Programme of study for Year 10 Chemistry

Autumn (1st term)	Autumn (2nd term)	Spring (1st term)	Spring (2nd term)	Summer (1st Term)	Summer (2nd term)
Other timescale: From: September To: November	Other timescale: From: November To: December	Other timescale: From: Jaunary To: February	Other timescale: From: February To: April	Other timescale: From: April To: May	Other timescale: From: June To: July
Topic / Big Question: Quantitative chemistry Chemical changes Skills(students should be able to do): AO1: Demonstrate knowledge and understanding of: scientific ideas; scientific techniques and procedures. AO2: Apply knowledge and understanding of: scientific ideas; scientific enquiry, techniques and procedures. AO3: Analyse information and ideas to: interpret and evaluate; make judgments and draw conclusions; develop and improve experimental procedures	Topic / Big Question: Energy changes Skills(students should be able to do) AO1: Demonstrate knowledge and understanding of: scientific ideas; scientific techniques and procedures. AO2: Apply knowledge and understanding of: scientific ideas; scientific enquiry, techniques and procedures. AO3: Analyse information and ideas to: interpret and evaluate; make judgments and draw conclusions; develop and improve experimental procedures.	Topic / Big Question: Rate and extent of chemical changes Skills(students should be able to do): AO1: Demonstrate knowledge and understanding of: scientific ideas; scientific techniques and procedures. AO2: Apply knowledge and understanding of: scientific ideas; scientific enquiry, techniques and procedures. AO3: Analyse information and ideas to: interpret and evaluate; make judgments and draw conclusions; develop and improve experimental procedures	Topic / Big Question: Organic chemistry Skills(students should be able to do): AO1: Demonstrate knowledge and understanding of: scientific ideas; scientific techniques and procedures. AO2: Apply knowledge and understanding of: scientific ideas; scientific enquiry, techniques and procedures. AO3: Analyse information and ideas to: interpret and evaluate; make judgments and draw conclusions; develop and improve experimental procedures	Topic / Big Question: Chemistry of the atmosphere Skills(students should be able to do) AO1: Demonstrate knowledge and understanding of: scientific ideas; scientific techniques and procedures. AO2: Apply knowledge and understanding of: scientific ideas; scientific enquiry, techniques and procedures. AO3: Analyse information and ideas to: interpret and evaluate; make judgments and draw conclusions; develop and improve experimental procedures.	Topic / Big Question: Chemistry of the atmospheres continued and revision Skills(students should be able to do): AO1: Demonstrate knowledge and understanding of: scientific ideas; scientific techniques and procedures. AO2: Apply knowledge and understanding of: scientific ideas; scientific enquiry, techniques and procedures. AO3: Analyse information and ideas to: interpret and evaluate; make judgments and draw conclusions; develop and improve experimental procedures
Key Learning Outcomes (students should know): Students should be able to explain reduction and oxidation in terms of loss or gain of oxygen. recall and describe the reactions, if any, of potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper with water or dilute acids and where appropriate, to place	Key Learning Outcomes (students should know): 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 given appropriate information. draw simple reaction profiles (energy level diagrams) for exothermic	Key Learning Outcomes (students should know): Be able to: 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 • draw, and interpret, graphs showing the quantity of product formed or quantity of reactant used up against time • draw tangents to the curves on these graphs and use the slope of the tangent as a	Key Learning Outcomes (students should know): Be able to: Students should be able to recognise substances as alkanes given their formulae in these forms. Students should be able to explain how fractional distillation works in terms of evaporation and condensation. Students should be able to write balanced equations for the complete combustion of	Key Learning Outcomes (students should know): Be able to: Students should be able to, given appropriate information, interpret evidence and evaluate different theories about the Earth's early atmosphere. describe the main changes in the atmosphere over time	Key Learning Outcomes (students should know): Key Learning Outcomes (students should know): Be able to: Students should be able to, given appropriate information, interpret evidence and evaluate different theories about the Earth's early atmosphere. describe the main changes in the atmosphere over

these metals in order of reactivity explain how the reactivity of metals with water or dilute acids is related to the tendency of the metal to form its positive ion deduce an order of reactivity of metals based on experimental results. interpret or evaluate specific metal extraction processes when given appropriate information identify the substances which are oxidised or reduced in terms of gain or loss of oxygen. write ionic equations for displacement reactions identify in a given reaction, symbol equation or half equation which species are oxidised and which are reduced. explain reactions of acids in terms of gain or loss of electrons, that these are redox reactions identify which species are oxidised and which are reduced in given chemical equations. predict products from given reactants	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 use reaction profiles to identify reactions as exothermic or endothermic Explain that the activation energy is the energy needed for a reaction to occur. Students should be able to calculate the energy transferred in chemical reactions using bond energies supplied. Students should be able to 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 (HT only) write the half equations for the electrode reactions in the hydrogen fuel cell.	measure of the rate of reaction • (HT only) calculate the gradient of a tangent to the curve on these graphs as a measure of rate of reaction at a specific time. Students should be able to recall how changing 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. Students should be able to 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. Students should be able to explain catalytic action in terms of activation energy. Students should be able to make qualitative predictions about the effect of changes on systems at	hydrocarbons with a given formula. Knowledge of trends in properties of hydrocarbons is limited to: • boiling points • viscosity • flammability Students should be able to balance chemical equations as examples of cracking given the formulae of the reactants and products. Students should be able to give examples to illustrate the usefulness of cracking. They should also be able to explain how modern life depends on the uses of hydrocarbons. 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 these alcohols. Students are not expected to write balanced chemical equations for the reactions of alcohols	and some of the likely causes of these changes Describe and explain the formation of deposits of limestone, coal, crude oil and natural gas. Students should be able to describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter. Students should be able to recall two human activities that increase the amounts of each of the greenhouse gases carbon dioxide and methane. evaluate the quality of evidence in a report about global climate change given appropriate information describe uncertainties in the evidence base Recognise the importance of peer review of results and of communicating results to a wide range of audiences. describe briefly four potential effects of global climate change Discuss the scale, risk and environmental implications of global climate change.	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. Students should be able to describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter. Students should be able to recall two human activities that increase the amounts of each of the greenhouse gases carbon dioxide and methane. evaluate the quality of evidence in a report about global climate change given appropriate information describe uncertainties in the evidence base Recognise the importance of peer review of results and of communicating results to a wide range of audiences. describe briefly four potential effects of global climate change Discuss the scale, risk and environmental implications of global climate change. describe actions to reduce emissions of carbon dioxide and methane •

use the formulae of common ions to deduce the formulae of salts. Students should be able to describe how to make pure, dry samples of named soluble salts from information provided. 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 (sulfuric, hydrochloric and nitric acids only) to find the reacting volumes accurately (HT Only) calculate the chemical quantities in titrations involving concentrations in mol/dm3 and in g/dm3. 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 describe neutrality and relative acidity in terms of the effect on hydrogen ion concentration and the numerical value of pH (whole numbers only).		equilibrium when given appropriate information. Students should be able to interpret appropriate given data to predict the effect of a change in concentration of a reactant or product on given reactions at equilibrium. Students should be able to interpret appropriate given data to predict the effect of a change in temperature on given reactions at equilibrium Students should be able to interpret appropriate given data to predict the effect of pressure changes on given reactions at equilibrium	other than for combustion reactions. Students should know the conditions used for fermentation of sugar using yeast. Students should be able to recognise alcohols from their names or from given formulae. Recognise carboxylic acids from their names or from given formulae. Students do not need to know the names of individual carboxylic acids other than methanoic acid, ethanoic acid, propanoic acid and butanoic acid. recognise addition polymers and monomers from diagrams in the forms shown 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. Students should be able to explain the basic principles of condensation polymerisation by reference to the functional groups in the monomers and the repeating units in the polymers.	describe actions to reduce emissions of carbon dioxide and methane • 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 Predict the products of combustion of a fuel given appropriate information about the composition of the fuel and the conditions in which it is used. Students should be able to describe and explain the problems caused by increased amounts of these pollutants in the air.	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 Predict the products of combustion of a fuel given appropriate information about the composition of the fuel and the conditions in which it is used. Students should be able to describe and explain the problems caused by increased amounts of these pollutants in the air. To support and consolidate scientific concepts (knowledge and understanding). This is done by applying and developing what is known and understood of abstract ideas and models. Through practical work we are able to make sense of new information and observations, and provide insights into the development of scientific thinking. 2. To develop investigative skills. These transferable skills include: • devising and investigating testable questions • identifying and controlling variables • Analysing, interpreting and evaluating data.

Students should be able to predict the products of the electrolysis of binary ionic compounds in the molten state. They should also be able to write ionic half equations. explain why a mixture is used as the electrolyte explain why the positive electrode must be continually replaced. Students should be able to predict the products of the electrolysis of aqueous solutions containing a single ionic compound.			Students should be able to name the types of monomers from which these naturally occurring polymers are made.		3. To build and master practical skills such as: • using specialist equipment to take measurements • handling and manipulating equipment with confidence and fluency • recognising hazards and planning how to minimise risk.
End of term 1 assessment to cover: End of topic test chemical changes End of topic test energy changes		End of term 2 assessment to cover: End of topic test on rate and extent of chemical changes End of topic test on organic chemistry		End of year assessment to cover: End of topic test on chemistry of the atmosphere End of year exam	

Building understanding: Rationale / breakdown for your sequence of lessons:

Chemical Changes: Starting with chemical changes is logical as it introduces students to the core principles of chemistry. This topic covers the various types of chemical reactions and their characteristics, laying the foundation for more advanced concepts.

Energy Changes: After students have grasped chemical changes, it's natural to move on to energy changes. This topic delves into the energy aspects of chemical reactions, including endothermic and exothermic reactions. It builds on the understanding of chemical reactions and introduces the concept of energy transfer during reactions.

Rate and Extent of Chemical Changes: Once students have a solid understanding of chemical reactions and energy changes, exploring the rate and extent of chemical changes is the next logical step. This topic introduces the kinetics of reactions, including factors affecting reaction rates, mechanisms, and equilibrium. It provides a more detailed look at the dynamics of chemical processes.

Organic Chemistry: Organic chemistry follows the foundation topics because it involves complex carbon-based compounds, including hydrocarbons, functional groups, and their reactions. By this point, students have acquired essential knowledge about chemical changes, energy changes, and reaction kinetics, which they can apply to understand the reactions and structures in organic chemistry.

Chemistry of the Atmosphere: This topic is positioned later in the sequence because it introduces environmental and atmospheric chemistry. After students have developed a strong understanding of the chemistry of reactions and the role of energy in chemical processes, they can better appreciate how chemical reactions impact the Earth's atmosphere, including the greenhouse effect, air pollution, and climate change.

This sequencing allows students to build upon their knowledge progressively, starting with fundamental chemical concepts and moving towards more specialized topics. It provides a structured approach to the subject, ensuring that students have the foundation to comprehend complex chemical processes and their environmental implications.

Home – Learning:
Workbooks for each unit are given to students to complete throughout the duration of unit delivery.

Reading / literacy:
Students are encouraged to prior reading on topics. In lessons students are taught how to construct answers through use of writing frames and exemplar answers where extended writing is required and command words and keywords that are relevant to the topic are consistently assessed in lessons through questioning and exam practice.

Numeracy:
Recognise and use expressions in decimal form: Recognise and use expressions in standard form; Use ratios, fractions and percentages; Make estimates of the results of simple calculations.
Handling data: Use an appropriate number of significant figures; Find arithmetic means; Construct and interpret frequency tables and diagrams, bar charts and histograms; Make order of magnitude calculations
Algebra: Understand and use the symbols: =, <>, >, ∝ , ~ ;Change the subject of an equation; Substitute numerical values into algebraic equations using appropriate units for physical quantities
Graphs: Translate information between graphical and numeric form; Understand that y = mx + c represents a linear relationship; Plot two variables from experimental or other data; Determine the slope and intercept of a linear graph; Draw and use the slope of a tangent to a curve as a measure of rate of change; interpret graphs for carbon dioxide production.
Geometry and trigonometry: Visualise and represent 2D and 3D forms including two dimensional representations of 3D objects; Calculate areas of triangles and rectangles, surface areas and volumes of cubes.

Enrichment / opportunities to develop cultural capital (including careers, WRL and SMSC):
Chemistry related trips are arranged during science week.