

A definition question is marked against fixed wording: the quantities named, and the relationship between them. These are written the way a mark scheme accepts them. Learn the italicised relationship – that is where the mark sits.

Quantities and units

Scalar – a quantity with magnitude only

Vector – a quantity with magnitude and direction

Precision – how close repeated readings are to each other; it is unrelated to whether they are correct

Accuracy – how close a reading is to the true value

Systematic error – an error that shifts every reading by the same amount or proportion, and which repeating cannot reduce

Random error – an error that varies unpredictably between readings, reduced by repeating and averaging

Mechanics

Displacement – the distance moved in a stated direction

Velocity – the rate of change of displacement

Acceleration – the rate of change of velocity

Force – the rate of change of momentum

Newton's first law – a body remains at rest or in uniform motion in a straight line unless acted on by a resultant force

Newton's third law – when two bodies interact, the forces they exert on each other are equal in magnitude, opposite in direction, and of the same type

Momentum – the product of mass and velocity

Principle of conservation of momentum – the total momentum of a system is constant provided no resultant external force acts

Elastic collision – a collision in which total kinetic energy is conserved; relative speed of approach equals relative speed of separation

Work done – the product of the force and the distance moved in the direction of the force

Power – the rate of doing work, or the rate of energy transfer

Centre of gravity – the point at which the entire weight of a body may be considered to act

Moment of a force – the product of the force and the perpendicular distance from the pivot to the line of action of the force

Couple – a pair of equal and opposite forces whose lines of action do not coincide

Principle of moments – for a body in equilibrium, the sum of clockwise moments about any point equals the sum of anticlockwise moments about that point

Pressure – force per unit area, acting normal to the surface

Upthrust – the upward force on a body in a fluid, equal to the weight of fluid displaced

Deformation and materials

Hooke's law – the extension is proportional to the applied force, provided the limit of proportionality is not exceeded

Stress – force per unit cross-sectional area

Strain – extension divided by original length; it has no unit

Young modulus – the ratio of stress to strain, for a material obeying Hooke's law

Elastic deformation – deformation from which the body returns to its original length when the load is removed

Plastic deformation – deformation which is permanent when the load is removed

Waves

Displacement (wave) – the distance of a point on the wave from its equilibrium position

Amplitude – the maximum displacement from the equilibrium position

Frequency – the number of complete oscillations per unit time

Wavelength – the distance between two adjacent points on a wave that are in phase

Phase difference – the fraction of a cycle, expressed as an angle, by which one oscillation leads or lags another

Intensity – power per unit area, proportional to the square of the amplitude

Progressive wave – a wave that transfers energy from one place to another without transferring matter

Transverse wave – a wave in which the oscillations are perpendicular to the direction of energy transfer

Longitudinal wave – a wave in which the oscillations are parallel to the direction of energy transfer

Polarisation – restriction of the oscillations of a transverse wave to a single plane containing the direction of travel

Principle of superposition – when two waves meet at a point, the resultant displacement is the vector sum of the individual displacements

Coherence – a constant phase difference between two waves, which requires the same frequency

Node / antinode – a node is a point of permanently zero displacement; an antinode is a point of maximum displacement

Electricity

- Electric current** – the rate of flow of charge
- Potential difference** – the energy transferred from electrical to other forms per unit charge passing between two points
- Electromotive force** – the energy transferred from other forms to electrical per unit charge driven round the circuit
- Resistance** – the ratio of potential difference across a component to the current through it
- Ohm's law** – the current in a metallic conductor is proportional to the potential difference across it, provided physical conditions such as temperature stay constant
- Resistivity** – the resistance of a sample of unit length and unit cross-sectional area, a property of the material
- Kirchhoff's first law** – the sum of currents into a junction equals the sum of currents out – a statement of conservation of charge
- Kirchhoff's second law** – round any closed loop, the sum of the e.m.f.s equals the sum of the p.d.s – a statement of conservation of energy

Fields

- Gravitational field strength** – the gravitational force per unit mass
- Gravitational potential** – the work done per unit mass in bringing a small mass from infinity to that point; it is always negative
- Newton's law of gravitation** – two point masses attract with a force proportional to the product of their masses and inversely proportional to the square of their separation
- Electric field strength** – the electric force per unit positive charge
- Electric potential** – the work done per unit positive charge in bringing a small charge from infinity to that point
- Coulomb's law** – two point charges exert a force proportional to the product of the charges and inversely proportional to the square of their separation
- Capacitance** – the charge stored per unit potential difference
- Magnetic flux density** – the force per unit length per unit current on a straight conductor placed at right angles to the field
- Magnetic flux** – the product of magnetic flux density and the area normal to the field
- Faraday's law** – the magnitude of the induced e.m.f. is proportional to the rate of change of magnetic flux linkage
- Lenz's law** – the direction of the induced e.m.f. is such as to oppose the change producing it

Thermal physics and oscillations

Internal energy – the sum of the random distribution of kinetic and potential energies of the molecules of a system

Specific heat capacity – the energy required per unit mass to raise the temperature by one kelvin

Specific latent heat of fusion – the energy required per unit mass to change state from solid to liquid without a change of temperature

First law of thermodynamics – the increase in internal energy equals the heat supplied to the system plus the work done on the system

Thermal equilibrium – two bodies are in thermal equilibrium when there is no net flow of thermal energy between them, which means they are at the same temperature

Simple harmonic motion – motion in which the acceleration is proportional to the displacement from a fixed point and always directed towards that point

Damping – the loss of energy, and hence amplitude, from an oscillating system because of resistive forces

Resonance – the large-amplitude response when a system is driven at its natural frequency, so energy transfer to the system is a maximum

Quantum and nuclear

Photon – a quantum of electromagnetic energy, of energy equal to Planck's constant times the frequency

Work function – the minimum energy required to remove an electron from the surface of a metal

Threshold frequency – the minimum frequency of incident radiation that will cause photoelectric emission from a given surface

de Broglie wavelength – the wavelength associated with a moving particle, equal to Planck's constant divided by its momentum

Nucleon number / proton number – the number of nucleons in a nucleus; the number of protons in a nucleus

Isotope – nuclei of the same element with the same proton number but different numbers of neutrons

Radioactive decay – the spontaneous and random emission of radiation from an unstable nucleus

Activity – the number of nuclear decays per unit time

Decay constant – the probability of decay of a nucleus per unit time

Half-life – the mean time taken for the number of undecayed nuclei, or the activity, to fall to half its initial value

Mass defect – the difference between the mass of a nucleus and the total mass of its separate nucleons

Binding energy – the energy required to separate a nucleus completely into its individual nucleons