

Cambridge International Examinations

Advanced Subsidiary Level in Physics

List of Glossary

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A

acceleration

The rate of change of an object's velocity:

$$a = \Delta v / \Delta t$$

Unit: ms^{-2} .

ampere

The SI unit of electric current (abbreviated A).

amplitude

The maximum displacement of a particle from its equilibrium position.

antinode

A point on a stationary wave with maximum amplitude.

average speed

The total distance travelled by an object divided by the total time taken.

B

base units

Defined units of the SI system from which all other units are derived.

best fit line

A straight line drawn as closely as possible to the points of a graph so that similar numbers of points lie above and below the line.

C

centre of gravity

The point where the entire weight of an object appears to act.

charge carrier

Any charged particle, such as an electron, responsible for a current.

closed system

A system of interacting objects in which there are no external forces.

coherent

Two sources are coherent when they emit waves with a constant phase difference.

components (of a vector)

The magnitudes of a vector quantity in two perpendicular directions.

compression

A region in a sound wave where the air pressure is greater than its mean value.

compressive

Describes a force that squeezes an object.

conservation of momentum

In a closed system, when bodies interact, the total momentum in any specified direction remains constant.

constructive interference

When two waves reinforce to give increased amplitude.

contact force

The force an object exerts on another with which it is in contact.

contrast

In a high-contrast image, there is a big difference in brightness between bright and dark areas.

coulomb

The SI unit of electrical charge (abbreviated C). A charge of 1 C passes a point when a current of 1 A flows for 1 s. $1\text{ C} = 1\text{ A s}$.

couple

A pair of equal and antiparallel forces having a turning effect but no resultant force.

D

density

The mass per unit volume of a material:

$$\rho = m/V$$

Unit: kg m^{-3} .

dependent variable

The variable in an experiment with a value that changes as the independent variable is altered by the experimenter.

derived units

Units which are combinations of the base units of the SI system.

destructive interference

When two waves cancel to give reduced amplitude.

diffraction

The spreading of a wave when it passes through a gap or past the edge of an object.

displacement

The distance moved by an object in a particular direction (measured from a fixed starting point).

Doppler effect

The change in frequency or wavelength of a wave observed when the source of the wave is moving towards or away from the observer (or the observer is moving relative to the source).

drift velocity, mean

The average speed of a collection of charged particles when a current flows.

dynamics

The study of motion using quantities such as force and mass.

E

e.m.f.

The total work done when unit charge is moved round a complete circuit. Unit: J C^{-1} or volt (V).

efficiency

The ratio of useful output energy to the total input energy for a device, expressed as a percentage:

efficiency =

$$(\text{useful output energy} / \text{total input energy}) \times 100\%$$

elastic limit

The value of stress beyond which an object will not return to its original dimensions.

elastic potential energy

Energy stored in a stretched or compressed material.

electric charge

A property of a body that gives rise to a force on the body when it is within an electric field.

electric field

A region in which a charged body experiences a force.

electric field strength

The force per unit positive charge at a point. Unit: V m^{-1} or N C^{-1} .

electric potential

The energy per unit charge due to a charged body's position in an electric field.

electrical resistance

The ratio of potential difference to current. Unit: ohm (Ω).

electrolyte

An electrically conducting solution. The conduction is due to positive and negative ions in the solution.

electromagnetic spectrum

The family of waves that travel through a vacuum at a speed of $3.00 \times 10^8\text{ m s}^{-1}$.

electronvolt

The energy gained by an electron travelling through a p.d. of 1 volt. $1 \text{ eV} = 1.60 \times 10^{-19} \text{ J}$.

elementary charge

The smallest unit of charge that a particle or an object can have. It has a magnitude of $1.60 \times 10^{-19} \text{ C}$.

energy

A calculated quantity which is conserved during any change; that which is transferred when a force does work.

equations of motion

Four interrelated equations that can be used to determine the displacement, initial velocity, final velocity and acceleration of a body moving with constant acceleration.

equilibrium

An object in equilibrium is either at rest or travelling with a constant velocity because the resultant force on it is zero.

extension

The change in the length of a material from its original length.

F

field lines

Lines drawn to represent the strength and direction of a field of force.

field of force

A region of space where an object feels a force; the force may be gravitational, electric, magnetic, etc.

force constant

The ratio of force to extension for a spring or a wire. Unit: Nm^{-1} .

free-body force diagram

A diagram showing all the forces acting on an object (but not the forces it exerts on other objects).

frequency

The number of oscillations per unit time. Unit: hertz (Hz).

H

hadron

Any particle which is affected by the strong nuclear force, made from two or three quarks or anti-quarks.

Hooke's law

The extension produced in an object is proportional to the force producing it.

I

independent variable

The variable in an experiment with a value that is altered by the experimenter.

inelastic

A collision is inelastic when kinetic energy is not conserved; some is transferred to other forms such as heat. Momentum and total energy are always conserved.

instantaneous speed

The speed of an object measured over a very short period of time.

intensity

The power transmitted normally through a surface per unit area:

intensity = power/cross-sectional area Unit: Wm^{-2} .

interference

The formation of points of cancellation and reinforcement where two coherent waves pass through each other.

internal energy

The sum of the random distribution of kinetic and potential energies of the atoms or molecules in a system.

internal resistance

The resistance of an e.m.f. source. The internal resistance of a battery is due to the chemicals within it.

isotopes

Nuclei of the same element with a different number of neutrons but the same number of protons.

I–V characteristic

A graph of current against voltage for a particular component of an electrical circuit.

K

kinematics

The study of motion using quantities such as time, distance, displacement, speed, velocity and acceleration.

kinetic energy

Energy of an object due to its motion.

Kirchhoff's first law

The sum of the currents entering any point (or junction) in a circuit is equal to the sum of the currents leaving that same point. This law represents the conservation of charge.

Kirchhoff's second law

The sum of the e.m.f.s round a closed loop in a circuit is equal to the sum of the p.d.s in that same loop.

L

lepton

A sub-atomic particle which is not affected by the strong nuclear force.

linear momentum

The product of an object's mass and its velocity, $p = mv$. Momentum is a vector quantity.

longitudinal wave

A wave in which the particles of the medium oscillate along the direction in which the wave travels.

M

mass

A measure of the amount of matter within an object. Unit: kilogram (kg).

mean drift velocity

The average speed of a collection of charged particles when a current flows.

mole

The amount of matter which contains 6.02×10^{23} particles.

moment

The moment of a force about a point is the magnitude of the force, multiplied by the perpendicular distance of the point from the line of the force. Unit: Nm.

N

neutrino

A lepton, released during beta-decay. neutron number The number of neutrons in the nucleus of an atom.

newton

The force that will give a 1 kg mass an acceleration of 1 m s^{-2} in the direction of the force. $1 \text{ N} = 1 \text{ kg m s}^{-2}$.

Newton's first law of motion

An object will remain at rest or keep travelling at constant velocity unless it is acted on by a resultant force.

Newton's law of gravitation

Any two point masses attract each other with a force that is directly proportional to the product of their masses and inversely proportional to the square of their separation.

Newton's second law of motion

The resultant force acting on an object is equal to the rate of change of its momentum. The resultant force and the change in momentum are in the same direction. Newton's third law of motion When two bodies interact, the forces they exert on each other are equal and opposite.

node

A point on a stationary wave with zero amplitude.

nuclear model of the atom

A model of the atom in which negative charges (electrons) are distributed outside a tiny nucleus of positive charge.

nucleon number

The number of neutrons and protons in the nucleus of an atom (also called mass number).

nucleon

A particle found in an atomic nucleus, i.e. a neutron or a proton.

nucleus

The tiny central region of the atom that contains most of the mass of the atom and all of its positive charge.

nuclide

A specific combination of protons and neutrons in a nucleus.

number density

The number of particles, such as free electrons, per unit volume in a material.

O

Ohm's law

The current in a metallic conductor is directly proportional to the potential difference across its ends, provided its temperature remains constant.

oscillation

A repetitive back-and-forth or up-and-down motion.

P

parallel

Describes components connected side-by-side in a circuit.

path difference

The difference in the distances travelled by two waves from coherent sources at a particular point.

perfectly elastic

A collision is perfectly elastic when kinetic energy is conserved. Momentum and total energy are always conserved.

period

The time taken by an object (e.g. a planet) to complete one cycle (e.g. an orbit). The period is also the time taken for one complete oscillation of a vibrating object. Unit: second (s).

phase

Refers to the point that an oscillating mass has reached in a complete cycle.

phase difference

The difference in the phases of two oscillating particles, expressed in degrees or radians.

positron

An anti-electron.

potential difference (p.d.)

The energy lost per unit charge by charges passing through a component. Unit: JC^{-1} or volt (V).

potential divider

A circuit in which two or more components are connected in series to a supply. The output voltage from the circuit is taken across one of the components.

potentiometer

A circuit which allows the measurement of an e.m.f. by comparison with a known e.m.f.

power

The rate at which energy is transferred or the rate at which work is done. Unit: watt (W).

precision

The smallest change in value that can be measured by an instrument or an operator. A precise measurement is one made several times, giving the same, or very similar, values.

pressure

The force acting normally per unit area of a surface:

$$p = F/A$$

Unit: Nm^{-2} or pascal (Pa).

principle of conservation of energy

The idea that, within a closed system, the total amount of energy in all its forms is unchanged during any change.

principle of moments

For an object in equilibrium, the sum of clockwise moments about a point is equal to the sum of anticlockwise moments about the same point.

principle of superposition

When two or more waves meet at a point, the resultant displacement is the sum of the displacements of the individual waves.

progressive wave

A wave that carries energy from one place to another.

proton number

The number of protons in the nucleus of an atom (also called atomic number).

Q

quarks

The fundamental particles of which hadrons are made.

R

red shift

The change in frequency or wavelength of a spectral line observed when the source of light is moving away from the observer; see Doppler effect.

reflection

The bouncing back of a wave from a surface.

refraction

The change in direction of a wave as it crosses an interface between two materials where its speed changes.

relative speed

The magnitude of the difference in velocities between two objects.

resistivity

A property of a material, a measure of its electrical resistance, defined by:

$$\rho = R \cdot A / L$$

Unit: $\Omega \text{ m}$.

resistor

An electrical component whose resistance in a circuit remains constant, is independent of current or potential difference.

resultant force

The single force that has the same effect as all of the forces acting on an object.

S

scalar quantity

A scalar quantity has magnitude but no direction.

semiconductor diode

An electrical component made from a semiconductor material (e.g. silicon) that only conducts in one direction. A diode in 'reverse bias' has an infinite resistance.

speed

The rate of change of the distance moved by an object:

$$\text{speed} = \text{distance} / \text{time}$$

Unit: ms^{-1} .

stationary wave

A wave pattern produced when two progressive waves of the same frequency travelling in opposite directions combine. It is characterized by nodes and antinodes. Also known as a standing wave.

strain

The extension per unit length produced by tensile or compressive forces:

$$\text{strain} = \text{extension} / \text{original length}$$

strain energy

The potential energy stored in an object when it is deformed elastically.

stress

The force acting per unit cross-sectional area: $\text{stress} = \frac{\text{force}}{\text{cross-sectional area}}$

strong nuclear force

A fundamental force which acts between hadrons.

systematic error

An error in readings which is repeated throughout an experiment, producing a constant absolute error or a constant percentage error.

T

terminal p.d.

The potential difference across an external resistor connected to an e.m.f. source.

terminal velocity

The maximum velocity of an object travelling through a fluid. The resultant force on the object is zero.

threshold voltage

The minimum forward bias voltage across a light-emitting diode (LED) when it starts to conduct and emit light.

torque of a couple

The product of one of the forces of a couple and the perpendicular distance between them. Unit: N m.

transverse wave

A wave in which the particles of the medium oscillate at right angles to the direction in which the wave travels.

triangle of forces

A closed triangle drawn for an object in equilibrium. The sides of the triangle represent the forces in both magnitude and direction.

U

upthrust

The upward force that a liquid exerts on a body floating or immersed in a liquid.

V

vector quantity

A quantity which has both magnitude and direction.

vector triangle

A triangle drawn to determine the resultant of two vectors.

velocity

The rate of change of the displacement of an object:

$\text{velocity} = \text{change in displacement} / \text{time}$

Unit: ms^{-1} . You can think of velocity as 'speed in a certain direction'.

viscous forces

Forces that act on a body moving through a fluid that are caused by the resistance of the fluid.

W

wave

A periodic disturbance travelling through space, characterized by a vibrating medium.

wavelength

The distance between two adjacent peaks or troughs in a wave.

weak nuclear force

A fundamental force, involved in radioactive β -decay.

weight

The force on an object caused by a gravitational field acting on its mass:

$\text{weight} = \text{mass} \times \text{acceleration of free fall}$

Unit: newton (N).

work done

The product of the force and the distance moved in the direction of the force.

Y

Young modulus

The ratio of stress to strain for a given material, resulting from tensile forces, provided Hooke's law is obeyed:

$\text{Young modulus} = \text{stress} / \text{strain}$

Unit: pascal (Pa; or MPa, GPa).

Z

zero error

A systematic error in an instrument that gives a non-zero reading when the t