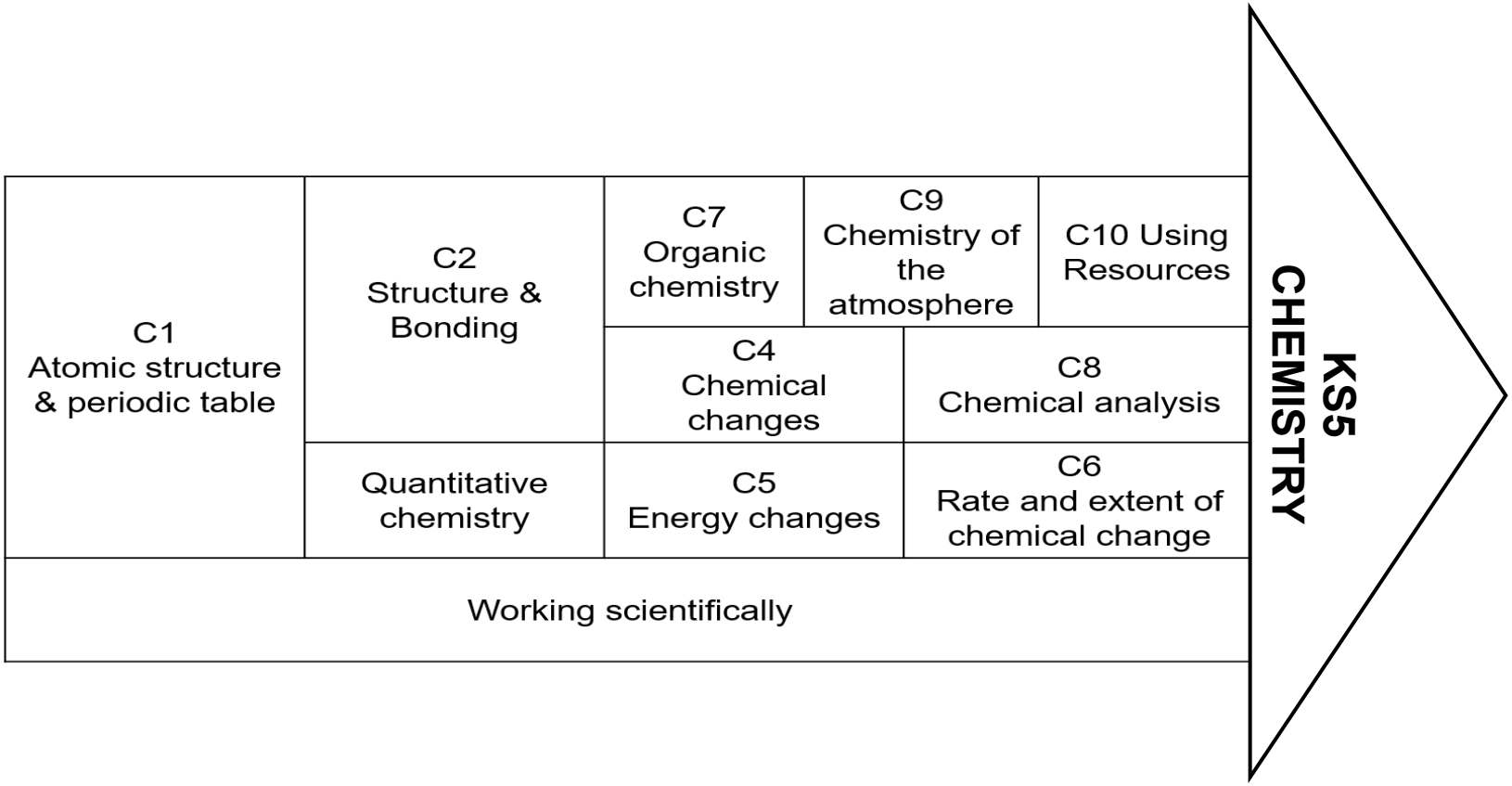
KS4 Chemistry – Curriculum overview



The above arrow shows the progression of chemistry topics across Key Stage 4. It shows how substantive knowledge is built upon in a sequential nature to prepare learners for KS5 chemistry. Running alongside and integrated throughout is the thread of working scientifically whereby students develop their knowledge of scientific methods, apparatus and data analysis.

KS4 Chemistry – Curriculum intent

<table>
<tr><th>Intent</th><th rowspan="2"></th><th colspan="3">What new knowledge/content do we introduce?</th><th></th></tr>
<tr><th>By the end of KS4 students are able to…</th><th>Year 10</th><th>Year 11</th><th>Choices</th><th>How does this curriculum incorporate the National Curriculum and go beyond? How does going beyond the NC ensure challenge?</th></tr>
<tr><td rowspan="3">Understand the structure of an atom and explain the types of bonding that can occur to form molecules and compounds.

Be capable of conducting practical work to demonstrate understanding of the separation of mixtures.

Explain chemical reactions in terms of collisions and have a secure understanding of the factors that affect the rate of reaction.

Understand the chemistry of the atmosphere and how humans are both contributing to, and attempting to reduce, environmental damage.</td><td rowspan="2">Autumn</td><td>Structure & bonding
Explaining types of bonding: metallic, ionic, covalent.
Formulae of elements
Comparison of metals and non-metals.
Explaining properties in terms of bonding.
Predicting reactivity based on bonding.</td><td>Organic chemistry
Fractional distillation
Products of complete and incomplete combustion
Alkanes vs. alkenes.</td><td rowspan="3">Chemistry of the atmosphere and using resources are taught in quick succession within the same term to emphasise the linkages between them. The former is concerned with the composition of the atmosphere and pollutants, whereas the second then looks at sustainable development and a chemists' approach to solving these problems.</td><td rowspan="3">KS4 chemistry goes beyond the national curriculum by providing opportunity for additional challenge and extension within each scheme of work. This often bridges the content between GCSE and A-level chemistry and permits students the opportunity to discovery the depth of A-level chemistry and uncover potential career pathways within the scientific fields. Further, there are also opportunities to enrich learning beyond the curriculum through the use of trips in the local area (e.g. treasure trails around Cambridge) or visiting guest speakers. There are also after-school sessions run</td></tr>
<tr><td>Quantitative chemistry
Relative atomic mass calculations
Calculating masses to predict balanced symbol equations
Calculate masses of reactants and products from a balanced symbol equation.</td><td>Chemical analysis
Purity vs. formulations
Identification of common gases</td></tr>
<tr><td>Spring</td><td>Chemical changes
Metal extraction including reduction and electrolysis.
Process and products of electrolysis.
Products of neutralisation reactions
How to produce a pure, dry sample of a soluble salt.</td><td>Chemistry of the atmosphere
Composition and development of the atmosphere
Human activities which contribute to greenhouse gases
Using resources
Sustainable development
Potable water
Extraction of copper</td></tr>
</table>

		Energy changes • Evaluate uses and applications of exothermic and endothermic reactions • Describe; activation energy is the energy needed for a reaction to occur	**Paper 1 and 2 revision** Focusing on drawing ideas together from across Years 7-11, making scientific links & understanding the results and conclusions form scientific investigations.		weekly for students to learn, revisit or further their understanding of a particular area of science.
	Summer	**Rates of chemical change** • Calculating rates of reaction • Collision theory • Effect of factors on rate of reaction • Reversible reactions • Equilibrium	**GCSE external examinations**		

	Rationale for this sequence	Structure and bonding builds upon the idea of atoms and ions established in Year 9 by exploring the many different ways that they bond to form molecules and compounds. Students then apply this knowledge of bonding to explain properties of substances. Subsequently, quantitative chemistry then uses a mathematical approach to calculate the concept of mass introduced in the previous topic. Students then learn new mathematical concepts (e.g. moles) which establishes a strong foundation for any aspect of mathematics that is subsequently needed (e.g. bond energy and rates of reaction). Both energy changes and chemical changes are explored in the next term. Here, there is some crossover in content (batteries and fuel cells link with electrolysis), but both build upon substantive knowledge from the first term. For example, chemical changes builds upon the idea of reactivity and properties that were introduced in the first term whereas energy changes requires the mathematical content from quantitative chemistry. The final topic again embeds mathematical skills learned prior and explicitly requires graphing of data. Therefore, teaching this topic towards the end of the year has allowed students the chance to perfect the thread of data analysis and graphing skills that has run throughout.	The first topic of Year 11 allows for consolidation of the major themes established in Year 10. Here, students learn about various separation techniques such as fractional distillation – which requires an understanding of mixtures and bonding. This theme is continued in the subsequent topic of chemical analysis, with students utilising practical skills to conduct a series of experiments. The following topics of chemistry of the atmosphere and using resources are taught next. The former directly follows from fractional distillation as students delve into finite resources, the combustion of hydrocarbons and their environmental effects. Using resources follows sequentially, with a focus on sustainable development and how an understanding of chemistry can be utilised to help solve real-world problems.		
	How does the KS4 Curriculum build on previous learning at KS3?	It is important to consider that we cannot assume the KS3 science curriculum has been effectively delivered; Covid-19 remote learning implications are evident in student's cumulative disfluency. Therefore the KS4 curriculum largely revisits, and then builds upon, many of the basic tenets of chemistry established in KS3. This is achieved by an increase in both depth and breadth as well as more complicated practical work.			
