Keyword	Definition	A1	A2	Topic
components	Parts of electric circuits, including bulbs, LDRs, thermistors, etc.	1	0	electricity
drift velocity	The average velocity of an electron as it travels through a wire due to a potential difference between two points. Surprisingly low. Typically just 1 m/s.	1	0	electricity
electrolyte	A fluid that contains ions that are free to move and hence conduct electricity.	1	0	electricity
fuse	An electrical component designed to heat up, melt and break the circuit (hence stop the current) when a specified amount of electric current passes through it. Used as a safety device.	1	0	electricity
I–V characteristic	A graph to show how the electric current through a component varies with the potential difference across it.	1	0	electricity
internal resistance	The resistance of a battery or cell, measured in ohms (Ω). Modelled as a small resistor r. Kirchoff equation: Emf = I (R + r).	1	0	electricity
light dependent resistor - LDR	A semi-conductor component that changes its resistance with changes in the light intensity (dark = high resistance, light = low resistance).	1	0	electricity
light emitting diode - LED	A semi-conductor component that only allows electric current to pass through it in one direction and that emits light when a p.d. is applied across it.	1	0	electricity
resistivity	The ratio of the product of resistance and cross-sectional area of a component and its length. Equation: ρ = R A / l. Units ohm-metre.	1	0	electricity
semiconductor	A material with a lower number density of conduction electrons than a conductor and therefore a higher resistance.	1	0	electricity
thermistor	A semi-conductor component that changes its resistance depending on its temperature. An NTC thermistor’s resistance reduces as the temperature increases.	1	0	electricity
upthrust	A force on an object due to a difference in pressure when immersed in a fluid. Good examples include the balloon and the boat.	1	0	electricity
infrared	A form of electromagnetic radiation with wavelengths between 7.4 x 10^–7 and 10^–3 m. Used in remote controls. Also known as thermal or heat radiation.	1	0	emradiation
microwaves	A form of electromagnetic radiation with wavelengths between 10^–4 and 10^–1 m. Used in mobile phone communications.	1	0	emradiation
radio waves	A form of electromagnetic radiation with wavelengths between 10^–1 m → 10^4 m. Used in telecommunications.	1	0	emradiation
ultraviolet	Ionising form of electromagnetic radiation with wavelengths between 10^–9 m and 3.7 × 10^–7 m. Causes sun tanning, cell mutations and skin cancers.	1	0	emradiation
X-rays	A form of electromagnetic wave with wavelengths between 10^–12 m and 10^–7 m. Used in X-ray photography, CAT scans.	1	0	emradiation
brittle	A property of a material. A material that distorts very little even when subject to a large stress and does not exhibit any plastic deformation. For example concrete.	1	0	materials
density	The mass per unit volume. Measured in kilograms per cubic metre (kg m^–3). A scalar quantity. Equation: ρ = m / V.	1	0	materials
ductile	A property of a material. Materials that have a large plastic region - therefore they can be drawn into a wire). For example copper.	1	0	materials

elastic deformation	The object will return to its original shape when the deforming force is removed.	1	0	materials
elastic limit	The point at which elastic deformation becomes plastic deformation.	1	0	materials
elastic potential energy	The energy stored in a stretched or compressed object (for example a spring). Measured in joules (J). A scalar quantity.	1	0	materials
extension	The change in length of an object when a force is applied to it, measured in metres (m). See Hooke's Law.	1	0	materials
force constant	The constant of proportionality (k) in Hooke's law. Measured in newtons per metre (N / m).	1	0	materials
Hooke's law	The extension of an elastic body is proportional to the force that causes it. $F = kx$	1	0	materials
plastic deformation	The object will not return to its original shape when the deforming force is removed, it becomes permanently distorted.	1	0	materials
polymeric material	A material made of many smaller molecules bonded together, often making tangled long chains. These materials often exhibit very large strains (e.g. 300%), for example rubber.	1	0	materials
spring constant	see force constant.	1	0	materials
strain	The extension per unit length. Equation: $\varepsilon = \Delta l / l$. A ratio so no units.	1	0	materials
stress	The force per unit cross-sectional area, measured in pascals (Pa). Equation: $\sigma = F / A$	1	0	materials
tensile force	Usually two equal and opposite forces acting on a wire in order to stretch it. When both forces have the value T, the tensile force is also T, not 2T.	1	0	materials
tensile stress	The tensile force per unit cross-sectional area.	1	0	materials
ultimate tensile strength	The maximum tensile force that can be applied to an object before it breaks.	1	0	materials
ultimate tensile stress	The maximum stress that can be applied to an object before it breaks.	1	0	materials
Young's modulus	The ratio of tensile stress to tensile strain, measured in pascals (Pa). Equation: $Ym = \sigma / \varepsilon$	1	0	materials
braking distance	The distance a vehicle travels whilst decelerating to a stop.	1	0	mechanics
compressive force	Two or more forces that have the effect of reducing the volume of the object on which they are acting.	1	0	mechanics
crumple zone	An area of a vehicle designed to increase the braking time during which the vehicle decelerates and so reduce the average force acting. $Ft = mv - mu$.	1	0	mechanics
displacement–time graph	A motion graph showing displacement against time for a given body.	1	0	mechanics
distance	How far an object travels, measured in metres (m), e.g. 12 m. A scalar quantity. A measure of the path travelled.	1	0	mechanics

drag	The resistive force that acts on a body when it moves through a fluid.	1	0	mechanics
drag coefficient	A characteristic that determines the amount of drag that acts on an object.	1	0	mechanics
force	A push or a pull on an object. The product of mass times acceleration. Measured in newtons (N). A vector quantity.	1	0	mechanics
instantaneous speed	The speed of an object at a given moment in time.	1	0	mechanics
mass (m)	A property of an object. The amount of matter or the resistance to acceleration. Measured in kilograms (kg). A scalar quantity.	1	0	mechanics
moment of a force	The turning effect due to a single force, measured in newton metres (N m). A vector quantity. Moment (of a force) = force x perpendicular distance to the line of action.	1	0	mechanics
principle of moments	For a body in rotational equilibrium the sum of the clockwise moments equals the sum of the anti-clockwise moments. Alternatively, $\Sigma \Gamma = 0$.	1	0	mechanics
stopping distance	The sum of the thinking distance and the braking distance. The total distance travelled from seeing the need to stop to the vehicle becoming stationary.	1	0	mechanics
terminal velocity	The velocity at which an object's drag force equals its accelerating force. Therefore there is no resultant force and zero acceleration.	1	0	mechanics
thinking distance	The distance travelled from seeing the need to stop to applying the brakes.	1	0	mechanics
torque	The turning effect due to a couple, measured in newton metres (N m).	1	0	mechanics
turning forces	One or more forces that if unbalanced will cause a rotation. See moments.	1	0	mechanics
vector	A physical quantity that has both magnitude (size) and direction. Examples include velocity, force, acceleration and electric current.	1	0	mechanics
electron	Negatively charged sub-atomic particle with a charge of 1.6×10^{-19} C. Conduction (free) electrons travel around circuits creating an electric current. A lepton.	1	0	particles
gradient of a graph	The change in y-axis over the change in the x-axis (rise over run). Equation $m = \Delta y / \Delta x$	1	0	practical
perpendicular	At right angles (90° or $\pi/2$ rad) to.	1	0	practical
de Broglie equation	An equation expressing the wavelength of a particle as a ratio of Planck's constant and the particle's momentum. $\lambda = h / mv$.	1	0	quantum
electron diffraction	Electrons behave as a wave when beamed through a gap and create diffraction patterns. For example through atoms in a crystal structure such as graphite. An example of wave–particle duality.	1	0	quantum
electronvolt	One electronvolt is the energy change of an electron when it moves through a potential difference of one volt. $1 \text{ eV} = 1.60 \times 10^{-19}$ J.	1	0	quantum
emission spectrum	A pattern of colours of light emitted by a substance with specific wavelengths. Explained by quantum mechanics, not waves. A unique 'fingerprint' for each element.	1	0	quantum
energy levels	One of the specific energies an electron can have when in an atom. Explained by quantum mechanics, not waves.	1	0	quantum

photocell	See LDR.	1	0	quantum
photoelectric effect	The emission of electrons from the surface of a material when electromagnetic radiation is incident on the surface. A quantum effect.	1	0	quantum
photon	A quantum of electromagnetic radiation. For example a photon of light is often described as a particle of light or a packet of wave energy.	1	0	quantum
Planck constant	Constant used in quantum physics. h = 6.63 × 10^–34 Js. See energy level equation: ΔE = hf	1	0	quantum
quantum	A discrete, indivisible quantity.	1	0	quantum
spectral line	A line relating to a specific frequency either missing from an absorption spectrum or present in an emission spectrum.	1	0	quantum
spectrum	A collection of waves with a range of frequencies, for example, the visible spectrum and the electromagnetic spectrum.	1	0	quantum
wave–particle duality	The theory that states all objects can exhibit both wave and particle properties.	1	0	quantum
work function energy	The minimum energy (Φ) required to release an electron from a material, measured in joules (J).	1	0	quantum
degree Celsius	Non-SI unit for temperature. For example 100°C = 373 kelvin.	1	0	thermal
fluid	A material that can flow from one place to another. Either a liquid or a gas.	1	0	thermal
Anti-node	A point of maximum amplitude along a stationary wave caused by constructive interference.	1	0	waves
coherence	Two waves with a constant phase relationship.	1	0	waves
diffraction	When a wave spreads out after passing around an obstacle or through a gap.	1	0	waves
fundamental frequency	The lowest frequency in a harmonic series where a stationary wave forms.	1	0	waves
harmonics	Whole-number multiples of the fundamental frequency of a stationary wave.	1	0	waves
interference	The addition of two or more waves (superposition) that results in a new wave pattern. Both constructive and destructive interference. See single and double slit experiments.	1	0	waves
longitudinal wave	A wave where the oscillations are parallel to the direction of wave propagation. For example sound and earthquake primary waves.	1	0	waves
Malus' law	A physical law describing the change in intensity of a transverse wave passing through a Polaroid analyser.	1	0	waves
monochromatic light	Light waves with a single frequency (or wavelength).	1	0	waves
node	A point that always has zero amplitude along a stationary wave caused by destructive interference.	1	0	waves

period	The time taken (T) for one complete pattern of oscillation. Measured in seconds (s). Equation T = 1 / f.	1	0	waves
phase difference	that have the same pattern of wave vibration are in phase: Φ = 0. Similarly, opposite pattern or out of phase: Φ = π radians.	1	0	waves
plane polarised wave	A transverse wave oscillating in only one flat two-dimensional space.	1	0	waves
polarisation	The process of turning an unpolarised wave into a plane polarised wave (for example, light passing through a Polaroid filter).	1	0	waves
progressive wave	A wave that travels from one place to another.	1	0	waves
reflection	When waves rebound from a barrier, changing direction but remaining in the same medium.	1	0	waves
refraction	When waves change direction when they travel from one medium to another due to a difference in the wave speed in each medium. See Snell's Law.	1	0	waves
Snell's Law	sin θ1 / sin θ2 = c1 / c2 = n2 / n1. Angle θ, wave speed c, refractive index n, wave travelling from medium 1 to medium 2. Angles measured to the normal line.	1	0	waves
stationary wave	A wave formed by the interference of two waves travelling in opposite directions.	1	0	waves
superposition	The principle that states that when two or more waves of the same type exist at the same place the resultant wave will be found by adding the displacements of each individual wave.	1	0	waves
transverse wave	A wave where the oscillations are perpendicular to the direction of wave propagation. For example water waves and electromagnetic waves.	1	0	waves
wave	A series of vibrations that transfer energy from one place to another.	1	0	waves
wavelength	The smallest distance between one point on a wave and the identical point on the next wave (e.g. the distance from one peak to the next peak), measured in metres (m).	1	0	waves
Young's double slit	An experiment to demonstrate the wave nature of light via superposition and interference. Produces light and dark 'fringes' on a screen or detector.	1	0	waves
astronomical unit	The average distance from the Earth to the Sun. 1 AU = 1.496 × 10^11 m.	0	1	astrophysics
big bang theory	The theory that the universe was created out of nothing from a single point. The universe was once much smaller, hotter and denser. It expanded from this state into the universe we see today.	0	1	astrophysics
binary stars	Two stars in orbit around their common centre of gravity.	0	1	astrophysics
black hole	The remains of the core of a very large star after it has gone supernova. It has an infinite density and a gravitational field strength so great that even light cannot escape.	0	1	astrophysics
closed universe	The situation if the mean density of the universe is greater than the critical density. The universe will collapse back into a single point (the 'big crunch').	0	1	astrophysics
comet	A body comprising mainly ice and rock in orbit around a star. These orbits are usually highly elliptical, on a different plane to the planetary orbits.	0	1	astrophysics
cosmological principle	On a large scale the universe is uniform; the universe is the same in all directions and of uniform density, provided a large enough volume is considered.	0	1	astrophysics

critical density of the universe	The average density of the universe above which the universe will collapse (closed universe) and below which the universe will expand forever (open universe). ρc = 9.5 × 10^–27 kg m^–3.	0	1	astrophysics
flat universe	The situation if the mean density of the universe is equal to the critical density. The galaxies in the universe will slow down but never quite stop. This situation is very unlikely.	0	1	astrophysics
galaxy	A large collection of stars orbiting its own centre of gravity. Our solar system is in the Milky Way spiral galaxy.	0	1	astrophysics
geostationary orbit	An orbit of the Earth made by a satellite that has the same time period as the rotation of the Earth (i.e. 24 hours) and is in the equatorial plane. Used for communications.	0	1	astrophysics
Hubble constant	The constant of proportionality used in Hubble's Law. S.I. units: Ho = 2.3 × 10^–18 s^–1. Popular units: H = (70 km/s) / MPc	0	1	astrophysics
Hubble's law	The speed of recession of a galaxy is directly proportional to its distance from the Earth. Use v = Hd. Recessional velocity v (m/s or km/s), distance d (m or Mega parsecs)	0	1	astrophysics
Kepler's third law	The period of a planet orbiting the sun squared is proportional to the mean radius of its orbit cubed. T^2 = k r^3.	0	1	astrophysics
light year	The distance light travels in a year through a vacuum. 1 light year = 9.461 × 10^15 metres.	0	1	astrophysics
main sequence star	A star in the main phase of its life, powered by nuclear fusion, fusing hydrogen into helium.	0	1	astrophysics
mean density of the universe	The average density of the universe.	0	1	astrophysics
meteorite	A fragment of rock (or occasionally metal such as iron) that has entered the Earth's atmosphere from space and has landed on the ground.	0	1	astrophysics
moon	A body orbiting a planet.	0	1	astrophysics
nebulae	A huge collection of mainly hydrogen gas forming a cloud-like structure in space. Often called a cloud of dust and gas or a star nursery.	0	1	astrophysics
neutron star	The remains of the core of a large star after it has undergone a supernova. It is incredibly dense and is composed mainly of neutrons. Also known as a pulsar.	0	1	astrophysics
Olbers' paradox	A paradox dealing with the finite or infinite nature of the universe. With an infinite numbers of stars in an infinite universe, no matter what direction you look you will always see a star along your line of sight. Therefore the night sky will be as bright as the day sky.	0	1	astrophysics
open universe	The situation if the mean density of the universe is less than the critical density. The universe will continue to expand.	0	1	astrophysics
parallax	The apparent change in position of an object to an observer compared to other objects much further away. Important in laboratory measurements and the parsec measurement in astrophysics.	0	1	astrophysics
parsec	A unit of distance originating from parallax triangulation methods applied to space. 1 Pc = 3.086 × 10^16 m. See parallax.	0	1	astrophysics
planet	A large, approximately spherical body, orbiting a star.	0	1	astrophysics
plasma	A state in which protons and electrons are not bound to one another because the temperature is too high. Occurs in the Sun and its atmosphere, fluorescent light tubes, plasma welding.	0	1	astrophysics
pulsar	see neutron star.	0	1	astrophysics

quark	A component of hadrons, possibly a fundamental particle. There are six types of quark; up, down, strange, charm, top and bottom.	0	1	astrophysics
quasar	Very distant objects with a very large brightness. Possibly galaxies with black holes at their centre.	0	1	astrophysics
red giant	A star in the later stages of its life that has nearly exhausted the hydrogen in its core. It therefore begins to fuse helium, cools and expands.	0	1	astrophysics
redshift	The apparent increase in wavelength caused when luminous objects (e.g. stars) move away from the observer. An example of the Doppler effect.	0	1	astrophysics
star	A large body in space emitting heat and light from nuclear fusion within its core.	0	1	astrophysics
Sun	The name given to our nearest star.	0	1	astrophysics
supernova	A huge explosion caused when a large star collapses in on itself.	0	1	astrophysics
universe	All the space, matter and energy that exists (i.e. everything that physically exists).	0	1	astrophysics
white dwarf	The end product of low mass stars when the outer layers have dispersed into space.	0	1	astrophysics
farad	Unit of capacitance (F). 1 farad is 1 coulomb of charge stored per volt. C = Q / V	0	1	capacitors
time constant	The time taken for the charge remaining on a capacitor to fall to 1/e of its original value. It can be found using the expression CR, measured in seconds (s).	0	1	capacitors
a.c. generator	A generator that uses slip rings to produce an alternating e.m.f. and so an alternating current.	0	1	electricity
alternating current	Electric current that reverses its direction with a constant frequency. For example the UK mains electricity supply is a.c. with a frequency of 50 Hz.	0	1	electricity
ammeter	A device used to measure electric current, connected in series with the components. Originally based on a moving coil galvanometer with a ‘shunt’ of resistors to turn it into an ammeter.	1	1	electricity
ampere	SI unit for electric current, e.g. current I = 4 A. Abbreviated amp.	1	1	electricity
back e.m.f	see induced e.m.f.	0	1	electricity
capacitance	The charge stored per unit potential difference, as given by C = Q / V. Measured in farads (F).	0	1	electricity
capacitor	An electrical component designed to store charge (electrons). Made from two plates of metal separated by an insulation layer.	0	1	electricity
capacitor discharge	Connecting a charged capacitor across a resistor and so enabling the charge to flow from one plate to another. The charge remaining decays exponentially, Q = Qo e^–t/CR.	0	1	electricity
charge	see electric charge.	1	1	electricity
conductor	A material with a high number density of free / conduction electrons and therefore a low resistance.	1	1	electricity

conservation of charge	Physical law stating that charge is conserved in all interactions; it cannot be created or destroyed.	1	1	electricity
conservation of momentum	Physical law stating that in the absence of external forces the total momentum of a system remains constant.	0	1	electricity
conventional current	A model used to describe the movement of charge in a circuit. Conventional current travels from + to –. Electrons travel in the opposite direction.	1	1	electricity
coulomb	Unit of electric charge (C), e.g. e = 1.6 × 10^–19 C. 1 coulomb = 1 amp × 1 second.	1	1	electricity
Coulomb's law	The force between two charges is proportional to the product of the charges and inversely proportional to the square of the distance between the charges.	0	1	electricity
current	see electric current.	1	1	electricity
dynamo	Direct current generator. A device that converts kinetic energy into electrical energy.	1	1	electricity
electric charge	Property of matter. Measured in coulombs (C), a scalar quantity. The difference in the number of protons and electrons.	1	1	electricity
electric current	The rate of flow of charge. An SI quantity. Measured in Amperes (A). A vector quantity. I = Q / t	1	1	electricity
electromotive force	The electrical energy transferred per unit charge when one form of energy is converted into electrical energy. E.m.f. measured in volts (V). Commonly called 'supply voltage'.	1	1	electricity
electron flow	The movement of electrons between a potential difference, from – to +. The opposite direction to conventional current.	1	1	electricity
insulator	A material with a small number density of free conduction electrons and therefore a very high resistance.	1	1	electricity
Kirchhoff's first law	The sum of the currents entering any junction is always equal to the sum of the currents leaving the junction. A form of conservation of charge. Note that current has direction given by + or – signs.	1	1	electricity
Kirchhoff's second law	The sum of the e.m.f.s is equal to the sum of the p.d.s in a closed loop. A form of conservation of energy.	1	1	electricity
newton	Unit of force (N). 1 N is the force which gives a mass of 1 kg an acceleration of 1 ms^–2. A person of mass 50kg has a weight of approximately 500 N on Earth.	1	1	electricity
ohm	Unit of resistance (Ω). 1 ohm = 1 volt per amp.	1	1	electricity
Ohm's law	The electric current (I) through a conductor is proportional to the potential difference (V) across it, provided physical conditions, such as temperature, remain constant. V = IR.	1	1	electricity
parallel circuit	A type of circuit where the components are connected in two or more branches and therefore provide more than one path for the electric current.	1	1	electricity
potential difference	The electrical energy transferred per unit charge when electrical energy is converted into some other form of energy. Measured in volts (V). V = E / Q	1	1	electricity
potential divider	A type of circuit containing resistors to split the p.d. in proportion to the resistances. Commonly seen in volume knobs and lighting dimmer switches.	1	1	electricity
potential gradient	The rate at which the potential difference changes with distance. For a uniform electric field; potential gradient E = V/d. Measured in V / m.	0	1	electricity

resistance	A property of a component that regulates the electric current through it. Measured in ohms (Ω). See Ohm's Law.	1	1	electricity
series circuit	A type of circuit where the components are connected end to end and therefore provide only one path for the electric current.	1	1	electricity
volt	Unit of potential difference and e.m.f. (V). For example, mains potential difference is. 230 V. 1 volt = 1 joule per coulomb.	1	1	electricity
voltmeter	Device used to measure the p.d. across a component. It is connected in parallel across a component.	1	1	electricity
electromagnetic wave	A self-propagating transverse wave that does not require a medium to travel through. Formed with electric and magnetic fields.	1	1	emradiation
gamma rays	A form of electromagnetic wave with wavelengths between 10^–16 m and 10^–9 m. Used in cancer treatment. Emitted from the nucleus during radioactive decay.	1	1	emradiation
angular momentum	A property of a rotating object that depends on its angular velocity. Angular momentum = moment of inertia x angular velocity.	0	1	engineering
electric field	A region of space where a charged particle experiences a force. The direction at a point is given by the force on a positive test charge at that point.	0	1	fields
electric field strength	Force per unit positive charge, given by E = F/q, measured in N C^–1.	0	1	fields
electromagnetic induction	The process of creating an electromotive force (e.m.f.) across a conductor with a changing magnetic field (mention flux linkage).	0	1	fields
Faraday's law	The magnitude of the induced e.m.f. is equal to the rate of change of flux linkage. Emf = d/dx ϕ	0	1	fields
field	A region in which a force operates.	0	1	fields
Fleming's left-hand rule	magnetic field. Thumb (motion), fore finger (magnetic field), middle finger (current), all at right angles to each other.	0	1	fields
Fleming's right-hand rule	a magnetic field. Thumb (motion), fore finger (magnetic field), middle finger (current), all at right angles to each other.	0	1	fields
global positioning system	A network of satellites used to determine an object's position on the Earth's surface via triangulation. GPS used in satellite navigation.	0	1	fields
gravitational field	A region in which a gravitational force acts on mass.	0	1	fields
gravitational field strength	The force acting per unit mass at a point. Measured in N kg^–1. On the surface of the Earth g = 9.81 N kg^–1.	0	1	fields
gravitational force	The force due a gravitational field acting on an object's mass. See Newton's Law of Gravity.	0	1	fields
gravitational potential energy	The energy stored by an object by virtue of the object being in a gravitational field. On Earth E = m g h.	0	1	fields
induced e.m.f.	The e.m.f. produced by electromagnetic induction.	0	1	fields
Lenz's law	The direction of any induced current is in a direction that opposes the flux change that causes it. Lenz provided the negative sign in Faraday's Law. Emf = - d/dx ϕ	0	1	fields

magnetic field	A region of space where a magnetic pole experiences a force. Field direction from North to South.	0	1	fields
magnetic field strength	An alternative name for magnetic flux density. Symbol B, measured in tesla (T).	0	1	fields
magnetic flux	The product of magnetic flux density and the area at right angles to the flux. Given by Φ = BA cos θ, measured in weber (Wb).	0	1	fields
magnetic flux density	A measure of the strength of the magnetic field as given by B = F/ILsinθ. Measured in tesla (T).	0	1	fields
magnetic flux linkage	The product of the magnetic flux and the number of turns on the coil it passes through. Given by magnetic flux linkage = NΦ, often measured in weber turns.	0	1	fields
mass spectrometer	A device using magnetic fields to sort accelerated charged particles by their mass, often used in conjunction with a velocity selector.	0	1	fields
Newton's law of gravitation	The gravitational force of attraction between two bodies is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centres of mass.	0	1	fields
tesla	Unit of magnetic flux density (T). 1 T is the magnetic flux density that will produce a force of 1 N on 1 m of wire carrying a current of 1 A perpendicular to the direction of the magnetic field.	0	1	fields
transformer efficiency	The ratio of the energy output of a transformer to its energy input.	0	1	fields
transformer, step-down	A device that has a greater number of wire turns on the input side than the output side and so reduces the e.m.f. and increases the electric current on the output side.	0	1	fields
transformer, step-up	A device that has a greater number of wire turns on the output side than the input side and so increases the e.m.f. and reduces the electric current on the output side.	0	1	fields
turns ratio	The ratio of turns of wire on the input (primary) side to the output (secondary) side of a transformer. This equals the ratio of the input e.m.f. to the output e.m.f.. Vp / Vs = Np / Ns	0	1	fields
velocity selector	A device using electric and magnetic fields to select a specific velocity of charged particles.	0	1	fields
weber	Unit of magnetic flux (Wb). 1 Wb is the flux when a magnetic flux density of 1 T passes through an area of 1 m^2 at right angles.	0	1	fields
homogeneous	Of uniform density.	0	1	materials
resultant force	The overall force when two or more forces are combined.	1	1	materials
acceleration	The rate of change of velocity. Measured in metres per second squared (m s^–2); a vector quantity. Equation: a = (v – u) / t.	1	1	mechanics
acceleration of free fall	The acceleration of a body falling under gravity. On Earth, g = 9.81 m s^–2.	1	1	mechanics
average speed	A measure of the total distance travelled in a certain time. Measured in m/s.	1	1	mechanics
centre of gravity	The point at which the entire weight of an object can be considered to act.	1	1	mechanics
centre of mass	see centre of gravity (N.B. although there is a technical difference it is not required at this level).	1	1	mechanics

centripetal acceleration	The acceleration of a body moving in a circle with constant speed, acting towards the centre of the circle. Given by a = v^2 / r, measured in ms^–2.	0	1	mechanics
centripetal force	The resultant force on an object, acting towards the centre of the circle causing it to move in a circular path. Given by F = mv^2 / r. Measured in newtons (N).	0	1	mechanics
circular motion	When an object travels along a circular path, either in a complete circle or as part of a curve with constant radius.	0	1	mechanics
components of a vector	The results from resolving a single vector into horizontal and vertical parts (or perpendicular parts).	1	1	mechanics
conservation of energy	Physical law stating that energy cannot be created or destroyed, only transformed from one form into another or transferred from one place to another. True for any closed system.	1	1	mechanics
couple	Two forces acting on an object that are equal in magnitude and opposite in direction to each other but not in the same straight line of action.	1	1	mechanics
critical damping	The damping of an oscillating system when resistive forces cause the amplitude to decay very quickly (e.g. a pendulum through thick treacle).	0	1	mechanics
damped oscillations	Oscillations in which the kinetic energy is converted into other forms and so the amplitude of the oscillation reduces.	0	1	mechanics
displacement	The distance travelled in a particular direction, measured in metres (m). For example 3 m North of the origin. A vector quantity.	1	1	mechanics
efficiency	The ratio of useful output energy to total input energy.	1	1	mechanics
elastic collision	In a perfectly elastic collision both kinetic energy and momentum are conserved.	0	1	mechanics
energy	The ability to do work, measured in joules (J). A scalar quantity. Energy transferred = work done. See work done.	1	1	mechanics
equations of motion	The ‘SUVAT’ equations used to describe displacement, acceleration, initial velocity, final velocity and time when a body undergoes a constant acceleration.	1	1	mechanics
equilibrium	When there is zero resultant force and zero resultant torque acting on an object.	1	1	mechanics
force	A push or a pull on an object. The product of mass x acceleration, measured in newtons (N); a vector quantity.	0	1	mechanics
free fall	When an object is accelerating under gravity without resistance. At the surface of the Earth g = 9.81 m s^–2.	1	1	mechanics
free-body diagram	A diagram containing only one body with the forces shown acting on that body, labelled with force arrows.	0	1	mechanics
gravitational constant	Constant of proportionality used in Newton’s law of gravitation. G = 6.673 × 10^–11 m^3 kg^–1 s^–2.	0	1	mechanics
impulse	The product of the force acting on a body and the time it is acting, given by impulse = FΔt. It can also be considered to be the change in momentum of a body. Measured in N s or kg m/s	0	1	mechanics
inelastic collision	A collision where momentum is conserved but kinetic energy is not conserved.	0	1	mechanics
joule	Unit of energy (J). 1 J is the work done when a force of 1 N moves its point of application 1 m in the direction of the force.	1	1	mechanics

kilowatt	Unit of power (kW). 1k W = 1000 W. Commonly used in calculations of domestic power use.	1	1	mechanics
kilowatt-hour	Unit of energy (kWh). Used by electricity companies when charging consumers for electricity. 1 kWh = 1000 W for 3600 s = 3.6 MJ.	1	1	mechanics
kinetic energy	The work an object (mass m kg) can do by virtue of its speed (v m/s), measured in joules (J). A scalar quantity. E = ½ mv^2	1	1	mechanics
linear momentum	The product of an object's mass and velocity, given by p = mv. Measured in kg ms^–1; a vector quantity.	0	1	mechanics
mass	SI quantity, measured in kilograms (kg). A scalar quantity. A measure of the matter in an object.	0	1	mechanics
moment of a force	The turning effect due to a single force, the product of the force and the perpendicular distance from a given point, measured in newton metres (Nm). A vector quantity.	0	1	mechanics
momentum	see linear momentum.	0	1	mechanics
Newton's first law	One of Newton's three laws of motion. An object will remain at rest or continue travelling at a constant velocity unless acted upon by an external / unbalanced force.	0	1	mechanics
Newton's second law	proportional to the resultant force acting on a mass, in the same direction as the force. Often written as F = Δp/Δt.	0	1	mechanics
Newton's third law	One of Newton's three laws of motion. When body A exerts a force on body B, body B exerts an equal and opposite force on body A.	0	1	mechanics
potential energy	Stored energy. See gravitational potential energy and elastic potential energy.	1	1	mechanics
power	The rate of doing work. Measured in watts (W), a scalar quantity. P = E / t	1	1	mechanics
pressure	Force per unit area. Measured in pascals (Pa). 1 Pa = 1 N m^-2. A scalar quantity. Equation: P = F / A	1	1	mechanics
resolution of vectors	Splitting a vector into horizontal and vertical components (or perpendicular components). Perpendicular components may be considered independently.	1	1	mechanics
resultant velocity	The overall velocity when combining two or more velocities.	1	1	mechanics
scalar	A physical property with magnitude (size) but not direction. For example, speed, distance, pressure, potential difference, etc.	1	1	mechanics
speed	The distance travelled per unit time, measured in metres per second (m / s), e.g. 12 m s^–1. A scalar quantity. Speed (v) = distance (s) / time (t).	1	1	mechanics
thrust	A type of force due to an engine.	1	1	mechanics
triangle of forces	If three force (vectors) acting at a point can be represented by the sides of a triangle, the forces are in equilibrium.	1	1	mechanics
velocity	The displacement per unit time, measured in metres per second (m / s) For example, $\underline{v}$ = 330 m s^–1, in the direction North. A vector quantity.	1	1	mechanics
velocity–time graph	A motion graph showing velocity against time for a given body.	1	1	mechanics

watt	Unit of power (W). For example, for a powerful LED lamp, P = 10 W. 1 watt = 1 joule per second.	1	1	mechanics
weight	The gravitational force on a body, measured in newtons. W = m g	1	1	mechanics
work	The product of force and the distance moved in the direction of the force. Also considered as the energy transferred from one form into another. Work W measured in joules (J). A scalar quantity.	1	1	mechanics
acoustic impedance	The property of a material that determines the intensity of ultrasound refracted at a boundary with another material. As given by Z = ρc, measured in kg m^–2 s^–1.	0	1	medical
attenuation coefficient	A constant (μ) used to calculate the intensity (I) of X-rays as they pass through a material. I = Io e^–μx.	0	1	medical
collimation	Focussing an electromagnetic wave (e.g. X-rays) to provide a parallel beam. A cylinder with two small holes at either end.	0	1	medical
Compton effect	The effect whereby X-rays deflected off particles have a longer wavelength than their initial wavelength.	0	1	medical
computerised axial tomography (CAT)	A process using X-rays in 3D and computers in order to produce an image of a slice through the body.	0	1	medical
endoscope	A coated bundle of optic fibres inserted into the body to provide an image of the internal organs without the need for invasive surgery.	0	1	medical
gamma camera	A detector of gamma photons emitted from a patient given a radioactive tracer. This is used to produce a real-time image of the path of the tracer through the body.	0	1	medical
half-value thickness	The distance in a medium over which X-ray intensity is attenuated to half its original value.	0	1	medical
impedance matching	The process of matching up materials with similar acoustic impedances to allow good transmission of ultrasound through the materials. For example the use of gel with ultrasound scanning.	0	1	medical
Larmor frequency	The frequency of precession (wobble) of a proton in a magnetic field. Given by 4.25 × 10^–7 × B, where B is the magnetic field strength. Used in magnetic resonance imaging (MRI) scanners.	0	1	medical
magnetic moment	A magnetic property caused by a charged particle spinning.	0	1	medical
magnetic resonance imaging	The use of powerful magnetic fields, the spin of hydrogen atoms and powerful computing to produce a detailed 3D scan of soft tissues in the body. Abbreviated MRI.	0	1	medical
piezoelectric effect	The change in volume of certain crystals when a potential difference is applied across them. Alternatively the production of an e.m.f. when certain crystals are placed under stress.	0	1	medical
positron emission tomography	The use of gamma photons produced when positrons annihilate with electrons inside the body to map out active areas within the body.	0	1	medical
precession	Wobble. The movement of a spinning object caused by the effect of a torque leading to a change in the direction of its axis of rotation.	0	1	medical
pulse repetition frequency	Number of ultrasound pulses per second in ultrasound imaging.	0	1	medical
tracer	A radioactive nuclide either ingested by, or injected into, a patient that emits gamma photons to be detected by a gamma camera. For example, Technetium.	0	1	medical
transducer	A device that converts a non-electrical signal (e.g. sound) into an electrical signal. For example a microphone.	0	1	medical

ultrasound	Sound waves above the audible range of human hearing (i.e. greater than 20 000 Hz).	0	1	medical
activity	The number of radioactive decays per unit time. Measured in becquerels (Bq).	0	1	nuclear
alpha particle	A particle comprising 2 protons and 2 neutrons ejected from the nucleus during radioactive decay.	0	1	nuclear
atom	The smallest part of a specific element. It comprises protons, neutrons in the nucleus orbited by electrons.	0	1	nuclear
becquerel	Unit of activity. 1 Bq is 1 radioactive decay per second.	0	1	nuclear
beta minus decay	The radioactive decay that causes emission of a beta particle and an antineutrino from the nucleus when a neutron breaks down into a proton under the influence of the weak nuclear force.	0	1	nuclear
beta particle	A high-speed electron emitted from the nucleus during beta decay.	0	1	nuclear
binding energy	The energy required to separate an atom into its component parts.	0	1	nuclear
binding energy per nucleon	The average energy required to remove a nucleon from the nucleus.	0	1	nuclear
chain reaction	One reaction causing one or more other reactions, which causes further reactions, etc. For example an ‘exponential’ nuclear chain reaction in a nuclear reactor or nuclear weapon.	0	1	nuclear
decay constant	The probability of radioactive decay. Given by λ = A/N, measured in s^–1.	0	1	nuclear
fission	The process of splitting a large nucleus into two smaller nuclides, often with the emission of several neutrons. This releases energy dur to the change in binding energy.	0	1	nuclear
fission products	The particles and energy released when a nucleus undergoes fission.	0	1	nuclear
fusion	The process of two nuclei joining together and releasing energy due to a change in binding energy.	0	1	nuclear
Geiger-Müller counter	A device used to measure radioactive decay by ionisation of the gas inside the Geiger-Müller tube.	0	1	nuclear
half-life	The average time taken for the activity (or undecayed nuclei) of a radioactive source to decrease to one half of its original value.	0	1	nuclear
ion	A particle that has a charge (imbalance) due to the loss or gain of electrons.	0	1	nuclear
ionisation	The process of adding or removing electron(s) from an atom. NB ionisation by radioactive particles only ever involves removal of electrons.	0	1	nuclear
isotopes	Nuclides with the same number of protons but different numbers of neutrons. For example carbon-12 and carbon-14.	0	1	nuclear
neutron	A component of a nucleus. It comprises 3 quarks (1 up and 2 down) and has no charge.	0	1	nuclear
neutron number	The number of neutrons inside a certain nucleus. Symbol N.	0	1	nuclear

nuclear reactor	A device that enables the energy released in nuclear fission to convert water to steam to turn turbines.	0	1	nuclear
nucleon	A particle in the nucleus; a proton or neutron.	0	1	nuclear
nucleon (mass) number	The number of neutrons added to the number of protons inside a certain nucleus. An alternative name for mass number. Symbol A.	0	1	nuclear
nucleus	The centre of an atom containing protons and neutrons.	0	1	nuclear
nuclide	A nucleus defined by the particular number of protons (Z) and neutrons (A – Z).	0	1	nuclear
proton	A component of a nucleus. It comprises 3 quarks (2 up and 1 down) and has a charge of 1.6 × 10^–19 C.	0	1	nuclear
proton number	The number of protons inside a certain nucleus. Also known as the atomic number. Symbol Z.	0	1	nuclear
radioactive decay	The breakdown of a radioactive nuclide causing the emission of an alpha particle, beta particle or gamma photon from the nucleus.	0	1	nuclear
radioactivity	The process of the decay of a radioactive nuclide.	0	1	nuclear
random	when they will decay. Statistical methods are used to model the large scale behaviour of radioactive materials.	0	1	nuclear
scattering	The deflection of charged particles off other charged particles. For example, Rutherford’s alpha particles scattered by the nucleii of gold atoms.	0	1	nuclear
slow neutrons	Neutrons that have been slowed by the use of a moderator such as graphite in a nuclear reactor. Also called thermal neutrons.	0	1	nuclear
spontaneous	Radioactive decay is spontaneous. Changing physical conditions (e.g. temperature or pressure) will not cause or prevent the decay of a radioactive nucleus.	0	1	nuclear
transmutation	The change of a nuclide by changing the number of protons and / or neutrons.	0	1	nuclear
unified atomic mass unit	Unit of mass (u), equal to 1/12 the mass of an atom of the carbon-12 nuclide.	0	1	nuclear
annihilation	The process when a particle and antiparticle interact and their combined mass is converted to energy via E = mc^2.	0	1	particles
antiparticle	A particle of antimatter that has the same rest mass but, if charged, the equal and opposite charge to its corresponding particle. For example the positron is the antiparticle of the electron.	0	1	particles
baryon	A particle consisting of three quarks (e.g. a proton or neutron).	0	1	particles
baryon number	A property of baryons and quarks that is conserved in particle interactions.	0	1	particles
bottom	Type of quark.	0	1	particles
charm	Type of quark.	0	1	particles

cloud chamber	A device used to detect a charged particle by the formation of small clouds along trails of ions. The earliest type of particle detector.	0	1	particles
down	Type of quark	0	1	particles
fundamental particle	A particle that cannot be broken down into smaller components, e.g. leptons.	0	1	particles
hadron	A particle consisting of quarks (i.e. baryons and mesons).	0	1	particles
lepton	A fundamental particle. For example an electron or a neutrino.	0	1	particles
lepton number	A property of leptons that is conserved in interactions.	0	1	particles
meson	A short-lived particle comprised of a quark and anti-quark pair.	0	1	particles
neutrino	A fundamental particle (lepton) with a very small mass and no charge.	0	1	particles
pair production	The process of creating a particle–antiparticle pair from a high-energy photon. For example X-ray → electron + positron.	0	1	particles
pion	An example of a meson containing a quark and antiquark. Limited to up and down quarks.	0	1	particles
spin	A property of a particle related to its angular momentum.	0	1	particles
strange	Type of quark.	0	1	particles
strangeness	The property of some quarks that is conserved in the strong interaction but not conserved in weak interactions.	0	1	particles
strong interaction	Interactions involving the strong nuclear force.	0	1	particles
strong nuclear force	The force between nucleons that holds the nucleus together. All particles that contain quarks can interact via the strong nuclear force.	0	1	particles
top	Type of quark.	0	1	particles
up	Type of quark.	0	1	particles
weak interaction	Interactions involving the weak nuclear force.	0	1	particles
weak nuclear force	The force that is responsible for beta decay. It occurs between leptons and during hadron decay.	0	1	particles
area	A physical quantity representing the size of a surface (A), measured in metres squared (m^2).	1	1	practical
exponential	A function that varies as the power of another quantity. For example if y = a^x, y varies exponentially with x.	0	1	practical

exponential decay	At any given time interval there is the same ratio of final value to starting value. For example capacitor discharge and radioactive decay. Of the form y = ka^x.	0	1	practical
inverse square law	A type of law that obeys the relationship, Force = k / distance squared, measured from the centre of the force field. For example Newton's law of gravitation and Coulomb's law for electrostatics.	0	1	practical
time interval	SI quantity, measured in seconds (s). A scalar quantity.	1	1	practical
absorption spectra	A spectrum of dark lines across the pattern of spectral colours produced when light passes through a gas and the gas absorbs certain frequencies, depending on the elements in the gas.	1	1	quantum
Einstein's mass/energy equation	Equation linking energy, mass and the speed of light in a vacuum. E = mc^2. Einstein concluded that the mass of an object would increase if energy were absorbed and vice versa.	0	1	quantum
line spectrum	A spectrum produced by a material that contains discrete frequencies, due to electron transitions between energy levels. A quantum effect.	1	1	quantum
threshold frequency	The lowest frequency of electromagnetic radiation that will result in the emission of photoelectrons from a specified metal surface. See photoelectric effect.	0	1	quantum
displacement – waves	The displacement of a body undergoing SHM from the rest or equilibrium position. Given by x = xo sin (2πft) or x= xo cos (2πft). Measured in metres (m).	0	1	SHM
forced oscillation	When a driving force acts on an object in order to keep it oscillating.	0	1	SHM
free oscillations	When an object oscillates without a driving force acting to keep it oscillating. Objects undergoing free oscillations vibrate at their natural frequency.	0	1	SHM
heavy damping	The reduction in amplitude of an oscillating system by large resistive forces, e.g. a pendulum travelling through water.	0	1	SHM
light damping	The damping of an oscillating system by small forces, e.g. a pendulum oscillating through air.	0	1	SHM
natural frequency	The frequency of the free oscillations of a system. For example the natural frequency of a pendulum is the frequency at which that pendulum will swing once released.	0	1	SHM
resonance	When the driving frequency is equal to the natural frequency of an oscillating system. This causes a dramatic increase in the amplitude of the oscillations.	0	1	SHM
simple harmonic motion	When the acceleration (a) of an object is directly proportional to its displacement (x) from the equilibrium position and in the opposite direction. SHM: a = –k x.	0	1	SHM
amount of substance	SI quantity. Number of particles such as molecules. Measured in moles (mol). See Avogadro's constant.	1	1	thermal
Avogadro constant	A constant giving the number of particles in 1 mol of a substance. NA = 6.022 × 10^23 mol^–1 particles.	0	1	thermal
Boltzmann constant	energy of the particles in the gas. It can be thought of as the gas constant for a single molecule. k = 1.3807 × 10^–23 J K^–1.	0	1	thermal
Boyle's law	The volume of a fixed mass of gas is inversely proportional to pressure exerted on it, provided temperature remains constant.	0	1	thermal
Brownian motion	The random movement of small particles (e.g. pollen or smoke particles) when suspended in a liquid or gas. Now known to be caused by collisions from much smaller molecules.	0	1	thermal
Celsius	see degree Celsius.	1	1	thermal

heat capacity	The amount of energy required to raise the temperature of an object by one kelvin. See specific heat capacity which is different.	0	1	thermal
ideal gas	A model gas that has internal energy only in the form of random kinetic energy, obeys all three gas laws.	0	1	thermal
ideal gas equation	The equation linking pressure of a gas (p), volume of a gas V (m^3), molar gas constant R (8.31 J/K/mol), number of moles of gas n and temperature T (kelvin). pV = nRT = NkT.	0	1	thermal
ideal gas temperature	Proportional to the volume of a fixed mass of an ideal gas at constant pressure. Measured in kelvin.	0	1	thermal
internal energy	The sum of all the kinetic and potential energies of molecules within a substance.	0	1	thermal
isotropic	The same in all directions.	0	1	thermal
kelvin	SI unit of temperature (K), e.g. 373 kelvin = 100 deg celsius. Absolute zero is zero kelvin.	0	1	thermal
kinetic model of a gas	The model used to explain properties of gases (pressure, volume, temperature) in terms of the movement and interaction of gas particles.	0	1	thermal
latent heat of fusion	The energy required to change the state of a substance at its melting point from solid to liquid. Measured in joules J. See also specific latent heat.	0	1	thermal
latent heat of vaporisation	The energy required to change the state of a substance at its boiling point from liquid to gas. Measured in joules J. See also specific latent heat of vaporisation.	0	1	thermal
molar gas constant	A constant used when dealing with gases. R = 8.31 J mol^–1 K^–1. See ideal gas equation.	0	1	thermal
mole	Amount of any substance containing 6.02 × 10^23 particles.	0	1	thermal
molecular ordering	A description of the arrangement of molecules within a substance.	0	1	thermal
molecular spacing	A measure of the average separation between molecules in a substance.	0	1	thermal
molecule	The smallest part of a specific chemical compound.	0	1	thermal
phase of a substance	Indicates whether a substance is a solid, a liquid or a gas.	0	1	thermal
specific heat capacity	The energy required to raise the temperature of 1 kg of a substance by 1 K. Measured in J kg^–1 K^–1.	0	1	thermal
specific latent heat of fusion	The energy required to change the state of 1 kg of a substance at its melting point from solid to liquid. Measured in J kg^–1.	0	1	thermal
specific latent heat of vaporisation	The energy required to change the state of 1 kg of a substance at its boiling point from liquid to gas. Measured in J kg^–1.	0	1	thermal
state of a substance	Indicates whether a substance is a solid, a liquid or a gas.	0	1	thermal
temperature	SI quantity, measured in kelvins (K). For example, the freezing point of water is 0 deg Celsius or 273 K. Symbol T or θ.	0	1	thermal

thermal equilibrium	The condition whereby two objects are at the same temperature and so there is no net thermal energy transfer between them.	0	1	thermal
volume	A physical quantity representing how much 3D space an object occupies, measured in metres cubed (m^3). V (cuboid) = l b h.	0	1	thermal
amplitude	The maximum displacement of a wave from its mean (or rest) position, measured in metres (m). Symbol A or xo.	1	1	waves
Doppler effect	The change in wavelength caused by the relative motion between the wave source and an observer. For example the change in pitch of a police siren as the car passes by.	0	1	waves
driving force	A force applied at regular intervals in order to keep an object oscillating.	0	1	waves
driving frequency	The frequency of the driving force applied to an oscillating object.	0	1	waves
frequency	The number of complete oscillations per unit time. Measured in hertz (Hz). For example main electricity f = 50 Hz. Equation: f = 1 / T.	1	1	waves
intensity	The energy incident per square metre of a surface per second, measured in watts per metre squared (Wm^–2). Intensity I = P / A , power P (watts), area A (m^2).	1	1	waves
phase difference – oscillations	that have the same pattern of wave vibration are in phase: Φ = 0. Similarly, opposite pattern or out of phase: Φ = π radians.	0	1	waves
radian	Unit of angle or phase difference. One radian is the angle subtended by an arc of equal length to the radii. Equation l = r θ radians. Conversion: 2π rad = 360deg.	1	1	waves
standing wave	An alternative name for a stationary wave.	1	1	waves
superposition	The principle that states that when two or more waves of the same type exist at the same place the resultant wave will be found by adding the displacements of each individual wave.	0	1	waves
time period	The time taken for one complete wave to pass a given point or one complete revolution of a circle, measured in seconds (s).	0	1	waves