

Chemistry Curriculum Outline 2024-2025

This outline provides a long-term overview of the knowledge and skills developed in this subject. More detailed short- and medium-term schemes of work, not published here, are available by contacting the Chemistry Department.

	Term 1	Term 2	Term 3	Term 4	Term 5
Year 13	<p>Unit Title: Arenes and phenols, carbonyl compounds. Acids, bases and buffers.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> The largely qualitative treatment of equilibria is developed within a quantitative and graphical context. This section also allows learners to develop practical quantitative techniques involved in the determination pH. Aromatic compounds are first introduced, including the central role of delocalisation within the chemistry of arenes and phenols. Directing groups are also introduced, including their importance to organic synthesis. The important carbonyl compounds, aldehydes and ketones, are then studied. Carboxylic acids and their related functional groups, acyl chlorides and esters, are studied. The importance of acyl chlorides in organic synthesis is emphasised. <p>Skills: PAG Skills. M0, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12.</p>	<p>Unit Title: Amines, amino acids, amides and chirality. Redox and electrode potentials. Transition elements.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> Redox chemistry permeates chemistry, including use of volumetric analysis for redox titrations and an introduction of electrochemistry in the context of electrode potentials. The periodic table within the context of the transition elements. The role of ligands in complex ions, stereochemistry, precipitation, ligand substitution and redox reactions. The colour changes and observations in these reactions increase the toolkit of qualitative inorganic tests for identifying unknown ionic compounds. Organic nitrogen compounds, including amines, amides and amino acids. Chirality and optical isomerism is also introduced. The importance of carbon-carbon bond formation in organic synthesis is stressed. Learners are also able to consider multi-stage synthetic routes towards an organic product. <p>Skills: PAG Skills. M0, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12.</p>	<p>Unit Title: Polyesters and polyamides. Synthesis. Finish transition elements. Lattice enthalpy.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> Condensation polymerisation is introduced and compared with addition polymerisation. Organic reactions are brought together from across the whole two years and put in the context of synthetic routes. The idea of retrosynthetic analysis is introduced and applied. Students are directed to fully learn the reactions available to a synthetic organic chemist and put them together to make a synthetic route. Students also learn the processes of separation and purification for both organic solids and liquids and the reasons for each stage. The periodic table within the context of the transition elements. The role of ligands in complex ions, stereochemistry, precipitation, ligand substitution and redox reactions. The colour changes and observations in these reactions increase the toolkit of qualitative inorganic tests for identifying unknown ionic compounds. Born-Haber cycles are used as a theoretical model to illustrate the energy changes associated with ionic bonding. <p>Skills: PAG Skills. M0, M1, M2, M3 & M4.</p>	<p>Unit Title: Enthalpy and entropy. Organic analysis, chromatography and spectroscopy.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> Entropy and free energy are introduced as concepts used to predict quantitatively the feasibility of chemical change. How analytical techniques (infrared spectroscopy, mass spectrometry and elemental analysis) may be used in combination with NMR spectroscopy to provide evidence of structural features in molecules. How unknown organic functional groups can be analysed and identified using simple test-tube tests. <p>Skills: PAG Skills. M0, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12.</p>	<p>Unit Title: Revision and Practice.</p> <p>Knowledge: Revision of material from across the whole course, emphasising the holistic nature of the subject and practice at putting together answers that require knowledge and understanding from across a number of areas of the course.</p> <p>Skills: PAG Skills. M0, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12.</p>

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
			HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12.			
Year 12	<p>Unit Title: Quant Chem and Electronic Structure Bonding, structure and properties.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> Basic atomic structure and isotopes. The role of acids, bases and salts in chemistry is developed in the context of neutralisation reactions. Finally, redox reactions are studied within the context of oxidation number and electron transfer. Atomic orbitals and electron configurations linked to the periodic table. The central role of electrons in ionic and covalent bonding is then studied. The important role of molecules is studied, including an explanation of polarity and intermolecular forces. How bonding and structure contribute to properties of substances. <p>Skills: PAG Skills. M0, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12.</p>	<p>Unit Title: Periodicity, redox, wet chemical analysis, acids.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> Periodic trends are first studied to extend the understanding of structure and bonding. Group properties are then studied using Group 2 and the halogens as typical metal and non-metal groups respectively, allowing an understanding of redox reactions to be developed further. How unknown ionic compounds can be analysed and identified using simple test-tube tests. <p>Skills: PAG Skills. M0, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12.</p>	<p>Unit Title: Basic concepts of organic chemistry. Enthalpy changes.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> Learners first learn about the importance of enthalpy changes, their uses and determination from experimental results including enthalpy cycles. Types of structures used routinely in organic chemistry, nomenclature, and the important concepts of homologous series, functional groups, isomerism and reaction mechanisms using curly arrows. The initial ideas are then developed within the context of the hydrocarbons: alkanes and alkenes. <p>Skills: PAG Skills. M0, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12.</p>	<p>Unit Title: Hydrocarbons AS rates, AS equilibria.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> Enthalpy changes, their uses and determination from experimental results including enthalpy cycles. Types of structures used routinely in organic chemistry, nomenclature, and the important concepts of homologous series, functional groups, isomerism and reaction mechanisms using curly arrows. The initial ideas are then developed within the context of the hydrocarbons: alkanes and alkenes. <p>Skills: PAG Skills. M0, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12.</p>	<p>Unit Title: Rates (AL) Alcohols, haloalkanes, IR spectroscopy, mass spectrometry.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> Alcohols, haloalkanes and the importance of polarity and bond enthalpy to organic reactions. Infrared spectroscopy and mass spectrometry are used to illustrate instrumental analysis as a valuable tool for identifying organic compounds. The largely qualitative treatment of reaction rates is developed within a quantitative and graphical context. <p>Skills: PAG Skills. M0, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12.</p>	<p>Unit Title: Equilibria (AL) Arenes and phenols.</p> <p>Knowledge:</p> <ul style="list-style-type: none"> The largely qualitative treatment of equilibria is developed within a quantitative and graphical context. Aromatic compounds are first introduced, including the central role of delocalisation within the chemistry of arenes and phenols. Directing groups are also introduced, including their importance to organic synthesis. <p>Skills: PAG Skills. M0, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12.</p>
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Year 11	<p>Knowledge:</p> <ul style="list-style-type: none"> Energy Changes Chemical Analysis <p>Skills: M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.</p>	<p>Knowledge: Reversible reactions and equilibrium, including Haber process and NPK fertilisers.</p> <p>Skills: M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.</p>		<p>Knowledge:</p> <ul style="list-style-type: none"> Further organic chemistry: alkenes, alcohols, carboxylic acids, polymers, amino acids, DNA. LCAs Ceramics, composites, glass, formulations. <p>Skills: M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.</p>	<p>Unit Title: Revision work from the whole spec.</p> <p>Knowledge: As outlined in previous sections.</p> <p>Skills: M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.</p>	
	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 10	<p>Knowledge:</p> <ul style="list-style-type: none"> Electrolysis. Bonding, structure and the properties of matter: covalent bonding, metallic bonding, 	<p>Knowledge: Bonding, structure and the properties of matter: covalent bonding, metallic bonding, allotropes of carbon, nanoscience.</p>	<p>Knowledge: Acids, bases and salts.</p> <p>Skills: M1, M2, M3, M4 & M5.</p>	<p>Knowledge: Titrations and titration calculations.</p> <p>Skills:</p>	<p>Knowledge: Periodic Table and studies of the groups.</p> <p>Skills:</p>	<p>Knowledge: Water</p> <p>Skills: M1, M2, M3, M4 & M5.</p>

	allotropes of carbon, nanoscience. Skills: M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	Skills: M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.
	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 9	Knowledge: • Particle Theory. • Basic Structure of Periodic Table. Skills: M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	Knowledge: • Bonding • Chemical changes - extracting metals • Using resources Skills: M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	Knowledge: Basic Organic Atmosphere, carbon footprint. Skills: M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	Knowledge: Chemistry of the atmosphere. Skills: M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	Knowledge: • The rate of chemical change. • Quantitative chemistry. Skills: M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	Knowledge: • The rate of chemical change. • Bonding, structure and the properties of matter: ionic bonding and electrolysis. Skills: M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.

Key/Legend/Notes:

KS5 Skills

- PAG Skills - Planning, Implementing, Analysis, Evaluating, Practical Skills, Techniques and Apparatus.
- M0 - Arithmetic and numerical computation
- M1 - Handling data
- M2 - Algebra
- M3 - Graphs
- M4 - Geometry and trigonometry
- HSW1 Use theories, models and ideas to develop scientific explanations
- HSW2 Use knowledge and understanding to pose scientific questions, define scientific problems, present scientific arguments and scientific ideas
- HSW3 Use appropriate methodology, including information and communication technology (ICT), to answer scientific questions and solve scientific problems
- HSW4 Carry out experimental and investigative activities, including appropriate risk management, in a range of contexts
- HSW5 Analyse and interpret data to provide evidence, recognising correlations and causal relationships
- HSW6 Evaluate methodology, evidence and data, and resolve conflicting evidence
- HSW7 Know that scientific knowledge and understanding develops over time
- HSW8 Communicate information and ideas in appropriate ways using appropriate terminology
- HSW9 Consider applications and implications of science and evaluate their associated benefits and risks
- HSW10 Consider ethical issues in the treatment of humans, other organisms and the environment
- HSW11 Evaluate the role of the scientific community in validating new knowledge and ensuring integrity
- HSW12 Evaluate the ways in which society uses science to inform decision making.

KS4 Skills

- M1 Arithmetic and numerical computation
- M2 Handling data
- M3 Algebra
- M4 Graphs
- M5 Geometry and trigonometry
- AT 1 Use of appropriate apparatus to make and record a range of measurements accurately, including mass, time, temperature, and volume of liquids and gases (links to A-level AT a).

- AT 2 Safe use of appropriate heating devices and techniques including use of a Bunsen burner and a water bath or electric heater (links to A-level AT b).
- AT 3 Use of appropriate apparatus and techniques for conducting and monitoring chemical reactions, including appropriate reagents and/or techniques for the measurement of pH in different situations (links to A-level AT a and d).
- AT 4 Safe use of a range of equipment to purify and/or separate chemical mixtures including evaporation, filtration, crystallisation, chromatography and distillation (links to A-level AT d and g).
- AT 5 Making and recording of appropriate observations during chemical reactions including changes in temperature and the measurement of rates of reaction by a variety of methods such as production of gas and colour change (links to A-level AT a and l).
- AT 6 Safe use and careful handling of gases, liquids and solids, including careful mixing of reagents under controlled conditions, using appropriate apparatus to explore chemical changes and/or products (links to A-level AT a and k).
- AT 7 Use of appropriate apparatus and techniques to draw, set up and use electrochemical cells for separation and production of elements and compounds (links to A-level AT d and j).
- AT 8 (chemistry only) Use of appropriate qualitative reagents and techniques to analyse and identify unknown samples or products including gas tests, flame tests, precipitation reactions, and the determination of concentrations of strong acids and strong alkalis (links to A level AT d)