SCERT Kerala · Class 11 · Physics

Physics

ORIGINAL STUDY COMPANION
PADIKAM
CLASS 11 | SCIENCE
Physics
Kerala SCERT / prescribed NCERT core lessons
14 chapter lessons
Quick explanations, core points, exam practice and chapter-specific notation in one consistent format.
Padikam explanations are independently written. Official textbooks are used as the coverage map, chapter sequence and terminology reference.

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Study rhythm
Read the quick explanation, recall the core points aloud, then answer the prompts without looking back. Use the official textbook links for full prescribed readings, activities and diagrams.
Textbook and verification links
1. https://samagra.kite.kerala.gov.in/files/samagra-resource/uploads2/tbookscmq/eng/11/1/Physics_1765009532929_656948014.pdf
2. https://samagra.kite.kerala.gov.in/files/samagra-resource/uploads2/tbookscmq/eng/11/1/Physics_1765009789921_583812029.pdf

CHAPTER 01
Units and Measurements
Quick understanding
Measurement connects a physical quantity with a standard unit and reports both value and uncertainty.
Core points Check your learning
Use SI base units and derived units consistently. Find the dimensions of gravitational constant G.
Significant figures show measurement precision.
Combine percentage errors in a
Dimensional analysis checks equations and converts
calculated quantity.
units, but cannot determine numerical constants.
Equation and notation
Percentage error = (absolute error / measured value) × 100
$[G] = M^{-1}L^{3}T^{-2}$
SYMBOLS AND UNITS

M: mass dimension L: length dimension
T: time dimension G: universal gravitational constant; [G] denotes its dimensions
Percentage error: dimensionless ratio expressed as %
One-line recall Use SI base units and derived units consistently.
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CHAPTER 02
Motion in a Straight Line
Quick understanding
Describe one-dimensional motion using position, displacement, velocity and acceleration.
Core points Check your learning
Slope of an x-t graph gives velocity. Interpret a piecewise velocity-time graph.
Slope of a v-t graph gives acceleration; area gives displacement. Solve a freely falling-body problem using a sign convention.
The constant-acceleration equations do not apply when acceleration varies.
Equation and notation
$v = u + at$
$s = ut + \frac{1}{2}at^2$
$v^2 = u^2 + 2as$
SYMBOLS AND UNITS
u: initial velocity (m s^{-1}) v: final velocity (m s^{-1})
a: acceleration (m s^{-2}) t: time (s)
s: displacement (m)
One-line recall Slope of an x-t graph gives velocity.
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CHAPTER 03
Motion in a Plane
Quick understanding
Treat vectors through components and analyse projectile and circular motion.
Core points Check your learning
Vector addition depends on magnitude and direction. Find the resultant of two perpendicular vectors.
Resolve a vector along convenient perpendicular axes. Derive time of flight and range for a projectile.
Projectile horizontal motion is uniform while vertical motion has acceleration g.
Equation and notation
$R = u^2 \sin 2\theta / g$
$T = 2u \sin \theta / g$
$a_c = v^2/r$
SYMBOLS AND UNITS
θ: projection angle R: horizontal range (m)
a_c: centripetal acceleration (m s^{-2}) u: initial speed (m s^{-1})
g: acceleration due to gravity (m s^{-2}) T: time of flight (s)
v: speed (m s^{-1}) r: circular-path radius (m)
One-line recall Vector addition depends on magnitude and direction.
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CHAPTER 04
Laws of Motion

Quick understanding
Use force and momentum to explain changes in motion and interactions between bodies.
Core points Check your learning
Inertia is resistance to change in velocity. Draw a free-body diagram for a block on a rough incline.
Net external force equals rate of change of momentum. Find tension and acceleration in a two-body system.
Action and reaction act on different bodies.
Equation and notation
$F = dp/dt$
For constant mass: $F = ma$
$f_s \leq \mu_s N$; $f_k = \mu_k N$
SYMBOLS AND UNITS
p: momentum (kg m s^{-1}) N: normal reaction (N)
μ: coefficient of friction F: net force (N)
m: mass (kg) t: time (s)
f_s, f_k: static and kinetic friction (N) μ_s, μ_k: coefficients of friction, dimensionless
One-line recall Inertia is resistance to change in velocity.

CHAPTER 05
Work, Energy and Power
Quick understanding
Connect force acting through displacement with energy transfer and rate of doing work.
Core points Check your learning
Work is the scalar product of force and displacement. Use a force-displacement graph to find work.
Net work changes kinetic energy. Compare power for two methods of lifting a load.
Mechanical energy is conserved when only conservative forces do work.
Equation and notation
$W = Fs \cos \theta$
$K = \frac{1}{2}mv^2$
$U = mgh$
$P = dW/dt = F \cdot v$
SYMBOLS AND UNITS
W: work (J) K, U: energy (J)
P: power (W) F: force (N)
s: displacement (m) θ: angle between force and displacement
m: mass (kg) v: speed (m s^{-1})
g: acceleration due to gravity (m s^{-2}) h: height (m)
t: time (s)
One-line recall Work is the scalar product of force and displacement.

CHAPTER 06
System of Particles and Rotational Motion
Quick understanding
Extend mechanics from one particle to systems, centre of mass and rotation about an axis.
Core points Check your learning
Centre of mass follows the net external force. Locate the centre of mass of two particles.
Torque changes angular momentum.

Solve a rolling body energy problem.
Moment of inertia depends on mass distribution and
axis.
Equation and notation
$\tau = r \times F$
$L = I\omega$
$K_{rot} = \frac{1}{2} I\omega^2$
$v_{cm} = R\omega$
SYMBOLS AND UNITS
τ: torque (N m) I: moment of inertia (kg m^2)
ω: angular velocity (rad s^{-1}) r: position vector from the axis (m)
F: force (N) L: angular momentum (kg $m^2 s^{-1}$)
K_{rot}: rotational kinetic energy (J) v_{cm}: centre-of-mass speed (m s^{-1})
R: rolling radius (m)
One-line recall Centre of mass follows the net external force.
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CHAPTER 07
Gravitation
Quick understanding
Apply universal attraction to planets, satellites, potential energy and escape.
Core points Check your learning
Gravitational force follows an inverse-square law. Derive acceleration due to gravity at
Earth's surface.
Field and potential are different: one is force per
mass, the other energy per mass. Compare orbital and escape speeds.
Satellite speed depends on orbital radius.
Equation and notation
$F = Gm_1m_2/r^2$
$g = GM/r^2$
$v_o = \sqrt{(GM/r)}$
$v_e = \sqrt{(2GM/R)}$
SYMBOLS AND UNITS
G: universal gravitational constant M: central mass (kg)
r: centre-to-centre distance (m) F: gravitational force (N)
m1, m2: interacting masses (kg) g: gravitational acceleration (m s^{-2})
v_o: orbital speed (m s^{-1}) v_e: escape speed (m s^{-1})
R: radius of the central body (m) G: 6.67 x 10^{-11} N m^2 kg^{-2}
One-line recall Gravitational force follows an inverse-square law.
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CHAPTER 08
Mechanical Properties of Solids
Quick understanding
Relate deformation to restoring force through stress, strain and elastic moduli.
Core points Check your learning
Stress has unit pascal; strain is dimensionless. Read a stress-strain curve.
Hooke's law holds only within the elastic limit. Find extension of a wire under load.
Young, bulk and shear moduli describe different
deformations.
Equation and notation
Young modulus Y = longitudinal stress / longitudinal strain
Elastic energy density = ½ × stress × strain
SYMBOLS AND UNITS
Y: Young modulus (Pa) ΔL: extension (m)

Stress: force per area (Pa) Strain: fractional deformation, dimensionless
One-line recall Stress has unit pascal; strain is dimensionless.
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CHAPTER 09
Mechanical Properties of Fluids
Quick understanding
Explain pressure, buoyancy, flow and surface effects in liquids and gases.
Core points Check your learning
Pressure at equal depth in a static fluid is equal. Find efflux speed from a tank.
Continuity expresses mass conservation. Explain capillary rise or aerodynamic lift.
Bernoulli's relation exchanges pressure, kinetic and
gravitational energy per volume.
Equation and notation
$P = P_0 + \rho gh$
$A_1 v_1 = A_2 v_2$
$P + \frac{1}{2}\rho v^2 + \rho gh = \text{constant}$
SYMBOLS AND UNITS
ρ: density (kg m^{-3}) η: viscosity (Pa s)
γ: surface tension (N m^{-1}) P, P_0: pressure and reference pressure (Pa)
g: acceleration due to gravity (m s^{-2}) h: depth or height (m)
A: cross-sectional area (m^2) v: fluid speed (m s^{-1})
One-line recall Pressure at equal depth in a static fluid is equal.
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CHAPTER 10
Thermal Properties of Matter
Quick understanding
Connect temperature with expansion, heat capacity, phase change and heat transfer.
Core points Check your learning
Temperature indicates thermal state; heat is energy Solve a calorimetry mixture problem.
transferred because of temperature difference.
Use linear expansion to find length
During a phase change, supplied heat changes state change.
rather than temperature.
Conduction, convection and radiation transfer heat
differently.
Equation and notation
$Q = mc\Delta T$
$Q = mL$
$\Delta L = \alpha L \Delta T$
SYMBOLS AND UNITS
c: specific heat capacity (J kg^{-1} K^{-1}) L: latent heat (J kg^{-1})
α: linear expansion coefficient (K^{-1}) Q: heat transferred (J)
m: mass (kg) ΔT: temperature change (K)
ΔL: length change (m) L: latent heat (J kg^{-1}) in Q = mL; original length (m) in
expansion
One-line recall Temperature indicates thermal state; heat is energy transferred because of temperature difference.
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CHAPTER 11
Thermodynamics
Quick understanding
Study energy exchange between a system and surroundings through heat, work and state variables.
Core points Check your learning

The first law is energy conservation for thermal systems.
Analyse an isothermal or adiabatic process on a P-V graph.
Sign convention must be stated before calculation.
Calculate work and internal-energy change.
No heat engine can convert all absorbed heat into work in a cycle.

Equation and notation

$\Delta Q = \Delta U + \Delta W$

For ideal gas: $PV = nRT$

$\eta = W/Q_H$

SYMBOLS AND UNITS

Q: heat supplied (J) U: internal energy (J)
W: work done by system (J) η: efficiency
ΔQ or q: heat supplied to the system (J) ΔU: internal-energy change (J)
ΔW or w: work (J) P: pressure (Pa)
V: volume (m^3) n: amount of gas (mol)
R: molar gas constant ($J\ mol^{-1}\ K^{-1}$) T: absolute temperature (K)
Q_H: heat absorbed from hot reservoir (J)

One-line recall The first law is energy conservation for thermal systems.

CHAPTER 12

Kinetic Theory

Quick understanding

Explain gas pressure and temperature through random molecular motion.

Core points

Ideal-gas assumptions simplify molecular interactions.
Use degrees of freedom to find molar heat capacity.
Absolute temperature measures average translational kinetic energy.

Check your learning

Relate rms speed to temperature.
Pressure results from momentum transfer at walls.

Equation and notation

$P = \frac{1}{3}\rho v_{rms}^2$

$\frac{1}{2}m\langle v^2\rangle = \frac{3}{2}k_B T$

$v_{rms} = \sqrt{(3RT/M)}$

SYMBOLS AND UNITS

k_B: Boltzmann constant v_{rms}: root-mean-square speed ($m\ s^{-1}$)
P: pressure (Pa) ρ: gas density ($kg\ m^{-3}$)
m: mass of one molecule (kg) T: absolute temperature (K)
R: molar gas constant M: molar mass ($kg\ mol^{-1}$)

One-line recall Ideal-gas assumptions simplify molecular interactions.

CHAPTER 13

Oscillations

Quick understanding

Model periodic motion and identify simple harmonic motion as motion with restoring acceleration proportional to displacement.

Core points

Amplitude is maximum displacement; period is time for one cycle.
Find the period of a spring or simple pendulum.
SHM acceleration always points toward equilibrium.
Energy shifts between kinetic and potential while

Check your learning

Write x, v and a at a stated phase.

total stays constant.
Equation and notation
$x = A\cos(\omega t + \varphi)$
$a = -\omega^2 x$
$T_{spring} = 2\pi\sqrt{(m/k)}$
$T_{pendulum} = 2\pi\sqrt{(l/g)}$
SYMBOLS AND UNITS
A: amplitude (m) ω: angular frequency (rad s^{-1})
φ: phase constant (rad) x: displacement (m)
a: acceleration (m s^{-2}) t: time (s)
T_{spring}, $T_{pendulum}$: period (s) m: oscillating mass (kg)
k: spring constant (N m^{-1}) l: pendulum length (m)
g: acceleration due to gravity (m s^{-2})
One-line recall Amplitude is maximum displacement; period is time for one cycle.

CHAPTER 14
Waves
Quick understanding
Describe travelling disturbances, superposition, standing waves and sound.
Core points Check your learning
Wave speed depends on the medium, while frequency is fixed by the source. Find harmonics in an open or closed pipe.
Superposition produces interference and standing waves. Use beat frequency to compare two sources.
Nodes have zero displacement; antinodes have maximum displacement.
Equation and notation
$v = f\lambda$
$y = A\sin(kx - \omega t)$
$f_{beat} = |f_1 - f_2|$
SYMBOLS AND UNITS
λ: wavelength (m) f: frequency (Hz)
$k = 2\pi/\lambda$: wave number (rad m^{-1}) v: wave speed (m s^{-1})
y: particle displacement (m) A: amplitude (m)
x: position (m) ω: angular frequency (rad s^{-1})
t: time (s) f_{beat}, f_1, f_2: frequencies (Hz)
One-line recall Wave speed depends on the medium, while frequency is fixed by the source.