

## Huntington School: Science Department



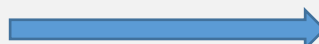
### Curriculum Intent: Key Stage Five Chemistry

The science department at Huntington School will have a curriculum which creates learners who will thrive in a changing world by giving them the knowledge to:

- Confidently and accurately work scientifically and solve scientific problems;
- Think creatively to overcome and tackle problems with resilience and an open mind-set;
- Appreciate and enjoy the uniqueness of science as a discipline;
- Seek further knowledge and skills independently, based upon a fascination of learning;
- Achieve great exam results that allow our students to progress to the next steps in their lives as scientifically informed citizens.

We will develop this in our students by:

- Using purposeful practical activities with an emphasis on understanding scientific ideas rather than participation.
- Highlighting the relevancy of science to the modern world.
- Assessing pupils starting points and their progress by using effective questioning.
- Creating a true multi- disciplinary approach to science where scientific skills are deployed confidently across all three sciences.
- Using guided practice and modelling to scaffold student's problem solving abilities.
- Being reflective practitioners who constantly evaluate and improve our practice.

	Big Idea	Foundations of KS4 	Y12 	Y13 
	Physical Chemistry	<b>C1 – Atomic Structure and the periodic table</b>	<b>Atomic Structure</b> Students will look at the fundamental particles, how mass spectrometry is used to identify elements and isotopes. Students will build upon the model of electronic configuration and extend it further to what is used at university level.	Links to this topic: This topic can be linked with every topic covered in the specification.
		<b>C3 – Quantitative Chemistry</b>	<b>Amount of substance</b> Students will look at the differences between relative atomic and relative molecular mass. Explore the concept of the mole. Complete calculations involving; the ideal gas equation, empirical formula, reacting masses, percentage yield and atom economy.  <b>Working scientifically</b> Students will complete a practical on the preparation of a standard solution and the subsequent standardisation with an acid of unknown concentration.	Links to this topic: This topic can be linked with every topic covered in the specification.
		<b>C2 – Bonding, structures and properties</b>	<b>Bonding, structures and properties</b> Students will review the concepts learnt at GCSE. They will be introduced to shapes of molecules and the different types of intermolecular forces and their effects on the properties of substances.	Links to this topic: This topic can be linked with every topic covered in the specification.
		<b>C5 – Energy Changes</b>	<b>Energetics</b> Students will be introduced to the concept of enthalpy. They will use calorimetry to determine an enthalpy change. Hess's Law will be used to calculate enthalpy changes involving the enthalpies of combustion and formation and bond enthalpy values. <b>Working Scientifically:</b> Students will use several different calorimetry techniques to record a temperature change, this will then be processed to calculate an enthalpy change using Hess's Law. Students will write a logical method and be able to evaluate the method used. Data processing includes drawing a suitable graph and using the correct calculation.	<b>Thermodynamics</b> Thermodynamic definitions are introduced, to help construct Born-Haber cycles to calculate and comment upon the magnitude of lattice enthalpy.  Entropy is introduced and used to calculate the Gibbs Free energy change, which can be applied to straight-line graphs.
		<b>C6 – Rate and extent of chemical change</b>	<b>Kinetics</b> Students will use collision theory to explain the effect of changing conditions on the rate of reaction. Maxwell-Boltzmann distribution curves will be introduced as a way of supporting collision theory. <b>Working Scientifically:</b> Students will plan an investigation into the effect of changing temperature on the rate of a chemical reaction. They will research suitable reactants, method, complete the practical and conduct suitable analysis.	<b>Rate Equations</b> Students are to be able to derive rate equations from experimental data and determine the orders of reaction. The Arrhenius Equation is used to calculate activation energy and applied to a straight-line graph.  <b>Working Scientifically:</b> Students will design and carry out a continuous monitoring method of a chemical reaction. They will research a suitable set of reagents, method and analyse the results.

				They will also investigate the initial rates method and use to determine the order of reaction with respect to a reactant.
			<b>Chemical Equilibria, Le Chatelier and <math>K_c</math></b> This unit builds upon the initial introduction at GCSE and further reinforces Le Chatelier's principle and the effect of changing conditions on the position of equilibria. The concept of the equilibrium constant is introduced and calculated.	<b>Equilibrium constant <math>K_p</math> for homogeneous systems</b> Students will calculate the $K_p$ for gas based equilibria, they will use, mole fractions and partial pressures.
		C4 – Chemical Changes	<b>Oxidation, reduction and redox equations</b> The definitions of oxidation, reduction and redox are covered. Oxidation states are introduced along with strategies to construct redox equations.	<b>Electrode potentials and electrochemical cells</b> Students will use the IUPAC convention for writing chemical cells and SHE. The commercial application of cells and batteries is covered; specifically looking at the hydrogen fuel cell and lithium ion cells <b>Working Scientifically:</b> Students will measure the EMF of several different chemical cells.
			<b>Acids and Bases</b> Students will calculate pH for strong and weak acids and bases. They will calculate the resulting pH after titrations of strong acids and strong bases, or weak acids and strong bases. They will also look at buffer action.  <b>Working scientifically:</b> Students will monitor the pH of a strong acid-strong base, strong acid-weak base, weak acid-strong base and weak acid-weak base titration and produce a pH curve.	
Inorganic Chemistry		C1 – Atomic Structure and the periodic table.	<b>Periodicity</b> Trends in melting point, atomic radius, ionisation energy are explained. Links will be made with the atomic structure and bonding topics.	<b>Properties of period 3 elements and their oxides</b> Students will describe the reactions of the period 3 elements with water and with oxygen. They will analyse the trend in melting and boiling point of the period 3 oxides in relation to their bonding and structure.
			<b>Group 2</b> Trends in melting point, ionisation energy and atomic radius are explored. Reactions with water and the solubility of the hydroxides and sulfates are observed. Uses of the Group 2 metals are researched.	
			<b>Group 7</b> Trends in boiling point, electronegativity, oxidising and reducing ability are explored. Chemical tests for the halide ions are investigated. Use of chlorine for water treatment is discussed. <b>Working Scientifically:</b> Research into the different inorganic chemical tests for positive and negative ions.	

Organic Chemistry				<p><b>Transition Metals</b> Students are introduced to the chemistry of the transition metals; coloured compounds, complex ions, variable oxidation state and show catalytic activity. Examples of how the transition metals are used in medicine and industry are included.</p>	
				<p><b>Reactions of aqueous ions in solution</b> Reactions observing the colour changes involving aqueous metal ions and the addition of; sodium hydroxide, ammonia, carbonate ions and multidentate ligands.</p> <p><b>Working Scientifically</b> Students will use these observations to identify unknown metal ions.</p>	
	C7 – Organic Chemistry C9 – Chemistry of the Atmosphere			<p><b>Nomenclature and isomerism</b> Students are introduced to IUPAC rules for naming organic compounds. Students are introduced to the two types of isomerism to be covered: structural and stereoisomerism</p>	<p><b>Optical Isomerism</b> Students look at how to draw optical isomers, how to recognise optical isomers and how to differentiate optical isomers. They will look at how optical isomers have influenced the pharmaceutical industry.</p>
				<p><b>Alkanes</b> This unit builds upon the content at GCSE. We review fractional distillation, cracking and combustion reactions. We introduce halogenation of alkanes by means of free radical substitution reactions and how this affects the ozone layer.</p>	
				<p><b>Halogenoalkanes</b> Introduction of nucleophilic substitution reactions and elimination reactions.</p>	
				<p><b>Alkenes</b> Introduction of the nature of the C=C. Electrophilic addition reactions. Addition polymerisation</p>	
				<p><b>Alcohols</b> Comparison of how ethanol is produced – via fermentation or hydration. This links to use of biofuels. Oxidation of alcohols to aldehydes and carboxylic acids. Elimination reactions to produce alkenes. <b>Working Scientifically:</b> Students will oxidise an alcohol to produce an aldehyde through reflux and distillation methods.</p>	<p><b>Aldehydes and ketones</b> Reactions of aldehydes and ketones; nucleophilic addition reactions, links to optical isomerism.</p>
					<p><b>Carboxylic acids and derivatives</b> Reactions of carboxylic acids to produce esters, this includes oils, fatty acids and the production of biodiesel. Derivatives include; acyl chlorides and acid anhydrides – reactions of both are studied. <b>Working Scientifically:</b> Students will prepare an organic solid (preparation of aspirin or paracetamol or</p>

				nitromethylbenzenecarboxylate). Students will prepare an organic liquid (ethyl ethanoate). Students will use; reflux, vacuum filtration, recrystallization, distillation techniques.
				<p><b>Aromatic Chemistry</b> Students will look at the bonding, structure and properties of benzene. Students will be introduced to the electrophilic substitution mechanism.</p> <p><b>Amines</b> Students will look at the preparation of amines, their basic properties and their nucleophilic properties. This unit will help review the topic "halogenoalkanes" covered in year 12.</p> <p><b>Polymers</b> This topic introduces condensation polymerisation. It also includes the disposal and environmental problems associated with polymers.</p> <p><b>Amino acids, proteins and DNA</b> This topic introduces amino acids and their properties. Proteins and enzymes are introduced and linked to chromatography and to the structure and function of DNA and anti-cancer drugs.</p> <p><b>Organic Synthesis</b> This is a summary unit of all the organic reaction pathways. It helps students make links between the reactions studied and allows them to design their own pathways and sequences of reactions if given a starting and ending material.</p>
			<p><b>Organic analysis</b> Introduction of infra-red analysis for organic compounds. Working scientifically: Research into the chemical tests for organic molecules.</p>	<p><b>NMR</b> This topic introduces <math>^1\text{H-NMR}</math> and <math>^{13}\text{C-NMR}</math> as a means to help identify the structure of an organic compound.</p> <p><b>Chromatography</b> Students will look at different types of chromatography; paper, TLC and gas chromatography. They will be able to explain how the process works and interpret the results.</p> <p><b>Working Scientifically:</b> Students will conduct a TLC experiment to find the composition of painkillers.</p>
CPAC	<p>The assessment of practical skills is a compulsory requirement of the A-Level Chemistry course. Students will complete a minimum of 12 required practical activities covering all the required practical techniques and apparatus as outlined by the specification. Teachers will assess these practical activities using the Common Practical Assessment Criteria (CPAC). Students will be assessed on the following;</p> <p>1a – following written procedures 2a – Correctly uses appropriate instrumentation, apparatus and materials (including ICT) to carry out investigative activities, experimental techniques and procedures with minimal assistance or prompting. 2b - Carries out techniques or procedures methodically, in sequence and in combination, identifying practical issues and making adjustments where necessary. 2c - Identifies and controls significant quantitative variables where applicable, and plans approaches to take account of variables that cannot readily be controlled. 2d - Selects appropriate equipment and measurement strategies in order to ensure suitably accurate results.</p>			

	<p>3a - Identifies hazards and assesses risks associated with those hazards, making safety adjustments as necessary, when carrying out experimental techniques and procedures in the lab or field.</p> <p>3b - Uses appropriate safety equipment and approaches to minimise risks with minimal prompting.</p> <p>4a - Makes accurate observations relevant to the experimental or investigative procedure.</p> <p>4b - Obtains accurate, precise and sufficient data for experimental and investigative procedures and records this methodically using appropriate units and conventions. 5. Researches, references and reports</p> <p>5a - Uses appropriate software and/or tools to process data, carry out research and report findings.</p> <p>5b - Cites sources of information demonstrating that research has taken place, supporting planning and conclusions.</p> <p>Students will have to keep their own record of the practical activities completed and students who demonstrate the required standard will be awarded a “pass” grade for their practical work. Practical work is also assessed in the three written exams.</p>
<b>Assessment</b>	<p>Students will experience a variety of different assessment techniques during the A-Level. They range from formative assessment during lessons – making use of whiteboards, quick quizzes, questioning and other written activities.</p> <p>Summative assessment will take the form of end of topic tests and practice mock papers.</p>
<b>Feedback</b>	<p><b>Verbal feedback</b> is recognised as having the greatest impact on student progress and will be at the core of our everyday teaching in Science at all key stages.</p> <p>Students will usually receive immediate verbal feedback on their contributions, ideas and questions in class. Verbal feedback is often given <i>whilst</i> students are completing tasks, students will usually act on this feedback and improve their work immediately, therefore there is no need for it to be recorded. Students may also receive immediate verbal feedback on their performance on short formative tasks such as mini-quizzes. Verbal feedback can be given on an individual, small group or whole-class basis.</p> <p><b>Other in-lesson feedback.</b> In science, students will receive feedback on short activities/tasks/quizzes/their Extended Learning (homework) frequently from lesson to lesson. Frequent use will be made of self- or peer- marking as an efficient method of students receiving immediate feedback and improving their work/knowledge/understanding.</p> <p><b>Teacher feedback on specific tasks.</b> Students will be provided with feedback from their teacher on their performance on specific tasks. This feedback could take many forms, again including (but not limited to) this list. This feedback will <u>always</u> provide guidance on how students’ work, knowledge or understanding can be improved and/or what students need to do next to make more progress. This feedback may also identify strengths/weaknesses in students’ work, if appropriate to the task.</p> <p><u>Y12/Y13</u> At least 3 formal tests/mock exams per year in each Science A-level</p> <p><b>Student responses.</b> Students are expected to act on all feedback. DIRT (Dedicated Improvement and Reflection Time) may be given in lessons for students to improve/correct/re-attempt their work or to complete tasks set in response to their identified areas of need. It should be clear that students’ work, knowledge or understanding has improved as a result of the feedback given. Automatic feedback on Teams will also be used to ensure that students receive effective and timely feedback.</p> <p><b>Teacher feedback on tests/exams.</b> Students will be provided with detailed feedback on formal tests, end of year exams and mock exams. This feedback could take many forms, including (but not limited to):</p> <ol style="list-style-type: none"> <li>a) marking and annotations on test papers</li> <li>b) written feedback addressed to individuals, small groups or on a whole-class basis</li> <li>c) verbal feedback addressed to individuals, small groups or on a whole-class basis</li> <li>d) re-teaching of specific science content, in response to areas of need identified during the marking process</li> <li>e) use of markschemes or other written resources (e.g. model answers) which provide feedback on how to improve specific answers and/or describe common mistakes/misconceptions</li> <li>f) feedback grids to identify areas of strength and weakness and/or guide students to reflect on their performance</li> </ol> <p>Test feedback in science will <u>always</u> (i) identify (or allow students themselves to identify) areas of strength and weakness, and (ii) provide guidance on how students’ exam responses can be improved and/or what students need to do next to improve their exam responses/performance in the future.</p>
<b>Homework</b>	<p><i>Frequency:</i> Homework tasks will be set on a weekly basis. Students are encouraged if they find a task challenging to seek support from their teacher.</p> <p><i>Types of tasks:</i></p> <ul style="list-style-type: none"> <li>▪ Reinforce and extend learning in class e.g. to practise examination questions.</li> <li>▪ Research in preparation for future tasks e.g. research properties of chemical elements, the applications and implications of using stem cells.</li> <li>▪ Embed key subject content in long term memory, e.g. the formulae for calculations.</li> <li>▪ Practise and develop skills e.g. review and annotation of class notes, graph plotting, identifying patterns, drawing conclusions, answering past exam questions.</li> <li>▪ Extension of learning from the lesson e.g. comprehension questions related to key learning.</li> <li>▪ Review learning by producing mind maps, revision cards etc.</li> <li>▪ Learning and revision for class tests and examinations.</li> <li>▪ Improvement and use of DIRT time to improve or develop set tasks.</li> </ul>

	<ul style="list-style-type: none"><li>▪ Wider/topical reading &amp; summarise - around the subject.</li></ul>
<b>How can I support my child at home?</b>	<ul style="list-style-type: none"><li>▪ Asking them about what they are learning</li><li>▪ Encouraging them to consolidate their notes as they go along</li><li>▪ Encouraging them to complete extended learning using their classwork</li><li>▪ Encouraging them to ask for help when they are stuck</li><li>▪ Encouraging them to produce revision resources as each topic is completed.</li><li>▪ CGP Revision resources; revision guide, workbook, pre-made flashcards. These can be purchased from the department.</li><li>▪ Helping them with homework tasks, especially quizzing them during revision extended learning.</li><li>▪ Encourage them to watch the news and discuss real-life applications –medicines, industrial applications.</li></ul>