

Science

Year 10 & 11 Curriculum Intent 2024 - 2025

Triple Science - Chemistry

The course is based on the AQA GCSE 9 – 1 Biology (8461) Specification and is taught across Year 10 and Year 11. Triple only content can be found in red. 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>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 Synoptic Assessments End of year 10 mock Year 11 mock External GCSE exams	<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 chemistry		<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 <i>Investigating mass changes using various apparatus</i> 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 	<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 Synoptic Assessments End of year 10 mock Year 11 mock External GCSE exams 	<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"> <i>Percentage yield and atom economy</i> How to calculate reacting masses in balanced equations What limiting reactants are and their effect on reacting mass calculations <i>How concentration of solutions is measured in chemistry</i> <i>What a titration is and how to carry one out</i> <i>The relationship between moles, concentration and</i> 	<ul style="list-style-type: none"> Calculating the mean of a data set and using the range as a measure of uncertainty <i>Describing how to carry out titrations using strong acids and strong alkalis</i> <i>Calculating the chemical quantities in titrations in both mol dm⁻³ and g dm⁻³</i> <i>Competent use of technical laboratory equipment (pipette, pipette filler and burette)</i> <i>Calculating the volumes of gaseous reactants and products from balanced equations</i> 	<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 Synoptic Assessments 	<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"> • <i>volume and the link between this and moles, mass and Mr</i> • 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 • <i>The volume of 1 mole of any gas is 24dm³</i> 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 • <i>Chemical cells and fuel cells</i> • <i>Alkaline cells and batteries</i> • <i>Rechargeable cells and batteries</i> • <i>Fuel cells and the overall reaction within them</i> 	<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 • Calculating the overall energy change in reactions from supplied data • Writing, balancing and interpreting chemical equations • Applying the reactivity of metals to displacement reactions • <i>Elucidation of chemical formulae</i> • <i>Writing and balancing general and ionic equations</i> • <i>Writing and balancing ionic half equations - Identifying species that have been oxidised or reduced</i> • <i>Predicting products from given reactants</i> • <i>Interpreting data relating to relative reactivity of metals used in cells</i> • <i>Evaluating the use of hydrogen fuel cells compared to other cells and batteries</i> • Drawing and interpreting reaction profiles for exothermic and endothermic reactions 	<ul style="list-style-type: none"> • End of year 10 mock • Year 11 mock • External GCSE exams 	

Big topics	Topic Name	Specification & NC Links	Skill Components	Assessment Points	from Key Stage 3 to Key Stage 5
Chemistry of the atmosphere		<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"> Combustion reactions Carbon dioxide production Other pollutants Locking up in rocks and the ocean Photosynthesis 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"> 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 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"> 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 Synoptic Assessments End of year 10 mock Year 11 mock External GCSE exams 	<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
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 	<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. 	<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 – all topics Year 9 Separating mixtures – evaporation, distillation Year 9 Atmosphere – climate change, recycling Year 12 Organic – alkenes, alkanes

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"> 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"> 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"> Data collection for required practicals Presentation and evaluation of collected data for required practicals Synoptic Assessments End of year 10 mock Year 11 mock External GCSE exams 	Year 13 Organic – polymers, synthesis
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 Synoptic Assessments End of year 10 mock Year 11 mock External GCSE exams 	<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
Organic Chemistry	Oil, fractions, cracking	<ul style="list-style-type: none"> The origin and composition of crude oil The Alkanes are a homologous series The general formula and structure of the alkanes 	<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 	<ul style="list-style-type: none"> Peer and Self Assessment embedded throughout Educake Quizzes Completion of practical 	<ul style="list-style-type: none"> Year 7 Separating mixtures – distillation Year 8 Reactions Year 9 Separating mixtures – distillation, fractional distillation

		<ul style="list-style-type: none"> • How fractional distillation is used to refine crude oil and 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 • The processes of thermal and steam cracking • Chemical reactions of alkenes • Usefulness of cracking in terms of supply and demand of molecules in crude oil • The unsaturated nature of alkenes and the chemical test for alkenes • <i>Structures and names of alcohols and carboxylic acids</i> • <i>Uses of alcohols</i> • <i>Chemical reactions of alcohols</i> • <i>Production of alcohols via fermentation</i> • <i>The functional groups for a range of organic molecules</i> • <i>Chemical reactions of carboxylic acids</i> • <i>The process and chemical notation for addition polymers and condensation polymerisation</i> • <i>The role of amino acids in the production of naturally occurring and synthetic condensation polymer</i> 	<ul style="list-style-type: none"> • Using molecular models to represent alkanes, alkenes • Use Molymod kits to build and interpret models of organic molecules • Evaluating the process of cracking in terms of sustainability • <i>Using molecular models to represent alkanes, alkenes, alcohols, carboxylic acids, esters, addition polymers and condensation polymers as well as overall chemical reactions</i> • <i>Describing the reactions of and interpreting formulaic reactions of alkenes, alcohols, carboxylic acids and amino acids</i> • <i>Recognising addition and condensation polymers from their monomers, repeating units and polymer structures</i> • <i>The basic principles of addition and condensation polymerisation</i> 	<ul style="list-style-type: none"> • Starter tasks which interleave knowledge from previous learning • Data collection for required practicals • Presentation and evaluation of collected data for practicals • Synoptic Assessments • Year 11 mock • External GCSE 	<ul style="list-style-type: none"> • Year 12 Organic – all topics • Year 13 Organic – all topics
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Rates of reaction	Haber process and NPK fertilisers	<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 • Le-Chateliers principle • The effect of changing conditions on equilibrium • Th effect of changing concentration on equilibrium • The effect of changing temperature on equilibrium – • The effect of changing pressure on equilibrium • <i>The Haber process</i> • <i>The production and uses of NPK fertilisers</i> 	<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 • Using a wide range of laboratory equipment to investigate rates of reaction: loss of mass, the gas syringe, inverted measuring cylinder, colour change. • Selecting appropriate techniques for monitoring the rate of a reaction • Investigating how changing concentration affects the rate of reaction • Predicting and explaining the effect on the rate of reaction when changing variables • Comparing data and results quantitatively • Explaining catalytic activity in terms of activation energy • Investigate catalytic effects in reactions • Comparing data and results quantitatively • Identifying reversible reactions • Making qualitative predictions about changes made to systems at equilibrium • Interpreting graphs of reaction conditions versus rate 	<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 practicals • Synoptic Assessments • Year 11 mock • 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"> • <i>Applying principles of dynamic equilibrium to the Haber process including the trade-off between rate of production and position of equilibrium</i> • <i>Comparing the industrial production and laboratory preparation of compounds that can be used as fertilisers the production and use of NPK fertilisers</i> 		
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 • <i>The metal ions: Lithium, Sodium, Potassium, Calcium and Copper can be identified using flame tests and the positive tests and problems associated with these tests</i> • 	<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). • <i>Representations of more complex chemistry apparatus.</i> • <i>Describing how to carry out flame tests</i> • <i>Describing how to carry out tests for anions and cations</i> • <i>Practical skills and development and apparatus use: Using chemical tests to identify the ions in unknown ionic compounds (Req Prac 7)</i> 	<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 practicals • Synoptic Assessments • Year 11 mock • 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

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"> • <i>The use of sodium hydroxide to test for as well as the absence of, metal ions -The carbonate ions test</i> • <i>The halide ions test</i> • <i>The sulfate ions test</i> • <i>How instrumental methods including flame emission spectroscopy are used to identify metal ions in solution</i> 			
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 Assessment • Mock exams • External GCSE 	

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.

