KESTEVEN AND SLEAFORD HIGH SCHOOL
Chemistry Scheme of Learning

Year 10 – Term 1/Topic 4 and Topic 3

Intent – Rationale

Pupils begin the year with the tail end of Topic 4, focussing on electrolysis. This was not previously covered as it was necessary for pupils to understand bonding which was taught at the end of Year 9. Electrolysis allows pupils to develop their understanding of bonding and apply it to real life uses. After electrolysis pupils begin the Quantitative Chemistry topic (Topic 3) which involved calculations based on chemical reactions. The exam board intended for this to be taught earlier on in the course before the Chemical Changes Topic (Topic 4), but we felt it would be too early to cover these difficult concepts in year 9. Much of this topic is Chemistry only so pupils need to be in sets. We also believe it is more useful for pupils to learn about the chemical reactions before applying mathematical concepts to them

Sequencing – what prior learning does this topic build upon?	**Sequencing – what subsequent learning does this topic feed into?**
• Unit 1 The nature of atoms and their sub-atomic particles. • Unit 2 The formation of ions and ionic bonding. The properties of ionic compounds. • KS3 Word equations and balanced symbol equations.	• All A level Chemistry Physical Chemistry learning.
What are the links with other subjects in the curriculum?	**What are the links to SMSC, British Values and Careers?**
• Base the content here on what you already know but there will be time in future to liaise further as part of our collaborative work	• The uses of electrolysis in industrial processes The use of chemical calculations in the development of all industrial chemical processes including pharmaceuticals.
What are the opportunities for developing literacy skills and developing learner confidence and enjoyment in reading?	**What are the opportunities for developing mathematical skills?**
FROM THE LIBRARY- Students should continue to access the previous Terms reading lists, and familiarise themselves further with the Science collection within the library.	• Positive and negative numbers • Mole calculations • Manipulation of formulae • Use of standard form

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Year 10 – Term 1/Unit 4 and Unit 3

Intent – Concepts

What knowledge will students gain and what skills will they develop as a consequence of this topic?
Know To know what happens in electrolysis To know the types of substance that can be electrolysed. To know what happens to ions during electrolysis To know how water affects the products of electrolysis. To know why some metals are extracted with carbon and others by electrolysis. To know the process of extracting aluminium from its ore. To know the half-equation at each electrode during the electrolysis of aluminium oxide. To know the half-equation at each electrode during the electrolysis of an aqueous solution. To know that the law of conservation of mass states that no atoms are lost or made during a chemical reaction so the mass of the products equals the mass of the reactants. To know that chemical reactions can be represented by symbol equations which are balanced in terms of the numbers of atoms of each element involved on both sides of the equation. To know what is meant by the relative formula mass of an element. To know that chemical equations can be interpreted in terms of moles. To know that the balancing numbers in a symbol equation can be calculated from the masses of reactants and products by converting the masses To know that the balancing numbers in a symbol equation can be calculated from the masses of reactants and products by converting the masses in grams to amounts in moles and converting the numbers of moles to simple whole number ratios To know that the concentration of a solution can be measured in mass per given volume of solution, eg grams per dm^3 **(g/dm^3)** To know that the concentration of a solution can be measured in mol/dm^3 To know that the amount in moles of solute or the mass in grams of solute in a given volume of solution can be calculated from its concentration in mol/dm^3

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To know that the amount in moles of a solute in a given volume of solution can be calculated from its concentration in mol/dm^3

To know that if the volumes of two solutions that react completely are known and the concentration of one solution is known, the concentration of the other solution can be calculated

To know that in a chemical reaction involving two reactants, it is common to use an excess of one of the reactants to ensure that all of the other reactant is used

To know that even though no atoms are gained or lost in a chemical reaction, it is not always possible to obtain the calculated amount of a product

To know that the amount of a product obtained is known as the yield. When compared with the maximum theoretical amount as a percentage, it is called the percentage yield

To know that the atom economy (atom utilisation) is a measure of the amount of starting materials that end up as useful products.

Apply

To be able to predict the products of the electrolysis of an aqueous solution.

To perform an investigation into the electrolysis of a solution using inert electrodes.

To be able to calculate the relative formula mass of a simple compound.

To understand that some reactions may appear to involve a change in mass

To be able to calculate the number of moles (or the mass) given the mass (or number of moles) of substance using simple ratios.

To be able to calculate the masses of reactants and products from the balanced symbol equation and the mass of a given reactant or product

To be able to calculate the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution

To be able to calculate the percentage yield of a reaction

To be able to calculate the volume of a gas at room temperature and pressure

Extend

To be able to predict the products of electrolysis.

To be able to represent the reactions at each electrode using half-equations.

To be able to calculate the relative formula mass of a complex compound

To be able to explain any observed changes in mass in non-enclosed systems during a chemical reaction given the balanced symbol equation for the reaction and explain these changes in terms of the particle model

To be able to calculate the number of moles (or the mass) given the mass (or number of moles) of substance using more complex ratios.

To be able to explain how the mass of a solute and the volume of a solution is related to the concentration of the solution.

To be able to determine the concentration of unknown solutions using titration techniques and calculations

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To be able to explain the effect of a limiting quantity of a reactant on the amount of products it is possible to obtain in terms of amounts in moles or masses in grams

To be able to calculate volumes of gaseous reactants and products from a balanced equation and a given volume of a gaseous reactant or product

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What subject specific language will be used and developed in this topic?	What opportunities are available for assessing the progress of students?

Oxidation	Loss of electrons/ gain of oxygen
Reduction	Gain of electrons/ loss of oxygen
Reactivity series	List of elements in order of their reactivity
Ion	An atom that has gained or lost an electron to form a charged particle
Cation	A positively charged ion
Anion	A negatively charged ion

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Electrode	A conducting rod connected to the positive and negative terminal of a cell or battery. It is used in electrolysis
Cathode	A negatively charged electrode which attracts cations
Anode	A positively charged electrode which attracts anions
Inert	Unreactive
Half equation	An equation that describes oxidation or reduction by showing the movement of electrons.
Solution	When an ionic compound is dissolved in water
Electrolysis	The breakdown of a substance containing ions using electricity
Bauxite	Ore containing aluminium oxide
Cryolite	A substance in which aluminium oxide is dissolved during the extraction of aluminium. It has a lower melting point than aluminium oxide
Hydroxide ion	OH^- produced during the electrolysis of solutions

Halide ion	An ion formed from Group 7 atoms e.g. Cl^-

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Relative Atomic Mass	The average mass of an atom of an element compared to carbon-12, taking into account naturally occurring isotopes
Relative Formula Mass	The total relative atomic masses added up in the ratio shown in the chemical formula of a substance
Mole	A quantity of 6.02×10^{23} The amount of substance in the relative atomic or formula mass in grams.
Avogadro Constant	The number of atoms, molecules or ions in a mole of any substance (6.02×10^{23} per mole)
Limiting Reactants	A reactant which is completely used up in a chemical reaction and determines the amount of product which can be made. Other reactants are said to be in excess
Concentration	The amount of solute dissolved in a certain volume of solvent
Titration	A method for measuring the volumes of two solutions that react together
End Point	The point in a titration where the reaction is complete and the titration should stop
Pipette	A glass tube used to measure accurate volumes of liquid. It is limited in that it can only measure one specific volume

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Burette	A long glass tube with a tap at one end and markings to show volumes of liquid. It is used to add known volumes of liquids that are measured very accurately
Concordant	When repeats in a titration are within 0.1 cm^3 of each other. At least two concordant results are needed. The first rough titration should not be included in this
Percentage Yield	The actual mass of product collected in the reaction divided by the maximum mass that could have been formed in theory, multiplied by 100
Atom Economy	A measure of the amount of starting materials that end up as useful products

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Intent – Concepts

Lesson title	Learning challenge	Higher level challenge	Suggested activities and resources
Introduction to electrolysis	To know what happens in electrolysis To know the types of substance that can be electrolysed.	To be able to predict the products of electrolysis.	
Electrolysis of molten compounds	To know what happens to ions during electrolysis To know how water affects the products of electrolysis.	To be able to represent the reactions at each electrode using half-equations.	
Electrolysis of aluminium oxide	To know why some metals are extracted with carbon and others by electrolysis. To know the process of extracting aluminium from its ore.	To know the half-equation at each electrode during the electrolysis of aluminium oxide.	
Electrolysis of solutions	To be able to predict the products of the electrolysis of an aqueous solution. To perform an investigation into the electrolysis of a solution using inert electrodes.	To know the half-equation at each electrode during the electrolysis of an aqueous solution.	
Revision	To prepare revision resources for a formal assessment of lessons in the topic "Electrolysis".		
Test and LAQ	To assess knowledge and understanding via examination questions and a		

	longer written response answer.		
The conservation of mass	To know that the law of conservation of mass states that no atoms are lost or made during a chemical reaction so the mass of the products equals the mass of the reactants.	To know that chemical reactions can be represented by symbol equations which are balanced in terms of the numbers of atoms of each element involved on both sides of the equation.	
Relative formula mass	To know what is meant by the relative formula mass of an element. To be able to calculate the relative formula mass of a simple compound.	To be able to calculate the relative formula mass of a complex compound.	
Explaining the conservation of mass	To understand that some reactions may appear to involve a change in mass	To be able to explain any observed changes in mass in non-enclosed systems during a chemical reaction given the balanced symbol equation for the reaction and explain these changes in terms of the particle model	
Moles	To be able to calculate the number of moles (or the mass) given the mass (or number of moles) of substance using simple ratios.	To be able to calculate the number of moles (or the mass) given the mass (or number of moles) of substance using more complex ratios.	

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Calculating masses from equations	To know that chemical equations can be interpreted in terms of moles. To be able to calculate the masses of reactants and products from the balanced symbol equation and the mass of a given reactant or product.	To know that the balancing numbers in a symbol equation can be calculated from the masses of reactants and products by converting the masses in grams to amounts in moles and converting the numbers of moles to simple whole number ratios	
Mid-topic Test	To assess knowledge and understanding via examination questions.		
Concentration	To know that the concentration of a solution can be measured in mass per given volume of solution, eg grams per dm^3 **(g/dm^3)** To be able to calculate the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution	To be able to explain how the mass of a solute and the volume of a solution is related to the concentration of the solution.	
Concentration and moles (Chem)	To know that the concentration of a solution can be measured in mol/dm^3 To know that the amount in moles of solute or the mass in grams of solute in a given volume of solution can be	To be able to explain how the concentration of a solution in mol/dm^3 is related to the mass of the solute and the volume of the solution	

	calculated from its concentration in mol/dm^3		
Titration calculations (Chem)	To know that the amount in moles of a solute in a given volume of solution can be calculated from its concentration in mol/dm^3 To know that if the volumes of two solutions that react completely are known and the concentration of one solution is known, the concentration of the other solution can be calculated	To be able to determine the concentration of unknown solutions using titration techniques and calculations	
Limiting Quantities	To know that in a chemical reaction involving two reactants, it is common to use an excess of one of the reactants to ensure that all of the other reactant is used	To be able to explain the effect of a limiting quantity of a reactant on the amount of products it is possible to obtain in terms of amounts in moles or masses in grams	
Percentage Yield (Chem)	To know that even though no atoms are gained or lost in a chemical reaction, it is not always possible to obtain the calculated amount of a product To know that the amount of a product obtained is known as the yield. When compared	To be able to calculate the percentage yield of a reaction	

	with the maximum theoretical amount as a percentage, it is called the percentage yield		
Atom Economy (Chem)	To know that the atom economy (atom utilisation) is a measure of the amount of starting materials that end up as useful products.	To be able to calculate the atom economy of a reaction to form a desired product from the balanced equation	
Gas volumes (Chem)	To know that the volume of one mole of any gas at room temperature and pressure (20^{o}C and 1 atmosphere pressure) is 24 dm^{3} To be able to calculate the volume of a gas at room temperature and pressure	To be able to calculate volumes of gaseous reactants and products from a balanced equation and a given volume of a gaseous reactant or product	
Revision	To prepare revision resources for a formal assessment of lessons in the topic “Chemical Calculations”.		
Test and LAQ (Chem)	To assess knowledge and understanding via examination questions and a longer written response answer.		