

Grade 3 skills checklist

218 skills: the first skills to learn. Tick each one when you can do it.

Cell biology

- ☐ **Name eukaryotic and prokaryotic cells** Animal and plant cells are eukaryotic; bacterial cells are prokaryotic. (Eukaryotes and prokaryotes)
- ☐ **Name the parts of an animal cell** Nucleus, cytoplasm, cell membrane, mitochondria and ribosomes. (Animal and plant cells)
- ☐ **Name the extra structures in plant cells** Chloroplasts, a permanent vacuole filled with cell sap, and a cell wall made of cellulose. (Animal and plant cells)
- ☐ **Name specialised animal and plant cells** Sperm, nerve and muscle cells in animals; root hair, xylem and phloem cells in plants. (Cell specialisation)
- ☐ **State what cell differentiation is** Differentiation is the process by which a cell becomes specialised for a particular function. (Cell differentiation)
- ☐ **State what magnification means** How many times bigger the image is than the real object. (Microscopy)
- ☐ **State where chromosomes are found** In the nucleus of a cell. (Chromosomes)
- ☐ **State what mitosis produces** Two genetically identical cells. (Mitosis and the cell cycle)
- ☐ **State what a stem cell is** An undifferentiated cell that can make more cells of the same type and can differentiate into other types of cell. (Stem cells)
- ☐ **Define diffusion** The net movement of particles from an area of higher concentration to an area of lower concentration. (Diffusion)
- ☐ **Define osmosis** The diffusion of water from a dilute solution to a concentrated solution through a partially permeable membrane. (Osmosis)
- ☐ **State what active transport is** The movement of substances from a more dilute solution to a more concentrated solution, against a concentration gradient. (Active transport)

Organisation

- ☐ **Put the levels of organisation in order** From smallest to largest: cell → tissue → organ → organ system → organism. (Principles of organisation)
- ☐ **Name the organs of the digestive system** Mouth and salivary glands, oesophagus, stomach, liver, gall bladder, pancreas, small intestine and large intestine. (The human digestive system)
- ☐ **Name the three types of blood vessel** Arteries carry blood away from the heart, veins carry blood back to the heart, and capillaries link them inside tissues. (The heart and blood vessels)
- ☐ **Name the four components of blood** Plasma, red blood cells, white blood cells and platelets. (Blood)
- ☐ **Name the vessels that supply heart muscle** The coronary arteries supply the heart muscle with oxygenated blood. (Coronary heart disease: a non-communicable disease)
- ☐ **Define health** Health is the state of physical and mental well-being. (Health issues)

- ☐ **Define a risk factor** A factor linked to an increased rate of a disease, such as part of a person's lifestyle or a substance in their body or environment. (The effect of lifestyle on some non-communicable diseases)
- ☐ **Define cancer** Cancer is the result of changes in cells that lead to uncontrolled growth and division. (Cancer)
- ☐ **Name the tissues in a leaf** Upper and lower epidermis, palisade mesophyll, spongy mesophyll, xylem and phloem, with guard cells around the stomata. (Plant tissues)
- ☐ **Name the parts of the plant transport system** The roots, stem and leaves form an organ system; xylem carries water and phloem carries sugars. (Plant organ system)

Infection and response

- ☐ **Define a pathogen** A pathogen is a microorganism that causes infectious (communicable) disease. (Communicable (infectious) diseases)
- ☐ **Name the four types of pathogen** Viruses, bacteria, fungi and protists; they can infect both animals and plants. (Communicable (infectious) diseases)
- ☐ **Name viral diseases of humans and plants** Measles and HIV in humans; tobacco mosaic virus (TMV) in plants. (Viral diseases)
- ☐ **Name two bacterial diseases** *Salmonella* food poisoning and gonorrhoea, a sexually transmitted disease. (Bacterial diseases)
- ☐ **Name a fungal disease of plants** Rose black spot is a fungal disease of roses. (Fungal diseases)
- ☐ **Name a disease caused by a protist** Malaria is caused by a single-celled protist. (Protist diseases)
- ☐ **Name the body's non-specific defences** The skin, the nose, the trachea and bronchi, and the stomach. (Human defence systems)
- ☐ **State what a vaccine contains** Small quantities of a dead or inactive form of a pathogen. (Vaccination)
- ☐ **State what antibiotics do** Antibiotics, such as penicillin, kill infective bacteria inside the body, curing bacterial diseases. (Antibiotics and painkillers)
- ☐ **State what painkillers do** Painkillers treat the symptoms of a disease but do not kill pathogens. (Antibiotics and painkillers)
- ☐ **Match drugs to their original sources** Digitalis from foxgloves, aspirin from willow, and penicillin from *Penicillium* mould (discovered by Alexander Fleming). (Discovery and development of drugs)

Bioenergetics

- ☐ **Write the word equation for photosynthesis** carbon dioxide + water → glucose + oxygen, with light written above the arrow. (Photosynthetic reaction)
- ☐ **State where photosynthesis takes place** In the chloroplasts of plant and algal cells, where chlorophyll absorbs light. (Photosynthetic reaction)
- ☐ **Name the factors affecting photosynthesis rate** Temperature, light intensity, carbon dioxide concentration and the amount of chlorophyll. (Rate of photosynthesis)
- ☐ **List the five uses of glucose** Respiration, starch for storage, fats or oils for storage, cellulose for cell walls, and amino acids for proteins. (Uses of glucose from photosynthesis)

- ☐ **State why organisms need energy** For chemical reactions that build larger molecules, for movement and for keeping warm. (Aerobic and anaerobic respiration)
- ☐ **Write the word equation for aerobic respiration** glucose + oxygen → carbon dioxide + water. (Aerobic and anaerobic respiration)
- ☐ **State how exercise changes heart and breathing** Heart rate, breathing rate and breath volume all increase. (Response to exercise)
- ☐ **Define metabolism** Metabolism is the sum of all the reactions in a cell or the body. (Metabolism)

Homeostasis and response

- ☐ **Define homeostasis** Regulating the internal conditions of a cell or organism to keep them at the optimum, in response to internal and external changes. (Homeostasis)
- ☐ **Name conditions controlled by homeostasis** In humans: blood glucose concentration, body temperature and water levels. (Homeostasis)
- ☐ **State what the nervous system does** It lets you react to your surroundings and coordinates your behaviour. (The human nervous system)
- ☐ **Define a hormone** A chemical secreted by a gland directly into the bloodstream, which carries it to a target organ. (Human endocrine system)
- ☐ **Name the organ that controls blood glucose** The pancreas monitors and controls blood glucose concentration. (Control of blood glucose concentration)
- ☐ **Name the main male and female hormones** Testosterone from the testes; oestrogen from the ovaries. (Hormones in human reproduction)
- ☐ **Name hormonal and non-hormonal contraceptive methods** E.g. the pill, implant, condom, diaphragm, IUD, spermicide, abstinence and sterilisation. (Contraception)

Inheritance, variation and evolution

- ☐ **Name the gametes in animals and plants** Animals: sperm and egg cells. Flowering plants: pollen and egg cells. (Sexual and asexual reproduction)
- ☐ **State how many parents each type needs** Sexual reproduction needs two parents; asexual reproduction needs only one. (Sexual and asexual reproduction)
- ☐ **State where and why meiosis happens** Cells in the reproductive organs divide by meiosis to form gametes. (Meiosis)
- ☐ **State where DNA is found** The genetic material in the nucleus is a chemical called DNA, contained in chromosomes. (DNA and the genome)
- ☐ **Define dominant and recessive alleles** A dominant allele is expressed even with one copy; a recessive allele is expressed only with two copies. (Genetic inheritance)
- ☐ **Describe polydactyly and cystic fibrosis** Polydactyly is having extra fingers or toes; cystic fibrosis is a disorder of cell membranes. (Inherited disorders)
- ☐ **State the number of chromosome pairs** Ordinary human body cells contain 23 pairs of chromosomes. (Sex determination)

- ☐ **Define variation** Differences in the characteristics of individuals in a population. (Variation)
- ☐ **Define evolution** A change in the inherited characteristics of a population over time through natural selection. (Evolution)
- ☐ **Define selective breeding** Humans breeding plants and animals for particular genetic characteristics. (Selective breeding)
- ☐ **State that evolution is widely accepted** The theory of evolution by natural selection is now widely accepted. (Evidence for evolution)
- ☐ **Define a fossil** The remains of organisms from millions of years ago, which are found in rocks. (Fossils)
- ☐ **Define extinction** A species is extinct when there are no remaining individuals of that species still alive. (Extinction)
- ☐ **Name an antibiotic-resistant bacterium** MRSA is resistant to antibiotics. (Resistant bacteria)
- ☐ **List the Linnaean groups in order** Kingdom, phylum, class, order, family, genus, species. (Classification of living organisms)

Ecology

- ☐ **Define population, community, habitat and ecosystem** A population is one species in a habitat, a community is all the populations there, and an ecosystem is the community interacting with the non-living environment. (Communities)
- ☐ **Define an abiotic factor** A non-living factor in the environment that can affect a community. (Abiotic factors)
- ☐ **Define a biotic factor** A living factor, such as another organism, that can affect a community. (Biotic factors)
- ☐ **Define an adaptation** A feature that helps an organism survive in the conditions where it normally lives. (Adaptations)
- ☐ **Name producers and consumers in a food chain** The producer comes first, then the primary, secondary and tertiary consumers. (Levels of organisation)
- ☐ **State that materials are recycled in ecosystems** Materials cycle through the living and non-living parts of an ecosystem, providing the building blocks for new organisms. (How materials are cycled)
- ☐ **Define biodiversity** The variety of all the different species of organisms on Earth, or within an ecosystem. (Biodiversity)
- ☐ **Name sources of water, air and land pollution** Water: sewage, fertiliser, toxic chemicals. Air: smoke, acidic gases. Land: landfill, toxic chemicals. (Waste management)
- ☐ **Name ways humans use land** Building, quarrying, farming and dumping waste. (Land use)
- ☐ **Define deforestation** Cutting down large areas of forest so the land can be used for something else. (Deforestation)
- ☐ **Name two gases that contribute to global warming** Carbon dioxide and methane. (Global warming)
- ☐ **Name programmes that protect biodiversity** Breeding programmes, protecting rare habitats, hedgerows and field margins, reducing deforestation and carbon dioxide emissions, and recycling. (Maintaining biodiversity)

Atomic structure and the periodic table

- ☐ **Tell elements from compounds using formulae** An element's formula has one symbol (Fe, O₂); a compound's formula has two or more different symbols (CO₂, NaCl). (Atoms, elements and compounds)
- ☐ **Recall symbols of the first 20 elements** Also the Group 1 and Group 7 elements and others in the course, with the correct capital and lower-case letters. (Atoms, elements and compounds)
- ☐ **Define a mixture** Two or more elements or compounds that are not chemically combined together. (Mixtures)
- ☐ **State that models change with new evidence** A scientific model may be changed or replaced when new experimental evidence doesn't fit it. (The development of the model of the atom)
- ☐ **Recall the charges of subatomic particles** Proton +1, neutron 0, electron -1. (Relative electrical charges of subatomic particles)
- ☐ **State where each particle is found** Protons and neutrons are in the nucleus; electrons are in shells around it. (Relative electrical charges of subatomic particles)
- ☐ **Recall relative masses of subatomic particles** Proton 1, neutron 1, electron very small. (Size and mass of atoms)
- ☐ **Recall how many electrons each shell holds** For the first 20 elements: 2 in the first shell, then up to 8 in the second and 8 in the third. (Electronic structure)
- ☐ **Identify groups and periods** Groups are the vertical columns; periods are the horizontal rows. (The periodic table)
- ☐ **State how early tables were ordered** By atomic weight, because protons, neutrons and electrons had not been discovered. (Development of the periodic table)
- ☐ **Locate metals and non-metals in the table** Metals are on the left and towards the bottom; non-metals are on the right and towards the top. (Metals and non-metals)
- ☐ **Name Group 0 and some of its elements** The noble gases: helium, neon, argon, krypton, xenon and radon. (Group 0)
- ☐ **Explain the name 'alkali metals'** They react with water to form hydroxides that dissolve to give alkaline solutions. (Group 1)
- ☐ **Recall the halogens and their states** At room temperature chlorine is a green gas, bromine a red-brown liquid and iodine a grey-black solid. (Group 7)

Bonding, structure, and the properties of matter

- ☐ **Name the three types of strong bond** Ionic, covalent and metallic. (Chemical bonds)
- ☐ **State that metals lose and non-metals gain electrons** Metal atoms lose outer electrons to form positive ions; non-metal atoms gain electrons to form negative ions. (Ionic bonding)
- ☐ **Describe an ionic compound as a giant structure** It is a giant structure (lattice) of ions arranged in a regular pattern. (Ionic compounds)
- ☐ **Describe a covalent bond as a shared pair** A covalent bond is a pair of electrons shared between two atoms. Covalent bonds are strong. (Covalent bonding)

-
- ☐ **State that metals have giant structures** The atoms in a metal are arranged in a regular pattern in a giant structure. (Metallic bonding)
-
- ☐ **Name the changes of state** Melting and freezing happen at the melting point; boiling and condensing happen at the boiling point. (The three states of matter)
-
- ☐ **Recall the four state symbols** (s) solid, (l) liquid, (g) gas, (aq) aqueous: dissolved in water. (State symbols)
-
- ☐ **State that ionic compounds have high melting points** Ionic compounds such as sodium chloride are solids at room temperature with high melting and boiling points. (Properties of ionic compounds)
-
- ☐ **State that small molecules have low boiling points** Substances made of small molecules are usually gases or liquids at room temperature. (Properties of small molecules)
-
- ☐ **State that polymers have very large molecules** Polymer molecules are long chains made of many repeating units. (Polymers)
-
- ☐ **Name examples of giant covalent structures** Diamond and graphite (both forms of carbon) and silicon dioxide (silica). (Giant covalent structures)
-
- ☐ **State that pure metals can be bent and shaped** The atoms in a pure metal are arranged in layers. (Properties of metals and alloys)
-
- ☐ **State that metals conduct electricity and heat** Metals are good conductors of electricity and of thermal energy. (Metals as conductors)
-
- ☐ **State that diamond is a form of carbon** Diamond is made only of carbon atoms, in a giant covalent structure. (Diamond)
-
- ☐ **Describe graphite as layers of carbon atoms** Graphite is made of layers of carbon atoms arranged in hexagonal rings. (Graphite)
-
- ☐ **Describe graphene as one layer of graphite** Graphene is a single layer of carbon atoms in hexagonal rings, one atom thick. (Graphene and fullerenes)
-

Quantitative chemistry

- ☐ **State the law of conservation of mass** No atoms are lost or made in a reaction, so the mass of the products equals the mass of the reactants. (Conservation of mass and balanced chemical equations)
-
- ☐ **Count the atoms in a formula** Multiply the small numbers by the big number in front, e.g. $2\text{H}_2\text{O}$ contains 4 hydrogen atoms and 2 oxygen atoms. (Conservation of mass and balanced chemical equations)
-
- ☐ **Read relative atomic masses from the periodic table** A_r is the larger of the two numbers in each box, e.g. O = 16, Na = 23. (Relative formula mass)
-
- ☐ **State that gases can enter or leave** In an open container, gases can escape into the air or react from the air. (Mass changes when a reactant or product is a gas)
-
- ☐ **Calculate a mean from repeat readings** Add up the results, leaving out any anomalous ones, and divide by how many you added. (Chemical measurements)
-
- ☐ **Recall the unit of concentration** Mass of solute per volume of solution, usually grams per dm^3 (g/dm^3). (Concentration of solutions)
-

Chemical changes

-
- ☐ **Name the oxide formed by a metal** A metal reacting with oxygen forms the metal oxide, e.g. magnesium + oxygen → magnesium oxide. (Metal oxides)
-
- ☐ **Recall the order of the reactivity series** Potassium, sodium, lithium, calcium, magnesium, (carbon), zinc, iron, (hydrogen), copper, from most to least reactive. (The reactivity series)
-
- ☐ **Explain why gold is found as the metal** Gold is so unreactive that it is found in the Earth as the metal itself, not as a compound. (Extraction of metals and reduction)
-
- ☐ **Name the products of metal + acid** A salt and hydrogen, e.g. magnesium + hydrochloric acid → magnesium chloride + hydrogen. (Reactions of acids with metals)
-
- ☐ **Name the salt type from each acid** Hydrochloric acid gives chlorides, nitric acid gives nitrates and sulfuric acid gives sulfates. (Neutralisation of acids and salt production)
-
- ☐ **Name reactants needed to make a salt** For example, copper(II) oxide and sulfuric acid make copper(II) sulfate. (Soluble salts)
-
- ☐ **Use pH to classify solutions** Below 7 is acidic, 7 is neutral and above 7 is alkaline. (The pH scale and neutralisation)
-
- ☐ **Name the electrodes and their charges** The cathode is the negative electrode and the anode is the positive electrode. (The process of electrolysis)
-
- ☐ **State the products from molten lead bromide** Lead is produced at the cathode and bromine at the anode. (Electrolysis of molten ionic compounds)
-

Energy changes

- ☐ **Define exothermic and endothermic reactions** Exothermic reactions transfer energy to the surroundings so their temperature rises; endothermic reactions take in energy so their temperature falls. (Energy transfer during exothermic and endothermic reactions)
-
- ☐ **Give examples of exothermic reactions** Combustion, many oxidation reactions and neutralisation are all exothermic. (Energy transfer during exothermic and endothermic reactions)
-
- ☐ **State what activation energy is** The minimum amount of energy that particles must have to react when they collide. (Reaction profiles)
-

The rate and extent of chemical change

- ☐ **Say what the rate of reaction measures** Rate is how quickly a reactant is used up or a product is formed. (Calculating rates of reactions)
-
- ☐ **Name the five factors that affect rate** Concentration of solutions, pressure of gases, surface area of solids, temperature and the presence of a catalyst. (Factors which affect the rates of chemical reactions)
-
- ☐ **State that particles must collide to react** A reaction can only happen when reactant particles collide with each other. (Collision theory and activation energy)
-
- ☐ **State what a catalyst does** It increases the rate of a reaction but is not used up. (Catalysts)
-
- ☐ **Recognise the reversible reaction symbol** $\rightleftharpoons$ The $\rightleftharpoons$ symbol shows that a reaction can go in both directions. (Reversible reactions)
-

- ☐ **Recall what exothermic and endothermic mean** Exothermic reactions transfer energy to the surroundings; endothermic reactions take in energy from the surroundings. (Energy changes and reversible reactions)
-

Organic chemistry

- ☐ **State what crude oil is** A finite resource found in rocks: the remains of an ancient biomass, mainly plankton, that was buried in mud. (Crude oil, hydrocarbons and alkanes)
-
- ☐ **Define a hydrocarbon** A compound whose molecules are made of hydrogen and carbon atoms only. (Crude oil, hydrocarbons and alkanes)
-
- ☐ **Name fuels produced from crude oil** Petrol, diesel oil, kerosene, heavy fuel oil and liquefied petroleum gases (LPG). (Fractional distillation and petrochemicals)
-
- ☐ **Name materials made by the petrochemical industry** Solvents, lubricants, polymers and detergents. (Fractional distillation and petrochemicals)
-
- ☐ **Name the products of complete combustion** A hydrocarbon burns completely in oxygen to form carbon dioxide and water. (Properties of hydrocarbons)
-
- ☐ **Define cracking** Breaking down large hydrocarbon molecules into smaller, more useful molecules. (Cracking and alkenes)
-

Chemical analysis

- ☐ **Define a pure substance in chemistry** A single element or a single compound, not mixed with any other substance. (Pure substances)
-
- ☐ **Define a formulation** A mixture that has been designed as a useful product. (Formulations)
-
- ☐ **Give examples of formulations** Fuels, cleaning agents, paints, medicines, alloys, fertilisers and foods. (Formulations)
-
- ☐ **Tell mixtures from pure substances on chromatograms** A mixture gives two or more spots; a pure substance gives a single spot. (Chromatography)
-
- ☐ **Describe the test for hydrogen** Hold a burning splint at the open end of a test tube of the gas. (Test for hydrogen)
-
- ☐ **State the positive result for hydrogen** Hydrogen burns rapidly with a pop sound (a 'squeaky pop'). (Test for hydrogen)
-
- ☐ **Describe the test for oxygen** Put a glowing splint into a test tube of the gas. (Test for oxygen)
-
- ☐ **State the positive result for oxygen** The glowing splint relights (bursts back into flame). (Test for oxygen)
-
- ☐ **Describe the test for carbon dioxide** Bubble the gas through limewater, or shake the gas with limewater. (Test for carbon dioxide)
-
- ☐ **State the positive result for carbon dioxide** The limewater turns milky (cloudy). (Test for carbon dioxide)
-
- ☐ **Describe the test for chlorine** Put damp litmus paper into the gas. (Test for chlorine)
-
- ☐ **State the positive result for chlorine** The litmus paper is bleached and turns white. (Test for chlorine)
-

Chemistry of the atmosphere

-
- ☐ **Name the two main gases in air** Nitrogen makes up about four-fifths of the air and oxygen about one-fifth. (The proportions of different gases in the atmosphere)
-
- ☐ **Give the percentages of nitrogen and oxygen** Air is about 80% nitrogen and about 20% oxygen. (The proportions of different gases in the atmosphere)
-
- ☐ **Say where the early atmosphere came from** Intense volcanic activity during the Earth's first billion years released the gases that formed it. (The Earth's early atmosphere)
-
- ☐ **Name the process that produced the oxygen** Photosynthesis by algae and plants produced the oxygen that is now in the atmosphere. (How oxygen increased)
-
- ☐ **Name a process that removed carbon dioxide** Photosynthesis by algae and plants took carbon dioxide out of the atmosphere. (How carbon dioxide decreased)
-
- ☐ **Name three greenhouse gases** Water vapour, carbon dioxide and methane are greenhouse gases. (Greenhouse gases)
-
- ☐ **Give two activities that release carbon dioxide** Burning fossil fuels and deforestation both increase the carbon dioxide in the atmosphere. (Human activities which contribute to an increase in greenhouse gases in the atmosphere)
-
- ☐ **State a major cause of climate change** An increase in the average global temperature is a major cause of climate change. (Global climate change)
-
- ☐ **Give one way to reduce carbon dioxide emissions** For example, generate electricity from renewable resources instead of burning fossil fuels. (The carbon footprint and its reduction)
-
- ☐ **Name the products of complete combustion** A fuel containing carbon and hydrogen forms carbon dioxide and water when it burns in plenty of oxygen. (Atmospheric pollutants from fuels)
-
- ☐ **State that carbon monoxide is toxic** Carbon monoxide is a toxic (poisonous) gas. (Properties and effects of atmospheric pollutants)
-

Using resources

-
- ☐ **State what humans use Earth's resources for** To provide warmth, shelter, food and transport. (Using the Earth's resources and sustainable development)
-
- ☐ **State what potable water means** Potable water is water that is safe to drink. (Potable water)
-
- ☐ **Say why waste water must be treated** Towns and industry produce large amounts of waste water that must be treated before it is released into the environment. (Waste water treatment)
-
- ☐ **Name the four stages of an LCA** Extracting and processing raw materials, manufacturing and packaging, use and operation, and disposal. (Life cycle assessment)
-
- ☐ **State the three ways to reduce resource use** Reduce use, reuse and recycle. (Ways of reducing the use of resources)
-

Energy

-
- ☐ **Define a system** A system is an object or a group of objects that you choose to study, e.g. a ball and the Earth. (Energy stores and systems)
-

- ☐ **Name the main energy stores** Kinetic, gravitational potential, elastic potential, thermal (internal), chemical, magnetic, electrostatic and nuclear. (Energy stores and systems)

- ☐ **Recall the kinetic and gravitational energy equations** $E_k = \frac{1}{2} m v^2$ and $E_p = m g h$: the specification says you must be able to recall both. (Changes in energy)

- ☐ **Name what affects the energy needed to heat** The energy needed depends on the mass, the material and the temperature rise. (Energy changes in systems)

- ☐ **State the unit of power** Power is measured in watts (W); 1 W is 1 joule transferred per second. (Power)

- ☐ **State the law of conservation of energy** Energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed. (Energy transfers in a system)

- ☐ **Identify useful and wasted energy transfers** E.g. for a lamp, light is the useful output and heating the surroundings is wasted. (Efficiency)

- ☐ **List the main energy resources** Fossil fuels (coal, oil, gas), nuclear fuel, bio-fuel, wind, hydro-electricity, geothermal, the tides, the Sun and water waves. (National and global energy resources)

- ☐ **Define a renewable energy resource** A resource that is being (or can be) replenished as it is used. (National and global energy resources)

Electricity

- ☐ **Name common components from their symbols** Recognise the cell, battery, switch, lamp, resistor, ammeter and voltmeter symbols. (Standard circuit diagram symbols)

- ☐ **State that current is a flow of charge** Electric current is a flow of electrical charge around a closed circuit. (Electrical charge and current)

- ☐ **Give the units of charge, current, time** Charge in coulombs (C), current in amperes (A) and time in seconds (s). (Electrical charge and current)

- ☐ **State the unit of resistance** Resistance is measured in ohms (Ω). (Current, resistance and potential difference)

- ☐ **Recall that an LDR's resistance falls in light** The resistance of an LDR decreases as light intensity increases. (Resistors)

- ☐ **Tell series and parallel circuits apart** Series: one loop, one path. Parallel: two or more branches connected across the same two points. (Series and parallel circuits)

- ☐ **State that mains electricity is ac** The mains supply is an alternating current (ac) supply. (Direct and alternating potential difference)

- ☐ **Recall the UK mains frequency and pd** The UK domestic supply has a frequency of 50 Hz and is about 230 V. (Direct and alternating potential difference)

- ☐ **Recall the colours of the three wires** Live is brown, neutral is blue, earth is green and yellow stripes. (Mains electricity)

- ☐ **State the unit of power** Power is measured in watts (W); 1 W is 1 joule per second. (Power)

- ☐ **Describe energy transfers in simple appliances** e.g. a kettle transfers energy electrically from the mains to the thermal energy store of the water. (Energy transfers in everyday appliances)

- ☐ **Describe what the National Grid is** A system of cables and transformers linking power stations to consumers. (The National Grid)
-

Particle model of matter

- ☐ **Draw particle diagrams for the three states** Solid: particles touching in regular rows; liquid: particles touching but jumbled; gas: particles far apart and random. (Density of materials)
-
- ☐ **Name the changes of state** Melting, freezing, boiling, evaporating, condensing and sublimating. (Changes of state)
-
- ☐ **State that heating increases the particles' energy** Heating a system transfers energy to its particles, so the energy they store increases. (Internal energy)
-
- ☐ **Describe the motion of gas molecules** They are in constant random motion, moving in all directions. (Particle motion in gases)
-

Atomic structure

- ☐ **Name the three particles in an atom** Protons and neutrons are in the nucleus; electrons are arranged around the nucleus. (The structure of an atom)
-
- ☐ **State what atomic number means** The atomic number is the number of protons in the nucleus. (Mass number, atomic number and isotopes)
-
- ☐ **Put the models of the atom in order** Tiny spheres, plum pudding, nuclear model, Bohr's energy levels, then protons and neutrons. (The development of the model of the atom)
-
- ☐ **Name the types of nuclear radiation** Alpha particles (α), beta particles (β), gamma rays (γ) and neutrons (n). (Radioactive decay and nuclear radiation)
-
- ☐ **Give precautions for handling radioactive sources** Use tongs, wear gloves, keep the source in a lead-lined box and spend as little time near it as possible. (Radioactive contamination)
-

Forces

- ☐ **Define scalar and vector quantities** A scalar has magnitude only; a vector has magnitude and an associated direction. (Scalar and vector quantities)
-
- ☐ **Define a force as a push or pull** A force acts on an object because of its interaction with another object, and is measured in newtons (N). (Contact and non-contact forces)
-
- ☐ **Name examples of contact forces** Friction, air resistance, tension and normal contact force act when objects are touching. (Contact and non-contact forces)
-
- ☐ **Define weight as the force due to gravity** Weight is measured in newtons (N); mass is measured in kilograms (kg). (Gravity)
-
- ☐ **Define resultant force** A single force that has the same effect as all the original forces acting together. (Resultant forces)
-
- ☐ **State that work done is energy transferred** When a force moves an object through a distance, energy is transferred and work is done. (Work done and energy transfer)
-

- ☐ **Explain why more than one force is needed** To stretch, bend or compress an object, forces must act on it in different directions. (Forces and elasticity)
- ☐ **State that distance is a scalar** Distance is how far an object moves; it does not involve direction. (Distance and displacement)
- ☐ **State that speed is a scalar** Speed is the distance travelled per unit time and has no direction. (Speed)
- ☐ **Define velocity** The velocity of an object is its speed in a given direction. (Velocity)
- ☐ **Describe motion from a distance–time graph** A horizontal line means stationary; a straight sloping line means constant speed. (The distance–time relationship)
- ☐ **Recognise balanced forces on a diagram** Equal-sized arrows in opposite directions mean the resultant force is zero. (Newton's First Law)
- ☐ **Define stopping distance as thinking plus braking** Thinking distance is covered during the reaction time; braking distance is covered while the brakes act. (Stopping distance)
- ☐ **Recall typical reaction times** Typical reaction times range from 0.2 s to 0.9 s. (Reaction time)
- ☐ **Name factors that increase braking distance** Higher speed, wet or icy roads, worn brakes and worn tyres. (Factors affecting braking distance 1)

Waves

- ☐ **Give examples of transverse and longitudinal waves** Transverse: ripples on water and all electromagnetic waves, such as light. Longitudinal: sound waves in air. (Transverse and longitudinal waves)
- ☐ **Label amplitude and wavelength on a diagram** Amplitude: from the undisturbed position to a crest (or trough). Wavelength: one complete wave, e.g. crest to crest. (Properties of waves)
- ☐ **Name the parts of the EM spectrum in order** Radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, gamma rays. (Types of electromagnetic waves)
- ☐ **State that EM waves are transverse** EM waves are transverse waves that transfer energy from a source to an absorber. (Types of electromagnetic waves)
- ☐ **Name the EM waves that harm body tissue** Ultraviolet, X-rays and gamma rays can have hazardous effects on human body tissue. (Properties of electromagnetic waves 2)
- ☐ **Match each EM wave to a use** E.g. radio waves: television and radio; X-rays: medical imaging. (Uses and applications of electromagnetic waves)

Magnetism and electromagnetism

- ☐ **State where a magnet's forces are strongest** The magnetic forces are strongest at the poles: the north (seeking) pole and the south (seeking) pole. (Poles of a magnet)
- ☐ **Predict attraction or repulsion between two poles** Like poles (N and N, or S and S) repel; unlike poles (N and S) attract. (Poles of a magnet)
- ☐ **Name the four magnetic materials** Iron, steel, cobalt and nickel are always attracted by a magnet. (Magnetic fields)
- ☐ **State that a current produces a magnetic field** When a current flows through a wire, a magnetic field is produced around the wire. (Electromagnetism)

