Medium Term Planning - Topic: Chemical changes

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	Aiming for Grade 4 LOs: • List the order of common metals in the reactivity series. • Use general equations to write specific word equations for metals listed in the reactivity series reacting with oxygen, water, and acid. • Safely make and record observations. Aiming for Grade 6 LOs: • Describe oxidation and reduction in terms of gain or loss of oxygen. • Write word equations for the metals listed in the reactivity series reacting with oxygen, water, and acid, and balance given symbol equations. • Predict observations for the metals listed in the reactivity series reacting with oxygen, water, and acid. Aiming for Grade 8 LOs: • Justify uses of metals in the reactivity series based on their chemical reactivity. • Write balanced symbol equations, with state symbols, for the metals listed in the reactivity series reacting with oxygen, water, and acid. • Evaluate in detail the investigation of metals plus acid, assessing the control of variables and the validity of conclusions drawn from the data collected. Aiming for Grade 4 LOs: • Recall a definition of a displacement reaction. • Use the reactivity series to determine whether a reaction between a metal and a different metal salt will occur. • Safely make and record observations. Aiming for Grade 6 LOs: • Explain why a displacement reaction occurs. • Write word equations and straightforward balanced symbol equations for displacement reactions. • Predict observations for the metals listed in the reactivity series reacting with a different metal salt. Aiming for Grade 8 LOs: • Describe displacement reactions using an ionic equation. • Write balanced symbol equations, with state symbols, for displacement reactions. • Determine and explain which species is oxidised and which species (metal atom or ion) is reduced in a displacement reaction in terms of electron transfer. Extracting metals: Aiming for Grade 4 LOs: • Define oxidation and reduction in terms of oxygen. • Describe how metals can be extracted. Aiming for Grade 6 LOs: • Identify species that are being oxidised and reduced in a chemical reaction. • Explain why some metals are found uncombined in the Earth's crust. Aiming for Grade 8 LOs: • Explain how carbon or hydrogen can be used to reduce an ore. • Evaluate the extraction process to obtain a metal from its ore. Salts from metals: Aiming for Grade 4 LOs: • Recall a definition of a salt. • Name a salt formed between a metal and sulfuric acid or hydrochloric acid. • Recall a general equation for a metal reacting with an acid and Aiming for Grade 6 LOs: • Describe how to make a salt by reacting a metal with an acid. • Write a balanced symbol equation to describe a reaction between a metal and sulfuric acid or hydrochloric acid. • Identify the chemical formula of the salt produced from the reaction between an acid and a metal. Aiming for Grade 8 LOs: • Explain the reaction between a metal and an acid. • Write ionic and half equations, including state symbols, to describe a reaction between a metal and sulfuric acid or hydrochloric acid. • Identify and explain in detail which species is oxidised and which is reduced. Insoluable bases:

	Aiming for Grade 4 LOs: • Safely prepare a pure, dry sample of a soluble salt from an insoluble base and a dilute acid. • Name a salt formed between a metal hydroxide or metal oxide and sulfuric acid or hydrochloric acid. • Recall a general equation for a base reacting with an acid and use it to write specific word equations. Aiming for Grade 6 LOs: • Describe a method to prepare a pure, dry sample of a soluble salt from an insoluble substance and a dilute acid. • Write a balanced symbol equation to describe a reaction between a metal hydroxide or oxide and sulfuric acid or hydrochloric acid. • Explain why the reaction between a base and a dilute acid is a neutralisation reaction. Aiming for Grade 8 LOs: • Explain the reaction between a metal oxide or metal hydroxide and an acid, including an ionic equation. • Generate the formulae of salts given the names of the metal or base and the acid • Explain how alkalis are a subgroup of bases. Making more salts: Aiming for Grade 4 LOs: • Safely make a salt by reacting a metal carbonate with a dilute acid. • Write a general word equation for metal carbonates and alkalis reacting with dilute acids and use this to make specific word equations. Aiming for Grade 6 LOs: • Describe how to make a dry sample of a salt from reacting a metal carbonate or an alkali with a dilute acid. • Write balanced symbol equations for neutralisation reactions. Aiming for Grade 8 LOs: • Explain the reaction between ammonia and dilute acids to produce salts and the agricultural importance of the salts. • Describe neutralisation using ionic equations, including the ionic equation for a carbonate plus an acid. Neutralisation and the pH scale: Aiming for Grade 4 LOs: • Safely use universal indicator to classify a solution as acidic or alkaline. • Describe the pH scale. • Recall an example of an alkaline, neutral, basic, and acidic chemical. Aiming for Grade 6 LOs: • Describe how universal indicator can be used to classify a chemical as acidic or alkaline. • Describe how solutions can be acidic or alkaline. • Describe the relationship between alkalis and bases. Aiming for Grade 8 LOs: • Evaluate how universal indicator or a data logger can be used to determine the approximate pH of a solution. • Use ionic equations to explain how solutions can be acidic or alkaline. • Explain how the pH of a solution changes as acid or alkali is added. Strong and weak acids: Aiming for Grade 6 LOs: • Recall examples of strong and weak acids. • Describe how an acid or alkali can be concentrated or dilute. • Describe how an acid or alkali can be weak or strong. Aiming for Grade 8 LOs: Explain the difference between concentration and strong or weak in • terms of acids and alkalis. • Use ionic equations to explain how acids can be strong or weak. Quantatively explain how the concentration of hydrogen ions relates • to the pH number.
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:** economical, reactivity, vigorously, increases, displace, concentrated, native, formula, indicator, alternatively.

	Vocabulary Tier 3: acid, alkali, base, displacement reaction, electrolysis, equilibrium, half equation, ionic equation, metal ore, neutral, neutralization, ore, oxidation, oxidized, pH, pH scale, reactivity series, reduction, reduced, salt, strong acid, weak acids. **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: 4.1.1 **Metals react with oxygen to produce metal oxides**. The reactions are oxidation reactions because metals gain oxygen. **Students should be able to explain reduction and oxidation in terms of loss or gain of oxygen**. 4.1.2 W**hen metals react with other substances the metal atoms form positive ions**. The reactivity of a metal is related to its tendency to form positive ions. **Metals can be arranged in order of their reactivity in a reactivity series.** The metals potassium, sodium, lithium, calcium, magnesium, zinc, iron, and copper can be put in order of their reactivity from their reactions with water and dilute acids. Students should be able to: • recall and describe the reactions, if any, of potassium, sodium, lithium, calcium, magnesium, zinc, iron, and copper with water or dilute acids and where appropriate, to place these metals in order of reactivity • **deduce an order of reactivity of metals based on experimental results.** The reactions of metals with water and acids are limited to room temperature and do not include reactions with steam. 4.1.2 **The non-metals hydrogen and carbon are often included in the reactivity series. A more reactive metal can displace a less reactive metal from a compound**. Students should be able to: • explain how the reactivity of metals with water or dilute acids is related to the tendency of the metal to form its positive ion. 4.1.4 **Oxidation is the loss of electrons and reduction is the gain of electrons.** Student should be able to: • write ionic equations for displacement reactions. 4.1.3 **Unreactive metals such as gold are found in the Earth as the metal itself but most metals are found as compounds that require chemical reactions to extract the metal. Metals less reactive than carbon can be extracted from their oxides by reduction with carbon.** Reduction involves the loss of oxygen. Knowledge and understanding are limited to the reduction of oxides using carbon. Knowledge of the details of processes used in the extraction of metals is not required. Students should be able to: • interpret or evaluate specific metal extraction processes when given appropriate information • **identify the substances which are oxidised or reduced in terms of gain or loss of oxygen.** 4.1.4 **Oxidation is the loss of electrons and reduction is the gain of electrons**. Student should be able to: • write ionic equations for displacement reactions • identify in a given reaction, symbol equation, or half equation which species are oxidised and which are reduced. 4.2.1 **Acids react with some metals to produce salts and hydrogen**. Students should be able to: • **explain in terms of gain or loss of electrons, that these are redox reactions**. 4.2.3 **Soluble salts can be made from acids by reacting them with solid insoluble substances such as metals. The solid is added to the acid until no more reacts and the excess solid is filtered off to produce a solution of the salt. Salt solutions can be crystallised to produce solid salts. Students should be able to describe how to make pure, dry samples of named soluble salts from information provided.** 4.2.2 **Acids are neutralised by bases (e.g., insoluble metal hydroxides and metal oxides) to produce salts and water. The particular salt produced in any reaction between an acid and a base depends on: • the acid used (hydrochloric acid produces chlorides, nitric acid produces nitrates, sulfuric acid produces sulfates) • the positive ions in the base.** Students should be able to: • predict products from given reactants • use the formulae of common ions to deduce the formulae of salts. 4.2.2 **Acids are neutralised by alkalis (e.g., soluble metal hydroxides) to produce salts and water, and by metal carbonates to produce salts, water, and carbon dioxide. The particular salt produced in any**

	reaction between an acid and a base or alkali depends on: • the acid used (hydrochloric acid produces chlorides, nitric acid produces nitrates, sulfuric acid produces sulfates) • the positive ions in the alkali or carbonate. Students should be able to: • predict products from given reactants • use the formulae of common ions to deduce the formulae of salts. 4.2.3 **Soluble salts can be made from acids by reacting them with solid insoluble substances, such as metal oxides, hydroxides, or carbonates, The solid is added to the acid until no more reacts and the excess solid is filtered off to produce a solution of the salt. Salt solutions can be crystallised to produce solid salts. Students should be able to describe how to make pure, dry samples of named soluble salts from information provided. Required practical: preparation of a pure, dry sample of a soluble salt from an insoluble substance and a dilute acid.** 4.2.4 **Acids produce hydrogen ions, H+ , in aqueous solutions. Aqueous solutions of alkalis contain hydroxide ions, OH− . The pH scale, from 0 to 14, is a measure of the acidity or alkalinity of a solution, and can be measured using universal indicator or a pH probe**. **A solution with pH 7 is neutral. Aqueous solutions of acids have pH values of less than 7 and aqueous solutions of alkalis have pH values greater than 7.** Students should be able to: • describe the use of universal indicator or a wide range indicator to measure the approximate pH of a solution • u**se the pH scale to identify acidic or alkaline solutions.** 4.2.6 A strong acid is completely ionised in aqueous solution. Examples of strong acids are hydrochloric acid, nitric acid, and sulfuric acid. A weak acid is only partially ionised in aqueous solution. Examples of weak acids are ethanoic acid, citric acid, and carbonic acid. For a given concentration of aqueous solutions, the stronger an acid, the lower the pH. As the pH decreases by one unit, the hydrogen ion concentration of the solution increases by a factor of 10. Students should be able to: • use and explain the terms dilute and concentrated (in terms of amount of substance), and weak and strong (in terms of the degree of ionisation) in relation to acids • describe neutrality and relative acidity in terms of the effect on hydrogen ion concentration and the numerical value of pH (whole numbers only).
Current learning to be developed in the future within:	A level chemistry students will again cover all the topic again, with a lot more detail acid base reactions also including titration calculations.
Assessment	Refer to assessment maps for formative and summative assessment opportunities.
Impact	Attainment and Progress – Refer to assessment results / data review documentation.