Term	Definition
Vector	A quantity which has both magnitude and direction
Scalar	A quantity which only has magnitude
Distance	The overall ground covered by an object during its motion
Displacement	The separation between two points in a named direction

Cut dotted horizontal lines. Fold vertical line.

Speed	The distance travelled per unit time
Velocity	The rate of change of displacement
Acceleration	The rate of change of velocity
Momentum	The product of a body's mass and velocity

Cut dotted horizontal lines. Fold vertical line.

The Principle of Conservation of Momentum

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In a closed system where no external forces act, momentum before is equal to momentum after

Force

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That which changes the velocity of an object

Newton (unit)

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A force of 1 newton gives an acceleration of $1ms^{-2}$ to a mass of 1kg

Weight

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The force at which a mass is attracted to the Earth

Term	Definition
Friction	The force that opposes motion between surfaces in contact
Newton's First Law	A body remains at rest or in constant motion unless acted on by a resultant force
Newton's Second Law	The rate of change of momentum is directly proportional to the applied force and takes place in the same direction in which the force acts
Newton's Third Law	For every action, there is an equal and opposite reaction

Cut dotted horizontal lines. Fold vertical line.

Work	Done when a force causes a body to be moved
Energy	The ability to do work
Potential Energy	Stored energy that a body can have due to its state or position
Kinetic Energy	Energy a body can have due to its motion

Cut dotted horizontal lines. Fold vertical line.

Joule (unit)

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1 Joule is the work done when an object is displaced by 1 meter by a force of 1 newton

The Principle of Conservation of Energy

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Energy can neither be created nor destroyed, but can change from one form to another

Power

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The rate at which is work is done

OR

The rate at which energy is converted

Watt (unit)

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Doing work equal to 1 Joule per second is the rate of 1 Watt of power

Cut dotted horizontal lines. Fold vertical line.

Term	Definition
Renewable Energy	Produced by a source which will not run out or be exhausted, eg wind, solar, tidal
Non-renewable Energy	Produced by a source which will eventually run out, eg oil, coal, natural gas
Machine Efficiency	Energy output as a percentage of energy input
Lever	A rigid body which is free to rotate about a fixed point

Cut dotted horizontal lines. Fold vertical line.

Centre of Gravity

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The point of an object through which the weight of that object appears to act

Torque

(the moment of a force)

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The product of the force applied and the perpendicular distance to the fulcrum

A Couple

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Two parallel and equal forces that act in opposite directions

Conditions for Equilibrium

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1. The clockwise moments must equal the anticlockwise moments
2. Total downward forces must equal total upward forces

Cut dotted horizontal lines. Fold vertical line.

Hooke's Law

When an object is bent, stretched or compressed by a displacement S, the restoring force F is directly proportional to the displacement – Provided the elastic limit is not exceeded

Simple Harmonic Motion

Motion where the object's acceleration is directly proportional to its displacement from a mean position and is always directed towards this mean position

Newton's Law of Universal Gravitation

The force felt between two bodies is directly proportional to the product of their masses and inversely proportional to the square of the distance between them

Centripetal Force

The force acting towards the center that is needed to keep a body moving in a circle

Term	Definition
Centripetal Acceleration	The acceleration that a body which is moving in a circle has towards the center of the circle
Angular Velocity	The angle (measured in radians) swept out per second
Periodic Time	The time taken to complete one full revolution
Kepler's Third Law	States that the square of the period of a satellite is directly proportional to the cube of its radius of orbit and inversely proportional the mass of the planet it is orbiting

Density	Mass per unit volume
Pressure	Force per unit area
Archimedes' Principle	When a body is fully or partially immersed in a fluid, it experiences an upthrust which is equivalent to the weight of the fluid displaced
Law of Flotation	A floating body will displace its own weight of fluid

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Cut dotted horizontal lines. Fold vertical line.

Boyle's Law

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For a fixed mass of gas at a constant temperature, volume is inversely proportional to pressure

Temperature

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The hotness or coldness of a body

Kelvin

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Unit of temperature

Heat

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Energy that causes a temperature change

Cut dotted horizontal lines. Fold vertical line.

Term	Definition
Thermometric Property	Any physical property that changes measurably with temperature
Heat Capacity	The heat energy needed to raise the temperature of a substance by 1 K [Symbol: C]
Specific Heat Capacity	The heat energy needed to raise the temperature of 1 kg of a substance by 1 K [Symbol: c]
Latent Heat	The heat energy needed to change the state of a substance without a change in temperature [Symbol: L]

Cut dotted horizontal lines. Fold vertical line.

Specific Latent Heat

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The heat energy needed to change the state of 1 kg of a substance without a change in temperature [Symbol: l]

Specific Latent Heat of Fusion

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The amount of heat energy needed to change 1 kg of a substance from a solid to a liquid without a change in temperature (i.e. Its melting point) [Symbol: L_f]

Specific Latent Heat of Vaporisation

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The amount of heat energy needed to change 1 kg of a substance from a liquid to a gas without a change in temperature (i.e. Its boiling point) [Symbol: L_v]

Conduction

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The transfer of heat through kinetic energy between adjacent particles of a medium, but the medium itself does not move (eg heat transfer through metal)

Convection	The transfer of heat through a fluid by the physical movement of the fluid (eg Boiling a pot of water)
Radiation	The transfer of heat by electromagnetic waves (eg the sun heating the Earth)
U-Value	The amount of heat energy passing through 1 m^2 of a substance per second when there is a temperature difference of 1 K between each side
Solar Constant	Average sun energy falling per second on 1 m^2 of the atmosphere of Earth. Value: $1.35 kWm^{-2}$

Term	Definition
Light	Electromagnetic radiation that is detectable by the human eye Wavelength: 400nm-700nm
Self-Luminous	An object that produces its own light (eg the sun)
Non-Luminous	An object that does not produce its own light and so reflects light from its surface, making it visible
Reflection	The bouncing of light off a surface

Laws of Reflection

1. The incident ray, the reflected ray and the normal at the point of incidence all lie in the same plane
2. The angle of incidence equals the angle of reflection

Real Image

Image formed by the actual intersection of rays

Virtual Image

Image formed by the apparent intersection of rays

Parallax

The apparent movement of one object relative to another. This is due to the motion of the observer.

Cut dotted horizontal lines. Fold vertical line.

Refraction	The bending of light as it passes from one medium to another
Laws of Refraction	1. The incident ray, the refracted ray and the normal all lie in the same plane 2. For a given pair of media, the sine of the angle of incidence is proportional to the sine of the angle of refraction (Snell's Law)
Refractive index	The ratio of the sine of the angle of incidence to the sine of the angle of refraction when light travels from air into the medium
Critical Angle	The angle of incidence in the denser medium when the angle of refraction in the rarer medium is 90°

Total Internal Reflection	This occurs when the angle of incidence in the denser medium is larger than the Critical Angle, and so the light is reflected back into the denser medium
Optic Fibre	Very thin, long and transparent material through which light travels by total internal reflection
Accommodation	The ability of the eye to focus on objects at varying distances by changing the shape of the lens
Power of a Lens	The reciprocal of the lens focal length, i.e. $^{1}/_{f}$

Magnification	The ratio of the image distance/height to the object distance/height
Wave	A disturbance that transfers energy through a medium, without any net movement of the medium
Medium	Required to carry a wave, with the exception of electromagnetic waves
Mechanical Waves	Those which require a medium to travel

Cut dotted horizontal lines. Fold vertical line.

Electromagnetic Waves

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Those which do not require a medium in which to travel. EM waves travel in a vacuum at the speed of light.

Electromagnetic Spectrum

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The range of EM waves.
From lowest to highest frequency:
Radio waves, Microwaves, Infra-red, Visible light, Ultraviolet, X-rays, Gamma rays

Transverse Wave

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One in which the vibrations are perpendicular to the direction in which the wave is travelling, eg light waves

Longitudinal Wave

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One in which the vibrations are parallel to the direction in which the wave is travelling, eg sound waves

Term	Definition
Travelling Wave	Transfers energy as it travels from the source producing it to all areas which it passes
Reflection	The bouncing of a wave off the surface of obstacles in its path
Refraction	The change in direction in which a wave is travelling when it travels from one medium to another
Coherent Sources	Those that are in phase and have the same frequency

Interference	Occurs when two or more waves meet. The resulting disturbance has an amplitude that is the algebraic sum of the individual amplitudes of each interfering wave.
Interference Pattern	Forms when two (or more) coherent sources meet
Constructive Interference	Occurs when two waves meet and the amplitude of the resultant wave is greater than the amplitude of each individual wave
Destructive Interference	Occurs when two waves meet and the amplitude of the resultant wave is less than the amplitude of each individual wave

Cut dotted horizontal lines. Fold vertical line.

Term	Definition
Diffraction	The sideways spreading of waves into the region after passing through/around a small gap/obstacle
Polarisation	When the vibrations of a wave are confined to one plane only
Stationary/Standing Wave	Formed when two waves meet which are travelling in opposite directions but have the same amplitude and frequency
Nodes	Points along a stationary wave that remain at rest

Term	Definition
Antinodes	Points along a stationary wave which experience maximum vibration and amplitude
Doppler Effect	The apparent change in frequency of a wave due to the relative motion of the source or the observer
Wavelength	The distance between two successive crests or troughs
Frequency	The number of complete oscillations of a wave per second

Velocity	The distance travelled by a wave per second
Amplitude	The maximum displacement of a point on a wave from the mean position
Periodic Time	The time taken for one complete oscillation of a wave
Dispersion	The separation of the different wavelengths/colours present in light

Term	Definition
Spectrometer	Instrument used in optics to examine spectra and measure the wavelength of light
Primary Colours	Form white light when combined. They are red, blue and green.
Secondary Colours	Formed by mixing two primary colours in equal intensity. They are yellow, magenta and cyan.
Complementary Colours	A primary colour and a secondary colour that form white when they are combined. These are: Blue with yellow, green with magenta and red with cyan.

Term	Definition
Infra-red Light	Light that is emitted by warm objects
Fluorescence	When a body absorbs UV radiation and re-emits it as visible light
Monochromatic Light	Light of one wavelength/colour only
Sound	Mechanical waves produced by a vibrating object, eg tuning fork

Acoustics	The study of sound
Fundamental Frequency	The frequency at which a body tends to vibrate if free to do so
Harmonics	Frequencies that are multiples of the fundamental frequency. If f = fundamental frequency, then f = 1st harmonic.
Overtones	Frequencies that are multiples of the fundamental frequency. If f = fundamental frequency, then 2f = 1st overtone.

Resonance

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When a body is forced to vibrate at its own natural frequency, resulting in large amplitude oscillations

The Threshold of Hearing

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The smallest intensity audible by the human ear at a frequency of 1000 Hz.
It has a value of $1x10^{-12}$ Wm^{-2}

Sound Intensity

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The power carried by sound waves per unit area in a direction perpendicular to that area

Sound Intensity Level

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Measured in decibels, it gives the intensity of a sound relative to the threshold of hearing

Electrostatics

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Properties of charged particles when they are at rest

Negative Charge

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Occurs when an object gains electrons

Positive Charge

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Occurs when an object loses electrons

Coulomb's Law

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The force between two point charges is directly proportional to the product of their charges and inversely proportional to the square of the distance between them

Electric Field

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A region of space where a positive electric charge experiences a force other than gravity

Electric Field Strength

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The force per unit charge at a certain point in an electric field

Potential Difference

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The work done in bringing unit positive charge from one point to another

Insulator

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A substance through which electric charge cannot flow

Conductor

A substance through which electric charge can flow

Coulomb

Unit of electric charge.
It is the quantity of charge that passes when a current of 1 A flows for 1 second.

Volt

The potential difference between two points is 1 volt if 1 joule of work is done in bringing 1 coulomb from one point to another

Capacitance

The ratio of charge to potential in a conductor

Term	Definition
Electric Field Line	The line along which a positive charge would travel in an electric field
Current	The rate of flow of charge
Ammeter	Device that measures current
Alternating Current (AC)	Current that constantly changes direction

Direct Current (DC)	Current that flows in one direction only
Electromotive Force (EMF)	Potential difference between terminals of a battery when no current is being drawn from the battery
Voltmeter	Device that measures potential difference across a component or a circuit
Resistance	The ratio of the voltage across a conductor to the current flowing through it

Cut dotted horizontal lines. Fold vertical line.

Ohm

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Unit of resistance.
A conductor has 1 ohm of resistance if a current of 1 A passes through it when a potential difference of 1 V is applied across it.

Ohm's Law

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If the temperature remains constant, the current flowing through a conductor is directly proportional to the potential difference across it

Resistivity

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The potential a material has for resistance

Joule's Law

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The rate of heat produced in a conductor is proportional to the square of the current flowing through it:
$P \propto I^2$

Ion	An atom/group of atoms that have lost or gained one or more electrons
Electrolysis	Causing a chemical reaction by passing a current through a liquid
Fuse	A safety device consisting of a wire which melts when a current above a pre-set value passes through it, interrupting the circuit and preventing electrocution
Miniature Circuit Breaker (MCB)	A safety device which breaks a circuit if a current above a pre-set value is detected

Residual Current Device (RCD)

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A safety device which breaks a circuit if a current difference between live and neutral above a pre-set value is detected

Radial Circuit

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One where a separate live and neutral wire are connected from the distribution box to an appliance which uses a large amount of current, eg an electric shower

Ring Circuit

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One where the live, neutral and earth terminal of each socket are connected to three corresponding wires arranged in a loop with each end of said loop connected to the distribution box

Bonding

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Whereby all metal pipes, taps and tanks are earthed as a safety precaution

Kilowatt-Hour	The amount of energy used per hour by a 1000 W appliance
Semiconductor	A substance whose resistivity is between that of a good conductor and that of a good insulator
Holes	Positively charged spaces in a substance which remain when electrons break free from a covalent bond
Doping	Increasing the conductivity of a semiconductor by the addition of impurities

Cut dotted horizontal lines. Fold vertical line.

Intrinsic Conduction

Occurs in pure semiconductors due to electrons moving from negative to positive and an equal number of holes moving in the opposite direction

Extrinsic Conduction

Increased conduction in a semiconductor due to the addition of impurities

Thermistor

A semiconductor whose resistance decreases as the temperature increases

Light Dependant Resistor (LDR)

A semiconductor whose resistance decreases as light intensity increases

Series

A circuit where there is no split

Parallel

A circuit where there is a split

Wheatstone Bridge

A circuit used to find an unknown value of a resistor through the use of ratios

P-Type Semiconductor

One in which the impurity added produces extra holes which are available for conduction, eg adding boron to silicon

N-Type Semiconductor

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One in which the impurity added produces more free electrons available for conduction, eg adding phosphorous to silicon

P-N Junction

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When a P and an N type semiconductor are joined together they form a single semiconductor which allows current to flow in only one direction only

Depletion Layer

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The insulative region at the meeting of the p-n junction where there are no majority charge carriers

Junction Voltage

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The potential difference across a p-n junction caused by holes and electrons moving across the junction when it was formed

Forward-Biased p-n junction

Positive terminal of battery to p-type and negative terminal of battery to n-type.
Conducts electricity.

Reverse-Biased p-n junction

Positive terminal of battery to n-type and negative terminal of battery of battery to p-type.
Does not conduct electricity.

Rectification

The conversion of alternating current (AC) to direct current (DC)

Light-Emitting Diode (LED)

A diode that emits light when in forward bias

Magnetic Field

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A region of space where magnetic forces can be felt

Magnetic Field Line

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A tangent on any point of a magnetic field line gives the magnetic field direction at this point

Right-Hand Grip Rule

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If the right hand grasps a wire with the thumb pointing in the direction of the current, the fingers coiled around the wire show the magnetic field direction around it

Fleming's Left-Hand Rule

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If the thumb, index finger and middle finger are all perpendicular to each other, with the index finger pointing in the direction of the magnetic field and the middle finger pointing in the direction of the current, then the thumb points in the direction of the force

Cut dotted horizontal lines. Fold vertical line.

Magnetic Flux Density (B)

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A vector at any point in the magnetic field whose magnitude is equivalent to the force experienced by a conductor of length 1 m, carrying current of 1 A, at right angles to the field at that point and has the same direction as the magnetic field lines

Tesla

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Unit of magnetic flux density. Magnetic flux density at a point is 1 if a 1 m long conductor carrying a current of 1 A experiences a force of 1 N when placed perpendicular to the field.

Weber

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Unit of magnetic flux. The magnetic flux over 1 m^2 is 1 Wb if placed in a field of magnetic flux density 1 T.

Electromagnet

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Made of a solenoid and a soft iron core. When current passes though the solenoid, the core becomes magnetic.

Term	Definition
Ampere	That constant current which, if maintained in two straight parallel conductors of infinite length, of negligible cross section and placed 1 m apart in a vacuum, would produce a force on each conductor of 2 x 10^{-7} newtons per meter of length
Electromagnetic Induction	Inducing an electromotive force by changing the magnetic flux in a closed loop
Faraday's Law	The size of the induced emf is directly proportional to the rate of change of flux
Lenz's Law	The direction of an induced current is always such as to oppose the change producing it

Term	Definition
Electrical Generator	Uses electromagnetic induction to convert mechanical energy to electrical energy
Mutual Induction	When a changing magnetic field in one coil causes an induced emf to appear in a nearby coil
Transformer	Device that changes the value of an alternating voltage
Self-Induction	Occurs when a changing magnetic field in a coil induces an emf in the coil itself

Electron

Sub-atomic negatively-charged particle that orbits the nucleus

Thermionic Emission

When electrons are released from the surface of a hot metal

Cathode Rays

Steams of extremely fast electrons travelling from the cathode to the anode in an evacuated tube

The electronvolt (eV)

The energy gained/lost by an electron as it moves through a p.d. of 1 V.
Its value is 1.6×10^{-19} J.

Term	Definition
Photoelectric Effect	The release of electrons from a metal surface when EM radiation of a certain frequency falls on it
Photon	A packet of electromagnetic energy, its energy is dependent on its frequency
Threshold Frequency	The minimum frequency needed for photoemission to occur, every metal has a unique value
Work Function	The minimum energy needed by a photon to remove an electron from the surface of a metal

Cut dotted horizontal lines. Fold vertical line.

X-Rays	High frequency EM radiation produced when high speed electrons strike a metal target
Emission Spectrum	Created when light from a luminous source is dispersed
Atomic Number (Z)	The number of protons in an element's nucleus
Mass Number (A)	The total number of protons and neutrons in the nucleus of an atom of a certain element

Cut dotted horizontal lines. Fold vertical line.

Isotopes

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Atoms that have the same atomic number but different mass numbers because of more/less neutrons present in the nucleus

Radioactivity

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The spontaneous disintegration or decay of the nucleus of certain atoms with the emission of one or more types of radiation

Energy Level

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A fixed energy level that an electron can have in an atom

Alpha (α) Radiation

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Fast-moving helium nuclei ejected from the nuclei of radioactive atoms

Term	Definition
Beta (β) Radiation	High speed electrons ejected from the nuclei of radioactive atoms
Gamma (γ) Radiation	High frequency electromagnetic radiation emitted from the nuclei of radioactive atoms
Ionisation	When an atom or molecule acquires a charge by gaining or losing electrons to form ions
Activity	The number of nuclei of a substance decaying per second

Cut dotted horizontal lines. Fold vertical line.

Term	Definition
Becquerel	The unit of Activity. Equivalent to 1 disintegration per second.
Law of Radioactive Decay	The activity of a sample is directly proportional to the amount left undecayed
Half-Life	The time taken for half a sample's present atoms to decay
Nuclear Fission	The splitting up of a large nucleus into two smaller nuclei of similar size with the release of energy and neutrons

Nuclear Fusion	The joining of two smaller nuclei to form a larger nucleus with the release of energy
Moderator	Usually graphite or heavy water, used in a nuclear reactor, to slow down neutrons so that they can cause fission reactions
Control Rods	Used in a nuclear reactor to absorb neutrons and therefore control the rate of reaction
Cosmic Rays	High-energy particles that originate in very distant parts of the universe. They mostly decay high in the Earth's atmosphere.

Linear Accelerator	An instrument used to accelerate charged particles in straight lines
Pair Annihilation	Happens when a particle and its antiparticle meet and annihilate each other
Strong Nuclear Force	The force that binds neutrons and protons together in the nucleus
Weak Nuclear Force	Involved in beta decay and the decay of neutrons to protons

Cut dotted horizontal lines. Fold vertical line.

Antiparticle	A particle that has the same mass as its corresponding particle but opposite charge, eg electron and positron
Quarks	Fundamental particles that are constituents of baryons and mesons (hadrons)
Leptons	Fundamental particles that are not subject to the strong nuclear forces but are subject to the weak nuclear force and gravitational force
Hadrons	Particles that are subject to the strong nuclear force

Cut dotted horizontal lines. Fold vertical line.

Meson

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A particle that is subject to the strong nuclear force and is composed of a quark and an antiquark

Baryon

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A particle that is subject to the strong nuclear force and is composed of three quarks

Neutrino

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A lepton with zero charge and nearly zero rest mass. There is a different type of neutrino associated with each type of lepton.

Pair Production

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A process whereby a particle and its antiparticle are produced