

Co-teaching document new ELC Science 5960 and Foundation Level GCSE Combined Science: Trilogy (8464)

Chemistry: Component 3 – Elements, mixtures and compounds

ELC Outcomes	Summary of content covered in ELC	Same theme covered in Combined but extra content	New content on same topic	Rest of Combined Foundation content
1. Atoms and elements	<p>All substances are made of atoms. An atom is the smallest part of an element.</p> <p>The elements are shown in the periodic table and elements in the same group of the periodic table have similar properties.</p>	<p>5.1.1.1 Extra parts – atomic symbols (first 20, Group 1 and Group 7)</p> <p>5.1.2.1 Arrangement of the periodic table in terms of electronic structure.</p>	<p>5.1.1.3 Development of the model of the atom.</p> <p>5.1.2.2 Development of the periodic table.</p>	<p>5.11 Key ideas</p> <p>5.1.1.4 Relative electrical charges of subatomic particles.</p> <p>5.1.1.5 Size and mass of atoms</p> <p>5.1.1.6 Relative atomic mass</p> <p>5.1.1.7 Electronic structure</p> <p>5.1.2.4 Group 0</p> <p>5.1.2.5 Group 1</p> <p>5.1.2.6 Group 7</p>
2. Elements and compounds	<p>Atoms combine with different atoms to form a compound. Compounds can be made by metals combining with non-metals or by non-metals combining with other non-metals. Simple reactions can be described as word equations.</p>	<p>5.1.1.1 Extra parts – energy changes; formulae and naming compounds; symbol equations.</p>		<p>5.2.1 Chemical bonds, ionic, covalent and metallic.</p>
Practical development	Investigate the reaction when magnesium burns in			

	oxygen (air) to produce magnesium oxide. Compare the properties of iron and sulfur with those of iron sulphide.			
3. States of matter	The three states of matter are solid, liquid and gas. Definitions of the changes between the three states using the terms melting, boiling, condensing and freezing. Simple particle model to explain the states of matter.	5.2.2.1 Predictions of state based on data; explanations of changes of state based on energy changes. 5.2.2.2 State symbols		5.2.2.3 Properties of ionic compounds 5.2.2.4 Properties of small molecules
Practical development	Investigate the changes in state from ice to steam.			
4. Forms (allotropes) of carbon	Diamond and graphite are both forms of carbon but with different structures that determine their properties.	5.2.3.1 Diamond 5.2.3.2 Graphite Details of bonding	5.2.3.3 Graphene and fullerenes	
Practical development	Investigate the properties of graphite as a lubricant and for writing.			
5. Mixtures	Mixtures contain two or more substances which are not chemically combined. The appropriate method to separate mixtures by filtration, distillation, crystallisation or	5.1.1.2 More complex definition of mixture. Inclusion of fractional distillation		5.8.1.1 Pure substances 5.8.1.2 Formulations

	chromatography			
Practical development	Use filtration / distillation / crystallisation to separate substances. Compare the time needed to filter mixtures of water and calcium carbonate that has different particle sizes.			
6. Chromatography	Describe how to separate mixtures by chromatography. Recognise that in paper chromatography, a solvent moves through the paper carrying different compounds different distances.	5.8.1.3 Chromatography – definitions of phases; use of R_f and correct use of significant figures; differences between pure and impure substances.		
Practical development	Investigate the different colours in inks or food colours using paper chromatography	Required practical 12 (6) – Investigate how paper chromatography can be used to separate and tell the difference between coloured substances. Students should calculate R_f values.		
7. Extraction of metals from their ores	Unreactive metals are found in the Earth as metals. Most metals are found as compounds that need chemical reactions to extract the metal. Metals less reactive than carbon can be extracted by heating the metal ore with carbon. An ore is a rock containing	5.4.1.3 Extraction of metals and reduction: Definition of reduction and identification of which substances are reduced/oxidised. Interpretation of data relating to metal extraction. 5.10.2.2 Ways of reducing the use of resources – part relevant to metals	5.1.2.3 Metals and non-metals in terms of electronic structure.	5.3 Quantitative chemistry 5.4.1.1 Metal oxides 5.4.3 Electrolysis (including the required practical 9: Investigate what happens when aqueous solutions are electrolysed using inert electrodes.) 5.10.2.1 Life cycle assessment 5.10.2.2 Ways of reducing the use of resources

	<p>enough metal to make it economic to extract it and large amounts of rock have to be quarried or mined to get metal ores.</p> <p>The effects of extracting metals can be reduced by recycling.</p>			
Practical development	Model smelting by extracting copper from malachite or lead from galena using carbon			
8. Properties of metals	<p>Metals have giant structures of atoms with strong bonds between the atoms so most metals have high melting points.</p> <p>Properties of metals</p> <p>Relate uses of metals to their properties. eg copper and aluminium.</p>	<p>5.2.2.7 Properties of metals and alloys: arrangement of atoms in layers.</p> <p>5.2.2.8 Metals as conductors – explanation of conductivity in terms of electrons.</p>		
Practical development	Compare the properties such as conductivity or density of some metals.			
9. Alloys	<p>Most metals in everyday use are alloys.</p> <p>An alloy is produced by mixing small amount of other elements with the metal eg steel.</p>	<p>5.2.2.7 Properties of metals and alloys: explanation in terms of the distortion of the layers of atoms.</p>		
Practical development	<p>Investigate the melting points of tin, lead and solder.</p> <p>Investigate the hardness of</p>			

	different alloys or steels.			
10. Polymers	<p>Polymers are made from small molecules called monomers joined together in very long chains. The uses of polymers are related to their properties.</p> <p>Polymers are not biodegradable (not broken down by microbes) and there are problems with the disposal of polymers.</p>	5.2.2.5 Polymers – recognition of polymers from diagrams showing bonding and structure.		5.2.2.6 Giant covalent structures
Practical development	Compare the biodegradability of different polymers and other materials			

Chemistry: Component 4 – Chemistry in our world

ELC Outcomes	Summary of content covered in ELC	Same theme covered in Combined but extra content	New content on same topic	Rest of Combined Foundation content
1. Acids and metal reactions	<p>Acids react with some metals to produce hydrogen. Hydrochloric acid produces chlorides. Sulfuric acid produces sulfates. Write word equations for the reactions when given the names of the reactants. Describe and carry out the test for hydrogen</p>	<p>5.4.1.2 The reactivity series: Reactions of Group 1 and transition metals with water and dilute acid; formation of ions; construction of a reactivity series including hydrogen and carbon; displacement.</p> <p>5.8.2.1 Test for Hydrogen</p>		5.3 Quantitative chemistry
Practical development	<p>Investigate the reactions of magnesium, zinc and iron with hydrochloric and sulfuric acids.</p> <p>Investigate the amount of hydrogen produced when acids react with metals</p>			
2. Neutralisation	<p>An acid is neutralised by an alkali or base to produce a salt and water. An acid is neutralised by a carbonate to produce a salt, water and carbon dioxide. Write word equations for</p>	<p>5.4.2.2 Neutralisation of acids and salt production: Addition of nitric acid; ions, formulae and symbol equations.</p> <p>5.4.2.3 Soluble salts: details of salt production.</p>	5.4.2.4 The pH scale and neutralisation	5.3 Quantitative chemistry

	<p>the reactions when given the names of the reactants.</p> <p>Describe and carry out the limewater test for carbon dioxide.</p>	5.8.2.3 Test for carbon dioxide		<p>5.8.2.2 Test for oxygen</p> <p>5.8.2.4 Test for chlorine</p>
Practical development	<p>Investigate the neutralisation of acids by bases, alkalis and carbonates.</p> <p>Produce solid salt crystals by evaporation of a salt solution.</p>	<p>Required practical 8: Preparation of a pure, dry sample or a soluble salt from an insoluble oxide or carbonate, using a Bunsen burner to heat dilute acid and a water bath or electric heater to evaporate the solution.</p>		
3. Energy and rate of reaction	<p>Describe reactions that transfer energy to the surroundings so that temperature increases.</p> <p>Describe reactions that take in energy from the surroundings so the temperature decreases.</p>	5.5.1.1 Energy transfers during exothermic and endothermic Reactions: definitions.		5.5.1.2 Reaction profiles and activation energy
Practical development	<p>Investigate the temperature changes that take place in combustion, oxidation and neutralisation reactions.</p> <p>Investigate the temperature changes when eg ammonium chloride dissolves in water or citric acid reacts with sodium hydrogen carbonate</p>	<p>Required practical 10: Investigate the variables that affect temperature changes in reacting solutions such as eg acid plus metals, acid plus carbonates, neutralisations, displacements of metals.</p>		

4. Increasing the rate of a chemical reaction.	<p>Describe the increase in the rate of a reaction caused by increasing the:</p> <ul style="list-style-type: none"> • temperature • concentration of reactants • surface area of reactants <p>or by adding a catalyst.</p> <p>Measure and record the:</p> <ul style="list-style-type: none"> • time for a reactant to be used up. • volume of gas produced • time for a solution to change colour/clarity 	<p>5.6.1.2 Factors which affect the rates of chemical reactions</p> <p>5.6.1.4 Catalysts: much more detail regarding how catalysts work</p>	<p>5.6.1.1 Calculating rates of reaction including use of graphs.</p> <p>5.6.1.3 Collision theory and activation energy</p>	5.6.2 Reversible reactions and dynamic equilibrium
Practical development	Investigate how to make a chemical reaction go faster.	Required practical 11: Investigate how changes in concentration affect the rates of reactions by a method involving measuring the volume of a gas produces and a method involving change in colour or turbidity.		
5. Changes in Earth's atmosphere	<p>Development of the Earth's current atmosphere.</p> <p>Photosynthesis and changes in the early atmosphere.</p>	<p>5.9.1.2 The Earth's early atmosphere: additional detail.</p> <p>5.9.1.3 How oxygen increased: Symbol equation for photosynthesis.</p>		
Practical development	Investigate the production of oxygen by aquatic plants in different conditions by counting bubbles			
6. The current atmosphere	Carbon dioxide from the early atmosphere has been locked up as	5.9.1.4 How carbon dioxide decreased: Additional detail.		

	carbonates and fossils in rocks. The present composition of the Earth's atmosphere	5.9.1.1 The proportions of different gases in the atmosphere		
Practical development	Compare the amount of carbon dioxide in fresh air and exhaled air			
7. Crude oil and fuels	Crude oil is a mixture of a large number of compounds. Fractional distillation to produce useful fuels, such as petrol and diesel.	5.7.1.1 Crude oil, hydrocarbons and alkanes: structural formulae; names of first four alkanes. 5.7.1.2 Fractional distillation and petrochemicals: additional details of the process and the families of compounds. 5.7.1.3 Properties of hydrocarbons: additional details relating to trends, properties and molecule size.	5.7.1.4 Cracking and alkenes	
Practical development	Compare prepared samples of fractions from crude oil/ demonstration of fractional distillation of prepared crude oil sample.			
8. Burning fuels	The products of total combustion of a fuel are carbon dioxide, water vapour and oxides of nitrogen. Some fuels produce sulfur dioxide when burned. Partial combustion due to	5.7.1.3 Properties of hydrocarbons: balanced equation for combustion of hydrocarbons 5.9.3.1 Atmospheric pollutants from fuels: predict products of combustion from given data.		

	<p>a limited air supply results in the production of carbon monoxide and, often, soot particles.</p> <p>Potential harm to the environment by burning fossil fuels:</p> <ul style="list-style-type: none"> oxides of sulfur and nitrogen (N_{Ox}) cause acid rain and may harm human health. carbon monoxide can cause death. solid particles can cause global dimming and harm human health. 	5.9.3.2 Properties and effects of atmospheric pollutants.		
Practical development	<p>Investigate the products of combustion.</p> <p>Compare 'roaring' and 'safety' Bunsen burner flames.</p> <p>Investigate the production of acid rain (spray a large cotton wool 'cloud' with water; hold above burning matches; squeeze the 'cloud' over a UI solution).</p>			
9. Human influences on the atmosphere	Carbon dioxide is produced by burning fossil fuels.	5.9.2.2 Human activities which contribute to an increase in greenhouse gases in the	5.9.2.1 Greenhouse gases 5.9.2.3 Global climate change 5.9.2.4 The carbon footprint and its reduction	

	<p>Methane is produced from landfills and farming.</p> <p>The effects of increased carbon dioxide and methane on the temperature of the atmosphere.</p>	<p>atmosphere: modelling change; evaluating evidence about global climate change.</p>		
10. Water for drinking	<p>Safe drinking water has few dissolved substances and low levels of microbes.</p> <p>Safe drinking water is produced by filtration and sterilisation.</p>	<p>5.10.1.2 Potable water: additional detail.</p>	<p>5.10.1.1 Using the Earth's resources and sustainable development 5.10.1.3 Waste water treatment</p>	<p>5.10.2.1 Life cycle assessment 5.10.2.2 Ways of reducing the use of resources</p>
Practical development	<p>Distil a salt water solution to produce fresh water.</p> <p>Investigate the amount of dissolved solids in water from different locations by evaporating samples and weighing residues.</p>	<p>Required practical 13: analysis and purification of water samples from different sources, including pH, dissolved solids and distillation. (cf ELC Biology Component 2 Outcome 7)</p>		