

3. PHYSICS

Class XI (Theory)

One Paper

Three Hours

Max Marks: 70

Units	Title	Weight age
Unit I	Physical World & Measurement	03
Unit II	Kinematics	10
Unit III	Laws of Motion	10
Unit IV	Work, Energy & Power	06
Unit V	Motion of System of particles & Rigid Body	06
Unit VI	Gravitation	05
Unit VII	Properties of Bulk Matter	10
Unit VIII	Thermodynamics	05
Unit XI	Behaviour of Perfect Gas & Kinetic Theory of gases	05
Unit X	Oscillations & Waves	10
Total		70

Unit I: Physical World and Measurement

Physics - scope and excitement; nature of physical laws; Physics, technology and society. Need for measurement: Units of measurement; systems of units; SI units, fundamental and derived units. Length, mass and time measurements; accuracy and precision of measuring instruments; errors in measurement; significant figures. Dimensions of physical quantities, dimensional analysis and its applications.

Unit II: 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, position-time graphs, relations 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 and notation, equality of vectors, multiplication of vectors by a real number; addition and subtraction of vectors. Relative velocity. Unit vector; Resolution of a vector in a plane - rectangular components. Motion in a plane. Cases of uniform velocity and uniform acceleration-projectile motion. Uniform circular motion.

Unit III: 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. Dynamics of uniform circular motion: Centripetal force, examples of circular motion (vehicle on level circular road, vehicle on banked road).

Unit IV: Work, Energy and Power

Scalar product of vectors. Work done by a constant force and a 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: elastic and inelastic collisions in one and two dimensions.

Unit V: 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. Vector product of vectors; moment of a force, torque, angular momentum, conservation of angular momentum with some examples. Equilibrium of rigid bodies, rigid body rotation and equations of rotational motion, comparison of linear and rotational motions; moment of inertia, radius of gyration. Values of moments of inertia for simple geometrical objects (no derivation). Statement of parallel and perpendicular axes theorems and their applications.

Unit VI: 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. Geo-stationary satellites.

Unit VII: Properties of Bulk Matter

Elastic behaviour, Stress-strain relationship, Hooke's law, Young's modulus, bulk modulus, shear, modulus of rigidity. Pressure due to a fluid column; Pascal's law and its applications (hydraulic lift and hydraulic brakes). Effect of gravity on fluid pressure. Viscosity, Stokes' law, terminal velocity, Reynold's number, streamline and turbulent flow. Bernoulli's theorem and its applications. Surface energy and surface tension, angle of contact, application of surface tension ideas to drops, bubbles and capillary rise. Heat, temperature, thermal expansion; specific heat - calorimetry; change of state - latent heat. Heat transfer-conduction, convection and radiation, thermal conductivity, Newton's law of cooling.

Unit VIII: Thermodynamics

Thermal equilibrium and definition of temperature (zeroth law of thermodynamics). Heat, work and internal energy. First law of thermodynamics. Second law of thermodynamics: reversible and irreversible processes. Heat engines and refrigerators.

Unit IX: 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; rms speed of gas molecules; degrees of freedom, law of equipartition of energy (statement only) and application to specific heats of gases; concept of mean free path, Avogadro's number.

Unit X: Oscillations and Waves

Periodic motion - period, frequency, displacement as a function of time. Periodic functions. Simple harmonic motion (S.H.M) and its equation; phase; oscillations of a spring-restoring force and force constant; energy in S.H.M.-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.

Practicals

Note: Every student will perform 10 experiments (5 from each section) and 8 activities (4 from each section) during the academic year. Two demonstration experiments must be performed by the teacher with participation of students. The students will maintain a record of these demonstration experiments. Schools are advised to see the guidelines for evaluation in practicals for Class XII. Similar pattern may be followed for Class XI.

SECTION A

Experiments

1. Use of Vernier Callipers
 - (i) to measure diameter of a small spherical/cylindrical body.
 - (ii) to measure dimensions of a given regular body of known mass and hence find its density.
 - (iii) to measure internal diameter and depth of a given beaker/calorimeter and hence find its volume.
2. Use of screw gauge
 - (i) to measure diameter of a given wire,
 - (ii) to measure thickness of a given sheet
 - (iii) to measure volume of an irregular lamina
3. To determine radius of curvature of a given spherical surface by a spherometer.
4. To find the weight of a given body using parallelogram law of vectors.
5. Using a simple pendulum, plot L-T and L-T² graphs. Hence find the effective length of second's pendulum using appropriate graph.
6. To study the relationship between force of limiting friction and normal reaction and to find co-efficient of friction between a block and a horizontal surface.
7. To find the downward force, along an inclined plane, acting on a roller due to gravitational pull of the earth and study its relationship with the angle of inclination by plotting graph between force and $\sin \theta$.

Activities

1. To make a paper scale of given least count, e.g. 0.2cm, 0.5cm.
2. To determine mass of a given body using a metre scale by principle of moments.
3. To plot a graph for a given set of data, with proper choice of scales and error bars.
4. To measure the force of limiting friction for rolling of a roller on a horizontal plane.
5. To study the variation in range of a jet of water with angle of projection.
6. To study the conservation of energy of a ball rolling down on inclined plane (using a double inclined plane).
7. To study dissipation of energy of a simple pendulum by plotting a graph between square of amplitude and time.

SECTION B

Experiments

1. To determine Young's modulus of elasticity of the material of a given wire.
2. To find the force constant of a helical spring by plotting graph between load and extension.
3. To study the variation in volume with pressure for a sample of air at constant temperature by plotting graphs between P and V, and between P and I/V.
4. To determine the surface tension of water by capillary rise method.
5. To determine the coefficient of viscosity of a given viscous liquid by measuring terminal velocity of a given spherical body.
6. To study the relationship between the temperature of a hot body and time by plotting a cooling curve.
7.
 - (i) To study the relation between frequency and length of a given wire under constant tension using sonometer.
 - (ii) To study the relation between the length of a given wire and tension for constant frequency using sonometer.
8. To find the speed of sound in air at room temperature using a resonance tube by two resonance positions.
9. To determine specific heat of a given (i) solid (ii) liquid, by method of mixtures.

Activities

1. To observe change of state and plot a cooling curve for molten wax.
2. To observe and explain the effect of heating on a bi-metallic strip.
3. To note the change in level of liquid in a container on heating and interpret the observations.
4. To study the effect of detergent on surface tension by observing capillary rise.
5. To study the factors affecting the rate of loss of heat of a liquid.
6. To study the effect of load on depression of a suitably clamped metre scale loaded
 - (i) at its end
 - (ii) in the middle.