VITEEE – 2024 -
PHYSICS

1. Mechanics and Properties of Matter

Law of conservation of linear momentum and its applications. Static and kinetic friction - laws of friction - rolling friction

Work done by a constant force and a variable force; kinetic energy - work-energy theorem - power.

Conservative forces: conservation of mechanical energy (kinetic and potential energies) - non-conservative forces: motion in a vertical circle - elastic and inelastic collisions.

Elastic behaviour - 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 - streamline and turbulent flow - critical velocity. Bernoulli's theorem and its applications.

Heat - temperature - thermal expansion: thermal expansion of solids - specific heat capacity: Cp, Cv - latent heat capacity. Qualitative ideas of Blackbody radiation: Wein's displacement Law - Stefan's law.

2. Electrostatics

Charges and their conservation; Coulomb's law - superposition principle. Electric field – electric field due to a point charge, electric field lines; electric dipole, electric field intensity due to a dipole - behaviour of a dipole in a uniform electric field. Electric potential - potential difference-electric potential due to a point charge and dipole - equipotential surfaces – electrical potential energy of a system of two point charges.

Electric flux-Gauss's law and its applications. Electrostatic induction-capacitor and capacitance – dielectrics- electric polarisation – parallel plate capacitor with and without dielectric – applications of capacitor – energy stored in a capacitor - Capacitors in series and in parallel – Van de Graaff generator.

3. Current Electricity & Magnetic Effects of Electric Current

Electric Current – drift velocity and mobility and their relation with electric current. Ohm's law, electrical resistance - V-I characteristics – electrical resistivity and conductivity-classification of materials in terms of conductivity – Carbon resistors – colour code for carbon resistors - combination of resistors – series and parallel – temperature dependence of resistance – internal resistance of a cell – potential difference and emf of a cell - combinations of cells in series and in parallel.

Kirchoff's law – Wheatstone's Bridge and its application - Metrebridge - special case of Wheatstone bridge - Potentiometer principle - comparing the emf of two cells.

Magnetic effect of electric current – Concept of magnetic field - Oersted's experiment – Biot-Savart law- Magnetic field due to a current carrying straight wire and circular coil – Tangent galvanometer – Bar magnet as an equivalent solenoid – magnetic field lines.

Ampere's circuital law and its application. Force on a moving charge in uniform magnetic field and electric field – cyclotron – Force on current carrying conductor in a uniform magnetic field – Forces between two parallel current carrying conductors - definition of ampere.

Torque experienced by a current loop in a uniform magnetic field - moving coil galvanometer – conversion to ammeter and voltmeter – current loop as a magnetic dipole - Magnetic dipole moment of a revolving electron.

4. Electromagnetic Induction and Alternating Current

Electromagnetic induction - Faraday's law - induced emf and current - Lenz's law. Self induction - Mutual induction - self inductance of a long solenoid - mutual inductance of two long solenoids. Methods of inducing emf - (i) by changing magnetic induction (ii) by changing area enclosed by the coil and (iii) by changing the orientation of the coil.

AC generator - (Single phase, three phase). Eddy current - applications - transformer - Alternating current - AC circuit with resistance - AC circuit with inductor - AC circuit with capacitor - LCR series circuit - Resonance and Q - factor - power in AC circuits.

5. Optics

Reflection of light, spherical mirrors, mirror formula. Refraction of light, total internal reflection and its applications, refraction at spherical surfaces, lenses, thin lens formula, lens maker's formula. Magnification, power of a lens, Resolving power, combination of thin lenses in contact, combination of a lens and a mirror. Refraction and dispersion of light through a prism.

Wavefront and Huygens's principle - Reflection, total internal reflection and refraction of plane wave at a plane surface using wavefronts. Interference - Young's double slit experiment and expression for fringe width - coherent source - Formation of colours in thin films - Newton's rings. Diffraction - differences between interference and diffraction of light. Polarisation of light waves - polarisation by reflection - Brewster's law - double refraction - nicol prism - uses of plane polarised light.

6. Dual Nature of Radiation, Atomic & Nuclear Physics

Electromagnetic waves and their characteristics - Electromagnetic spectrum - Photoelectric effect - Light waves and photons - particle nature of light - photocells and their applications.

Atomic structure – discovery of the electron – specific charge (Thomson's method) and charge of the electron (Millikan's oil drop method) – alpha scattering – Rutherford's atom model.

Nuclear properties - nuclear radii, masses, binding energy, density, charge - isotopes, isobars and isotones - nuclear mass defect - binding energy - stability of nuclei

Nature of nuclear forces - Radioactivity - alpha, beta and gamma radiations and their properties - Radioactive decay law - half life - mean life - artificial radioactivity - radio isotopes - effects and uses. Radio carbon dating. Nuclear fission - chain reaction - atom bomb - nuclear reactor - nuclear fusion.

7. Semiconductor Devices and their Applications

Semiconductor basics - energy bands in solids: difference between metals, insulators and semiconductors - semiconductor doping - Intrinsic and Extrinsic semiconductors. Formation of P-N Junction - Barrier potential and depletion layer-P-N Junction diode - Forward and reverse bias characteristics - diode as a rectifier - Zener diode- LED. Junction transistors - characteristics - transistor as a switch - transistor as an amplifier - transistor as an oscillator.

Logic gates - NOT, OR, AND, EXOR using discrete components - NAND and NOR gates as universal gates - De Morgan's theorem - Laws and theorems of Boolean algebra.

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VITEEE – 2024
CHEMISTRY

1. Physical Chemistry

Atomic Structure - Bohr's atomic model-Sommerfeld's extension of atomic structure; Electronic configuration and Quantum numbers; Shapes of s, p, d, f orbitals - Pauli's exclusion principle - Hund's Rule of maximum multiplicity- Aufbau principle. Emission and absorption spectra, line and band spectra; Hydrogen spectrum – Lyman, Balmer, Paschen, Brackett and Pfund series; de Broglie's theory; Heisenberg's uncertainty principle – wave nature of electron – Schrodinger wave equation (No derivation). Eigen values and eigen functions. Chemical bonding and hybridization of atomic orbitals involving s, p and d orbitals.

Thermodynamics, Chemical Equilibrium and Chemical Kinetics - I and II Laws of thermodynamics – spontaneous and non-spontaneous processes, entropy, Gibb's free energy – Standard Gibbs free energy change (ΔG^0) and chemical equilibrium – significance of entropy. Rate of a chemical reaction, factors affecting rates of reaction: concentration, temperature, pressure and catalyst; Law of mass action – Le Chatelier's principle, applications of chemical equilibrium. Rate expression, order, and molecularity of reactions, zero order, first order and pseudo first order reaction – half-life period. Determination of rate constant and order of reaction. Temperature dependence of rate constant – Arrhenius equation, activation energy and its calculation; elementary concept of collision theory of bimolecular gaseous reactions.

Solutions - Colligative properties of dilute solutions; Different methods for expressing the concentration of solution - molality, molarity, mole fraction, percentage, the vapour pressure of solutions and Raoult's Law - Ideal and non-ideal solutions, vapour pressure - composition, plots for ideal and non-ideal solutions

2. Inorganic and Material Chemistry

The s-block elements – properties and chemical reactivity of alkali and alkaline earth metals

The p-block elements – Phosphorous compounds: PCl_3, PCl_5 – Oxides, Hydrogen halides, Inter-halogen compounds and Xenon fluoride compounds

General characteristics of d – block elements – Electronic Configuration – Oxidation states of first row transition elements and their colours. Occurrence and principles of extraction: Copper, Silver, Gold and Zinc. Preparation and properties of $CuSO_4$, $AgNO_3$ and $K_2Cr_2O_7$.

Lanthanides – Introduction, electronic configuration, general characteristics, oxidation state – lanthanide contraction, uses, brief comparison of Lanthanides and Actinides

Introduction to coordination chemistry - IUPAC nomenclature of mononuclear coordination compounds; Isomerism, Geometrical isomerism in 4-coordinate, 6-coordinate complexes. Theories on coordination compounds – Werner's theory (brief), Valence Bond theory. Uses of coordination compounds. Bioinorganic compounds (Haemoglobin and chlorophyll).

Solid-State Chemistry - Lattice – unit cell, systems, types of crystals, packing in solids; Ionic crystals – Imperfections in solids – point defects, X-Ray diffraction – Electrical Property, Amorphous solids (elementary ideas only)

Surface Chemistry - Adsorption- physisorption and chemisorption; Catalysis – homogeneous and heterogeneous catalysis

3. Analytical Chemistry

Electrochemistry - Redox reactions; Theory of electrical conductance; metallic and electrolytic conductance. Faraday's laws – theory of strong electrolytes – Specific resistance, specific conductance, equivalent and molar conductance – Variation of conductance with dilution – Kohlrausch's Law – Ionic product of water, pH, and pH– buffer solutions – use of pH values. Cells – Electrodes and electrode potentials – construction of cell, EMF values and standard electrode potentials, Nernst equation and its application to chemical cells. Relation between Gibbs energy change and EMF of a cell, dry cell, electrolytic cells and Galvanic cells; lead accumulator; Fuel cells, Corrosion, and its prevention.

Environmental Chemistry - Environmental pollution - Atmospheric, water and soil.

4. Basic Principles of Organic Chemistry

Carbon – tetravalency, hybridization; Classification of organic compounds – functional groups; Homologous series; Nomenclature (IUPAC); Homolytic and heterolytic bond cleavage; carbocations, carbanions and free radicals; electrophiles and nucleophiles; Inductive effect, electromeric effect, resonance and hyperconjugation.

Common organic reactions **-** Substitution, addition, elimination and rearrangement

Isomerism in Organic Compounds: Definition, Classification – structural isomerism, stereo isomerism – geometrical and optical isomerism. Optical activity - chirality – compounds containing chiral centres – R, S notation, D, L notation.

Detection of the functional groups in organic compounds: Hydroxyl (alcoholic and phenolic), carbonyl (aldehyde and ketones) carboxyl and amino groups.

5. Properties and Chemistry of Functionalized Organic Compounds

Alcohols and Ethers - Nomenclature of alcohols – Classification of alcohols - distinction between 1°, 2° and 3° alcohols – General methods of preparation of primary alcohols, properties. Methods of preparation of dihydric alcohols: Glycol – Properties – Uses. Methods of preparation of trihydric alcohols - Properties – Uses. Aromatic alcohols – preparation and properties of phenols and benzyl alcohol; Ethers – Nomenclature of ethers – general methods of preparation of aliphatic ethers - Properties – Uses. Aromatic ethers – Preparation of Anisole – Uses

Carbonyl Compounds - Nomenclature of carbonyl compounds – Comparison of aldehydes and ketones. General methods of preparation of aldehydes – Properties – Uses. Aromatic aldehydes – Preparation of benzaldehyde – Properties and Uses. Ketones – general methods of preparation of aliphatic ketones (acetone) – Properties – Uses. Aromatic ketones – preparation of acetophenone – Properties – Uses, preparation of benzophenone – Properties. Name reactions; Clemmensen reduction, Wolff – Kishner reduction, Cannizzaro reaction, Claisen Schmidt reaction, Benzoin Condensation, Aldol Condensation. Preparation and applications of Grignard reagents.

Carboxylic Acids and their derivatives - Nomenclature – Preparation of aliphatic monocarboxylic acids – formic acid – Properties – Uses. Monohydroxy mono carboxylic acids; Lactic acid – Synthesis of lactic acid. Aliphatic dicarboxylic acids; Preparation of oxalic and succinic acids. Aromatic acids: Benzoic and Salicylic acids – Properties – Uses. Derivatives of carboxylic acids; acetyl chloride (CH_3COCl) – Preparation – Properties – Uses. Preparation of acetamide, Properties – acetic anhydride – Preparation, Properties. Preparation of esters – methyl acetate – Properties

6. Organic Nitrogen Compounds

Organic Nitrogen Compounds - Aliphatic nitro compounds – Preparation of aliphatic nitroalkanes – Properties – Uses. Aromatic nitro compounds – Preparation – Properties – Uses. Distinction between aliphatic and aromatic nitro compounds. Amines; aliphatic amines – General methods of preparation – Properties – Distinction between 1°, 2° and 3° amines. Aromatic amines – Synthesis of benzylamine – Properties, Aniline – Preparation – Properties – Uses. Differences between aliphatic and aromatic amines. Aliphatic nitriles – Preparation – properties – Uses. Diazonium salts – Preparation of benzene diazonium chloride – Properties.

7. Biomolecules and Polymers

Carbohydrates – Distinction between sugars and non-sugars, structural formulae of glucose, fructose, and sucrose, with their linkages, invert sugar – definition, examples of oligo and polysaccharides

Amino acids and Proteins – Classification of amino acids with examples, Peptides - properties of peptide bond; Proteins - primary, secondary, tertiary and quaternary structure (qualitative idea only), denaturation of proteins, enzymes

Lipids - Definition, classification with examples, difference between fats, oils, and waxes.

Nucleic acids – Chemical constitution of DNA and RNA

Polymers - Classification – Natural and synthetic, methods of polymerization (addition and condensation), copolymerization. Some important polymers: natural and synthetic like polythene, nylon, polyesters, Bakelite, rubber. Biodegradable and non-biodegradable polymers.

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VITEEE – 2024 –
MATHEMATICS

1. Matrices and their Applications

Algebra of matrices, Determinants and its properties – Adjoint and inverse of a square matrix using determinants and elementary transformations – Rank, Test of consistency and solution of simultaneous linear equations up to three variables – Solution of Linear Programming problem in two Variables.

2. Trigonometry and Complex Numbers

Fundamentals of Trigonometry, Trigonometric, inverse Trigonometric functions and their properties, heights and distances.

Complex number system – conjugate, properties, ordered pair representation. Argand diagram, Algebra of complex numbers, modulus and argument (or polar form) of a complex number. Solution of polynomial equations – De Moivre's theorem and its applications. Roots of a complex number – Cube and fourth roots.

3. Analytical Geometry of two dimensions

Coordinate geometry – Equation of a straight line and family of straight lines - Properties
Definition of a conic – general equation of a conic, classification with respect to the general equation of a conic and eccentricity. Equations of conic sections (parabola, ellipse and hyperbola) in standard forms and general forms – Directrix, Focus and Latus-rectum – parametric form of conics and chords. – Tangents and normal's – Cartesian form and parametric form – equation of chord of contact of tangents.

4. Vector Algebra

Scalar Product and Vector product of two Vectors, properties and applications – Scalar and Vector triple product – Properties.

5. Analytical Geometry of Three Dimensions

Coordinates of a point in space, the distance between two points, section formula, directions ratios and direction cosines, the angle between two intersecting lines. Skew lines, the shortest distance between them and its equation. Equations of a line and a plane in different forms, the intersection of a line and a plane, coplanar lines.

6. Differential Calculus

Limits, continuity and differentiability of functions – properties – applications: tangent, normal and angle between curves.
Mean value theorem – Rolle's Theorem, Lagrange Mean Value Theorem, Taylor's and Maclaurin's series**,** stationary points, increasing, minima **of** decreasing, maxima, **functions of** one variable, concavity and points of inflexion-Errors and approximations.

7. Integral Calculus and its Applications

Simple definite integrals – fundamental theorems of calculus, properties of definite integrals, Reduction formulae – Area of bounded regions, length of the curves.

8. Differential Equations

Differential equations – formation, order and degree. Solution of first order differential equations: Variables separable, Homogeneous, Linear equations and applications.

9. Probability and Distributions

Basics of Probability – Axioms – Addition law – Conditional probability – Multiplicative law – Baye's Theorem.
Random variables – probability density function**,** distribution functions, mathematical expectation, variance – Discrete distributions: Binomial and Poisson.

10. Discrete Mathematics

Sets – Relations – Functions – Binary Operations. Sequence and series (AP, GP, HP) – Binomial Theorem – Counting Techniques
Mathematical logic – logical statements, connectives, truth tables, logical equivalence, tautology, contradiction.

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VITEEE – 2024–
BIOLOGY

1. Taxonomy

Need for classification; three domains of life. Linnaean, Whittaker, Bentham and Hooker systems of classification. Salient features and classification of non-chordates up to phyla levels and chordates up to class levels. Morphology and anatomy of flowering plants. Structural organization in insects (cockroach)

2. Cell and Molecular Biology

Cell theory. Prokaryotic cell and it's ultrastructure. Eukaryotic cell- cell wall, cell membrane, cytoskeleton, nucleus, chloroplast, mitochondria, endoplasmic reticulum, Golgi bodies, ribosomes, lysosomes, vacuoles and centrosomes. Cell cycle and division - amitosis, mitosis and meiosis. Search for genetic material; structure of DNA and RNA; replication, transcription, genetic code, translation, splicing, gene expression and regulation (lac operon) and DNA repair.

3. Reproduction

Asexual reproduction – binary fission, sporulation, budding, gemmule formation and fragmentation, Vegetative propagation in plants. Sexual reproduction in flowering plants - structure of flowers. Pollination, fertilization, development of seeds and fruits, seed dispersal, apomixis, parthenocarpy and poly-embryony. Human reproductive system - Gametogenesis, menstrual cycle, fertilization, implantation, embryo development upto blastocyst formation, pregnancy, parturition and lactation. Assisted reproductive technologies.

4. Genetics and evolution

Chromosomes - structure and types, linkage and crossing over, recombination of chromosomes, mutation and chromosomal aberrations. Mendelian inheritance, chromosomal theory of inheritance, deviation from Mendelian ratio (incomplete dominance, co-dominance, multiple allelism, pleiotrophy), sex linked inheritance and sex determination in humans.
Darwinism, neo Darwinism, Hardy and Weinberg's principle and factors affecting the equilibrium: selection, mutation, migration and random genetic drift.

5. Human health and diseases

Pathogens, parasites causing human diseases (malaria, dengue, chickengunia, filariasis, COVID, ascariasis, typhoid, pneumonia, common cold, amoebiasis, ring worm) and their control. Basic concepts of immunology, vaccines, antibiotics, cancer, HIV and AIDS. Adolescence, drug and alcohol abuse.

6. Biochemistry

Structure and function of carbohydrates, lipids and proteins. Enzymes – types, properties and enzyme action. Metabolism - glycolysis, fermentation and Kreb's cycle.

7. Plant physiology

Movement of water, food, nutrients, gases and minerals. Passive diffusion, facilitated diffusion, and active transport. Imbibition, osmosis, apoplast and symplast transport and guttation. Macro and micronutrients and their deficiency symptoms. Transpiration, photosynthesis (light and dark reactions) and electron transport chain. Hormones and growth regulators, photo- periodism and vernalization. Nitrogen cycle and biological nitrogen fixation.

8. Human physiology

Digestion and absorption, breathing and respiration, body fluids and circulation, excretory system, endocrine system, nervous system, skeletal and muscular systems. Locomotion and movement, growth, aging and death. Hormones - types of hormones, functions and disorders.

9. Biotechnology and its applications

Recombinant DNA technology, applications in health, agriculture and industries; genetically modified organisms; Human insulin, vaccine and antibiotic production. Stem cell technology and gene therapy. Apiculture and animal husbandry. Plant breeding, tissue culture, single cell protein, fortification, Bt crops and transgenic animals. Microbes in food processing, sewage treatment, waste management and energy generation. Biocontrol agents and biofertilizers. Bio-safety issues, biopiracy and patents. Human and rice genome projects. DNA fingerprinting.

10. Biodiversity, ecology and environment

Ecosystems: components, types, pyramids, nutrient cycles (carbon and phosphorous), ecological succession and energy flow in an ecosystem; Biodiversity - concepts, patterns, importance, conservation, hot spots, endangered organisms, extinction, Red data book, botanical gardens, national parks, sanctuaries, museums, biosphere reserves and Ramsar sites. Environmental issues: pollution and its control. Solid and radioactive waste management. Climate change impact and its mitigation. Population attributes - growth, birth and death rate and age distribution.

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VITEEE – 2024-ENGLISH & APTITUDE

ENGLISH

Multiple Choice Questions to test the comprehension of a short passage or line of poems, English grammar, and pronunciation. Please note that the passages, lines of poems, dialogues, grammar, and pronunciation items are chosen to suit the level of higher secondary or equivalent education.

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APTITUDE

Multiple Choice Question. Assessment will be the following topics.

1. Data Interpretation
2. Data Sufficiency
3. Syllogism
4. Number Series, Coding, and Decoding
5. Clocks, Calendars, and Directions

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