Curriculum Content Map

Subject: Chemistry | **Year group: 13**

	TERM 1	TERM 2	TERM 3
Unit title & description	Physical Chemistry	Inorganic Chemistry	Organic Chemistry
Knowledge 	• Thermodynamics: Born-Haber Cycles, Gibbs free energy (ΔG) and entropy (ΔS) changes • Rate equations and determination of rate equations • Equilibrium constant, K_p, for homogeneous systems • Electrode Potentials and electrochemical cells, commercial applications of electrochemical cells • Acids and Bases: Brønsted-Lowry acid-base equilibria in aqueous solution, definition and determination of pH, The ionic product of water (K_w), weak acids and bases, K_a for weak acids, pH curves, titrations and indicators, Buffer action	• Properties of Period 3 elements and their oxides • Transition metals: General properties, substitution reactions, shapes of complex ions, formation of coloured ions, variable oxidation states, use as catalysts • Reactions of ions in aqueous solution: iron (II), iron (III), copper and aluminium	• Optical Isomerism • Aldehydes and ketones • Carboxylic acids and derivatives: esters, acylation. • Aromatic Chemistry: bonding, electrophilic substitution • Amines: preparation, base properties and nucleophilic properties • Polymers: condensation polymerisation, biodegradability and disposal of polymers • Amino Acids, proteins and DNA: Enzymes, action of anticancer drugs • Organic Synthesis • Nuclear magnetic Resonance spectroscopy (NMR) • Chromatography

Skills 	• Constructing Born Haber cycles • Calculating Gibbs free energy and entropy changes • Using ΔG to predict the feasibility of a reaction • Interpreting graphs of ΔG and ΔS against temperature • Analysing experimental rate data to determine rate order • Carrying out two experimental procedures to measure rate (iodine clock and measuring gas volume) • Analysing graphs and calculating gradients, determining coefficients and taking natural logs of numbers to allow analysis of data. • Using voltmeters to measure the electrode potential of an electrochemical cell • Using electrode potentials of standard hydrogen half cells paired with metal half cells to calculate the EMF value. • To determine the feasibility of a reaction using electrode potentials • To conduct a practical to measure EMF value • Calculating the pH of an acid and base and buffer solution • To calibrate a pH meter using buffer solutions and then use it to measure the end point of an acid-base titration accurately • To analyse and draw pH curves for all combinations of weak acid, weak base, strong acid and strong base. • To predict and calculate the change in pH when an acid or base is added to a buffer solution	• Solve problems set in practical contexts • Apply scientific knowledge to practical contexts • Presentation of data in appropriate formats • Evaluate results and draw conclusions with reference to measurement uncertainties and errors • Process and analyse data using appropriate maths skills • Consider margin of error, precision and accuracy of data • Know and understand how to use a wide range of experimental and practical instruments, equipment and techniques • Use of laboratory equipment correctly • Safely and carefully handle solids and liquids, including corrosive, irritant, flammable and toxic substances • Linking factual knowledge about the structure of different compounds to their physical data to explain the melting point across period 3 and ability to apply this to other periods • Understand and draw the shapes of complex ions • Understand and draw cis-trans and optical isomers • Apply scientific knowledge to practical contexts • Plot and interpret graphs	• Apply scientific knowledge to practical contexts • Comment on experimental design and evaluate scientific methods • Presentation of data in appropriate formats • Evaluate results and draw conclusions with reference to measurement uncertainties and errors • Process and analyse data using appropriate maths skills • Know and understand how to use a wide range of experimental and practical instruments, equipment and techniques • Drawing the structure of optical isomers • Write equations for chemical reactions • Drawing mechanisms for chemical reactions • Identify the reagents for a given chemical change • Interpretation of NMR spectrum to identify the structure of a molecule

Literacy 	• Using scientific vocabulary • Defining scientific key words • Extended writing: Explaining scientific concepts • Describing and evaluating practical methods	• Using scientific vocabulary • Defining scientific key words • Extended writing: Explaining scientific concepts • Describing and evaluating practical methods	• Using scientific vocabulary • Defining scientific key words: Optical Isomerism, Stereoisomers, chiral, racemic, nucleophile, electrophile, base • Extended writing: Explaining scientific concepts • Describing and evaluating practical methods
Numeracy 	• Calculating a variety of numerical values and manipulating equations to calculate different quantities • Drawing and analysing graphs of rate data, pH, ΔG and ΔS • Calculating units	• Write and **balance** equations for the reactions between the oxides of the elements across period 3 and given acids and bases • Explaining the difference in stability of multi-dentate ligands with respect to enthalpy and entropy of a substitution reactions • Determine the concentration of a solution from a graph of absorption vs concentration • Calculate energy changes when light is absorbed by transition metals using Plank's constant • Calculating oxidation state of transition metals in different complexes • Writing and balancing equations for redox titrations • Perform calculations for the titrations of iron (II) and ethandioate with permanganate, and other similar redox reactions • Understand and draw the shapes of complex ions	• Visualise and represent 2D and 3D forms including two-dimensional representation of 3D objects: Draw a 3D representation of chiral centres in various species • Calculation of R_f values from a chromatogram • Use of thermochemical evidence from enthalpies of hydrogenation to account for the stability of aromatic rings such as benzenes

Enrichment learning 	• Working as a team to conduct a practical • Project based work involving the research of a hypothesis, constructing a method and carrying it out.	• Required practical: Test tube reactions to identify transition metal ions – working independently to carry out the tests, make and record observations and interpret data. • Learning about the use of catalysts to speed up the reactions in the Haber process (ammonia) and the contact process (sulfuric acid) and understanding the cost implications of industrial processes	• Industrial uses of organic compounds such as manufacture of dyes, as solvents, in perfumes and food flavourings) • Industrial synthesis of polymers such as nylon and polyesters • The principle of a drug acting as an enzyme inhibitor by blocking the active site • Use of cisplatin as a cancer drug • Understanding why drugs can have adverse side effects • Explain why it is economically beneficial to design production methods with fewer steps and high atom economy
British values 	• Listening to others, given a range of choices and allowed to research independently	• Listening to others, given a range of choices and allowed to research independently	• Listening to others, given a range of choices and allowed to research independently The environmental impact of polymers and how to design those that are biodegradable. • The advantages and disadvantages of different methods of disposal of polymers including landfill, combustion and recycling
Character 	• Resilience is built through failures and mistakes during practical activities. They can build confidence through evaluating methods. Students can independently research concepts and experiments to plan a method. • Regular DIRT tasks around exam questions helps to encourage students to correct and improve their work		
Careers 	• References will be made to the beauty, healthcare and pharmaceutical industries. pH is important for drug synthesis and buffer solutions are used in shampoos etc. The mathematical, problem solving, analytical and evaluative skills are all transferable to the financial sector, healthcare, engineering and law.		
Assessment opportunities 	• Assessed through CPAC, • Homework, • AP points • End of Topic mini-tests • AfL in lessons • DO now activities that assess knowledge recall • Extended writing DIRT tasks		