Curriculum Plans: Year ___13___ (Chemistry)

	Topic	**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	1.8 Thermodynamics 1.11 Electrode Potentials 3.7 to 3.9 Isomerism and carbonyl compounds	**- The definition of lattice enthalpy, including enthalpy of lattice formation and lattice dissociation.** **- How to construct and use Born-Haber cycles to calculate lattice enthalpies, ionization energies, and electron affinities.** **- The concept of enthalpy of solution and hydration enthalpy, and their role in calculating overall enthalpy changes for dissolving ionic substances.** **- The relationship between enthalpy, entropy, and Gibbs free energy and how they determine the feasibility of a reaction ($\Delta G = \Delta H - T\Delta S$).** **- The concept of redox reactions occurring in electrochemical cells and how electrons are transferred between a reducing agent and an oxidizing agent through an external circuit.** **- How to measure electrode potentials relative to the standard hydrogen electrode under standard conditions (298 K, 100 kPa, 1.00 mol dm^{-3} ion solution).** **- How standard electrode potentials are listed as an electrochemical series to predict the direction of redox reactions**	- Constructing and analyzing Born-Haber cycles to calculate lattice enthalpies and other thermodynamic quantities. - Performing calculations involving Gibbs free energy (ΔG) and entropy (ΔS) to predict whether a reaction is feasible. - Applying the relationship between enthalpy, entropy, and temperature to determine reaction conditions. - Writing and interpreting half-equations for electrode reactions. - Constructing the conventional representation of an electrochemical cell and calculating the EMF of a cell. - Using standard electrode potentials to predict the direction of redox reactions and testing predictions experimentally. - Measuring the EMF of an electrochemical cell in a practical setting.	**- Lattice enthalpy** **- Born-Haber cycle** **- Enthalpy of formation** **- Ionization energy** **- Electron affinity** **- Enthalpy of solution** **- Hydration enthalpy** **- Gibbs free energy (ΔG)** **- Entropy (ΔS)** **- Feasibility** **- Electrode potential** **- Standard electrode potential (E°)** **- Electrochemical series** **- Redox reaction** **- EMF (electromotive force)** **- Electrochemical cell** **- Fuel cell**	Each unit throughout the year is assessed using both peer assessment of Homework and Teacher assessment of end of unit tests

		and calculate cell potentials (EMF). **- The distinction between non-rechargeable, rechargeable, and fuel cells, and their applications in providing energy.** **- The concept of optical isomerism as a form of stereoisomerism, arising from chirality in molecules with a chiral centre (asymmetric carbon atom).** **- Enantiomers and their non-superimposable mirror images, and their effects on plane-polarized light.** **- The concept of racemic mixtures and why they are optically inactive.** **- Aldehydes and ketones contain the carbonyl group, which undergoes nucleophilic addition reactions.** **- Aldehydes can be oxidized to carboxylic acids, and reduced to primary alcohols, while ketones reduce to secondary alcohols.** **- Chemical tests to distinguish between aldehydes and ketones, such as Fehling's solution and Tollens' reagent.** **- The formation of hydroxynitriles by nucleophilic addition of carbonyl compounds with KCN.** **- Carboxylic acids are weak acids, strong enough to liberate CO_2 from carbonates.** **- Esters are formed by reacting carboxylic acids with alcohols in the presence of an acid catalyst.** **- Carboxylic acids and esters can be**	- Drawing structural formulas of enantiomers and identifying chiral centres in molecules. - Interpreting the 3D structures of chiral molecules and racemic mixtures. - Writing nucleophilic addition mechanisms for the reduction of aldehydes and ketones. - Performing chemical tests to distinguish between aldehydes and ketones experimentally. - Understanding the safety precautions when using hazardous reagents like KCN. - Synthesizing esters by reacting alcohols with carboxylic acids and purifying the product. - Conducting hydrolysis reactions to obtain carboxylic acids or their salts from esters. - Preparing soap (saponification) and biodiesel from oils and fats.	**- Chiral centre** **- Enantiomer** **- Racemic mixture (racemate)** **- Optical activity** **- Carbonyl group** **- Nucleophilic addition** **- Fehling’s solution** **- Tollens' reagent** **- Hydroxynitriles** **- Carboxylic acid** **- Ester** **- Esterification** **- Hydrolysis** **- Saponification** **- Biodiesel**	

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		hydrolysed under acidic or alkaline conditions. **- Common uses of esters, such as in solvents, perfumes, and food flavourings.** **- The industrial importance of biodiesel, produced by the reaction of vegetable oils with methanol.**			
Michaelmas 2	1.11 Electrode potentials (Continued) 1.12 Acids, Bases and pH 3.10 and 3.11 Aromatics and Amines 3.12 Polymers 3.13 Amino Acids, Proteins and DNA	**- The definitions of acids and bases using the Brønsted–Lowry theory: acids as proton donors and bases as proton acceptors.** **- The concept of pH and how it is calculated using the hydrogen ion concentration: $\mathrm{pH}=-\log[\mathrm{H}+]$** **- The ionic product of water, Kw, and how it varies with temperature.** **- The use of Ka and pKa to measure the strength of weak acids.** **- The concepts of buffer solutions and how they resist changes in pH upon addition of small amounts of acid or base.**	- Calculating pH from hydrogen ion concentrations and vice versa. - Using Kw to calculate the pH of strong bases. - Performing calculations involving weak acids, Ka, and pKa. - Preparing buffer solutions and calculating their pH under different conditions.	**- Brønsted–Lowry acid** **- Brønsted–Lowry base** **- pH scale** **- Kw (ionic product of water)** **- Ka (acid dissociation constant)** **- pKa** **- Buffer solution**	
		- The structure of benzene and its stability due to delocalised π electrons. **- Electrophilic substitution reactions of benzene (nitration and Friedel-Crafts acylation).** **- The evidence for the delocalised model over Kekulé's model of benzene.**	- Writing mechanisms for electrophilic substitution reactions of benzene. - Predicting the products of benzene reactions, such as nitration or acylation.	**- Aromaticity** **- Electrophilic substitution** **- Nitration** **- Friedel-Crafts acylation** **- Delocalised π electrons**	
		- Amines as weak bases and their reactions with acids to form salts.	- Writing mechanisms for nucleophilic substitution	**- Amine** **- Nucleophilic**	

		- Preparation of aliphatic and aromatic amines. **- Nucleophilic substitution and reduction as methods for synthesizing amines.** **- The formation of addition and condensation polymers.** **- How to deduce the structure of the polymer from the monomer and vice versa.** **- The environmental impact of polymer disposal and recycling.** **- The general structure of amino acids and their zwitterionic form.** **- Peptide bond formation and the primary structure of proteins.** **- The role of hydrogen bonding in protein structure and DNA base pairing.**	reactions involving amines. - Performing reactions involving amines and predicting products, such as salts formed from amines reacting with acids. - Predicting the monomers used to form a given polymer. - Drawing the repeating unit of a polymer based on its monomer structure. - Evaluating the environmental implications of different polymer disposal methods. - Drawing the structure of amino acids and peptides. - Explaining hydrogen bonding in the secondary and tertiary structure of proteins. - Predicting the outcomes of peptide hydrolysis.	**substitution** **- Reduction** **- Weak base** **- Addition polymer** **- Condensation polymer** **- Monomer** **- Polymer recycling** **- Amino acid** **- Peptide bond** **- Zwitterion**	
Lent 1	1.12 Acids, Bases and pH (continued) 2.4 Period 3 3.14 Further Organic Synthesis	**- The reactions of Period 3 elements (Na, Mg, Al, Si, P, S) with oxygen, resulting in oxides such as Na_2O, MgO, Al_2O_3, SiO_2, P_4O_{10}, SO_2, and SO_3.** **- The pH of solutions formed when these oxides react with water, illustrating trends in acidity and basicity across the period.** **- The melting points of the oxides and how**	- Writing balanced equations for the reactions of Period 3 elements with oxygen and water. - Explaining trends in reactivity, pH, and melting points based on bonding type.	**- Acidic oxide** **- Basic oxide** **- Amphoteric oxide** **- pH**	

	3.15 and 3.16 NMR and Chromatography	**they relate to structure and bonding (ionic vs covalent).**			
		- The process of organic synthesis involving multiple reaction steps to create organic compounds. **- The importance of designing efficient synthesis routes with high atom economy and minimal environmental impact.**	- Planning multi-step synthesis routes for organic compounds using reactions from the specification. - Evaluating the efficiency of synthetic pathways and considering environmental factors.	**- Organic synthesis** **- Atom economy** **- Reaction pathway** **- Green chemistry**	
		- The principles of nuclear magnetic resonance (NMR) spectroscopy and its application in determining the structure of organic compounds. **- The use of ^{1}H NMR and ^{13}C NMR spectra to identify different environments for hydrogen and carbon atoms, respectively.** **- The significance of chemical shifts and integration in interpreting NMR spectra.**	- Analyzing ^{1}H and ^{13}C NMR spectra to deduce molecular structures. - Using integration data to determine the number of hydrogen atoms in different environments.	**- NMR spectroscopy** **- Chemical shift** **- Integration** **- Tetramethylsilane (TMS)**	
		- The principles of chromatography and its applications for separating and identifying components in mixtures. **- Different types of chromatography, including thin-layer chromatography (TLC), column chromatography, and gas chromatography (GC).**	- Performing separations using various chromatography techniques. - Calculating Rf values and interpreting chromatograms to identify substances.	**- Chromatography** **- Rf value** **- Thin-layer chromatography (TLC)** **- Gas chromatography (GC)**	

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Lent 2	2.4 Period 3 (continued) 2.5 and 2.6 Transition metals and aqueous chemistry 3.15 and 3.16 NMR and Chromatography (continued)	**- The general properties of transition metals, including complex formation, colored ions, variable oxidation states, and catalytic activity.** **- The role of ligands in coordination complexes and the significance of coordination number.** **- The substitution reactions involving monodentate ligands like H_2O, NH_3, and Cl^-.** **- The formation of metal-aqua ions such as $[M(H_2O)_6]^{2+}$ for Fe and Cu, and $[M(H_2O)_6]^{3+}$ for Al and Fe.** **- The differences in acidity between $[M(H_2O)_6]^{2+}$ and $[[M(H_2O)_6]^{3+}$ and their amphoteric nature.** **- The simple test-tube reactions of these ions with bases like OH^-, NH_3, and CO_3^{2-}.**	- Identifying and drawing the shapes of various transition metal complexes. - Writing balanced equations for substitution reactions and explaining the chelate effect. - Performing colorimetric analysis to determine the concentration of colored transition metal ions in solution. - Performing and analyzing test-tube reactions of metal-aqua ions with various reagents. - Explaining the observed outcomes based on the metal ion's charge and size.	**- Transition metal** **- Ligand** **- Coordination complex** **- Chelate effect** **- Coordination number** **- Metal-aqua ion** **- Amphoteric** **- Hydroxide ion** **- Ligand exchange**	
Trinity 1	Revision				
Trinity 2					