GCSE Science – Schemes of Work

Chemistry

Unit 1: Chemistry 1

*The suggested timings relate to the learning outcomes rather than to the activities.

Spec Reference	Summary of the Specification Content	Learning Outcomes *What most candidates should be able to do*	Suggested timing (hours)	***Opportunities to develop Scientific Communication skills*** ***Possible activities***	Opportunities to apply Practical and Enquiry skills	Self/Peer assessment Opportunities & resources *reference to past questions that indicate success Candidates should:*
C1.1 Fundamental Ideas in Chemistry						
C1.1.1 Atoms						
a	All substances are made of atoms.	Recognise that elements are made from only one type of particle known as an atom	1	**Developing explanations using ideas and models** Use of scientific conventions to identify elements by chemical symbols.	**Developing explanations using ideas and models** Modelling of atoms (using physical models or computer simulations)	Resources: Periodic table can be found on the BBC website at www.bbc.co.uk/learningzone/clips by searching for clip '4406'. PPT C1 1.1 F & H
b	Atoms are represented by symbols.	Describe how symbols represent atoms of different elements and the conventions for writing these symbols				
c	Atoms have a small central nucleus, of protons and neutrons, surrounded by electrons.	Describe the structure of an atom in terms of protons, neutrons and electrons		Calculate how many protons, electrons and neutrons are therein an atom of a specified element?. Use examples with atomic numbers from 1-20	**Developing explanation using ideas and models** **Describe** a model for the structure of an atom. **Describe** what scientists used to think atoms were like and **explain** what evidence changed people's thinking?	

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d	The relative electrical charges are as shown: Proton – charge of +1 Neutron – no charge Electron – charge of -1 Two of these particles are charged.	State the charges on sub-atomic particles.				
e	In an atom, the number of electrons is equal to the number of protons in the nucleus. Atoms have no overall electrical charge.	Interpret the periodic table to work out the number of each type of sub-atomic particle for a named atom.				
f	All atoms of a particular element have the same number of protons.	Discuss the differences between elements in terms of the number of protons, neutrons and electrons they have			Developing explanations using ideas and models Describe how many electrons there can be in the first, second and third energy shells.	

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g h	Atoms of different elements have different numbers of protons. The number of protons in an atom of an element is its atomic number. The sum of the protons and neutrons in an atom is its mass number. Electrons occupy particular energy levels. Each electron in an atom is at a particular energy level (in a particular shell). The electrons in an atom occupy the lowest available	Define the terms atomic number and mass number Use the idea of electron shells to describe electron arrangements for elements up to 20			Communication for audience and purpose Role Play – using pupils to represent protons, neutrons and electrons, build up the idea of full and complete energy shells with 2 in the first, 8 in the second and 8 in the third energy shell	

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	energy levels (innermost available shells).					

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C1.1.2 The Periodic Table						
a b	Elements in the same group in the periodic table have the same number of electrons in their highest energy level (outer electrons) and this gives them similar chemical properties. The elements in Group 0 of the periodic table are called the noble gases. They are unreactive because their atoms have stable arrangements of electrons	Use the pattern of the electron arrangement of elements within a group to predict the behaviour of other members of the group Describe the electronic structure of the noble gases Explain why atoms with full outer shells are unreactive	1	Use of word equations to communicate chemical reactions How Science Works: Making a prediction. What is the reaction of Caesium (Cs) likely to be? show video clip of reaction with water. Extended writing Work in groups to share ideas about the pattern of electronic structure in Group 0 and research the properties of the noble gases. They describe and explain their findings linking complete energy shells to the idea of stability and that they are unreactive	Working critically with primary evidence What do you see when alkali metals are placed into water? (Na, Li, K only) Why does adding universal indicator to the water result in a change in colour to purple after the reaction of alkali metals with water? How does the reactivity change for this reaction change as you go down the group? Reaching agreement on scientific explanations Why does the reactivity of alkali metals increase down the group? Discuss and agree an explanation.	Peer assessment. Presentations from group work are peer assessed against criteria based on how effectively they have communicated the learning outcomes, PPT C1.1.2 Foundation tier only

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C1.1.3 Chemical Reactions						
a	When elements react, their atoms join with other atoms to form compounds. This involves giving, taking or sharing electrons to form ions or molecules. Compounds formed from metals and non-metals consist of ions. Compounds formed from non-metals consist of molecules. In molecules the atoms are held together by covalent bonds.	Describe the electron arrangements of sodium and chlorine. Explain how an electron is transferred to chlorine from sodium to form two charged particles called ions that attract each other. Recognise that compounds made from a metal and a non-metal are made from ions. Describe the bonding in non-metal compounds as covalent	1	Developing explanations using ideas and models Discuss: Reasons why sodium and chlorine react together incorporating the idea of the stability of a full electron shell. Developing explanations using ideas and models Research and share outcomes through presenting and writing descriptions and explanations: • bonding in water ,carbon dioxide and chlorine gas. [*Highlight the need to be able to draw diagrams of simple covalent molecules]* • the work of John Dalton to	Stimulus Show video clip or demonstrate sodium burning in chlorine to make sodium chloride. Reaching agreement on scientific explanations How do two chemicals- one a toxic gas and the other highly reactive with water combine to make a chemical compound which is essential to human life? If patterns are applied to the chemical compound H_2O , then you might expect it to be a gas and not a liquid at room temperature. Discuss what the implications would be to living	.A video on alkali metals can be found on the BBC website at www.bbc.co.uk/learningzone/clips by searching for clip '4407'. You can find a variety of resources including video clips on the website at www.rsc.org/education/teachers/resources/alchemy/index.htm

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b c	Chemical reactions can be represented by word Equations Chemical reactions can be represented by word equations or by symbol equations. No atoms are lost or made during a chemical reaction so the mass of the products equals the mass of the reactants	Construct word equations for chemical reactions using correct symbols **HT Explain how to balance a given symbol equation** Use the concept of conservation of mass to explain that all atoms involved in a reaction must be accounted for. Calculate the amount of a product or reactant from masses of other products and reactants (the use of relative atomic masses and relative molecular masses is not needed here). **HT only** **Construct balanced symbol equations to represent chemical reactions**		include his ideas about atoms, elements, compounds, bonding and symbols **Developing explanations using ideas and models** • Write word equations for all reactions seen so far in the unit • Develop skills to communicate through use of symbolic equations. Apply these skills to write balanced symbol equations for all equations met so far in the unit	and non-living things if water on Earth were normally a gas? **Working critically with primary/secondary evidence** Using the idea of reacting masses to calculate the amount of a product or reactant from masses of other products and reactants	PPT C1.1.3 Foundation tier only

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					Assessing risk and working safely, Obtaining and presenting evidence, Working critically with evidence What happens to the mass of the test tube when you carry out a precipitation reaction? Does the same thing happen with all reactions?	

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C1.2 Limestone and Building Materials. Rocks provide essential building materials. Limestone is a naturally-occurring resource that provides a starting point for the manufacture of cement and concrete.						
C1.2.1 Calcium carbonate						
a	Limestone, mainly composed of the compound calcium carbonate ($CaCO_3$), is quarried and can be used as a building material.	Describe and explain how limestone($CaCO_3$) is obtained from the ground Evaluate the positive benefits of using limestone as a building material against the negative aspects of quarrying. Determine the key chemical reactions of limestone ($CaCO_3$), and present these as a flow chart Make links between the chemical reactions of limestone ($CaCO_3$) and the many uses of this chemical compound.	2	**Working critically with secondary evidence** Use data to discuss amounts of limestone used annually in Britain. Generate a pie chart to show these uses **Applications, Implications and cultural understanding** In groups consider and evaluate the environmental, social and economic effects of using limestone and producing building materials from it. **Extended writing:- presenting and writing arguments** Write a letter to a local paper or MP either supporting or objecting to the opening of a proposed new limestone quarry in their area	**Planning an approach, Assessing risk and working safely, Obtaining and presenting evidence,** How can limestone be changed into limewater? What chemical reactions are involved? HT only **Balance symbol equations from these reactions**	Debate the advantages and disadvantages of opening a limestone quarry in the near to your school. Assess against how well the argument was developed and presented. PPT C1 1.2.1 Foundation and Higher tier

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b d e	Calcium carbonate can be decomposed by heating (thermal decomposition) to make calcium oxide and carbon dioxide. Calcium oxide reacts with water to produce calcium hydroxide, which is an alkali that can be used in the neutralisation of acids. A solution of calcium hydroxide in water (limewater) reacts with carbon dioxide to produce calcium carbonate. Limewater is used as a test for carbon			Developing explanations using ideas and models From discussion about the chemical reactions of limestone construct flow chart and show word equations for reactions involved.		

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	dioxide. Carbon dioxide turns limewater cloudy.					
c f	The carbonates of magnesium, copper, zinc, calcium and sodium decompose on heating in a similar way. Carbonates react with acids to produce carbon dioxide, a salt and water. Limestone is damaged by acid rain.	Use the chemical reactions of metal carbonates to explain the cause and effect of acid rain	1		**Assessing risk and working safely, Obtaining and presenting evidence** What happens when metal carbonates react with acids? **Planning an approach,** Given five samples of rock ores each containing different amounts of copper carbonate, plan an investigation to determine which ore is most likely to contain the most copper carbonate.	Resources: Mg, Cu, Zn, Ca, Na, carbonates. Dilute hydrochloric acid, test tubes, boiling tubes with delivery tubes, clamps and stands, matches and spills and limewater.
g	Limestone is heated with clay to make cement. Cement is mixed with sand to make mortar	Explain the differences in the making and composition of cement, mortar and concrete.	1	**Research:** Find out why limestone is used in agriculture **Communication for audience and purpose:**	**Obtaining and presenting primary evidence:** Which mix produced the best concrete? **Planning an approach-** which is	http://www.bbc.co.uk/learningzone/clips/why-concrete-is-brittle/13763.html peer assess either

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	and with sand and aggregate to make concrete.			How are cement, mortar and concrete made? Present this is a way that is interesting and accessible to another group of Year 10 pupils Use the video clip as a stimulus for writing an information sheet about concrete	the best composition for reinforced concrete?	of the communication activities in terms of its content, interest and presentation

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C1.3 Metals Metals are very useful in our everyday lives. Ores are naturally-occurring rocks that provide an economic starting point for the manufacture of metals. Iron ore is used to make iron and steel. Copper can be easily extracted but copper-rich ores are becoming scarce so new methods of extracting copper are being developed. Aluminium and titanium are useful metals but are expensive to produce. Metals can be mixed together to make alloys.						
C1.3.1 Extracting metals						
a	Ores contain enough metal to make it economical to extract the metal. The economics of extraction may change over time.	Explain how an ore is different from a rock.	1	**Discussion:** on making metals, ores, gold and silver etc. Discuss and relate extraction methods to limestone quarrying, and talk about metal recycling to reduce impact of quarrying and economic considerations.	**Enquiry-** have a range of ore sample to allow pupils to compare directly with the metal which is extracted from them **Working critically with primary evidence** Use the reaction of metals with dilute acid to gather evidence as to why gold, copper and silver are used for jewellery	Any available e.g. malachite (copper) , haematite (iron)
b	Ores are mined and may be concentrated before the metal is extracted and purified.	Explain why it may be necessary to concentrate an ore before extraction.		**Applications and Implications: Explain** the benefits a company can gain by concentrating a metal ore before refining it.	**Practical activity:** Can you concentrate an ore? **Working critically with primary evidence**	

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c	Unreactive metals such as gold are found in the Earth as the metal itself but most metals are found in compounds that require chemical reactions to extract the metal.	Explain why some rare metals were discovered before more common metals			1. compare each other's' results. 2. Plot graph of class results of mass used against mass lost, 3. Mention variables are continuous. 4. Identify range of data. 5. Describe relationship between mass used and mass lost. 6.	
d	Metals that are less reactive than carbon can be extracted from their oxides by reduction with carbon, for example iron oxide is reduced in the blast furnace to make iron.	Use the idea of the reactivity to explain how metals are extracted from their ores	1	Extended writing- Presenting and writing descriptions and explanations Using an example (eg the blast furnace), **explain** how metals which are less reactive than carbon can be extracted from their ore by reduction by carbon	Working critically with evidence The first samples of copper man made were found in camp fires. How could this have happened? State and test your hypothesis Can you get copper back from copper oxide?	Consider the quality of written work to assess Write clear description and explanations about the process. Link ideas together so that there is a logical flow to the

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						piece. All writing is accurately written with minimal errors in spelling, punctuation and grammar.

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f	Copper can be extracted from copper-rich ores by heating the ores in a furnace (smelting). The copper can be purified by electrolysis. The supply of copper rich ores is limited	Use data on current availability of metal ores to determine how much of the metal is available for extraction	1	Communication for audience and purpose Research : • review/ investigate how copper is mined, extracted and purified by electrolysis. • review/ investigate how aluminium is mined, extracted and purified by electrolysis.	Obtaining and presenting evidence, Electrolysis of copper sulfate solution with copper electrodes Demonstration of electrolysis of molten zinc chloride or lead bromide.	RSC Alchemy has section on Copper refining which can be found at www.rsc.org/Education/Teachers/Resources/Alchemy/index.htm Copper sulfate solution 0.5 mol dm^{-3}, copper electrodes, power pack 100cm^3 beaker, wires and light bulb. Crucible, carbon electrodes, power supply, connecting wires, lamp, Bunsen burner and fume cupboard.
e	Metals that are more reactive than carbon, such as aluminium, are extracted by electrolysis of molten compounds. The use of large amounts of energy in the extraction of these metals makes them expensive.	Predict the relative energy costs associated with different kinds of metal extraction		Present findings in a way that makes the information understandable and interesting to others in the group	Applications, Implications and cultural understanding Investigate using solutions how to electroplate everyday objects and consider the uses of this technique	
h	Copper can be obtained from solutions of copper					

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g	New ways of extracting copper from low-grade ores are being researched to limit the environmental impact of traditional mining. Copper can be extracted by phytomining, or by bioleaching.	Describe and explain how phytomining and biobleaching limit the environmental effect of traditional mining	1	Discuss the reactivity series and link to Data sheet and metal extraction made. Presenting and writing arguments: Research so that pupils can describe and explain how phytomining and biobleaching limit the environmental effect of traditional mining	Obtaining and presenting evidence Use the displacement reactions of copper sulfate solution and a range of metals eg. Mg, Fe, Al, Zn to **explain** the order of reactivity What would the advantages and disadvantages of a necklace made from iron be compared with one made from copper? Developing Argument: **Evaluate** the merits of a method of extraction in terms of cost and environmental impact . Practical Activity: Grow cabbage plants or other types of brassica plants to extract metal from	Assess against how well the argument was developed and presented.

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					contaminated soil, and process to obtain the metal.	
j	We should recycle metals because extracting them uses limited resources and is expensive in terms of energy and effects on the environment.	Evaluate benefits of recycling metals in terms of economic and environmental benefits.	1	Applications, Implications and cultural understanding **Research :** Working in pairs/groups, research/find out the benefits of recycling metals such as iron, copper, aluminium. Communication for audience and purpose Give groups of candidates a metal, and some questions. Candidates prepare an A4 sheet, poster or word document to email to rest of class about their answers. Questions could be: ▪ How is your metal extracted, and why is this method used? ▪ What pollutants are produced in its		Candidates present five minute briefing on their metal. PPT C1 1.3.1 Foundation and Higher tier

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				extraction? ▪ How much of the metal is re-cycled? ▪ How is it recycled? ▪ Explain why recycling the metal is both good for the environment, economically sound (saves money), and saves on limited reserves of ores.		

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C1.3.2 Alloys						
a b	Iron from the blast furnace contains about 96% iron. The impurities make it brittle and so it has limited uses. Most iron is converted into steels. Steels are alloys since they are mixtures of iron with carbon. Some steels contain other metals. Alloys can be designed to have properties for specific uses. Low-carbon steels are easily shaped, high-carbon steels are hard, and stainless	Explain how iron from a blast furnace is impure and has limited uses Explain how and why iron is turned into steel.	1	Communication for audience and purpose Research : • Complete a project on iron, steel and alloys to explain their differences. • the meaning of 'carat' in relation to gold, and the reasons for the different proportions of gold in each type of gold.	Can you make some bronze? Is there enough to make a medal? Working critically with secondary evidence Use data- How does the percentage of carbon in a steel affect its properties?	

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c	steels are resistant to corrosion. Most metals in everyday use are alloys. Pure copper, gold, iron and aluminium are too soft for many uses and so are mixed with small amounts of similar metals to make them harder for everyday use.	Explain why the properties of alloys are related to their structures				

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C1.3.3 Properties and uses of metals						
a b	The elements in the central block of the periodic table are known as transition metals. Like other metals they are good conductors of heat and electricity and can be bent or hammered into shape. They are useful as structural materials and for making things that must allow heat or electricity to pass through them easily. Copper has properties that make it useful for electrical wiring and plumbing.	Describe and explain the properties of named transition elements.	1	Return to periodic table and mark the position of the transition metals. Communication for audience and purpose Discussion : Teacher-led discussion on properties and uses of copper, aluminium and titanium.. Concentrating on the idea of using properties to explain which metal is best for the job. Research : The properties and uses of a range of transition metals: chromium, manganese, mercury etc. Encourage different groups to research different elements so that the findings can be shared on a Wiki	Working critically with primary evidence Practical: (KS3 Revision- if appropriate) Can you demonstrate some of the properties of metals?	Metal samples such as iron (thin long nails or wire), copper foil, aluminium foil, lead foil, and any others available, beakers and access to hot water, conductivity testing kit (power pack, wires, and bulb). Peer assessment: Encourage pupils to peer assess the different element pages in terms of quality of the its content, interest and presentation

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c	Low density and resistance to corrosion make aluminium and titanium useful metals.					

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C1.4 Crude Oil and Fuels Crude oil is derived from an ancient biomass found in rocks. Many useful materials can be produced from crude oil. Crude oil can be fractionally distilled. Some of the fractions can be used as fuels. Biofuels are produced from plant material. There are advantages and disadvantages to their use as fuels. Fuels can come from renewable or non-renewable resources. C1.4.1 Crude oil						
a b	Crude oil is a mixture of a very large number of compounds. A mixture consists of two or more elements or compounds not chemically combined together. The chemical properties of each substance in the mixture are unchanged. It is possible to separate the substances in a	Represent alkanes using molecules Describe what the structural formula shows.	2	Recap what a mixture is, and explain that crude oil is a mixture. Discussion: How these properties affect how we use hydrocarbons as fuels, diesel in winter, amount of soot etc. Developing explanations using ideas and models Name each formula and draw methane, ethane and propane as examples of alkanes in both forms. Show as models. Elicit general formula for alkanes. Discuss: the use of a line as	Demonstration: Experiment of distillation of crude oil (CLEAPPS recipe), followed by analysis and burning of obtained fractions. Obtaining and presenting primary evidence Draw diagram of experiment and chart the results from the demonstration: Molymods or similar.	Fake crude oil (CLEAPPS/Hazcard recipe), boiling tube with side arm, bung for boiling tube with 0 - 360^{0}C thermometer, side arm, four test tubes, 250cm^3 beaker, four watch glasses, heat mat, matches and spills and fume cupboard.

fraction	colour	viscosity	ease of ignition	amount of smoke

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c	mixture by physical methods including distillation. Most of the compounds in crude oil consist of molecules made up of hydrogen and carbon atoms only (hydrocarbons). Most of these are saturated hydrocarbons called alkanes, which have the general formula C_nH_{2n+2} .			representing a single covalent bond.		

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C1.4.2 Hydrocarbons						
b	The many hydrocarbons in crude oil may be separated into fractions, each of which contains molecules with a similar number of carbon atoms, by evaporating the oil and allowing it to condense at a number of different temperatures. This process is fractional distillation.	Describe fractional distillation and explain how the process is based on each compound having a different boiling point.	1	Working critically with secondary evidence Discussion: Differences between the demo and fractional distillation as continuous process. Use video as stimulus.	Developing argument Use idea supply and demand of the following fractions from crude oil • Petrol • Paraffin • Diesel • Fuel oil and other long chain oils to explain why more shorter chain alkanes are needed.	Information and videos of fractional distillation can be found on BBC GCSE Bitesize at www.bbc.co.uk/schools/gcsebitesize PPT C1 1.4.1 & 1.4.2- Foundation and Higher tier
c	Some properties of hydrocarbons depend on the size of their molecules. These	Classify the fractions produced from crude oil according to their structure, properties and uses.		Communication for audience and purpose		

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	properties influence how hydrocarbons are used as fuels.			Research and present an overview of the main fractions from crude oil in terms of their structure, properties and uses. Present these as a brochure		

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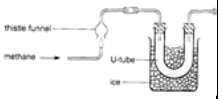
C1.4.3 Hydrocarbon fuels						
a c d	Most fuels, including coal, contain carbon and/or hydrogen and may also contain some sulfur. Sulfur dioxide causes acid rain, carbon dioxide causes global warming, and solid particles cause global dimming. Sulfur can be removed from fuels before they are burned, for example in vehicles. Sulfur dioxide can be removed from the	Describe the products which are released when a fuel burns Explain why these waste products can pose problems Describe how harmful emissions are reduced. Evaluate the impact on the environment of burning hydrocarbon fuels	1	**Applications, Implications and cultural understanding** Describe the problems caused to human health by particulates Research t- what are the effects of carbon monoxide on the human body? Discuss examples of where carbon monoxide has been the cause of accidental deaths, how this has happened and ways to ensure public safety? **Communication for audience and purpose** Write a safety brochure outlining the safe use of disposable barbeques. Include details of the health risks of incorrect use. **Applications, Implications and cultural understanding** What are the advantages and disadvantages of using hydrogen as a	Use observations from following demonstration to describe and explain the products of combustion **Working critically with primary evidence** How can hydrogen (and oxygen) be produced from acidified water?	PPT C1 1.4.3 Foundation and Higher tier Burning a candle, and passing exhaust gases through anhydrous copper sulfate/cooling U tube and cobalt chloride paper, then limewater. 

Spec Reference	Summary of the Specification Content	Learning Outcomes *What most candidates should be able to do*	Suggested timing (hours)	***Opportunities to develop Scientific Communication skills*** ***Possible activities***	Opportunities to apply Practical and Enquiry skills	Self/Peer assessment **Opportunities & resources** *reference to past questions that indicate success Candidates should:*
e	waste gases after combustion, for example in power stations. Biofuels, including biodiesel and ethanol, are produced from plant material. There are economic, ethical and environmental issues surrounding their use.	Evaluate developments in the production and uses of better fuels for example hydrogen and ethanol		fuel? Developing argument Why are people reluctant to give up using petrol and diesel in their cars in favour of fuels such as ethanol and hydrogen. ? What could be done to encourage this change?		
b	The combustion of hydrocarbon fuels releases energy. During combustion the carbon and hydrogen in the fuels are oxidised.	Calculate the amount of energy produced by a burning fuel. Discuss different types of error, and how to reduce them.	1	Discuss: ideas of reproducibility of results and using other people's data/secondary sources to confirm findings. Also good to mention types of errors eg zero error, systematic error, random errors and how to deal with them.	Obtaining and presenting evidence Skills involved: • Plan an approach • Select and mange variables • Assess risk and work safely	Boiling tube/beaker. Tripod, gauze, fuel burner eg alcohol burner, micro-burner, candle, mounted needle to hold Weetabix bottle

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					How much energy is produced when different fuels are burnt?	top, balance and measuring cylinders.

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C1.5 Other useful substances from crude oil. Fractions from the distillation of crude oil can be cracked to make smaller molecules including unsaturated hydrocarbons such as ethene. Unsaturated hydrocarbons can be used to make polymers and ethene can be used to make ethanol. Ethanol can also be made by fermentation.						
C1.5.1 Obtaining useful substances from crude oil						
a	Hydrocarbons can be broken down (cracked) to produce smaller, more useful molecules. This process involves heating the hydrocarbons to vaporise them. The vapours are either passed over a hot catalyst or mixed with steam and heated to a very high temperature so that thermal	Describe the process of cracking	1	Developing argument 100 years ago petrol was a waste product, but now we can't get enough of it! Explain- in pairs- how cracking how cracking makes larger molecules into smaller, more useful ones including a group of compounds called alkenes Communication for audience and purpose How can you best communicate the	Applications, Implications and cultural understanding Demonstrate cracking or use video to show process of cracking.	You can find a variety of resources including video clips on the RSC website at www.rsc.org/Education/Teachers/Resources/Alchemy/index.htm See Exampro Extra Online Practical Guide: Cracking liquid paraffin.

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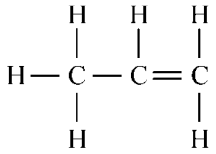
	decomposition reactions then occur. The products of cracking include alkanes and unsaturated hydrocarbons called alkenes.			structural formulae of alkenes ?		
b		Describe what alkenes are and how they can be written and drawn				
b c d e	Alkenes have the general formula C_nH_{2n} . Alkenes react with bromine water, turning it from orange to colourless. Some of the products of cracking are useful as fuels.	Recognise alkenes from their formulae in any of the forms: C_3H_6  Explain how cracking solves energy supply and demand problems.		**Explain** the decolourisation of bromine water when added to an alkene using symbols and equations **Predict**: reactions of a variety of molecules displaying single and double bonds with bromine water. **Communication for audience and purpose** Why is the breaking down of large molecules useful?	**Obtaining and presenting evidence,** How do you test for the presence of a double bond in an unknown hydrocarbon?	

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		Explain how the addition a of bromine water can be a test for a double bond				

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C1.5.2 Polymers						
a	Alkenes can be used to make polymers such as poly(ethene) and poly(propene). In these reactions, many small molecules (monomers) join together to form very large molecules (polymers).	Describe what a polymer is and why it is useful Explain how polymers are made from alkanes Use equations to model the formation of polymers Explain that different polymers have different properties and uses Explain why the development of biodegradable polymers is important to the environment Evaluate the advantages and disadvantages of using products from crude oil	1	**Communication for audience and purpose** Use molecular models to demonstrate how polymers form. Modelling polymer chains could be by: ▪ each pupil making a monomer either with model or drawn onto front of paper chain piece. ▪ two pupils joining their monomer together and drawing on back structure at the joining. ▪ groups joining together to make long chain with monomer structure on front of each piece of paper and polymer structure on rear of chain. Explain how ethene or propene polymerises	**Demo:** Making Perspex Pupils can look into the applications of this process by researching the discovery of polytetrafluoroethene (PTFE) and some of its uses	PPT 1.5.2 Foundation only

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b	Polymers have many useful applications and new uses are being developed, for example: new packaging materials, waterproof coatings for fabrics, dental polymers, wound dressings, hydrogels, smart materials (including shape memory polymers)	Know that we use a wide range of polymers developed for specific purposes. Identify from properties relevant uses for a polymer.	1	Communication for audience and purpose Should we burn oil as a fuel, or should we make it into polymers and other chemicals? What are the advantages and disadvantages of burning products of crude oil rather than using them to make polymers and other chemicals?	Obtaining and presenting evidence, ▪ making a polymer from cornstarch Selecting and managing variables ▪ How strong is a plastic bag? ▪ Are polymer fabrics waterproof? ▪ How much water will a nappy absorb?	PPT 1.5.2 (ii) Peer assess the QWC using the criteria identified in the PowerPoint
c	Many polymers are not biodegradable: so they are not broken down by microbes and this can lead to problems with waste disposal.	Evaluate the impact of polymers on the environment and identify possible solutions		Developing argument Charging for carrier bags and the use of non- disposable shopping bags is a good thing. Discuss		

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d	Plastic bags are being made from polymers and cornstarch so that they break down more easily. Biodegradable plastics made from cornstarch have been developed.	Use the idea of resource limitation to discuss the effect of crude oil running out on the production of plastics Evaluate information about the ways in which crude oil and its products are used.				

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C1.5.3 Ethanol						
a b	Ethanol can be produced by reacting ethene with steam in the presence of a catalyst. Ethanol can also be produced by fermentation with yeast, using renewable resources.	Compare the environmental and economic advantages and disadvantages of producing ethanol from renewable and non-renewable sources.	1	Applications, Implications and cultural understanding Evaluate the advantages and disadvantages of making ethanol from renewable and non-renewable sources.	Obtaining and presenting evidence, How could you make ethanol from yeast?	PPT C1 1.5.3- Foundation and Higher tier Part c of higher example could be used as a debate with peer assessment as to how many of the points from the mark scheme have been developed in the argument

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C1.6 Plant oils and their uses Many plants produce useful oils that can be converted into consumer products including processed foods. Emulsions can be made and have a number of uses. Vegetable oils can be hardened to make margarine. Biodiesel fuel can be produced from vegetable oils.						
C1.6.1 Vegetable oils						
a b	Some fruits, seeds and nuts are rich in oils that can be extracted. The plant material is crushed and the oil removed by pressing or in some cases by distillation. Water and other impurities are removed. Vegetable oils are important foods and fuels as they provide a lot of energy. They also provide us with nutrients.	Describe two ways in which vegetable oils are obtained. Evaluate the economic, ethical and environmental issues surrounding the use of biofuels	1	Presenting and writing descriptions and explanations How olive oil is made? What are the positives, negatives and risks in using plant material to produce and use as fuels? Discuss : The role of oils (and fats) in cooking- discuss boiled potatoes and chips; compare flavour, texture, cooking time and smell Presenting and writing arguments Describe : How biofuels are made. Explain:	Obtaining and presenting evidence, Observe the extraction of lavender oil or orange/lemon oil by steam distillation. Applications, Implications and cultural understanding • What is a carbon-neutral fuel? • Is biodiesel a carbon-	BBC report on biofuels BBC website www.bbc.co.uk by searching for 'Quick guide: Biofuels' .

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c	Vegetable oils have higher boiling points than water and so can be used to cook foods at higher temperatures than by boiling. This produces quicker cooking and different flavours but increases the energy that the food produces when it is eaten.			Why biofuels are useful Evaluate : The economic, ethical and environmental issues surrounding the use of biofuels	neutral fuel? In countries such as Malaysia large areas of forest are cleared for palm oil production. • Describe the effect of this on the human population and habitats. • Explain why it may be better to use clearer grassland rather than cleared forest to grow crops • Evaluate the advantages and disadvantages of using cleared farmland for this purpose.	

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C1.6.2 Emulsions						
a b	Oils do not dissolve in water. They can be used to produce emulsions. Emulsions are thicker than oil or water and have many uses that depend on their special properties. They provide better texture, coating ability and appearance, for example in salad dressings, ice creams, cosmetics and paints. HT only **Emulsifiers have hydrophilic and hydrophobic Properties.**	Describe how emulsions form Describe the properties of emulsifiers Explain the uses of emulsions in food cosmetics and paints Present annotated diagrams to show how emulsifier molecules have a hydrophilic 'head' and a hydrophobic 'tail'	1	**Presenting and writing descriptions and explanations** **Discuss:** Why we need emulsifiers in foods and the risks they can pose. **Describe:** what happens when oil and water mix? **Explain** how does an emulsifier work? **Communication for audience and purpose** Prepare a short presentation giving the advantages of emulsions in either food products, paint or cosmetics **HT only** Explain the role of an emulsifying agent using the terms hydrophobic and hydrophilic.	**Selecting and managing variables** **Assessing risk and working safely** Which is the best emulsifying agent - egg, mustard or lecithin? Identify: • risks in the practical, and how to control them. • variables to control How long does it take for emulsions to separate out? Working critically with primary evidence How can you analyse your results and display the results effectively?	PPT C1 1 .6.1& 2 Vegetable Oils and emulsions Foundation and Higher tier

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C1.6.3 Saturated and unsaturated oils						
a	Vegetable oils that are unsaturated contain double carbon–carbon bonds. These can be detected by reacting with bromine water.	Describe how to detect unsaturated bonds	1	**Working critically with primary/secondary evidence** **Describe:** What would you see if bromine water were added to sunflower oil and olive oil? **Explain** these observations	**Working critically with secondary evidence** How do the melting points of oils such as olive oil, palm oil, sunflower oil and rapeseed oil make them useful ingredients in spreads, cakes and pastries?	
b	**HT only** **Vegetable oils that are unsaturated can be hardened by reacting them with hydrogen in the presence of a nickel catalyst at about 60°C.** **Hydrogen adds to the carbon–carbon double bonds. The hydrogenated oils have higher melting**	Explain why hydrogenated oils may be useful in spreads, cakes and pasties				

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	points so they are solids at room temperature, making them useful as spreads and in cakes and pastries.					

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C1.7 Changes in the Earth and its atmosphere The Earth and its atmosphere provide everything we need. The Earth has a layered structure. The surface of the Earth and its atmosphere have changed since the Earth was formed and are still changing. The atmosphere has been much the same for the last 200 million years and provides the conditions needed for life on Earth. Recently human activities have resulted in further changes in the atmosphere. There is more than one theory about how life was formed.						
C1.7.1 The Earth's crust						
a b	The Earth consists of a core, mantle and crust, and is surrounded by the atmosphere. The Earth's crust and the upper part of the mantle are cracked into a number of large pieces (tectonic plates).	Describe the structure of the Earth Explain the theory of continental drift Explain why it took many years for the theory of continental drift to be accepted	1	Presenting and writing descriptions and explanations Describe what tectonic plates are and where they can be found. Explain: what causes the plates to move Explain the theory of continental drift and why Wegener's ideas were not accepted at first. What caused the change which means that these ideas are now accepted?	Developing explanations using ideas and models Is a hard-boiled egg with a cracked shell a good or not so good model for the structure of the Earth? Explain Investigate Wegener's theory of crustal movement.	Exampro Extra Online Chemistry Activity: Earth structure determination.
c	Convection currents within the Earth's mantle driven by heat released by natural	Explain how convection currents inside the Earth move tectonic plates	1		Developing explanations using ideas and models Use treacle and biscuits to	PPTC1_1.7.1 Foundation and Higher tier

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d	radioactive processes cause the plates to move at relative speeds of a few centimetres per year. The movements can be sudden and disastrous. Earthquakes and/or volcanic eruptions occur at the boundaries between tectonic plates.	Explain where earthquakes and volcanoes are most likely to occur Explain why scientists cannot accurately predict when earthquakes and volcanic eruptions will occur		Describe: Where earthquakes and volcanoes usually happen. Explain: Why do volcanoes and earthquakes develop at plate boundaries? Communication for audience and purpose Write a communication leaflet for people living near a volcano giving information about what the early warning signs that an eruption might be. Explain why it is hard to predict exactly what may happen but what information they should expect.	model how convection currents cause tectonic plates to move	combined

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C1.7.2 The Earth's atmosphere						
a	For 200 million years, the proportions of different gases in the atmosphere have been much the same as they are today: ▪ about four-fifths (80%) nitrogen ▪ about one-fifth (20%) oxygen ▪ small proportions of various other gases ▪ including carbon dioxide, water vapour and noble gases.	Describe the atmosphere today.	1	Describe the main elements and compounds in air? Explain: Why is nitrogen is used in food packaging?	**Obtaining and presenting evidence,** **Working critically with primary evidence** How can you work out the percentage of oxygen in the air by heating copper?	RSC Alchemy disc has section on gases from the air. Further information can be found at www.rsc.org/Education/Teachers/Resources/Alchemy/index.htm A video on Joseph Priestley and the discovery of gases can be found on the BBC website at www.bbc.co.uk/learningzone/clips by searching for clip'2078'
l	**HT only** **Air is a mixture of gases with different**	**HT only** **Describe how gases in the air can be separated by fractional**		Describe and explain how gases in the air can be separated.		

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	boiling points and can be fractionally distilled to provide a source of raw materials used in a variety of industrial processes.	distillation of liquefied air				
b c	During the first billion years of the Earth's existence there was intense volcanic activity. This activity released the gases that formed the early atmosphere and water vapour that condensed to form the oceans. There are several theories about how the atmosphere was	Describe some of the theories scientists have to explain what the Earth's early atmosphere was like, where it came from and how it changed. Describe which gases may have made up the early atmospheres and where they came from Explain how the atmosphere may have slowly changed to form the one we have today Explain how evolution of life	1	Presenting and writing arguments Produce a timeline which **describes** how the Earth's atmosphere has changed since the earth was formed (thought to be about 4.5 billion years ago). Explain how it is thought these changes have happened Communication for audience and purpose Produce newspaper front page report for the headline, 'Oxygen hits the atmosphere' Dateline 3.6 billion years	Developing explanations using ideas and models Miller and Urey carried out the 'primordial soup' experiment in 1952. Describe the experiment and evaluate whether this	PPT C1 1.7.2 Foundation and Higher tier

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	formed.	affected the atmosphere Explain what scientists do know how life began		ago.	experiment shows how life started on Earth Working critically with secondary evidence Evaluate the evidence that gases in the atmosphere came from comets	
d	One theory suggests that during this period the Earth's atmosphere was mainly carbon dioxide and there would have been little or no oxygen gas (like the atmospheres of Mars and Venus today). There may also have been water vapour and small proportions of methane and ammonia.					
f	Plants and algae produced the oxygen that is now in the atmosphere.					

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d e	There are many theories as to how life was formed billions of years ago. HT only One theory involves the interaction between hydrocarbons, ammonia and lightning.					
g h	Most of the carbon from the carbon dioxide in the air gradually became locked up in sedimentary rocks as carbonates and fossil fuels. The oceans also act	Describe where most of the carbon from carbon dioxide in the early atmosphere has gone Explain why the amount of carbon dioxide in the atmosphere has remained roughly constant for the last 200 million years but has now started to rise	1	Presenting and writing descriptions and explanations Discussion and construction of a chemical carbon cycle which could be used to describe to a KS3 class showing carbon present as: ▪ CO_2 in the air ▪ CO_2 in the sea	Planning an approach Obtaining and presenting evidence Can carbonates be found in animal shells?	

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i	as a reservoir for carbon dioxide but increased amount of carbon dioxide absorbed by the oceans has an impact on the marine environment. Nowadays the release of carbon dioxide by burning fossil fuels increases the level of carbon dioxide in the atmosphere.	Explain the effects of human activities on the atmosphere including global warming Describe how changes in carbon dioxide levels affect marine life		▪ carbonates as shells ▪ carbonates as sedimentary rocks ▪ carbon in living things ▪ fossil fuels Explain how does human impact on these levels,		