

SCIENCE DEPARTMENT KEY STAGE 4 CHEMISTRY CURRICULUM OVERVIEW

The Science department key stage 4 curriculum is designed to implement the Academy's vision of "Deepening Learning, Raising Aspiration", in line with the OAT curriculum strategy of "Teach, Develop, Change". Our curriculum is carefully designed to build resilience, aspiration and independence in our learners. We carefully design the KS4 curriculum to further develop and build upon prior learning at KS3.

Science in key stage 4 continues with the process of building upon and deepening scientific knowledge and the understanding of ideas developed in earlier key stages in the subject disciplines of biology, chemistry and physics.

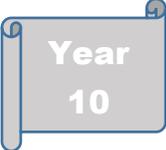
For some students, studying the sciences in key stage 4 provides the platform for more advanced studies, establishing the basis for a wide range of careers. For others, it will be their last formal study of subjects that provide the foundations for understanding the natural world and will enhance their lives in an increasingly technological society.

Science 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 science. They should be helped to appreciate the achievements of science in showing how the complex and diverse phenomena of the natural world can be described in terms of a number of key ideas relating to the sciences which are inter-linked, and which are of universal application.

Diversity

Our Science curriculum covers many of the world's greatest Scientists including Darwin and Dalton (England), Einstein (Germany), Boyle (Ireland). We introduce a wide range of Scientists during the learning of the three different disciplines in Science, for example in Physics, radioactivity, we learn about Marie Curie (Poland) who discovered radium, Katherine Johnson (African American) whose calculations enabled the USA moon landing. In Biology, we learn about the work of Rosalind E Franklin (England) who, through x-ray crystallography was central to the understanding of the molecular structure of DNA. In Chemistry, we teach about Percy Julian (African American) a renowned research chemist who was a pioneer in the chemical synthesis of medicinal drugs from plants. We discuss innovations with related subjects and this includes Mary Jackson, NASA's first black female engineer and Ada Lovelace a mathematician and pioneer of computing.

We introduce the students to new and emerging technologies from around the world in the context of their wider learning and celebrate events such as Earth Day and National Technology Day. We encourage our students to discuss and debate views on Science from other religions such as Hinduism and Creationists.


 Year
10

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	Bonding, Structures and the Properties of Matter						Quantitative Chemistry					
	Atomic Structure and the Periodic Table					Diversity						
	Model of the atom The periodic table Transition metals		Chemical bonding Bonding and structure Structure of carbon Nanoparticles				Chemical measurements Amounts of substances		Atom economy Concentrations			
Spring	Chemical Changes						Energy Changes					
	Reactivity of metals Reactions of acids with metals		Electrolysis				Exothermic and endothermic reactions		Chemical and fuel cells			
Summer	The Rate and Extent of Chemical Change						Organic Chemistry					
	Rate of reaction		Reversible reactions and equilibrium				Carbon compounds as fuels Reactions of alkenes and alcohols		Polymers			

Autumn Half Term 1

Block 1 – Weeks 1 to 3

Atomic Structure and the Periodic Table

- Studying the model of the atom in detail
- Advanced study of the periodic table
- Exploring the historical development of the periodic table and atomic structure
- Studying transition metals

Block 2 – Weeks 4 to 6

Structure Bonding and the Properties of Matter

- Studying theories of structure and bonding
- Explain physical and chemical properties of materials
- Studying the structure and bonding of metals
- Studying the properties of nanoparticles

Notes/Links/Interleaving

- **Refers back to Particles and Compounds (Year 7) and Chemistry Fundamentals 1 (Year 9) and links to A Level Chemistry topics**

Additional Higher Content

- Write balanced half equations and ionic equations
- Evaluation of particle model

Autumn Half Term 2

Block 3 – Weeks 7 to 9

Quantitative Chemistry

- Using quantitative analysis to determine formulae of compounds and equations for reactions
- Explain observed changes in mass in non-closed systems during chemical reactions
- Represent the distribution of results and make estimations of uncertainty

Block 4 – Weeks 10 to 12

Quantitative Chemistry

- Calculating relative formula mass, chemical measurements and mass of solute in given volume
- Calculate the mass of a solute in a given volume of solution of known concentration
- Calculate percentage yield and atom economy

Notes/Links/Interleaving

- **Refers back to Particles and Compounds (Year 7) and Chemistry Fundamentals 2 (Year 9) and links to A Level Chemistry topics**

Additional Higher Content

- Using moles and Avogadro's constant
- Explain the effect of limiting a reactant with relation to the product in a reaction

Spring Half Term 1

Block 1 – Weeks 1 to 4

Chemical Changes

- Further study of the reactivity series
- Studying metal extraction processes
- Understand the neutralisation of acids and salt production
- Describe how to carry out titrations using strong acids and alkalis

Block 2 – Weeks 4 to 6

Chemical Changes

- Explain the process of electrolysis
- Predict the products of electrolysis in the molten state
- Predict the products of aqueous solutions

Notes/Links/Interleaving

- **Refers back to Particles and Compounds (Year 7), Chemical Reactions (Year 8) and Chemistry Fundamentals 2 (Year 9) and links to A Level Chemistry topics**

Additional Higher Content

- Explain redox reactions in terms of gain or loss of electrons
- Calculate chemical quantities in titrations
- Studying strong and weak acids
- Using half equations

Spring Half Term 2

Block 3 – Weeks 7 to 9

Energy Changes

- Distinguish between endothermic and exothermic reactions
- Evaluate applications of exothermic and endothermic reactions
- Draw, use and explain reaction profiles (energy level diagrams)

Block 4 – Weeks 10 to 12

Energy Changes

- Investigate the variables that affect temperature changes in reacting solutions
- Studying chemical and fuel cells
- Evaluate the use of hydrogen fuel cells

Notes/Links/Interleaving

- **Refers back to Particles (Year 7), Chemical Reactions (Year 8), and Chemistry Fundamentals 1 (Year 9) and links to A Level Chemistry**

Additional Higher Content

- Calculate the energy change in chemical reactions
- Write half equations for electrode reactions in the hydrogen fuel cell

Summer Half Term 1**Block 1 – Weeks 1 to 4****The Rate and Extent of Chemical Change**

- Calculate mean rate of reaction from given information
- Draw and interpret graphs showing the quantity of product formed
- Describe the factors that affect the rates of chemical reactions

Block 2 – Weeks 4 to 6**The Rate and Extent of Chemical Change**

- Predict and explain the effects of changing conditions using collision theory
- Studying catalysts in reactions
- Explain reversible reactions and equilibrium in terms of energy transferred

Notes/Links/Interleaving

- Refers back to Particles (Year 7), Chemical Reactions and Chemistry of the Earth (Year 8), Fundamentals of Chemistry 1 (Year 9) and links to A Level Chemistry

Additional Higher Content

- Calculate the gradient of a tangent to the curve
- Studying the effects of changing condition on equilibrium

Summer Half Term 2**Block 3 – Weeks 7 to 9****Organic Chemistry**

- Studying crude oil, hydrocarbons and alkanes
- Explain how fractional distillation works
- Studying cracking and alkenes
- Write balanced equations for combustion of hydrocarbons and cracking

Block 4 – Weeks 10 to 12**Organic Chemistry**

- Explain how modern life depends on the uses of hydrocarbons
- Recall the structure of alkenes and alcohols
- Studying the reactions of alkenes and alcohol
- Studying polymers

Notes/Links/Interleaving

- Refers back to Chemical Reactions and Chemistry of the Earth (Year 8), Fundamentals of Chemistry 1 (Year 9) and links to A Level Chemistry

Additional Higher Content

- Explain the basic principles of condensation polymerisation
- Reaction of amino acids to form proteins

Year
11

Week 1

Week 2

Week 3

Week 4

Week 5

Week 6

Week 7

Week 8

Week 9

Week 10

Week 11

Week 12

Chemical Analysis

Diversity

Chemistry of the Atmosphere

Autumn

Purity, formulations and chromatography
Identification of common gases

Chemical and spectroscopic identification of ions

Composition and evolution of earth's atmosphere

Carbon dioxide and methane as greenhouse gases
Common atmospheric pollutants**Using Resources****Revision**

Spring

Using earth's resources and obtaining potable water
Life cycle assessment and recyclingUsing materials
The Haber processAll topics
Exam skills and practice

Summer

Revision and Exams**Revision and Exams**All topics
Exam skills and practice

Chemistry paper 1 and paper 2

Autumn Half Term 1**Block 1 – Weeks 1 to 3****Chemical Analysis**

- Distinguish pure and impure substances and identify formulations
- Studying chromatography
- Describe the processes and results of tests to identify common gases

Block 2 – Weeks 4 to 6**Chemical Analysis**

- Identify ions by chemical and spectroscopic means
- Use chemical tests to identify the ions in unknown compounds
- Studying instrumental methods of analysis

Notes/Links/Interleaving

- Refers back to Particles (Year 7), Chemical Reactions (Year 8) and links to A Level Chemistry

Additional Higher Content

- Evaluation of different methods of analysis

Autumn Half Term 2**Block 3 – Weeks 7 to 9****Chemistry of the atmosphere**

- Recall the composition of the atmosphere
- Interpret evidence evaluating different theories about Earth's early atmosphere
- Recall human activities which increase greenhouse gases
- Describe the effects of climate change

Block 4 – Weeks 10 to 12**Chemistry of the atmosphere**

- Describe actions to reduce carbon footprint
- Describe atmospheric pollutants from fuels
- Explain the effects of these pollutants

Notes/Links/Interleaving

- Refers back to Compounds (Year 7), Chemistry of the Earth (Year 8) and links to A Level Chemistry

Additional Higher Content

- Evaluate evidence about global climate change and recognise the importance of peer reviewed results

Spring Half Term 1**Block 1 – Weeks 1 to 3****Using Resources**

- Studying sustainable development
- Distinguish between potable and pure water and steps in water treatment
- Analyse and purify water from different sources
- Carry out simple life cycle assessments

Block 2 – Weeks 4 to 6**Using Resources**

- Evaluate ways of reducing the use of limited resources
- Studying corrosion and its prevention
- Studying alloys, alloys, polymer and composites
- Explain aspects of the Haber process and the use of fertilisers

Notes/Links/Interleaving

- Refers back to Chemistry of the Earth (Year 8) and links to A Level Chemistry

Additional Higher Content

- Evaluate alternative biological methods of metal extraction
- Interpret graphs of reactions conditions for the Haber process versus rate

Spring Half Term 2**Block 3 – Weeks 7 to 9****Paper 1 Revision**

- All topics

Block 4 – Weeks 10 to 12**Paper 1 and Paper 2 Revision**

- All topics

Notes/Links/Interleaving

- Revision of the whole course

Additional Higher Content

- Higher level content as taught throughout the course

Summer Half Term 1	
Block 1 – Weeks 1 to 3	Block 2 – Weeks 4 to 6
Paper 2 Revision <ul style="list-style-type: none">All topics	Revision and Exams <ul style="list-style-type: none">Chemistry paper 1 and paper 2
Notes/Links/Interleaving <ul style="list-style-type: none">Revision of the whole course	Additional Higher Content <ul style="list-style-type: none">Higher level content as taught throughout the course
Summer Half Term 2	
Block 3 – Weeks 7 to 9	Block 4 – Weeks 10 to 12
Revision and Exams <ul style="list-style-type: none">Chemistry paper 1 and paper 2	Revision and Exams <ul style="list-style-type: none">Chemistry paper 1 and paper 2
Notes/Links/Interleaving <ul style="list-style-type: none">Revision of the whole course	Additional Higher Content <ul style="list-style-type: none">Higher level content as taught throughout the course