Cornwallis Academy
Ambitions for All

SMILE
SUCCESSFUL | MOTIVATED | INSPIRED | LEARNING | EXCITED & ENGAGED

Year 11 Triple Science GCSE Chemistry

C1 Atomic structure and the Periodic table

Learning Objectives

- Describe the structure of an atom: protons, neutrons, electrons.
- Understand isotopes and relative atomic mass (RAM).
- Explain the arrangement of elements in the Periodic Table.
- Describe trends in groups: Group 1 (alkali metals) and Group 7 (halogens).
- Understand electron configuration and how it relates to chemical properties.
- Explain how the Periodic Table is arranged by atomic number and properties.

What previous knowledge is required?

Basic idea of elements, compounds, and mixtures.

- Atomic symbols and chemical formulae.
- Simple particle model (atoms, molecules, ions).
- Basic lab safety and handling of chemicals.

How will this topic content help with future learning?

- Foundation for **C2 Bonding, Structure & Properties** (ionic, covalent, metallic bonding).
- Essential for **C3 Quantitative Chemistry** (moles, calculations).
- Supports understanding of **C4 Chemical Changes** (reactions of metals and halogens).
- Helps explain **chemical reactivity trends** in groups and periods.

Common Misconceptions

- Atoms are "empty space with electrons floating around" → electrons occupy **clouds/energy levels**, not random paths.
- All atoms of an element are identical → isotopes have different numbers of neutrons.
- Mass is lost in reactions → total mass is conserved (Law of Conservation of Mass).
- Metals are "all reactive the same" → reactivity depends on group and element.
- Periodic trends are exact → trends show general patterns, with exceptions.

National Curriculum / Specification

- KS4 Chemistry: "Atoms, elements, compounds, isotopes, and the Periodic Table."
- AQA 8462 C1: Atomic Structure and the Periodic Table.
- Practical skills: relative atomic mass, test for elements (halogens, metals).

Bonding, Structure and properties of matter

Learning Objectives

- Explain ionic, covalent, and metallic bonding.
- Describe properties of ionic, covalent, and metallic substances.
- Understand giant and simple molecular structures.
- Explain melting/boiling points, conductivity, and solubility.
- Understand structure-property relationships in materials.

What previous knowledge is required?

- Atomic structure (C1).
- Chemical formulae and valency.
- Particle model and states of matter.

How will this topic content help with future learning?

- Foundation for **C3 Quantitative Chemistry** (stoichiometry, reacting masses).
- Explains properties of materials in **C4 Chemical Changes** and **C5 Energy Changes**.
- Supports understanding of **nanoparticles, polymers, and materials science** in later units.

Common Misconceptions

- Covalent molecules conduct electricity → only ions conduct, covalent molecules usually don't.
- Metals are "soft" → metals are malleable, but hardness varies with structure.
- All compounds are giant lattices → many covalent compounds are **small/simple molecules**.
- Bonds "break to release energy" → energy is needed to break bonds, released when bonds form.

National Curriculum / Specification

- KS4 Chemistry: "Bonding, structure and properties of materials."
- AQA 8462 C2: Bonding, Structure & Properties.
- Practical skills: investigating melting/boiling points, conductivity tests.

Quantitative Chemistry

Learning Objectives

- Calculate relative formula mass (Mr) and moles.
- Use equations to calculate masses in reactions.
- Understand concentration (mol/dm^3) and solution calculations.
- Understand yield, atom economy, and limiting reactants.
- Apply the **conservation of mass** to chemical reactions.

What previous knowledge is required?

- Atomic structure and bonding (C1–C2).
- Chemical formulae and balanced equations.
- Basic arithmetic, ratios, and percentages.

How will this topic content help with future learning?

- Essential for **C4 Chemical Changes** (calculating reacting masses, solutions).
- Supports **C6 Rates of Reaction & Equilibrium** (concentration calculations).
- Helps in **C7 Organic Chemistry** (stoichiometry of reactions).

Common Misconceptions

- Mass is "lost" in reactions → mass is conserved.
- Percentage yield >100% → impossible; errors due to impurities or measurement.
- Moles = molecules → moles relate to **Avogadro's number**, not direct count.
- Concentration and volume are independent → concentration = moles ÷ volume.

National Curriculum / Specification

- KS4 Chemistry: "Calculations in chemistry, reacting masses, solutions, yield and atom economy."
- KS4 Chemistry: "Calculations in chemistry, reacting masses, solutions, yield and atom economy."
- AQA 8462 C3: Quantitative Chemistry.
- Practical skills: measuring mass changes, solution preparation.

C4 Chemical Changes

Learning Objectives

- Describe reactivity series of metals.
- Predict and explain displacement reactions.
- Understand oxidation, reduction, acids, bases, and neutralisation.
- Explain electrolysis of molten salts and aqueous solutions.
- Understand pH, indicators, and strength of acids/bases.

What previous knowledge is required?

- Atomic structure, bonding (C1–C2).
- Moles and reacting masses (C3).
- Understanding of ions and ionic compounds.

How will this topic content help with future learning?

- Foundation for **C5 Energy Changes** (reaction type and energy).
- Supports **C6 Rates & Equilibrium** (reversible reactions).
- Essential for industrial chemistry and electroplating processes.

Common Misconceptions

- Acids always "neutralise everything" → only bases/alkalis are neutralised.
- Metals "react the same" → reactivity depends on the element.
- Oxidation = gain of oxygen only → oxidation is **loss of electrons** in modern definition.
- Electrolysis is only for molten salts → aqueous solutions also electrolyse, products differ.

National Curriculum / Specification

- KS4 Chemistry: "Reactivity, acids, bases, salts, electrolysis."
- AQA 8462 C4: Chemical Changes.
- Practical skills: neutralisation, titration, electrolysis experiments.

C5 Energy Changes

Learning Objectives

- Define exothermic and endothermic reactions.
- Draw and interpret energy level diagrams.
- Investigate temperature changes in reactions.
- Explain bond energy calculations.
- Relate energy changes to chemical reactions in everyday life.

What previous knowledge is required?

- Bonding and structure (C2).
- Reactivity and reaction types (C4).
- Basic understanding of energy, heat, and temperature.

How will this topic content help with future learning?

- Supports **C6 Rates of Reaction** (activation energy).
- Helps understand **C7 Organic Chemistry** reactions and energy changes.
- Useful for **industrial chemistry and calorimetry calculations**.

Common Misconceptions

- Exothermic reactions "use energy" → they release energy.
- Endothermic reactions "produce energy" → they absorb energy.
- Energy diagrams show only products → must show **reactants, products, and activation energy**.

National Curriculum / Specification

- KS4 Chemistry: "Energy changes in chemical reactions, bond energy, reaction profiles."
- AQA 8462 C5: Energy Changes.
- Required practical: temperature change investigations.

C6 Rate and Extent of Chemical Change

Learning Objectives

- Explain how reaction rate is measured.
- Describe collision theory.
- Explain effects of temperature, concentration, surface area, and catalysts.
- Interpret rate graphs.
- Explain reversible reactions and dynamic equilibrium.
- Understand Le Chatelier's principle (changes in conditions).

What previous knowledge is required?

- Particle model (C1).

- Bonding and reactions (C2–C4).
- Energy changes (C5).
- Basic graphs and data interpretation.

How will this topic content help with future learning?

- Essential for **industrial processes (Haber, Contact process)**.
- Links to **organic reactions (C7)** and equilibrium systems.
- Supports understanding of **real-world manufacturing and optimisation**.

Common Misconceptions

- Catalysts increase yield → they only increase rate.
- Higher temperature makes particles "bigger" → it increases kinetic energy.
- Equilibrium means equal amounts of reactants/products → it means rates are equal, not amounts.
- Only gases react in collision theory → all particles can collide.

National Curriculum / Specification

- KS4 Chemistry: "Rates of reaction and equilibrium."
- AQA 8462 C6: Rates of Reaction & Equilibrium.
- Required practical: investigating rate of reaction (e.g. gas production).

C7 Organic Chemistry

Learning Objectives

- Describe crude oil as a mixture of hydrocarbons.
- Explain fractional distillation and fractions.
- Understand alkanes and alkenes.
- Describe cracking and polymerisation.
- Identify addition reactions of alkenes.
- Understand uses of hydrocarbons and fuels.

What previous knowledge is required?

- Bonding and structure (C2).
- Combustion and reactions (C4–C5).
- Basic understanding of mixtures and separation techniques.

How will this topic content help with future learning?

- Supports **fuels and energy resources (C9)**.
- Links to **polymers, materials science, and industry**.
- Helps understand **environmental impact of fuels (C8–C9)**.

Common Misconceptions

- Crude oil is a pure substance → it is a mixture.
- All hydrocarbons are gases → depends on chain length.
- Burning fuels only produces energy → also produces CO_2 and pollutants.
- Polymers are natural only → many are synthetic.

National Curriculum / Specification

- KS4 Chemistry: "Organic chemistry, hydrocarbons, crude oil, polymers."
- AQA 8462 C7: Organic Chemistry.
- Practical skills: fractional distillation models, polymer formation demonstrations.

C8 Chemical Analysis

Learning Objectives

- Identify pure substances and mixtures.
- Understand chromatography techniques.
- Describe gas tests (H_2, O_2, CO_2, Cl_2).
- Use flame tests for metal ions.
- Understand instrumental analysis (e.g. spectroscopy).
- Explain purity and melting/boiling point tests.

What previous knowledge is required?

- Mixtures and separation techniques (C1–C2).
- Atomic structure and ions.
- Basic laboratory skills and safety.

How will this topic content help with future learning?

- Supports **environmental chemistry (C9)**.
- Essential for **forensics, medicine, and industrial quality control**.
- Links to **analytical chemistry and scientific investigation skills**.

Common Misconceptions

- Pure substances are always safe → purity is unrelated to safety.
- Chromatography identifies substances automatically → requires comparison with known substances.
- Gas tests are interchangeable → each gas has a specific test.

National Curriculum / Specification

- KS4 Chemistry: "Chemical analysis, purity, chromatography, gas tests."
- AQA 8462 C8: Chemical Analysis.
- Required practical: chromatography of inks and dyes.

C9 Chemistry of the Atmosphere

Learning Objectives

- Describe the composition and evolution of Earth's atmosphere.
- Explain greenhouse gases and the greenhouse effect.
- Understand human impacts on climate change.
- Describe carbon cycle processes.
- Explain atmospheric pollutants and their effects.

What previous knowledge is required?

- Combustion reactions (C4–C5).
- Organic chemistry and fuels (C7).

- Basic environmental science (B7 Ecology).

How will this topic content help with future learning?

- Links to **environmental science and sustainability**.
- Supports understanding of **global climate systems and ecosystems**.
- Connects chemistry to real-world environmental issues.

Common Misconceptions

- Greenhouse effect is harmful → it is natural but enhanced by human activity.
- Oxygen is most abundant gas → nitrogen is most abundant.
- CO_2 is the only greenhouse gas → water vapour and methane also contribute.
- Pollution only affects air → it affects water and soil too.

National Curriculum / Specification

- KS4 Chemistry: "Atmosphere and environmental chemistry."
- AQA 8462 C9: Chemistry of the Atmosphere.
- Links to climate change, sustainability, and carbon cycle.

C10 Using Resources

Learning Objectives

- Understand finite and renewable resources.
- Explain potable water treatment.
- Describe sewage treatment processes.
- Understand life cycle assessment (LCA).
- Evaluate recycling and sustainable use of materials.
- Describe corrosion and methods of prevention.

What previous knowledge is required?

- Chemistry of materials and bonding (C2).
- Environmental impacts (C7–C9).
- Basic separation techniques (C1–C8).

How will this topic content help with future learning?

- Supports **sustainability and environmental science studies**.
- Links to **engineering, materials science, and industry**.
- Develops understanding of **resource management and climate responsibility**.

Common Misconceptions

- Recycling solves all environmental problems → it reduces but does not eliminate impact.
- Finite resources are only fossil fuels → metals and minerals are also finite.
- Water is naturally pure → requires treatment for safe use.
- Rust prevention stops all corrosion → only slows or prevents it under certain conditions.

National Curriculum / Specification

- KS4 Chemistry: "Using resources and sustainability."
- AQA 8462 C10: Using Resources.

- Practical links: water purification and environmental impact studies.