IMS328	EDClass Science – Chemistry Rationale	
Issue number 1		
Approved by Danielle Myles	Date: 04.04.2024	

Science - Chemistry Rationale

Why is the study of chemistry important?

The study of chemistry is the part of science which aspires to give learners an understanding of matter, chemical reactions and the composition of the Earth and atmosphere. Learners will develop an understanding of the skills needed to manipulate the natural world, for material extraction and use in industry. Chemistry provides a link to the other sciences, with the common theme of mass and the state of matter running throughout.

Why study chemistry in this order?

The chemistry curriculum builds upon key themes outlined in KS2. At KS3 we start with the particle model as this basic component knowledge underpins all our understanding of chemistry and allows learners to understand the behaviour of matter. Following the particle model learners deepen their understanding of atomic structure using models, the elements and how they interact. This covers how materials can be separated and how they react. The KS4 curriculum allows for components of knowledge from KS3 to be built upon, whilst introducing further models of the atom and exploring the trends in the periodic table in relation to chemical and physical properties. Organic chemistry is introduced in KS4, and is the stream of chemistry that allows learners to understand organic compounds and their uses in industrial processes, therefore applying their knowledge to the real world.

What previous learning is needed?

Learners should have gained an understanding of matter and changes of state from the KS2 curriculum. They should also have an understanding of how mixtures are made and how some substances can be separated. Learners should have an awareness that some materials can be dissolved and that chemical changes cannot be easily reversed. Assessment opportunities are embedded into the curriculum to diagnose specific content areas learners should revisit before potentially progressing.

What are the links to literacy?

Learners are taught how to describe key processes, and are given the opportunity to develop their critical thinking and therefore questioning skills. Learners are taught to analyse, and produce written explanations of observations. Opportunities for reading are provided within the curriculum, helping learners to make links between ideas, and evaluate written pieces of text.

What are the links to numeracy?

Numeracy skills are fundamental throughout the chemistry unit. Learners will be expected to use numbers in simple calculations initially, and work their way towards more challenging equations. Units of

measurement are taught and applied to chemical calculations. Learners are taught to display data collected from experiments in tables and graphs. Mathematical language is then used to analyse and evaluate this data. Within chemistry, learners are taught to make reference to the periodic table and use the data from this, along with equations which they are expected to recall, to interpret chemical equations quantitatively.
Questions posed to learners will target maths skills at a level of demand appropriate for their key stage.

How is SMSC embedded?
Within chemistry, discussion takes place around using finite resources from the Earth and the life cycle of products. This provides the opportunity to morally consider the effect of using finite resources on future generation. Learners are taught about the key scientists that contributed to the development of the periodic table and the model of the atom. This provides the chance to develop a respect for the opinions of others. In KS3 chemistry, learners are taught how to minimise the risk of injury to themselves and others, whilst carrying out practical work in a lab. This outlines the expectations of learners in social situations; empowering them with the skills required to deal with hazards safely. These skills are further built upon in KS4 chemistry. Within organic chemistry, learners are taught about crude oil and its place within industry, allowing learners to consider the cultural impact of industrial processes.

How are British Values embedded?
Links to democracy are provided within lessons, which consider the impact of pollution and climate change on the environment. Learners are given the chance to evaluate the opinions held by political parties and can form their own ideas about how they can implement future change in society and the environment.
Within the KS3 lab skills topic, learners are taught the importance of following rules to ensure the safety of themselves and others. They are taught about the risks associated with using chemicals, and the consequences of not using them correctly, clearly linking the rule of law.
Learners are provided with the tools to make informed choices about the use of finite resources, how to stay safe in a lab and the environmental impact of industrial processes. Furthermore, learners are taught to question theories and are encouraged to approach scientific problems with an open mind, with all of the above encouraging individual liberty.
Developing a tolerance and mutual respect of others is embedded throughout the chemistry curriculum, with learners being taught to respect the development of scientific models and the opinions of others.

How are equal opportunities embedded?

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Lessons will be accessible for all learners, with written tasks being scaffolded through a variety of means. Model answers to calculations and written tasks will be provided. Learners will be provided with a range of question types to check their understanding, ranging from multiple choice questions, to free text explanation, evaluation or analytical questions.

How are links made to the Wider World / Cultural Capital / Experiences / Cross-Curricular?

There are multiple links to the wider world within the chemistry curriculum, with specific lessons focusing on industrial processes, such as desalination and the Haber process.

Cross-curricular links are frequently made between chemistry and maths, with all scientific investigations and calculations of chemical quantities, requiring the use of at least one mathematical skill.

Links to geography are present within the chemistry curriculum, particularly in the earth and atmosphere topics, where global warming and climate change are discussed. Furthermore, scientific processes such as the rock cycle and water cycle are outlined in both chemistry and geography.

Historical links are present within the atomic structure and the periodic table topics, with a timeline of historical events being provided, to notify learners how scientific models have changed over time.

Chemistry is closely linked to both biology and physics. The chemistry of molecules is essential to understand biological processes, such as digestion, respiration and photosynthesis. An understanding of chemistry is also required to appreciate medicine, such as how drugs are developed, and the impact of different drugs on the body. States of matter, atoms and the behaviour of particles are discussed within chemistry, as well as physics. The use of different energy resources is considered in chemistry and is further developed in physics, where the process of generating electricity from these energy sources is taught.

Chemistry provides the opportunity for cultural capital. As industry and climate change are discussed, learners will develop their cultural awareness. The accumulation of knowledge of the world around us and skills that can be utilised in everyday life are taught. Examples of these skills include measuring quantities, understanding the chemical and physical properties of substances and applying this knowledge to the uses of materials.

What key knowledge will be covered?

Within KS3 chemistry, the following topics are covered:

- The Particle Model of Matter
- Atoms, Elements and Compounds
- Pure and Impure Substances

- Chemical Reactions
- Chemical Energetics
- The Periodic Table
- Materials
- Earth and Atmosphere
- Scientific Skills and Lab Safety

Within KS4 chemistry, the following topics are covered:

- Atomic Structure
- The Periodic Table
- Bonding, Structure and the Properties of Matter
- Chemical Quantities and Calculations
- Chemical Changes
- Energy Changes
- Rate and Extent of Chemical Change
- Organic Chemistry
- Chemical Analysis
- The Atmosphere
- Sustainable Development

What key skills will be covered?

- Development of scientific thinking e.g making predictions and evaluating risks in a lab
- Experimental skills and strategies e.g writing a method for experiments and recording observations
- Analysis and evaluation e.g translating data between graphical and numerical form
- Scientific quantities, units, symbols and nomenclature e.g using prefixes and power of ten and calculating significant figures.

Are there interleaving opportunities?

Interleaving opportunities are provided throughout the chemistry curriculum. Firstly, scientific knowledge, mathematical skills and key vocabulary that are introduced in KS3 are built upon in KS4. Furthermore, topics within the chemistry curriculum allow for a constant recall of knowledge, whereby component knowledge helps learners access further topics. For example, knowledge of atomic structure is required to access further topics on bonding and quantitative chemistry. Exam style questions may

require knowledge from earlier topics to be consolidated, and learners will be given the opportunity to practice this when answering questions within lessons.

How is key vocabulary embedded?

Key vocabulary is introduced and defined in every chemistry lesson. Learners are given model answers to show how this key vocabulary can be used effectively when answering questions. Learners are expected to produce written explanations of observations, whilst confidently using tier three vocabulary.

How is level 2 vocabulary embedded?

Tier 2 vocabulary is used within exam style questions and in scientific explanations. Within lessons, opportunities are taken to explain the context of the tier 2 language, so it is clear how it applies to scientific content.

What are the common misconceptions?

There are many misconceptions within chemistry, including:

- Volume is the same as mass/weight
- Gases do not have mass and do not exist as you cannot see them
- Oxygen is the same as air
- Particles in a liquid are not in contact with each other
- All acids are dangerous
- Alkalis are acids because they can cause burns
- When something dissolves, it disappears
- When a solid is dissolved into a liquid, the liquid does not become any heavier
- Atoms in mixtures are chemically bonded
- All metals are solids at room temperature