KS5 Curriculum Map – Chemistry:

Topic	Substantive Knowledge This is the specific, factual content for the topic, which should be connected into a careful sequence of learning.	Disciplinary Knowledge (Skills) This is the action taken within a particular topic in order to gain substantive knowledge.	Assessment Opportunities What assessments will be used to measure student progress?
Atomic structure	• History of atomic structure • Isotopes • Mass Spectrometry • Spdf electron configuration • Ionisation energy • Ionisation energy trends • Physical properties of p3 (atomic radius, mp)	• Idea that scientific models change over time based on experimental evidence • Use significant figures appropriately when calculating values from data. • Rearrange equations and substitute in formulae to calculate time of flight. • Predict reactivity and charge on ions based on size of nuclear charge, distance, shielding, and IE value, and relate this to positions on the periodic table. • Use IE as evidence for electron structure	• Class questions + calculations • Whiteboards • Discussion in class
Bonding	• Ionic bonding • Covalent bonding • Polar bonds • Shape • Intermolecular forces • Metallic bonding • Physical properties of different structure types	• Determine bonding type based on electronegativity values • Use VSEPR theory to predict shapes of molecules up to 6 electron pairs • Predict trends in boiling point based on bonding type and /or intermolecular forces	• Test • Molymods • Extended writing
Calculations	• Avogadro's constant • Empirical formula • Reacting Mass • Limiting reagent • % yield • Atom economy	• Calculate numbers of particles using Avogadro's number as a large number that constitutes a mole • Relate atom economy to economic and environmental concerns	• Required practical • Class calculation exercises • Method design

	• Solution calculations • Titrations (including back titration) • Gas volumes and the ideal gas equation	• Manipulate data accurately taking experimental uncertainties into account • Correctly carry out practical work using apparatus to generate accurate data • Explain and calculate gas volumes and pressure using the idea that size of gas particle is independent of gas volume.	
Energetics	• Exothermic and endothermic reactions • Use of calorimetry • Standard conditions • Bond enthalpy • Hess' Law • Definitions for formation and combustion	• Draw energy level diagrams • Identify most accurate means of calculating enthalpy allowing for the fact that bond enthalpy are mean values and maybe less accurate • Design experiments to control variables • Us graphs to calculate enthalpy changes accurately from experimental data	• Required prac • Method design • Data processing
Equilibria	• Le Chatelier's principle • Kc Calculations • Kp	• Predict changes in the position of equilibrium based on a change in conditions • Determine the effect of condition changes on the value of equilibrium constant • Derive units for the equilibrium constant • Use quadratic equations to solve Kc calculations • Carry out titration work accurately to generate experimental data	• in class calculation questions • Experimental method • Data processing
Rates of reaction	• Maxwell – Boltzmann energy distribution • Methods of monitoring rates of reaction • Conditions affecting rates of reaction • Catalysts	• Predict changes in the rate of a chemical reaction based on collision theory • Use the area under a curve to explain the effect of changes in temperature and catalyst for Maxwel Boltzmann curves • Calculate mean rate and rate at a given point in time • Evaluate accuracy and quantity of data from experiment	• Required practical • Method design • Extended writing

Introduction to inorganic Chemistry	• Different types of reaction (precipitation, thermal decomposition, acid) • Solubility rules	• Write equations for common reaction types • Correctly determine formulae for a range of compounds • Process experimental data to draw conclusions about reaction types • Make observations and record them accurately • Apply the law of conservation of mass to chemical calculations	• Short exercises in class • Practical work • GCSE content test
Group 2	• Trends in atomic radius, IE and mp • Reactions and uses • Solubility of hydroxides and sulfates	• Predict trends in mp unit knowledge of structure and bonding • Write relevant ionic and chemical equations for reactions of group 2 • Make and record experimental observations	• Practical work
Redox and group 7	• Oxidation numbers • Oxidising and reducing agents • Trends in reactivity, electronegativity, boiling points, oxidising / reducing ability • Uses of group 7 elements • Reactions with water and of sodium halides with conc sulfuric acid • Ion tests	• Balance redox equations using half equations • Explain trends in group 7 using electronegativity and IE, Inter molecular forces and structure • Discuss ethical considerations relating to additives to water	• Required practical • Whiteboards • Short exercises in class
Introduction to Organic Chemistry	• Functional groups • Isomers (including geometric and optical) • Different properties for isomers	• Nam organic compounds using IUPAC rules • Correctly apply different types of formula • Identify E/Z isomers based on the fact that the nature of double bonds prevents rotation • Apply SIP priority rules to name isomers	• Molymods • whiteboards
Alkanes	• Crude oil and fractional distillation • Combustion • Pollutants • Cracking • Free radical substitution (including ozone depletion)	• Show electron movement by curly arrows • Explain why free radicals are highly reactive	• Mechanism writing

Haloalkanes	• Nucleophilic substitution • Bond strength and polarity of C-X bond • Elimination reactions • Conditions	• Relate atomic radius to bond strength and use this o predict trends in rate of reaction	• Practical work • Mechanism writing • Molymods
Alkenes	• Structure + bonding • Addition reactions • Addition polymerisation	• Predict major and minor products using understanding of positive inductive effect (electron donating / withdrawing groups) • Predict structures of reactive intermediates • Compare stability of intermediates (relation to major / minor products)	• Synoptic questions • Naming practice
Alcohols	• Trends in physical properties • Formation of alcohols • Oxidation reactions • Elimination reactions • Tests for functional groups	• Predict physical properties based on the length of C chain • Evaluate of different methods of alcohol production • Write equations for redox reactions • Carry out practical wok safely and complete a risk assessment • Distil a product and heat under reflux	• Practical work • Synoptic questions • Required practical (distillation and Chemical tests)
Amines and condensation polymers	• Trends in physical properties • Base strength • Preparation of amines • Reactions of amines • Uses • Condensation polymerisation	• Determine properties of a base • Predict base strength of organic compounds using understanding of electron donating and withdrawing groups • Determine products of reaction for nucleophilic substitution (including further substitution) based on reaction conditions • Consider ability of different polymers to biodegrade / recycle	• Practical work • Molymods • Extended writing
Biochemistry	• Amino acids • Protein structures and function • Effect of pH • Hydrolysis • DNA structure	• Explain folding of polymers in terms of intermolecular forces • Explain denaturing enzymes using knowledge of acid reactions • Calculate and explain Rf values	• Molecule drawing • Synoptic questions • Test

Rates of reaction	• Rate equation • Determining mechanism from rate equation • Activation Energy and Arrhenius equation	• Determine the Rate determining step for a reaction using experimental data • Determine order of reaction from graph data • Determine activation energy using graphs • Use software to process experimental data	• Practical work • Data processing • Graph plotting • Method design
Thermodynamics	• Definitions of enthalpy terms • Born Haber cycles • Experimental and theoretical lattice enthalpy • Solubility cycles • Entropy • Gibbs free energy	• Understanding of Hess' law • Predict degree of covalency using the ideal ionic model • Convert units when combining different terms together in a calculation • Explain differences in spontaneity using graph skills (y=mx+c)	• In class calculations • Drawing cycles
Acids and bases	• Bronsted Lowry definition • Lewis definition • pH • Kw • Weak and strong acids • Ka calculation • Buffers • Salt pH • Titration curves • indicators	• Recall general acid reactions • Use logs to calculate pH • assumptions and approximations used in these calculations • equilibrium reactions • titration methods • variables and reliability of data (calibration)	• Required practical • In class calculations • Method design • Sketching of curves
Electrochemistry	• Voltaic cell • Standard conditions • Standard Hydrogen electrode • Representing cells • Commercial applications	• Determine oxidation numbers for elements in a range of compounds • Deduce redox equations • Apply knowledge of equilibria to explain cells	• Required practical • Method design • Equation writing and calculation in class • Test
Alehydes and ketones	• Reduction using $NaBH_4$ • Nucleophilic addition mechanisms	• Recall Organic oxidation reactions • Carry out tests to identify functional groups • Explain why nucleophilic addition reactions involving CN^- produce a racemic mixture	• Molymods • White boards • Mechanism drawing.

Carboxylic acids and derivatives	• Properties and uses of esters. • Biodiesel • Esterification reactions • Nucleophilic addition-elimination mechanisms • Acid anhydrides, acyl chlorides and amides • Synthesising, analysing and testing aspirin. • Synthesis and purification of ethyl ethanoate Recrystallisation	• Recall Weak acids and their reactions • Draw mechanisms for carbonyl reactions using polarity of C=O bond. • Comparing the strength of nucleophiles (e.g. water, ammonia and amines). • Prepare an organic solid and liquid using appropriate separation and purification techniques	• Required practical • Diagram drawing
Aromatic compounds	• Bonding and structure of benzene • Stability • Electrophilic substitution reactions (nitration and Friedel-Crafts acylation. Drawing mechanisms and describing uses of products.	• Evaluate and compare evidence for the stability of benzene. • Calculate stability based on thermochemical data and bond length data.	• Flow diagram questions • Synoptic questions • Synthesis questions
Synthesis and analysis	• IR spectroscopy • C-13 and H-1 NMR spectroscopy • Thin layer and gas-liquid chromatography	• Recall reaction conditions for reactions on the specification • Construct synthesis pathways and draw relevant mechanisms. • Evaluate production methods based on number of steps, yield and atom economy. • Determine molecular formulae using mass spectrometry data • Interpret data from data tables • Calculate Rf values for chromatography	• Required practical • Problem based questions
Transition metals	• Coordination complexes • Ligand substitution reactions • Coloured compounds • Variable oxidation states • Catalytic activity- homogeneous and heterogeneous catalysts • Use of cis-platin	• Write formulae for complex ions • Determine coordination number. • Deduce shapes and explain isomerism for a range of compounds • Deduce the stability of complexes based on entropic and thermodynamic factors • Calculate concentrations using redox chemistry • Carry out practical work on aqueous chemistry to record observations accurately	• Required practical • Extended questions • Whiteboards

Period 3	• Trends and properties of period 3 oxides • Reactions with water	• Explain trends using acid base chemistry and pH • Describe the structure and bonding	• Problem based questions