Christ the King Catholic High School

Science/Chemistry Curriculum 2023 - 2024

Upper Key Stage 2

Science teaching in upper KS2 should enable students to develop a deeper understanding of a wider range of scientific ideas compared to lower KS2 and KS1.

They should do this by exploring and talking about their ideas; asking their own questions about scientific phenomena and selecting the best methods to answer these questions. At this point of study the students should encounter more abstract ideas and begin to recognise how this helps them understand and make predictions about the world around them. Students should draw conclusions based on data and observations and use evidence and knowledge to explain their findings.

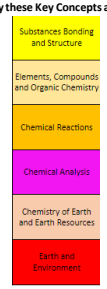
Students should read, spell and pronounce science vocabulary correctly.

Please see Mid/Long term plans for more detail.

Overall Rationale:

The curriculum in science has been designed around the best evidence of what works best to deliver the best learning experience for our students. The curriculum is sequenced such that it builds on knowledge and skills throughout KS3 and KS4 and has 5 key concepts that are the core of the learning of each discipline.

In Chemistry these Key Concepts are:



Working Scientifically (WS) Skills build up within this structure and in Year 7 include 2 WS units at the start and end of the year to help build and embed the procedural knowledge needed to access subsequent WS Skills.

For greater detail please see Science Curriculum Maps and Mid/Long Term Plans.

Year 7

Term 1

Particles and their Behaviour

Key Concept: Substances, Bonding & Structures

Core Concepts:
- Definitions of material and substance
- Factors in the particle model that determine properties of materials
- Properties of substances in different states
- Particle arrangement, separation and movement in different states
- Density and states of matter
- Particles and changes of state
- Diffusion

Rationale: *Particle chemistry is at the foundation of the understanding of the chemical world. The unit centres around the key concept: Substances. Bonding & Structures and builds on the pre-requisite knowledge gained at KS1 & 2. The unit allows access to the second unit of study ; Elements, Atoms & Compounds.*

Elements, Atoms and Compounds:

Key Concept: Elements, Compounds & Organic Chemistry

Core Concepts:
- Definitions of atoms, element, molecules and compound
- What the Periodic Table shows
- Chemical symbols of elements
- The differing properties between a compound and the elements in it
- Writing and interpreting chemical formulae
- Writing and interpreting chemical names

Rationale: *The ideas of this unit are best illustrated practically and so the unit follows the first chemistry unit as well as the 'introduction to science' module. This ensures that student have the procedural knowledge to access working scientifically skills at this level. The topic underpins all of Chemistry and will be the foundation of all KS4 Chemistry topics.*

Term 2

Reactions:

Key Concept: Chemical Reactions

Core Concepts:
- Definitions of chemical reactions, reactants and products
- Describing oxidation, combustion and decomposition reactions
- Predicting the products of oxidation reactions
- The difference between chemical reactions and physical changes
- Writing word equations for oxidation, combustion, decomposition and simple reactions
- Describing balanced equations
- Using the Law of Conservation of Mass to calculate mass of reactants and products
- The energy changes in exothermic and endothermic changes
- Explaining the Law of Conservation of mass

Rationale: *This topic introduces students to many different types of chemical reaction. It builds on understanding from KS2 of classifying matter and reversible and irreversible changes. It also links to our KS3 work on atoms and elements and builds to show students how to describe the changes in reactions through word and symbol equations, thus preparing students for calculations needed at GCSE.*

Term 3

Acids & Alkalis

Key Concept: Chemical Reactions

Core Concepts:
- Define acid, alkali, neutralisation and salt
- Describing hazards linked to using acids
- The difference between concentrated and dilute solutions
- Colour of indicator paper and solution on addition to acidic, alkaline and neutral solutions
- The PH scale
- Predicting pH values
- Useful neutralisation reactions
- How pH changes during neutralisation
- Predicting the salts formed from bases and acids
- Describing how to make a salt

Rationale: *At KS2 students look at the way acids react with bicarbonate of soda. This unit extends this further and lays the groundwork to explore acids and alkali reactions in detail in KS4. It also connects with units 1-3 and thus acts as a aid to assessing progress in year 7.*

Year 8

The Periodic Table

Key Concept: Elements, Compounds & Organic Chemistry

Core Concepts:
- The meaning of physical and chemical properties
- Groups and periods and trends in the periodic table
- Uses of elements

The physical and chemical properties of the following groups;
- Group 1
- Group 7
- Group 0

Rationale: *The periodic table is a young Chemist's best tool, it allows us to notice patterns and predict the chemical and physical properties of each element based on its location. In this unit, students build on their ideas of classification from KS2 and prior learning in KS3 and create the foundation to successfully moving onto KS4.*

Metals & Acids

Key Concept: Chemical Reactions

Core Concepts:
- Reactions and word equations of metals with acid, oxygen and water
- Describing the reactivity series
- Making predictions based on the reactivity series
- Explaining displacement reactions
- Understanding methods of extraction of metals from ores
- Calculating mass of metal in an ore
- Explaining and describing properties of ceramics
- Explaining properties of polymers

Rationale: *This unit explores the chemical and physical properties of metals, and how they are extracted and used. It also focuses on other transformational materials like ceramics. All core concepts will be expanded on in KS4 as they form a key area of materials science.*

Separation Techniques:

Key Concept: Chemical Analysis

Core Concepts:
- Meanings of pure, mixture, solvent, solute, solution, dissolve and solubility
- Use of a temperature/time graph to determine if a substance is pure
- Compare mixtures & compounds
- Explain dissolving and evaporating using the particle model

Rationale: *In KS2,students learnt about classifying and separating things according to their properties. In this unit students learn how to explain how each technique works on the particle level in preparation for KS4, where they will extend this knowledge to incorporate a greater understanding of energy.*

The Earth:

Key Concept: Earth & Environment

Core Concepts:
- The composition of the Earth and atmosphere
- The process of making sedimentary, igneous and metamorphic rock
- Uses and properties of sedimentary, igneous and metamorphic rock
- Rock cycle
- Uplift and how this provides evidence for the rock cycle
- Carbon cycle
- Describing why concentration of carbon dioxide did not fluctuate for many years
- Describing the greenhouse effect, heating and climate change and the associated impacts
- Recycling

Rationale: *In this unit students build on their KS2 understanding of different rocks to be able to categorise all rocks and their properties. They will learn to explain how minerals are cycled through the Earth to create new materials from old. They will learn how the build-up of carbon dioxide is leading to dramatic changes to our climate. The unit will later link to KS4 where students discuss the environmental impact of the materials we use and climate crisis we are in.*

Year 9

Particle Models and State Changes

Key Concept: Substances, Bonding & Structures

Core Concepts:
- Particle model
- State change

Rationale: *This topic builds on students' knowledge from KS2 regarding classification and the prior learning in KS3 and creates the foundation to move on to KS4 with a deep understanding of what the Periodic Table, which will help them determine and make predictions about given elements physical and chemical properties.*

Atoms and Periodic Table

Key Concept: Elements, Compounds & Organic Chemistry

Core Concepts:
- Periodic table
- Atoms and elements
- Compound molecules

Rationale: *In all applications, scientists and engineers take advantage of the properties of different elements to make materials best suited to their jobs. This unit explores some common elements and their properties, looks at how they fit into the modern Periodic Table, and revisits earlier work on particles and Mendeleev. This will support students journey at KS4 Chemistry as students begin to look inside the atom and prepare go subatomic at GCSE.*

Chemical Change:

Key Concept: Chemical Reactions

Core Concepts:
- Word equations
- Conservation of Mass

Rationale: *This unit revisits all the knowledge built up in years 7 and 8 involving chemical reactions and looks at how this schema can be applied to new situations. The unit looks at how this knowledge has led to the development of new technologies and helps to bridge the gap to further study at GCSE.*

Useful Chemical Reactions:

Key Concept: Chemical Reactions/ Earth and Environment

Core Concepts:
- Materials
- Word Equations

Rationale: *This unit builds on the learning done across KS3 so far and helps students apply their knowledge to the way society uses certain compounds to make the world a better place. This will lay a strong foundation for progression to chemistry at KS4, but also helps students realise the role of chemistry in the wider world, hopefully realising the careful thought that goes into the production of the chemicals we use in our daily lives.*

C1 Atomic Structure & The Periodic Table

Key Concept: Elements, Compounds & Organic Chemistry

Core Concepts:
- The models we use to represent an atom
- The development of the model of the atom over time
- Isotopes and their importance
- Why elements differ in their reactivity
- Why transition metals are different to group1 and their uses

Rationale: *The unit is the first unit of the GCSE Chemistry course and builds on the foundation unit; particles and their behaviour. Understanding of atomic structure leads us to an understanding of how chemicals bond, react and exhibit particular properties and is paramount to further understanding and thus this forms the first GCSE unit of study.*

Year 10

C2 Atomic Structure & The Periodic Table

Key Concept: Substances, Bonding & Structures

Core Concepts:
- What happens to particles as substances change state?
- Why is so much energy needed to melt some substances?
- What are the different types of chemical bonds?
- Why can metals conduct electricity?
- Why are diamonds so hard and graphite so soft?

Rationale: *In unit 1 students learned the subatomic structure of the atom and understood how this relates to properties of group 1 and 7 elements in terms of reactivity. This unit introduces the three models of bonding and then links to how properties such as melting point, conductivity and strength relate to these models.*

C3 Chemical Quantities & Calculations

Key Concept: Chemical Analysis

Core Concepts:
- How is mass conserved in chemical reactions?
- What happens to mass changes when gases are given off?
- How can we measure amounts of substances?
- How can we calculate amounts needed?
- Maximising Chemical Yields.

Rationale: *In unit 3 students learn many of the mathematical aspects of chemistry that are crucial to a deeper understanding in later units. Students will start by revisiting relative atomic mass and formula mass, and are introduced to the Avogadro constant and calculations involving mass and moles, then concentrations of solutions, and volumes of gas. Sequencing of this unit facilitates maximum time to practice and relate these skills across the chemistry curriculum.*

C4 Chemical Changes

Key Concept: Chemical Reactions

Core Concepts:
- Why are some metals more reactive than others?
- Why are some metals extracted by reduction with carbon?
- How do acids and bases produce neutral salts?
- Why are some acids strong but others are weak?
- Why are some metals produced by electrolysis?

Rationale: *In unit 4 students build on their fundamental understanding of reactivity and acids. Now that they have a understanding of atomic structure and bonding they are able to understand how oxidation, reduction and reactivity link to this atomic structure. The unit introduces half equations and the process of electrolysis.*

C5 Energy Changes

Key Concept: Chemical Reactions

Core Concepts:
- What are the energy changes in reactions?
- How do we represent energy changes?
- How can we explain energy changes?
- How are cells able to make voltage?
- How are cells able to produce energy?

Rationale: *Unit 5 continues to help students build schema around the key concept of chemical reactions. Now that students have studied P1 Energy and understand how the loss and gain of electrons relates to reactivity they are able to understand how this relates to energy changes.*

C6 The Rate and Extent of Chemical Change

Key Concept: Chemical Reactions

- How can we measure reaction rates?
- What effects the end of a reaction?
- How can we calculate rates of reaction?
- What factors effect the rate of reaction?
- How can reactions be in equilibrium?

Rationale: *Unit 6 introduces the mathematical and WS skills needed to make measurements of chemical reactions and deepens students understanding of the 'real life' meaning of the understanding of chemistry gained in units 1 to 5.*

Year 11

C7: Hydrocarbons

Key Concept: Chemistry of Earth & Earth's Resources

- Crude oil and hydrocarbons
- Properties of hydrocarbons
- Alcohols & Carboxylic acids
- Addition & Condensation Polymers
- Amino Acids and Natural Polymers

Rationale: *In unit 7 students make links from Unit 2 regarding bonding in polymers and from KS3 work on Global Warming. Triple Science Students should begin to make stronger schema regarding the relationship between bonding and chemical and physical properties particularly regarding organic molecules.*

C8: Chemical Analysis

Key Concept: Chemical Analysis

Core Concepts:
- How can we tell if a substance is pure?
- How can we separate a substance to analyse it?
- How can we analyse positive ions?
- How can we analyse negative ions?
- How can we use instrumental techniques for analysis?

Rationale: *In Unit 8 students revisit techniques they have met before in KS3 and during Unit 1. The unit allows for reinforcement of their understanding of the substantive knowledge of the core techniques and ensure practice of procedural knowledge of the techniques. For Triple Scientists the sequencing of this unit ensure understanding of ion formation and graphical elements of the unit.*

C9 The Atmosphere

Key Concept: Earth & Environment

Core Concepts:
- What was the Earth's early atmosphere?
- Why did the Earth's early atmosphere change?
- What are the consequences of the Greenhouse Effect?
- Can we reduce the effect of human activity?

Rationale: *In unit 9 revisit the science of the atmosphere and gain a deeper understanding of types of evidence and how reliability of proxy and direct evidence can vary and inform peer review leading to the acceptance of ideas. The sequencing ensures students have the best analytical, mathematical and literacy skills and knowledge needed to make informed opinions.*

C10: Sustainable Development

Key Concept: Earth & Environment/Chemistry of Earth & Earth's Resources

Core Concepts:
- How can we sustain resources for future generations?
- How can we sustain access to clean drinking water and treatment?
- Reducing resource waste.
- Feeding the population.
- What other ways can we extract metals?

Rationale: *Unit 10 is an excellent place to finish by relating students learning journey to the sustainability of methods, materials and their environmental impact for future generations.*

Christ the King Catholic High School | Science Department

Enrichment, Personal Development & Extracurricular	The curriculum is designed along side the best evidence to ensure the best learning experience for our students and is based on 6 key pillars; • Coherence • High Expectations • Metacognitive learning • Learner Identity • Responsive Teaching & Learning • Awe and Wonder The department run numerous trips and visits to local universities and colleges and promote science in science week via the sharing of peer science projects or via community events such as primary science clubs. The school also has a weekly STEM club.	**Careers Education & Cultural Capital**	Relevance of Science to learners is integrated throughout the curriculum components and resources, including student-facing content on accessible Science and diverse scientists in society. Support for teachers promoting learner identity and identification with Science is provided through CPD and resources available on the kerboodle platform. These explore the impact and relevance to learners' lives and society, and pathways in Science, for each of the six key concepts for each discipline. (see MT/LT plans)
Numeracy	Mathematical skills are fundamental to success within scientific disciplines and, as such, learners' development of these crucial skills is emphasised within all curriculum materials. In particular, application of skills and knowledge learnt within the Maths curriculum to scientific contexts can be a sticking point for learners, and the curriculum is designed to support learners with this throughout KS3 and KS4 and within all resources. Maths skills are incorporated into all relevant lessons and further supported by targeted resources. See MT/LT Plans for more information.	**Metacognition**	Understanding of how an individual learns and self-regulation of that learning are key to develop effective Science learners. The EEF notes that incorporating metacognition and self-regulation approaches in teaching and learning leads to great positive impact on learner progress. This ownership of learning is developed in a number of ways including for example; • Incorporation of the plan-monitor-evaluate cycle within relevant activities and resources, so that learners become familiar with planning the steps they will take within an activity or to solve a problem, monitoring their progress, and evaluating what they have learned. • Direct teaching and practice of a range of metacognitive strategies throughout the lesson content and student resources, as appropriate for the scientific topic at hand, followed by use of metacognitive strategies outside of class to review and reflect. • Consistent teacher-led modelling of thinking and problem-solving skills, to demonstrate how an expert employs strategies like the plan-monitor-evaluate cycle. • Fostering metacognitive talk in the classroom at appropriate opportunities. • Dedicated support within teaching materials and targeted PD resources for teachers.
Literacy	Effective use of vocabulary, reading and writing skills, and scientific communication are all integral to long-term success in Science. Practice of literacy skills is therefore embedded throughout the Science curriculum, following a progression designed around the EEF's Improving Secondary Science recommendations. Literacy skills are developed through the use of literacy trackers to highlight key vocabulary and definitions, lesson activities, targeted guidance and activities. Literacy is also emphasised throughout the new activate KS3 scheme specifically to target recommendations within the Oxford University Press Bridging the Word Gap report, which highlighted literacy as a major target area for improvement in the transition to Secondary school.	**Catholic Ethos**	Science is delivered with the CTK virtues at it's core. The core pillars of the curriculum include 'awe and wonder' not only to instil a fascination with the world in which we live but equally importantly to deepen our students faith and spiritual journey by relating the wonders of our world to our Catholic faith. The curriculum also links closely to the CTK WAY and the department actively promote the awarding of merits for particular aspects of learning and the curriculum.