

Grade 6 checklist

167 skills. Tick each one when you can do it. For grade 6 you need the skills for the grades below it too.

Atomic structure and the periodic table

- ☐ **Balance symbol equations** Change only the large numbers in front of formulae until every element has the same number of atoms on each side. (Atoms, elements and compounds)
- ☐ **Choose a method from given data** Use information about solubility and boiling points to choose and justify a separation technique. (Mixtures)
- ☐ **Compare plum pudding and nuclear models** Positive charge and mass spread out, compared with concentrated in a tiny nucleus with mostly empty space around it. (Development of the model of the atom)
- ☐ **Work out a particle's overall charge** Charge = protons – electrons, e.g. 12 protons and 10 electrons gives a 2+ ion. (Relative charges of subatomic particles)
- ☐ **Find protons, neutrons and electrons in ions** Protons and neutrons as in the atom; one electron fewer for each + charge, one more for each – charge. (Size and mass of atoms)
- ☐ **Decide which isotope is more abundant** The A_r is closer to the mass number of the more abundant isotope. (Relative atomic mass)
- ☐ **Give the electronic structure of simple ions** Remove or add outer electrons, e.g. Na^+ is 2,8 and Cl^- is 2,8,8. (Electronic structure)
- ☐ **Explain why it is called 'periodic'** Similar properties occur at regular intervals as the atomic number increases. (The periodic table)
- ☐ **Explain why Mendeleev's table was accepted** Elements were later discovered that filled the gaps and had the properties he predicted. (Development of the periodic table)
- ☐ **Classify an element using data** Use melting point, conductivity, appearance and the type of oxide as evidence. (Metals and non-metals)
- ☐ **Predict a property from a trend** Estimate a missing value in a table so that it fits the pattern. (Group 0)
- ☐ **Explain why helium is also unreactive** Its only shell is the first shell, which is full with 2 electrons. (Group 0)
- ☐ **Explain their similar reactions using electrons** They all have one electron in their outer shell, which they lose to form 1+ ions. (Group 1)
- ☐ **Predict properties of rubidium and caesium** Use the trends: even more vigorous reactions and similar products, e.g. RbOH and RbCl . (Group 1)
- ☐ **Write equations for displacement reactions** e.g. $\text{Cl}_2 + 2\text{NaBr} \rightarrow 2\text{NaCl} + \text{Br}_2$, with the colour change. (Group 7)
- ☐ **Use data to compare the two groups** Quote values from a table, with units, to support each comparison. (Comparison with Group 1 elements)
- ☐ **Use Roman numerals for ion charges** Iron(II) means Fe^{2+} and iron(III) means Fe^{3+} . (Typical properties)

- ☐ **Identify a transition metal from evidence** Coloured compounds, more than one ion charge or use as a catalyst point to a transition metal. (Typical properties)
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Bonding, structure and the properties of matter

- ☐ **Describe what the electrons do in each bond** Electrons are transferred (ionic), shared in pairs (covalent) or delocalised (metallic). (Chemical bonds)
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- ☐ **Work out the formula of an ionic compound** Balance the charges so the total is zero, e.g. Ca^{2+} and Cl^- give CaCl_2 . (Ionic bonding)
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- ☐ **Work out an empirical formula from a diagram** Count the ions of each type and simplify the ratio, e.g. 8 : 16 gives XY_2 . (Ionic compounds)
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- ☐ **Draw molecules with double and triple bonds** Oxygen, O_2 , has a double bond (two shared pairs); nitrogen, N_2 , has a triple bond (three shared pairs). (Covalent bonding)
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- ☐ **Deduce a molecular formula from a diagram** Count every atom of each element in one molecule, e.g. C_2H_6 for ethane. (Covalent bonding)
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- ☐ **Explain why the metal particles are positive ions** Each atom has lost its outer electrons to the delocalised electrons, so it has more protons than electrons. (Metallic bonding)
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- ☐ **Link melting and boiling points to forces** The stronger the forces between the particles, the more energy is needed and the higher the melting and boiling points. (The three states of matter)
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- ☐ **Recognise that single atoms lack bulk properties** One atom does not have properties such as colour, melting point or conductivity; these come from huge numbers of particles. (The three states of matter)
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- ☐ **Tell (l) apart from (aq)** Water itself and molten substances are (l); substances dissolved in water are (aq). (State symbols)
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- ☐ **Explain conduction in terms of moving ions** When molten or dissolved, the ions are free to move and carry charge; in the solid they are held in fixed positions. (Properties of ionic compounds)
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- ☐ **Say which forces are overcome on boiling** The intermolecular forces are overcome; the covalent bonds inside the molecules do not break. (Properties of small molecules)
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- ☐ **Explain why polymers are solids at room temperature** Their large molecules have relatively strong intermolecular forces, which need more energy to overcome than those between small molecules. (Polymers)
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- ☐ **Recognise giant covalent structures from diagrams** A network of atoms all joined by covalent bonds, continuing in all directions, with no separate molecules. (Giant covalent structures)
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- ☐ **Explain why alloys are harder than pure metals** Atoms of different sizes distort the layers, so the layers cannot slide over each other as easily. (Properties of metals and alloys)
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- ☐ **Explain thermal conduction in metals** Energy is transferred through the metal by the delocalised electrons. (Metals as conductors)
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- ☐ **Explain why diamond does not conduct electricity** All four outer electrons of each carbon atom are used in bonds, so there are no delocalised electrons. (Diamond)
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- ☐ **Explain why graphite conducts electricity** One electron from each carbon atom is delocalised and can move through the structure, carrying charge. (Graphite)

- ☐ **Explain graphite's very high melting point** The many strong covalent bonds within the layers must be broken. (Graphite)

- ☐ **Explain the properties of graphene** Strong covalent bonds make it very strong; delocalised electrons let it conduct electricity. (Graphene and fullerenes)

- ☐ **Compare nanoparticle sizes with atoms and molecules** An atom has a radius of about 0.1 nm, so a nanoparticle is tens to hundreds of atoms across. (Sizes of particles and their properties)

- ☐ **Calculate a cube's surface area to volume ratio** Surface area = $6 \times \text{side}^2$; volume = side^3 ; ratio = surface area $\div$ volume. (Sizes of particles and their properties)

- ☐ **Explain possible risks of nanoparticles** They may get into the body or into cells and cause harm, and their long-term effects are not yet known. (Uses of nanoparticles)

Quantitative chemistry

- ☐ **Write balanced equations from word equations** Write the correct formula for each substance (e.g. O_2 , H_2 , HCl , MgCl_2) and then balance it. (Conservation of mass and balanced equations)

- ☐ **Calculate percentage by mass of an element** Divide the total A_r of that element in the formula by the M_r , then multiply by 100. (Relative formula mass)

- ☐ **Use an equation to predict the mass change** Look for (g): a gas reactant means the mass goes up, a gas product means it goes down. (Mass changes when a reactant or product is a gas)

- ☐ **Calculate the uncertainty from the range** Uncertainty = $\pm$ half the range, e.g. a range of 0.4 g gives ± 0.2 g. (Chemical measurements and uncertainty)

- ☐ **Calculate moles from mass** moles = mass (g) $\div$ M_r . (Moles)

- ☐ **Calculate the masses shown in an equation** For each substance, mass = balancing number $\times$ M_r , e.g. $2\text{H}_2\text{O}$ is 36 g. (Amounts of substances in equations)

- ☐ **Convert each reacting mass into moles** Divide each mass by its M_r , using O_2 , H_2 , Cl_2 or N_2 for gaseous elements. (Using moles to balance equations)

- ☐ **Explain why a reactant is used in excess** To make sure that all of the other reactant is used up. (Limiting reactants)

- ☐ **Predict how the limiting reactant affects product** The amount of product is proportional to the amount of limiting reactant; extra excess reactant makes no more product. (Limiting reactants)

- ☐ **Calculate the mass of solute in a solution** Mass = concentration (g/dm^3) $\times$ volume (dm^3). (Concentration of solutions)

- ☐ **Calculate actual mass from percentage yield** Actual mass = % yield $\div$ 100 $\times$ theoretical mass. (Percentage yield)

- ☐ **Use balancing numbers in atom economy** Multiply each M_r by its balancing number before adding, e.g. 2Fe counts as $2 \times 56 = 112$. (Atom economy)

☐ **Explain why high atom economy matters** Less waste and fewer raw materials, which is better for sustainable development and cheaper. (Atom economy)

☐ **Calculate concentration in mol/dm³** Concentration = moles of solute ÷ volume of solution in dm³.
(Concentrations in mol/dm³)

☐ **Calculate moles from concentration and volume** Moles = concentration (mol/dm³) × volume (dm³).
(Concentrations in mol/dm³)

☐ **Recall the volume of one mole of gas** 1 mol of any gas occupies 24 dm³ at room temperature and pressure (20 °C and 1 atmosphere). (Volumes of gases)

☐ **Calculate gas volume from moles** Volume (dm³) = moles × 24. (Volumes of gases)

Chemical changes

☐ **Balance equations for metals reacting with oxygen** Write correct formulae first, then balance with numbers in front, e.g. $4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$. (Metal oxides)

☐ **Write equations for displacement reactions** For example, zinc + copper sulfate → zinc sulfate + copper.
(The reactivity series)

☐ **Identify what is oxidised and reduced** The metal oxide loses oxygen so it is reduced; carbon gains oxygen so it is oxidised. (Extraction of metals and reduction)

☐ **Identify the species oxidised and reduced** An atom that becomes a positive ion is oxidised; a positive ion that becomes an atom is reduced. (Oxidation and reduction in terms of electrons)

☐ **Write balanced symbol equations for these reactions** For example, $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$.
(Reactions of acids with metals)

☐ **Work out salt formulae from ion charges** Balance the charges so they add to zero, e.g. Ca^{2+} and NO_3^- give $\text{Ca}(\text{NO}_3)_2$. (Neutralisation and salt production)

☐ **Describe the full method for a salt** Warm acid, add solid until in excess, filter, evaporate some water, crystallise, then dry the crystals. (Soluble salts)

☐ **Write the ionic equation for neutralisation** $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$. (The pH scale and neutralisation)

☐ **Explain how to find the end point accurately** Swirl, add dropwise near the end point, use a white tile and read the burette at eye level. (Titrations)

☐ **Define strong and weak acids** A strong acid is completely ionised in aqueous solution; a weak acid is only partially ionised. (Strong and weak acids)

☐ **Explain the terms dilute and concentrated** They describe the amount of acid in a given volume of solution, not how much it ionises. (Strong and weak acids)

☐ **Explain why solid ionic compounds do not conduct** In a solid the ions are held in fixed positions in a lattice, so they cannot move to carry charge. (The process of electrolysis)

☐ **Explain how each product forms** Metal ions are attracted to the cathode and gain electrons; non-metal ions are attracted to the anode and lose electrons. (Electrolysis of molten ionic compounds)

- ☐ **Explain why cryolite is used** Mixing aluminium oxide with cryolite lowers the melting point, so less energy is needed. (Using electrolysis to extract metals)

- ☐ **Explain where hydrogen and hydroxide ions come from** A small number of water molecules break down into hydrogen ions and hydroxide ions. (Electrolysis of aqueous solutions)

- ☐ **Describe tests for the gases produced** Hydrogen gives a squeaky pop, oxygen relights a glowing splint and chlorine bleaches damp litmus paper. (Electrolysis of aqueous solutions)

- ☐ **Write cathode half equations for metal ions** For example, $\text{Cu}^{2+} + 2\text{e}^{-} \rightarrow \text{Cu}$. (Half equations at electrodes)

- ☐ **Write anode half equations for halide ions** For example, $2\text{Cl}^{-} \rightarrow \text{Cl}_2 + 2\text{e}^{-}$. (Half equations at electrodes)

Energy changes

- ☐ **Describe the temperature change required practical** Mix measured amounts in a polystyrene cup, stir, and record the starting and the highest (or lowest) temperature. (Energy transfer in exothermic and endothermic reactions)

- ☐ **Evaluate uses of exothermic and endothermic reactions** Judge hand warmers, self-heating cans and cold packs using given data on temperature change, cost, safety and reuse. (Energy transfer in exothermic and endothermic reactions)

- ☐ **Draw a reaction profile** Show the reactants and products at the correct relative heights, a curve with a peak above both, and labelled arrows. (Reaction profiles)

- ☐ **Count the bonds in displayed formulae** Find how many of each type of bond there are, e.g. $\text{H}-\text{O}-\text{H}$ has two $\text{O}-\text{H}$ bonds and $\text{O}=\text{C}=\text{O}$ has two $\text{C}=\text{O}$ bonds. (Energy change of reactions (bond energies))

- ☐ **Explain exothermic or endothermic using bond energies** Compare the energy needed to break the bonds with the energy released when the new bonds form. (Energy change of reactions (bond energies))

- ☐ **Explain how rechargeable cells are recharged** When an external electrical current is supplied, the chemical reactions are reversed. (Cells and batteries)

- ☐ **Use voltage data to order metals by reactivity** The bigger the difference in reactivity between the two metals, the bigger the voltage of the cell. (Cells and batteries)

- ☐ **Give advantages and disadvantages of hydrogen fuel cells** For example, they are refuelled in minutes, but hydrogen is a flammable gas that is difficult to store. (Fuel cells)

The rate and extent of chemical change

- ☐ **Draw a tangent to a rate curve** Draw a straight line that touches the curve at the chosen time; its slope is a measure of the rate at that time. (Calculating rates of reactions)

- ☐ **Sketch rate curves for changed conditions** A faster reaction has a steeper start and levels off sooner, at the same height if the amounts of reactants are the same. (Factors which affect the rate of reaction)

- ☐ **Identify and control the variables** Independent: concentration; dependent: time taken or volume of gas; control: temperature, volumes, and mass and size of solid. (Factors which affect the rate of reaction)

- ☐ **Explain the effect of temperature fully** Particles move faster, so collisions are more frequent and more energetic, and more of them have at least the activation energy. (Collision theory and activation energy)

- ☐ **Explain how a catalyst increases the rate** It provides a different pathway for the reaction that has a lower activation energy. (Catalysts)

- ☐ **Draw a reaction profile with a catalyst** Show a lower peak between the same reactant and product energy levels. (Catalysts)

- ☐ **Explain how conditions change the direction** Changing a condition such as temperature can make the forward or the reverse reaction happen. (Reversible reactions)

- ☐ **Use observations as evidence of reversibility** E.g. a white solid re-forming at the cool top of a heated tube shows the reverse reaction happening. (Reversible reactions)

- ☐ **Link the colour changes to energy changes** Blue to white takes in energy (endothermic); white to blue gives out energy (exothermic). (Energy changes and reversible reactions)

- ☐ **Give the energy change for the reverse reaction** Same amount, opposite direction: e.g. forward takes in 50 kJ, reverse gives out 50 kJ. (Energy changes and reversible reactions)

- ☐ **Explain why the equilibrium is dynamic** Both the forward and reverse reactions are still happening, at the same rate. (Equilibrium)

- ☐ **Find when equilibrium is reached from data** Equilibrium starts when the amounts or concentrations stop changing (the lines become horizontal). (Equilibrium)

- ☐ **Explain what shifting right or left means** Shifting right gives more products at equilibrium; shifting left gives more reactants. (Changing conditions and equilibrium)

- ☐ **Know a catalyst does not move equilibrium** A catalyst speeds up both reactions equally, so equilibrium is reached faster but its position does not change. (Changing conditions and equilibrium)

- ☐ **Predict the effect of removing a product** More reactants react until equilibrium is reached again, so more product forms. (Effect of changing concentration)

- ☐ **Predict the effect of adding more product** The position shifts to the left, so more reactants form. (Effect of changing concentration)

- ☐ **Predict heating an endothermic reaction** Raising the temperature increases the relative amount of products at equilibrium. (Effect of temperature changes)

- ☐ **Predict the effect of increasing the pressure** The position shifts towards the side with the smaller number of molecules. (Effect of pressure changes)

- ☐ **Predict the effect of decreasing the pressure** The position shifts towards the side with the larger number of molecules. (Effect of pressure changes)

Organic chemistry

- ☐ **Describe the features of a homologous series** Same general formula, each member differs from the next by CH_2 , similar chemical reactions and a gradual trend in physical properties. (Crude oil, hydrocarbons and alkanes)

- ☐ **Explain fractional distillation using evaporation and condensation** Crude oil is evaporated; the vapours rise and each hydrocarbon condenses where the temperature falls below its boiling point. (Fractional distillation and petrochemicals)

- ☐ **Balance complete combustion equations** Balance C, then H, then O; if you need half an O₂, double every number. (Properties of hydrocarbons)
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- ☐ **Balance cracking equations** The total numbers of carbon and hydrogen atoms must be the same on both sides, e.g. C₁₀H₂₂ → C₈H₁₈ + C₂H₄. (Cracking and alkenes)
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- ☐ **Explain why cracking is needed using data** The supply of long-chain fractions is greater than demand, and the demand for short-chain fuels is greater than supply. (Cracking and alkenes)
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- ☐ **Draw displayed formulae of the first four alkenes** Show every bond, with one C=C and exactly four bonds on each carbon atom. (Structure and formulae of alkenes)
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- ☐ **Tell alkanes and alkenes apart from formulae** Alkanes fit C_nH_{2n+2} and have single bonds only; alkenes fit C_nH_{2n} and have a C=C. (Structure and formulae of alkenes)
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- ☐ **Explain what happens in an addition reaction** Atoms add across the C=C, which becomes a single bond; only one product forms. (Reactions of alkenes)
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- ☐ **Write balanced equations for alcohol combustion** For example, C₂H₅OH + 3O₂ → 2CO₂ + 3H₂O. (Alcohols)
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- ☐ **Draw the displayed formula of a carboxylic acid** Show the –COOH group with a C=O bond and a C–O–H. (Carboxylic acids)
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- ☐ **Draw the repeating unit from a monomer** Change the C=C to C–C, keep the other atoms, and draw bonds out through brackets with n. (Addition polymerisation)
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- ☐ **Calculate the number of monomers in a polymer** Divide the relative formula mass of the polymer by that of the monomer. (Addition polymerisation)
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- ☐ **Identify the small molecule lost** Usually water, H₂O, formed each time two monomers join. (Condensation polymerisation)
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- ☐ **Name the functional groups in polyester monomers** A diol has two –OH groups; a dicarboxylic acid has two –COOH groups. (Condensation polymerisation)
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- ☐ **Name the two functional groups in amino acids** An amine group, –NH₂, and a carboxylic acid group, –COOH. (Amino acids)
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- ☐ **State what amino acids polymerise to form** Polypeptides; different amino acids joined in the same chain make proteins. (Amino acids)
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- ☐ **Explain why proteins are so varied** They are made from many different amino acids, which can be joined in different orders. (DNA and other naturally occurring polymers)
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Chemical analysis

- ☐ **Calculate masses and percentages in formulations** Mass of component = percentage ÷ 100 × total mass, and the reverse. (Formulations)
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- ☐ **Name the stationary and mobile phases** The paper is the stationary phase; the solvent is the mobile phase that moves through it. (Chromatography)
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- ☐ **Give R_f values to suitable significant figures** R_f has no units; give it to the significant figures asked for, usually 2. (Chromatography)
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- ☐ **Explain the pop with an equation** Hydrogen reacts rapidly with oxygen in the air: $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$. (Test for hydrogen)
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- ☐ **Explain why the splint relights** The gas has a much higher concentration of oxygen than air (about 20%), so the splint burns fast enough to relight. (Test for oxygen)
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- ☐ **Identify gases using all four tests** Match each result to hydrogen, oxygen, carbon dioxide or chlorine. (Test for chlorine)
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- ☐ **Explain why mixtures give unclear results** Some flame colours can be masked by others, e.g. by the strong yellow of sodium. (Flame tests)
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- ☐ **Work out hydroxide formulae from ion charges** One OH^- for each positive charge on the metal ion, e.g. $\text{Al}(\text{OH})_3$. (Metal hydroxides)
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- ☐ **Write balanced equations for forming precipitates** e.g. $\text{CuSO}_4 + 2\text{NaOH} \rightarrow \text{Cu}(\text{OH})_2 + \text{Na}_2\text{SO}_4$. (Metal hydroxides)
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- ☐ **Balance equations for acids with carbonates** e.g. $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$. (Carbonates)
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- ☐ **Explain why nitric acid is added** It removes carbonate ions, which would also form a precipitate with silver nitrate. (Halides)
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- ☐ **Explain why hydrochloric acid is not used** It contains chloride ions, which would give a white precipitate every time. (Halides)
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- ☐ **Explain why hydrochloric acid is added** It removes carbonate ions, which would also give a white precipitate with barium chloride. (Sulfates)
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- ☐ **Explain why sulfuric acid cannot be used** It contains sulfate ions, so it would always give a white precipitate. (Sulfates)
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- ☐ **Compare instrumental methods with chemical tests** Instruments handle tiny samples and mixtures and measure amounts; chemical tests are cheap and simple. (Instrumental methods)
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- ☐ **Give disadvantages of instrumental methods** The equipment is expensive, needs trained operators, and results must be compared with reference data. (Instrumental methods)
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- ☐ **Identify every metal ion in a mixture** A mixture's spectrum contains all the lines of each metal ion present. (Flame emission spectroscopy)
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- ☐ **Explain advantages over flame tests** It works with mixtures (no masking), measures concentrations and is more sensitive. (Flame emission spectroscopy)
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Chemistry of the atmosphere

- ☐ **Use ratios and fractions for gases in air** Nitrogen : oxygen is about 80 : 20, which simplifies to 4 : 1, and four-fifths is the same as 80%. (Proportions of gases in the atmosphere)
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- ☐ **Explain how the oceans removed carbon dioxide** Carbon dioxide dissolved in the oceans and carbonates were precipitated, forming sediments. (The Earth's early atmosphere)
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- ☐ **Explain why evidence about it is limited** The time scale is about 4.6 billion years, so no one could measure it and little evidence survives. (The Earth's early atmosphere)
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- ☐ **Describe how the percentage of oxygen increased** Over the next billion years plants evolved and oxygen gradually increased to a level that let animals evolve. (How oxygen increased)
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- ☐ **Explain two effects of photosynthesis on air** Photosynthesis adds oxygen to the atmosphere and removes carbon dioxide from it at the same time. (How oxygen increased)
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- ☐ **Describe how crude oil and natural gas formed** Remains of plankton buried in mud on the sea bed were changed by heat and pressure over millions of years. (How carbon dioxide decreased)
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- ☐ **Describe the greenhouse effect using wavelengths** The warm surface emits long wavelength radiation, which greenhouse gases absorb and re-emit in all directions. (Greenhouse gases)
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- ☐ **Explain why peer review matters** Other experts check the methods, data and conclusions before publication, which reduces errors and bias. (Human activities that increase greenhouse gases)
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- ☐ **Describe trends in carbon dioxide data** Quote values from a graph or table and calculate changes, e.g. the increase or percentage increase over a period. (Human activities that increase greenhouse gases)
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- ☐ **Explain how warming causes sea levels to rise** Ice on land melts and flows into the sea, and sea water expands as it warms. (Global climate change)
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- ☐ **Give reasons why actions may be limited** Scientific disagreement, lack of public information and education, lifestyle changes, economic considerations and incomplete international cooperation. (The carbon footprint and its reduction)
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- ☐ **Describe actions to reduce methane emissions** For example, collect methane from landfill to use as a fuel, send less waste to landfill, and reduce livestock numbers. (The carbon footprint and its reduction)
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- ☐ **Describe how oxides of nitrogen form** At the high temperatures in engines, nitrogen and oxygen from the air react together. (Atmospheric pollutants from fuels)
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- ☐ **Explain how particulates cause global dimming** Particulates reflect sunlight back into space, so less sunlight reaches the Earth's surface. (Properties and effects of atmospheric pollutants)
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- ☐ **Describe the health effects of these pollutants** Sulfur dioxide and oxides of nitrogen cause respiratory problems, and particulates can damage the lungs. (Properties and effects of atmospheric pollutants)
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Using resources

- ☐ **Classify a resource as finite or renewable** Use the information given: compare how quickly the resource forms or regrows with how quickly it is used. (Using resources and sustainable development)
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- ☐ **Describe the water purification required practical** Test the pH, find the mass of dissolved solids by evaporation, and purify the water by distillation. (Potable water)
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- ☐ **Describe what happens at each stage** For example, in sedimentation solids settle to form sludge, leaving the liquid effluent on top. (Waste water treatment)
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- ☐ **State what industrial waste water needs** Removal of organic matter and harmful chemicals. (Waste water treatment)
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- ☐ **Describe how bioleaching works** Bacteria are used to produce leachate solutions that contain metal compounds. (Alternative methods of extracting metals)
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- ☐ **Name ways to get copper from solutions** Displacement using scrap iron, or electrolysis. (Alternative methods of extracting metals)
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- ☐ **Calculate totals from LCA data tables** Add up the values for each stage, and compare products per item or per use. (Life cycle assessment)
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- ☐ **Explain why separation is needed for recycling** The amount of separation depends on the material and the properties required of the final product. (Ways of reducing the use of resources)
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- ☐ **Explain why aluminium does not corrode away** A layer of aluminium oxide on its surface protects the metal from further corrosion. (Corrosion and its prevention)
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- ☐ **Explain how galvanising protects iron** The zinc coating is a barrier and, if scratched, the more reactive zinc corrodes instead of the iron. (Corrosion and its prevention)
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- ☐ **Explain why alloys are harder than pure metals** Atoms of different sizes distort the layers, so the layers cannot slide over each other as easily. (Alloys as useful materials)
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- ☐ **Convert between carats and percentage of gold** 24 carat is 100% gold, so percentage of gold = carats $\div$ 24 $\times$ 100; 18 carat is 75% gold. (Alloys as useful materials)
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- ☐ **Explain why LD and HD poly(ethene) differ** Both are made from ethene but under different conditions, giving branched or mostly unbranched chains. (Ceramics, polymers and composites)
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- ☐ **Write the balanced equation** $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$; the reaction is reversible and the forward reaction is exothermic. (The Haber process)
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- ☐ **Name salts made from phosphate rock** Nitric acid gives phosphoric acid and calcium nitrate; sulfuric acid gives calcium sulfate and calcium phosphate; phosphoric acid gives calcium phosphate. (Production and uses of NPK fertilisers)
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