This qualification is linear, with all of the assessments of the program of study occurring at the end of Year 11 during the summer exam season. Students will start this qualification in December of Year 9 following the completion of the KS3 Program of study. This is to allow the full breadth and depth of the KS4 course to be delivered allowing us to stretch and challenge the most-able to master the course and achieve the top grades, and also allow time for support and differentiation where required. The topics studied during Year 9 appear on both the Trilogy specification and the Separate Science specification to allow for co-teaching. Following the options process started in Year 9, student will then move onto their specific chosen science course as they enter Year 10.

During Year 9 student will be taught 3 lessons of Science per week, one for Biology, Chemistry and Physics. In Year 10, students have 5 hours of Science curriculum, we follow a rotation timetable system to allow an even spread of time for the 3 sciences. In Year 11, students have 7 hours of science curriculum time, spread across the 3 subjects.

The aim of the GCSE Chemistry course is:

- Impart a systematic body of scientific knowledge and facts, and an understanding of scientific concepts, principles, themes and patterns in chemistry.
- Further students' appreciation of the practical nature of chemistry, developing experimental skills based on correct and safe laboratory techniques, developing analytical and evaluative skills to determine clear conclusions.
- Develop application skills to allow students to ‘think outside the box’ with unfamiliar examples, applying their knowledge and understanding of key chemical processes and systems.
- Develop an appreciation of the importance of accurate experimental work to scientific method and reporting, ensuring complicated methods are followed and measurements recorded to a high level of precision.
- Develop the application of specific mathematics skills used in chemistry.
- Develop students' ability to form hypotheses and design experiments to test them, writing clear methods identifying specific apparatus and techniques required.
- Sustain and develop an enjoyment of, and interest in, the world of chemistry and its applications.
- Foster an appreciation of the significance of chemistry in wider personal, social, environmental, economic and technological contexts, with a consideration of ethical issues
- Develop future Scientists who will continue the study of Chemistry onto A level and Higher Education

Key ideas.

• matter is composed of tiny particles called atoms and there are about 100 different naturally occurring types of atoms called elements

• elements show periodic relationships in their chemical and physical properties

• these periodic properties can be explained in terms of the atomic structure of the elements

• atoms bond by either transferring electrons from one atom to another or by sharing electrons

• the shapes of molecules (groups of atoms bonded together) and the way giant structures are arranged is of great importance in terms of the way they behave

• there are barriers to reaction so reactions occur at different rates

• chemical reactions take place in only three different ways:

• proton transfer, • electron transfer and • electron sharing

• energy is conserved in chemical reactions so can therefore be neither created or destroyed.

Prior learning

Science is a core subject that students have studied at KS3, the aim of KS4 Science is to build on these foundations as part of our spiral curriculum, increasing the level of demand and challenge as students' cognitive ability develops. The rationale behind the teaching order is to ensure the building blocks are in place as we progress through the topics, allowing students to fully access each topic. There are season considerations too, with Photosynthesis topics and ecology topics being studied during the summer months to allow for practical activities to take place.

Delivery

Year	Topic	Term	Content	Paper
9	4.1.1 A simple model of the atom, symbols, relative atomic mass, electronic charge and isotopes	Spring	4.1.1.1 Atoms, elements and compounds 4.1.1.2 Mixtures 4.1.1.3 The development of the model of the atom (common content with physics) 4.1.1.4 Relative electrical charges of subatomic particles 4.1.1.5 Size and mass of atoms 4.1.1.6 Relative atomic mass 4.1.1.7 Electronic structure The underlying principles of subatomic particles, shells and RAM which lay foundations for later principles of bonding, structure, group trends, reactions and calculations in chemistry.	1
9	4.1.2 The periodic table	Summer	4.1.2.1 The periodic table 4.1.2.2 Development of the periodic table 4.1.2.3 Metals and non-metals 4.1.2.4 Group 0 4.1.2.5 Group 1 4.1.2.6 Group 7	1
9	4.1.3 Properties of transition metals	Summer	4.1.3.1 Comparison with Group 1 metals 4.1.3.1 Typical properties An appreciation and understanding of the history of the Periodic Table, and how the arrangement of elements and reactivity trends in groups can be linked to atomic structure from the previous unit 4.1.1	1
9/10	4.2 Bonding, structure, and the properties of matter	Summer/Autumn	4.2.1 Chemical bonds, ionic, covalent and metallic 4.2.1.1 Chemical bonds 4.2.1.2 Ionic bonding 4.2.1.3 Ionic compounds 4.2.1.4 Covalent bonding 4.2.1.5 Metallic bonding	1
10	4.2.2 How bonding and structure are related to the properties of substances	Autumn	4.2.2.1 The three states of matter 4.2.2.2 State symbols 4.2.2.3 Properties of ionic compounds 4.2.2.4 Properties of small molecules 4.2.2.5 Polymers 4.2.2.6 Giant covalent structures 4.2.2.7 Properties of metals and alloys 4.2.2.8 Metals as conductors	1

10	4.2.3 Structure and bonding of carbon		4.2.3.1 Diamond 4.2.3.2 Graphite 4.2.3.3 Graphene and fullerenes	1
10	4.2.4 Bulk and surface properties of matter including nanoparticles		4.2.4.1 Size of particles and their properties 4.2.4.2 Uses of nanoparticles A full coverage of the main aspects of structure and bonding, using concepts from 4.1.1 and 4.1.2, which are fundamental as part of the comprehension for the rest of the course, as the theories can be used to explain the physical and chemical properties of substances. Also, used to underpin formulae and balanced symbol questions with state symbols.	
10	4.3.1 Chemical measurements, conservation of mass and the quantitative interpretation of chemical equations	Autumn	4.3.1.1 Conservation of mass and balanced chemical equations 4.3.1.2 Relative formula mass 4.3.1.3 Mass changes when a reactant or product is a gas 4.3.1.4 Chemical measurements	1
	4.3.2 Use of amount of substance in relation to masses of pure substances		4.3.2.1 Moles (HT only) 4.3.2.2 Amounts of substances in equations (HT only) 4.3.2.3 Using moles to balance equations (HT only) 4.3.2.4 Limiting reactants (HT only) 4.3.2.5 Concentration of solutions	1
	4.3.3 Yield and atom economy of chemical reactions		4.3.3.1 Percentage yield 4.3.3.2 Atom economy	1
	4.3.4 Using concentration of solutions in mol/dm^3			1
	4.3.5 Use of amount of substance in relation to volumes of gases		Quantitative analysis is used to determine compound formulae, reaction equations and monitor yield. This unit is a key part of chemical language and theory and underpins future content both in a theoretical and practical sense.	1
10	4.4.1 Reactivity of metals	Spring	4.4.1.1 Metal oxides 4.4.1.2 The reactivity series	1

			4.4.1.3 Extraction of metals and reduction 4.4.1.4 Oxidation and reduction in terms of electrons (HT only)	
	4.4.2 Reactions of acids		4.4.2.1 Reactions of acids with metals 4.4.2.2 Neutralisation of acids and salt production 4.4.2.3 Soluble salts 4.4.2.4 The pH scale and neutralisation 4.4.2.5 Titrations 4.4.2.6 Strong and weak acids (HT only)	1
	4.4.3 Electrolysis		4.4.3.1 The process of electrolysis 4.4.3.2 Electrolysis of molten ionic compounds 4.4.3.3 Using electrolysis to extract metals 4.4.3.4 Electrolysis of aqueous solutions 4.4.3.5 Representation of reactions at electrodes as half equations (HT only) Knowing and understanding chemical reactions allows students to make predictions (from principles in 4.2) of new substances as well as uses and applications. Methods of extracting materials from our planet using electrolysis and other methods to enhance our lives is also explored using underlying principles from the unit. Titration work further builds and develops on quantitative analysis from 4.3. Electrolysis also prepares students for chemical and fuel cells in the next unit.	1
10	4.5.1 Exothermic and endothermic reactions	Summer	4.5.1.1 Energy transfer during exothermic and endothermic reactions 4.5.1.2 Reaction profiles 4.5.1.3 The energy change of reactions (HT only	1
	4.5.2 Chemical cells and fuel cells		4.5.2.1 Cells and batteries 4.5.2.2 Fuel cells Energy changes are a fundamental part of chemistry and underpin later concepts of kinetics and equilibria. The topic serves as useful end to Paper 1 content and the Year 10 course.	1
10/11	4.6.1 Rate of reaction	Summer/Autumn	4.6.1.1 Calculating rates of reactions 4.6.1.2 Factors which affect the rates of chemical reactions 4.6.1.3 Collision theory and activation energy	2

			4.6.1.4 Catalysts	
11	4.6.2 Reversible reactions and dynamic equilibrium		4.6.2.1 Reversible reactions 4.6.2.2 Energy changes and reversible reactions 4.6.2.3 Equilibrium 4.6.2.4 The effect of changing conditions on equilibrium (HT only) 4.6.2.5 The effect of changing concentration (HT only) 4.6.2.6 The effect of temperature changes on equilibrium (HT only) 4.6.2.7 The effect of pressure changes on equilibrium (HT only) How fast chemical reactions occur and how far they occur are imperative concepts of physical chemistry. A lot of important ideas from Paper 1 are revisited and developed here. The Haber process is used as a basis of Le Chatelier's principle and then revised later in the course.	2
11	4.7.1 Carbon compounds as fuels and feedstock		4.7.1.1 Crude oil, hydrocarbons and alkanes 4.7.1.2 Fractional distillation and petrochemicals 4.7.1.3 Properties of hydrocarbons 4.7.1.4 Cracking and alkenes	2
11	4.7.2 Reactions of alkenes and alcohols		4.7.2.1 Structure and formulae of alkenes 4.7.2.1 Reactions of alkenes 4.7.2.3 Alcohols 4.7.2.4 Carboxylic acids	2
11	4.7.3 Synthetic and naturally occurring polymers		4.7.3.1 Addition polymerisation 4.7.3.2 Condensation polymerisation 4.7.3.3 Amino acids 4.7.3.4 DNA Organic chemistry is an important separate branch of chemistry. Principles of bondng, structure and chemical changes from Year 10 are fundamental here and may be revisited briefly. A comprehension of organic chemistry allows students to appreciate that new and useful products such as medicines, flavourings, plastics, fibres and fuels stem from specialists in this field	
11	4.8.1 Purity, formulations and chromatography		4.8.1.1 Pure substances 4.8.1.2 Formulations 4.8.1.3 Chromatography	2

11	4.8.2 Identification of common gases		4.8.2.1 Test for hydrogen 4.8.2.2 Test for oxygen 4.8.2.3 Test for carbon dioxide 4.8.2.4 Test for chlorine	2
11	4.8.3 Identification of ions by chemical and spectroscopic means		4.8.3.1 Flames tests 4.8.3.2 Metal hydroxides 4.8.3.3 Carbonates 4.8.3.4 Halides 4.8.3.5 Sulfates 4.8.3.6 Instrumental methods 4.8.3.7 Flame emission spectroscopy Chemical analysis is best taught near the end of a course as its serves as a revision of previous and new chemical reactions but also how those reactions can be used to identify unknown substances in a variety of contexts. A useful comparison is made of chemical and more modern instrumental methods (developed hugely at A level)	2
11	4.9.1 The composition and evolution of the Earth's atmosphere		4.9.1.1 The proportions of different gases in the atmosphere 4.9.1.2 The Earth's early atmosphere 4.9.1.3 How oxygen increased 4.9.1.4 How carbon dioxide decreased	2
11	4.9.2 Carbon dioxide and methane as greenhouse gases		4.9.2.1 Greenhouse gases 4.9.2.2 Human activities which contribute to an increase in greenhouse gases in the atmosphere 4.9.2.3 Global climate change 4.9.2.4 The carbon footprint and its reduction	2
11	4.9.3 Common atmospheric pollutants and their sources		4.9.3.1 Atmospheric pollutants from fuels 4.9.3.2 Properties and effects of atmospheric pollutants A standalone unit which demonstrates an appreciation of atmospheric chemistry as well as revising chemical reactions and equations.	2
11	4.10.1 Using the Earth's resources and obtaining potable water	Spring	4.10.1.1 Using the Earth's resources and sustainable development 4.10.1.2 Potable water 4.10.1.3 Waste water treatment 4.10.1.4 Alternative methods of extracting metals (HT only)	2
11	4.10.2 Life cycle assessment and recycling		4.10.2.1 Life cycle assessment 4.10.2.2 Ways of reducing the use of resources	2

11	4.10.3 Using materials		4.10.3.1 Corrosion and its prevention 4.10.3.2 Alloys as useful materials 4.10.3.3 Ceramics	
11	4.10.4 The Haber process and the use of NPK fertilisers		4.10.4.1 The Haber process 4.10.4.2 Production and uses of NPK fertilisers A splendid way to complete a chemistry course by looking at the chemistry of materials found naturally and produced synthetically as well as a wide range of applications of theoretical (bonding and structure) and experimental chemistry to show how chemists can develop materials and processes which can enhance society in the world at large. Also, a responsible look at sustainability and environmental impact.	

Assessment at end of topics – At the end of each major topic, there is an end of topic assessment, this has been created using EXAMPRO (AQA exam question database), with assessments being created in line with the AQA Science papers, for the correct balance of high, medium and low demand questions for Higher / Foundation tiers.

Final external assessment breakdown table

Paper 1:
What's assessed Topics 1–5: Atomic structure and the periodic table; Bonding, structure, and the properties of matter; Quantitative chemistry, Chemical changes; and Energy changes.
How it's assessed • Written exam: 1 hour 45 minutes • Foundation and Higher Tier • 100 marks • 50% of GCSE
Questions • Multiple choice, structured, closed short answer and open response.

Paper 2:
What's assessed Topics 6–10: The rate and extent of chemical change; Organic chemistry; Chemical analysis, Chemistry of the atmosphere; and Using resources.
How it's assessed • Written exam: 1 hour 45 minutes • Foundation and Higher Tier • 100 marks • 50% of GCSE
Questions • Multiple choice, structured, closed short answer and open response.

Further curriculum support:

www.kerboodle.com – online textbook

Seneca learning

BBC Bitesize – Trilogy - https://www.bbc.co.uk/bitesize/examspecs/z8r997h

CPG Complete revision and Practice Book

CGP Required Practical exam skills book – 10 minute tests

Enrichment activities

GCSE Science Live event in Birmingham / Sheffield (Year 10)

Progression – where can subject take you

GCSE Chemistry provides an excellent platform to the progression onto KS5 A levels in Biology, Chemistry, Physics and Psychology.