Science

INTENT- KS3

We create a positive and safe learning environment, where students feel confident to explore ideas surrounding science. KS3 is about students finding their feet, learning the foundations and skills that are required by excellent scientists. In Year 7 we start learning about cells, atoms and forces, the essential building blocks for building the knowledge in our science curriculum. Science is a hierarchical subject, where success in each of the three specialisms is reliant on mastery of all that sits below. The principal focus of science teaching in KS3 is to develop a deeper understanding of a range of scientific ideas in the subject disciplines of biology, chemistry and physics. Pupils should begin to see the connections between these subject areas and become aware of some of the big ideas underpinning scientific knowledge and understanding.
Our intent is to ensure that students have a developed understanding of the World and Universe they live in, allowing them to be successful in any route they choose; providing opportunity for academic or personal success within the Sciences, or wider career network. We are inclusive with all of our students within the KS3 curriculum, learning essential practical and team work skills encouraging students to develop scientific enquiry skills to explore the world around them.

SKILLS AND KNOWLEDGE

	Students will develop their KNOWLEDGE of	Students will develop their SKILLS in
7	**The particulate nature of matter:** Properties of the different states of matter, the particle model, gas pressure and changes of state **Atoms, elements and compounds:** simple (Dalton) atomic model; differences between atoms, elements and compounds; chemical symbols and formulae for elements and compounds; conservation of mass changes of state and chemical reactions. **Chemical reactions:** chemical reactions as the rearrangement of atoms; representing chemical reactions using formulae and using equations; combustion, thermal decomposition, oxidation and displacement reactions; defining acids and alkalis in terms of neutralisation reactions; the pH scale for measuring acidity/alkalinity; and indicators; reactions of acids with metals to produce a salt plus hydrogen; reactions of acids with alkalis to produce a salt plus water; catalysts **Energetics:** energy changes on changes of state (qualitative); exothermic and endothermic chemical reactions (qualitative).	**Scientific attitudes**: pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility; understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review; evaluate risks. **Experimental skills and investigations**: 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 fieldwork and 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 possible improvements; apply sampling techniques. **Analysis and evaluation:** 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. **Measurement:** understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature; use and derive simple equations and carry out appropriate calculations; undertake basic data analysis including simple statistical techniques

	Students will develop their KNOWLEDGE of	Students will develop their SKILLS in
8	**Pure and impure substances:** the concept of a pure substance; mixtures, including dissolving; diffusion in terms of the particle model; simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography; the identification of pure substances. **The Periodic Table:** varying physical and chemical properties of different elements; principles underpinning the Mendeleev Periodic Table; Periodic Table: periods and groups; metals and non-metals; how patterns in reactions can be predicted with reference to the Periodic Table; properties of metals and non-metals; chemical properties of metal and non-metal oxides with respect to acidity. **Materials:** order of metals and carbon in the reactivity series; use of carbon in obtaining metals from metal oxides; properties of ceramics, polymers and composites; Earth and atmosphere; composition and structure of the Earth; rock cycle and the formation of igneous, sedimentary and metamorphic rocks; Earth as a source of limited resources and the efficacy of recycling; the carbon cycle; composition of the atmosphere; production of carbon dioxide by human activity and the impact on climate	**Scientific attitudes**: pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility; understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review; evaluate risks. **Experimental skills and investigations**: 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 fieldwork and 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 possible improvements; apply sampling techniques. **Analysis and evaluation:** 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. **Measurement:** understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature; use and derive simple equations and carry out appropriate calculations; undertake basic data analysis including simple statistical techniques

SKILLS AND KNOWLEDGE

	Students will develop their KNOWLEDGE of	Students will develop their SKILLS in
9	**Atomic structure and the Periodic Table:** a simple model of the atom consisting of the nucleus and electrons, relative atomic mass, electronic charge and isotopes; number of particles in a given mass of a substance; modern Periodic Table, showing elements arranged in order of atomic number; position of elements in the Periodic Table in relation to their atomic structure and arrangement of outer electrons; properties and trends in properties of elements in the same group; characteristic properties of metals and non-metals; chemical reactivity of elements in relation to their position in the Periodic Table **Structure, bonding and the properties of matter:** changes of state of matter in terms of particle kinetics, energy transfers and the relative strength of chemical bonds and intermolecular forces; types of chemical bonding: ionic, covalent, and metallic; bulk properties of materials related to bonding and intermolecular forces; bonding of carbon leading to the vast array of natural and synthetic organic compounds that occur due to the ability of carbon to form families of similar compounds, chains and rings; structures, bonding and properties of diamond, graphite, fullerenes and graphene.	**Scientific attitudes**: pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility; understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review; evaluate risks. **Experimental skills and investigations**: 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 fieldwork and 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 possible improvements; apply sampling techniques. **Analysis and evaluation:** 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. **Measurement:** understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature; use and derive simple equations and carry out appropriate calculations; undertake basic data analysis including simple statistical techniques

INTENT- KS4

Our KS4 curriculum builds on the strong foundations that students have set up themselves in KS3. Teaching the sciences in KS4 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 that 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 science has evolved with time. The sciences taught are linked to different careers in the scientific world. We are inclusive of all students providing triple science for all and differentiating these disciplines to allow all to succeed, this includes the addition of entry level certificate.

SKILLS AND KNOWLEDGE

	Students will develop their KNOWLEDGE of	Students will develop their SKILLS in
10 & 11	**Chemical changes:** determination of empirical formulae from the ratio of atoms of different kinds; balanced chemical equations, ionic equations and state symbols; identification of common gases; the chemistry of acids; reactions with some metals and carbonates; pH as a measure of hydrogen ion concentration and its numerical scale; electrolysis of molten ionic liquids and aqueous ionic solutions; reduction and oxidation in terms of loss or gain of oxygen **Energy changes in chemistry:** Measurement of energy changes in chemical reactions; Bond breaking, bond making, activation energy and reaction profiles **Rate and extent of chemical change:** factors that influence the rate of reaction: varying temperature or concentration, changing the surface area of a solid reactant or by adding a catalyst; factors affecting reversible reactions. **Chemical analysis:** distinguishing between pure and impure substances; separation techniques for mixtures of substances: filtration, crystallisation, chromatography, simple and fractional distillation; quantitative interpretation of balanced equations; concentrations of solutions in relation to mass of solute and volume of solvent.	**The development of scientific thinking:** ways in which scientific methods and theories develop over time; using a variety of concepts and models to develop scientific explanations and understanding; appreciating the power and limitations of science and considering ethical issues which may arise; explaining everyday and technological applications of science; evaluating associated personal, social, economic and environmental implications; and making decisions based on the evaluation of evidence and arguments; evaluating risks both in practical science and the wider societal context, including perception of risk; recognising the importance of peer review of results and of communication of results to a range of audiences. **Experimental skills and strategies:** using scientific theories and explanations to develop hypotheses; planning experiments to make observations, test hypotheses or explore phenomena; applying a knowledge of a range of techniques, apparatus, and materials to select those appropriate both for fieldwork and for experiments; carrying out experiments appropriately, having due regard to the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations; recognising when to apply a knowledge of sampling techniques to ensure any samples collected are representative; making and recording observations and measurements using a range of apparatus and methods; evaluating methods and suggesting possible improvements and further investigations.

SKILLS AND KNOWLEDGE

	Students will develop their KNOWLEDGE of	Students will develop their SKILLS in
10&11	**Chemical and allied industries:** life cycle assessment and recycling to assess environmental impacts associated with all the stages of a product's life; the viability of recycling of certain materials; carbon compounds, both as fuels and feedstock, and the competing demands for limited resources; fractional distillation of crude oil and cracking to make more useful materials; extraction and purification of metals related to the position of carbon in a reactivity series. **Earth and atmospheric science:** evidence for composition and evolution of the Earth's atmosphere since its formation; evidence, and uncertainties in evidence, for additional anthropogenic causes of climate change; potential effects of, and mitigation of, increased levels of carbon dioxide and methane on the Earth's climate; common atmospheric pollutants: sulphur dioxide, oxides of nitrogen, particulates and their sources; Earth's water resources and obtaining potable water.	**Analysis and evaluation:** applying the cycle of collecting, presenting and analysing data, including; presenting observations and other data using appropriate methods; translating data from one form to another; carrying out and representing mathematical and statistical analysis; representing distributions of results and making estimations of uncertainty; interpreting observations and other data, including identifying patterns and trends; making inferences and drawing conclusions; presenting reasoned explanations, including relating data to hypotheses; being objective, evaluating data in terms of accuracy, precision, repeatability and reproducibility and identifying potential sources of random and systematic error; communicating the scientific rationale for investigations, including the methods used, the findings and reasoned conclusions, using paper-based and electronic reports and presentations. **Vocabulary, units, symbols and nomenclature:** developing their use of scientific vocabulary and nomenclature; recognising the importance of scientific quantities and understanding how they are determined; using SI units and IUPAC chemical nomenclature unless inappropriate; using prefixes and powers of ten for orders of magnitude (e.g. tera, giga, mega, kilo, centi, milli, micro and nano); interconverting units; using an appropriate number of significant figures in calculations.

CURRICULUM LESSONS ALLOCATED OVER THE 2 WEEK TIMETABLE

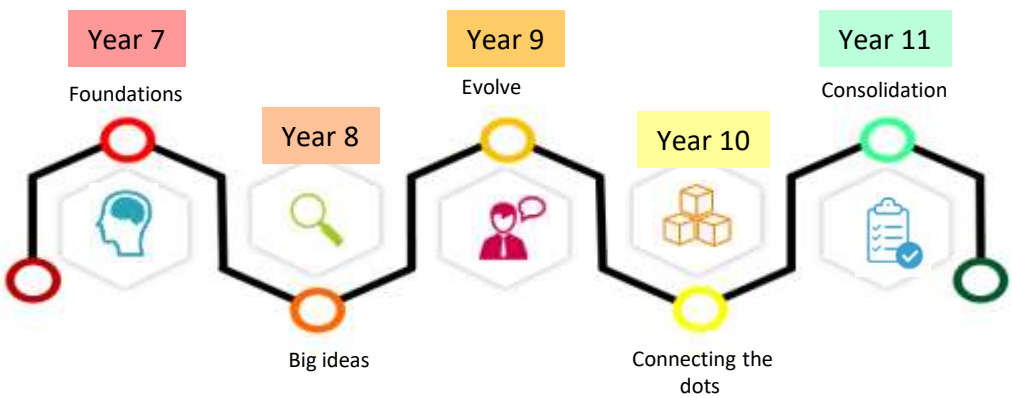
Year 7	Year 8	Year 9 – 2 hours	Year 10 - 3 hours	Year 11 - 3 hours
2 hours	2 hours	2 hours	3 hours	3 hours

OVERVIEW

Qualification gained by the end of year 11: GCSE in Chemistry

Whole school vision links developed in this subject	After school destinations linked to this subject	
• Allowing student to be encouraged in their learning by providing a safe learning environment so they can be ambitious and achieve above and beyond • British values through mutual respect • Inclusive for all- same setting but differentiated work. • Supporting local providers	Analytical Chemist Accountant/ Auditor Chemical Engineer Chemical Development Engineer Lecturer Environmental Chemist Forensic Researcher	Forensic Scientist Patent Agent Purification Scientist Toxicologist

Science CURRICULUM THEMES



Cross Curriculum links in Science

- Geography- rock cycle,
- Maths- calculations, graphs
- History- history of periodic table/ atom
- PE- anatomy & lifestyle
- English- literacy
- CA- field science

Year 7- Chemistry Curriculum

CUMBRIA FUTURES FEDERATION

*Curriculum theme: **Foundations***
In Year 7, students lay the foundations to their knowledge, cementing previous knowledge from KS2 and adding more knowledge and skills to their mind-sets.

KS2 recap

Students are given a baseline test to assess their entry level to KS3. Our first chapter is to introduce science 1 skills, students learn about variables, predicting, planning obtaining results, analysing concluding and evaluating. These are all the fundamental skills needed for experiments.

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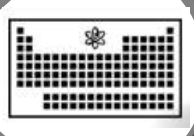


1. C1.1 Particles

In this chapter students build on the changing state chapter from Year 7 and are introduced to the concept of particles and the properties of solids, liquids and gases.

2. C1.2 Atoms, elements and compounds

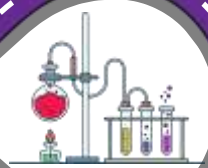
In this chapter students learn about the basics of chemistry, what atoms are, what they make (elements), how they make compounds and chemical formula.

3. C1.3 Metal reactions

In this chapter students learn the foundations of chemistry and are introduced to simple chemical reactions. They also learn the basics of acids and alkalis and the pH scale

4. C1.4 Acids & Alkali

In this chapter students learn about acids and alkali's, their properties, how to test for them in chemicals, neutralize them by making salts which is linked to GCSE chemistry and using the pH scale.



Progressing into Year 8

End of year assessment

Year 8- Chemistry Curriculum

CUMBRIA FUTURES FEDERATION

Curriculum theme: ***Big ideas***

In Year 8, students develop their knowledge further in an attempt to describe some understanding of science. They discover that all matter in the Universe is made of very small particles and organisms are organised on a cellular basis and have a finite life span and students begin to develop their understanding of these big ideas.

Year 7 recap

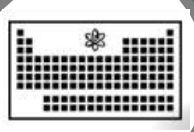
Students again complete a short chapter about science 1 skills. Students recap knowledge about variables, predicting, planning, obtaining results, analysing concluding and evaluating. These are all the fundamental skills needed for experiments.

2. C2.2 Pure and impure Substance

In this chapter students learn the foundations in chemistry and are introduced to the particle theory and use it to identify pure and impure substances from particle diagrams and describe different separation techniques

4. C2.4 Earth and atmosphere

In this chapter students are introduced to the structure and composition of the Earth before moving on to to look at the carbon cycle and the effects of human activity on the environment.

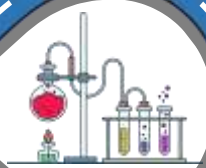


1.C2.1 Periodic table

In this chapter students review and build on their knowledge from the Particles and Reactions chapters and are introduced to the periodic table and how it links to the physical and chemical properties of elements and their compounds.

3. C2.3 Metal reactions

In this chapter students review and build on their knowledge from the Reactions and Periodic table chapters and learn about the properties of metals.



Progressing into Year 9

End of year test

Year 9- Chemistry Curriculum

CUMBRIA FUTURES FEDERATION

Curriculum theme: ***Evolve***

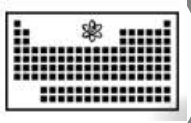
In Year 9, students start to bring together knowledge and skills to create a big picture of the world of science. They begin to understand how all three disciplines link together as well as linking to the outside world.

Year 8 recap

Students begin their GCSE course in Year 9. Building on their prior learning and knowledge from Year 7 and Year 8.

1. C1 Atomic Structure

In this chapter students build on their knowledge from the particles and periodic table chapters by developing their understanding of atoms



2. C2 Periodic table

In this chapter students review and build on their knowledge from the particles and periodic table chapters by describing the development of the periodic table and the trends in the properties of elements across the periodic table.

3. C3 Structure and bonding

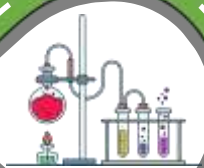
In this chapter students review and build on their knowledge from chapter 1, atomic structure and chapter 2, periodic table by describing different types of bonding and explaining the properties of ionic compounds, covalent compounds and metals. The concepts of nanoparticles is introduced

4. C4 Chemical Calculations

In this chapter students review and build on their knowledge from the chapter 1, atomic structure and chapter 2, periodic table by calculating atomic mass and relative formula mass, before going onto learn about moles. This chapter also reviews and builds on the chemical reactions chapter from KS3 through titration experiments

5. C5 Chemical Changes

In this chapter students review and build on their knowledge from the chemical reactions, reactivity and Energetics chapters by explaining how the extraction of a metal from its ore depends on the reactivity of the metal and using ionic equations for neutralisation reaction



Progressing into Year 10

End of year exams

Year 10- Chemistry Curriculum

CUMBRIA FUTURES FEDERATION

Curriculum theme: ***Connecting the dots***

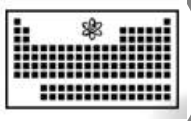
In Year 10, knowledge is linked together in students minds as it is this linking, or construction, that creates understanding. This linking takes time and requires students to engage in practice and a degree of struggle to promote reorganisation of ideas that will ultimately lead to a personal understanding.

Year 9 recap

Transition test

1. C6 Electrolysis

In this chapter students review and build on their knowledge from the reactivity chapter and are introduced to electrolysis.



2. C7 Energy Changes

In this chapter students review and build on their knowledge from the energetics chapter and draw reaction profile diagrams and complete bond energy calculations.

3. C8 Rates and equilibrium

In this chapter students review and build on their knowledge from the energetics chapter by investigating and explaining how different factors affect the rate of chemical reactions.

4. C9 Crude oil and fuels

In this chapter students review and build on their knowledge from the energy, particles and energetics chapters by describing hydrocarbon fuels and how they are obtained from crude oil.

5. C10 Organic reactions

In this chapter students review and build on their knowledge from the crude oils and fuels chapter by learning the foundations of organic chemistry.

6. C11 Polymers

In this chapter students review and build on their knowledge from the crude oils and fuels chapter by describing polymerisation reactions.

Progressing into Year 11

End of year tests, preparation for revision and mock exams.

Year 11- Chemistry Curriculum

CUMBRIA FUTURES FEDERATION

Curriculum theme: ***Consolidation***

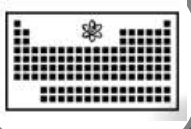
In Year 11, students start to consolidate their knowledge in preparation for exams and putting their knowledge and skills to the test.

Year 10 Recap

Transition tests, preparation, revision and mock exams.

1. C11 Polymers

In this chapter students review and build on their knowledge from the crude oils and fuels chapter by describing polymerisation reactions.



2. C12 Chemical analysis

In this chapter students review and build on their knowledge from the chapter by describing methods used to analyse chemicals.

3. C13 Earths atmosphere

In this chapter students review and build on their knowledge from the Materials and the Earth chapter by explaining the change so in the composition of the Earth's atmosphere.

4. C14 The earths resources

In this chapter students review and build on their knowledge from the Materials and the Earth chapter by describing the processing methods of different resources obtained from the Earth.

5. C15 Using our resources

In this chapter students build on their knowledge from The Earth's resources by describing the production of ammonia via the Haber cycle.

6. Revision

Once all content has been completed, students will start revision for their GCSE's. This will be a mixture of all 3 sciences, they will also complete mini assessments. Revision is tailored to the student's requirements (what they believe they need to revise) as well as what we believe they need more work on.

6. Exams

Students will sit two exams per science. Paper 1 in chemistry covers C1 to C6 and paper 2 covers C7 to C15. Each paper is 1 hour and 15 minutes.

Potential destinations

Careers in chemistry: Analytical Chemist, Accountant/ Auditor, Chemical Engineer, Chemical Development Engineer, Lecturer, Environmental Chemist, Forensic Researcher, Forensic Scientist, Patent Agent, Purification Scientist, Toxicologist