Curriculum Plans: Year _12____ (Chemistry)

	Unit	Knowledge: By the end of the unit students will know:	Skills: What skills will students have developed by the end of this unit?	Key terms: What new key terms and vocabulary will be learnt in this unit?	Summative Assessment: How will pupils be assessed in this unit?
Michaelmas 1	1.1 Atomic Structure 1.5 Kinetics 3.1 Introduction to Organic Chemistry 1.3 Bonding and Structure	**- The structure of an atom, including protons, neutrons, and electrons, along with their relative charges and masses.** **- The definitions of mass number (A) and atomic number (Z), and how these relate to the number of fundamental particles.** **- The existence and concept of isotopes.** **- The principles of mass spectrometry, including ionization, acceleration, ion drift, detection, and data analysis.** **- How to interpret mass spectra to determine isotopic abundances and calculate relative atomic mass.** **- The principles of collision theory and how it affects reaction rates.** **- The concept of activation energy and its significance in determining whether reactions occur.** **- How the Maxwell-Boltzmann distribution explains the distribution of molecular energies in gases.**	- Ability to calculate the number of protons, neutrons, and electrons in atoms and ions from atomic and mass numbers. - Understanding and explaining the concept of isotopes. - Interpretation of mass spectra to deduce the relative isotopic mass and abundance. - Use of significant figures and weighted means in calculations. - Writing electron configurations for atoms and ions up to Z=36Z = 36Z=36. - Defining and calculating ionization energies. - Ability to explain the relationship between molecular collisions and reaction rates. - Interpreting Maxwell-Boltzmann distribution curves and explaining temperature effects on reaction rates. - Investigating and explaining the effect of temperature, concentration,	**- Isotope** **- Mass number (A)** **- Atomic number (Z)** **- Ionization energy** **- Electron configuration** **- Time of flight (TOF) mass spectrometer** **- Relative atomic mass** **- Isotopic abundance** **- Collision theory** **- Activation energy** **- Maxwell-Boltzmann distribution** **- Rate of reaction** **- Catalyst** **- Reaction rate** **- Concentration** **- Pressure**	Each unit throughout the year is assessed using both peer assessment of Homework and Teacher assessment of end of unit tests

		- The effect of temperature on the rate of reaction and how a small temperature change can lead to a significant increase in reaction rate. **- The impact of concentration and pressure on collision frequency and reaction rates.** **- How catalysts work by providing an alternative reaction route with a lower activation energy.**	and pressure changes on reaction rates. - Practical skills in monitoring reaction rates using different methods (e.g., continuous monitoring, initial rate method). - Drawing and interpreting Maxwell-Boltzmann distribution curves.		
		- The basics of organic chemistry, including the diversity of organic compounds. **- The importance of carbon in organic chemistry and how organic compounds range from fuels to biological molecules.** **- How to use the IUPAC system for naming organic compounds.** **- The different ways of representing the structure of organic compounds (empirical, molecular, general, structural, displayed, and skeletal formulas).** **- The concept of homologous series and functional groups.**	- Drawing and interpreting various formula representations (empirical, molecular, structural, displayed, skeletal). - Applying IUPAC rules to name organic compounds with up to six carbon atoms. - Drawing the structure of organic compounds based on IUPAC names. - Explaining reaction mechanisms, including free-radical mechanisms and the use of curly arrows in non-radical mechanisms.	**- IUPAC nomenclature** **- Homologous series** **- Empirical formula** **- Molecular formula** **- Structural formula** **- Displayed formula** **- Skeletal formula** **- Free-radical mechanism** **- Curly arrow** **- Structural isomerism** **- Stereoisomerism** **- E-Z isomerism**	
		- How different types of chemical bonds (ionic, covalent, and metallic) are formed and the principles behind each type of bonding. **- The concept of electrostatic**	- Ability to draw Lewis structures and predict the shapes of molecules using electron pair repulsion theory. - Identifying bond types in different compounds based on their formulas.	**- Electronegativity** **- Bond polarity** **- Intermolecular forces** **- Dipole-dipole forces** **- Van der Waals forces**	

		attraction between ions in ionic bonding and between nuclei and electrons in covalent bonding. **- The nature of metallic bonding and the concept of delocalized electrons.** **- The relationship between bonding and the physical properties of materials (e.g., melting point, conductivity).** **- The different types of crystal structures (ionic, metallic, macromolecular, molecular) and examples of each.** **- The concept of electronegativity and how it affects bond polarity.**	- Predicting and explaining the physical properties of substances from their bonding and structure. - Drawing and interpreting diagrams to represent various crystal structures. - Calculating bond polarity and explaining the effects of electronegativity on molecular polarity.	**(London dispersion forces)** **- Hydrogen bonding** **- Macromolecular structure** **- Crystal structure**	
Michaelmas 2	1.3 Bonding and Structure (Continued) 1.2 Amount of Substance 3.2 to 3.3 Alkanes and Halogenoalkanes 3.4 to 3.5 Alkenes and Alcohols	**- The concept of the mole as a unit for amount of substance and how it applies to atoms, molecules, and ions.** **- The use of the Avogadro constant in relation to the number of particles in a mole.** **- How to calculate relative atomic mass (Ar) and relative molecular mass (Mr).** **- The ideal gas equation, $pV=nRT$, and its application in calculating properties of gases under varying conditions.** **- The relationship between empirical and molecular formulas and how to calculate each from**	- Ability to perform calculations using the mole concept, including converting between mass, number of moles, and number of particles using the Avogadro constant. - Using the ideal gas equation to calculate unknown quantities (e.g., pressure, volume, or temperature of gases). - Performing percentage yield and atom economy calculations. - Writing and balancing chemical equations and using them to carry out stoichiometric calculations. - Determining empirical and molecular formulas from experimental data.	**- Mole** **- Avogadro constant** **- Relative atomic mass (Ar)** **- Relative molecular mass (Mr)** **- Ideal gas equation $pV=nRT$** **- Empirical formula** **- Molecular formula** **- Stoichiometry** **- Percentage yield** **- Atom economy**	
Lent 1	1.2 Amount of Substance (Continued) 3.4 to 3.5 Alkenes and				

	Alcohols (Continued)	**experimental data.** **- The importance of balanced equations in determining the amounts of reactants and products.** **- The principles behind the combustion and chlorination of alkanes.** **- The reactivity of halogenoalkanes and their substitution reactions with nucleophiles like OH^-, CN^-, and NH_3.** **- The mechanism of ozone depletion and the role of chlorofluorocarbons (CFCs) in this process.** **- The structure and reactivity of alkenes, including electrophilic addition reactions and polymerization.** **- The production and oxidation of alcohols, and their uses in industry, particularly ethanol as a biofuel.**	- Writing and interpreting mechanisms for free-radical substitution, nucleophilic substitution, and electrophilic addition reactions. - Predicting the products of combustion and reactions of alkanes, halogenoalkanes, and alkenes. - Testing organic compounds for unsaturation using bromine water. - Practical skills in synthesizing alcohols and separating products using techniques like distillation and recrystallization.	**- Alkanes** **- Halogenoalkanes** **- Electrophilic addition** **- Polymerization** **- Nucleophilic substitution** **- Ozone depletion** **- Free radical** **- Biofuel**	
Lent 2	1.6 Equilibria and Redox 3.6 Organic Analysis	**- The concept of dynamic equilibrium and how, in a reversible reaction, the rates of the forward and reverse reactions are equal at equilibrium.** **- Le Chatelier's principle and how**	- Applying Le Chatelier's principle to predict the effects of changing temperature, pressure, and concentration on the position of equilibrium. - Constructing and interpreting the	**- Dynamic equilibrium** **- Le Chatelier's principle** **- Equilibrium constant KcK_cKc** **- Homogeneous**	

		changes in temperature, pressure, and concentration affect the position of equilibrium. **- How a catalyst affects the rate of reaction but not the position of equilibrium.** **- The definition and mathematical expression of the equilibrium constant KcK_cKc for homogeneous systems.**	expression for the equilibrium constant Kc from balanced equations. - Performing calculations involving Kc values from equilibrium concentrations. - Understanding how changes in temperature influence the value of Kc - Using spectroscopic techniques to identify organic compounds and analyse their structures.	**equilibrium** **- Reversible reaction**	
		- The definitions of oxidation and reduction in terms of electron transfer. **- The role of oxidising agents as electron acceptors and reducing agents as electron donors.** **- How to assign oxidation states to elements in compounds and ions.** **- How to write and balance redox half-equations for oxidation and reduction processes.** **- How to combine half-equations to form an overall redox equation.**	- Ability to determine oxidation states for elements in compounds and ions. - Writing redox half-equations for oxidation and reduction reactions. - Combining half-equations to form balanced overall redox equations. - Applying redox concepts to various chemical reactions.	**- Oxidation** **- Reduction** **- Oxidising agent** **- Reducing agent** **- Redox reaction** **- Oxidation state** **- Half-equation**	
		- The use of test-tube reactions to identify organic functional groups such as alcohols, aldehydes,	- Conducting test-tube reactions to identify organic compounds. - Using mass spectrometry to deduce the molecular formula of organic	**- Mass spectrometry** **- Molecular ion peak**	

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		alkenes, and carboxylic acids. **- The principles behind mass spectrometry and how it can be used to determine the molecular formula of a compound.** **- How infrared (IR) spectroscopy is used to identify functional groups based on absorption of infrared radiation by chemical bonds.**	compounds. - Interpreting infrared spectra to identify functional groups and determine molecular structures. - Applying organic analysis techniques to determine the presence of impurities in compounds.	**- Infrared (IR) spectroscopy** **- Functional group** **- Fingerprint region** **- Wavenumber** **- Electromagnetic spectrum**	
Trinity 1	2.1 periodicity 2.2 and 2.3 Group 2 and Group 7 1.4 Energetics	**- The structure and classification of the Periodic Table, including the classification of elements as s, p, d, or f block based on their proton number.** **- Trends in atomic radius, first ionization energy, and melting points across Period 3 (from sodium to argon) and the underlying reasons for these trends in terms of atomic structure and bonding.** **- How these properties reflect the electronic configurations of the elements in Period 3.** **- The properties and trends of Group 2 elements, including atomic radius, first ionization energy, and melting points of the elements from magnesium (Mg) to barium (Ba).** **- The reactions of Group 2 elements with water, including the general**	- Ability to explain and predict trends in atomic radius, ionization energy, and melting points across a period. - Explaining the melting points of the elements based on their bonding type (metallic, covalent, or ionic). - Identifying the relationships between an element's position in the Periodic Table and its physical and chemical properties. - Explaining and predicting trends in reactivity, atomic size, ionization energy, and melting points for Group 2 elements. - Performing laboratory experiments to test the reactions of Group 2 metals with water and their	**- Atomic radius** **- Ionization energy** **- Melting point** **- S, p, d, f block elements** **- Trends in periodicity** **- Alkaline earth metals** **- Ionization energy** **- Reactivity** **- Hydroxides** **- Sulfates** **- Solubility**	

		trend in reactivity. **- The solubility trends of hydroxides and sulfates in Group 2 and their applications, such as barium sulfate ($BaSO_4$) in medicine and calcium hydroxide ($Ca(OH)_2$) in agriculture.** **- The applications of magnesium in extracting titanium and the role of calcium oxide (CaO) in removing sulfur dioxide (SO_2) from flue gases.**	hydroxide solubility. - Conducting tests for sulfate ions using acidified barium chloride solution and explaining the significance of the results.		
		- The properties and trends of the halogens in Group 7, including their physical properties such as electronegativity and boiling points. **- The trends in oxidizing ability down the group and how this affects the reactivity of halogens with halide ions in displacement reactions.** **- The reactivity of halides, including their reducing abilities when reacting with concentrated sulfuric acid.** **- The use of silver nitrate solution to identify halide ions and the trend in solubility of silver halides in ammonia.**	- Explaining and predicting trends in electronegativity, boiling points, and oxidizing/reducing abilities of the halogens. - Carrying out tests for halide ions using acidified silver nitrate and interpreting the results. - Performing reactions involving halogens and halide ions, recording and analyzing observations.	**- Halogens** **- Oxidizing agent** **- Reducing agent** **- Electronegativity** **- Displacement reaction**	
		- The concept of enthalpy change (ΔH) and the difference between endothermic and exothermic reactions.	- Performing calculations involving enthalpy changes using the calorimetry equation. - Using Hess's law to calculate	**- Enthalpy change (ΔH)** **- Exothermic reaction** **- Endothermic reaction**	

		- The significance of standard enthalpy changes, including the standard enthalpy of combustion (ΔcH^{o}) and standard enthalpy of formation (ΔfH^{o}). **- The calorimetry equation $q=mc\Delta T$ for calculating heat changes in reactions, where mmm is the mass, ccc is the specific heat capacity, and ΔT\Delta TΔT is the temperature change.** **- The applications of Hess's law to calculate enthalpy changes for reactions from known enthalpies of combustion or formation.** **- The concept of mean bond enthalpy and how it can be used to estimate reaction enthalpies.**	unknown enthalpy changes. - Estimating enthalpy changes from bond enthalpies and understanding the limitations of this method. - Reporting results with appropriate significant figures and units.	**- Standard enthalpy of combustion (ΔcH^{o})** **- Standard enthalpy of formation (ΔfH^{o})** **- Calorimetry** **- Hess's law** **- Mean bond enthalpy**	
Trinity 2	1.9 Rate Equations 1.10 Equilibria in Gases	**- The mathematical relationship between the rate of a chemical reaction and the concentration of reactants, expressed through the rate equation** **- The significance of the orders of reaction in relation to the reaction mechanism and how they are determined experimentally.** **- The Arrhenius equation - How changes in temperature affect the rate constant and, consequently, the rate of reaction.**	- Defining and calculating the order of reaction from concentration-time data. - Using concentration-time graphs to deduce rates and determine orders of reaction (0, 1, or 2) with respect to reactants. - Performing calculations using the rate equation and the Arrhenius equation to find unknown values	**- Rate equation** **- Rate constant** **- Order of reaction** **- Activation energy** **- Arrhenius equation** **- Initial rate** **- Concentration-time graph**	

		- The definition of the equilibrium constant K and its significance in reversible gas phase reactions. **- How to derive partial pressures from mole fractions and total pressure.** **- The mathematical expression for Kp for a homogeneous system in equilibrium, relating to the partial pressures of reactants and products.** **- How changes in temperature and pressure affect the position of equilibrium and the value of Kp** **- The concept that a catalyst affects the rate of reaching equilibrium but does not change the value of the equilibrium constant**	- Constructing and interpreting the expression for Kp based on balanced equations for gas phase reactions. - Performing calculations involving Kp and deriving partial pressures. - Predicting qualitative effects of changes in temperature and pressure on the position of equilibrium and Kp. - Understanding the application of Kp in industrial processes to optimize conditions for maximum yield.	**- Equilibrium constant KpK_pKp** **- Partial pressure** **- Homogeneous equilibrium** **- Reversible reaction** **- Catalyst**	