

Lesson number	Lesson title	Lesson objectives
Chapter 1 Atomic Structure and Periodic Table		
1.1	Elements and compounds	<ul style="list-style-type: none"> Identify symbols of elements from the periodic table Recognise the properties of elements and compounds. Identify the elements in a compound
1.2	Atoms, formulae and equations	<ul style="list-style-type: none"> Learn the symbols of the first 20 elements in the periodic table. Use symbols to describe elements and compounds. Use formulae to write equations.
1.3	Mixtures	<ul style="list-style-type: none"> Recognise that all substances are chemicals Understand that mixtures can be separated into their components Suggest suitable separation and purification techniques for mixtures.
1.4	Changing ideas about atoms	<ul style="list-style-type: none"> Learn how models of the atom changed as scientists gathered more data. Consider the data Rutherford and Marsden collected. Link their data to our model of the atom.
1.5	Modelling the atom	<ul style="list-style-type: none"> Explore the structure of atoms. Consider the sizes of atoms. Explore the way atomic radius changes with position in the periodic table.
1.6	Relating charges and masses	<ul style="list-style-type: none"> Compare protons, neutrons and electrons. Find out why atoms are neutral. Relate the number of charged particles in atoms to their position in the periodic table.
1.7	Sub-atomic particles	<ul style="list-style-type: none"> Find out what the periodic table tells us about each element's atoms. Learn what isotopes are. Use symbols to represent isotopes.
1.8	Electronic structure	<ul style="list-style-type: none"> Find out how electrons are arranged in atoms. Use diagrams and symbols to show which energy levels they occupy. Use number notation to represent electronic structure.
1.9	The periodic table	<ul style="list-style-type: none"> Explain how the electronic structure of atoms follows a pattern. Recognise that the number of electrons in an element's atoms outer shell corresponds to the element's group number. Use the periodic table to make predictions.
1.10	Developing the periodic table	<ul style="list-style-type: none"> Find out how the periodic table has changed over the years. Explore Mendeleev's role in its development. Consider the accuracy of Mendeleev's predictions.
1.11	Comparing metals and non-metals	<ul style="list-style-type: none"> Review the physical properties of metals and non-metals. Compare the oxides of metals and of non-metals. Make predictions about unknown metals and non-metals.
1.12	Metals and non-metals	<ul style="list-style-type: none"> Explore the links between electron configurations of elements and their properties. Find out what happens to the outer electrons when metals react. Draw diagrams to show how ions form.
1.13	Key concept: The outer electrons	<ul style="list-style-type: none"> Review the patterns in the periodic table. Compare the trends in Group 1 and Group 7. Relate these trends to the number of outer electrons and the sizes of atoms.
1.14	Exploring Group 0	<ul style="list-style-type: none"> Explore the properties of noble gases. Find out how the mass of their atoms affects their boiling points. Relate their chemical properties to their electronic structures.
1.15	Exploring Group 1	<ul style="list-style-type: none"> Explore the properties of Group 1 metals. Compare their reactivity. Relate their reactivity to their electronic structures.

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1.16	Exploring Group 7	<ul style="list-style-type: none"> • Explain why Group 7 non-metals are known as 'halogens'. • Compare their reactivity. • Relate their reactivity to their electronic structures.
1.17	Reaction trends and predicting reactions	<ul style="list-style-type: none"> • Review the patterns in the periodic table. • Compare the trends in Group 1 and Group 7. • Relate these trends to the way atoms form ions.
1.18	Transition metals	<ul style="list-style-type: none"> • Compare the properties of transition metals with those of Group 1 metals. • Explore the uses of transition metals. • Find out why they can form compounds with different colours.
1.19	Maths skills: Standard form and making estimates	<ul style="list-style-type: none"> • Consider the sizes of particles. • Use numbers in standard form to compare sizes. • Use numbers in standard form in calculations.
Chapter 2 Structure and Bonding		
2.1	Chemical bonds	<ul style="list-style-type: none"> • Describe the three main types of bonding. • Explain how electrons are used in the three main types of bonding. • Explain how bonding and properties are linked.
2.2	Ionic bonding	<ul style="list-style-type: none"> • Represent an ionic bond with a diagram. • Draw dot-and-cross diagrams for ionic compounds. • Work out the charge on the ions of metals from the group number of the element.
2.3	Ionic compounds	<ul style="list-style-type: none"> • Identify ionic compounds from structures. • Explain the limitations of diagrams and models. • Work out the empirical formula of an ionic compound.
2.4	Covalent bonding	<ul style="list-style-type: none"> • Identify single bonds in molecules and structures. • Draw dot- and-cross diagrams for small molecules. • Deduce molecular formulae from models and diagrams.
2.5	Metallic bonding	<ul style="list-style-type: none"> • Describe why metals form giant structures. • Explain how metal ions are held together. • Explain the delocalisation of electrons.
2.6	Three states of matter	<ul style="list-style-type: none"> • Use data to predict the states of substances. • Explain the changes of state. • Use state symbols in chemical equations.
2.7	Properties of ionic compounds	<ul style="list-style-type: none"> • Describe the properties of ionic compounds. • Relate their melting points to forces between ions. • Explain when ionic compounds can conduct electricity.
2.8	Properties of small molecules	<ul style="list-style-type: none"> • Identify small molecules from formulae. • Explain the strength of covalent bonds. • Relate the intermolecular forces to the bulk properties of a substance.
2.9	Polymer structures	<ul style="list-style-type: none"> • Recognise polymers from their unit formulae. • Explain why some polymers can stretch. • Explain why some plastics do not soften on heating.
2.10	Giant covalent structures	<ul style="list-style-type: none"> • Recognise giant covalent structures from diagrams. • Explain the properties of giant covalent structures. • Recognise the differences in different forms of carbon.
2.11	Properties of metals and alloys	<ul style="list-style-type: none"> • Identify metal elements and their properties, and metal alloys. • Describe the purpose of a tin-lead alloy. • Explain why alloys have different properties to those of elements.
2.12	Diamond	<ul style="list-style-type: none"> • Identify why diamonds are so hard. • Explain how the properties relate to the bonding in diamond. • Explain why diamond differs from graphite. •

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Chapter 2 Structure and Bonding		
2.13	Graphite	<ul style="list-style-type: none"> Describe the structure and bonding of graphite. Explain the properties of graphite. Explain the similarity to metals.
2.14	Graphene and fullerenes	<ul style="list-style-type: none"> Describe the structure of graphene. Explain the structure and uses of the fullerenes. Explain the structure of nanotubes.
2.15	Nanoparticles, their properties and uses	<ul style="list-style-type: none"> Relate the sizes of nanoparticles to atoms and molecules Explain that there may be risks associated with nanoparticles. Evaluate the use of nanoparticles for specific purposes.
2.16	Key concept: Sizes of particles and orders of magnitude	<ul style="list-style-type: none"> Identify the scale and measurements of length. Explain the conversion of small lengths to metres. Explain the relative sizes of electrons, nuclei and atoms.
2.17	Maths skills: Visualise and represent 2D and 3D shapes	<ul style="list-style-type: none"> Use two-dimensional (2D) diagrams and 3D models to: <ul style="list-style-type: none"> represent atoms, molecules and ionic structure represent giant covalent structures calculate empirical formulae of ionic structures.
Chapter 3 Chemical quantities and calculations		
3.1	Key concept: Conservation of mass and balanced equations	<ul style="list-style-type: none"> Explore ideas about the conservation of mass. Consider what the numbers in equations stand for. Write balanced symbol equations.
3.2	Relative formula mass	<ul style="list-style-type: none"> Review the differences between the isotopes of an element. Distinguish between the mass of an atom and the relative atomic mass of an element. Use relative atomic masses to calculate relative formula masses.
3.3	Mass changes when gases are in reactions	<ul style="list-style-type: none"> Find out how mass can be gained or lost during a reaction. Find the mass of carbon dioxide released per gram of copper carbonate decomposed. Assess the accuracy of our measurements.
3.4	Chemical measurements and uncertainty	<ul style="list-style-type: none"> Explore ideas about the accuracy of measurements. Consider how closely measurements reflect true values. Explore ways of estimating the uncertainty in a set of measurements.
3.5	Moles	<ul style="list-style-type: none"> Describe the measurements of amounts of substances in moles. Calculate the amount of moles in a given mass of a substance. Calculate the mass of a given number of moles of a substance.
3.6	Amounts of substances in equations	<ul style="list-style-type: none"> Calculate the masses of substances in a balanced symbol equation. Calculate the masses of reactants and products from symbol equations. Calculate the mass of a given reactant or product.
3.7	Using moles to balance equations	<ul style="list-style-type: none"> Convert masses in grams to amounts in moles. Balance an equation given the masses of reactants and products. Change the subject of a mathematical equation.
3.8	Concentration of solutions	<ul style="list-style-type: none"> Relate mass, volume and concentration. Calculate the mass of solute in solution. Relate concentration in mol/dm³ to mass and volume.
3.9	Key concept: Percentage yield	<ul style="list-style-type: none"> Calculate the percentage yield from the actual yield. Identify the balanced equation needed for calculating yields. Calculate theoretical product amounts from reactant amounts.
3.10	Atom economy	<ul style="list-style-type: none"> Identify the balanced equation of a reaction. Calculate the atom economy of a reaction to form a product. Explain why a particular reaction pathway is chosen.

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Chapter 3 Chemical quantities and calculations		
3.11	Using concentrations of solutions	<ul style="list-style-type: none"> Describe how to carry out titrations. Calculate concentrations in titrations in mol/dm³ and in g/dm³. Explain how the concentration of a solution in mol/dm³ is related to the mass of the solute and the volume of the solution.
3.12	Amounts of substance in volumes of gases	<ul style="list-style-type: none"> Explain that the same amount of any gas occupies the same volume at room temperature and pressure (rtp). Calculate the volume of a gas at rtp from its mass and relative formula mass. Calculate the volumes of gases from a balanced equation and a given volume of a reactant or product.
3.13	Key concept: Amounts in chemistry	<ul style="list-style-type: none"> Use atomic masses to calculate formula masses. Explain how formula mass relates to the number of moles. Explain how the number of moles relates to other quantities.
3.14	Maths skills: Change the subject of an equation	<ul style="list-style-type: none"> Use equations to demonstrate conservation. Rearrange the subject of an equation. Carry out multi-step calculations.
Chapter 4 Chemical changes		
4.1	Metal oxides	<ul style="list-style-type: none"> Explore what happens when metals burn or corrode. Classify chemical changes as oxidation or reduction. Review the properties of metal oxides.
4.2	Reactivity series	<ul style="list-style-type: none"> Compare the reactivity of metals. Observe some reactions between metal atoms and metal ions. Consider why some metals are more reactive than others.
4.3	Extraction of metals	<ul style="list-style-type: none"> Find out where metals come from. Extract iron from its oxide using carbon. Consider how other metals are extracted from their ores.
4.4	Oxidation and reduction in terms of electrons	<ul style="list-style-type: none"> Observe some reactions between metal atoms and metal ions. Learn to write ionic equations and half equations. Classify half equations as oxidation or reduction.
4.5	Reaction of metals with acids	<ul style="list-style-type: none"> React an acid and a metal to make a salt. Predict the formulas of salts. Write balanced symbol equations and half equations.
4.6	Neutralisation of acids and salt production	<ul style="list-style-type: none"> React an acid and an alkali to make a salt. Predict the formulae of salts. Write balanced symbol equations.
4.7	Soluble salts	<ul style="list-style-type: none"> React an acid and a metal to make a salt. Predict the formulae of salts. Write balanced symbol equations and half equations.
4.8	Required practical: Preparing a pure, dry sample of a soluble salt	<ul style="list-style-type: none"> React a carbonate with an acid to make a salt. Describe each step in the procedure. Determine the purity of the product.
4.9	pH and neutralisation	<ul style="list-style-type: none"> Estimate the pH of solutions. Identify weak and strong acids and alkalis. Investigate pH changes when a strong acid neutralises a strong alkali.
4.10	Required practical: titration	<ul style="list-style-type: none"> Use an acid to neutralise a known volume of alkali. Use a burette to determine the volume of an acid needed. Use the results to determine the concentration of an alkali.
4.11	Strong and weak acids	<ul style="list-style-type: none"> Explore the factors that affect the pH of an acid. Find out how the pH changes when an acid is diluted. Find out how the concentrations of solutions are measured.

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Chapter 4 Chemical changes		
4.12	The process of electrolysis	<ul style="list-style-type: none"> • Explore what happens when a current passes through a solution of ions. • Find out what an electrolyte is and what happens when it conducts electricity. • Find out how electricity decomposes compounds.
4.13	Electrolysis of molten ionic compounds	<ul style="list-style-type: none"> • Look in detail at the electrolysis of lead bromide. • Communicate the science behind the extraction of elements from molten salts. • Write balanced half equations for electrolysis reactions.
4.14	Using electrolysis to extract metals	<ul style="list-style-type: none"> • Review the connection between the reactivity series and the ways metals are extracted. • Consider how aluminium is extracted from aluminium oxide. • Learn the oxidation and reduction reactions involved.
4.15	Electrolysis of aqueous solutions	<ul style="list-style-type: none"> • Investigate the products formed when copper sulfate is electrolysed • Predict what products other solutions will give • Write half equations for reactions at electrodes
4.16	Required practical: Electrolysis	<ul style="list-style-type: none"> • Devise a hypothesis. • Devise an investigation to test your hypothesis. • Decide whether the evidence supports your hypothesis.
4.17	Key concept: Electron transfer, oxidation and reduction	<ul style="list-style-type: none"> • Review ion formation. • Classify half equations as oxidation or reduction. • Review patterns in reactivity.
4.18	Maths skills: Make order of magnitude calculations	<ul style="list-style-type: none"> • Explore the factors that affect the acidity of rain. • Find out how acid concentrations are compared. • Explore the link between hydrogen ion concentration and pH.
Chapter 5 Energy changes		
5.1	Key concept: Endothermic and exothermic reactions	<ul style="list-style-type: none"> • Explore the temperature changes produced by chemical reactions. • Consider how reactions are used to heat or cool their surroundings. • Investigate how these temperature changes can be controlled.
5.2	Required practical: Temperature changes	<ul style="list-style-type: none"> • Devise a hypothesis. • Devise an investigation to test your hypothesis. • Decide whether the evidence supports your hypothesis.
5.3	Reaction profiles	<ul style="list-style-type: none"> • Use diagrams to show the energy changes during reactions. • Show the difference between exothermic and endothermic reactions using energy profiles. • Find out why many reactions start only when energy or a catalyst is added.
5.4	Energy change of reactions	<ul style="list-style-type: none"> • Identify the bonds broken and formed during a chemical reaction. • Consider why some reactions are exothermic and others are endothermic. • Use bond energies to calculate overall energy changes.
5.5	Cells and batteries	<ul style="list-style-type: none"> • Make simple cells and measure their voltages. • Consider the importance of cells and batteries. • Find out how larger voltages can be produced.
5.6	Fuel cells	<ul style="list-style-type: none"> • Find out how fuel cells work. • Compare and contrast the uses of hydrogen fuel cells, batteries and rechargeable cells. • Learn what reactions take place inside hydrogen fuel cells.
5.7	Maths skills: Recognise and use expressions in decimal form	<ul style="list-style-type: none"> • Read scales in integers and using decimals. • Calculate the energy change during a reaction. • Calculate energy transferred for comparison.