# CARE Academy

excel beyond expectancy

**for Competitive Examinations**

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Care Chemistry–C–Tuition Centre


## UG TRB – PHYSICS SYLLABUS

### Unit – 1 Mechanics

Newton's laws – Impulse and impact – laws of impact – direct impact and oblique impact between two smooth spheres – loss of K.E – motion of two interacting bodies – reduced mass – centre of gravity – centre of gravity of a solid hemisphere – hollow hemisphere – tetrahedron and solid cone – friction – types of friction – angle of friction – equilibrium of rigid bodies – moment of inertia – angular momentum and kinetic energy of a revolving body – moment of inertia of sphere, shell and cylinder – parallel and perpendicular axes theorem – rolling – Kepler's laws of planetary motion – Newton's law of gravitation – determination of G by Boy's method – gravitational field and potential – variation of acceleration due to gravity on height, depth and altitude – orbital and escape velocities – earth and geostationary satellites – limitations of Newton's laws.

### Unit – 2-Thermal Physics

Kinetic theory of gases – postulates – mean free path – ideal gas equation – degrees of freedom – Boltzmann's law of equipartition of energy – Maxwell's law of distribution of molecular speed – atomicity of gases – specific heat capacity of gases ratio of $c_p$ and $c_v$ – calculation for monoatomic and diatomic gases – Mayer's relation – experimental determination of $c_p$ and $c_v$ – Joule-Kelvin effect – theory and experiment – liquefactionof gases – hydrogen, oxygen, air, helium – thermal conductivity of solids – Forbe's and Lee's disc method – Stefan's law – determination of Stefan's constant – solar constant – temperature of the Sun – firstlaw of thermodynamics – isothermal, adiabatic, isochoric, isobaric, cyclic processes– Carnot's engine – Carnot's cycle – second law of thermodynamics – Carnot's theorem – entropy – reversible and irreversible process – Maxwell's thermodynamic relations and their applications – thirdlaw of thermodynamics.

### Unit – 3 Properties of Matter and Acoustics

Moduli of elasticity – relations among three moduli of elasticity – bending moment – uniform and non-uniform bending – couple per unit twist – torsionaloscillation – elasticconstants and their determination – viscosity – determination of highly viscous liquid by Stokes' method – streamline and turbulent flow – Reynold's number – Poiseuille's flow – applications of viscosity – surface tension – capillary rise – method of drops – surfacetension of mercury – Quicnke's method.

Simple harmonic motion – combination of two SHMs in straight line and right angles – Lissajou's figures – free, damped, forced oscillations – laws of transverse vibrations – sonometer, and Melde's string – resonance – intensity and loudness of sound – beats– Doppler effect – velocity of sound in solids and gasses – ultrasonic – production, properties and applications – acousticsof auditoria.

### Unit – 4 Electricity and Magnetism

Coulomb's law – permittivity – relative permittivity – electric field intensity – due to point charge – Guass' theorem and its applications – electric potential – relation between potential and intensity – electric dipole moment – potentialand intensity due to dipole – capacitance – capacity of parallel plates, spherical and cylindrical capacitors – energy stored in a capacitor – electrometers – measurement of potential and dielectric constant – Ohm's law – resistivity and conductivity – Kirchhoff's laws for a loop and a junction – internal resistance of a cell andemf– thermoelectricity – Peltier, Thomson coefficients.

Biot-Savarts law – Ampere' s law – magnetic field around current carrying conductors magnetic force on charge and current elements – force between two current carrying parallel conductors – Faraday's laws of electromagnetic induction – self and mutual induction – induction coil and its uses – eddy currents – transformers – energy losses – skin effect – advantages of ac over dc – dynamos and motors – magnetic poles – magnetic moments - susceptibility and permeability – dia, par and ferro magnetism – hysteresis – B-H curve – energy loss due to hysteresis.

**Unit – 5 Atomic and Nuclear Physics**

Bohr's atom model –hydrogen atom –spectraof hydrogen and hydrogen like atoms – Rydberg's constant –special quantisation – Sommerfeld model –quantum numbers – vector atom model – electronic structures –Pauli's exclusion principle –electronic configuration – magnetic moment due to orbital motion and electron spin – Bohr magnetron – Stern and Gerlachexperimental – fine structure of sodium d line – Zeeman effect –anomalousZeeman effect – theoretical explanation.

General properties of nuclei and nuclear models – nuclear size, charge and mass determination – nuclear spin magnetic dipole moment – mass defect, binding energy and packing fraction – nuclear forces – shell model – liquid drop model – fission, fusion and nuclear reactions – induced radioactivity – artificial transmutation – application of radio isotopes – discovery, production and detection of neutrons –cyclotron, synchrotron and betatron – radiation detectors – ionisation chamber –G.M. counter – elementary particles – classification –pions, muons, k mesonshyperons – conservation laws – cosmic rays.

**Unit – 6**

**Quantum Mechanics and Relativity**

Wave nature of particles – deBroglie waves – Davison and Germer experiment – waves and particle duality – photoelectric effect – photo electric multiplier – Einstein's equation – Compton Effect – experimental verification of Compton effect – wave nature of electron – Heisenberg's uncertainty principle – position and momentum, energy and time uncertainty – Schrodinger's wave equation – probability amplitude –properties of wave function– normalization – potential barriers – tunnelling across barriers – particle in a box (one dimension only)

Relativity — postulate of Special theory of Relativity – Lorentz transformation of equations and its application – length contraction, time dilation – variation of mass with velocity – Mass energy equivalence - Physical Significance.

**Unit – 7**

**Solid State Physics**

Crystalline and amorphous solids – crystal lattice – structure of crystals – periodicity and plane in crystal – translational and rotational symmetry – crystallography – fundamental types of lattices in two and three dimensions – Bravais lattice – lattice systems, unit cell – primitive lattice vectors – packing fraction – Miller indices – crystal planes and directions – reciprocal lattice vectors – xrays – Bragg's law – crystal diffraction by x rays -x ray spectroscopy – characteristic x ray spectra – x ray absorption and fluorescence –Mosley's law – uses of x rays – Laue and Bragg equations – symmetry elements and symmetry groups – types of crystal – different types of chemical bonds – ionic, covalent, metallic – vanderWaals bond.

**Unit – 8**

**Optics and Spectroscopy**

Defect of images – spherical aberration – methods of minimizing spherical aberration – chromatic aberration –their rectification – deviation without dispersion and dispersion without deviation – eyepiece – interference – young's double slit experiment – colours of

thin film – Newton's rings – air wedge – diffraction – Fresnel and Fraunhoffer types – zone plate and diffraction grating – prism – Huygens's explanation – polarisation – double refraction - Nicol prism – quarter and half wave plates – production and detection of plane, circular and elliptically polarised light – optical activity – determination of specific rotatory power usingpolarimeter– optic fiber – fiber optic sensors – fibre optic communication systems and their advantages – laser – stimulated emission – population inversion – ruby and helium-neon laser and applications – UV and IR spectroscopy and applications – Raman effect – explanation on the basis of quantum theory – experimental arrangement – applications of Raman effect.

**Unit – 9**

**Electrical circuits and Electronics**

AC circuits with R, L and C –complex impedance and phase diagram – R-L and R-C circuits – series and parallel resonant-LCR circuits – sharpness of resonance Q factor – power in A.C. circuit –choke coil.

Semiconductor – energy band theory of solids and insulators, conductors and semiconductors – intrinsic and extrinsic semiconductors – electrons and holes as charge carriers – P type and N type semi-conductors – junction diodes –characteristics curve of diode – diode applications – Light Emitting Diodes, Photodiodes – junction transistors – characteristics of transistors –rectifier, amplifier and oscillator circuits – AM and FM transmission and reception with block diagrams – Logic circuits – NOT, AND, OR, NAND, NOR and Ex-OR gates – truth tables – Boolean algebra – deMorgan's theorems – Karnaugh map simplification –opamp IC – summing, difference, integrator and differentiator circuits using opamp – astable and monostable multi vibrators – flip- flop circuits.

**Unit – 10 Experimental Physics**

Errors and approximations – types of errors – absolute, relative and percentage of errors – significant figures – advantages of average – leastcount of instruments – calibration techniques – curve plotting – least square refinement – dimensional analysis and uses – parallax method – Verniercalipers – screw gauge – travelling microscope – optic lever – Haier's apparatus – calorimeter – Barton's radiation correction – focal length of concave lens by contact – galvanometer – conversion of galvanometer into ammeter and voltmeter – calibration of low range ammeter and voltmeter – ballistic galvanometer –figure of merit – Ohm meter – multimeter– tangent galvanometer – magnetometer – meter bridge – potentiometer– LCR circuits – registers and counters.