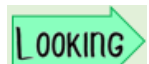
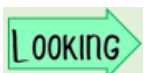


Year 11 Analysis (GCSE Trilogy Chemistry)

Topic 8 Analysis	Rationale (Layering, Why this why now?)	Knowledge goals: <i>You need to know....</i> ... <i>that</i> (Declarative) ... <i>how to</i> (Procedural) L ADDERING	Key Tier 3 vocabulary	Core skills and enrichment opportunities.
4.8 Chemical Analysis Chemists have developed a range of qualitative tests to detect specific chemicals. The tests are based on reactions that produce a gas with distinctive properties, or a colour change or an insoluble solid that appears as a precipitate. Instrumental methods provide fast, sensitive and accurate means of analysing chemicals. Forensic scientists and drug control scientists rely on such instrumental	 Year 8 Reaction types  Year 11 Chemical Analysis Post 16 Analysis using a range of chromatography techniques. Gas tests.	Pure Substances and Formulations ... <i>that</i> a formulation is a specific mixture that has been designed as a useful product. Pure substances have a specific boiling point. Mixtures boil over a range of temperatures. <i>how to</i> distinguish between a pure substance and a mixture. <i>how to</i> apply knowledge to past exam questions	Pure, substance, melting point, boiling point, impure, mixture, product, purpose, fertilisers,	a) Numeracy Analysis and evaluation of data based questions using graphs and/or tables for analysis. b) Literacy Scientific literacy on gas formulae c) Reading Reading for learning on case studies. d) Cultural Capital/Careers Forensic science Food quality scientist e) Cross curricular knowledge links Food technology – food additives and food safety f) Misconceptions A pure substance in chemistry means that it is only one type of particle, pure in general language means it hasn't had anything extra added to it such as pure orange juice. Orange juice isn't pure in chemistry as it contains
		Testing for Common Gases ... <i>that</i> carbon dioxide, oxygen, hydrogen and chlorine have specific tests which can be used to identify them <i>how to</i> carry out the tests for carbon dioxide, hydrogen, chlorine and oxygen <i>how to</i> apply knowledge to past exam questions	Hydrogen, chlorine, carbon dioxide	
		Chromatography ... <i>that</i> chromatography can be used to separate mixtures and can give information to help identify substances. <i>how to</i> calculate R _f values <i>how to</i> set up an investigation to find the content/solubility of a dye and to calculate the R _f value. <i>how to</i> apply knowledge to past exam questions	Solvent, solute, chromatography, stationary phase, mobile phase.	

methods in their work.				sugars, water, pulp, and lots of other things.
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Year 11 Atomic Structure and the Periodic Table (GCSE Trilogy Chemistry)

Topic	Rationale (Layering, Why this why now?)	Knowledge goals: <i>You need to know....</i> <i>...that (Declarative)</i> <i>how to (Procedural)</i> L ADDERING	Key Tier 3 vocabulary	Core skills and enrichment opportunities.
4.1 Atomic Structure and the Periodic Table The periodic table provides chemists with a structured organisation of the known chemical elements from which they can make sense of their physical and chemical properties The historical development of the periodic table and models of atomic structure provide good examples of how scientific ideas and explanations develop over time as new	 Year 7 Matter, separating mixtures. Year 8 Elements, periodic table. Year 9 Atomic Structure and the Periodic Table  Post 16 Atomic structure Structure and bonding	<u>Compounds and Formulae</u> <i>...that</i> Elements are materials made up of one type of atom. Compounds contain two or more different types of atom, chemically bonded together <i>.... how to</i> distinguish between compounds and elements and write simple chemical formulae. Interpret particle diagrams. <i>.... how to</i> apply knowledge to past examination questions	Atom, element, compound	a) <u>Numeracy</u> Electronic configuration b) <u>Literacy</u> Learn significant number of subject specific vocabulary and use in correct context. c) <u>Reading</u> Describe how scientific models develop over time. Reading in different formats e.g. timeline. d) <u>Cultural Capital/Careers</u> Understand the historical significance and contributions of Dalton and Mendeleev to the development of the periodic Table. e) <u>Cross curricular knowledge links</u> DT – materials f) <u>Misconceptions</u> Chemicals are not bad for you, everything is made up of chemicals. We can't see atoms and haven't been able to until
		<u>Separating Mixtures</u> <i>...that</i> a mixture is made up of two or more substances that are not chemically joined together. Mixtures can be separated according to their properties. <i>.... how to</i> select the best method for separation of a given mixture, including appropriate apparatus. <i>...why</i> a particular method is most appropriate. <i>.... how to</i> apply knowledge to past examination questions	Mixture, purity, separation, evaporation, filtration, evaporation, chromatography Solute, solvent, solution.	
		<u>Structure of the Atom</u> <i>...that</i> the atom can be describes in terms of sub atomic particles. Isotopes are atoms of elements with the same number of protons but different numbers of neutrons. <i>...how to</i> calculate the numbers of protons, electrons and neutrons in an atom. <i>.... how to</i> apply knowledge to past examination questions	Protons, electrons, neutrons, isotopes, sub atomic particle, electronically neutral.	

evidence emerges.		<u>Developing the Atomic Model</u> <i>...that</i> the model of the atom has changed over time, starting with Dalton's idea of atoms being tiny solid balls to the plum pudding model to the Bohr model of the atom that is used today. <i>....how to</i> compare models of the atom over time. <i>.... how to</i> apply knowledge to past examination questions	Plum pudding, Bohr, nuclear model, Rutherford.	around 2018, scientists have used other practical techniques to be able to predict what we know about atoms. Theories of atoms have changed over time, a theory is not just an idea, and it has experimental evidence behind it. There is not only one type of atom but 118 known types, these types are called elements.
		<u>Electron Configuration</u> <i>...that</i> electrons have a specific arrangement in the atom, occupying the lowest energy level first and filling up a shell before moving to the next. <i>....how to</i> arrange the electrons of the first 20 elements. <i>.... how to</i> apply knowledge to past examination questions	Electrons, shells, energy levels Electron configuration. occupy	
		<u>The Periodic Table</u> <i>...that</i> the Periodic table is arranged in columns called groups and rows called periods. The structure of the Periodic table has changed over time. <i>....how to</i> the scientists John Newlands, and Dimitri Mendeleev contributed to the development of the Periodic table. <i>.... how to</i> apply knowledge to past examination questions	Period, group	
		<u>Group 1 Elements</u> <i>...that</i> group 1 are known as the alkali metals and react in a similar way, but the reactivity increases down the group. <i>....how to</i> account for the increase in reactivity down group 1. <i>.... how to</i> apply knowledge to past examination questions	Electron configuration, shielding, reactivity.	
		<u>Group 7 Elements</u> <i>...that</i> group 7 elements are known as the halogens and undergo displacement reactions. Group 7	Reactivity, electrons, displacement.	

		elements react in a similar way, but the level of reactivity decreases down the group. ...<i>how to</i> explain the trend in reactivity down group 7. <i>how to</i> apply knowledge to past examination questions		
		<u>Group 0 and Transition Metals</u> ...<i>that</i> transition metals are less reactive, denser, harder, and stronger than group 1 metals. Transition metals can be used as catalysts and have coloured compounds. ...<i>that</i> Group 0 are known as the Noble gases, have full shells of electrons. ...<i>how to</i> compare the reactivity of group 1 and the transition metals. Explain the unreactivity of group 0 <i>how to</i> apply knowledge to past examination questions	Transition metal Noble gases Electron configuration	

Year 11 Chemical Changes (GCSE Trilogy Chemistry)

Topic 5	Rationale (Layering, Why this why now?)	Knowledge goals: <i>You need to know....</i> <i>...that (Declarative)</i> <i>how to (Procedural)</i> L ADDERING	Key Tier 3 vocabulary	Core skills and enrichment opportunities.
4.4 Chemical Changes Understanding of chemical changes began when people began experimenting with chemical reactions in a systematic way and organising their results logically. Knowing about these different chemical changes meant that scientists could begin to predict exactly what new substances would be formed and use this knowledge to develop a wide range of different materials and processes	← LINKING Year 7 Acids and alkalis Metals and non- metals Year 8 Types of reaction Year 9 Chemical changes, reactions of metals, reactivity series and acids and alkalis → LOOKING Post 16 Acid, alkali titrations. Types of acid. Neutralisation reactions.	<u>Metals and Metal Oxides</u> <i>...that</i> metals have distinct properties. <i>....how to</i> distinguish between group 1 and transition metals. <i>... how to</i> apply knowledge to past exam questions.	Metals, transition metals, groups, oxidation, catalyst	a) <u>Numeracy</u> Balancing ionic equations for more able students. b) <u>Literacy</u> Etymology of words to describe metallic properties e.g. lustre.
		<u>Metals in Acid</u> <i>...that</i> metals react with acids to produce a salt and hydrogen. <i>...that</i> metal reactivity depends upon the position in the reactivity series. <i>....how to</i> construct word equations. <i>... how to</i> apply knowledge to past exam questions.	Reactivity, metal, acid, product, reactant, salt, hydrogen	c) <u>Reading</u> Methods, hazard warnings, extraction of aluminium reading to extract knowledge. Application of hydrogen homes. d) <u>Cultural Capital/Careers</u> Hydrogen extraction for fuels (hydrogen homes)
		<u>Reactivity Series and Displacement Reactions</u> <i>...that</i> the reactivity series places metals in increasing order of reactivity and can be used to predict reactions.	ionic compounds, reactivity series, displacement	e) <u>Cross curricular knowledge links</u> Environmental impacts of large scale metal extraction – recycling metals and alternative metal extraction f) <u>Misconceptions</u>

		... <i>how to</i> use the reactivity series to predict whether a displacement reaction will happen. ... <i>how to</i> apply knowledge to past exam questions.		Not all metals are found as pure metal on Earth, most are found in rocks as metal oxides or metal carbonates which are called ores. During electrolysis the metal is not always produced, if the metal is higher in reactivity than hydrogen then hydrogen is produced. A solution of the metal hydroxide would also be produced which is then later purified to produce the pure metal.
		<u>Extracting Metals</u> ...<i>that</i> the position of a metal in the reactivity series determines the method of extraction from its ore. <i>how to</i> evaluate the social, economic and environmental impacts of quarrying. ... <i>how to</i> apply knowledge to past exam questions.	Reactivity series, metal, ore extraction, displace	
		<u>The Process of Electrolysis</u> ...<i>that</i> electrolysis is a process which separates ionic compounds. <i>how to</i> describe and explain the process of basic electrolysis <i>how to</i> represent the process at the electrodes using half equations ... <i>how to</i> apply knowledge to past exam questions.	Electrolysis, anode, cathode, anion, cation, electrolyte, electrodes, half equations	
		<u>Extracting Aluminium</u>	Bauxite, aluminium, electrodes, electrolysis, half equations	

		...<i>that</i> aluminium is a reactive metal that requires electrolysis to be separated from its ores. <i>how</i> the extraction of aluminium is adjusted and has special conditions ... <i>how to</i> apply knowledge to past exam questions.		
		<u>Aqueous Electrolysis</u> ...<i>that</i> aqueous solutions of ionic compounds can be separated using electrolysis. <i>how to</i> predict the products of aqueous electrolysis ... <i>how to</i> apply knowledge to past exam questions.	Aqueous, prediction, products, reactivity series, halogens	
		<u>Electrolysis RP</u> <i>how to</i> predict the products of electrolysis then test the predictions using the practical equipment. ... <i>how to</i> apply knowledge to past exam questions.	Aqueous, hazards, risks, electrolyte, anode, cathode	
		<u>Acids, Alkalis and Bases</u> ...<i>that</i> acids, alkalis, and bases are chemicals which react in neutralisation reactions.	Acid, alkali, base, pH, neutralisation, indicators, strong, weak	

		... <i>how to</i> explain the differences between strong and weak acids. ... <i>how to</i> apply knowledge to past exam questions.		
		<u>Indicators and pH Scale</u> ...<i>that</i> indicators are chemicals which change colour to indicate pH of acids and alkalis. ...<i>how to</i> use the pH scale to indicate the pH of acids and alkalis. ... <i>how to</i> apply knowledge to past exam questions.	Indicators, litmus, universal indicators, acids, alkalis	
		<u>Neutralisation and Naming Salts</u> ...<i>that</i> a salt is formed from an acid and a base. The metal and the acid determine the salt formed. ...<i>how to</i> construct word equations for neutralisation reactions. ... <i>how to</i> apply knowledge to past exam questions.	Neutralisation, salts, word equations	
		<u>Making a soluble salt RP</u> ...<i>how to</i> prepare a pure, dry sample of a soluble salt from an insoluble oxide or carbonate.	evaporation, crystallisation, base, neutralisation, excess	

		... <i>how to</i> apply knowledge to past exam questions.		
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Year 11 Chemistry of the Atmosphere (GCSE Trilogy Chemistry)

Topic	Rationale (Layering, Why this why now?)	Knowledge goals: <i>You need to know....</i> <i>...that (Declarative)</i> <i>.... how to (Procedural)</i> L ADDERING	Key Tier 3 vocabulary	Core skills and enrichment opportunities.
4.8 Chemistry of the Atmosphere The Earth's atmosphere is dynamic and forever changing. The causes of these changes are sometimes man-made and sometimes part of natural cycles. Scientists use software to predict weather and climate change as there are many variables that can influence this. The problems caused by increased levels of air pollutants require scientists and	 Year 7 Materials Year 8 Earth – climate Year 10 Earth's resources Chemical changes  Post 16 Organic chemistry, biofuels	Composition of the Atmosphere <i>... that</i> the atmosphere is a mixture of gases <i>...that</i> theories about what was in the Earth's early atmosphere and how the atmosphere was formed have changed over time. <i>...how to</i> interpret graphs and charts which compare atmospheres. <i>...how to</i> apply knowledge to past exam questions	Composition, atmosphere	a) Numeracy Construct and interpret tables, graphs and charts on the composition of atmosphere of planets in the solar system. b) Literacy Scientific literacy – CO and CO ₂ c) Reading Reading and summarising accounts on the development of the atmosphere and the effects of climate change. d) Cultural Capital/Careers Climate scientist. COP 25. International government agreements on mitigating climate change. George Monbiot – political activist on climate change and the environment. e) Cross curricular knowledge links Geography – climate change (f) Misconceptions
		Evolution of the Atmosphere <i>...that</i> the Earth's atmosphere evolved from early Earth to modern Earth <i>...how to</i> interpret evidence and evaluate different theories about the Earth's early atmosphere. <i>...how to</i> apply knowledge to past exam questions	Evolution, dissolving, sedimentary photosynthesis	
		Carbon Dioxide and the Greenhouse Effect <i>...that</i> climate change is impacted by the greenhouse effect, <i>....how to</i> describe and explain the greenhouse effect and its consequences. <i>...how to</i> apply knowledge to past exam questions	Carbon dioxide, methane, radiation, greenhouse gases, greenhouse effect.	
		Global Warming and Climate Change <i>...that</i> climate change is having a significant impact on the way we live, the weather and the habitats in our world. <i>....how to</i> evaluate the impact climate change will have on agriculture, animals, ecosystems, coastal regions and water supplies. <i>...how to</i> apply knowledge to past exam questions	climate change, environment, impact, precipitation, ecosystem	

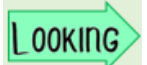
engineers to develop solutions that help mitigate human activity.		<u>Products of Combustion</u> <i>...that</i> combustion of fuels releases harmful products <i>...how to</i> prove the products of complete combustion <i>....how to</i> link named emissions with the associated consequence. <i>...how to</i> apply knowledge to past exam questions	Pollutants, emissions, combustion, global dimming, Sulphur dioxide Nitrogen oxides, Carbon monoxide	The gas we breath in for respiration isn't the largest part of our atmosphere The proportion of gases has stayed the same for around 200 million years, it has only started to change over the last 200 in a very small way Global warming and cooling are natural and have happened in cycles since Earth was a ball of molten rock, the argument is that humans have impacted on this cycle. Climate change and global warming are different, climate change is changes to the weather that can have drastic consequences, and global warming is the average warming of the Earth that causes climate change.
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Year 11 Energy Changes (GCSE Chemistry)

Topic	Rationale (Layering, Why this why now?)	Knowledge goals: <i>You need to know....</i> <i>...that (Declarative)</i> <i>how to (Procedural)</i> L ADDERING	Key Tier 3 vocabulary	Core skills and enrichment opportunities.
4.5 Energy Changes Energy changes are an important part of chemical reactions. The interaction of particles often involves transfers of energy due to the breaking and formation of bonds. Reactions in which energy is released to the surroundings are exothermic reactions, while those that take in thermal energy are endothermic. These interactions between particles can produce heating or cooling effects that are used in a range of everyday applications.	 Year 8 Endothermic and exothermic reactions  Post 16 Energetics	<u>Exothermic and Endothermic</u> <i>...that</i> exothermic reactions release heat energy and endothermic absorb heat energy from their surroundings. <i>.... how to</i> draw reaction profiles for exothermic and endothermic reactions <i>.... how to</i> apply knowledge to past examination questions	Exothermic, endothermic, profiles, activation energy, surroundings	a) <u>Numeracy</u> Analysis and evaluation of data based questions using graphs and/or tables for energy transfer Carry out bond energy calculations b) <u>Literacy and reading</u> Reading methods in order to follow instructions. Student safety sheets in order to evaluate risks in a practical. c) <u>Cultural Capital/Careers</u> Food hygienist and preparation – hot and cold cans. Medics hot and cold packs. DoFE – hand warmers d) <u>Cross curricular knowledge links</u> DT – Materials design of hot/cold cans
		<u>Bond Enthalpy Calculations</u> <i>...that</i> bonding breaking is endothermic and bond formation is exothermic <i>...how to</i> calculate bond enthalpy changes <i>.... how to</i> apply knowledge to past examination questions	Enthalpy, exothermic, endothermic, ΔH .	
		<u>Temperature Changes RP</u> <i>...how to</i> safely conduct a practical to investigate temperature changes in a reaction	Extrapolation, variables, hazard, risk, control	

		 <i>how to</i> draw a graph from which data can be extrapolated <i>how to</i> apply knowledge to past examination questions	PE – hot/cold packs e) <u>Misconceptions</u> It requires energy to break bonds and releases energy when bonds are made. The enthalpy change is a balance between energy used from bond breaking and bond making. Endothermic reactions are cold as they take in thermal (heat) energy from the surroundings.
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Year 11 Organic Chemistry (GCSE Trilogy Chemistry)

Topic 6	Rationale (Layering, Why this why now?)	Knowledge goals: <i>You need to know....</i> <i>...that (Declarative)</i> <i>... how to (Procedural)</i> L ADDERING	Key Tier 3 vocabulary	Core skills and enrichment opportunities.
4.7 Organic Chemistry The chemistry of carbon compounds is so important that it forms a separate branch of chemistry. A great variety of carbon compounds is possible because carbon atoms can form chains and rings linked by C-C bonds. The main sources of organic compounds are living, or once-living materials from plants and animals. These sources include fossil fuels, a major source of feedstock for the petrochemical industry. Chemists take organic	 Year 8 Elements, compounds, mixtures Year 9 Atomic structure, separating mixtures, organic and chemistry of the Atmosphere Year 10 Organic chemistry Using resources  Post 16 Organic chemistry	Crude Oil <i>...that</i> crude oil is a non-renewable resource made from the remains of microscopic organisms living in the sea. <i>...how to</i> interpret data linked to the availability and use of crude oil over time. <i>...how to</i> apply knowledge to past examination questions	Crude oil, heat, pressure, mixture, hydrocarbon	a) Numeracy Interpreting charts and graphs on data linking crude oil and its uses. Using general formulae to predict formulae of alkanes and alkenes. b) Literacy Systematic naming of molecules in homologous series: meth-, eth-, prop-, etc. Key words in terms of properties of hydrocarbons and the etymology of these words. c) Reading Reading for information retrieval. Literacy homework. d) Cultural Capital/Careers Organic chemistry can help you get into careers in forensics, pharmaceuticals, making perfumes and flavours (Christmas dinner flavoured crisps!) (e) Cross curricular knowledge links DT: polymers as design materials. Geography – crude oil as a finite resources (f) Misconceptions
		Fractional Distillation <i>...that</i> crude oil can be separated into hydrocarbons of similar properties, called fractions. <i>...how to</i> describe the process of fractional distillation and explain the principles behind it. <i>...how to</i> apply knowledge to past examination questions	crude oil, fractional distillation, fraction, alkane, mixture, separation	
		Alkanes and Properties <i>...that</i> the properties of alkanes vary according to the length of the carbon chain. <i>...how to</i> distinguish between alkanes according to viscosity, flammability, boiling point. <i>...how to</i> apply knowledge to past examination questions	Flammable, viscous, saturated	
		Cracking Hydrocarbons <i>...that</i> long chain hydrocarbons can be split into smaller ones by cracking; thermal or catalytic. <i>...how to</i> construct cracking equations <i>...how to</i> distinguish between saturated and unsaturated compounds using bromine water. <i>...how to</i> apply knowledge to past examination questions	Cracking, thermal, catalytic, saturated, unsaturated	

molecules and modify to make new, useful materials such as polymers, pharmaceuticals, perfumes and flavourings, dyes and detergents.		<u>Alkenes and Polymers</u> <i>...that</i> alkenes are carbon compounds containing a C=C bond <i>...that</i> polymers are formed from alkenes <i>...how to</i> apply knowledge to past examination questions	Unsaturated, cracking, thermal, catalytic, monomer, polymer.	Organic does not mean natural – it chemistry it refers to carbon chemistry. The “hydro” in hydrocarbons does not mean water – it means hydrogen. Saturated means no double bonds present – not a “saturated solution” Fractions themselves are a mixture of compounds with similar properties. Fractional distillation is separation, cracking is thermal decomposition.
		<u>Balancing Combustion Equations</u> <i>...the</i> products of complete and incomplete combustion of hydrocarbons. <i>...how to</i> construct word equations to represent the combustion of hydrocarbons. <i>...how to</i> balance equations to show combustion of hydrocarbons. <i>...how to</i> apply knowledge to past examination questions	Combustion, complete, incomplete	

Year 11 Quantitative Chemistry (GCSE Trilogy Chemistry)

Topic	Rationale (Layering, Why this why now?)	Knowledge goals: <i>You need to know....</i> <i>...that (Declarative)</i> <i>how to (Procedural)</i> L ADDERING	Key Tier 3 vocabulary	Core skills and enrichment opportunities.
4.3 Quantitative Chemistry Chemists use quantitative analysis to determine the formulae of compounds and the equations for reactions. Given this information, analysts can then use quantitative methods to determine the purity of chemical samples and to monitor the yield from chemical reactions. Identifying different types of chemical reactions allows chemists to make sense of how different chemicals react together, to establish patterns and to make predictions about the behaviour of other chemicals. Chemical equations provide a means of representing chemical reactions and are a key way for chemists to	 Linking Year 8 Periodic table Year 9 Atomic structure and periodic table, chemical changes, acids and alkalis Year 10 Quantitative  Looking Post 16 Quantitative chemistry	<u>Relative Atomic and Relative Formula Mass</u> <i>...that</i> relative atomic masses are found on the periodic table <i>...how to</i> calculate relative atomic and relative formula mass <i>...how to</i> calculate percentage element in a compound <i>.... how to</i> apply knowledge to past examination questions	Mass number, formula mass, formula, equation, reactants, products	<u>Numeracy</u> A wide range of calculation on moles, RFM, reacting masses, limiting factors, concentration of solutions. Analysis and evaluation of data based questions using graphs and/or tables for quantitative questions. <u>Literacy and reading</u> <u>Cultural Capital/Careers</u> Chemical engineers, pharmaceuticals, toxicology, river water analysis <u>Cross curricular knowledge links</u> Rearranging equations, converting units, percentages all linked with maths skills <u>Misconceptions</u> When balancing equations you can't change how the compounds are made up – this means you can't add
		<u>Conservation of Mass</u> <i>...that</i> mass is conserved in a reaction <i>...how to</i> use chemical equations to evaluate conservation of mass <i>.... how to</i> apply knowledge to past examination questions	Conservation, mass, balanced	
		<u>Conservation of Mass Practical</u> <i>...that</i> mass does not always appear to be conserved in a reaction	Safety, crucible, balance, weighing boat	

communicate chemical ideas.		...<i>how to</i> complete a practical to investigate conservation of mass safely <i>how to</i> apply knowledge to past examination questions		or take away any of the 'small numbers'. Some reactions look like mass is lost however it is normally a product that is a gas escaping from wherever the reaction is happening.
		<u>Introduction to Moles</u> ...<i>that</i> a mole is a chemical quantity ...<i>how to</i> calculate moles using the correct equation ...<i>how to</i> rearrange the moles equation <i>how to</i> apply knowledge to past examination questions	Mole, quantity, mass, relative atomic/formula mass, Avogadro's constant	HT ONLY. A mole is just a number. As atoms are so small it is impossible to talk about 1 atom of a substance, we can only really talk about them in very large amounts. So, a mole was created as a standard, it stands for 6.02×10^{23} particles.
		<u>Reacting Masses</u> ...<i>that</i> moles can be used to calculate required masses of reagents and predicted masses of products ...<i>how to</i> apply the moles equation to calculating reacting masses <i>how to</i> apply knowledge to past examination questions	Moles, reacting masses, balanced equation, conservation	Understanding the correct units and their conversions. Appreciation of standard form and manipulation of standard form within calculations. Scale of what a decimetre is. Use of non-integers in balancing equations.
		<u>Concentration of Solutions</u> ...<i>that</i> cubic decimetres are a unit of concentration ...<i>how to</i> convert between units	Solutions, concentration, volume, solute, decimetre, cubic centimetre, mass	

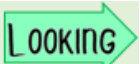
		...<i>how to</i> calculate the concentration of solutions. <i>how to</i> apply knowledge to past examination questions		
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Year 11 Rate and extent of chemical change (GCSE Trilogy Chemistry)

Topic	Rationale (Layering, Why this why now?)	Knowledge goals: <i>You need to know....</i> <i>...that (Declarative)</i> <i>how to</i> <i>(Procedural)</i> L ADDERING	Key Tier 3 vocabulary	Core skills and enrichment opportunities.
4.6 Rate and extent of chemical change Chemical reactions can occur at vastly different rates. Whilst the reactivity of chemicals is a significant factor in how fast chemical reactions proceed, there are many variables that can be manipulated in order to speed them up or slow them down. Chemical reactions may also be reversible and therefore the effect of different variables needs to be established in order to identify how to maximise the yield of desired product. In industry, chemists and chemical engineers	 Year 8 Rates of reaction  Year 11 Apply rate and extent of chemical change knowledge to extended questions. Post 16 Rate of reaction and kinetics	Measuring Rate of Reaction <i>...that</i> mean rate of reaction can be determined by measuring quantity of mass used or product released <i>...how to</i> determine the rate of a chemical reaction by interpreting data <i>.... how to</i> apply knowledge to past examination questions	Product, reactant, rate, mean, gradient	a) Numeracy Analysis and evaluation of data based questions using graphs and/or tables for rates and chemical changes. Learners need to employ the use of suitable units when measuring and collecting data. There is a need for learners to develop their mathematical mastery to determine the gradient of a straight line. Learners will also need to be able to determine the intercept on a linear graph.
		Factors affecting rate of reaction <i>...that</i> the rate of reaction can be changed by altering conditions <i>...how to</i> use collision theory to explain the effect of changing conditions on the rate of reaction <i>.... how to</i> apply knowledge to past examination questions	Collision, particle, energy, activation, rate, concentration, pressure, sufficient, catalyst, temperature, surface area, state	
		Changing Surface Area <i>...how to</i> measure the rate of reaction during a practical for production of gaseous products <i>...how to</i> represent data using graphs <i>.... how to</i> apply knowledge to past examination questions	Dependent, independent, control, variable, surface area, delivery tube	
				b) Literacy and reading Analysis and evaluation of data based questions using extended text for use of changing conditions on the Haber process.

determine the effect of different variables on reaction rate and yield of product. Whilst there may be compromises to be made, they carry out optimisation processes to ensure that enough product is produced within a sufficient time, and in an energy-efficient way.		<u>Changing Concentration</u> ...<i>how to</i> measure the rate of reaction during a practical which produces solid ...<i>how to</i> represent data using graphs ...<i>how to</i> describe and explain the shape of a graph <i>how to</i> apply knowledge to past examination questions	Dependent, independent, control, variable, rate, concentration, hydrochloric, thiosulphate. Erlenmeyer, obscure, hypothesis, conclusion	c) <u>Cultural Capital/Careers</u> How the Haber Process has had an impact on the global economy. d) <u>Cross curricular knowledge links</u> Opportunities for learners to demonstrate their research skills e) <u>Misconceptions</u> Not all reactions happen quickly, some take millions of years to happen! Mass and energy are never lost or created; however, it might look like the mass goes down during a reaction. But this is because a gas will be given off and has escaped. Catalysts are not part of the reaction; they just interact with the atoms to help them react. Particles collide all the time however not all collisions cause a reaction, this is because they don't have enough energy for the reaction to occur.
		<u>Reversible Reactions</u> ... <i>that</i> some chemical reactions are reversible ...<i>how to</i> represent reversible reactions <i>how to</i> apply knowledge to past examination questions	Reactant, product, forward, backward, reversible, equilibrium, rate, anhydrous, hydrated	
		<u>Equilibria and Le Chateliers</u> ... <i>that</i> chemical reactions reach a state of equilibria ...<i>how to</i> apply the three steps to success to Le Chateliers principle <i>how to</i> apply knowledge to past examination questions	Reactant, product, forward, backward, reversible, equilibrium, Le Chatelier.	

Year 11 Structure, Bonding and the Properties of Matter (GCSE Trilogy Chemistry)

Topic	Rationale (Layering, Why this why now?)	Knowledge goals: <i>You need to know....</i> <i>...that (Declarative)</i> <i>.... how to (Procedural)</i> L ADDERING	Key Tier 3 vocabulary	Core skills and enrichment opportunities.
4.2 Structure, Bonding and the Properties of Matter Chemical bonds are the glue that hold substances together. The attraction of one atom to another determines a substances chemical reactivity and its physical properties. Understanding how these can be determined by considering the atoms involved within the substance can be used to advance our understanding of materials science and where research may go in the immediate future.	 Year 7 Properties of metals and non-metals Year 8 Periodic table Year 9 Atomic structure Year 10 Structure and Bonding  Post 16 AS Bonding unit	Forming Ions <i>...that</i> ions are formed from the loss and gain of electrons into electron shells <i>...how to</i> represent ions using dot and cross diagrams <i>...how to</i> describe and explain ionic bond formation using dot and cross diagrams. <i>.... how to</i> apply knowledge to past examination questions	Ion, positive, negative, cation, anion, transfer, noble gas, configuration, ionic	a) Numeracy Analysis and evaluation of data based questions using graphs and/or tables for bonding properties. b) Literacy and reading Analysis and evaluation of data based questions using extended text for use of polymers and nanoparticles.
		Ionic Compounds <i>...that</i> ionic compounds can be represented in different ways <i>...that</i> the specific bonding in ionic compounds leads to different properties <i>...how to</i> construct the formula of common ionic compounds <i>.... how to</i> apply knowledge to past examination questions	Giant, lattice, 3D, ions, conductivity, brittle, soluble, electrostatic	c) Cultural Capital/Careers The development of new and diverse nanoparticles for use in everyday life. d) Cross curricular knowledge links Opportunities for learners to demonstrate their research skills
		Covalent Bonding <i>...that</i> covalent bonds are formed from the sharing of electrons <i>...how to</i> draw dot and cross diagrams to represent simple covalent molecules <i>...how to</i> explain the properties of simple covalent compounds in terms of structure and bonding <i>.... how to</i> apply knowledge to past examination questions	Covalent, dot and cross, sharing, valence, intermolecular forces	e) Misconceptions When a substance dissolves or changes state no bonds are broken, this is often confused as FORCES between molecules are overcome when a change of state happens. Non metals do-not conduct electricity however graphite, graphene and

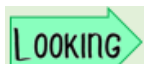
		<u>Polymers</u> <i>...that</i> simple covalent molecules can form polymers <i>...how to</i> draw the structure of polymers and repeat units <i>.... how to</i> apply knowledge to past examination questions	Polymer, manufactured, covalent, molecule, monomer, repeat unit polymerisation, thermosetting, thermosoftening, intermolecular	fullerenes made purely from carbon (a non-metal) can conduct electricity. To be stable each atom wants a full outer shell of electrons, hydrogen and helium need 2 electrons, however every other atom wants 8. You only need to know the first 20 elements as this rule works for them.
		<u>Giant Covalent Molecules</u> <i>...that</i> carbon can exist in three different forms called allotropes <i>...that</i> the different bonding in these allotropes leads to the different properties of the allotropes <i>...how to</i> explain the properties of these allotropes in terms of structure and bonding <i>.... how to</i> apply knowledge to past examination questions	Brilliant, strong, hard, lubricant,	In ionic bonding electrons are not shared, they are given and taken. It is then those differently charged ions that are attracted to each other forming the bond.
		<u>Nanoparticles</u> <i>...that</i> nanoscience is the study of nano-sized particles <i>...how to</i> explain the properties of nanoparticles in terms of structure and bonding <i>...how to</i> calculate surface area to volume ratio <i>.... how to</i> apply knowledge to past examination questions	Nanoparticle, surface area to volume ratio	Ionic compounds are not just two or three ions (NaCl is not 1 sodium ion and 1 chlorine ion), there are millions of ions that make up the compounds, the formula shown is the simplest way to write the ratio of ions.
		<u>Metallic Bonding</u> <i>...that</i> metallic bonding occurs in metals <i>...how to</i> explain the properties of metals in terms of structure and bonding <i>.... how to</i> apply knowledge to past examination questions	Delocalised, electrostatic, electron, conduction	

Alloys and Transition Metals

...*that* alloys are mixture of metals and either metals or non-metals
...*how to* explain the properties of alloys in terms of structure and bonding
...*that* transition metals have a range of properties
.... *how to* apply knowledge to past examination questions

Mixtures, properties, malleable, proportion, stainless, sonorous, malleable, ductile, reflective, conductor, catalyst, compound

Year 11 Earths Resources (GCSE Trilogy Chemistry)

Topic	Rationale (Layering, why this why now?)	Knowledge goals: <i>You need to know....</i> <i>...that (Declarative) ... how to (Procedural)</i> L ADDERING	Key Tier 3 vocabulary	Core skills and enrichment opportunities.
4.10 Earths resources Industries use the Earth's natural resources to manufacture useful products. To operate sustainability, chemists seek to minimise the use of limited resources, use of energy, waste, and environmental impact in the manufacture of these products. Chemists also aim to develop ways of disposing of products at the end of their useful life in ways that ensure that materials and stored energy are utilised. Pollution, disposal of waste products and changing land use has a significant effect on the environment, and environmental chemists' study how human activity has affected the Earth's	 Year 7 Fossil fuels Year 9 Organic chemistry  Year 11 Apply Earths resources and using resources knowledge. Post 16 Sustainability, polymers	The Earth's Resources <i>...that</i> the Earth provides all the resources needed for human survival. <i>... how to</i> distinguish between finite and renewable sources. <i>... how to</i> apply knowledge to past exam questions.	Resources, warmth, shelter, food, transport, natural, agriculture, fuels, finite, renewable.	a) Numeracy Extract and interpret information about resources from charts, graphs, and tables. Use orders of magnitude to evaluate significance of data. b) Literacy and reading Analysis and evaluation of data-based questions using extended text for LCAs and metal extraction methods. Methods to produce potable water, comparison, and evaluation. Reading for information retrieval. c) Cultural Capital/Careers How composites have had an impact on everyday life. The Haber process, its place in history and the modern impacts of fertiliser development. Access to potable water and purification of water sources in different locations around the
		Potable Water <i>...that</i> potable water is different to pure water. <i>... how to</i> test the purity of water. <i>... how to</i> describe the differences between the treatment of ground water and freshwater <i>... how to</i> apply knowledge to past exam questions.	Potable, pure, sterilising, desalination, reverse osmosis, filter.	
		Wastewater Treatment <i>...that</i> sewage can be treated to make it safe to drink. <i>... how to</i> purify wastewater. <i>... how to</i> apply knowledge to past exam questions.	Sewage, grit, sedimentation, anaerobic digestion, aerobic, effluent, sludge, agricultural.	
		Water RP <i>...how to</i> purify salt water by simple distillation.	Distillation, Liebig condenser, evaporation, condensing, boiling point	

natural cycles and how damaging effects can be minimised.		... <i>how to</i> test the purity of the water produced. ... <i>how to</i> apply knowledge to past exam questions.		global – the challenges and implications of water safe for everyone to drink. d) <u>Cross curricular knowledge links</u> The Haber process, its place in history and the modern impacts of fertiliser development – links to History and Geography. Design Technology – materials and their uses. e) <u>Misconceptions</u> Water has been cycled through the water cycle millions of times; it can be purified easily. The reduction of energy use in cleaning water and recycling materials will reduce the amount of carbon dioxide produced. Fossil fuels will run out as it is a non-renewable resource, it can be made still however it takes longer to make it than the time we use it in.
		<u>Alternative Extraction of Metals</u> ...<i>that</i> the Earth's resources of metal ores is limited. ... <i>how to</i> use alternative extraction methods to access low grade ores. ... <i>how to</i> apply knowledge to past exam questions.	Metal ores, phytomining, bioleaching, bacteria, leachate, electrolysis, metal extraction.	
		<u>Life Cycle Assessments</u> ...<i>that</i> life cycle assessments are carried out to assess environmental impact of products. ... <i>how to</i> carry out a life cycle assessment for shopping bags made of paper and plastic. ... <i>how to</i> apply knowledge to past exam questions.	Life cycle assessment, manufacturing, packaging, lifetime, quantified, processing.	
		<u>Reducing the Use of Resources</u> ...<i>that</i> reducing, reusing, and recycling help to conserve resources. ... <i>how to</i> evaluate ways of reducing the use of materials. ... <i>how to</i> apply knowledge to past exam questions.	Metals, glass, building materials, ceramics, quarrying, mining, recycled, melting, recasting, scrap, ore, extraction.	