KESTEVEN AND SLEAFORD HIGH SCHOOL

Chemistry Scheme of Learning

Year 11 – Term 1 Topic 8 Chemical Analysis

Intent – Rationale

To teach the principles of the analysis and identification of common gases and to develop the practical skills required for these.

To teach the processes behind the development of the formulations of useful products.

To teach the principles of the analysis and identification of common ions and to develop the practical skills required for these. (Triple only)

Sequencing – what prior learning does this topic build upon?	Sequencing – what subsequent learning does this topic feed into?
• **KS3 Topics 4 and 12** **Prior learning about ionic compounds (C1-C5)**	• A level Units on identification techniques such as Mass sepectrometry
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	•
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	

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Chemistry Scheme of Learning

Year 11 Term 3

Intent – Concepts

What knowledge will students gain and what skills will they develop as a consequence of this topic?

Know

- To know that a pure substance is a single element or compound, not mixed with any other substance.
- To know that pure elements and compounds melt and boil at specific temperatures. Melting point and boiling point data can be used to distinguish pure substances from mixtures.
- To know that 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, eg pure milk.
- To know that 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.
- To know that 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.
- To know that 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.
- To know that 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
- 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.
- The test for oxygen uses a glowing splint inserted into a test tube of the gas. The splint relights in oxygen.
- The test for carbon dioxide uses an aqueous solution of calcium hydroxide (lime water). When carbon dioxide is shaken with or bubbled through limewater the limewater turns milky (cloudy).
- The test for chlorine uses litmus paper. When damp litmus paper is put into chlorine gas the litmus paper is bleached and turns white.
- *To know that 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 an orange-red flame
• copper compounds result in a green flame.

- *To know that in a sample containing a mixture of ions is used some flame colours can be masked*
- *To know that elements and compounds can be detected and identified using instrumental methods. Instrumental methods are accurate, sensitive and rapid.*
- *To know that flame emission spectroscopy is an example of an instrumental method used to analyse metal ions in solutions.*
- *To know that 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.*
- *To know that sodium hydroxide solution can be used to identify some metal ions (cations).*
- *To know that 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.*
- *To know that 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.*
- *To know that carbonates react with dilute acids to form carbon dioxide gas.*
- *Carbon dioxide can be identified with limewater*
- *To know that 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*
- *To know that sulfate ions in solution produce a white precipitate with barium chloride solution in the presence of dilute hydrochloric acid*

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Apply

- To be able to use melting point and boiling point data to distinguish pure from impure substances.
- To be able to identify formulations given appropriate information
- To be able to explain how paper chromatography separates mixtures
- To be able to suggest how chromatographic methods can be used for distinguishing pure substances from impure substances
- To be able to interpret chromatograms and determine Rf values from chromatograms
- To safely carry out and record the results of the tests for hydrogen, oxygen, carbon dioxide and chlorine.
- *To be able to state advantages of instrumental methods compared with the chemical tests in the specification*
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Extend

- *To 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.*
- *To be able to write balanced equations for the reactions to produce the insoluble hydroxides.*
- *To be able to use flame tests and ion tests to identify the ions present in an unknown solution*

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

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Intent – Concepts

Lesson title	Learning challenge	Higher level challenge	Suggested activities and resources
Pure substances and mixtures	• To know that a pure substance is a single element or compound, not mixed with any other substance. • To know that pure elements and compounds melt and boil at specific temperatures. Melting point and boiling point data can be used to distinguish pure substances from mixtures. • To know that 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, eg pure milk. • To know that 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.	• To be able to use melting point and boiling point data to distinguish pure from impure substances. • To be able to identify formulations given appropriate information	
Chromatography	• To know that 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. • To know that 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. •	• To know that 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 • To be able to explain how paper chromatography separates mixtures • To be able to suggest how chromatographic methods can be used for distinguishing pure substances from impure substances • To be able to interpret chromatograms and determine Rf values from chromatograms	
Testing for gases	• 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. • The test for oxygen uses a glowing splint inserted into a test tube of the gas. The splint relights in oxygen. • The test for carbon dioxide uses an aqueous solution of calcium hydroxide (lime water).	• To safely carry out and record the results of the tests for hydrogen, oxygen, carbon dioxide and chlorine.	

	When carbon dioxide is shaken with or bubbled through limewater the limewater turns milky (cloudy). • The test for chlorine uses litmus paper. When damp litmus paper is put into chlorine gas the litmus paper is bleached and turns white.		
Flame tests and emission spectra (Triple only)	• *To know that 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 an orange-red flame* *• copper compounds result in a green flame.* • *To know that in a sample containing a mixture of ions is used some flame colours can be masked* • *To know that elements and compounds can be detected and identified using instrumental methods. Instrumental methods are accurate, sensitive and rapid.* • *To know that flame emission spectroscopy is an example of an instrumental method used to analyse metal ions in solutions.* • *To know that 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.*	• *To be able to state advantages of instrumental methods compared with the chemical tests in the specification* • *To 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.*	
Identifying cations (Triple only)	• *To know that sodium hydroxide solution can be used to identify some metal ions (cations).* • *To know that 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.* • *To know that 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.*	• *To be able to write balanced equations for the reactions to produce the insoluble hydroxides.*	
Identifying anions (Triple only)	• *To know that carbonates react with dilute acids to form carbon dioxide gas.*	• *To be able to use flame tests and ion tests to identify the ions present in an unknown solution*	

	• *Carbon dioxide can be identified with limewater* • *To know that 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* • *To know that sulfate ions in solution produce a white precipitate with barium chloride solution in the presence of dilute hydrochloric acid*		
End of module test			