Medium Term Planning - Topic: Electrolysis

Curriculum Intent	**In addition to working further on objectives from Year __, pupils will be taught, following National Curriculum guidelines, the following this topic:**
Skills/National Curriculum Links	Introduction to electrolysis: Aiming for Grade 4 LOs: • Define electrolysis. • Write a word equation to describe the electrolysis of a molten ionic compound. Aiming for Grade 6 LOs: • Describe electrolysis in terms of movement of ions. • Write a balanced symbol equation including state symbols for the overall electrolysis of a molten ionic compound. • Predict the products at each electrode for the electrolysis of molten ionic compound. Aiming for Grade 8 LOs: • Explain why electrolysis can only occur when an ionic compound is molten or in aqueous solution. • Describe electrolysis with half equations at the electrodes. • Explain the classification of the reactions at each electrode as oxidation or reduction. Changes at the electrodes: Aiming for Grade 4 LOs: • State that oxygen can be produced at the anode when some solutions are electrolysed. • State that hydrogen can be produced at the cathode when some solutions are electrolysed. • Write a word equation to describe electrolysis of a solution. Aiming for Grade 6 LOs: • Describe electrolysis of solutions in terms of movement of ions. • Write a balanced symbol equation including state symbols for the overall electrolysis of a solution. • Predict the products at each electrode for the electrolysis of a molten ionic compound or its solution. Aiming for Grade 8 LOs: • Explain how hydrogen ions and hydroxide ions can be present in solutions, including a balanced symbol equation with state symbols, for the reversible reaction in which water ionises. • Describe electrolysis with half equations at the electrodes. • Explain the classification of reactions at the electrodes as oxidation or reduction. Extraction of aluminium: Aiming for Grade 4 LOs: • State that aluminium can be extracted from aluminium oxide using electrolysis. • Write a word equation to describe the electrolysis of aluminium oxide. Aiming for Grade 6 LOs: • Describe the electrolysis of aluminium oxide. • Explain why electrolysis is an expensive metal extraction method and illustrate this with the extraction of aluminium. • Explain why cryolite is added to aluminium oxide in the industrial extraction of aluminium. Aiming for Grade 8 LOs: • Explain why electrolysis is used to extract aluminium from compounds. • Describe electrolysis with half equations at the electrodes. • Explain the classification of the reactions at each electrode as oxidation or reduction. Electrolysis of aqueous solutions: Aiming for Grade 4 LOs: • State the products of the electrolysis of brine and a use for each. • Safely electrolyse a solution, with guidance provided. Aiming for Grade 6 LOs: • Describe how to electrolyse brine in terms of ions moving. • Predict the products of electrolysis of a solution. • Plan and carry out an electrolysis investigation. Aiming for Grade 8 LOs: • Explain the electrolysis of brine using half equations, classifying reactions at the electrode as oxidation or reduction. • Evaluate in detail an investigation they have planned and carried out, commenting on their methodology and quality of the data collected. • Compare and contrast the electrolysis of a compound in solution with its electrolysis as a molten compound.

Spiritual, moral, social, and cultural development	**SMSC:** group work from practical activities in this section. Also pupils can work in groups to produce a timeline for the development of the periodic table. **PSHE/British Values:** The history of the is important development of the atom when learning about british values and world values. Students will complete teamwork, leadership and put science into everyday situations. They will show mutual respect during classwork. **Skills Builder:**Listening (Receiving, retaining and processing info), Speaking (The oral transmission of info and ideas), Problem solving (Find a solution to a situation or challenge), Creativity (imagination and generation of new ideas), Staying positive (The ability to use tactics and strategies to overcome setbacks), aiming high (Set clear and tangible goals), Leadership and teamwork
Numeracy	
Literacy	**Vocabulary Tier 2:** products, circuit, deposited, temperature, evaporating, molten, neutral, discharged, concentration, displace, impurities. **Vocabulary Tier 3:** anode, brine, cahode, electrolyte, half equation, inert. **Reading:** Following a written method and read risk assessments. Students may be directed to the textbook; this could be in lesson or at home on Kerboodle. **Writing:** Describing and explaining scientific phenomenon, free response writing for describing precautions taken, use of word mat to promote sentence formation. **Oracy:** inclusion of BEST resources which are research evidence on common misunderstandings in science, effective diagnostic questioning and formative assessment, constructivist approaches to building understanding, and effective sequencing of key concepts that promote metacognitive talk and dialogue.
Becoming future ready	**Careers/Employability:** Scientist Chemist Drug development Teacher Post-doctoral researcher
Adaptation **QFT/SEND Provision**	Throughout this topic, quality first teaching will provide differentiation: **By product:** Linear assessments and differentiated practical work. **By resource:** Lessons are differentiated per class and students, worksheets are available if support and assessments are linear. **By Intervention**: by providing different levels of supervision and support **By Progressive Questioning:** exploring pupils' understanding through interactive dialogue. **By Grouping:** according to prior attainment, gender, social preference, preferred learning style. **By Offering Optional Activities:** In class or as homework, to extend learning. This QFT/SEND provision will be explicit within the lesson-by-lesson schemes of work.
Implementation Curriculum Delivery Learning Outcomes **(Core Knowledge)**	To be able to: 4.3.1 When an ionic compound is melted or dissolved in water, the **ions are free to move about** within the liquid or solution. These liquids and solutions are able to conduct electricity and are called electrolytes. Passing an electric current through electrolytes causes the ions to move to the electrodes. **Positively charged ions move to the negative electrode (the cathode), and negatively charged ions move to the positive electrode (the anode).** Ions are discharged at the electrodes producing elements. This process is called electrolysis. Throughout Section 4.3 higher-tier students should be able to write half equations for the reactions occurring at the electrodes during electrolysis, and may be required to complete and balance supplied half equations. 4.3.2 When a simple ionic compound (e.g., lead bromide) is electrolysed in the molten state using inert electrodes, the metal (lead) is produced at the cathode and the non-metal (bromine) is produced at the anode. Students should be able to predict the products of the electrolysis of binary ionic compounds in the molten state. 4.3.1 H Throughout Section 4.3 higher tier students should be able to write half equations for the reactions occurring at the electrodes during electrolysis, and may be required to complete and balance supplied half equations. 4.3.4 The ions discharged when an aqueous solution is electrolysed using inert electrodes depend on the relative reactivity of the elements involved. At the negative electrode (cathode), hydrogen is produced if the metal is more reactive than hydrogen. At the positive electrode (anode), oxygen is produced unless the solution contains halide ions when the halogen is produced. This happens because in the aqueous solution water molecules break down producing hydrogen ions and hydroxide ions that are discharged. **Students should be able to predict the products of the electrolysis of aqueous solutions containing a single ionic compound.** 4.3.1 H Throughout Section 4.3 highertier students should be able to write half equations for the reactions occurring at the electrodes during electrolysis, and may be required to complete and balance supplied half equations. 4.3.3 **Metals can be extracted from molten compounds using electrolysis**. Electrolysis is used if the metal is too reactive to be extracted by reduction with carbon or if the metal reacts with carbon. Large amounts of energy are used in the extraction process to melt the compounds and to produce the electrical current. Aluminium is manufactured by the electrolysis of a molten mixture of aluminium oxide and cryolite using carbon as the positive electrode (anode). Students should be able to: • explain why a mixture is used as the electrolyte • explain why the positive electrode must be continually replaced. 4.3.5 H During

	electrolysis, at the cathode (negative electrode), positively charged ions gain electrons and so the reactions are reductions. At the anode (positive electrode), negatively charged ions lose electrons and so the reactions are oxidations. Reactions at electrodes can be represented by half equations, for example: $2H^+ + 2e^- \rightarrow H_2$ and $4OH^- \rightarrow O_2 + 2H_2O + 4e^-$ or $4OH^- - 4e^- \rightarrow O_2 + 2H_2O$ 4.3.1 H Throughout Section 4.3 higher-tier students should be able to write half equations for the reactions occurring at the electrodes during electrolysis, and may be required to complete and balance supplied half equations. 4.3.4 The ions discharged when an aqueous solution is electrolysed using inert electrodes depends on the reactivity of the elements involved. At the negative electrode (cathode), hydrogen is produced if the metal is more reactive than hydrogen. At the positive electrode (anode), oxygen is produced unless the solution contains halide ions when the halogen is produced. This happens because in the aqueous solution water molecules break down producing hydrogen ions and hydroxide ions that are discharged. Students should be able to predict the products of the electrolysis of aqueous solutions containing a single ionic compound. 4.3.5 During electrolysis, at the cathode (negative electrode), positively charged ions gain electrons and so the reactions are reductions. At the anode (positive electrode), negatively charged ions lose electrons and so the reactions are oxidations. Reactions at electrodes can be represented by half equations, for example: $2H^+ + 2e^- \rightarrow H_2$ and $4OH^- \rightarrow O_2 + 2H_2O + 4e^-$ or $4OH^- - 4e^- \rightarrow O_2 + 2H_2O$ Required practical: Investigate what happens when aqueous solutions are electrolysed using inert electrodes. This should be an investigation involving developing a hypothesis.
Current learning to be developed in the future within:	A level chemistry students will again cover all the topic again, with an emphasis on half equation, ad looking at oxidation states.
Assessment	Refer to assessment maps for formative and summative assessment opportunities.
Impact	Attainment and Progress – Refer to assessment results / data review documentation.