Curriculum Map Year 11– Chemistry

Topic Name		Scientific Skills	Essential Knowledge (misconceptions or really tricky bits are highlighted in red)	Prior Learning (KS3 or Y10)	Assessment
Structures and Bonding	*Autumn HT1 (approx.8 lessons)*	**Demonstrating that I can:** • Visualise and represent 2D and 3D forms including two dimensional representations of 3D objects. • Recognise substances as small molecules, polymers or giant structures from diagrams showing their bonding. • Recognise substances as metallic giant structures from diagrams showing their bonding.	**In this topic I will know how to:** • explain chemical bonding in terms of electrostatic forces and the transfer or sharing of electrons. • draw dot and cross diagrams for ionic compounds • work out the charge on the ions of metals and non-metals from the group number of the element, limited to the metals in Groups 1 and 2, and non-metals in Groups 6 and 7 • deduce that a compound is ionic from a diagram of its structure • describe the limitations of using dot and cross, ball and stick, two and three-dimensional diagrams to represent a giant ionic structure • work out the empirical formula of an ionic compound • recognise common substances that consist of small molecules • draw dot and cross diagrams for the molecules • represent the covalent bonds in small molecules, in the repeating units of polymers and in part of giant covalent structures • deduce the molecular formula of a substance • predict the states of substances at different temperatures • explain the different temperatures at which changes of state occur in terms of energy transfers and types of bonding • recognise giant covalent structures • explain why alloys are harder than pure metals • explain the properties of graphite and graphene • recognise graphene and fullerenes from diagrams and descriptions • give examples of the uses of fullerenes, including carbon nanotubes. <u>HT</u> explain the limitations of the particle theory in relation to changes of state when particles are represented by solid inelastic spheres which have no forces between them. • compare ‘nano’ dimensions to typical dimensions of atoms and molecules. • evaluate the use of nanoparticles • explain that there are possible risks associated with the use of • nanoparticles.	**Before I start this topic, I need to know:** • solids, liquids and gases and phase changes how do we classify solids liquids and gases • what properties do each possess • how the atoms are arranged and how does this allow for specific properties • state symbols in chemical equations • atomic structure • What is the relative charge on a proton? • What is the relative charge of an electron? • Electron arrangement • What an ion is	**Knowledge and skills will be assessed by:** Assessment booklet Deduce the charge on the ions of metals and non-metals from the group number of the element Describe how ionic compounds are formed Draw dot and cross diagrams for the molecules of oxygen, water and methane Describe the limitations of using dot and cross, ball and stick, two and three-dimensional diagrams to represent a giant ionic structure Explain why alloys are harder than pure metals Explain the properties of diamond in terms of its structure and bonding. Explain the properties of graphite in terms of its structure and bonding. End of topic assessment

QUANTITATIVE CHEMISTRY	*Autumn HT2* *(approx.11 lessons*	**Demonstrating that I can:** • Rearrange equations and use them correctly. • Round up or down to 2dp or 3sf correctly. • How to convert units by scaling up or down e.g. g to kg or cm^3 to dm^3 • Use ratios, fractions and percentages. • <u>HT</u> • Work with standard form (Avogadro's number)	**In this topic I will know how to:** • Find the relative atomic mass of an element from the Periodic Table. • Calculate the relative formula mass of a compound. • Calculate the % of an element in a compound. • Describe what the concentration of a solution is • Calculate the concentration of a solution in g/dm^3 or the mass of solute with a given concentration. **<u>HT</u>** • Balance a symbol equation • Calculate the number of moles of a substance from a given mass or volume of gas • Understand how to find mole ratios from a balanced symbol equation • Calculate the mass of reactant or product in a reaction using the mole ratios • Identify the limiting reagent in a chemical reaction • Calculate the number of particles in a solution with a given concentration and volume • calculate the percentage yield of a product from the actual yield of a reaction. • calculate the atom economy of a reaction to form a desired product from the balanced equation. • describe how to carry out titrations using strong acids and strong alkalis only (sulfuric, hydrochloric and nitric acids only) to find the reacting volumes accurately. HT • calculate the theoretical mass of a product from a given mass of reactant and the balanced equation for the reaction. • explain why a particular reaction pathway is chosen to produce a specified product. • explain how the concentration of a solution in mol/dm3 is related to the mass of the solute and the volume of the solution. • calculate the chemical quantities in titrations involving concentrations in mol/dm^3 and in g/dm^3 • calculate the volume of a gas at room temperature and pressure from its mass and relative formula mass. • calculate volumes of gaseous reactants and products from a balanced equation and a given volume of a gaseous reactant or product	**Before I start this topic, I need to know:** • How to locate an atomic or mass number on the Periodic Table • The difference between elements and compounds, atoms and elements. • How to write basic chemical formulae like H_2O and know how many atoms and elements are in the molecule. • Particle theory • The term solution (aq) and be able to describe a solution in terms of particles, dissolving, soluble and insoluble. • Be able to understand the terms volume and mass and understand how to measure them in the lab.	**Knowledge and skills will be assessed by:** Assessment booklet State that mass is conserved and explain why, including describing balanced equations in terms of conservation of mass. Describe what the relative formula mass (Mr) of a compound is and calculate the relative formula mass of a compound, given its formula. Calculate the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution. HT Explain the effect of limiting the quantity of a reactant on the amount of products in terms of moles or masses in grams Explain how the mass of a solute and the volume of a solution is related to the concentration of the solution. calculate the percentage yield of a product from the actual yield of a reaction. calculate the theoretical mass of a product from a given mass of reactant and the balanced equation for the reaction. calculate the atom economy of a reaction to form a desired product from the balanced equation. calculate the volume of a gas at room temperature and pressure from its mass and relative formula mass. Required practical: determination of the reacting volumes of solutions of a strong acid and a strong alkali by titration. (HT only) determination of the concentration of one of the solutions in mol/dm3 and g/dm3 from the reacting volumes and the known concentration of the other solution. End of topic assessment

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<tr>
<td rowspan="2">Chemical Changes 1</td>
<td rowspan="2">Spring HT3 (approx.8 lessons</td>
<td rowspan="2">Demonstrating that I can:
• mix reagents to explore chemical changes and/or products.
• safely use appropriate heating devices and techniques including use of a Bunsen burner and a water bath or electric heater.
• use appropriate apparatus and techniques for conducting chemical reactions, including appropriate reagents.
• safely use of a range of equipment to purify and/or separate chemical mixtures including evaporation, filtration, crystallisation.
• safely use and careful handle liquids and solids, including careful mixing of reagents under controlled conditions.

HT
• Make order of magnitude calculations.</td>
<td>In this topic I must know how to:
• explain reduction and oxidation in terms of loss or gain of oxygen.
• Work out an order of reactivity of metals based on experimental results.
• interpret or evaluate specific metal extraction processes identifying the substances which are oxidised or reduced.
• predict products from given reactants.
• use the formulae of common ions to deduce the formulae of salts.
• describe the use of universal indicator or a wide range indicator to measure the approximate pH of a solution.
• use the pH scale to identify acidic or alkaline solutions.

HT
• write ionic equations for displacement reactions.
• identify in a reaction, symbol equation or half equation which species are oxidised, and which are reduced.
• explain what redox reactions are.
• use and explain the terms dilute and concentrated (in terms of amount of substance), and weak and strong (in terms of the degree of ionisation) in relation to acids</td>
<td>Before I start this topic, I must know:
• Most metals are found combined with other elements, as a compound, in ores. The more reactive a metal, the more difficult it is to separate it from its compound. Carbon displaces less reactive metals, while electrolysis is needed for more reactive metals
• Metals react with oxygen to form oxides.
• Metals can be arranged as a reactivity series in order of how readily they react with other substances. Some metals react with acids to produce salts and hydrogen.
• The pH of a solution depends on the strength of the acid: strong acids have lower pH values than weak acids.
• Mixing an acid and alkali produces a chemical reaction, neutralisation, forming a chemical called a salt and water.
• Acids have a pH below 7, neutral solutions have a pH of 7, alkalis have a pH above 7.
• Acids and alkalis can be corrosive or irritant and require safe handling.</td>
<td rowspan="2">Knowledge and skills will be assessed by:

Assessment booklet
Plan an investigation to find the order of reactivity of three metals using the temperature change when each metal reacts with hydrochloric acid.
Name common salts
Use the formulae of common ions to deduce the formulae of salts.
Use the pH scale to identify acidic or alkaline solutions.

Required practical activity: preparation of a pure, dry sample of a soluble salt from an insoluble oxide or carbonate, using a Bunsen burner to heat dilute acid and a water bath or electric heater to
evaporate the solution.

HT
identify in a reaction which species are oxidised, and which are reduced.
Write ionic equations for displacement reactions.
use and explain the terms dilute and concentrated (in terms of amount of substance), and weak and strong (in terms of the degree of ionisation) in relation to acids.
End of topic assessment</td>
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<tr>
<td>• describe the use of universal indicator or a wide range indicator
• to measure the approximate pH of a solution
• use the pH scale to identify acidic or alkaline solutions.
• describe how to carry out titrations using strong acids and strong alkalis only to find the reacting volumes accurately
HT
• calculate the chemical quantities in titrations involving concentrations in mol/dm3 and in g/dm3.</td>
<td>Required practical: determination of the reacting volumes of solutions of a strong acid and a strong alkali by titration</td>
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Chemical Changes 2	*Spring HT4 (approx.6 lessons*	**Demonstrating that I can:** • use of appropriate apparatus and techniques for conducting and monitoring chemical reactions. • use of appropriate apparatus and techniques to draw, set up and use electrochemical cells for separation and production of elements and compounds. • use scientific theories and explanations to develop hypotheses. • plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena. • apply a knowledge of a range of techniques, instruments, apparatus and materials to select those appropriate to the experiment. • carry out experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations. • make and record observations and measurements using a range of apparatus and methods.	**In this topic I must know how to:** • predict the products of the electrolysis of ionic compounds in the molten state. • explain why a mixture is used in the extraction of Aluminium from its ore and why the positive electrode must be continually replaced. • predict the products of the electrolysis of aqueous solutions containing an ionic compound. **HT** • Represent reactions at electrodes as half equations	**Before I start this topic, I must know:** • An ore is a naturally occurring rock containing sufficient minerals for extraction. • Extraction is the separation of a metal from a metal compound. • Recycling is the processing of a material so that it can be used again. • Electrolysis is using electricity to split up a compound into its elements.	**Knowledge and skills will be assessed by:** Assessment booklet predict the products of the electrolysis of ionic compounds in the molten state. explain why a mixture is used in the extraction of Aluminium from its ore and why the positive electrode must be continually replaced. predict the products of the electrolysis of aqueous solutions containing an ionic compound. Required practical activity: investigate what happens when aqueous solutions are electrolysed using inert electrodes. HT Represent reactions at electrodes as half equations. End of topic assessment
Reflection and preparation for examinations	*Summer HT5*				
Examination period	*Summer HT6*				