

Physics definitions |

All the definitions you need to know for the exam, explained simply.

Basic

- Scalar
⇒ A quantity which has a magnitude, but no direction.
- Vector
⇒ A quantity which has both a magnitude and a direction.
- Mass (m) (kg)
⇒ The quantity of matter in a body regardless of its volume or of any forces acting on it.
- Weight (w) (N)
⇒ The measure of the force of gravity on a body.

Linear motion

- Displacement (s) (m)
⇒ Distance travelled in a given time.
- Velocity (v/u) (m/s)
⇒ Rate of change of displacement with respect to time.
- Acceleration (a) (m/s²)
⇒ Rate of change of velocity with respect to time.

Force

- Force (f) (N)
⇒ Anything which causes something to accelerate.
- Momentum (p) (kgm/s)
⇒ The product of a body's velocity and mass.

Pressure

- Density (ρ) (kg/m³)
⇒ Mass per unit volume.
- Pressure (p) (Pa)
⇒ Force per unit area.
- Volume (V) (m³)
⇒ The amount of space that a substance or object occupies.

Moments

- Lever
⇒ A rigid body free to rotate about a fixed point known as a fulcrum.
- Moment
⇒ The magnitude of the force multiplied by the perpendicular distance from the axis to the force.
- Couple
⇒ A pair of equal parallel forces that turn in opposite directions.

Work, Energy and Power.

- Work (W) (J / Nm)
⇒ The energy given to a body by a force moving it through a displacement in the same direction as the applied force.
- Energy (E) (J)
⇒ The ability to do work.
- Potential Energy (E) (J)
⇒ Energy due to position or conformation.
- Kinetic Energy (E) (J)
⇒ Energy due to movement
- Power (P) (w)
⇒ The rate the work is done. / The rate of energy conversion.
- Efficiency (Eff) (%)
⇒ The comparison of energy put in to useful energy returned.

Circular Motion

- Radian (θ) (rad)
⇒ Unit of angle derived from an arc with an equal length to its radius.
- Linear speed (v) (m/s)
⇒ The distance travelled along the arc with respect to time.
- Tangential speed (v) (m/s)
⇒ Linear speed tangential to the circle.
- Angular velocity (ω) (rad/s)
⇒ The rate of change to angle with respect to time.
- Period (T) (s)
⇒ The time taken to complete one revolution.
- Centripetal Force (F) (N)
⇒ The force directed towards the centre of a circle that is necessary to keep a body moving in a circular path.
- Centripetal Acceleration (a) (m/s^2)
⇒ The acceleration towards the centre of a circle that holds a body in orbit.

- Geostationary Orbit
⇒ An orbit which takes place in the same plane of rotation as the planet and has an equal angular velocity. It only works for 1 height.

Simple Harmonic Motion

- SHM
⇒ A form of periodic motion in which the acceleration is always:
 - ◆ Directed towards the equilibrium.
 - ◆ Proportional to the displacement from the equilibrium.
- Oscillating
⇒ To move or swing back and forth with a steady rhythm.
- Cycle
⇒ The movement from one extreme to the other and back again.
- Frequency (f) (Hz)
⇒ Cycles per second.
- Period (T) (s)
⇒ The time taken to complete one cycle.
- Amplitude
⇒ The maximum displacement either side of the equilibrium.
- Damping
⇒ An effect that reduces the amplitude of oscillations over time.

Optics

- Incident ray
⇒ The light ray coming into the mirror/lens.
- Reflected/Refracted ray
⇒ The light ray leaving the mirror/lens.
- Normal
⇒ The perpendicular line drawn at the point of incidence of light.
- Angles of incidence and reflection.
⇒ The angles between the rays and the normal.
- Real Image
⇒ Image caused by the intersection of real light rays.
- Virtual Image
⇒ Image caused by the apparent intersection of light rays.
- Parallax
⇒ The difference in the apparent position of an object viewed through two different lines of sight.
- Centre of Curvature (c)
⇒ The theoretical centre of the sphere from which a curved mirror is taken.
- Principle Axis
⇒ The line joining the optical centre of the mirror to C.

- Pole (p)
⇒ The point where the principle axis intersects the mirror.
- Focal Point (f)
⇒ Halfway between C and the pole.
- Optical Distances
⇒ Object Distance (u) (m)
⇒ Image Distance (v) (m)
⇒ Focal Length (f) (m)

	Plane mirror	Concave mirror	Convex mirror	Convex lens	Concave lens
Object distance (u)	Always positive				
Image distance (v)	Always positive	Positive if real, negative if virtual.	Always negative	Positive if real, negative if virtual	Always negative
Focal length (f)	Always positive	positive	negative	positive	negative
Magnification (m)	Positive for upright, negative for inverted				

- Refraction
⇒ The bending of light at a boundary as it passes from 1 medium to another.
- Total Internal Reflection
⇒ When a light ray, travelling from a denser medium to a rarer medium at an angle greater than the critical angle, is completely reflected.
- Critical Angle
⇒ The angle in a denser medium that results in an angle of 90 degrees in the rarer medium.
- Mirages
⇒ Superior
 ♦ Cool air on warm air.
⇒ Inferior
 ♦ Warm air on cool air.
- Lens Power (P) (m^{-1})
⇒ The ability to converge or diverge rays.

Heat

- Heat (Q) (J)
⇒ A form of energy that causes a rise in temperature.
- Temperature (θ)(k/c)
⇒ The measure of the effect of heat energy on a body
- Thermometric property
⇒ A physical property that changes measurably and repeatedly with temperature change.

- Heat capacity (C) (J/K)
⇒ The heat required to change something's temperature by 1 kelvin.
- Specific heat capacity (c) (J/kg/K)
⇒ The amount of heat required to change 1 kg of a substance by 1 kelvin.
- Latent heat (L) (J)
⇒ The heat required to change a substance from 1 form to another without a change in temperature.
- Specific latent heat (l) (J/kg)
⇒ The heat required to change 1 kg of a substance from 1 form to another without a change in temperature.
 - ◆ ...of vaporisation: gas ↔ liquid
 - ◆ ...of fusion: liquid ↔ solid
- Conduction
⇒ The transfer of heat energy in a solid by passing on kinetic energy from molecule to molecule.
- Convection
⇒ The transfer of heat energy by circulation of the heated parts of a liquid or gas.
- Radiation
⇒ The transfer of heat energy as electromagnetic waves, without the need for a medium.
 - ◆ Infrared waves
- Solar constant
⇒ The amount of solar energy hitting 1m^2 of the earth's atmosphere every second.
- U-value
⇒ The amount of heat energy that can be transmitted across 1m^2 of a material every second, so long as there is a temperature difference of 1K each side of the material.

WAVES

- Frequency (f) (Hz)
⇒ Amount of wave fronts passing through a point every second. (pitch)
- Amplitude
⇒ The maximum displacement of the mean position. (loudness)
- Wavelength
⇒ Distance between wave fronts.
- Mechanical Waves
⇒ Require a medium to travel through and physically disrupt that medium.
- Electromagnetic Waves
⇒ Do not require a physical medium but cause electric and magnetic disruption.
- Travelling Waves
⇒ A wave in motion through a medium without causing an overall displacement of the medium.
- Longitudinal Waves
⇒ Wave vibrates parallel to the direction of propagation.

- Transverse Waves
⇒ Wave vibrates perpendicular to the direction of propagation.
- Diffraction
⇒ The spreading out of a wave as it moves through a gap or around an obstacle.
- Interference
⇒ When waves, in the same medium, combine to form a resultant amplitude.
⇒ Constructive
 - ◆ When waves combine to form a greater amplitude.
 ⇒ Destructive
 - ◆ When waves combine to form a lesser amplitude.
- Polarisation
⇒ When a wave is confined to a single plane.
- Standing Waves
⇒ Waves of the same frequency and amplitude that constructively and destructively interfere to form a wave pattern in a confined space.
- Node
⇒ Part of a standing wave which does not move.
- Antinode
⇒ Part of a standing wave which moves the most.
- The Doppler Effect
⇒ The relative change in frequency due to the relative motion of the source and observer.
- Fundamental Frequency (f) (Hz)
⇒ The largest standing wave.
- Sound Quality
⇒ The number of overtones/harmonics present.
- Overtones/Harmonics
⇒ Integer multiples of the fundamental frequency.
 - ◆ 1st harmonic = f
 - ◆ 1st overtone = 2f
- Intensity (I) (W/m^2)
⇒ The amount of sound energy passing through $1m^2$ perpendicular to the direction of propagation.
- Resonance
⇒ The transfer of energy between 2 bodies with the same natural frequency.
- Dispersion
⇒ The separation of light into its constituent colours.
- Colours
⇒ Primary
 - ◆ The three colours that combine to make white light.
 ⇒ Secondary
 - ◆ Combining 2 primary colours in equal amounts.
 ⇒ Complementary
 - ◆ Secondary colours that combine with primary colours to create white.

Electricity

- Conductor
⇒ A medium that allows electric charge to flow easily through it.
- Insulator
⇒ A medium that does not allow electric charge to flow easily through it.
- Electric field lines
⇒ Show the direction and strength of a force due to a positive charge in the field.
- Electric field strength
⇒ The force that a 1 coulomb charge would experience at a point in an electric field.
- Potential difference / voltage (V) (v)
⇒ The work required to move a charge of 1 coulomb from 1 point to another.
 - ◆ Unless specified the second point is ground.
- Electromotive Force EMF (E) (v)
⇒ Similar to voltage but created by induction.
- Capacitor
⇒ A device capable of storing an electrical charge.
- Current (I) (A)
⇒ A flow of charge through a conductor
 - ◆ Electrons, Ions, Holes
- Series
⇒ A circuit where there is no split.
- Parallel
⇒ A circuit where there is a split.
- Resistance (R) (Ω)
⇒ The ratio of potential difference across an object to the current flowing through it.
- Potential divider
⇒ A circuit structure that divides a voltage between 2 sub circuits.
- Resistivity
⇒ The potential a material has for resistance.
 - ◆ Length
 - ◆ Cross-sectional area
 - ◆ Material
- Wheatstone bridge
⇒ A circuit used to find the value of an unknown resistor via ratios.
 - ◆ Meter bridge
- Semiconductors
⇒ Materials with a resistivity between that of a good conductor and a good insulator
- Semiconductor conduction
⇒ Intrinsic
 - ◆ Conduction due to electrons and holes in a pure semiconductor material
⇒ Extrinsic
 - ◆ Increased conductivity due to the controlled addition of impurities

- ⇒ Doping
 - ◆ The controlled addition of impurities to a semiconductor to increase conductivity
- Semiconductor types
 - ⇒ P-type
 - ◆ Silicon with doped boron to increase the amount of holes in the semiconductor. There is a surplus of free positive charge carrying particles, yet the net charge is still 0.
 - ⇒ N-type
 - ◆ Silicon with doped phosphorus to increase the amount of free electrons in the semiconductor. There is a surplus of free negative charge carrying particles, yet the net charge is still 0.
- P-N diode / junction
 - ⇒ When a P and an N type semiconductor are joined together they form a single semiconductor which allows current to only flow in 1 direction.
- Depletion layer
 - ⇒ The region in the middle of a P-N diode / junction that is almost void of charge carrying particles due to a voltage being created.
- Magnetic field
 - ⇒ A region in space in which an isolated north pole would experience a force.
- Magnetic field lines
 - ⇒ The direction of the field is the direction of the force experienced by an isolated north pole.
- Magnetic Flux Density (B) (T)
 - ⇒ The magnetic flux density at a point in space is a vector quantity, whose magnitude is equal to the magnitude of the force experienced, by a current carrying conductor, of 1 meter with a current of 1 amp flowing through it and whose direction is the direction of the force experienced by an isolated north pole at that point in space.
 - ⇒ $F = BIl$
 - ⇒ $F = B(1)(1): F = B$
- 1 Ampere
 - ⇒ 1 amp is the constant current when 2 straight infinitely long parallel conductors are 1 meter apart, in a vacuum, with negligible cross-sectional area; experience a force between them of 2×10^{-7} N/m.
- Magnetic flux (Φ) (Wb)
 - ⇒ Number of magnetic field lines passing through a surface.
- Electromagnetic induction
 - ⇒ When a change in magnetic field creates an EMF in a conductor which in turn produces a current.
 - ⇒ Mutual induction
 - ◆ A change in magnetic field in 1 coil produces an EMF in another adjacent coil.
 - ⇒ Self-induction
 - ◆ A change in magnetic field in 1 coil produces a back EMF in itself.
- Transformer
 - ⇒ A device which can change the voltage of alternating current.
 - ◆ Step up / Step down

- Domestic electricity
 - ⇒ Ring circuit
 - ◆ Plug sockets
 - ◆ Normal appliances
 - ◆ 2 rings, live and neutral (decreases heating)
 - ⇒ Radial circuit
 - ◆ Large currents
 - ◆ Large appliances
 - ⇒ Lighting circuit
 - ◆ Lights connected in parallel
- Safety devices
 - ⇒ Fuses
 - ◆ A thin strip of metal with a known melting point, excessive current melts the strip breaking circuit, it is a 1-time use.
 - ⇒ Miniature Circuit Breaker MCB
 - ◆ Limits maximum current. Uses magnetic properties of current and breaks circuit if current becomes too high. It can be reset and re used.
 - ⇒ Residual Current Device RCD
 - ◆ Compares outgoing to incoming current. It will break the circuit if there is a difference between the 2.
 - ◆ Current is not lost in circuits, voltage is.
- Relay
 - ⇒ A solenoid that is used to trigger a mechanical process.
- Rectification
 - ⇒ The conversion of AC into DC using a diode or full bridge rectifier.
- LED
 - ⇒ A semiconductor that emits light as holes and free electrons combine.
- Transistor
 - ⇒ A semiconductor component with 3 connections that is capable of being used as a rapid switch between high and low current for computing logic.
 - ◆ Base: acts as a gate, alters output.
 - ◆ Collector: main input, stopped by Base.
 - ◆ Emitter: output.
- Logic gate
 - ⇒ A device comprised of transistors, capable of performing binary decisions in an electronic circuit, according to Boolean functions.
- Boolean logic
 - ⇒ Logic that uses combinations of 2 possibilities.
 - ◆ High / Low
 - ◆ True / False
 - ◆ 1 / 0
- Logic gates
 - ⇒ And gate
 - ◆ Will only have a high output if all inputs are high.

- ⇒ Or gate
 - ◆ Will have a high output if any input is high.
- ⇒ Not gate
 - ◆ Will have an output opposite to the input
 - ◆ High - > Low
 - ◆ Low - > High

MODERN PHYSICS

- The Electron Volt (W) (eV)
 - ⇒ The amount of energy lost or gained in moving an electron through a potential difference of 1V.
- Thermionic-emission
 - ⇒ The emission of electrons from the surface of a hot metal.
- The Photoelectric Effect / Photo-emission
 - ⇒ The emission of electrons from the surface of a metal when light of a suitable frequency falls on it.
 - ⇒ Threshold Frequency (F_0) (Hz)
 - ◆ The minimum frequency for photo-emission to take place.
 - ⇒ The Work Function
 - ◆ The minimum energy of a photon required for photo-emission to take place.
- Activity (A) (s^{-1})
 - ⇒ The number of nuclei decaying per second.
- Half Life ($T_{1/2}$) (s)
 - ⇒ The time taken for half a radioactive sample to decay.
- Radioactive Decay
 - ⇒ The spontaneous disintegration of a nucleus with the emission of 1 or more types of radiation.
- Nuclear Fission
 - ⇒ The splitting of a large nucleus into 2 similarly sized nuclei with the release of neutrons and energy.
- Nuclear Fusion
 - ⇒ The joining of 2 smaller nuclei into a larger nucleus with the emission of energy.
- Critical mass
 - ⇒ The minimum mass of fissile material required to sustain a chain reaction.
- The Mole / Avogadro's Number
 - ⇒ A mole of any substance has as many particles as there are atoms in 12g of C_{60} .

PARTICLE PHYSICS

- Transmutation
 - ⇒ The forced change in protons of a nucleus to produce a different element.
- The 4 fundamental forces
 - ⇒ Gravitation
 - ◆ A force which attracts all matter, it is extremely weak in comparison but its range is limitless, it effects all particles with mass.
 - ⇒ Electromagnetic
 - ◆ A force which interacts with all charged particles, it is the second strongest force with a limitless range, it is used in chemical bonding.
 - ⇒ Weak Nuclear
 - ◆ A force relating to beta decay that has a range of a nucleon, it is the second weakest force and effects all particles with mass.
 - ⇒ Strong Nuclear
 - ◆ A force which binds a nucleus together, it is the strongest force and has a range of a large nucleus (uranium 238), it effects all hadrons.
- Antimatter
 - ⇒ Matter composed of antiparticles which are particles identical to their counterpart in every way however charge is opposite.
 - ◆ A positron is an antiparticle of an electron with a charge of 1.
- Accelerators
 - ⇒ Linear
 - ◆ Accelerates charged particles using very large potential differences in a straight line.
 - ⇒ Circular
 - ◆ Accelerates charged particles using magnets to maintain circular motion and pulsed electrical current to accelerate the particles.
- Pair Production
 - ⇒ The simultaneous creation of a particle and its antiparticle from electromagnetic energy incident on a surface.
- Pair Annihilation
 - ⇒ The combining of a particle and its antiparticle resulting in their destruction and the emission of electromagnetic energy.
- The Particle Zoo
 - ⇒ Fermions
 - ◆ All particles with mass
 - ⇒ Leptons (electron)
 - ◆ Fundamental fermions that do not experience the strong nuclear force.
 - ⇒ Hadrons
 - ◆ Fermions which experience all 4 forces.
 - ⇒ Baryons (proton - uud, neutron - dud)
 - ◆ Hadrons formed from 3 quarks
 - ⇒ Mesons (pion - u \bar{d} , kaon - us)
 - ◆ Hadrons formed from a quark and an anti-quark

⇒ Quarks (up, down; strange, charm; top, bottom)

- ◆ A fundamental particle with a non-integer charge, combine in integer charges to form hadrons.