

Physics I

Exam Topics

One-Dimensional Motion

- Motion at constant speed
- Definition and distinction of terms
- Graphical description of motion
- Algebraic description of motion
- Free fall

Vectors and two-dimensional motion

- Vectors and scalars
- Graphical addition of vectors
- Trigonometric addition of vectors
- Projectile motion
- Relative Motion

Dynamics, Statics, and Forces

- Newton's Laws
- Multiple Body Problems
- Elevators
- Inertial coordinate system
- Free-body diagrams
- Mass and Weight
- Friction and Normal Forces
- Spring force
- Equilibrium

Torque and Rotational Equilibrium

- Fulcrum and Lever-arm
- Rotational equilibrium
- Center of mass

Circular motion

- Centripetal acceleration
- Required centripetal force
- Uniform circular motion
- Vertical circles
- Universal gravitation and satellite motion

Work and Energy

- Work and Kinetic Energy
- Gravitational Potential Energy
- Elastic Potential Energy
- Conservation of Energy
- Power

Static electricity

- Electric charge, electroscopes
- Inductive and conductive charging
- Insulators, conductors and conservation of charge
- Coulomb's Law
- Fields, field lines and electric field
- Dipoles and capacitors

Electrical potential

- Work and PE in gravitational and electrical fields
- Field lines and equipots
- Electric potential — concept and formula
- Electron-volt
- Parallel plate capacitors — field and potential

Current electricity

- Current, potential and resistance
- Analogies — water in pipes, traffic
- Batteries, switches and bulbs
- Resistance and resistivity
- Ohm's Law and electric power
- Resistors in combination, equivalent circuits
- Kirchoff's laws
- Ammeters, voltmeters and galvanometers

Magnetism

- Magnets, compasses and the earth
- Magnetic materials, domains and poles
- Magnetic field and right-hand-rule
- Magnetic force on a moving charge — mass spec and TV
- Magnetic force on a current — motor effect
- Magnetic field of a wire and solenoid — right-hand-rule
- Force between two wires

Electromagnetic induction

- Generator effect

Impulse and Momentum

- Newton's Second Law Revisited
- Impulse and linear momentum in one-dimension
- Conservation of momentum
- Elastic and Inelastic collisions
- Momentum in two dimensions

Simple Harmonic Motion

- Spring force and potential energy revisited
- Observable properties and required conditions for SHM
- Analogy to uniform circular motion
- Position, velocity and acceleration
- Period, frequency and amplitude; trig notation
- Simple pendulum
- Other oscillations — physical pendulum, torsional, damped

Waves and Sound

- Waves in nature, types and purpose of waves
- Wave pulses on a string
- Principle of superposition, interference
- Standing waves, resonance, beats
- Speed, frequency and wavelength
- Intensity of sound; response of the ear
- Doppler effect

Geometric Optics

- Reflection
- Plane mirrors, real and virtual images
- Spherical and Parabolic mirrors, ray tracing
- Refraction, Snell's Law, and index of refraction
- Lenses, ray tracing for thin lenses

Physical Optics and Electromagnetic Waves

- Nature of light; atomic emission
- Types of em waves
- Apparent depth, fish-eye lens and total internal reflection
- Scattering and polarization
- Intensity of light