Glossary

A

Acceleration Change of velocity per second (in metres per second per second, m/s^2).

Accuracy An accurate measurement is close to the true value.

Acid rain Rain that is acidic due to dissolved gases, such as sulphur dioxide, produced by the burning of fossil fuels.

Activity Number of atoms of a radioactive substance that decay each second.

Alpha emission The process in which a large unstable nucleus becomes stable by emitting an alpha particle.

Alpha particle scattering Scattering of alpha particles (usually in a narrow beam) by nuclei of the atoms of a thin metal foil.

Alpha radiation Alpha particles, each composed of two protons and two neutrons, emitted by unstable nucleus.

Amplitude The maximum disturbance of the particles in a substance (e.g. air) when sound waves pass through it.

Analogue signal A signal that varies continuously in amplitude or frequency between a maximum and minimum value.

Angle of incidence The angle between the incident ray and the normal.

Angle of reflection The angle between the reflected ray and the normal.

Anomalous A measurement that is well away from the pattern shown by other results.

Antistatic material Material that is a poor insulator and which is used to conduct charge to earth.

Atom The smallest part of an element.

Atomic nucleus Positively charged object composed of protons and neutrons at the centre of every atom with one or more electrons moving round it.

Atomic number The number of protons in a nucleus, symbol *Z* (also called the proton number).

B

Background microwave radiation Electromagnetic radiation emitted shortly after the Big Bang. Its discovery confirmed the Big Bang theory.

Background radioactivity Radioactivity from substances around us.

Bar charts Used when the independent variable is categoric and the dependent variable is continuous.

Beta emission A process in which a neutron-rich nucleus becomes stable as a result of a neutron changing into a proton, creating and emitting a beta particle (i.e. an electron) at the instant of change.

Beta radiation Beta particles which are high-energy electrons created in and emitted from unstable nuclei.

Bias The influence placed on scientific evidence because of: wanting to prove your own ideas; supporting the person who is paying you; political influence; the status of the experimenter.

Big Bang theory The theory that the Universe was created in a massive explosion (the Big Bang) and that the Universe has been expanding ever since.

Billion A thousand million.

Biomass fuel Fuel from plants or animal waste.

Black hole An object in space that has so much mass that nothing, not even light, can escape from its gravitational field.

Braking distance The distance travelled by a vehicle during the time its brakes act.

C

Cable Two or three insulated wires surrounded by an outer layer of rubber or flexible plastic.

Camera An instrument for photographing an object by using a converging lens to form a real image of the object on a film (or on electronic pixels) in a light-proof box.

Carrier wave Waves used to carry a signal.

Categoric variable These tell us the name of the variable, e.g. type of wire used for a resistance investigation.

Causal link One change in a variable has caused a change in another variable. You can only be reasonably certain of this when you have valid and reliable evidence. E.g. increasing the length of the wire causes an increase in resistance.

Centre of mass The point where an object's mass may be thought to be concentrated.

Centripetal force The resultant force towards the centre of a circle acting on an object moving in a circular path.

Chain reaction Reactions in which one reaction causes further reactions, which in turn cause further reactions, etc. A nuclear chain reaction occurs when fission neutrons cause further fission, so more fission neutrons are released. These go on to produce further fission.

Chance When there is no scientific link between the two variables. E.g. increased sea temperatures and increased diabetes.

Charging by friction The process of charging certain insulating materials by rubbing with a dry cloth, causing electrons to transfer between the material and the cloth.

Charging without direct contact The process in which an insulated conductor is charged without being in direct contact with a charged object.

Chip An electronic component which contains an integrated circuit.

Circuit Components connected together so that current passes through them.

Circuit breaker An electromagnetic switch that opens and cuts the current off if too much current passes through it.

Communications satellite A satellite that orbits the Earth above the equator in a circular orbit, usually with a period of 24 hours in the same direction as the Earth's spin, so it stays directly above the same place on the Earth's surface.

Component A part or device in an electric circuit.

Compound A substance made of two or more types of atom chemically joined together.

Concave mirror A curved mirror with a surface that bends in.

Conclusion A conclusion considers the results and states how those results match the hypothesis. The conclusion must not go beyond the data available.

Conduction Heat transfer in a substance due to motion of particles in the substance.

Conduction electrons Electrons that move about freely inside a metal because they are not attached to individual atoms.

Conservation of energy Energy cannot be created or destroyed.
Conservation of momentum Momentum is conserved in any collision or explosion provided no external forces act on the objects that collide or explode.
Continuous variable A continuous variable can be any numerical value, e.g. length of wire used in a resistance investigation.
Control variable These are the variables that might affect your result and therefore must be kept the same for a valid investigation. E.g. voltage used in a resistance investigation.
Control rods Metal rods (made of boron or cadmium) used to absorb excess fission neutrons in a nuclear reactor so that only one fission neutron per fission on average goes on to produce further fission.
Controlled An experiment is controlled when all variables that might affect your result (apart from the independent variable) have been kept constant.
Convection Heat transfer in a liquid or gas due to convection currents.
Convection currents The flow of a fluid due to differences in temperature. E.g. circulation of the upper part of the Earth's mantle.
Converging lens A lens that makes light rays parallel to the principal axis converge to (i.e. meet at) a point; also referred to as a convex lens.
Convex mirror A curved mirror with a surface that bends out.
Coolant Fluid in a sealed circuit pumped through the core of a nuclear reactor to remove thermal energy to a heat exchanger.
Coulomb (C) The unit of electrical charge, equal to the charge passing a point in a (direct current) circuit in 1 second when the current is 1 A.

D

Data Measurements or observations of a variable. Plural of datum.
Deceleration Change of velocity per second when an object slows down.
Density Mass per unit volume of a substance.
Dependent variable The variable that you are measuring as a result of changing the independent variable, e.g. current measured in a resistance investigation.
Diffusion Spreading out of particles away from each other.
Digital signal A signal that consists of a sequence of pulses which are at two levels only, either high (1) or low (0).
Directly proportional A graph will show this if the line of best fit is a straight line through the origin.
Discrete variable These are numerical, but can only be whole numbers, e.g. numbers of layers of insulation.
Diverging lens A lens that makes light rays parallel to the axis diverge (i.e. spread out) as if from a single point; also referred to as a concave lens.
Doppler effect The change of wavelength (and frequency) of the waves from a moving source due to the motion of the source.
Drag force A force opposing the motion of an object due to fluid (e.g. air) flowing past the object as it moves.
Dynamo effect The effect in which a potential difference is generated in a wire or coil when the wire or coil cuts across the lines of a magnetic field.

E

Earth wire A wire used to connect the metal case of an appliance to earth so that the case cannot become live.
Earthed Connected to the ground by means of a conducting lead or wire.
Economic How science affects the cost of goods and services. E.g. developing wind power might increase the cost of electricity.

Efficiency This is defined as:

$$\frac{\text{Useful energy transferred by a device}}{\text{Total energy supplied to the device}}$$

Effort The force applied to a device used to raise a weight or shift an object.
Elastic A material is elastic if it is able to regain its shape after it has been squashed or stretched.
Elastic potential energy Energy stored in an elastic object when work is done to change its shape.
Electric current The rate of flow of electric charge (in amperes, A).
Electric potential energy Energy of a charged object due to its charge (in joules, J).
Electrical energy Energy transferred by the movement of charge.
Electrical power The rate of transfer of electrical energy (in watts, W).
Electromagnetic waves Electric and magnetic disturbances that transfer energy from one place to another. The spectrum of electromagnetic waves, in order of increasing wavelength, is as follows: gamma and X-rays, ultraviolet radiation, visible light, infra-red radiation, microwaves, radio waves.
Electrons Negative particles found outside the nucleus of an atom.
Element A substance made up of only one type of element.
Energy forms Ways in which energy is stored or transferred, including **chemical energy**: energy stored in fuel; **elastic (or strain energy)**: energy stored in a squashed or stretched object; **electrical energy**: energy transferred by an electric current; **gravitational potential energy**: energy of an object due to its position, **kinetic energy**: energy of a moving object, **thermal energy**: energy of an object due to its temperature.
Energy transfer Energy transferred from one place to another.
Energy transformation Energy change from one form to another.
Ethical Whether it is 'right' or 'wrong' to do something. E.g. experimentation on nuclear weapons.
Equilibrium (of forces) The state of an object when it is at rest.
Evidence Scientific evidence should be reliable and valid. It can take many forms. It could be an observation, a measurement or data that somebody else has obtained.
Expansion of the Universe The motion of galaxies away from each other, discovered from the observations that the red shift (and therefore the speed) of the distant galaxies increases with their distance.

F

Fair test Only the independent variable is affecting your dependent variable, all other variables are kept the same.
Fluid A liquid or a gas.
Focal length The distance from the centre of a lens or a curved mirror to the point where light rays parallel to the principal axis are focused (or, in the case of a convex mirror or a diverging lens, appear to diverge from).
Force A force can change the motion of an object (in newtons, N).
Fossil fuel Coal, oil or gas or any other fuel formed long ago from the fossilised remains of dead plants or creatures.
Free electrons Electrons that move about freely inside a metal and are not held inside an atom.
Frequency The number of complete waves passing a point each second. The unit of frequency is the hertz (Hz).
Friction force A force opposing the relative motion of two surfaces where they are in contact with each other.

Fuse A fuse contains a thin wire that melts and cuts the current off if too much current passes through it.
Fusion The process in which small nuclei fuse to become larger nuclei.

G

Gamma radiation Electromagnetic radiation emitted from unstable nuclei in radioactive substances.
Geostationary satellite A satellite that orbits the Earth above the equator in a circular orbit with a period of 24 hours in the same direction as the Earth's spin so it always stays directly above the same place on the Earth's surface.
Global dimming A gradual reduction in the amount of light reaching the Earth's surface due to particles in the atmosphere.
Global warming Warming of the Earth due to greenhouse gases in the atmosphere trapping infra-red radiation from the surface.
Gravitational field strength The force of gravity on an object of mass 1 kg (in newtons per kilogram, N/kg).
Gravitational potential energy Energy of an object due to its position in a gravitational field. Near the Earth's surface, change of g.p.e. (in joules, J) = weight (in newtons, N) × vertical distance moved (in metres, m).
Greenhouse gases Gases such as carbon dioxide in the atmosphere that absorb infra-red radiation from the Earth's surface.

H

Half-life of a radioactive isotope Time taken for the number of nuclei of the isotope (or mass of the isotope) in a sample to halve.
Heat transfer Energy transfer due to a temperature difference: see thermal radiation, conduction and convection.
High mass star A star that has a much greater mass than the Sun.
Hypothesis Using theory to suggest explanations for observations, e.g. 'I think that radiation from nuclear power plants has caused mutation in fish.'

I

Impact force The force acting on an object when it collides with another object; the two objects experience equal and opposite forces.
Independent variable The variable that you have decided to change in an investigation, e.g. the length of wire used in a resistance investigation.
Induced p.d. The potential difference generated in a wire or coil when the wire or coil cuts across the lines of a magnetic field.
Infra-red radiation Electromagnetic waves between visible light and microwaves in the electromagnetic spectrum.
Interference Unwanted variations on waves carrying a signal.
Interval measurements The values of your independent variable that you choose within the range e.g. 10 cm^3; 20 cm^3; 30 cm^3; 40 cm^3; 50 cm^3.
Ionisation Any process in which atoms become charged.
Ionising radiation Radiation that ionises substances it passes through. Alpha, beta, gamma and X-radiation are all ionising.
Ionosphere Layer of ionised gases in the atmosphere which reflect radio waves of frequency less than 30 MHz.
Ion A charged atom.
Isotopes Atoms of an element that contain different numbers of neutrons in their nuclei.

K

Kilowatt hour (kW h) Electrical energy supplied to a 1 kW electrical device in 1 hour.
Kinetic energy Energy of a moving object due to its motion; kinetic energy (in joules, J) = $\frac{1}{2}$ × mass (in kilograms, kg) × (speed)^2 (in m^2/s^2).

L

Law of force between charged objects Like charges repel; unlike charges attract.
Limiting factors Factors which limit the rate of a reaction, e.g. photosynthesis.
Line graphs Used when the independent and the dependent variables are both continuous.
Line of best fit Used to show the underlying relationship between the independent and the dependent variables. It should fit the pattern in the results and have roughly the same number of plots on each side of the line. It could be a straight line or a curve. Remember to ignore any anomalies!
Linear These are straight line graphs that can be positive (as the length of wire increases so too does the resistance) or negative (as the time increases the velocity decreases).
Link due to association When two variables change together, but they are both linked by a third variable. E.g. air temperature and voltage produced by a photoelectric cell, both are linked to the radiation from the Sun.
Link due to chance When there is no scientific link between the two variables. E.g. increased sea temperatures and increased diabetes.
Live wire The wire of a mains circuit that has a potential that alternates from positive to negative and back each cycle.
Load The weight of an object raised by a device used to lift the object, or the force applied **by** a device when it is used to shift an object.
Loudness Depends on the amplitude of the sound waves that make up a sound.
Low mass star A star that has a much smaller mass than the Sun.

M

Magnification The image height ÷ the object height.
Magnifying glass A converging lens used to magnify a small object which must be placed between the lens and its focal point.
Mass The amount of matter in an object; a measure of the difficulty of changing the motion of an object (in kilograms, kg).
Mass number The total number of protons and neutrons in the nucleus of an atom (symbol *A*).
Mean Add up all of the measurements and divide by how many measurements there are. Don't forget to ignore any anomalous results.
Model Description of a theory or theories that suggests further ideas that could test those theories. E.g. 'plum pudding' model of the atom that was tested and found not to be correct. A better model was then suggested.
Moderator A solid or liquid used in a nuclear reactor to slow fission neutrons down so they can cause further fission.
Modulation The process of varying the amplitude or frequency of a carrier wave so it can carry a signal.
Moment The turning effect of a force defined by the equation Moment of a force (in newton metres) = force (in newtons) × perpendicular distance from the pivot to the line of action of the force (in metres).
Momentum Mass (in kilograms, kg) × velocity (in m/s).
Monitoring satellite A satellite in a low circular orbit that takes it over the Earth's North and South Poles in each orbit.
Motive force A force on a powered object (e.g. a vehicle) that makes it move.

Motor effect When a current is passed along a wire in a magnetic field and the wire is not parallel to the lines of the magnetic field, a force is exerted on the wire by the magnetic field.

N

National Grid The network of cables and transformers used to transfer electricity from power stations to consumers (i.e. homes, shops, offices, factories, etc.).
Net Overall.
Neutral wire The wire of a mains circuit that is earthed at the local sub-station so its potential is close to zero.
Neutron star The highly compressed core of a massive star that remains after a supernova explosion.
Neutrons Neutral particles found in the nucleus of an atom.
Normal The line perpendicular to the mirror surface (or boundary where refraction occurs) at the point of incidence of a light ray.
Nuclear energy Energy released from an unstable atom as a result of a change in its nucleus.
Nuclear fission The process in which certain nuclei (uranium 235 and plutonium 239) split into two fragments when struck by a neutron, releasing energy and two or three neutrons as a result.
Nuclear fission reactor A reactor that releases energy as a result of nuclear fission inside it.
Nuclear fusion The process in which small nuclei are forced together so they fuse with each other to form a larger nucleus, releasing energy in the process.
Nuclear model of the atom Every atom contains a positively charged nucleus consisting of neutrons and protons. This is where most of its mass is concentrated, and it is much smaller than the atom. Electrons move about in the space surrounding the nucleus.

O

Ohm's law The current through a resistor at constant temperature is directly proportional to the potential difference across the resistor.
Ohmic conductor A conductor that has a constant resistance and therefore obeys Ohm's law.
Opinion Opinions are personal judgements. Opinions can be formed from scientific evidence or non-scientific ideas.
Ordered variable Variables that can be put into an order, e.g. small, large, huge lumps of rock.
Oscilloscope A device used to display the shape of an electrical wave.
Ozone layer Layer of ozone gas in the Earth's atmosphere that absorbs ultraviolet radiation.

P

Parallel Components connected in a circuit so that the potential difference is the same across each one.
Parallel circuit rules 1. The potential difference across components in parallel is the same. 2. The total current passing through components in parallel is shared between the components.
Pay-back period (or time) Length of time for the savings from an improvement to match the actual cost of the improvement.
Period The time taken for a satellite to orbit the Earth once.
Photosynthesis The process by which plants make food using carbon dioxide, water and light energy.
Pitch depends on the frequency of the sound waves that make up a sound.
Pivot The point about which an object turns when acted on by a force that makes it turn.
Plum pudding model of the atom A model of the atom which supposed that the positive charge was evenly spread throughout its matter and the negative charge was held in tiny particles (electrons) inside the atom.
Plasma A gas consisting of bare nuclei (i.e. atoms stripped of their electrons).
Plug A plug has an insulating case and is used to connect the cable from an appliance to a socket.
Pollution The contamination of air, water or soil by substances which are harmful to living organisms.
Potential difference A measure of the difference in electric potential energy per unit charge between two charged objects (in volts, V).
Power The energy transformed per second. The unit of power is the watt (W).
Precision Where your repeat results are very close to each other. This is related to the smallest scale division on the measuring instrument used.
Prediction A hypothesis that can be used to design an investigation e.g. 'I predict that if I increase the length of wire the current will decrease'.
Principal focus The point where light rays parallel to the principal axis of a lens or curved mirror are focused (or, in the case of a convex mirror or a diverging lens, appear to diverge from).
Principle of Moments For an object in equilibrium,
The sum of all the clockwise moments about any point = the sum of all the anticlockwise moments about that point.
Proton number See **atomic number**.
Protons Positive particles found in the nucleus of an atom.
Protostar The concentration of dust clouds and gas in space that forms a star.
Pumped storage station A power station that uses electricity to store energy by pumping water uphill to an upper reservoir. Electricity is generated when water in the upper reservoir is allowed to flow downhill.

R

Radiation Energy carried by waves.
Radioactive substances Substances with unstable nuclei that emit alpha, beta or gamma radiation when they become more stable.
Radiograph An X-ray picture.
Random changes Changes that cannot be predicted.
Random error Measurements when repeated are rarely exactly the same. If they differ randomly then it is probably due to human error when carrying out the investigation.
Range The maximum and minimum values.
Real image An image formed by a lens or concave mirror that can be projected on a screen.
Red giant A star that has expanded and cooled, resulting in it becoming red and much larger and cooler than it was before it expanded.
Red shift Increase in the wavelength of electromagnetic waves emitted by a star or galaxy due to its motion away from us. The faster the speed of the star or galaxy, the greater the red shift is.
Reflection of light When a light ray is reflected from a mirror, the angle of incidence is equal to the angle of reflection.
Refraction The change of direction of a light ray when it passes across a boundary between two transparent substances (including air).
Reliability The trustworthiness of data collected.
Reliable Describes data we can trust. E.g. others can get the same results, even using different methods.

Renewable energy Energy from sources that never run out, including wind energy, wave energy, tidal energy, hydroelectricity, solar energy and geothermal energy.

Resistance Resistance (in ohms, Ω) = potential difference (in volts, V) ÷ current (in amperes, A).

Resistors in parallel Resistors in a circuit with the same potential difference across each one. The bigger the resistance of a resistor, the smaller the current that passes through it

Resistors in series Resistors in a circuit with the same current passing through them. Their combined resistance = sum of the individual resistances.

Resonates When sound vibrations build up in a musical instrument and cause the sound from the instrument to become much louder.

Resultant force The combined effect of the forces acting on an object.

S

Sankey diagram Diagram to show the energy transfer through a device.

Sensitivity The smallest change that an instrument can detect, e.g. 0.1 mm.

Series Components connected in a circuit so that the same current passes through them are in series with each other.

Series circuit rules 1. The current through components in series is the same. 2. The total potential difference across components in series is shared between the components.

SETI Search for extra-terrestrial intelligence.

Short-circuit A circuit fault in which two wires at different potentials touch and a large current passes between them at the point of contact.

Social issues How science influences and is influenced by its effects on our friends and neighbours. E.g. building a wind farm next to a village.

Socket A mains socket is used to connect the mains plug of a mains appliance to the mains circuit.

Solar cell Electrical cell that produces a voltage when in sunlight; solar cells are usually connected together in solar cell panels.

Solar heating panel Sealed panel designed to use sunlight to heat water running through it.

Sound echo Sound waves from a source of sound reflected from a smooth wall.

Speed Distance travelled per second (in metres/second, m/s).

Speed of a wave Distance travelled per second by a wave.

Static electricity Charge 'held' by an insulator or an insulated conductor.

Stopping distance Braking distance + thinking distance.

Supernova The explosion of a massive star after fusion in its core ceases and the matter surrounding its core collapses on to the core and rebounds.

Sustainable development Using natural resources in a way which also conserves them for future use.

Systematic error If the data is inaccurate in a constant way, e.g. all results are 10 mm more than they should be. This is often due to the method being routinely wrong.

T

Technology Scientific knowledge can be used to develop equipment and processes that can in turn be used for scientific work.

Telescope, optical Instrument consisting of lenses (and/or a mirror) used to make distant objects appear larger or brighter.

Telescope, radio Large concave metal dish and aerial used to detect radio waves from space.

Terminal velocity The velocity reached by an object when the drag force on it is equal and opposite to the force making it move.

Theory A theory is not a guess or a fact. It is the best way to explain why something is happening. E.g. the Big Bang theory is the best way to describe how the Universe started. Theories can be changed when better evidence is available.

Thermal radiation Energy transfer by electromagnetic waves emitted by objects due to their temperature.

Thinking distance The distance travelled by the vehicle in the time it takes the driver to react.

Three-pin plug A three-pin plug has a live pin, a neutral pin and an earth pin. The earth pin is used to earth the metal case of an appliance so the case cannot become live.

Time base control An oscilloscope control used to space the waveform out horizontally.

Transformer Electrical device used to change an (alternating) voltage. A **step-up transformer** is used to step the voltage up, e.g. from a power station to the grid voltage. A **step-down transformer** is used to step the voltage down, e.g. from the grid voltage to the mains voltage used in homes and offices.

U

Ultrasonic waves Sound waves above the frequency range of the human ear (i.e. above 18 000 Hz).

Useful energy Energy transferred to where it is wanted in the form it is wanted.

V

Valid Describes an investigation that successfully gathers the data needed to answer the original question. Data may not be valid if you have not carried out a fair test.

Valid data Evidence that can be reproduced by others and answers the original question.

Van de Graaff generator A large insulated metal dome charged by the motion of a rubber belt brushing against a friction pad.

Velocity Speed in a given direction (in metres/second, m/s).

Virtual image An image, seen in a mirror (or lens), from which light rays appear to come after being reflected by the mirror (or being refracted by the lens).

Volt (V) The unit of potential difference, equal to energy transfer per unit charge in joules per coulomb.

W

Wasted energy Energy that is not usefully transferred or transformed.

Wavelength The distance from one wave peak to the next wave peak along the waves.

Weight The force of gravity on an object (in newtons).

White dwarf A star that has collapsed from the red giant stage to become much hotter and denser than it was.

Work Energy transferred by a force, given by:
Work done (in joules, J) = force (in newtons, N) × distance moved in the direction of the force (in metres, m).

Y

Y-gain control An oscilloscope control used to adjust the height of the waveform.

Z

Zero error A systematic error, often due to the measuring instrument having an incorrect zero. E.g. forgetting that the end of the ruler is not at zero.