Chemistry Curriculum Overview – Year 12 (Teacher B)

Sequencing of topics	What knowledge will students develop? (Including key terminology)	What skills will students develop? (Including literacy & numeracy)	Assessment opportunities	Homework opportunities	Personal development (Ursuline Values, Catholic Social Teaching, Cultural Capital, Cross-curricular, Careers)	Curriculum links
			Autumn Term 1			
Equilibrium constant Kp for homogeneous systems	• The equilibrium constant Kp is deduced from the equation for a reversible reaction occurring in the gas phase. • Kp is the equilibrium constant calculated from partial pressures for a system at constant temperature	• Derive partial pressure from mole fraction and total pressure • Construct an expression for Kp for a homogeneous system in equilibrium • Perform calculations involving Kp • Make predict the qualitative effects of changes in temperature and pressure on the position of equilibrium and value of Kp	Starter quizzes for each lesson to review previous knowledge and understanding Regular peer and self-assessment of class and home work within lessons	Students calculate the partial pressures of reactants and products at equilibrium. Students calculate the value of an equilibrium constant Kp	Contact and Haber industrial processes in the chemical manufacture industry	AS chemistry - equilibrium constant Kc - rates of reaction
Rate equations	• The rate of a chemical reaction is related to the concentration of reactants by a rate equation of the form: Rate = $k[A]^m [B]^n$ • The orders m and n are restricted to the values 0, 1, and 2. • The rate constant k varies with temperature as shown by the equation: k = Ae–Ea/RT	• Perform calculations using the rate equation • Explain the qualitative effect of changes in temperature on the rate constant k • Perform calculations using the equation k = Ae–Ea/RT • Able to rearrange the equation k = Ae–Ea/RT into the form ln k = –Ea /RT + ln A and know how to use this rearranged equation with experimental data to plot a straight line graph with slope –Ea /R	Completing exam-style assessments in class and during revision sessions under timed conditions	Students use a graph of concentration–time and calculate the rate constant of a zero-order reaction by determination of the gradient	**Solidarity and Dignity in Work -** global industries working together to bring about change for the greater good, fair salaries and nonexploitive practices across the globe	

Autumn Term 2						
Acids and bases	• Understand Brønsted–Lowry acid–base equilibria in aqueous solution • Definition and determination of pH • The ionic product of water, K_W • Weak acids and bases Ka for weak acids • pH curves, titrations and indicators • Buffer action	• Convert concentration of hydrogen ions into pH and vice versa • Calculate the pH of a solution of a strong acid from its concentration • Students use an appropriate number of decimal places in pH calculations and understand standard form when applied to K_W • Construct an expression for Ka • Perform calculations relating the pH of a weak acid to the concentration of the acid and the dissociation constant, Ka • Convert Ka into pKa and vice versa. • Sketch and explain the shapes of typical pH curves • Use pH curves to select an appropriate indicator. • Explain the action of acidic and basic buffers • Calculate the pH of acidic buffer solutions	Required practical 9: Investigate how pH changes when a weak acid reacts with a strong base and when a strong acid reacts with a weak base Students could be asked to prepare and test a buffer solution with a specific pH value Exam questions	Students carry out pH calculations. Students carry out Kw calculations. Calculations for pH of strong bases using the K_w Carry out pKa calculations Calculate Ka of a weak acid from the pH at half neutralisation data Plot pH curves to show how pH changes during reactions Buffer calculations	Industrial chemist I production of chemicals for the manufacturing industry Environmental scientist uses pH to the environment and pollution Biochemist uses buffer solutions	**GCSE Chemistry** - acids and bases - weak acids
Thermodynamics	• Define the terms used in the Born-Haber cycle	• Calculate lattice enthalpies using the following data: enthalpy of formation, ionisation energy, enthalpy of	Students could be asked to find ΔS for vaporization of		Chemist and chemical engineers use thermodynamic	**GCSE Chemistry** - Exothermic and

	• Construct Born–Haber cycles to calculate lattice enthalpies using these enthalpy changes • Construct Born–Haber cycles to calculate one of the other enthalpy changes • Define the term enthalpy of hydration • Perform calculations of an enthalpy change using these cycles • Gibbs free-energy change, ΔG, and entropy change, ΔS	atomisation, bond enthalpy and electron affinity • Use cycles to calculate enthalpies of solution for ionic compounds from lattice enthalpies and enthalpies of hydration. • Calculate entropy changes from absolute entropy values • Use the relationship ΔG = ΔH – TΔS to determine how ΔG varies with temperature • Use the relationship ΔG = ΔH – TΔS to determine the temperature at which a reaction becomes feasible.	water using a kettle Students determine ΔS and ΔH from a graph of ΔG versus T	Calculations of lattice enthalpy using the Born-Haber cycles Calculations to determine Gibbs free-energy, entry changes and temperature at which a reaction becomes feasible Exam practice questions in preparation for mock exams	calculations for many industrial reactions **Solidarity and Dignity in Work -** global industries working together to bring about change for the greater good, fair salaries and nonexploitive practices across the globe	endothermic reactions AS Chemistry -Energetics
Spring Term 1						
Mock Exams Electrode potentials and electrochemical cells	• Year 13 Mock exams • Electrode potentials and cells	• Exams practice • Use $E^{\ominus}$ values to predict the direction of simple redox reactions • Calculate the EMF of a cell • Write and apply the conventional representation of a cell. • Make simple cells and use them to measure unknown electrode potentials	Plan and carry out an experiment to investigate the effect of changing conditions, such as concentration or temperature, in a voltaic cell	Writing half-equations Write the conventional representation of a cell Calculations of EMF of a cell	Manufacturing industry for the production of batteries for everyday uses such as smartphones, laptops and cars Electroplating – coating a surface in metal by using electrical current	**GCSE Chemistry** - Redox reactions - half equations - electrolysis AS Chemistry

	• Commercial applications of electrochemical cells	• Use $E^{\ominus}$ values to predict the direction of simple redox reactions, then test these predictions by simple test-tube reactions • Use given electrode data to deduce the reactions occurring in non-rechargeable and rechargeable cells • Deduce the EMF of a cell	such as $Zn\|Zn^{2+}\|\|Cu^{2+}\|Cu$	Research how knowledge and understanding of electrochemical cells has evolved from the first voltaic battery	Electropolishing – removing ions by electrical current Manufacturers use electrochemistry to separate brine in sodium hydroxide and chlorine for use in cleaning products	-redox reactions
Spring Term 2						
Transition metals	• General properties of transition metals • Substitution reactions • Shapes of complex ions	• Transition metal characteristics of elements Ti–Cu arise from an incomplete d sub-level in atoms or ions • Define ligand, complex and co-ordination • Carry out test-tube reactions of complexes with monodentate, bidentate and multidentate ligands to compare ease of substitution • Carry out test-tube reactions of solutions of metal aqua ions with ammonia or concentrated hydrochloric acid • Understand and draw the shape of complex ions • Understand the origin of cis–trans and optical isomerism. • Draw cis–trans and optical isomers	Required practical 11: Carry out simple test-tube reactions to identify transition metal ions in aqueous solution Research and present the chelate effect, in terms of the balance between the entropy and enthalpy change in these reactions	Complete properties of transition metals worksheet Substitution reactions worksheet Shapes of complex worksheet	Research chemist uses transition metals for developing anti-cancer drugs Transition metals are used in a variety of industries from jewellery to construction, so there are many careers associated with transition metals **Solidarity and Dignity in Work -** global industries working together to bring about change for the greater good, fair salaries and nonexploitive practices across the globe	**AS Chemistry** - shapes - bonding - substitution reactions - redox reactions

	• Formation of coloured ions • Variable oxidation states • Catalysts • Reactions of ions in aqueous solution	• Describe the types of stereoisomerism shown by molecules/ complexes • Determine the concentration of a solution of copper(II) ions by colorimetry- practical skills • Determine the concentration of a solution from a graph of absorption versus concentration • Practical skills: conduct experiment for the reduction of vanadate(V) with zinc in acid • Carry out test-tube reactions of Tollens' reagent to distinguish aldehydes and ketones • Carry out redox titration to determine the mass of iron in iron tablets • Explain the importance of variable oxidation states in catalysis; with the aid of equations, how V_2O_5 acts as a catalyst in the Contact process, how Fe^{2+} ions catalyse the reaction between I^- and $S_2O_8^{2-}$, how Mn^{2+} ions autocatalyse the reaction between $C_2O_4^{2-}$ and MnO_4^- • Practical opportunity for students to show and to understand how transition metal ions can be identified	Perform calculations using data from titrations and redox reactions Investigate Mn^{2+} as the autocatalyst in the reaction between ethanedioic acid and acidified potassium manganate(VII) Required practical 11: Carry out simple test-tube reactions to identify transition metal ions in aqueous solution.	Determine the concentration of a coloured complex ion from data of colorimetry Calculations to determine the mass of iron in iron tablets, percentage of iron in steel, sand, Mr of ethanedioic acid, concentration of H_2O_2 in hair bleach Worksheet to check knowledge and understanding of reactions of transition metal ions in		

		by test-tube reactions in the laboratory		aqueous solution		
Summer Term 1						
Properties of Period 3 elements and their oxides	• Trends in reactions of elements with oxygen • Trends in the melting point of the oxides of period 3 elements • Reactions of oxides of the elements with water and pH of solutions formed • Structures of the acids and anions formed when oxides of phosphorus and sulfur react with water	• Practical skills: carry out reactions of elements with oxygen and test the pH of the resulting oxides. • Explain the trend in the melting point of the oxides of the elements Na–S in terms of their structure and bonding • Explain the trends in the reactions of the oxides with water in terms of the type of bonding present in each oxide • Write equations for the reactions that occur between the oxides of the elements Na–S and given acids and bases.	Practise past paper questions Students carry out research to develop an in-depth understanding of how and why these reactions occur and create a PPT presentation to present to the class	Research on period 3 elements and their oxides reactions Worksheet to consolidate understanding of period 3 elements	Industrial chemist produces many chemicals related to period 3 elements and their use can be found in insecticides and fungicides **Solidarity and Dignity in Work -** global industries working together to bring about change for the greater good, fair salaries and nonexploitive practices across the globe	AS chemistry of periodicity-melting point, structure and bonding GCSE Chemistry of Group 1 and 2 reactions
Summer Term 2						
Revision	• Exam practice • A Level examinations	• Exams				