Wallington
County Grammar School

The Chemistry Curriculum

Whole School Curriculum Intent:	Wallington County Grammar School is a highly academic but pastorally minded school which delivers a curriculum that enables all students to embody our motto - *Per Ardua ad Summa*, Through Difficulties to the Heights. Each Subject Leader has autonomy over their own curriculum and its intent, i.e. its subject content, skills content, sequencing and assessment schedule. This is vital to ensure the academic curriculum is designed by highly qualified subject experts. The intentions behind whole school approach to curriculum design taken by senior leaders are to provide: ● **Breadth** - We intend to provide a broad, academic and liberal curriculum that equips students with the body of human knowledge and different ways of thinking necessary to succeed in and enjoy their education, careers and wider lives. ● **Depth** - We do not want our students to simply study the national curriculum and examination specifications with grades being our sole focus. We aim for our students to become true scholars of the disciplines that they are learning so that they achieve a deep and sophisticated level of knowledge and understanding. ● **Values** - We aim for our students to develop our four core values: commitment, courage, compassion and creativity. ● **Democracy** - We aim for all our students to have the necessary knowledge and confidence, not just to participate in the democracy of the United Kingdom, but to lead it.
Subject Curriculum Intent:	The intent of our Chemistry curriculum is to provide a high level of academic challenge while nurturing curiosity, critical thinking, and independence. At Wallington County Grammar School, where a significant proportion of students go on to study STEM subjects, medicine, and related fields, we ensure that the curriculum equips students with the knowledge, skills, and confidence needed to succeed at the highest levels. We deliver a well-sequenced and knowledge-rich curriculum that enables students to: ● **Build a deep and connected understanding** of key principles such as atomic structure, bonding, energetics, kinetics, equilibrium, and organic synthesis; ● **Develop precision in practical skills**, analytical methods, and data evaluation, preparing students for both examinations and the demands of university-level science; ● **Engage with real-world contexts**, including chemical applications in health, industry, and the environment, to foster scientific literacy and ethical awareness; ● **Think and communicate like scientists**, with increasing fluency in scientific language, logic, and mathematical reasoning. The curriculum is deliberately ambitious, with structured opportunities to stretch the most able, support future medics and STEM applicants, and

	promote curiosity beyond the specification through competitions, lectures, and super-curricular study.
Subject Curriculum Aims:	The School Chemistry curriculum builds upon the national curriculum for science to achieve the following: ● **Deepen Foundational and Advanced Knowledge:** The curriculum will provide a comprehensive understanding of core chemical principles. Students will develop a strong mathematical proficiency to solve complex problems, a skill essential for university-level STEM and medical courses. ● **Foster Scientific Inquiry and Practical Expertise:** The curriculum will help to develop high level of scientific literacy through hands-on practical work. Students will master a wide range of laboratory techniques and develop the critical thinking skills to design experiments, analyze data rigorously, and draw evidence-based conclusions. ● **Connect Chemistry to the Real World:** Students will understand how chemistry is a central science that links to physics, biology, and medicine. We will explore its applications in drug development, materials science, and environmental sustainability, inspiring students to see its relevance and potential for future innovation. ● **Prepare for Top Universities and Beyond:** The curriculum is designed to exceed standard requirements, ensuring students are exceptionally well-prepared for the intellectual demands of Russell Group and Oxbridge courses such as Natural Sciences and Medicine. We will nurture intellectual curiosity and independent learning, giving them the confidence and skills to excel in their chosen fields.
Exam Boards	GCSE: Pearson A Level: AQA

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Y7	• Introduction and Safety • Particle Theory	• Elements, Compounds and Mixtures	• Separating Substances	• Types of Chemical Reaction	• Types of Chemical Reaction	• Acids and Bases
	Assessment 1 Format:	45 minute exam containing short answer questions and multiple choice questions		Assessment 2 Format:	50 minute exam containing short answer questions and multiple choice questions	
Y8	• Atomic Structure and the Periodic table	• Atomic Structure and the Periodic table (continued) • Heat Energy Changes •	• Heat Energy Changes (continued) • Reactivity Series	• Reactivity Series (continued)	• Earth and Atmosphere	• Earth and Atmosphere
	Assessment 1 Format:	45 minute exam containing short answer questions and multiple choice questions		Assessment 2 Format:	50 minute exam containing short answer questions and multiple choice questions	
Y9	• States of matter and Separating Substances • Structure of the Atom and Periodic Table	• Structure of the Atom and Periodic Table (continued) • Structure and Bonding	• Structure and Bonding (continued) • Groups 1, 7 and 0.	• Reactivity, Ores, Transition Metals, Alloys and Corrosion	• Rates of Reaction • Bulk and Surface Properties of Matter	• Bulk and Surface Properties of Matter (continued) • Testing for Ions
	Assessment 1 Format:	45 Minute exam containing short answer questions, MCQs and up to 2 6 mark questions.		Assessment 2 Format:	90 Minute exam containing short answer questions, MCQs and up to 2 6 mark questions.	
Y10	• Calculations involving Masses and Quantitative Analysis	• Calculations involving Masses and Quantitative Analysis (continued) • Acids, Bases and Salts	• Acids, Bases and Salts (continued) • Fuels and Hydrocarbons	• Fuels and Hydrocarbons (continued) • Pollutants and Atmosphere	• Alcohols and Carboxylic Acids	• Polymers
	Assessment 1 Format:	45 Minute exam containing short answer questions, MCQs and up to 2 6 mark questions.		Assessment 2 Format:	90 Minute exam containing short answer questions, MCQs and up to 2 6 mark questions.	
Y11	• Heat Energy Changes • Reversible Reactions	• Reversible Reactions (continued) • Electrolysis	• Electrolysis (continued) • Fuel Cells	• Revision	• Revision	

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
	Mock Format:	90 Minute exam containing short answer questions, MCQs and up to 2 6 mark questions.		Assessment 2 Format:	The previous year's papers.	
L6th	• Atomic Structure & Periodicity • Bonding	• Bonding (continued) • Redox	• Group 2, 7 and Period 3 • Energetics	• Energetics (continued) • Chemical Equilibria • Kinetics	• Kinetics (continued)	• Rate Equations
	• Amount of Substance	• Introduction to Organic Chemistry • Alkanes • Halogenoalkanes	• Halogenoalkanes (continued) • Alkenes	• Alcohols • Carbonyls and Optical Isomerism	• Carbonyls and Optical Isomerism (continued)	• Chromatography and Mass Spec
	Assessment 1 Format:	2 85 minute exams with a range of short answer questions and MCQs.		Assessment 2 Format:	2 90 minute exams with a range of short answer questions and MCQs.	
U6th	• Thermodynamics • Acids and Bases	• Acids and Bases (continued) • Electrochemistry	• Electrochemistry (continued)	• Transition Metals		
	• Carboxylic Acids and Esters • Acyl Chlorides	• Aromatic Chemistry	• Amines • Polymers, Amino Acids and DNA	• NMR		
	Mock Format:	2 90 minute exams with a range of short answer questions and MCQs.				

Key Vocabulary

Key Stage 3

Set 1: Particulate Nature of Matter

Particle	A tiny unit that makes up all matter.
Solid	A state of matter with fixed shape and volume; particles are tightly packed.
Liquid	A state of matter with a fixed volume but no fixed shape.
Gas	A state of matter that has no fixed shape or volume; particles move freely.
Change of state	When matter changes between solid, liquid, and gas (e.g. melting, boiling).
Diffusion	The spreading out of particles from an area of high to low concentration.
Conservation of mass	In a chemical or physical change, no mass is lost or gained.

Set 2: Atoms, Elements & Compounds

Atom	The smallest particle of an element.
Element	A substance made of only one type of atom.
Compound	A substance made of two or more elements chemically bonded together.
Mixture	Two or more substances not chemically bonded.
Chemical symbol	A one- or two-letter abbreviation for an element (e.g. O for oxygen).

Word equation	A way to show a chemical reaction using words (e.g. hydrogen + oxygen → water).

Set 3: Pure and Impure Substances

Pure substance	A material made of only one type of particle.
Solute	The substance that dissolves in a solvent.
Solvent	The liquid that dissolves a solute.
Solution	A solute dissolved in a solvent.
Filtration	Separating solids from liquids using a filter.
Distillation	Separating substances by boiling and condensing.
Chromatography	A method to separate mixtures of dyes or inks.

Set 4: Chemical Reactions

Chemical reaction	A process where new substances are formed.
Reactants	The starting substances in a chemical reaction.
Products	The new substances formed in a chemical reaction.
Neutralisation	A reaction between an acid and a base to form a salt and water.
Combustion	A reaction with oxygen that releases heat, usually burning.
Acid	A substance with a pH less than 7.
Alkali	A base that dissolves in water with a pH greater than 7.

Set 5: Earth and Environment

Fossil fuel	Fuel formed from dead organisms over millions of years (e.g. coal, oil).

Greenhouse gas	Gases like CO_2 and methane that trap heat in the atmosphere.
Climate change	Long-term changes in Earth's temperature and weather patterns.
Recycling	Reusing materials to reduce waste and save resources.
Rock cycle	The process of rocks changing between different types over time.

GCSE

1. Key Concepts in Chemistry

Atom	The smallest particle of an element that retains its properties.
Element	A substance made of only one type of atom.
Compound	A substance made from two or more elements chemically bonded.
Mixture	Two or more substances not chemically bonded.
Atomic number	Number of protons in an atom.
Mass number	Total number of protons and neutrons in an atom.
Isotope	Atoms of the same element with different numbers of neutrons.
Relative atomic mass (Ar)	Average mass of an element’s atoms compared to carbon-12.
Mole	A quantity of particles (6.02×10^{23}).
Empirical formula	Simplest whole-number ratio of atoms in a compound.

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2. States of Matter and Mixtures

Solid	State of matter with fixed shape and volume.
Liquid	State with fixed volume, takes the shape of its container.

Gas	State with no fixed shape or volume.
Solvent	Liquid that dissolves a solute.
Solute	Substance that dissolves in a solvent.
Solution	Mixture formed when a solute dissolves in a solvent.
Distillation	Separation using boiling and condensing.
Chromatography	Separation method for mixtures like inks or dyes.
Rf value	Distance moved by a substance ÷ distance moved by solvent.

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3. Chemical Changes

Acid	A substance that produces H^+ ions in water.
Alkali	A base that produces OH^- ions in water.
Neutralisation	Reaction of an acid with a base to form salt and water.
Salt	Compound formed from an acid when H^+ is replaced by a metal or NH_4^+.
Titration	Technique to find the concentration of an acid or alkali.
Indicator	Substance that changes colour in acids and alkalis.
Electrolysis	Breaking down a substance using electricity.
Anode	Positive electrode.
Cathode	Negative electrode.
Oxidation	Loss of electrons or gain of oxygen.
Reduction	Gain of electrons or loss of oxygen.

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4. Extracting Metals and Equilibria

Reactivity series	List of metals in order of reactivity.
Displacement reaction	A more reactive element replaces a less reactive one.
Ore	A rock containing enough metal to be extracted.
Carbon reduction	Extraction of metals by reacting with carbon.
Reversible reaction	A reaction that can go forwards and backwards.
Equilibrium	When the forward and reverse reactions occur at the same rate.
Le Chatelier's Principle	Predicts how changes affect the position of equilibrium.

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5. Rates of Reaction and Energy Changes

Rate of reaction	How fast reactants turn into products.
Collision theory	Reactions happen when particles collide with enough energy.
Catalyst	Substance that speeds up a reaction without being used up.
Activation energy	Minimum energy needed for a reaction to occur.
Exothermic	Reaction that releases heat energy.
Endothermic	Reaction that absorbs heat energy.
Bond energy	Energy needed to break or make chemical bonds.

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6. Organic Chemistry and Fuels

Hydrocarbon	Compound made of hydrogen and carbon only.
Alkane	Saturated hydrocarbon with single bonds.
Alkene	Unsaturated hydrocarbon with a double bond.
Crude oil	Mixture of hydrocarbons found underground.

Fractional distillation	Separation of crude oil into fractions by boiling point.
Complete combustion	Burning with sufficient oxygen to produce CO_2 and H_2O.
Incomplete combustion	Burning with limited oxygen, producing carbon monoxide or soot.
Greenhouse gas	Gas that traps heat in the atmosphere (e.g. CO_2, CH_4).

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7. Chemical Analysis

Pure substance	Made of one type of element or compound.
Formulation	A mixture designed for a specific use (e.g. paint, medicine).
Flame test	Method to identify metal ions by flame colour.
Precipitation reaction	Forms an insoluble solid in a solution.
Gas test	Tests for specific gases like H_2, O_2, CO_2, Cl_2.

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8. Earth and Atmospheric Science

Carbon footprint	Total CO_2 emissions caused by an activity or product.
Climate change	Long-term changes in temperature and weather.
Acid rain	Rain made acidic by SO_2 or NO_x in the atmosphere.
Potable water	Water that is safe to drink.
Desalination	Removal of salt from seawater.
Life cycle assessment (LCA)	Study of a product's environmental impact from start to end.

A-level

1. Atomic Structure

Isotope	Atoms of the same element with different numbers of neutrons.
Mass spectrometry	Technique to determine relative atomic/molecular masses.
First ionisation energy	Energy needed to remove one mole of electrons from one mole of gaseous atoms.
Nuclear charge	Total positive charge of the nucleus (number of protons).
Shielding	Reduction in attraction between nucleus and outer electrons due to inner shells.
Successive ionisation energies	Energies required to remove electrons one by one from the same atom.

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2. Amount of Substance

Mole	Amount of substance containing 6.022×10^{23} particles (Avogadro's constant).
Molar mass	Mass of one mole of a substance (g/mol).
Empirical formula	Simplest whole-number ratio of atoms in a compound.
Molecular formula	Actual number of atoms in a molecule.
Percentage yield	(Actual yield ÷ Theoretical yield) × 100.
Atom economy	(Mr of desired product ÷ Total Mr of all products) × 100.
Ideal gas equation	PV = nRT (P = pressure, V = volume, n = moles, R = gas constant, T = temp).

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3. Bonding

Ionic bond	Electrostatic attraction between oppositely charged ions.
Covalent bond	A shared pair of electrons between atoms.
Dative covalent bond	A covalent bond where both electrons come from the same atom.
Electronegativity	Ability of an atom to attract electrons in a covalent bond.
Intermolecular forces	Forces between molecules (e.g. van der Waals, dipole-dipole, hydrogen bonds).
Bond enthalpy	Energy needed to break one mole of bonds in the gaseous state.
Lattice enthalpy	Energy released when one mole of an ionic lattice forms from gaseous ions.

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4. Energetics

Enthalpy change (ΔH)	Heat energy change at constant pressure.
Exothermic reaction	Reaction that releases heat (ΔH is negative).
Endothermic reaction	Reaction that absorbs heat (ΔH is positive).
Hess's Law	Total enthalpy change is independent of the route taken.
Calorimetry	Experimental method to measure energy changes in reactions.
Mean bond enthalpy	Average energy required to break a specific type of bond in gaseous molecules.

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5. Kinetics

Activation energy	Minimum energy needed for a reaction to occur.

Catalyst	A substance that increases the rate of reaction without being used up.
Rate of reaction	Change in concentration of reactant or product per unit time.
Rate-determining step	The slowest step in a reaction mechanism which controls the overall rate.
Order of reaction	Power to which the concentration of a reactant is raised in the rate equation.
Rate constant (k)	Proportionality constant in the rate equation.

6. Chemical Equilibria

Dynamic equilibrium	Forward and reverse reactions occur at equal rates in a closed system.
Le Chatelier's Principle	Equilibrium shifts to oppose changes in conditions.
Equilibrium constant (Kc)	Ratio of product to reactant concentrations at equilibrium.
Kp	Equilibrium constant for gases using partial pressures.

7. Redox and Electrochemistry

Oxidation	Loss of electrons or increase in oxidation number.
Reduction	Gain of electrons or decrease in oxidation number.
Oxidation number	Charge an atom would have if electrons were fully transferred.
Redox reaction	A reaction involving both oxidation and reduction.
Electrochemical cell	A system that converts chemical energy into electrical energy.
Standard electrode potential	Voltage of a half-cell relative to a standard hydrogen electrode.

8. Thermodynamics (Year 13)

Enthalpy of formation	Enthalpy change when one mole of a compound is formed from its elements.
Enthalpy of atomisation	Enthalpy change when one mole of gaseous atoms is formed from the element.
Entropy (S)	Measure of disorder or randomness.
Free energy change (ΔG)	Determines if a reaction is feasible: $\Delta G = \Delta H - T\Delta S$.

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9. Organic Chemistry

Functional group	Group of atoms responsible for the characteristic reactions of a compound.
Homologous series	A family of compounds with the same functional group and general formula.
Nucleophile	Electron pair donor.
Electrophile	Electron pair acceptor.
Substitution reaction	Atom or group is replaced by another.
Elimination reaction	Atoms are removed from a molecule to form a double bond.
Hydrolysis	Reaction with water that splits a molecule.
Esterification	Reaction between an alcohol and a carboxylic acid to form an ester.
Stereoisomerism	Compounds with the same structural formula but different spatial arrangement.
Optical isomerism	Type of stereoisomerism where molecules are mirror images (chiral).

10. Analytical Techniques

Infrared spectroscopy	Identifies functional groups using absorption of IR radiation.
Mass spectrometry	Determines molecular mass and structure via fragmentation patterns.
NMR spectroscopy	Uses magnetic fields to deduce structure from hydrogen environments.
Chemical shift	Position of NMR signals relative to a reference.

Suggested Reading List

Key Stage 3

Bad science, Ben Goldacre

Key Stage 4

A brief history of nearly everything, bill bryson
Bad science, Ben Goldacre
Chemistry Review
Elements: A Visual Exploration of Every Known Atom in the Universe by Theodore Gray

A-level

A Short History Of Nearly Everything – Bill Bryson
Just Like A Whale – Steve Jones
The Blind Watchmaker (and others) – Richard Dawkins
The Chemistry of Life – Steven Rose
The Periodic Table – Primo Levi
The Disappearing Spoon – Sam Kean
Periodic Tales: The Curious Lives Of The Elements – Hugh Aldersey-Williams
Reactions – Peter Atkins
A Brief History of Time – Stephen Hawking
Why Does E=mc2? – Brian Cox

Bad Science – Ben Goldacre (A MUST for prospective medical students)
The Geek Manifesto: Why Science Matters – Mark Henderson