GCSE Triple Science - Chemistry

Curriculum Overview 2023 2024

The curriculum encourages the development of fundamental Chemistry knowledge and understanding through opportunities of working scientifically. GCSE study in Chemistry provides the foundations for understanding the physical world. Chemistry understanding is changing our lives and is vital to the world's future prosperity, and all students should be taught essential aspects of the knowledge, methods, processes, and uses of this field. Chemistry helps students to develop curiosity about the natural world, gives them insight into how science works, and provides an appreciation of its relevance to their everyday lives. The scope and nature of such study is broad, coherent, practical and satisfying, and thereby encourages students to be inspired, motivated and challenged by the subject and its achievements. Students are helped to appreciate how the complex and diverse phenomena of the physical world can be described in terms of a small number of key ideas which are inter-linked and are of universal application.

Science has changed our lives and is vital to the world's future prosperity in such a technological age. Our students learn the essential knowledge, methods, processes and uses of science in order to be prepared for life in the modern world. Through building up a body of key knowledge and concepts, pupils will be encouraged to recognise the power of rational explanation and to inspire curiosity and a sense of excitement about natural phenomena. They will be encouraged to understand how science can be used to explain what is occurring, predict how things will behave, and analyse causes. Students be used to challenge, and will become future prepared, critical thinkers. We aim to inspire and produce motivated, highly skilled scientists who are independent life- long learners and who can accurately relate complex concepts to local and world- wide contexts.

At Brine Leas School we provide a balanced science curriculum with breadth and depth in order to help students achieve. Science does not stand alone and many of the concepts taught will help support a student's understanding of other subjects such as PE, Geography, History, Phsycology and Maths. At KS4 we follow the national curriculum using Kerboodle as a starting point for our lessons. This is an excellent, resource rich scheme, which we adapt to suit our students and our local context. Each lesson has a lesson ppts adapted for the group which is shared on Teams. Each powerpoint provides carefully selected activities, model answers, and opportunities for academic reading. Relevant clips to review content and show practicals and the principles of scientific enquiry are embedded into each. Students are provided with a booklet containing a glossary of tier 3 vocabulary and lesson resources. Students are also given knowledge organisers to use in lessons and at home for self-testing, review and revision. In order to provide further breadth and depth, all students care encouraged to opt for Triple Science should they wish.

Periodic review and evaluation of the Science schemes of work continue to develop and respond to our intent to develop and embed challenge, metacognition, long-term retention and scientific literacy into our curriculum. The course aims to equip our young learners with the

independent study skills they need to develop to be successful in their future pathways. Lesson powerpoints provide the basis for consistent of delivery of our curriculum and structured homeworks are set to support students in their independent learning to foster a culture of hard work that leads to achievement and encourages life-long learning. Knowledge organisers and glossaries are provided at the start of topics to embed third tier vocabulary and to provide clarity of learning intent.

The main aim of our curriculum is to provide students with the key knowledge and skills to achieve well and become good scientists, with a clear understanding of the importance of science as a STEM subject in the modern world. Science is also vital for the personal development of well-rounded, informed, healthy individuals. Our curriculum supports students social, moral, spiritual and cultural development by facilitating a sense of enjoyment and fascination in learning about themselves, others and the world around them, use of imagination and creativity in their learning and encouraging a willingness to reflect on their experiences. Many topics such as genetic screening, human impact on the world, our changing atmosphere, generating electricity etc. provide the opportunity to create an interest in investigating and offering reasoned views about moral and ethical issues, and being able to understand and appreciate the viewpoints of others on these issues. Students are also encouraged to develop and use a range of social skills particularly during practical activities and project work. Science provides a platform to teach the fundamentally important biological knowledge that contributes to relationship and sex education and health and well-being. Throughout ks3 and 4 we explore key ideas address topics such as physical health and fitness, the effect of drugs, tobacco and alcohol, healthy eating, prevention of disease and adolescent bodies, sexual relationships, sexual health and contraception.

A significant focus is placed upon developing our students as accomplished practical scientists. Using the core principles of good investigative techniques and the associated maths skills. Students will experience what makes a strong and valid investigation and know how to develop their own method and carry out an investigation safely and efficiently. Building these practical skills throughout the course will enable all students to progress to A- level or science apprenticeships with a well-developed knowledge and wide experience of working scientifically. In addition to planning and carrying out an investigation the students will have to learn how to interpret and use the data or observations that they have generated. The skills that the students acquire in data analysis are invaluable as a transferable life skill. Also the ability to use calculations and determine the validity and significance of the data are wider skills that could be employed across many employment sectors. In the process of analysis they will learn to spot patterns and link that to scientific theory, again these skills are very transferable beyond a science setting.

Science at Brine Leas should be challenging, fascinating, and provide the knowledge and transferrable skills that are invaluable in preparing students for their life ahead. We aim for a large proportion of students to go on to study science further and to have science- based careers.

Assessment

Termly exams in Chemistry consist of a mixture of long and short answer questions as well as multiple choice questions- 15% of questions relate to practical skills, 20% of the marks available will test maths skills.

Homework
Exam style questions, creation of knowledge organisers and revision cards, practical write ups, and webquests.

Clubs and/or intervention
Revision sessions and homework support.

Parental/Carer support
Teams resources, knowledge organisers parent fact sheet, and email communication/SWAY.

Helpful sources of information
Teams, AQA website, GCSE Bitesize, Kerboodle.com, and Seneca learning. Oak National Academy lessons

Connections to future pathways
Careers: industrial chemist, environmental chemistry, pharmacist, lab technician, civil engineer, engineering, particle scientist, doctor, dentist, vet, vetinary nurse, hair technician, nurse.

Future learning: Applied science, Chemistry A level, Forensic science, Chemistry, Btec National in applied science, Environmental science, Biochemistry degree, Particle scientist

Year 10 Overview

Term	Knowledge	Assessment	Connections to learning

Autumn 1	**Periodic Table, Structure & Bonding** The periodic table provides chemists with a structured organisation of the known chemical elements from which they can make sense of their physical and chemical properties. The historical development of the periodic table and models of atomic structure provide good examples of how scientific ideas and explanations develop over time as new evidence emerges. The arrangement of elements in the modern periodic table can be explained in terms of atomic structure which provides evidence for the model of a nuclear atom with electrons in energy levels. Chemists use theories of structure and bonding to explain the physical and chemical properties of materials. Analysis of structures shows that atoms can be arranged in a variety of ways, some of which are molecular while others are giant structures. Theories of bonding explain how atoms are held together in these structures. Scientists use this knowledge of structure and bonding to engineer new materials with desirable properties. The properties of these materials may offer new applications in a range of different technologies. Chemists use theories of structure and bonding to explain the physical and chemical properties of materials. Analysis of structures shows that atoms can be arranged in a variety of ways, some of which are molecular while others are giant structures. Theories of bonding explain how atoms are held together in these structures. Scientists use this knowledge of structure and bonding to engineer new materials with desirable properties. The properties of these materials may offer new applications in a range of different technologies. CC: How important to our daily lives was learning about the structure of the atom?		
	➢ <u>Atomic Structure</u> ➢ Atoms ➢ Balancing equations ➢ Separating mixtures ➢ Distillation and chromatography ➢ History of the atom ➢ Structure or the atom ➢ Isotopes and ions ➢ Electronic structure ➢ <u>The Periodic Table-</u>	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ Unit 1 exam at the end of term ➢ End of year 10 exam and mock exam	➢ Atomic Structure taught in year 9 (GCSE) and KS3 -- ‘Acids and Alkalis’, ‘The particle model’, ‘Atoms, elements and molecules’, ‘The Periodic Table’, ‘Reactivity’ and ’Metals and their uses’, ➢ ‘Properties and Changes of Materials’ and ‘electricity’ KS2

	➢ Development of the periodic table ➢ Electronic structures and the periodic table ➢ Group1- the alkali metals ➢ Group 7- the halogens ➢ Explaining trends ➢ Transition Metals	➢ In lesson retrieval quiz and multiple choice hinge questions	➢ SMSC – Students appreciated the social and cultural challenges faced by scientists developing the Periodic Table (4a) ➢ Maths/numeracy - Students should recognise trends in data supplied
	➢ <u>Structure and bonding</u> ➢ States of matter ➢ Atoms and Ions ➢ Ionic Bonding ➢ Giant Ionic structures ➢ Covalent bonding ➢ Structure of simple molecules ➢ Giant covalent structures ➢ Fullerenes and graphene ➢ Bonding in metals ➢ Giant metallic structures ➢ Nanoparticles ➢ Applications of nanoparticles	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ Unit 1 exam at the end of term ➢ End of year 10 exam and mock exam ➢ In lesson retrieval quiz and multiple choice hinge questions	➢ Atomic Structure taught in year 9 (GCSE) and KS3 -- 'The particle model', 'Atoms, elements and molecules', 'The Periodic Table' and 'Metals and their uses', ➢ 'Properties and Changes of Materials' and 'Electricity' KS2
Autumn 2	**Quantitative Chemistry & Chemical Changes** Chemists use quantitative analysis to determine the formulae of compounds and the equations for reactions. Given this information, analysts can then use quantitative methods to determine the purity of chemical samples and to monitor the yield from chemical reactions. Chemical reactions can be classified in various ways. Identifying different types of chemical reaction allows chemists to make sense of how different chemicals react together, to establish patterns and to make predictions about the behaviour of other chemicals. Chemical equations provide a means of representing chemical reactions and are a key way for chemists to communicate chemical ideas.		

	Understanding of chemical changes began when people began experimenting with chemical reactions in a systematic way and organising their results logically. Knowing about these different chemical changes meant that scientists could begin to predict exactly what new substances would be formed and use this knowledge to develop a wide range of different materials and processes. It also helped biochemists to understand the complex reactions that take place in living organisms. The extraction of important resources from the Earth makes use of the way that some elements and compounds react with each other and how easily they can be 'pulled apart'. CC: Should we stop using some chemicals due to their adverse impact on the environment?		
	<u>Quantitative chemistry,</u> ➢ Relative masses and moles ➢ Equations and calculations ➢ From masses to balances equations ➢ The yield of a chemical reaction ➢ Atom economy ➢ Expressing concentrations ➢ Titrations ➢ Titration calculations ➢ Volume of gases <u>chemical change</u> ➢ The reactivity series ➢ Displacement reactions ➢ Extracting metals ➢ Salts from metals ➢ Salts from insoluble bases ➢ Making more salts ➢ Neutralisations and the pH scale ➢ Strong and weak acids	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ Aqa end of year 10 exam- term 2 and mock exams ➢ In lesson retrieval quiz and multiple choice hinge questions ➢ Required Practical	➢ KS3 'atoms, elements and molecules', maths skills lessons, 'reactivity', 'acids and alkalis', 'metals and their uses' and 'the particle model'. ➢ KS4 'Atomic Structure' ➢ 'Properties and Changes of Materials' at KS2

Spring 1 & 2	**Electrolysis & Energy Changes** When an ionic compound is melted or dissolved in water, the ions are free to move about within the liquid or solution. These liquids and solutions are able to conduct electricity and are called electrolytes. Passing an electric current through electrolytes causes the ions to move to the electrodes. Positively charged ions move to the negative electrode (the cathode), and negatively charged ions move to the positive electrode (the anode). Ions are discharged at the electrodes producing elements. This process is called electrolysis. Energy changes are an important part of chemical reactions. The interaction of particles often involves transfers of energy due to the breaking and formation of bonds. Reactions in which energy is released to the surroundings are exothermic reactions, while those that take in thermal energy are endothermic. These interactions between particles can produce heating or cooling effects that are used in a range of everyday applications. Some interactions between ions in an electrolyte result in the production of electricity. Cells and batteries use these chemical reactions to provide electricity. Electricity can also be used to decompose ionic substances and is a useful means of producing elements that are too expensive to extract any other way CC: Should we keep using aluminium due to the high energy cost in its extraction?		
	➢ <u>Electrolysis</u> ➢ Introduction to electrolysis ➢ Changes to electrodes ➢ The extraction of aluminium ➢ Electrolysis of aqueous solutions ➢ <u>Energy changes</u> ➢ Exothermic and endothermic reactions ➢ Using energy transfers from reactions ➢ Reaction profiles ➢ Bond energy calculations ➢ Chemical Cells & Batteries ➢ Fuel cells	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ Aqa end of year 10 exam- term 2 and mock exams ➢ In lesson retrieval quiz and multiple choice hinge questions	➢ KS3 ‘atoms, elements and molecules’, maths skills lessons, 'energy’, ‘current electricity’ 'reactivity’, ‘energy transfers’ ‘combustion’ and ‘mixtures and separation’. ➢ KS4 ‘crude oil and fuels’, ‘rates and equilibrium’ and ‘using our resources’ ➢ ‘Properties and Changes of Materials’ and ‘Electricity’ KS2 ➢ SMSC – Students appreciate the social and moral importance and

			impact of developing new energy resources such as fuel cells (2b&c – The Moral Development of Pupils) ➢ GCSE Physics - 'Energy and energy resources' and 'Particles at work'
Summer 1	**Rates & Equilibrium** Chemical reactions can occur at vastly different rates. Whilst the reactivity of chemicals is a significant factor in how fast chemical reactions proceed, there are many variables that can be manipulated in order to speed them up or slow them down. Chemical reactions may also be reversible and therefore the effect of different variables needs to be established in order to identify how to maximise the yield of desired product. Understanding energy changes that accompany chemical reactions is important for this process. In industry, chemists and chemical engineers determine the effect of different variables on reaction rate and yield of product. Whilst there may be compromises to be made, they carry out optimisation processes to ensure that enough product is produced within a sufficient time, and in an energy-efficient way. CC: Should we opt for alternative slower industrial reactions due to their lesser environmental impact?		
	➢ Rates and equilibrium ➢ Rate if reaction ➢ Collision theory and surface area ➢ The effect of temperature ➢ The effect of concentration and pressure ➢ The effect of catalysts ➢ Reversible reactions ➢ Energy and reversible reactions ➢ Dynamic equilibrium ➢ Altering conditions	➢ Exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper 2 exam/ hinge questions/ retrieval quiz, required practical sheets	➢ KS4 Chemistry 'Using Our Resources' ➢ 'Energy changes', 'structure and' bonding and particle model of matter taught in year 10 (GCSE) and KS3 - 'The particle model', 'Atoms, elements and molecules' and 'Reactivity' ➢ 'Properties and Changes of Materials' at KS2

			➢ SMSC – Students appreciate the social and cultural contributions of scientists such as Haber (4a) ➢ Maths/numeracy - Students should be able to present record and present data in tabular and graphical form. Students should also be able to analyse graphical data to calculate rate of reaction. ➢ Physics and biology GCSE – particle model, collision theory and factors affecting rate of reaction/photosynthesis.
Summer 2	**Crude Oil & Fuels** The chemistry of carbon compounds is so important that it forms a separate branch of chemistry. A great variety of carbon compounds is possible because carbon atoms can form chains and rings linked by C-C bonds. This branch of chemistry gets its name from the fact that the main sources of organic compounds are living, or once-living materials from plants and animals. These sources include fossil fuels which are a major source of feedstock for the petrochemical industry. Chemists are able to take organic molecules and modify them in many ways to make new and useful materials such as polymers, pharmaceuticals, perfumes and flavourings, dyes and detergents. CC: Should we all be responsible for finding alternatives for products and materials derived from crude oil?		

	➢ Crude oil and fuels ➢ Hydrocarbons ➢ Fractional distillation ➢ Burning hydrocarbon fuels ➢ Cracking hydrocarbons	➢ Exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper 2 exam/ hinge questions/ retrieval quiz, required practical sheets	➢ KS4 Chemistry 'Our Atmosphere' and 'Earth's Resources' ➢ 'Energy changes', 'structure and bonding' and 'Atomic structure' year 10 (GCSE) and KS3 'Atoms, elements and molecules', 'Energy' 'Combustion', 'Rocks' 'Energy Transfers' and 'Reactivity' ➢ 'Properties and Changes of Materials' and 'Rocks' at KS2 ➢ SMSC – Students appreciate the social and moral impact of their activities in terms of energy and resource requirement (2b&c – The Moral Development of Pupils) ➢ Physics and biology GCSE – 'n Ecosystems and Biodiversity' and 'Energy Resources'

Year 11 Overview

Term	Knowledge	Assessment	Connections to learning

Autumn 1	**Organic reactions & Polymers** The chemistry of carbon compounds is so important that it forms a separate branch of chemistry. A great variety of carbon compounds is possible because carbon atoms can form chains and rings linked by C-C bonds. This branch of chemistry gets its name from the fact that the main sources of organic compounds are living, or once-living materials from plants and animals. These sources include fossil fuels which are a major source of feedstock for the petrochemical industry. Chemists are able to take organic molecules and modify them in many ways to make new and useful materials such as polymers, pharmaceuticals, perfumes and flavourings, dyes and detergents. CC: Should all carrier bags be made of biodegradable starch-based polymers?		
	➢ <u>Organic Reactions</u> ➢ Reactions of the alkenes ➢ Structures of alcohols, carboxylic acids and esters ➢ Reactions and uses of alcohols ➢ Carboxylic acids and esters ➢ Addition polymerisation ➢ Condensation polymerisation ➢ Natural polymers ➢ DNA	➢ Exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper 2 exam/ hinge questions/ retrieval quiz, required practical sheets	➢ KS3 'making materials', 'combustion', 'atoms, elements and molecules', 'food and nutrition' and 'genetics and evolution' ➢ KS4 'atomic structure', 'rates and equilibrium' and 'crude oil and fuels' ➢ KS2 - 'properties and change of materials' and 'evolution and inheritance' ➢ GCSE Biology 'reproduction', 'organisation and the digestive system' and 'cells and organisation'

Autumn 2	**Chemical Analysis & The Earth's Atmosphere** Analysts have developed a range of qualitative tests to detect specific chemicals. The tests are based on reactions that produce a gas with distinctive properties, or a colour change or an insoluble solid that appears as a precipitate. Instrumental methods provide fast, sensitive and accurate means of analysing chemicals, and are particularly useful when the amount of chemical being analysed is small. Forensic scientists and drug control scientists rely on such instrumental methods in their work. The Earth's atmosphere is dynamic and forever changing. The causes of these changes are sometimes man-made and sometimes part of many natural cycles. Scientists use very complex software to predict weather and climate change as there are many variables that can influence this. The problems caused by increased levels of air pollutants require scientists and engineers to develop solutions that help to reduce the impact of human activity CC: As instrumental drug testing becomes more sensitive, is this fair to athletes?		
	➢ Chemical analysis ➢ Pure substances and mixtures ➢ Analysing chromatograms ➢ Testing for gases ➢ Tests for positive ions ➢ Tests for negative ions ➢ Instrumental analysis ➢ The Earth's atmosphere ➢ History of the atmosphere ➢ Our evolving atmosphere ➢ Greenhouse gases ➢ Global climate change ➢ Atmospheric pollutants	➢ Exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper 2 exam/ hinge questions/ retrieval quiz, required practical sheets	➢ SMSC 2 The Moral Development of pupils (B,C) Students appreciate the social and moral consequence of their activity ➢ KS3 'ecosystems', mixtures and separation', 'atoms elements and molecules', 'Energy', 'Energy Transfers', 'Earth and space', 'combustions' and 'Plant growth' ➢ KS4 'Crude oil and fuels' ➢ GCSE Physics 'Energy transfer by heating ➢ GCSE Biology 'Photosynthesis', 'respiration', 'genetics and

			evolution' and 'biodiversity and ecosystems, ➢ KS2 - 'Earth and space', 'Plants' 'Properties and change of materials' and 'living thing and their habitats'
Spring 1	**The Earth's Resources** Industries use the Earth's natural resources to manufacture useful products. In order to operate sustainably, chemists seek to minimise the use of limited resources, use of energy, waste and environmental impact in the manufacture of these products. Chemists also aim to develop ways of disposing of products at the end of their useful life in ways that ensure that materials and stored energy are utilised. Pollution, disposal of waste products and changing land use has a significant effect on the environment, and environmental chemists study how human activity has affected the Earth's natural cycles, and how damaging effects can be minimised. CC: Should mobile phone manufacturers publicise the impact of producing their products on finite resources from the Earth?		
	➢ <u>The Earth's Resources</u> ➢ Finite and renewable resources ➢ Making water safe to drink ➢ Water treatment ➢ Extracting metals from ores ➢ Life cycle assessments ➢ Reduce, reuse & Recycle	➢ Exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper 2 exam/ hinge questions/ retrieval quiz, required practical sheets	➢ <u>SMSC 2 The Moral Development of pupils (B,C)</u> Students appreciate the social and moral consequence of their activity ➢ KS3 'ecosystems', 'mixtures and separation', 'atoms elements and molecules', 'Energy', 'Energy Transfers', 'Earth and space', 'combustions', 'rocks' and 'Plant growth'

			➢ KS4 'Crude oil and fuels', 'Chemical changes' and 'electrolysis' ➢ GCSE Biology - 'Biodiversity and ecosystems'
Spring 2	**Using our resources** Industries use the Earth's natural resources to manufacture useful products. In order to operate sustainably, chemists seek to minimise the use of limited resources, use of energy, waste and environmental impact in the manufacture of these products. Chemists also aim to develop ways of disposing of products at the end of their useful life in ways that ensure that materials and stored energy are utilised. Pollution, disposal of waste products and changing land use has a significant effect on the environment, and environmental chemists study how human activity has affected the Earth's natural cycles, and how damaging effects can be minimised. CC: Should we all be re-using items rather than recycling them?		
	➢ Using our resources ➢ Rusting ➢ Useful Alloys ➢ The properties of polymers ➢ Glass, ceramics and composites ➢ Making Ammonia ➢ The economics of the Haber Process ➢ Making fertilisers in the lab ➢ Making fertilisers in industry	➢ Exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper 2 exam/ hinge questions/ retrieval quiz, required practical sheets	➢ KS3 'making materials', 'metals and their uses', 'atoms, elements and molecules' and 'plant growth' ➢ KS4 'atomic structure', 'rates and equilibrium', 'organic reactions and polymers', 'structure and bonding' and 'crude oil and fuels' ➢ KS2 - 'properties and change of materials' ➢ GCSE Biology 'Photosynthesis' and

			‘biodiversity and ecosystems’ ➢ SMSC – Students appreciate the social and cultural contributions of scientists such as Haber (4a) ➢ <u>SMSC 2 The Moral Development of pupils (B,C)</u> Students appreciate the social and moral consequence their requirement for food and the production of chemicals to ensure that