Medium Term Planning - Topic: Chemical analysis

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	Pure substances and mixtures: Aiming for Grade 4 LOs: • State what a pure substance is. • Describe how melting point and boiling point data can be used to identify pure substances. • State what a formulation is. Aiming for Grade 6 LOs: • Describe the difference between pure substances, impure substances, and formulations. • Explain how melting point and boiling point data can be used to determine the purity of a substance. • State uses of formulations Aiming for Grade 8 LOs: • Justify the classification of pure substances, impure substances, and formulations when data is supplied. • Explain in detail the use of formulations. • Calculate percentage composition of components in a range of formulations. Analysing chromatograms: Aiming for Grade 4 LOs: • Describe and safely carry out a method to make a paper chromatogram. • Describe how to calculate Rf values. • Describe a use of chromatography. Aiming for Grade 6 LOs: • Explain how chromatography separates solutes. • Calculate Rf values from given data. • Use a chromatogram to determine if a sample is pure or impure. Aiming for Grade 8 LOs: • Explain why different substances and different conditions will have different Rf values. • Calculate Rf values from a chromatogram, using an appropriate number of significant figures. • Interpret a chromatogram to identify unknown substances. Testing for gases: Aiming for Grade 4 LOs: • Safely carry out the laboratory test for hydrogen, oxygen, carbon dioxide, and chlorine. • Describe how to safely carry out the laboratory test for chlorine gas. • Identify hydrogen, carbon dioxide, and oxygen from a laboratory test. Aiming for Grade 6 LOs: • Explain why limewater turns milky when it reacts with carbon dioxide. • Interpret results to identify a gas that is present. • Explain why hydrogen 'pops' near a naked flame. Aiming for Grade 8 LOs: • Write balanced symbol equations, including state symbols, for the reactions of limewater with carbon dioxide and hydrogen with oxygen. • Explain why a glowing splint re-ignites in oxygen. • Explain why chlorine gas turns damp indicator paper colourless. Testing for positive ions: Aiming for Grade 4 LOs: • Safely carry out a flame test. • Safely carry out testing for metal ions using sodium hydroxide. • Write a word equation for the reaction between sodium hydroxide and a specified metal salt solution. Aiming for Grade 6 LOs: for positive ions • Identify a metal ion from the colour of a flame or the colour of the hydroxide precipitate. • Write balanced symbol equations, including state symbols, for the production of an insoluble metal hydroxide. • Explain why a flame test cannot be used to identify a mixture of metal solutions. Aiming for Grade 8 LOs: • Evaluate flame tests as a method for identifying of positive metal ions. • Write balanced ionic equations, including state symbols for the production of an insoluble metal hydroxide. • Explain why iron(II) hydroxide solution often changes colour when it stands in air.

	Testing for negative ions: Aiming for Grade 4 LOs: • Safely carry out testing for carbonates, halides, and sulfate ions. • Write a word equation for the reaction when a specific carbonate, halide, or • sulfate is being tested with support. Aiming for Grade 6 LOs: • Identify the presence of carbonate, a specific halide, or sulfate ions from simple laboratory tests. • Write balanced symbol equations, including state symbols for the reactions in the simple laboratory tests for carbonate, halide, or sulfate ions. • Explain why it can be difficult to identify halides using this method. Aiming for Grade 8 LOs: • Evaluate the halide ion test. • Write balanced ionic equations, including state symbols, for simple laboratory tests for carbonate, halide, or sulfate ions. • Explain in detail how to identify a compound from the results of simple laboratory tests. Instrumental analysis: Aiming for Grade 4 LOs: • List some of the advantages and disadvantages of instrumental techniques. • State an example of an instrumental technique. • State a use for flame emission spectroscopy. Aiming for Grade 6 LOs: • Compare and contrast instrumental techniques with simple laboratory tests. • Describe the main processes of flame emission spectroscopy. • Explain how flame emission spectroscopy is an improvement on flame tests. Aiming for Grade 8 LOs: • Evaluate the use of instrumental techniques. • Explain how metal ions emit light when in a flame. • Interpret results from flame emission spectroscopy when data is given.
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:** **Vocabulary Tier 3:** pipette, Rf, retention factor **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	To be able to: 8.1.1 In chemistry, a pure substance is a single element or compound, not mixed with any other substance. **Pure elements and compounds melt and boil at specific temperatures.** Melting point and boiling point

Learning Outcomes **(Core Knowledge)**	data can be used to distinguish pure substances from mixtures. In everyday language, a pure substance can mean a substance that has had nothing added to it, so it is unadulterated and in its natural state, for example, pure milk. Students should be able to use melting point and boiling point data to distinguish pure from impure substances. 8.1.2 **A formulation is a mixture that has been designed as a useful product**. Many products are complex mixtures in which each chemical has a particular purpose. Formulations are made by mixing the components in carefully measured quantities to ensure that the product has the required properties. Formulations include fuels, cleaning agents, paints, medicines, alloys, fertilisers, and foods. Students should be able to identify formulations given appropriate information. Students do not need to know the names of components in proprietary products. 8.1.3 **Chromatography can be used to separate mixtures** and can give information to help identify substances. Chromatography involves a stationary phase and a mobile phase. Separation depends on the distribution of substances between the phases. The ratio of the distance moved by a compound (centre of spot from origin) to the distance moved by the solvent can be expressed as its Rf value: **Rf = distance moved by substance / distance moved by solvent** Different compounds have different Rf values in different solvents, which can be used to help identify the compounds. The compounds in a mixture may separate into different spots depending on the solvent but a pure compound will produce a single spot in all solvents. Students should be able to: • explain how paper chromatography separates mixtures • suggest how chromatographic methods can be used for distinguishing pure substances from impure substances • **interpret chromatograms and determine Rf values from chromatograms**. • provide answers to an appropriate number of significant figures. **Required practical: Investigate how paper chromatography can be used to separate and tell the difference between coloured substances. Students should calculate Rf values.** 8.2.1 The test for hydrogen uses a burning splint held at the open end of a test tube of the gas. **Hydrogen burns rapidly with a pop sound**. 8.2.2 The test for oxygen uses a glowing splint inserted into a test tube of the gas. **The splint relights in oxygen**. 8.2.3 The test for carbon dioxide uses an aqueous solution of calcium hydroxide (limewater). When carbon dioxide is shaken with or bubbled through limewater **the limewater turns milky (cloudy)**. 8.2.4 The test for chlorine uses litmus paper. When damp litmus paper is put into chlorine gas the litmus paper is bleached and turns white. 8.3.1 Flame tests can be used to identify some metal ions (cations). Lithium, sodium, potassium, calcium, and copper compounds produce distinctive colours in flame tests: • lithium compounds result in a crimson flame • sodium compounds result in a yellow flame • potassium compounds result in a lilac flame • calcium compounds result in a red flame • copper compounds result in a green flame. If a sample containing a mixture of ions is used some flame colours can be masked. Students should be able to identify species from the results of the tests in 8.3.1 to 8.3.5. Flame colours of other metal ions are not required knowledge. 8.3.2 **Sodium hydroxide solution can be used to identify some metal ions (cations)**. Solutions of aluminium, calcium, and magnesium ions form white precipitates when sodium hydroxide solution is added but only the aluminium hydroxide precipitate dissolves in excess sodium hydroxide solution. Solutions of copper(II), iron(II), and iron(III) ions form coloured precipitates when sodium hydroxide solution is added. Copper(II) forms a blue precipitate, iron(II) a green precipitate, and iron(III) a brown precipitate. Students should be able to write balanced equations for the reactions to produce the insoluble hydroxides. Students are not expected to write equations for the production of sodium aluminate. 8.3.3 Carbonates react with dilute acids to form carbon dioxide gas. Carbon dioxide can be identified with limewater. 8.3.4 Halide ions in solution produce precipitates with silver nitrate solution in the presence of dilute nitric acid. Silver chloride is white, silver bromide is cream, and silver iodide is yellow. 8.3.5 Sulfate ions in solution produce a white precipitate with barium chloride solution in the presence of dilute hydrochloric acid. **Required practical: Use of chemical tests to identify the ions in unknown single ionic compounds covering the ions from sections 8.3.1 to 8.3.5.** 8.3.6 Elements and compounds can be detected and identified using instrumental methods. **Instrumental methods are accurate, sensitive, and rapid**. 8.3.7 Flame emission spectroscopy is an example of an instrumental method used to analyse metal ions in solutions. The sample is put into a flame and the light given out is passed through a spectroscope. The output is a line spectrum that can be analysed to identify the metal ions in the solution and measure their concentrations. Students should be able to interpret an instrumental result given appropriate data in chart or tabular form, when accompanied by a reference set in the same form, limited to flame emission spectroscopy.
Current learning to be developed in the future within:	A level chemistry students will study organic chemistry as a whole section at A level. They recap the knowledge at GCSE and then extend on this in detail.
Assessment	Refer to assessment maps for formative and summative assessment opportunities.
Impact	Attainment and Progress – Refer to assessment results / data review documentation.