

Year 10 Topic Seven - Analysis (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.
4.8 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	 Linking Year 8 Reaction types  Looking Year 11 Chemical Analysis Post 16 Analysis using a range of chromatography techniques. Gas tests.	<u>Lesson 1 – Pure Substances and Formulations</u> <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.	Pure, substance, melting point, boiling point, impure, mixture, product, purpose, fertilisers,	a) <u>Numeracy</u> Analysis and evaluation of data based questions using graphs and/or tables for analysis. b) <u>Literacy</u> Scientific literacy on gas formulae c) <u>Reading</u> Reading for learning on case studies. d) <u>Cultural Capital/Careers</u> Forensic science e) <u>Cross curricular knowledge links</u> f) <u>Misconceptions</u> 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
		<u>Lesson 2, 3, 4 – Required Practical – Testing for Ions</u> <i>...that</i> positive metal and negative non-metal ions can be distinguished using indicative tests <i>....how to</i> use indicative tests to identify common ions <i>....how to</i> safely complete an indicative tests practical	Flame tests, metals, ions, solutions, precipitates, carbonates, halide, sulphates	
		<u>Lesson 5 – Testing for Common Gases and Instrumental Analysis</u> <i>...that</i> carbon dioxide, oxygen, hydrogen and chlorine have specific tests which can be used to identify them <i>...that</i> instrumental methods of analysis have advantages over traditional methods <i>....how to</i> analysis flame emission spectroscopy data to determine ions in a compound	Identification, instrumental, accurate, sensitive, rapid, flame emission spectroscopy, spectroscope, spectrum, concentrations, metal ions	

instrumental methods in their work.				sugars, water, pulp, and lots of other things. .
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Year 10 Topic Three Chemical 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.
4.4 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	 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  Year 11 Chemical changes – paper 1 Post 16 Acid, alkali titrations. Types of acid. Neutralisation reactions.	<u>Lesson 1 – 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. <i>....how to</i> use the reactivity series to predict whether or not a displacement reaction will happen.	ionic compounds, reactivity series, displacement	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. 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) e) <u>Cross curricular knowledge links</u> Environmental impacts of large scale metal extraction – recycling metals and alternative metal extraction f) <u>Misconceptions</u>
		<u>Lesson 2 – 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	Electrolysis, anode, cathode, anion, cation, electrolyte, electrodes, half equations	
		<u>Lesson 3 – The Extraction of Aluminium</u> <i>...that</i> aluminium is a reactive metal that requires electrolysis to be separated from its ores	Bauxite, aluminium, electrodes, electrolysis, half equations	

		 <i>how</i> the extraction of aluminium is adjusted and has special conditions		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>Lesson 4 – 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	Aqueous, prediction, products, reactivity series, halogens	
		<u>Lesson 5 – Electrolysis Required Practical</u> <i>how to</i> predict the products of electrolysis then test the predictions using the practical equipment	Aqueous, hazards, risks, electrolyte, anode, cathode	
		<u>Lesson 6 – Neutralisation, pH and Indicators</u> ... <i>that</i> acids, alkalis and bases are chemicals which react in neutralisation reactions <i>how to</i> explain the differences between strong and weak acids	Acid, alkali, base, pH, neutralisation, indicators, strong, weak	
		<u>Lesson 7 and 8 – Titration Required Practical</u> ... <i>that</i> unknown concentrations can be determined using a titration reaction <i>how to</i> safely complete a titration practical to achieve concordant results	Titration, burette, pipette, indicator, end point, acid, alkali, concentration, concordant	

Year 10 Topic Four – 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.	← Linking Year 8 Endothermic and exothermic reactions → Looking Year 11 Apply energy change knowledge and detailed use of cells and batteries. Post 16 Energetics	<u>Lesson 1 – 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	Exothermic, endothermic, profiles, activation energy, surroundings	a) Numeracy Analysis and evaluation of data based questions using graphs and/or tables for energy transfer Carry out bond energy calculations b) Literacy and reading Reading methods in order to follow instructions. Student safety sheets in order to evaluate risks in a practical. c) Cultural Capital/Careers Food hygienist and preparation – hot and cold cans. Medics hot and cold packs. DoFE – hand warmers d) Cross curricular knowledge links DT – Materials design of hot/cold cans
		<u>Lesson 2 – Bond Enthalpy Calculations</u> <i>...that</i> bonding breaking is endothermic and bond formation is exothermic <i>...how to</i> calculate bond enthalpy changes	Enthalpy, exothermic, endothermic, ΔH .	
		<u>Lesson 3 and 4 – Temperature Changes Practical</u> <i>...how to</i> safely conduct a practical to investigate temperature changes in a reaction <i>.... how to</i> draw a graph from which data can be extrapolated	Extrapolation, variables, hazard, risk, control	

				PE – hot/cold packs
		<u>Lesson 5 – Fuel Cells and Batteries</u> <i>...that</i> cells and batteries use chemical reactions to produce an electrical current <i>.... how to</i> evaluate the use of hydrogen fuel cells <i>...how to</i> write half equations for the processes inside a hydrogen fuel cell	Fuel cell, battery, ions, half equations	e) Misconceptions 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.

Year 10 Topic Six - Organic (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.
4.7 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 molecules and modify to make new, useful materials such as polymers, pharmaceuticals, perfumes and	 Year 8 Elements, compounds, mixtures Year 9 Atomic structure, separating mixtures  Year 10 Organic chemistry Using resources Post 16 Organic chemistry	<u>Lesson 1 – Alkanes and Alkenes Review</u> <i>...that</i> hydrocarbons can be classified as alkenes and alkanes <i>...how to</i> differentiate between alkenes and alkanes	Alkanes, alkenes, double bond, unsaturated, saturated, functional group, homologous series	a) <u>Numeracy</u> Interpreting charts and graphs on data linking crude oil and its uses. Using general formulae to predict formulae of alkanes and alkenes. b) <u>Literacy</u> 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) <u>Reading</u> Reading for information retrieval. Literacy homework - Comparison and evaluation of the environmental impacts of production of ethanol from steam hydration of ethane and fermentation of glucose with yeast. d) <u>Cultural Capital/Careers</u> Organic chemistry can help you get into careers in forensics,
		<u>Lesson 2 – Alkenes and their Reactions</u> <i>...that</i> alkenes undergo reactions in which atoms are added to the carbons in the double bond <i>...how to</i> test for the presence of the alkene functional group <i>...how to</i> represent the polymerisation of alkenes and predict the products of addition polymerisation	Alkanes, alkenes, double bond, unsaturated, addition reactions, functional group, polymer	
		<u>Lesson 3 – Alcohols, Carboxylic Acids and Esters</u> <i>...that</i> alcohols, carboxylic acids and esters are homologous series with differing functional groups which affects their chemical reactivity <i>... how to</i> test for the different functional groups and write equations for their reactions	Functional group, carboxylic acid, ester, ethyl ethanoate, strong and weak acids, Combustion, oxidising agent, fermentation, glucose, yeast	
		<u>Lesson 4 – Condensation Polymers</u> <i>...that</i> condensation polymers are formed from two different monomers to give a polymer and water	Condensation polymerisation, monomers, repeat units	

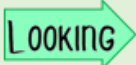
flavourings, dyes and detergents.		... <i>how to</i> represent condensation polymers		pharmaceuticals, making perfumes and flavours (Christmas dinner flavoured crisps!) How synthetic polymers have had an impact on everyday life. History of the discovery of DNA as a polymer chain. (e) <u>Cross curricular knowledge links</u> DT: polymers as design materials. Geography – crude oil as a finite resources Biology – biochemistry, amino acids, proteins and DNA (f) <u>Misconceptions</u> 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>Lesson 5 – Biochemistry</u> ...<i>that</i> polymers exist naturally, for example proteins and DNA ...<i>how</i> natural polymers form ... <i>how to</i> describe the structure of DNA in detail.	Amino acids, polypeptides, proteins, cellulose, starch, deoxyribonucleic acid, polymer chains, nucleotides, double helix	

Year 10 Topic Five - Rate and extent of chemical change (GCSE 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.
4.6 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 kinetics	<u>Lesson 1 – Measuring Rate of Reaction</u> <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	Product, reactant, rate, mean, gradient	a) <u>Numeracy</u> 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. b) <u>Literacy and reading</u> Analysis and evaluation of data based questions using extended text for use of changing conditions on the Haber process.
		<u>Lesson 2 – Factors affecting rate of reaction</u> <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	Collision, particle, energy, activation, rate, concentration, pressure, sufficient, catalyst, temperature, surface area, state	
		<u>Lesson 3 and 4 – Changing Surface Area</u> <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	Dependent, independent, control, variable, surface area, delivery tube	
		<u>Lesson 5, 6 and 7 – 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	Dependent, independent, control, variable, rate, concentration, hydrochloric, thiosulphate. Erlenmeyer, obscure, hypothesis, conclusion	

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.		...<i>how to</i> describe and explain the shape of a graph		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>Lesson 8 – Reversible Reactions</u> ... <i>that</i> some chemical reactions are reversible ...<i>how to</i> represent reversible reactions	Reactant, product, forward, backward, reversible, equilibrium, rate, anhydrous, hydrated	
		<u>Lesson 9 and 10 – 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	Reactant, product, forward, backward, reversible, equilibrium, Le Chatelier.	
		<u>Lesson 11 – Haber Process</u> ... <i>that</i> the Haber process is a major industrial reaction ...<i>how to</i> explain the compromise conditions required in the Haber process	Haber process, ammonia, reactor, fertilisers	

Year 10 Topic One - Bonding, Structures and Properties (GCSE 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.
4.2 Bonding, Structures and Properties 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.	 Linking Year 7 Properties of metals and non-metals Year 8 Periodic table Year 9 Atomic structure  Looking Year 11 Apply bonding knowledge and detailed use of nanoparticle Post 16 AS Bonding unit	Lesson 1 – 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	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. 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 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.
		Lesson 2 – Ionic Compounds <i>...that</i> ionic compounds can be represented in different ways. <i>...how to</i> describe and explain ionic bond formation using dot and cross diagrams.	Giant, lattice, 3D, ions	
		Lesson 3 – Properties of Ionic Compounds <i>...that</i> the specific bonding in ionic compounds leads to different properties. <i>...how to</i> construct the formula of common ionic compounds.	Conductivity, brittle, soluble, electrostatic	
		Lesson 3 and 4 – 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	Covalent, dot and cross, sharing, valence, intermolecular forces	

				Non metals do-not conduct electricity however graphite, graphene and fullerenes made purely from carbon (a non-metal) can conduct electricity.
		Lesson 5 – Polymers <i>...that</i> simple covalent molecules can form polymers <i>...how to</i> draw the structure of polymers and repeat units	Polymer, manufactured, covalent, molecule, monomer, repeat unit polymerisation, thermosetting, thermosoftening, intermolecular	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.
		Lesson 6 – Giant Covalent Molecules <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	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.
		Lesson 7 – Nanoparticles <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	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.
		Lesson 8 – Metallic Bonding <i>...that</i> metallic bonding occurs in metals <i>...how to</i> explain the properties of metals in terms of structure and bonding	Delocalised, electrostatic, electron, conduction	An ionic bond is the attraction between positive and negative ions (multiples of

		<u>Lesson 9 – Alloys and Transition Metals</u> <i>...that</i> alloys are mixture of metals and either metals or non-metals <i>...how to</i> explain the properties of alloys in terms of structure and bonding <i>...that</i> transition metals have a range of properties	Mixtures, properties, malleable, proportion, stainless, sonorous, malleable, ductile, reflective, conductor, catalyst, compound	each) however electrons must be transferred for those charges to appear.
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Year 10 Topic Eight - Earths resources and using resources (GCSE 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 and using 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	 Year 7 Fossil fuels Year 9 Organic chemistry  Year 11 Apply Earths resources and using resources knowledge. Post 16 Polymers	<u>Lesson 1 – The Earths Resources</u> <i>...that</i> the Earth provides all the resources needed for human survival. <i>... how to</i> distinguish between finite and renewable sources.	Resources, warmth, shelter, food, transport, natural, agriculture, fuels, finite, renewable.	a) <u>Numeracy</u> Extract and interpret information about resources from charts, graphs, and tables. Use orders of magnitude to evaluate significance of data. b) <u>Literacy and reading</u> 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) <u>Cultural Capital/Careers</u> How composites have had an impact on everyday life. The Haber process, its place in history and the modern impacts of fertiliser development.
		<u>Lesson 2– 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.	Metal ores, phytomining, bioleaching, bacteria, leachate, electrolysis, metal extraction.	
		<u>Lesson 3 – Reduce, Reuse and Recycle and Life Cycle Assessments</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>...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.	Life cycle assessment, manufacturing, packaging, lifetime, quantified, processing. Metals, glass, building materials, ceramics, quarrying, mining, recycled, melting, recasting, scrap, ore, extraction.	

environmental chemists' study how human activity has affected the Earth's natural cycles and how damaging effects can be minimised.		<u>Lesson 4 – Materials</u> <i>...that</i> most everyday metals we use are alloys and they have specific uses. <i>... how to</i> interpret and evaluate the composition and uses of alloys. <i>...that</i> the properties of materials are related to their uses. <i>... how to</i> compare the physical properties of glass and clay ceramics, polymers, and composites.	Alloys, jewellery, proportion, carats, shaped, malleable, ductile, corrosion, resistant, density. Limestone, borosilicate, temperature, clay, pottery, conditions, density, thermosoftening, polymers, thermosetting, composites.	Access to potable water and purification of water sources in different locations around the 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>Lesson 5 – Corrosion and its Prevention</u> <i>...that</i> rusting is an example of corrosion. <i>... how to</i> prevent rusting.	Corrosion, environment, rusting, air, water, coating, barrier, electroplating, greasing, painting, reactive, galvanise, sacrificial protection.	
		<u>Lesson 6 – The Haber Process</u> <i>...that</i> the Haber process is used to manufacture ammonia, which is used to produce nitrogen-based fertilisers. <i>... how to</i> apply the principles of dynamic equilibrium to the Haber process. <i>... how to</i> explain the compromise conditions used in the Haber process.	Manufacture, fertiliser, Haber process, catalyst, pressure, reversible reaction, equilibrium	
		<u>Lesson 7 – Production and Uses of NPK Fertilisers</u> <i>...that</i> NPK fertilisers are used to improve agricultural productivity. <i>...that</i> phosphate rock must be treated and cannot be directly used as a fertiliser. <i>... how to</i> compare the industrial production of fertilisers with laboratory preparations.	Industrial, production, processes, fertilisers, formulations, preparation, laboratory	

		Lesson 8 – 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.	Potable, pure, sterilising, desalination, reverse osmosis, filter.	
		Lesson 9 – Wastewater Treatment <i>...that</i> sewage can be treated to make it safe to drink. <i>... how to</i> purify wastewater.	Sewage, grit, sedimentation, anaerobic digestion, aerobic, effluent, sludge, agricultural.	
		Lesson 10 – Water RP <i>... how to</i> purify salt water by simple distillation. <i>... how to</i> test the purity of the water produced.	Distillation, Liebig condenser, evaporation, condensing, boiling point	

Year 10 Two Quantitative (GCSE Chemistry)

Topic Quantitative Chemistry	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.
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 communicate chemical ideas.	 Year 8 Periodic table Year 9 Atomic structure and periodic table, chemical changes, acids and alkalis  Year 11 Apply quantitative knowledge across a broad range of questions. Post 16 Quantitative chemistry	<u>Lesson 1 – 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	Mass number, formula mass, formula, equation, reactants, products	a) <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. b) <u>Literacy and reading</u> c) <u>Cultural Capital/Careers</u> Chemical engineers, pharmaceuticals, toxicology, river water analysis d) <u>Cross curricular knowledge links</u> Rearranging equations, converting units, percentages all linked with maths skills e) <u>Misconceptions</u> When balancing equations you can't change how the compounds are made up – this means you can't add
		<u>Lesson 2 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	Conservation, mass, balanced	
		<u>Lesson 3 – Conservation of Mass Practical</u> <i>...that</i> mass does not always appear to be conserved in a reaction <i>...how to</i> complete a practical to investigate conservation of mass safely	Safety, crucible, balance, weighing boat	

		<u>Lesson 4 - 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 your knowledge to questions	Mole, quantity, mass, relative atomic/formula mass, Avogadro's constant	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. 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. 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>Lesson 5 – 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	Moles, reacting masses, balanced equation, conservation	
		<u>Lesson 6 – Using Moles to Balance Equations</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 find stoichiometry to balance equations	Balancing, stoichiometry, moles	
		<u>Lesson 7 – Limiting Reactants</u>	Stoichiometry, limiting reactant, excess	

		...<i>that</i> quantity of product is limited by the quantity of reactant ...<i>how to</i> apply the moles equation to find the limiting reactant in a reaction		
		<u>Lesson 8 – Percentage Yield and Atom Economy</u> ...<i>that</i> reactions do not always produce a 100% yield ...<i>how to</i> calculate percentage yield for given reactions ...<i>how to</i> calculate atom economy for given reactions	Completion, reversible, yield, reactant, product, theoretical, atom economy	
		<u>Lesson 9 – Concentration of Solutions</u> ...<i>that</i> cubic decimetres are a unit of concentration ...<i>how to</i> convert between units ...<i>how to</i> calculate the concentration of solutions.	Solutions, concentration, volume, solute, decimetre, cubic centimetre, mass	
		<u>Lesson 10 – Titration Calculations</u> ...<i>that</i> the concentration of an unknown acid or alkali can be found via a titration reaction ...<i>how to</i> calculate the concentration of an unknown using the concentration equations	Solutions, concentration, volume, solute, decimetre, cubic centimetre, mass,	

		<u>Lesson 11 – Volume of Gases</u> <i>...that</i> one mole of gas occupies a set volume <i>...how to</i> calculate the volume of gas using the moles equation	Volume, temperature, pressure, volumes, gaseous	
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