

Chemistry Curriculum Outline 2023-2024

	Term 1	Term 2	Term 3	Term 4	Term 5
Year 13	 Unit Title: Arenes and phenols, carbonyl compounds. Acids, bases and buffers. 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 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. Skills: MO, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW9, HSW10, HSW11, HSW12. 	 Unit Title: Amines, amino acids, amides and chirality. Redox and electrode potentials. Transition elements. Knowledge: Redox chemistry permeates chemistry, including use of volumetric analysis for redox titrations and an introduction of electrochemistry in the context of electrochemistry in the context of electrochemistry in the context of electrochemistry, precipitation, ligand substitution and redox reactions. 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. Skills: MO, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12. 	 Unit Title: Polyesters and polyamides. Synthesis. Finish transition elements. Lattice enthalpy. Knowledge: 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. Skills: PAG Skills. M0, M1, M2, M3 & M4. HSW1, HSW2, HSW4, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12. 	 Unit Title: Enthalpy and entropy. Organic analysis, chromatography and spectroscopy. 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. Skills: PAG Skills. MO, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12. 	Unit Title: Revision and Practice. 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. Skills: PAG Skills. M0, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12.

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
	Unit Title: Quant Chem and Electronic Structure Bonding, structure and properties.	Unit Title: Periodicity, redox, wet chemical analysis, acids.	Unit Title: Basic concepts of organic chemistry. Enthalpy changes.	Unit Title: Hydrocarbons AS rates, AS equilibria.	Unit Title: Rates (AL) Alcohols, haloalkanes, IR spectroscopy, mass spectrometry.	Unit Title: Equilibria (AL) Arenes and phenols.
Year 12	 Knowledge: 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. Skills: PAG Skills. M0, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW1, HSW1,	 Knowledge: 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. Skills: PAG Skills. M0, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12. 	 Knowledge: 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. Skills: PAG Skills. M0, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12. 	 Knowledge: 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. Skills: PAG Skills. M0, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW9, HSW0, HSW10, HSW11, HSW12. 	 Knowledge: 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. Skills: PAG Skills. M0, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12. 	 Knowledge: 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. Skills: PAG Skills. M0, M1, M2, M3 & M4. HSW1, HSW2, HSW3, HSW4, HSW5, HSW6, HSW7, HSW8, HSW9, HSW10, HSW11, HSW12.
	Term 1	Term 2	Term 3	Term 4	Term 5	
Year 11	 Knowledge: Energy Changes Chemical Analysis Skills: M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8. 	 Knowledge: Reversible reactions and equilibrium, including Haber process and NPK fertilisers. Skills: M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8. 		 Knowledge: Further organic chemistry: alkenes, alcohols, carboxylic acids, polymers, amino acids, DNA. LCAs Ceramics, composites, glass, formulations. Skills: M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8. 	 Unit Title: Revision work from the whole spec. Knowledge: As outlined in previous sections. Skills: M1, M2, M3, M4 & M5. 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 10	 Knowledge: Electrolysis. Bonding, structure and the properties of matter: covalent bonding, metallic bonding, allotropes of carbon, nanoscience. 	Knowledge: Bonding, structure and the properties of matter: covalent bonding, metallic bonding, allotropes of carbon, nanoscience. Skills: M1, M2, M3, M4 & M5.	Knowledge: Acids, bases and salts. Skills: M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	Knowledge: Titrations and titration calculations. Skills: M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	Knowledge: Periodic Table and studies of the groups. Skills: M1, M2, M3, M4 & M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	Knowledge: Water 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.				
	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.
	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 8	 Unit Title: Matter - C1 - Periodic Table and Elements. Knowledge: Most substances are not pure elements, but compounds or mixtures containing atoms of different elements. They have different properties to the elements they contain. The elements in a group all react in a similar way and sometimes show a pattern in reactivity. As you go down a group and across a period the elements show patterns in physical properties. Skills: Use a range of equipment, analyse patterns, discuss limitations, draw conclusions, present data, communicate ideas, construct explanations, critique ideas/opinions, justify ideas/opinions, collect data, devise questions, plan variables, test hypothesis, estimate risks, examine consequences, review theories & interrogate sources. 		 1erm 3 1erm 4 Unit Title: Reactions - C2 - Chemical Energy and Types of Reactions. Knowledge: During chemical reaction bonds are broken (requiring energy) and new bonds formed (releasing energy). If the energy released is greater than the energy required, the reaction is exothermic. If the reverse, it is endothermic. Combustion is a reaction with oxygen in which energy is transferred to the surroundings as heat and light. Thermal decomposition is a reaction where a single reactant is broken down into simpler products by heating. Chemical changes can be described by a model where atoms and molecules in reactants rearrange to make the products and the total number of atoms is conserved. Skills: Use a range of equipment, analyse patterns, discuss limitations, draw conclusions, present data, communicate ideas, construct explanations, critique ideas/opinions, justify ideas/opinions, collect data, devise questions, plan variables, test hypothesis, estimate risks, examine consequences, review theories & interrogate sources. 		 I erm 5 I erm 6 Unit Title: Earth - C3 - Climate and Earth Resources. Knowledge: Carbon is recycled through natural processes in the atmosphere, ecosystems, oceans and the Earth's crust (such as photosynthesis and respiration) as well as human activities (burning fuels). Greenhouse gases reduce the amount of energy lost from the Earth through radiation and therefore the temperature has been rising as the concentration of those gases has risen. Scientists have evidence that global warming caused by human activity is causing changes in climate. There is only a certain quantity of any resource on Earth, so the faster it is extracted, the sooner it will run out. Recycling reduces the need to extract resources. Most metals are found combined with other elements, as a compound, in ores. The more reactive a metal, the more difficult it is to separate it from its compound. Carbon displaces less reactive metals, while electrolysis is needed for more reactive metals. Skills: Use a range of equipment, analyse patterns, discuss limitations, draw conclusions, present data, communicate ideas, construct explanations, critique ideas/opinions, justify ideas/opinions, collect data, devise questions, plan variables, test hypothesis, estimate risks, examine consequences, review theories & interrogate sources. 	
	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6

1	Unit Title:	Unit Title:	Unit Title:
]	KS2 Baseline Test – where am I in science (Term 1)	Reactions – C2 – Acids and Alkalis and Metals and Non-Metals	Earth – C3 - Universe
ear 7	 Matter - C1 – Particle Model and Separating Mixtures Knowledge: Properties of solids, liquids and gases can be described in terms of particles in motion but with differences in the arrangement and movement of these same particles: closely spaced and vibrating (solid), in random motion but in contact (liquid), or in random motion and widely spaced (gas). Observations where substances change temperature or state can be described in terms of particles gaining or losing energy. A pure substance consists of only one type of element or compound and has a fixed melting and boiling point. Mixtures may be separated due to differences in their physical properties. The method chosen to separate a mixture depends on which physical properties of the individual substances are different. 	 Knowledge: The pH of a solution depends on the strength of the acid: strong acids have lower pH values than weak acids. Mixing an acid and alkali produces a chemical reaction, neutralisation, forming a chemical called a salt and water. Metals and non-metals react with oxygen to form oxides which are either bases or acids. Metals can be arranged as a reactivity series in order of how readily they react with other substances. Some metals react with acids to produce salts and hydrogen. Skills: Use a range of equipment, analyse patterns, discuss limitations, draw conclusions, present data, communicate ideas, construct explanations, critique ideas/opinions, justify ideas/opinions, collect data, devise questions, plan variables, test hypothesis, estimate risks, examine consequences, review theories & interrogate sources.	 Knowledge: The solar system can be modelled as planets rotating on tilted axes while orbiting the Sun, moons orbiting planets, and sunlight spreading out and being reflected. This explains day and year length, seasons and the visibility of objects from Earth. Our solar system is a tiny part of a galaxy, one of many billions in the Universe. Light takes minutes to reach Earth from the Sun, four years from our nearest star and billions of years from other galaxies. Skills: Use a range of equipment, analyse patterns, discuss limitations, draw conclusions, present data, communicate ideas, construct explanations, critique ideas/opinions, justify ideas/opinions, collect data, devise questions, plan variables, test hypothesis, estimate risks, examine consequences, review theories & interrogate sources.
	Skills: Use a range of equipment, analyse patterns, discuss limitations, draw conclusions, present data, communicate ideas, construct explanations, critique ideas/opinions, justify ideas/opinions, collect data, devise questions, plan variables, test hypothesis, estimate risks, examine consequences, review theories & nterrogate sources.		

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)