Klinefelter's syndromes.
- Molecular basis of Inheritance: Search for genetic material and DNA as genetic material; Structure of DNA and RNA; DNA packaging; DNA replication; Central dogma; Transcription, genetic code, translation; Gene expression and regulation-Lac Operon; Genome and human genome project; DNA finger printing.
- Evolution: Origin of life; Biological evolution and evidences for biological evolution from Paleontology, comparative anatomy, embryology and molecular evidence); Darwin's contribution, Modern Synthetic theory of Evolution; Mechanism of evolution-Variation (Mutation and Recombination) and Natural Selection with examples, types of natural selection; Gene flow and genetic drift; Hardy-Weinberg's principle; Adaptive Radiation; Human evolution.

### Biology and Human Welfare

- Health and Disease; Pathogens; parasites causing human diseases (Malaria, Filariasis, Ascariasis. Typhoid, Pneumonia, common cold, amoebiasis, ring worm); Basic concepts of immunology-vaccines; Cancer, HIV and AIDS; Adolescence, drug and alcohol abuse.

### Biotechnology and Its Applications

- Principles and process of Biotechnology: Genetic engineering (Recombinant DNA technology).
- Application of Biotechnology in health and agriculture: Human insulin and vaccine production, gene therapy; Genetically modified organisms-Bt crops; Transgenic Animals; Biosafety issues-Biopiracy and patents.

## **Ecology and environment**

- Organisms and environment: Habitat and niche; Population and ecological adaptations; Population interactions-mutualism, competition, predation, parasitism; Population attributes-growth, birth rate and death rate, age distribution.
- Ecosystem: Patterns, components; productivity and decomposition; Energy flow; Pyramids of number, biomass, energy; Nutrient cycling (carbon and phosphorous); Ecological succession; Ecological Services-Carbon fixation, pollination, oxygen release.
- Biodiversity and its conservation: Concept of Biodiversity; Patterns of Biodiversity; Importance of Biodiversity; Loss of Biodiversity; Biodiversity conservation; Hotspots, endangered organisms, extinction, Red Data Book, biosphere reserves, National parks and sanctuaries.
- Environmental issues: Air pollution and its control; Water pollution and its control; Agrochemicals and their effects; Solid waste management; Radioactive waste management; Greenhouse effect and global warming; Ozone depletion; Deforestation; Any three case studies as success stories addressing environmental issues.