Curriculum Map Year 10 Chemistry

Topic Name		Scientific Skills	Essential Knowledge (misconceptions or really tricky bits are highlighted in red)	Prior Learning (KS3 or Y10)	Assessment
Fundamentals	*Autumn HT1 (approx.14 lessons)*	**Demonstrating that I can:** • safely use of a range of equipment to separate chemical mixtures. • describe how scientific methods and theories develop over time - the difference between the plum pudding model of the atom and the nuclear model of the atom. • represent the electronic structures of the first twenty elements. • use SI units and the prefix nano. • recognise expressions in standard form. • Recognise and use expressions in decimal form. • Use ratios, fractions and percentages.	**In this topic I will know how to:** • use the nuclear model to describe atoms. • calculate the relative atomic mass of an element given the percentage abundance of its isotopes. • suggest suitable separation and purification techniques for mixtures. • explain how paper chromatography separates mixtures and suggest how chromatographic methods can be used for distinguishing pure substances from impure substances. • interpret chromatograms and determine Rf values from chromatograms. • explain how the position of an element in the periodic table is related to the arrangement of electrons in its atoms and hence to its atomic number. • describe the steps in the development of the periodic table. • explain how properties of the elements in Group 0, 1 and 7 depend on the outer shell of electrons of the atoms and predict properties down the group.	Before I start this topic, I need to know: • What atoms, elements, mixtures and compounds are • use the names and symbols of the first 20 elements in the periodic table and name compounds of these elements from formulae or symbol equations. • write word (or symbol) equations for the reactions. • Mixtures may be separated due to differences in their physical properties. The method chosen to separate a mixture depends on which physical properties of the individual substances are different.	**Knowledge and skills will be assessed by:** Assessment Booklet Can describe the subatomic particles in the atom Represent the electronic structures of the first twenty elements of the periodic table in both forms Describe the difference between the plum pudding model of the atom and the nuclear model of the atom. Explain what an isotope is and how to calculate their relative atomic masses Describe, explain and give examples of Distillation Calculate Rf values Describe these steps in the development of the periodic table Explain how properties of the elements in Group 0 depend on the outer shell of electrons of the atoms Predict physical properties from given trends down group 1. Predict physical properties from given trends down group 7 and use displacement reactions to determine order of reactivity. Required practical: Investigate how paper chromatography can be used in forensic science to identify an ink mixture used in a forgery. End of topic assessment
			• describe the differences in transition metals compared with Group 1 in melting points, densities, strength, hardness and reactivity with oxygen, water, and halogens. • know many transition elements have ions with different charges, form coloured compounds and are useful as catalysts.	• the location of the Transition and Alkali metals in the Periodic Table • the properties of the Alkali metals	describe the differences in transition metals compared with Group 1 End of topic assessment
Using resources	*Autumn HT2 (approx.10 lessons*	**Demonstrating that I can:** • safely use appropriate heating devices and techniques including use of a Bunsen burner and a water bath. • use appropriate apparatus and techniques for the measurement of pH in different situations. • safely use of a range of equipment to purify and/or separate chemical mixtures including evaporation, distillation.	**In this topic I will know how to:** • state examples of natural products that are supplemented or replaced by agricultural and synthetic products. • distinguish between finite and renewable resources. • distinguish between potable water and pure water. • describe the differences in treatment of ground water and salty water. • comment on the ease of obtaining potable water from waste, ground, and salt water.	**Before I start this topic, I need to know:** • There is only a certain quantity of any resource on Earth, so the faster it is extracted, the sooner it will run out. • Recycling reduces the need to extract resources. • A pure substance consists of only one type of element or compound and has a fixed melting and boiling point.	**Knowledge and skills will be assessed by:** Assessment booklet Distinguish between potable water and pure water Describe how wastewater is treated Life Cycle Assessment Comparative LCA for shopping bags made from plastic and paper

		• apply 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. • evaluate methods and suggest possible improvements and further investigations. • extract and interpret information about resources from charts, graphs and tables. • carry out simple comparative LCAs for shopping bags made from plastic and paper • use orders of magnitude to evaluate the significance of data. • recognise and use expressions in decimal form. • Use ratios, fractions and percentages. • Make estimates of the results of simple calculations. • Use an appropriate number of significant figures.	• Know how a Life cycle assessments (LCAs) is carried out to assess the environmental impact of products • evaluate ways of reducing the use of limited resources. HT • evaluate alternative biological methods of metal extraction – phytomining and bioleaching	• Acids have a pH below 7, neutral solutions have a pH of 7, alkalis have a pH above 7.	Evaluate ways of reducing the use of limited resources Evaluate alternative biological methods of metal extraction, given appropriate information. Required practical: Analysis and purification of water samples from different sources, including pH, dissolved solids and distillation.
		• Investigate the conditions for rusting.	• describe experiments and interpret results to show that both air and water are necessary for rusting. • explain sacrificial protection in terms of relative reactivity. • interpret and evaluate the composition and uses of alloys. • compare the physical properties of glass and clay ceramics, composites, and metals. • explain how the properties of materials are related to their uses and select appropriate materials.	• the reactions of metals with water • compare the structure of an alloy as opposed to a pure metal. • Know what a composite is.	interpret results to show that both air and water are necessary for rusting. evaluate the composition and uses of alloys. explain how the properties of materials are related to their uses and select appropriate materials. End of topic assessment
Organic chemistry	*Autumn HT2 (approx.13 lessons*	**Demonstrating that I can:** • Make models of alkane molecules using the molecular modelling kits. • Visualise and represent 2D and 3D forms including two dimensional representations of 3D objects. •	**In this topic I must know how to:** • recognise substances as alkanes given their formulae. • explain how fractional distillation works in terms of evaporation and condensation. • recall how boiling point, viscosity and flammability change with increasing molecular size. • write balanced equations for the complete combustion of hydrocarbons. • describe the conditions used for catalytic cracking and steam cracking • recall the colour change when bromine water reacts with an alkene. • balance chemical equations as examples of cracking given the formulae of the reactants and products and give examples to illustrate the usefulness of cracking.	**Before I start this topic, I must know:** • Distillation is the separating substances by boiling and condensing liquids. • Evaporation is a way to separate a solid dissolved in a liquid by the liquid turning into a gas. • Chemical formula shows how the elements present in a compound and their relative proportions. • Compound is two or more different elements strongly bonded together. • Chemical bond is the force that holds atoms together in molecules. • Fuel stores energy in a chemical store which it can release as heat. • Conserved is when the quantity of something does not change after a process takes place. • Write word (or symbol) equations for the reactions.	**Knowledge and skills will be assessed by:** Assessment booklet Explain how fractional distillation works in terms of evaporation and condensation Show graphically how boiling point changes with increasing molecular size. Write balanced equations for the complete combustion of hydrocarbons with a given formula. Describe in general terms the conditions used for catalytic cracking and steam cracking. Balance chemical equations as examples of cracking given the formulae of the reactants and products.

		• Recognise substances that are alkenes from their names or from given formulae. • Use models to represent condensation polymerisation. • Use models to explain how a molecule of DNA is formed.	• Describe the difference between an alkane and an alkene. • Draw the displayed structural formulae for the first four members of the alkenes. • Explain why alkenes are called unsaturated molecules. • describe the reactions and conditions for the addition of hydrogen, water and halogens to alkenes. • draw fully displayed structural formulae of the first four members of the alkenes and the products of their addition reactions with hydrogen, water, chlorine, bromine and iodine. • describe what happens when any of the first four alcohols react with sodium, burn in air, are added to water, react with an oxidising agent. • recall the main uses of alcohols. • know the conditions used for fermentation of sugar using yeast. • recognise alcohols from their names or from given formulae. • Describe the reactions of carboxylic acids. • Recognise carboxylic acids from their formulae. • Explain the reaction of ethanoic acid with an alcohol. • describe what happens when carboxylic acids react with carbonates, dissolve in water, react with alcohols. • recognise addition polymers and monomers from diagrams and from the presence of the functional group C=C in the monomers • draw diagrams to represent the formation of a polymer from a • given alkene monomer. • relate the repeating unit to the monomer. • explain how low density and high-density poly(ethene) are both produced from ethene • explain the difference between thermosoftening and thermosetting polymers in terms of their structures. HT • explain the basic principles of condensation polymerisation by reference to the functional groups in the monomers and the repeating units in the polymers. • Describe the functional group of an amine. • Identify the two functional groups of an amino acid. • Explain how different amino acids build proteins. • Describe the components of natural polymers. • Explain the structure of proteins and carbohydrates. • Explain how a molecule of DNA is constructed.	• Test for carbon dioxide	Draw the displayed formula of ethene. Draw the displayed formula of the compound formed when bromine, iodine, hydrogen and water react with ethene. Explain why dibromoethane is saturated, but ethene is unsaturated. Write the structural and draw the displayed formula for the first four alcohols. State how you can recognise them from their name and from the formula. Describe what happens when propanol/methanol react with sodium, burn in air, are added to water, react with acidified sodium dichromate. Recognise carboxylic acids from their formulae. Name the compounds produced when ethanoic acid reacts with ethanol and write a word equation. Draw diagrams to represent the formation of a polymer from a given alkene monomer. Explain the difference between thermosoftening and thermosetting polymers in terms of their structures. Explain the principles of condensation polymerisation. Identify the two functional groups of an amino acid (glycine) Explain how a molecule of DNA is constructed. End of topic assessment
Atmosphere	*Spring HT3 (approx.7 lessons*	**Demonstrating that I can:** • recognise and use expressions in decimal form. • Use ratios, fractions and percentages.	**In this topic I must know how to:** • interpret evidence and evaluate different theories about the Earth's early atmosphere. • describe the main changes in the atmosphere over time and some of the likely causes of these changes. • describe and explain the formation of deposits of limestone, coal, crude oil and natural gas. • describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter. • describe uncertainties in the evidence base and recognise the importance of peer review of results and of communicating results to a wide range of audiences. • discuss the scale, risk, and environmental implications of global climate change.	**Before I start this topic, I must know:** • Carbon is recycled through natural processes in the atmosphere, ecosystems, oceans and the Earth's crust (such as photosynthesis and respiration) as well as human activities (burning fuels). • Greenhouse gases reduce the amount of energy lost from the Earth through radiation and therefore, the temperature has been rising as the concentration of those gases has risen.	**Knowledge and skills will be assessed by:** Assessment booklet Compare the early atmosphere with the modern atmosphere Explain the causes of the main changes in the atmosphere Evaluate a carbon footprint

			• describe actions to reduce emissions of carbon dioxide and methane and give reasons why actions may be limited. • describe how carbon monoxide, soot (carbon particles), sulfur dioxide and oxides of nitrogen are produced by burning fuels. • describe and explain the problems caused by increased amounts of pollutants in the air.	• Scientists have evidence that global warming caused by human activity is causing changes in climate. • Methane and carbon dioxide are greenhouse gases. • Earth's atmosphere contains around 78% nitrogen, 21% oxygen, <1% carbon dioxide, plus small amounts of other gases.	
Chemical Analysis	*Spring HT4 (approx.5 lessons*	**Demonstrating that I can:** • Perform flame tests to identify different metal ions. • Make precipitates of metal hydroxides.	**In this topic I must know how to:** • use melting point and boiling point data to distinguish pure from impure substances. • identify formulations. • Perform the gas tests for hydrogen, oxygen, carbon dioxide and chlorine. • Identify an unknown species from the results of the tests for metal ions / metal hydroxides / carbonates / halides / sulfates. • write word and balanced equations for the reactions. • state advantages of instrumental methods compared with the chemical tests. • interpret an instrumental result given appropriate data in chart or tabular form.	**Before I start this topic, I must know:** Mixtures may be separated due to differences in their physical properties. The method chosen to separate a mixture depends on which physical properties of the individual substances are different.	**Knowledge and skills will be assessed by:** Required practical: use of chemical tests to identify the ions in unknown single ionic compounds. End of topic assessment

Rates of reaction	*Summer HT5 (approx.18 lessons*	**Demonstrating that I can:** • Translate information between graphical and numeric form. • Drawing and interpreting appropriate graphs from data to determine rate of reaction. • Plot two variables from experimental or other data. • Determine the slope and intercept of a linear graph. • use of appropriate apparatus to make and record a range of measurements accurately, including mass, temperature, and volume of liquids and gases. • make and record appropriate observations during chemical reactions including the measurement of rates of reaction by a variety of methods such as production of gas and colour change. • safe use and careful mixing of reagents under controlled conditions, using appropriate apparatus to explore chemical changes. • use scientific theories and explanations to develop hypotheses. • 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. • evaluate methods and suggest possible improvements and further investigations. . • use an appropriate number of significant figures. • find arithmetic means. HT Draw and use the slope of a tangent to a curve as a measure of rate of change.	**In this topic I must know to:** • calculate the mean rate of a reaction. • draw, and interpret, graphs showing the quantity of product formed or quantity of reactant used up against time. • recall how changing these factors affects the rate of chemical reactions. • predict and explain using collision theory the effects of changing conditions of concentration, pressure and temperature on the rate of a reaction. • predict and explain the effects of changes in the size of pieces of a reacting solid in terms of surface area to volume ratio. • use simple ideas about proportionality when using collision theory to explain the effect of a factor on the rate of a reaction. • identify catalysts in reactions from their effect on the rate of reaction and because they are not included in the chemical equation for the reaction and explain catalytic action in terms of activation energy. • energy changes and reversible reactions HT • draw tangents to curves and use the slope of the tangent as a measure of the rate of reaction. • make qualitative predictions about the effect of changes on systems at equilibrium. • interpret data to predict the effect of a change in concentration of a reactant or product on given reactions at equilibrium. • interpret data to predict the effect of a change in temperature on given reactions at equilibrium. • interpret data to predict the effect of pressure changes on given reactions at equilibrium.	**Before I start this topic, I must know:** • The difference between a chemical reaction and physical change. • How to write word equations • A range of types of chemical reaction e.g. neutralisation, combustion • That all matter is made of particles called atoms. The difference between elements and compounds, atoms and elements. • The terms reactant and product. • Basic apparatus and practical techniques • How to draw a line graph	**Knowledge and skills will be assessed by:** Assessment booklet Calculate the mean rate of a reaction from given information about the quantity of a reactant used or the quantity of a product formed and the time taken Identify catalysts in reactions from their effect on the rate of reaction Predict and explain using collision theory the effects of changing temperature on the rate of a reaction Predict and explain using collision theory the effects of changing concentration on the rate of a reaction Draw a graph of data gathered during an investigation Analyse data and evaluate practical procedure Explain the effects of changes in the size of pieces of a reacting solid in terms of surface area to volume ratio Interpret graphs showing the quantity of product formed or quantity of reactant used up against time Required practical: Investigate how changes in concentration affect the rates of reactions by a method involving the production of a gas and a method involving a colour change Describe the reversible reaction for ammonium chloride Describe the reversible reaction for anhydrous/hydrated copper sulfate be able to make predictions about the effect of changes on systems at equilibrium when given appropriate information.
			• recall a source for the nitrogen and a source for the hydrogen used in the Haber process. HT • interpret graphs of reaction conditions versus rate in the Haber process • apply the principles of dynamic equilibrium in Reversible reactions and dynamic equilibrium to the Haber process. • explain the trade-off between rate of production and position. • of equilibrium • explain how the commercially used conditions for the Haber process are related to the availability and cost of raw materials and energy supplies, control of equilibrium position and rate.		interpret graphs of reaction conditions versus rate in the Haber process explain the trade-off between rate of production and position of equilibrium. End of topic assessment

<table>
<tr>
<td rowspan="2">Energy changes</td>
<td rowspan="2">Summer HT6 (approx.8 lessons</td>
<td>

use appropriate apparatus to make and record a range of measurements accurately, including mass, temperature, and volume of liquids.
make and record appropriate observations during chemical reactions
use scientific theories and explanations to develop hypotheses.
plan experiments or devise procedures to make observations, test hypotheses, check data or explore phenomena.
apply knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment.
carry out experiments appropriately - the accuracy of measurements and health and safety considerations.
make and record observations and measurements using a range of apparatus and methods.
evaluate methods and suggest possible improvements and further investigations.
recognise and use expressions in decimal form.
use an appropriate number of significant figures.
find arithmetic means.
translate information between graphical and numeric form.
plot two variables from experimental or other data

</td>
<td>
In this topic I must know to:

distinguish between exothermic and endothermic reactions on the basis of the temperature change of the surroundings.
evaluate uses and applications of exothermic and endothermic reactions.
draw simple reaction profiles (energy level diagrams) for exothermic and endothermic reactions showing the relative energies of reactants and products, the activation energy and the overall energy change, with a curved line to show the energy as the reaction proceeds.

HT

calculate the energy transferred in chemical reactions using bond energies supplied.

</td>
<td rowspan="2">
Before I start this topic, I need to know:

During a chemical reaction, bonds are broken (requiring energy) and new bonds formed (releasing energy). If the energy released is greater than the energy required, the reaction is exothermic. If the reverse, it is endothermic.
What activation energy is

</td>
<td>
Knowledge and skills will be assessed by:
Assessment booklet
Distinguish between exothermic and endothermic reactions on the basis of the temperature change of the surroundings
Draw appropriate graph for given data
Draw simple reaction profiles (energy level diagrams) for exothermic and endothermic reactions showing the relative energies of reactants and products, the activation energy and the overall energy change, with a curved line to show the energy as the reaction proceeds
Calculate the energy transferred in chemical reactions using bond energies supplied.
Required practical: Investigate the variables that affect temperature changes in reacting solutions, such as acid plus metals, acid plus carbonates, neutralisations, displacement of metals
End of topic as assessment
</td>
</tr>
<tr>
<td>

safe and careful use of liquids

</td>
<td>

interpret data for relative reactivity of different metals and evaluate the use of cells.
evaluate the use of hydrogen fuel cells in comparison with rechargeable cells and batteries

</td>
<td>
use data for relative reactivity of different metals and evaluate the use of cells.
evaluate the use of hydrogen fuel cells in comparison with rechargeable cells and batteries
</td>
</tr>
</table>