

OCR 21st Century GCSE Chemistry A

Chemistry					
	Syllabus point (text abridged)	Boardworks Presentations			
		GCSE Science	Additional Science	Separate Sciences	
C1: Air Quality	C1.1 Which chemicals make up air, and which ones are pollutants? How do I make sense of data about air pollution?	Recall that the Earth is surrounded by an atmosphere made up mainly of nitrogen, oxygen and argon, plus small amounts of water vapour, carbon dioxide, and other gases.	Earth's Atmosphere		
	Recall that the relative proportions of gases in the atmosphere are about 78% nitrogen, 21% oxygen and 1% argon.	Earth's Atmosphere			
	Recall that human activity adds small amounts of carbon monoxide, nitrogen oxides and sulfur dioxide to the atmosphere.	Earth's Atmosphere Climate Change			
	Recall that human activity also adds extra carbon dioxide and small particles of solids (e.g. carbon) to the atmosphere.	Earth's Atmosphere Climate Change Combustion and Alternative Fuels			
	Recall that some of these substances, called pollutants, are directly harmful to humans and some are harmful to the environment and so cause harm to humans indirectly.	Earth's Atmosphere			
	When using their own and given data relating to measured concentrations of atmospheric pollutants, or the composition of the atmosphere: <ul style="list-style-type: none"> - uses data rather than opinion in justifying an explanation - can suggest reasons why a measurement may be inaccurate - can suggest reasons why several measurements of the same quantity may give different results - when asked to evaluate data, makes reference to its reliability (i.e. is it repeatable?) - can calculate the mean of a set of repeated measurements - from a set of repeated measurements of a quantity, uses the mean as the best estimate of the true value - can explain why repeating measurements leads to a better estimate of the quantity - can make a sensible suggestion about the range within which the true value of a measured quantity probably lies - can justify the claim that there is/is not a 'real difference' between two measurements of the same quantity - can identify any outliers in a set of data, and give reasons for including or discarding them. 				

Chemistry					
	Syllabus point (text abridged)	Boardworks Presentations			
		GCSE Science	Additional Science	Separate Sciences	
C1: Air Quality	C1.2 What chemical reactions produce air pollutants? What happens to these pollutants in the atmosphere?	Recall that coal is mainly carbon.	Non-Renewable Energy Resources (Physics)		
	Recall that petrol, diesel fuel and fuel oil are mainly compounds of hydrogen and carbon (hydrocarbons).	Making Oil Useful Fractions from Oil			
	Recall that when fuels burn, atoms of carbon and / or hydrogen from the fuel combine with atoms of oxygen from the air to produce carbon dioxide and / or water (hydrogen oxide).	Combustion and Alternative Fuels			
	Recall that atoms are rearranged during a chemical reaction.		Chemical Reactions		
	Interpret representations of the rearrangement of atoms during a chemical reaction.		Chemical Reactions		
	Understand that during the course of a chemical reaction the numbers of atoms of each element must be the same in the products as in the reactants.		Chemical Reactions		
	Understand that the conservation of atoms during combustion reactions has implications for air quality.	Earth's Atmosphere			
	Recall that the properties of the reactants and products are different.		Chemical Reactions	Chemical Analysis – Chemical Techniques	
	Understand how sulfur dioxide is produced if the fuel contains any sulfur.	Making Oil Useful Earth's Atmosphere			
	Understand how burning fossil fuels in power stations and for transport pollutes the atmosphere with: <ul style="list-style-type: none"> - carbon dioxide and sulfur dioxide - carbon monoxide and particulate carbon (from incomplete burning) - nitrogen oxides (from the reaction between atmospheric nitrogen and oxygen at the high temperatures inside engines). 	Combustion and Alternative Fuels Earth's Atmosphere Climate Change			
Relate the formulas for carbon dioxide, CO ₂ ; carbon monoxide, CO; sulfur dioxide, SO ₂ ; nitrogen monoxide NO; nitrogen dioxide, NO ₂ , and water H ₂ O, to visual representations of their molecules.	Earth's Atmosphere				

	<p>Recall that nitrogen monoxide NO, is formed during the combustion of fuels in air, and is subsequently oxidised to nitrogen dioxide NO₂ (NO and NO₂ are jointly referred to as 'NOx').</p>	<p>Earth's Atmosphere</p>		
	<p>Understand that atmospheric pollutants cannot just disappear, they have to go somewhere:</p> <ul style="list-style-type: none"> - particulate carbon is deposited on surfaces, making them dirty - sulfur dioxide and nitrogen dioxide react with water and oxygen to produce acid rain - carbon dioxide is used by plants in photosynthesis - carbon dioxide dissolves in rain water and in sea water. <p>(Candidates are not required to write word or symbol equations).</p>	<p>Earth's Atmosphere Climate Change</p>		

Chemistry				
	Syllabus point (text abridged)	Boardworks Presentations		
		GCSE Science	Additional Science	Separate Sciences
C1: Air Quality	<p>C1.3 Is air pollution harmful to me or to my environment?</p> <p>When given data relating to effect of air quality:</p> <ul style="list-style-type: none"> - can identify absence of replication as a reason for questioning a scientific claim - can explain why scientists regard it as important that a scientific claim can be replicated by other scientists - can identify the outcome and the factors that may affect it - can suggest how an outcome might be affected when a factor is changed - can give an example from everyday life of a correlation between a factor and an outcome - uses the ideas of correlation and cause appropriately when discussing historical events or topical issues in science - can explain why a correlation between a factor and an outcome does not necessarily mean that one causes the other and can give an example to illustrate this - can suggest factors that might increase the chance of an outcome, but not invariably lead to it - can explain that individual cases do not provide convincing evidence for or against a correlation. 			

Chemistry					
	Syllabus point	Boardworks Presentations			
		GCSE Science	Additional Science	Separate Sciences	
C1: Air Quality	C1.4 What choices can we make personally, locally, nationally or globally to improve air quality?	Understand how atmospheric pollution caused by power stations which burn fossil fuels can be reduced by: <ul style="list-style-type: none"> - using less electricity - removing sulfur from natural gas and fuel oil - removing sulfur dioxide and particulates (carbon and ash) from the flue gases emitted by coal-burning power stations. 	Earth's Atmosphere Climate Change		
	Understand that the only way of producing less carbon dioxide is to burn less fossil fuels.	Earth's Atmosphere Climate Change			
	Understand how atmospheric pollution caused by exhaust emissions from motor vehicles can be reduced by: <ul style="list-style-type: none"> - burning less fuel by having more efficient engines - using low sulfur fuels - using catalytic converters, which convert nitrogen monoxide to nitrogen and oxygen and carbon monoxide to carbon dioxide - adjusting the balance between public and private transport - having legal limits to emissions (which are enforced by the use of MOT tests). 	Combustion and Alternative Fuels Earth's Atmosphere Climate Change			
	Have awareness that, in the context of emissions of pollutants into the atmosphere, scientific research and applications are subject to official regulations and laws.	Earth's Atmosphere Climate Change			

Chemistry					
	Syllabus point	Boardworks Presentations			
		GCSE Science	Additional Science	Separate Sciences	
C2: Material Choices	C2.1 What different properties do different material have?	Interpret information about how solid materials can differ with respect to properties such as: <ul style="list-style-type: none"> - melting points - strength (in tension or compression) - stiffness - hardness - density. 	Metals and Alloys Making Polymers Designer Materials	Ionic Bonding Covalent Bonding The Transition Metals The Alkali Metals	
		Relate properties to the uses of materials such as plastics, rubbers and fibres.	Making Polymers Designer Materials		
		Relate the effectiveness and durability of a product to the materials used to make it.	Metals and Alloys Designer Materials		
		Interpret information about the properties of materials such as plastics, rubbers and fibres to assess the suitability of these materials for particular purposes.			
		With respect to data from the measurement of properties of materials: <ul style="list-style-type: none"> - uses data rather than opinion in justifying an explanation - can suggest reasons why a measurement may be inaccurate - can suggest reasons why several measurements of the same quantity may give different results - when asked to evaluate data, makes reference to its reliability (i.e. is it repeatable?) - can calculate the mean of a set of repeated measurements and use it as the best estimate of the true value - can explain why repeating measurements leads to a better estimate of the quantity - can make a sensible suggestion about the range within which the true value of a measured quantity probably lies - can justify the claim that there is/is not a 'real difference' between two measurements of the same quantity - can identify any outliers in a set of data, and give reasons for including or discarding them - can identify, in a plan for an investigation of the effect of a factor on an outcome, the fact that other factors are controlled as a positive feature, or the fact that they are not as a design flaw - can explain why it is necessary to control all factors thought likely to affect the outcome other than the one being investigated. 			

Chemistry				
	Syllabus point	Boardworks Presentations		
		GCSE Science	Additional Science	Separate Sciences
C2: Material Choices	Recall that the materials we use are chemicals, or mixtures of chemicals, and state examples.			
	Recall that materials can be obtained or made from living things and give examples such as cotton, paper, silk and wool.	Making Polymers		
	Understand that there are synthetic materials which are alternatives to materials from living things.	Making Polymers Designer Materials		
	Interpret representations of rearrangements of atoms during a chemical reaction.			
	Understand that during the course of a chemical reaction the numbers of atoms of each element must be the same in the products as in the reactants.		Chemical Reactions	
	Recall that crude oil consists mainly of hydrocarbons which are chain molecules of varying lengths made from carbon and hydrogen atoms only.	Making Oil Useful Fractions from Oil		
	Recall that only a small percentage of crude oil is used for chemical synthesis.	Making Oil Useful Fractions from Oil		
	Recall that the petrochemical industry refines crude oil to produce fuels, lubricants and the raw materials for chemical synthesis.	Making Oil Useful Fractions from Oil		
	Understand that some small molecules can join together to make very long molecules called polymers and that the process is called polymerisation.	Making Polymers		
	Understand that by using polymerisation, a wide range of materials may be produced.	Making Polymers Designer Materials		
Recall an example of a material that has replaced an older material because of its superior properties.	Designer Materials			

Chemistry

C2: Material Choices	Syllabus point	Boardworks Presentations		
		GCSE Science	Additional Science	Separate Sciences
		<p>Understand how the properties of solid materials depend on how the particles they are made from are arranged and held together.</p>	Metals and Alloys	Ionic Bonding Covalent Bonding
<p>Relate the strength of the forces between the particles to the amount of energy needed for them to break out of the solid structure, and to the temperature at which the solid melts.</p>		Ionic Bonding Covalent Bonding		
<p>Understand how modifications in polymers produce changes to their properties (see C2.1), to include modifications such as:</p> <ul style="list-style-type: none"> - increased chain length - cross-linking - the use of plasticizers - increased crystallinity. 	Making Polymers			

Chemistry

C2: Material Choices	Chemistry			
	Syllabus point (text abridged)	Boardworks Presentations		
		GCSE Science	Additional Science	Separate Sciences
C2.4 When buying a product, what else should we consider besides its cost and how well it does its job? How should we manage the wastes that arise from our use of materials?	Recall the key features of a life cycle assessment (LCA) including: <ul style="list-style-type: none"> - the main requirements for energy input - the environmental impact and sustainability of making the material from natural resources - the environmental impact of making the product from the material - the environmental impact of using the product - the environmental impact of disposing of the product by incineration, landfill or recycling. 			
	Understand how the outcomes of a Life Cycle Assessment (LCA) for a particular material will depend on which product is made from the material.			
	When given appropriate information relating to a Life Cycle Assessment (LCA), compare and evaluate: <ul style="list-style-type: none"> - the use of different materials for the same job - the use of the same material for different jobs. 			
	In the context of a Life Cycle Assessment: <ul style="list-style-type: none"> - can distinguish questions that could be addressed using a scientific approach from questions that could not - can identify the groups affected and the main benefits and costs of a course of actions for each group - can explain the idea of sustainable development and apply it to specific situations - shows awareness that scientific research and applications are subject to official regulations and laws - can distinguish between what can be done (technical feasibility) and what should be done (values) - can explain why different courses of action may be taken in different social and economic contexts. 			

Chemistry

C3: Food Matters	Chemistry			
	Syllabus point	Boardworks Presentations		
		GCSE Science	Additional Science	Separate Sciences
C3.1 What is the difference between intensive and organic farming?	Recall that many chemicals in living things are natural polymers (limited to carbohydrates and proteins).			
	Recall that cellulose, starch and sugars are carbohydrates which consist of carbon, hydrogen and oxygen.			
	Recall that amino acids and proteins consist mainly of carbon, hydrogen, oxygen and nitrogen.			
	Understand that there is continual cycling of elements through consumption of living organisms and decay.			Soil and Nutrients (Biology)
	Describe the main stages of the nitrogen cycle.			Soil and Nutrients (Biology)
	Understand that where crops are harvested, elements such as nitrogen, potassium and phosphorus , are lost from the soil so that the land becomes less fertile unless these elements are replaced.			Soil and Nutrients (Biology)
	Recall and explain the methods used by organic and intensive farmers to maintain the fertility of soils used to grow crops.			
	Understand that yields from crops may be reduced by pests and disease.			
	Understand that organic and intensive farmers use different methods to protect crops against pests and diseases, and that these can have different effects on the environment.			
	Understand that farmers have to follow the UK national standards to claim their products are organic.			
	When provided with information about the methods used in farming: <ul style="list-style-type: none"> - can identify the groups affected and the main benefits and costs of a course of action for each group - can explain the idea of sustainable development, and apply it to specific situations - show awareness that scientific research and applications are subject to official regulations and laws - can distinguish between what can be done (technical feasibility) from what should be done (values) - can explain why different courses of action may be taken in different social and economic contexts. 			

Chemistry					
	Syllabus point	Boardworks Presentations			
		GCSE Science	Additional Science	Separate Sciences	
C3: Food Matters	C3.2 Why are chemicals deliberately added to food?	Recall that food colours can be used to make processed food look more attractive.	Food Chemistry		
		Recall that flavourings enhance the taste of food.	Food Chemistry		
		Understand that artificial sweeteners help to reduce the amount of sugar in processed foods and drinks.			The Chemical Industry
		Recall that emulsifiers and stabilisers help to mix ingredients together that would normally separate, such as oil and water.	Food Chemistry		
		Understand that preservatives help to keep food safe for longer by preventing the growth of harmful microbes.	Food Chemistry		
		Understand that antioxidants are added to foods containing fats or oils to prevent them deteriorating by reaction with oxygen in the air.	Food Chemistry		
		Understand that additives with an E number have passed a safety test and been approved for use in the UK and the rest of the EU.	Food Chemistry		
		Understand that there are health concerns about the use of some additives. (Understanding of how emulsifiers and stabilisers function is not required.)	Food Chemistry		

Chemistry

Chemistry					
	Syllabus point	Boardworks Presentations			
		GCSE Science	Additional Science	Separate Sciences	
C3: Food Matters	C3.3 How can we make sure that our food does not contain chemicals that may be harmful to health?	Recall examples of natural chemicals in plants which may be toxic, cause harm if not cooked properly, or may give rise to allergies in some people (for example, poisonous mushrooms, uncooked cassava, gluten in wheat, peanut allergy).	Food Chemistry		
		Recall an example of a harmful chemical in food, produced by moulds that contaminate crops during storage (for example, aflatoxin in nuts and cereals).	Food Chemistry		
		Understand that chemicals used in farming such as pesticides and herbicides may remain in the products we eat.			
		Understand that harmful chemicals may form during food processing and cooking.	Food Chemistry		
		Understand the steps that people can take to reduce their exposure to harmful chemicals.			
		Understand how food labelling can help consumers decide which products to buy.			
		Understand the role of the scientific advisory committees which carry out risk assessments to determine the safe levels of chemicals in food.	Food Chemistry		
		Understand the role of the Food Standards Agency as an independent food safety watchdog set up by an Act of Parliament to protect the public's health and consumer interests in relation to food.	Food Chemistry		
		In the context of stages in the 'food chain': <ul style="list-style-type: none"> - show awareness that scientific research and applications are subject to official actions and laws - can explain why it is impossible for anything to be completely safe - can identify examples of risk which arise from new scientific or technological advances - can suggest ways of reducing specific risks - can interpret and discuss information on the size of risks, presented in different ways - can identify, or propose, an argument based on the precautionary principle. 	Food Chemistry		

Chemistry

C3: Food Matters	Chemistry			
	Syllabus point	Boardworks Presentations		
		GCSE Science	Additional Science	Separate Sciences
C3.4 Why does what we eat affect our health?	Understand that digestion breaks down natural polymers to smaller, soluble compounds that are absorbed and transported in the blood (illustrated by the breakdown of starch to glucose sugar and proteins to amino acids).		Enzymes (Biology)	
	Recall that cells grow by building up amino acids from the blood into new proteins.			
	Recall that these parts of the body consist mainly of protein: muscle, tendons, skin, hair, haemoglobin in blood.			
	Recall that excess amino acids are broken down in the liver to form urea, which is excreted by the kidneys in urine.			The Kidneys (Biology)
	Understand that high levels of sugar, common in some processed foods, are quickly absorbed into the blood stream, causing a rapid rise in the blood sugar level.			
	Recall that there are two types of diabetes (type 1 and type 2), and that it is particularly late-onset diabetes (type 2) which is more likely to arise because of poor diet.			
	Understand that obesity is one of the risk factors for type 2 diabetes.			
	Understand that type 1 diabetes arises when the pancreas stops producing enough of the hormone, insulin. But that type 2 diabetes develops when the body no longer responds to its own insulin or does not make enough insulin.			
	Recall that type 1 diabetes is controlled by insulin injections and that type 2 diabetes can be controlled by diet and exercise.			
	In the context of diet and health: <ul style="list-style-type: none"> - can discuss a given risk, taking account of both the chance of it occurring and the consequences if it did - can suggest benefits of activities that have a known risk - can offer reasons for people's willingness (or reluctance) to accept the risk of a given activity - can discuss personal and social choices in terms of a balance of risk and benefit. 			

Chemistry					
	Syllabus point (text abridged)	Boardworks Presentations			
		GCSE Science	Additional Science	Separate Sciences	
C4: Chemical Patterns	C4.1 What are the patterns in the properties of elements?	Recall that atoms of each element have different proton numbers.		Atomic Structure Patterns in the Periodic Table	
		Understand that arranging the elements in order of their proton numbers gives repeating patterns in the properties of elements.		Patterns in the Periodic Table	
		Be able to use the Periodic Table to obtain the names, symbols, relative atomic masses and proton numbers of elements.		Patterns in the Periodic Table	
		Recall that a group of elements is a vertical column in the Periodic Table and that the elements have similar properties.		Patterns in the Periodic Table	
		Recall that a period is a row of elements in the Periodic Table.		Patterns in the Periodic Table	
		Be able to use the Periodic Table to classify an element as a metal or non-metal.		Patterns in the Periodic Table	
		Be able to use patterns in the Periodic Table to interpret data and predict properties of elements. (Candidates will be given a copy of the Periodic Table (as in Appendix H) with the examination paper.)		Patterns in the Periodic Table	
		Recall and recognise the chemical symbols for the group 1 metals: lithium, sodium and potassium.		The Alkali Metals	
		Recall that the alkali metals tarnish rapidly in moist air but are shiny when freshly cut.		The Alkali Metals	
		Be able to use qualitative and quantitative data to identify patterns and make predictions about the properties of group 1 metals (for example, melting point, boiling point, density, formulae of compounds and relative reactivity).		The Alkali Metals	
		Describe the reactions of lithium, sodium and potassium with cold water.		The Alkali Metals	
		Recall that alkali metals react with water to form hydrogen and an alkaline solution of a hydroxide with the formula MOH.		The Alkali Metals	
		Recall that alkali metals react vigorously with chlorine to form colourless, crystalline salts with the formula MCl.		The Alkali Metals	
Understand and be able to give examples to show that the alkali metals become more reactive as the group is descended.		The Alkali Metals			

Recall the main hazard symbols and be able to give the safety precautions for handling hazardous chemicals (limited to harmful, toxic, irritant, corrosive, oxidizing, highly flammable).			
Explain the precautions necessary when working with group 1 metals and alkalis.			
Recall and recognise the chemical symbols for the atoms and molecules of the group 7 elements: chlorine, bromine and iodine.		The Halogens	
Recall the states of the halogens at room temperature and pressure.		The Halogens	
Recall the colours of the halogens in their normal physical state at room temperature and as gases.		The Halogens	
Recall that the halogens consist of diatomic molecules.		The Halogens	
Recall that the halogens can bleach dyes and kill bacteria in water.		The Halogens	
Be able to use qualitative and quantitative data to identify patterns and make predictions about the properties of the group 7 elements (for example, melting point, boiling point, formulae of compounds and relative reactivity).		The Halogens	
Recall and be able to give examples to show that the halogens become less reactive as the group is descended.		The Halogens	
Explain the safety precautions necessary when working with the halogens.			
Recall the formulae of: <ul style="list-style-type: none"> - hydrogen, water and halogen molecules - the halides and hydroxides of group 1 metals. 		The Halogens The Alkali Metals	
Be able to balance unbalanced symbol equations.		Quantitative Chemistry	Further Electro- chemistry
Be able to write balanced equations to describe the chemical reactions of group 1 metals with water and halogens.		The Alkali Metals	
Recall and use state symbols: (s), (l), (g) and (aq) in equations.		Chemical Reactions	Chemical Analysis – Chemical Techniques

Chemistry					
	Syllabus point (text abridged)	Boardworks Presentations			
		GCSE Science	Additional Science	Separate Sciences	
C4: Chemical Patterns	C4.2 How do chemists explain the patterns in the properties of elements?	Describe the structure of an atom in terms of protons and neutrons in a very small central nucleus with electrons arranged in shells around the nucleus.		Atomic Structure	
		Recall the relative masses and charges of protons, neutrons and electrons.		Atomic Structure	
		Recall that in any atom the number of electrons equals the number of protons.		Atomic Structure, Patterns in the Periodic Table	
		Recall that all the atoms of the same element have the same number of protons.		Atomic Structure, Patterns in the Periodic Table	
		Recall that the elements in the modern Periodic Table are arranged in order of proton number.		Patterns in the Periodic Table	
		Recall that some elements emit distinctive flame colours when heated (for example, lithium, sodium and potassium).		The Alkali Metals	Chemical Analysis – Chemical Techniques
		Understand that the light emitted from an element gives a characteristic line spectrum.			Chemical Analysis – Chemical Techniques
		Understand that the study of spectra has helped chemists to discover new elements.			Chemical Analysis – Instrumental Techniques
		Understand that the discovery of some elements depended on the development of new practical techniques (for example, spectroscopy).			Chemical Analysis – Instrumental Techniques
		Be able to use simple conventions (for example, 2.8.1 or dots in circles) to represent the electron arrangements in the atoms of the first 20 elements in the Periodic Table.		Atomic Structure Patterns in the Periodic Table	
		Recall that a shell (or energy level) fills across a period.		Atomic Structure Patterns in the Periodic Table	
		Understand that the chemical properties of an element are determined by its electron arrangement, illustrated by the electron configurations of the atoms of elements in groups 1 and 7.		Atomic Structure, Patterns in the Periodic Table, The Alkali Metals, The Halogens	

Chemistry

Chemistry					
		Boardworks Presentations			
		GCSE Science	Additional Science	Separate Sciences	
C4: Chemical Patterns	C4.3 How do chemists explain the properties of compounds of group 1 and 7 elements?	Recall that molten compounds of metals with non-metals conduct electricity and that this is evidence that they are made up of charged particles called ions.		Ionic Bonding Electro-chemistry	
		Recall that an ion is an atom (or group of atoms) that has gained or lost electrons and so has an overall charge.		Ionic Bonding Electro-chemistry	
		Account for the charge on the ions of group 1 and group 7 elements by comparing the number and arrangement of the electrons in the atoms and ions of these elements.		Ionic Bonding The Alkali Metals The Halogens	
		Work out the formulae of ionic compounds given the charges on the ions.		Ionic Bonding	
		Work out the charge on one ion given the formula of a salt and the charge on the other ion.		Ionic Bonding	
		Recall that compounds of group 1 metals and group 7 elements are ionic.		Ionic Bonding The Alkali Metals The Halogens	
		Understand that solid ionic compounds form crystals because the ions are arranged in a regular lattice.		Ionic Bonding	
		Describe what happens to the ions when an ionic crystal melts or dissolves in water.		Ionic Bonding	
		Explain that ionic compounds conduct electricity when molten or when dissolved in water because the ions are charged and they are able to move around independently in the liquid.		Ionic Bonding Electro-chemistry	

Chemistry					
	Syllabus point (text abridged)	Boardworks Presentations			
		GCSE Science	Additional Science	Separate Sciences	
C5: Chemicals of the Natural Environment	C5.1 What types of chemicals make up the atmosphere and hydrosphere?	Recall that dry air consists of gases, some of which are elements (for example, oxygen, nitrogen and argon) and some compounds (for example, carbon dioxide).	Earth's Atmosphere		
		Recall the symbols for the atoms and molecules of these gases in the air.	Earth's Atmosphere		
		Recall that most non-metal elements and most compounds between non-metal elements are molecular.		Covalent Bonding	
		Understand that some molecular elements and compounds have low melting and boiling points.		Covalent Bonding	
		Interpret qualitative and quantitative data about the properties of molecular elements and compounds, for example melting and boiling points.			
		Understand that the elements and compounds in the air are gases because they consist of small molecules with weak forces of attraction between the molecules.		Covalent Bonding	
		Understand that pure molecular compounds do not conduct electricity because their molecules are not charged.		Covalent Bonding	
		Understand that bonding within molecules is covalent and arises from the electrostatic attraction between the nuclei of the atoms and the electrons shared between them: covalent bonds are strong.		Covalent Bonding	
		Translate between representations of molecules including molecular formulae, 2-D diagrams in which covalent bonds are represented by lines and 3-D diagrams for: <ul style="list-style-type: none"> - elements that are gases at 20°C - simple molecular compounds 			
		Recall that the Earth's hydrosphere (oceans) consists mainly of water with some dissolved compounds.			Soap and Water
		Recall that sea water in the hydrosphere is 'salty' because it contains dissolved ionic compounds called salts.	Building Material and Rocks		Soap and Water
		Understand that solid ionic compounds form crystals because the ions are arranged in a regular way.		Ionic Bonding	
		Understand that ions in a crystal are held together by the attraction between opposite charges: this is ionic bonding.		Ionic Bonding	
		Understand how the physical properties of solid ionic compounds (melting point, boiling point, electrical conductivity) relate to their giant, three-dimensional structures.		Ionic Bonding	
		Describe what happens to the ions when an ionic crystal dissolves in water.		Ionic Bonding	

	Explain that ionic compounds conduct electricity when dissolved in water because the ions are charged and they are able to move around independently in the liquid.		Ionic Bonding Electro-chemistry	
	Be able to work out the formulae for salts in the sea given a table of charges on ions (for example sodium chloride, magnesium chloride, magnesium sulfate, potassium chloride and potassium bromide.).		Ionic Bonding Chemical Reactions	

Chemistry					
	Syllabus point (text abridged)	Boardworks Presentations			
		GCSE Science	Additional Science	Separate Sciences	
C5: Chemicals of the Natural Environment	C5.2 What types of chemicals make up the Earth's lithosphere?	Recall that the Earth's lithosphere (the rigid outer layer of Earth made up of the crust and the part of the mantle just below it) is made up of a mixture of minerals.	Earth's Structure		
		Recall that silicon, oxygen and aluminium are very abundant elements in the crust.			
		Be able to interpret data about the abundances of elements in rocks.			
		Recall that much of the silicon and oxygen is present in the Earth's crust as the compound silicon dioxide.		Covalent Bonding	
		Recall the properties of silicon dioxide (for example, hardness, melting point, electrical conductivity and solubility in water).		Covalent Bonding	
		Explain the properties of silicon dioxide in terms of a giant structure of atoms held together by strong covalent bonding (for example, melting point, boiling point, hardness, solubility and electrical conductivity).		Covalent Bonding	
		Understand that silicon dioxide is found as quartz in granite, and is the main constituent of sandstone.			
		Understand that some minerals are valuable gemstones because of their rarity, hardness and appearance.		Covalent Bonding	
	Interpret data and explain the uses and properties of other elements and compounds with giant covalent structures (no recall expected).		Covalent Bonding		

		Chemistry			
		Syllabus point (text abridged)	Boardworks Presentations		
			GCSE Science	Additional Science	Separate Sciences
C5: Chemicals of the Natural Environment	C5.3 Which chemicals make up the biosphere?	Understand that living things are mainly made up from compounds containing the elements carbon, hydrogen, oxygen and nitrogen with small amounts of other elements such as phosphorus and sulphur.			
		Interpret data about the percentage composition of carbohydrates, proteins, fats and DNA.			
		Recall that carbohydrates, proteins and DNA are molecular.			
		Given a diagram of a molecule, identify the elements in the compound and write its formula.	Making Polymers	Covalent Bonding	
		Interpret flow charts describing chemical changes in cycles between the spheres (for example, the oxygen, carbon or nitrogen cycles) (no recall expected).	Climate Change (Carbon Cycle)		

Chemistry					
	Syllabus point (text abridged)	Boardworks Presentations			
		GCSE Science	Additional Science	Separate Sciences	
C5: Chemicals of the Natural Environment	C5.4 How can we extract useful metals from minerals?	Recall that ores are rocks that contain varying amounts of minerals from which metals can be extracted.	Extracting Metals		
		Recall that for some minerals, large amounts of ore need to be mined to recover small percentages of valuable minerals (for example, in copper mining).	Extracting Metals		
		Recall examples of metals that can be extracted by heating the oxide with carbon (for example, zinc, iron and copper (technical details not required)).	Extracting Metals Metals and Alloys		
		Recall that when a metal oxide loses oxygen it is reduced while the carbon gains oxygen and is oxidised.	Extracting Metals Electro-chemistry		
		Understand that some metals are so reactive that their oxides cannot be reduced by carbon.	Extracting Metals Metals and Alloys		
		Be able to balance unbalanced symbol equations.		Quantitative Chemistry	Further Electro-chemistry
		Recall and use state symbols: (s), (l), (g) and (aq) in equations.		Chemical Reactions	Chemical Analysis – Chemical Techniques
		Be able to use the Periodic Table to obtain the relative atomic masses of elements.		Quantitative Chemistry Patterns in the Periodic Table	
		Be able to calculate the mass of the metal that can be extracted from a mineral given its formula or an equation.		Quantitative Chemistry	
		Describe electrolysis as the decomposition of an electrolyte with an electric current.		Electro-chemistry	
		Understand that electrolytes include molten ionic compounds.		Electro-chemistry	
		Describe what happens to the ions when an ionic crystal melts.		Ionic Bonding Electro-chemistry	
		Recall that, during electrolysis, metals form at the negative electrode and non-metals form at the positive electrode,		Electro-chemistry	
Describe the extraction of aluminium from aluminium oxide by electrolysis.		Electro-chemistry			

	<p>Show that during electrolysis of molten aluminium oxide the positively charged aluminium ions gain electrons from the negative electrode to become neutral atoms.</p>		Electro-chemistry	
	<p>Show that during electrolysis of molten aluminium oxide, negatively charged oxide ions lose electrons to the positive electrode to become neutral atoms which then combine to form oxygen molecules.</p>		Electro-chemistry	
	<p>Use ionic theory to explain the changes taking place during the electrolysis of a molten salt (limited to using diagrams or symbol equations to account for the conductivity of the molten salt and the changes at the electrodes).</p>		Electro-chemistry	
	<p>Recall the properties of metals related to their uses (limited to strength, malleability, melting point and electrical conductivity).</p>	Metals and Alloys	The Alkali Metals The Transition Metals	
	<p>Explain the properties of metals in terms of a giant structure of atoms held together by strong metallic bonding.</p>	Metals and Alloys		
	<p>Understand that in a metal crystal there are positively charged ions held closely together by a sea of electrons that are free to move.</p>	Metals and Alloys		
	<p>Evaluate, given appropriate information, the impacts on the environment that can arise from the extraction, use and disposal of metals.</p>	Extracting Metals		

Chemistry					
	Syllabus point (text abridged)	Boardworks Presentations			
		GCSE Science	Additional Science	Separate Sciences	
C6: Synthesis	C6.1 Chemicals and why we need them	Understand the importance of chemical synthesis to provide food additives, fertilisers, dyestuffs, paints, pigments and pharmaceuticals.			The Chemical Industry
		Interpret information about the sectors, scale and importance of chemical synthesis in industry and in laboratories.			
		Recall the formulae of the following chemicals: chlorine gas, hydrogen gas, nitrogen gas, oxygen gas, hydrochloric acid, nitric acid, sulfuric acid, sodium hydroxide, sodium chloride, sodium carbonate, potassium chloride, magnesium oxide, magnesium hydroxide, magnesium carbonate, magnesium sulfate, calcium carbonate, calcium chloride.	Building Materials and Rocks	Covalent Bonding The Halogens Chemical Reactions	Chemical Analysis – Chemical Techniques Soap and Water
		Work out the formulae of ionic compounds given the charges on the ions (from C4).		Ionic Bonding	
		Work out the charge on one ion given the formula of a salt and the charge on the other ion (from C4).		Ionic Bonding	
		Recall the main hazard symbols and understand the safety precautions to use when handling hazardous chemicals.			
		Recall examples of pure acidic compounds which are solids (citric and tartaric acids), liquids (sulfuric, nitric and ethanoic acids) or gases (hydrogen chloride).			
		Recall that common alkalis include the hydroxides of sodium, potassium and calcium.			Understanding Acids and Alkalis
		Recall the pH scale.		Chemical Reactions	Understanding Acids and Alkalis Chemical Analysis – Chemical Techniques
		Recall the use of indicators and pH meters to measure pH.		Chemical Reactions	Understanding Acids and Alkalis Chemical Analysis – Chemical Techniques
		Recall the characteristic reactions of acids that produce salts to include the reactions with metals, oxides, hydroxides and carbonates.		Chemical Reactions	
Write balanced equations with state symbols to describe the characteristic reactions of acids.		Chemical Reactions			

	Recall that the reaction of acid with an alkali to form a salt is a neutralization reaction.		Chemical Reactions	Understanding Acids and Alkalis Titration
	Balance unbalanced symbol equations.		Quantitative Chemistry	Further Electro-chemistry
	Explain that acidic compounds produce aqueous hydrogen ions, $\text{H}^+(\text{aq})$, in water.		Chemical Reactions	Understanding Acids and Alkalis
	Explain that alkaline compounds produce aqueous hydroxide ions, $\text{OH}^-(\text{aq})$, when they dissolve in water.		Chemical Reactions	Understanding Acids and Alkalis
	Write down the formula of the salt produced given the formulae of the acid and the alkali.		Chemical Reactions	
	Explain that during a neutralization reaction, the hydrogen ions from the acid react with hydroxide ions from the alkali to make water: $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$.		Chemical Reactions	

Chemistry					
	Syllabus point (text abridged)	Boardworks Presentations			
		GCSE Science	Additional Science	Separate Sciences	
C6: Synthesis	C6.2 Planning, carrying out and controlling chemical synthesis	Identify the stages in a given chemical synthesis of an inorganic compound including: <ul style="list-style-type: none"> - choosing the reaction or series of reactions to make the required product - carrying out a risk assessment - working out the quantities of reactants to use - carrying out the reaction in suitable apparatus in the right conditions (such as temperature, concentration or the presence of a catalyst) - separating the product from the reaction mixture - purifying the product - measuring the yield and checking the purity of the product. 			
		Understand the purpose of these techniques: dissolving, crystallisation, filtration, evaporation, drying in an oven or dessicator.			Soap and Water
		Understand the importance of purifying chemicals and checking their purity.			
		Understand that a balanced equation for a chemical reaction shows the relative numbers of atoms and molecules of reactants and products taking part in the reaction.		Quantitative Chemistry	Further Quantitative Chemistry
		Understand that the relative atomic mass of an element shows the mass of its atom relative to the mass of other atoms.		Quantitative Chemistry	
		Be able to use the Periodic Table to obtain the relative atomic masses of elements.		Atomic Structure Patterns in the Periodic Table	
		Calculate the relative formula mass of a compound using the formula and the relative atomic masses of the atoms it contains.		Quantitative Chemistry	
		Calculate the masses of reactants and products from balanced equations.		Quantitative Chemistry	Further Quantitative Chemistry
		Calculate percentage yields given the actual and the theoretical yield.		Quantitative Chemistry	The Chemical Industry
		Describe how to carry out an acid-alkali titration accurately (solid sample weighed out into a titration flask, dissolved in water and then titrated with acid or alkali from a burette). (Making up of standard solutions is not required).			Titration

	Substitute results in a given formula to interpret titration results quantitatively.			Titration
	Understand why it is important to control the rate of a chemical synthesis (to include safety and economic factors).			The Chemical Industry
	Explain the term: 'rate of chemical reaction'.		Rate of Reaction	
	Describe methods for following the rate of a reaction (for example, by collecting a gas, weighing the reaction mixture or observing the formation of a colour or precipitate).		Chemical Reactions Rates of Reaction	Further Quantitative Chemistry
	Interpret results from experiments that investigate rates of reactions.		Rates of Reaction	
	Recall that reaction rates vary with the particle size of insoluble chemicals, the concentration of solutions of soluble chemicals and the temperature of the reaction mixture.		Rates of Reaction	
	Understand that catalysts speed up chemical reactions while not being used up in the chemical changes.		Rates of Reaction	The Chemical Industry
	Interpret information about the control of rates of reaction in chemical synthesis.			
	Use simple collision theory to explain how rates of reaction depend on the concentration of solutions of soluble chemicals.		Rates of Reaction	

Chemistry					
	Syllabus point (text abridged)	Boardworks Presentations			
		GCSE Science	Additional Science	Separate Sciences	
C7: Further Chemistry	C7.1 Alcohols, carboxylic acids and esters	Recall that there is a family of hydrocarbons called alkanes.	Making Oil Useful		
		Recall the names and molecular formulae of the alkanes methane, ethane, propane and butane.	Making Oil Useful		
		Translate between molecular, structural and ball-and-stick representations of simple organic molecules.			
		Recall that alkanes burn in plenty of air to give carbon dioxide and water.	Combustion and Alternative Fuels		
		Understand that alkanes are unreactive towards aqueous reagents because C—C and C—H bonds are unreactive.		Covalent Bonding	
		Represent chemical reactions by balanced equations, including state symbols.		Chemical Reactions Quantitative Chemistry	Chemical Analysis – Chemical Techniques
		Recall the names and molecular formulae of methanol and ethanol.			CFCs and Alcohols
		Recall two uses of methanol and two of ethanol.			CFCs and Alcohols
		Recognise the formulae of alcohols.			CFCs and Alcohols
		Understand that the characteristic properties of alcohols are due to the presence of the –OH functional group.			CFCs and Alcohols
		Recall how ethanol compares in its physical properties with water and with alkanes.			CFCs and Alcohols
		Understand that alcohols burn in air because of the presence of a hydrocarbon chain.			CFCs and Alcohols
		Recall the reaction of alcohols with sodium and how this compares with the reactions of water and alkanes with this metal.			CFCs and Alcohols
		Understand that the characteristic properties of carboxylic acids are due to the presence of the –COOH functional group.			Carboxylic Acids and Esters
		Recall the names and formulae of methanoic and ethanoic acids.			Carboxylic Acids and Esters
Recognise the formulae of carboxylic acids.			Carboxylic Acids and Esters		

	Recall that many carboxylic acids have unpleasant smells and tastes and are responsible for the smell of sweaty socks and the taste of rancid butter.			Carboxylic Acids and Esters
	Understand that carboxylic acids show the characteristic reactions of acids with metals, alkalis and carbonates.			Carboxylic Acids and Esters
	Recall that vinegar is a dilute solution of ethanoic acid.			Carboxylic Acids and Esters
	Understand that carboxylic acids react with alcohols, in the presence of a strong acid catalyst, to produce esters.			Carboxylic Acids and Esters
	Write a word equation for the formation of an ester.			Carboxylic Acids and Esters
	Recall that esters have distinctive smells.			Carboxylic Acids and Esters
	Recall that esters are responsible for the smells and flavours of fruits.			Carboxylic Acids and Esters
	Recall the use of esters in products such as food, perfumes, solvents and plasticisers.			Carboxylic Acids and Esters
	Understand the procedure for making an ester (such as ethyl ethanoate) from a carboxylic acid and an alcohol.			Carboxylic Acids and Esters
	Understand techniques used to make a liquid ester including heating under reflux, distillation, purification by treatment with reagents in a tap funnel and drying.			Carboxylic Acids and Esters
	Understand that fats are esters of glycerol and fatty acids.			
	Recall that living organisms make fats and oils as an energy store.			
	Recall that animal fats are mostly saturated molecules and that vegetable oils are mostly unsaturated molecules.	Food Chemistry		
	Understand that in saturated compounds all the C—C bonds are single but that in unsaturated compounds there are C=C double bonds.	Making Oil Useful Food Chemistry		

Chemistry					
	Syllabus point (text abridged)	Boardworks Presentations			
		GCSE Science	Additional Science	Separate Sciences	
C7: Further Chemistry	C7.2 Energy changes in chemistry	Understand the terms exothermic and endothermic.		Energy Transfer	
		Use simple energy level diagrams to represent exothermic and endothermic changes.		Energy Transfer	
		Understand that energy is needed to break chemical bonds and that energy is given out when chemical bonds form.		Energy Transfer	
		Use data on the energy needed to break given covalent bonds to estimate the overall energy change in simple examples (for example, the formation of steam or hydrogen halides from their elements).		Energy Transfer	Food and Fuels
		Understand the term activation energy in terms of the energy needed to break bonds to start a reaction.		Energy Transfer	

Chemistry					
	Syllabus point (text abridged)	Boardworks Presentations			
		GCSE Science	Additional Science	Separate Sciences	
C7: Further Chemistry	C7.3 Reversible reactions and equilibria	Understand that some chemical reactions are reversible.		Reversible Reactions	
		Understand that reversible reactions reach a state of equilibrium.		Reversible Reactions	
		Understand the dynamic equilibrium explanation for chemical equilibrium.		Reversible Reactions	
		Understand the difference between strong and weak acids in terms of dynamic equilibrium.			Understanding Acids and Alkalis
		Recall that hydrochloric acid is a strong acid but that carboxylic acids are weak acids.			Understanding Acids and Alkalis Carboxylic Acids and Esters

Chemistry					
	Syllabus point (text abridged)	Boardworks Presentations			
		GCSE Science	Additional Science	Separate Sciences	
C7: Further Chemistry	C7.4 Analysis	Understand the difference between qualitative and quantitative methods of analysis.			Chemical Analysis– Chemical Techniques
		Understand that an analysis must be carried out on a sample that represents the bulk of the material under test.			Chemical Analysis– Chemical Techniques
		Understand that many analytical methods are based on samples in solution.			Chemical Analysis– Chemical Techniques
		Understand the need for standard procedures for the collection, storage and preparation of samples for analysis.			
		Recall that in chromatography, substances are separated by movement of a mobile phase through a stationary phase.	Food Chemistry		Chemical Analysis – Instrumental Techniques
		Know the meaning of the terms aqueous and non-aqueous as applied to solvents.			
		Understand that for each component in a sample there is a dynamic equilibrium between the stationary and mobile phases.			
		Understand that a separation by chromatography depends on the distribution of the compounds in the sample between the mobile and stationary phases.			Chemical Analysis – Instrumental Techniques
		Understand the use of standard reference materials in chromatography.			Chemical Analysis – Instrumental Techniques
		Describe and compare paper and thin-layer chromatography.			Chemical Analysis – Instrumental Techniques
		Use the formula: R _f = $\frac{\text{distance travelled by solute}}{\text{distance travelled by solvent}}$			Chemical Analysis – Instrumental Techniques
Understand the use of locating agents in paper or thin-layer chromatography.			Chemical Analysis – Instrumental Techniques		

	Recall in outline the procedure for separating a mixture by gas chromatography (gc).			Chemical Analysis – Instrumental Techniques
	Understand the term retention time as applied to gc.			
	Interpret print-outs from gc analyses.			Chemical Analysis – Instrumental Techniques
	Understand the main stages of a quantitative analysis: <ul style="list-style-type: none"> - measuring out accurately a specific mass or volume of the sample - working with replicate samples - dissolving the samples quantitatively - measuring a property of the solution quantitatively - calculating a value from the measurements - estimating the degree of uncertainty in the results 			Titration
	Recall that concentrations of solutions are measured in g/dm ³ .			Titration
	Recall the procedure for making up a standard solution.			Titration
	Calculate the concentration of a given volume of solution given the mass of solvent.			Titration
	Calculate the mass of solute in a given volume of solution with a specified concentration.			Soap and Water
	Recall the procedure for carrying out an acid-base titration using a pipette and burette.			Titration
	Substitute results in a given formula to interpret titration results quantitatively.			Titration
	Use the balanced equation and relative formula-masses to interpret the results of a titration.			Titration
	Use values from a series of titrations to assess the degree of uncertainty in a calculated value.			Titration

		Chemistry			
		Boardworks Presentations			
Syllabus point (text abridged)		GCSE Science	Additional Science	Separate Sciences	
C7: Further Chemistry	C7.5 Green chemistry	Recall and use the terms 'bulk' (made on a large scale) and 'fine' (made on a small scale) in terms of the chemical industry.			
		Recall examples of chemicals made on a large scale (ammonia, sulfuric acid, sodium hydroxide, phosphoric acid) and examples of chemicals made on a small scale (drugs, food additives, fragrances).			The Chemical Industry, Understanding Acids and Alkalis
		Interpret information about the work done by people who make chemicals (no recall expected).			The Chemical Industry
		Understand that new chemical products or processes are the result of an extensive programme of research and development (for example, catalysts for new processes).	Designer Materials		The Chemical Industry
		Understand that governments have strict regulations to control chemical processes as well as the storage and transport of chemicals to protect people and the environment.			The Chemical Industry
		Understand that the production of useful chemicals involves several stages (to include the preparation of feedstocks, synthesis, separation of products, handling of by-products and wastes, and the monitoring of purity).			
		Understand that sustainability of any chemical process depends on: <ul style="list-style-type: none"> - whether or not the feedstock is renewable - the atom economy - the nature and amount of by-products or wastes and what happens to them - the energy inputs or outputs - the environmental impact - the health and safety risks - the social and economic benefits. 			The Chemical Industry
		Understand that a catalyst provides an alternative route for a reaction with a lower activation energy.		Rates of Reaction	The Chemical Industry
		Represent chemical reactions by balanced equations, including state symbols.		Chemical Reactions Quantitative Chemistry	Chemical Analysis – Chemical Techniques
		Calculate the masses of reactants and products from balanced equations including state symbols.		Quantitative Chemistry	Further Quantitative Chemistry
		Calculate the masses of reactants and products from balanced equations.		Quantitative Chemistry	Further Quantitative Chemistry
		Understand how ethanol is made on an industrial scale as a fuel, a solvent and as a feedstock for other processes.			CFCs and Alcohols

	Understand that there is a limit to the concentration of ethanol solution that can be made by fermentation.			Using Micro-organisms for Food (Biology)
	Understand how ethanol solution can be concentrated by distillation to make products such as whisky and brandy.			Using Micro-organisms for Food (Biology)
	Understand the optimum conditions for making ethanol by fermentation of sugar with yeast, taking into consideration temperature and pH.			CFCs and Alcohols
	Understand how genetically modified <i>E. coli</i> bacteria can be used to convert waste biomass from a range of sources into ethanol and recall the optimum conditions for the process.			CFCs and Alcohols
	Recall in outline the synthetic route for converting ethane (from oil refining) into ethanol.			CFCs and Alcohols
	Interpret data about these processes and evaluate their sustainability.			CFCs and Alcohols