

Science

Year 10 & 11 Curriculum Intent 2024 - 2025

Combined Science (Trilogy) - Chemistry

The course is based on the AQA GCSE 9 – 1 Combined Science Trilogy Chemistry (8464) Specification and is taught across Year 10 and Year 11. It is our intention as Science Department to provide all children, regardless of their prior learning, background, or special needs, with a broad and balanced science curriculum. We aim to promote positive attitudes to science as an interesting and enjoyable subject as well as to develop pupils' awareness of how science impacts on their everyday life.

Students at KS4 have 3 lessons of each science per fortnight.

How can I support my child at home?

- Ensure weekly homework is completed on SatchelOne/Educake
- Use the knowledge organisers to support retention of knowledge and understanding
- Help encourage revision, especially around assessment times: [Revision techniques from BBC Bitesize - BBC Bitesize](#)

How else can my child increase their knowledge and love of science?

While outside reading isn't required for Science, it can be very beneficial to inspire, motivate and help students progress. In addition to books, online videos and journals may be of interest to your child

Websites and journals we recommend:

- BBC Bitesize
- Seneca Learning - www.Senecalearning.com
- TED ED - <https://www.youtube.com/teded/featured>
- In a nutshell - <https://www.youtube.com/user/Kurzgesagt>
- Freescience lessons - https://www.youtube.com/channel/UCqbOeHaAUXw9II7sBVG3_bw

- Primrose Kitten - <https://primrosekitten.org/gcse-science/> or on youtube - <https://www.youtube.com/channel/UCBgvmal8AR4QIK2e0EfJwaA>
- BMJ News - www.bmj.com/new
- Nature - www.nature.com/
- New Scientist - www.newscientist.com/
- RSB Letters & Opinions - royalsocietypublishing.org/journal/rsbl

Books we recommend (some push KS4+ knowledge):

- Adam Kay – This is going to hurt
- Matthew Walker – Why we sleep
- Dean Burnett – The idiot brain
- Adam Nicolson – The sea is not made of water
- Emma Young – Super senses
- Bill Bryson – The body
- Randall Munroe – What if?: Serious scientific questions to absurd hypothetical questions
- Bill Bryson – A short history of nearly everything
- Ben Goldacre – Bad science
- Charles Darwin – Origin of the Species
- Matt Ridley – Genome
- James Watson: DNA
- Daniel Chamovitz – What a plant knows
- Steven Pinker – The language instinct
- Steven Pinker – How the mind works
- Richard Dawkins – The selfish gene
- Jonny Keeling – Seven World One Planet
- Professor Brian Cox – Forces of Nature
- Professor Brian Cox – Wonders of Life
- Sir David Attenborough – Amazing Rare things.

Big topics	Topic Name	Specification & NC Links	Skill Components	Assessment Points	from Key Stage 3 to Key Stage 5
Enquiry Processes	Taught throughout all topics	<ul style="list-style-type: none"> • evaluate risks and alter practice accordingly • ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience • make predictions using scientific knowledge and understanding • select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate • use appropriate techniques, apparatus, and materials during laboratory work, paying attention to health and safety • make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest improvements • apply mathematical concepts and calculate results • present observations and data using appropriate methods, including tables and graphs • interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions • present reasoned explanations, including explaining data in relation to predictions and hypotheses • evaluate data, showing awareness of potential sources of random and systematic error • identify further questions arising from their results. • undertake basic data analysis including simple statistical techniques 	<ul style="list-style-type: none"> • Recall key terminology. • Identify hazard symbols and describe ways to reduce risks • Choose appropriate lab equipment to complete practical activities • Draw labelled scientific diagrams of equipment • Use a Bunsen burner safely • Draw tables to hold data • Draw bar graphs to show discontinuous data • Draw line graphs to show continuous data • Plan a method to test one variable • Complete a practical to obtain valid results • Analyse data gained • Calculate means • Produce extended writing through practical write ups • Collaborate and communicate in completion of practicals 	<ul style="list-style-type: none"> • Bar charts and analysis (Forces) • Line graphs (States of Matter) • Method writing (Reactions) • Educake quizzes • Synoptic Assessments 	<ul style="list-style-type: none"> • planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary • taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate • recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs • using test results to make predictions to set up further comparative and fair tests • reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and a degree of trust in results, in oral and written forms such as displays and other presentations <p style="text-align: center;">KS4 – All required practicals</p>

Topic Name	Big ideas	Specification & NC Links	Skill Components	Assessment Points	from Key Stage 3 to Key Stage 5
Chemical Changes	Bonding recap and further chemical changes	<ul style="list-style-type: none"> • Recap year 9 bonding • How metals react with oxygen, water and acids • The order of metals, including carbon and hydrogen, in the reactivity series • What oxidation and reduction are in terms of electrons, oxygen and hydrogen • How metals are extracted from their ores using carbon reduction • The pH scale and the use of a variety of indicators • The link between pH, [H⁺] and orders of magnitude • Neutralisation of acids and salt production • The general equation for neutralisation • The difference between strong and weak acids • How covalent compounds form • Properties of covalent compounds • Properties of metals and alloys and metallic bonding • How ionic compounds form • Properties of ionic compounds • The process of electrolysis including all key terms - How the electrolysis of molten ionic compounds yields products • How electrolysis can be used to extract more reactive metals • How the electrolysis of aqueous solutions yields products 	<ul style="list-style-type: none"> • Mixing reagents to explore chemical changes and products -Applying the reactivity of metals including carbon and hydrogen to displacement reactions • Elucidating chemical formulae • Writing and balancing general and ionic equations Writing and balancing ionic half equations • Identifying species that have been oxidised or reduced • Predicting products from given reactants • Competence of carrying out a multistep procedure, preparation of a pure, dry sample of a soluble salt • Using the pH scale to identify acidic or alkaline solutions -Measuring the pH of different acids and bases at different concentrations • Making orders of magnitude calculations • Using the words, weak, strong, dilute and concentrated and neutral when applied to acids and their reactions • Drawing and interpreting dot-cross diagrams for covalent compounds • Explaining how different substances conduct electricity • Explaining the properties of alloys • Determining numbers of sub-atomic particles Drawing dotcross diagrams • Calculating charges on ions • Determining formulae of ionic compounds • Setting up a simple electrochemical cell • Applying redox to write and balance half equations • Evaluating the processes involved in extracting metals from the ground and then by electrolysis • 	<ul style="list-style-type: none"> • Peer and Self Assessment embedded throughout • Educake Quizzes • Completion of practical • Starter tasks which interleave knowledge from previous learning • Data collection for required practicals • Presentation and evaluation of collected data for required practicals • Correct interpretation of results • Synoptic Assessments • End of year mock yr 10 & 11 • External GCSE • 	<ul style="list-style-type: none"> • Year 7 reactions • Year 8 periodic table • Year 8 reactions • Year 9 changing theories – atomic structure • Year 9 periodic table • Year 9 atomic structure • Year 12 Physical – bonding, redox reactions, equilibria, • Year 13 Physical – thermodynamics, rate equations, electrochemical cells, acids and bases

Big topics	Topic Name	Specification & NC Links	Skill Components	Assessment Points	from Key Stage 3 to Key Stage 5
Quantitative	Conservation of mass, calculating abundance, concentration	<ul style="list-style-type: none"> Consolidation of writing and balancing equations - Be familiar with specific key terms e.g. relative atomic mass/formula mass, mole, limiting reactant The conservation of mass law Avogadro's number Amounts of substance can be measured in moles How conservation of mass can be understood using formula masses and moles in balanced equations How to calculate % of an element in a compound 	<ul style="list-style-type: none"> Converting units Using appropriate numbers of significant figures Writing, balancing and interpreting chemical equations Using formula mass to calculate moles and vice versa Recognising and using expressions in standard form Using ratios, fractions and percentages Changing the subject of a variety of equations Converting units Using appropriate numbers of significant figures Identifying anomalous results and making estimations of uncertainty Calculating the mean of a data set and using the range as a measure of uncertainty 	<ul style="list-style-type: none"> Peer and Self Assessment embedded throughout Educake Quizzes Completion of practical Starter tasks which interleave knowledge from previous learning Data collection for required practicals Presentation and evaluation of collected data for required practicals Correct interpretation of results Synoptic Assessments End of year mock yr 10 & 11 External GCSE 	<ul style="list-style-type: none"> Year 7 reactions Year 8 reactions Year 9 separating mixtures Year 12 Physical – equilibria, amount of substance Year 12 Inorganic – periodicity, group 2, group 7 Year 12 Organic – all topics Year 13 Physical – equilibria, acids and bases Year 13 Inorganic - reactions of ions Year 13 Organic – all topics
Energy changes	Energy changes in different chemical reactions	<ul style="list-style-type: none"> Energy is conserved during chemical reactions What exothermic and endothermic reactions are including everyday examples of them How reaction profiles are used to represent chemical reactions What activation energy is Energy is needed to break chemical bonds Energy is released when new bonds are formed 	<ul style="list-style-type: none"> Writing, balancing and interpreting chemical equations Measuring temperature changes of simple chemical reactions and classifying them as exo or endothermic Investigating the variables that affect temperature changes Drawing and interpreting reaction profiles for exothermic and endothermic reactions Calculating the overall energy change in reactions from supplied data 	<ul style="list-style-type: none"> Peer and Self Assessment embedded throughout Educake Quizzes Completion of practical Starter tasks which interleave knowledge from previous learning Data collection for required practicals Presentation and evaluation of collected data for required practicals 	<ul style="list-style-type: none"> Year 7 reactions Year 8 reactions Year 12 Physical – energetics, kinetics Year 13 Physical – thermodynamics, rate equations

Big topics	Topic Name	Specification & NC Links	Skill Components	Assessment Points	from Key Stage 3 to Key Stage 5
				<ul style="list-style-type: none"> • Correct interpretation of of results • Synoptic Assessments • End of year mock yr 10 & 11 • External GCSE 	
Atomic structure	Review atomic structure and periodic table from year 9	<ul style="list-style-type: none"> • Recap: a simple model of the atom • The development of the periodic table • The structure of the modern periodic table • The chemistry of the elements of Group 1, Group 7 and Group 0 	<ul style="list-style-type: none"> • Fluency in the use of IUPAC nomenclature regarding element symbols and electronic structures. • Construction and use of word and symbol equations. • Explaining how new evidence can lead to changes in accepted models • Application of key mathematical skills • Processing data to reveal patterns within elemental properties and interpreting data and graphs of elemental data. 	<ul style="list-style-type: none"> • Peer and Self Assessment embedded throughout • Educake Quizzes • Completion of practical • Starter tasks which interleave knowledge from previous learning • Data collection for required practicals • Presentation and evaluation of collected data for required practicals • Correct interpretation of of results • Synoptic Assessments • End of year mock yr 10 & 11 • External GCSE 	<ul style="list-style-type: none"> • Year 7 reactions • Year 8 periodic table • Year 8 reactions • Year 9 changing theories • Year 9 periodic table • Year 9 atomic structure • Year 12 Physical - atomic structure, amount of substance • Year 12 Inorganic – periodicity, group 2 and group 7
Chemistry of the atmosphere	Climate change, greenhouse effect, effect of human activity	<ul style="list-style-type: none"> • The theory of how the Earth's early atmosphere was generated, how it has changed and what has and is currently changing it. Specifically: <ul style="list-style-type: none"> o Combustion reactions o Carbon dioxide production o Other pollutants o Locking up in rocks and the ocean • Photosynthesis 	<ul style="list-style-type: none"> • Explaining how (new) evidence can lead to changes in and/or re-enforcement of, accepted models. • Be able to evaluate the quality of evidence • Be able to describe uncertainties in evidence • Be able to describe how a range of pollutants are formed and predict the products of combustion reactions 	<ul style="list-style-type: none"> • Peer and Self Assessment embedded throughout • Educake Quizzes • Completion of practical • Starter tasks which interleave knowledge from previous learning 	<ul style="list-style-type: none"> • Year 7 Our Earth – structure, types of rocks, rock formation, resources • Year 9 Atmosphere – all topics Year 12 Organic – alkanes, halogenoalkanes

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		<ul style="list-style-type: none"> The proportions of the different gases in the atmosphere Principles behind the greenhouse effect How human activities contribute towards the greenhouse effect Principles behind and effects of climate change The definition of a carbon footprint, how its value is arrived at and how it can be reduced A range of common atmospheric pollutants, their sources and effects 	<ul style="list-style-type: none"> Be able to describe and explain the problems caused by increased levels of pollutants Be able to describe effects of global climate change Be able to discuss the scale, risk and environmental implications of climate change Be able to describe actions to reduce greenhouse gas emission but also why these may be limited 	<ul style="list-style-type: none"> Data collection for required practicals Presentation and evaluation of collected data for required practicals Correct interpretation of results Synoptic Assessments End of year mock yr 10 & 11 External GCSE 	
Organic Chemistry	Oil, fractions, cracking	<ul style="list-style-type: none"> How to calculate reacting masses in balanced equations What limiting reactants are and their effect on reacting mass calculations How concentration of solutions is measured in chemistry - Be familiar with specific key terms e.g. relative atomic mass/formula mass, mole, limiting reactant, yield, concentration The uncertainty associated with any measurements taken The origin and composition of crude oil The Alkanes are a homologous series The general formula and structure of the alkanes How fractional distillation is used to refine crude oil 	<ul style="list-style-type: none"> Interpreting models of organic molecules Making predictions of properties based upon regularly changing patterns Explaining the process of fractional distillation Using molecular models to represent alkanes, alkenes 	<ul style="list-style-type: none"> Peer and Self Assessment embedded throughout Educake Quizzes Completion of practical Starter tasks which interleave knowledge from previous learning Data collection for required practicals Presentation and evaluation of collected data for required practicals Correct interpretation of results 	<ul style="list-style-type: none"> Year 7 Separating mixtures – distillation Year 8 Reactions Year 9 Separating mixtures – distillation, fractional distillation Year 12 Organic – all topics Year 13 Organic – all topics

Big topics	Topic Name	Specification & NC Links	Skill Components	Assessment Points	from Key Stage 3 to Key Stage 5
		<ul style="list-style-type: none"> • Uses of the fractions from crude oil • Properties of hydrocarbons: boiling points, viscosity and flammability • The cracking of hydrocarbons to produce alkenes and useful alkanes 		<ul style="list-style-type: none"> • Synoptic Assessments • End of year mock yr 10 & 11 • External GCSE 	
Rates of reaction		<ul style="list-style-type: none"> • What rate of reaction is and the different ways that it can be monitored, measured and calculated • The factors that affect the rate of chemical reactions • How changing these factors affects the rate of chemical reactions: Collision theory, Activation energy • What catalysts are and how they affect the rate of reactions and reaction profiles • That some reactions are reversible and examples of reversible reactions • Energy changes in reversible reactions • That some reactions are reversible and examples of reversible reactions • Energy changes in reversible reactions • The concept of chemical equilibrium • Le-Chateliers principle 	<ul style="list-style-type: none"> • Writing, balancing and interpreting chemical equations • Drawing and interpreting graphs from given or experimental data • Calculating the mean rate of reaction • Drawing tangents to curves • Measuring the gradient of tangents • Identifying reversible reactions <p>Making qualitative predictions about changes made to systems at equilibrium</p>	<ul style="list-style-type: none"> • Peer and Self Assessment embedded throughout • Educake Quizzes • Completion of practical • Starter tasks which interleave knowledge from previous learning • Data collection for required practicals • Presentation and evaluation of collected data for required practicals • Correct interpretation of of results • Synoptic Assessments • End of year mock yr 10 & 11 • External GCSE 	<ul style="list-style-type: none"> • Year 7 Reactions – all topics • Year 8 Reactions – all topics • Year 12 Physical – energetics, kinetics, equilibria • Year 13 Physical – thermodynamics, rate equations, equilibria

Big topics	Topic Name	Specification & NC Links	Skill Components	Assessment Points	from Key Stage 3 to Key Stage 5
		<ul style="list-style-type: none"> The effect of changing conditions on equilibrium The effect of changing concentration on equilibrium The effect of changing temperature on equilibrium The effect of changing pressure on equilibrium 			
Earth's resources		<ul style="list-style-type: none"> A range of renewable and finite resources and their origins. What sustainable development is How water treated and is made potable Ways of reducing the use of resources What a Life Cycle Assessment is How recycling, re-using and reducing can all have an impact on sustainability 	<ul style="list-style-type: none"> Recalling key terminology. Explaining how agriculture has an impact on the use of resources Explaining how water (from a range of sources) is treated and made potable Using simple laboratory equipment to make pure water by distillation. Carry out and interpret chemical tests to the water before and after Applying understanding of sustainable development to a range of familiar and unfamiliar examples How to carry out a simple Life Cycle Assessment Processing data from a wide range of sources relating to a wide range of products, services and processes 	<ul style="list-style-type: none"> Peer and Self Assessment embedded throughout Educake Quizzes Completion of practical Starter tasks which interleave knowledge from previous learning Data collection for required practicals Presentation and evaluation of collected data for required practicals Correct interpretation of results Synoptic Assessments End of year mock yr 10 & 11 External GCSE 	<ul style="list-style-type: none"> Year 7 Our earth – all topics Year 9 Separating mixtures – evaporation, distillation Year 9 Atmosphere – climate change, recycling Year 12 Organic – alkenes, alkanes Year 13 Organic – polymers, synthesis

Big topics	Topic Name	Specification & NC Links	Skill Components	Assessment Points	from Key Stage 3 to Key Stage 5
Chemical Analysis	Recap of separating processes and further chemical analysis	<ul style="list-style-type: none"> The difference between pure substances and mixtures and formulations Physical separation processes including: Filtration, crystallisation, simple and fractional distillation and chromatography Testing for the gases: <ul style="list-style-type: none"> Hydrogen Oxygen Carbon dioxide and Chlorine can be identified by simple laboratory tests and the positive test results for these gases 	<ul style="list-style-type: none"> Fluency in the use of IUPAC nomenclature regarding representations of apparatus Construction and use of word and symbol equations. -Be able to explain how chromatography separates mixtures. Interpretation of chromatograms Describing how to carry out tests for gases Application of key mathematical skills: Calculating Rf values or distances moved by a solvent or a substance during chromatography. Practical skills and development and apparatus use: Setting up running paper chromatography (Req Prac 6). 	<ul style="list-style-type: none"> Peer and Self Assessment embedded throughout Educake Quizzes Completion of practical Starter tasks which interleave knowledge from previous learning Data collection for required practicals Presentation and evaluation of collected data for required practicals Correct interpretation of results Synoptic Assessments End of year mock yr 10 & 11 External GCSE 	<ul style="list-style-type: none"> Year 7 separating mixtures Year 7 reactions Year 8 reactions Year 9 separating mixtures Year 12 Organic - analysis
Consolidation	All topics	<ul style="list-style-type: none"> Revise all topics in the specification 	<ul style="list-style-type: none"> Recall key terminology. Apply knowledge from all topics Devise methods to investigate scientific theories Interpret given data Complete practice questions 	<ul style="list-style-type: none"> Peer and self assessments throughout Educake Quizzes Synoptic Assessments External GCSE exams 	

Cultural and skills lessons:

- Throughout the year students will also complete lessons to improve their cultural capital and skills such as problem solving. These themes will include:
 - How to revise
 - How to use textbooks
 - How to use Seneca learning and BBC bitesize to aid independent learning

Assessment: Year 10 and 11 students will be assessed throughout the year through summative and formative assessments.. They will also complete mock exams based on previous years external GCSE exams.

