

Key Stage 5 CHEMISTRY: Year 12

Overall Curriculum Goals – Develop extended and sustained chemical literacy and understanding through investigation of organic reactions and physical properties of matter					
Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
<p>PHYSICAL CHEMISTRY</p> <ul style="list-style-type: none"> Determine numbers of sub-atomic particles Explain what an isotope is Calculate relative atomic mass Calculate relative formula mass Create chemical formulae Balance chemical equations Explain what a mole is Determine empirical formulae Determine the formula of a hydrated salt Perform calculations involving moles, masses, concentrations and volumes Use molar ratios to calculating reacting masses or volumes State the formulae of common acids Explain what strong and weak acids are Create equations for neutralisation reactions Describe how to make a standard solution Perform titration <p>ORGANIC CHEMISTRY</p> <ul style="list-style-type: none"> Describe where electrons are located in atoms Determine the electronic configuration of atoms and ions Explain how ionic bonding occurs Explain properties of ionic compounds due to their structure Explain how covalent bonding occurs Draw dot-cross diagrams to represent ionic and covalent bonding Explain what a dative bond is Use electron pair repulsion theory to determine the 	<p>PHYSICAL CHEMISTRY</p> <ul style="list-style-type: none"> Determine the atom economy of a reaction Determine the percentage yield of a reaction Determine the oxidation number of elements in a compound Determine formulae of compounds of transition elements Explain what oxidation and reduction are Determine whether a reaction is redox Explain the manifestations of periodicity Explain trends in ionisation energy Determine equations for ionisations Explain physical properties in terms of structure and bonding Explain what metallic bonding is Explain the bonding in giant covalent structures Describe reactions of Group 2 elements and compounds Describe reactions of Group 7 elements Explain trends in boiling point and reactivity of Group 7 elements Describe how to determine unknown ions in qualitative tests <p>ORGANIC CHEMISTRY</p> <ul style="list-style-type: none"> Describe hydrocarbons as saturated or unsaturated Identify homologous series Identify functional groups Differentiate between aliphatic, aliphatic alicyclic and aromatic compounds Use IUPAC rules to name compounds Use different kinds of formula to represent compounds 	<p>PHYSICAL CHEMISTRY</p> <ul style="list-style-type: none"> Construction of enthalpy profile diagrams Determination of enthalpy changes from experimental results Determine enthalpy change using average bond enthalpies Determine enthalpy changes indirectly using enthalpy cycles Construct cooling curves for endothermic and exothermic reactions <p>ORGANIC CHEMISTRY</p> <ul style="list-style-type: none"> Describe the combustion and substitution reactions of the alkanes Explain the mechanism of reaction of electrophilic addition Apply Markownikoff's rule to determine products of addition reactions Explain how addition polymers are made, processed and recycled Describe new bio- and photo-degradable polymers Explain the polarity and solubility of alcohols Classify alcohols as primary, secondary or tertiary Explain the combustion and oxidation reactions of alcohols Explain the elimination and substitution reactions from alcohols Classify haloalkanes as primary, secondary or tertiary Explain the hydrolysis reactions of haloalkanes Explain the mechanism of nucleophilic substitution Explain the differing rates of hydrolysis of the haloalkanes 	<p>PHYSICAL CHEMISTRY</p> <ul style="list-style-type: none"> Predict effect on reaction rate of changing factors using collision theory Calculate reaction rates from gradients on a concentration-time graph Explain the role of a catalyst Describe economic benefits of using catalysts Explain what is meant by sustainable development Explain the qualitative relationship between the Boltzmann distribution and activation energy Explain what equilibrium is Explain Le Chatelier's principle Apply Le Chatelier's principle to unfamiliar equilibria Explain compromise conditions between rate and yield Derive expressions for the equilibrium constant, K_c Calculate numerical value of K_c given equilibrium concentrations Explain the link between the value of K_c and the position of equilibrium Explain how infra-red spectroscopy works Interpret an infra-red spectrum to identify bonds within a molecule Explain how infra-red spectroscopy can be used to monitor air pollution Identify molecular mass from a mass spectrum Use fragment ion peaks to identify structures <p>ORGANIC CHEMISTRY</p> <ul style="list-style-type: none"> Analyse functional groups in compounds and propose 	<p>PHYSICAL CHEMISTRY</p> <ul style="list-style-type: none"> Construction of a rate equation when given orders of reaction Calculate rate constant, k, and determine units Explain the effect of orders of reaction on rate Identify orders of reaction from concentration-time graphs Identify orders of reaction from rate-concentration graphs Determine orders of reaction from initial rates data Explain different experimental methods for monitoring rate of reaction Predict rate equation from rate-determining step Predict mechanism of reaction from overall equation and rate-determining step Explain the effect of temperature on the rate constant Use the Arrhenius equation to determine rate constant Construct graphs from relevant data of rate constant and temperature Use the Arrhenius equation to determine the activation energy, E_a, and pre-exponential factor, A. <p>ORGANIC CHEMISTRY</p> <ul style="list-style-type: none"> Explain the differences between the Kekule model and the delocalised model of benzene Use conventions to systematically name aromatic compounds Explain the electrophilic substitution reactions of benzene Explain the mechanism for the electrophilic substitution reactions of benzene 	<p>PHYSICAL CHEMISTRY</p> <ul style="list-style-type: none"> Determine quantities present at equilibrium when given relevant data Write expressions for K_c and K_p for homogeneous and heterogeneous equilibria Calculate values of K_c including units Calculate mole fractions and values of K_p including units Explain the qualitative effect of temperature on equilibrium constant Explain the constancy of equilibrium when concentration and pressure are changed <p>Examination skills in extended response, multiple choice and practical questions</p>

<p>geometry and bond angle of a compound</p> <ul style="list-style-type: none"> • Explain what is meant by electronegativity • Explain how polar bonds form • Explain how polar molecules form • Explain how intermolecular forces form and compare their strength • Explain the anomalous properties of water 	<ul style="list-style-type: none"> • Analyse different kinds of formula to identify functional groups and name compounds • Explain what is meant by structural isomerism • Explain the shapes of alkanes • Explain the variation of boiling point of the alkanes • Describe the bonding in a C=C bond • Describe the reactions of alkenes • Explain what is meant by stereoisomerism • Use Cahn-Ingold-Prelog priority rules to name stereoisomers 	<ul style="list-style-type: none"> • Describe the uses of organohalogen compounds • Explain the historical destruction of ozone by organohalogen compounds • Explain the mechanism of the destruction of ozone by CFCs 	<p>synthetic schemes to produce a desired product</p> <ul style="list-style-type: none"> • Construct a two-stage reaction pathway to produce a desired product • Explain how to use appropriate apparatus to perform distillation and reflux techniques • Explain how to use appropriate apparatus to purify an organic liquid 	<ul style="list-style-type: none"> • Explain the acidity of phenols • Describe the electrophilic substitution reactions of phenols • Describe the directing effects of benzene substituents • Construct synthetic pathways considering directing effects 	
Key Vocabulary/Concepts/Ideas		Key Vocabulary/Concepts/Ideas		Key Vocabulary/Concepts/Ideas	
<p>Isotope Relative atomic mass Mole Water of crystallisation</p> <p>Orbital Ion Dative covalent bond Electronegativity Polarity Dipole</p>	<p>Oxidation number Redox Disproportionation Periodicity Ionisation energy</p> <p>Hydrocarbon Homologous series Functional group Aliphatic Aromatic Alicyclic General formula Skeletal formula Displayed formula Structural formula Radical Alkanes Alkenes Substitution Stereoisomerism</p>	<p>Enthalpy change of combustion Enthalpy change of formation Enthalpy change of reaction Enthalpy change of neutralisation Standard states Standard conditions Average bond enthalpy</p> <p>Addition Electrophile Homolytic and heterolytic fission Markownikoff's rule Addition polymer Alcohols Oxidation Reflux Distillation Elimination Haloalkanes Nucleophile Hydrolysis</p>	<p>Homogeneous and heterogeneous Activation energy Dynamic equilibrium Le Chatelier's principle</p> <p>Synthetic scheme Retrosynthesis</p>	<p>Rate of reaction Order of reaction Rate constant Half-life Rate determining step</p> <p>Benzene Delocalised model Phenols Directing effects</p>	<p>Equilibrium constant Mole fraction</p>
Assessment		Assessment		Assessment	
<ul style="list-style-type: none"> • Summer Task Assessment • Maths Assessment • October Progress Test • Structure and Bonding Progress Assignment and Check • Structure and Bonding Test 	<ul style="list-style-type: none"> • Moles Progress Assignment and Check • Moles, Acids and Redox Test • Organic Chemistry Progress Assignment and Check 	<ul style="list-style-type: none"> • Formulae and Isomerism Test • Periodicity Progress Assignment and Check • Further Organic Chemistry Progress Assignment and Check • Mid-year Exam 	<ul style="list-style-type: none"> • Enthalpy Progress Assignment and Check • Alcohols, Haloalkanes and Synthesis Test • Energetics Test 	<ul style="list-style-type: none"> • Analysis Progress Assignment and Check • Pre-Final Exam • Benzenes Progress Assignment and Check • Benzenes and Phenols Test 	<ul style="list-style-type: none"> • Rates of Reaction Progress Assignment and Check • Final Exam 1 – Breadth in Chemistry • Final Exam 2 – Depth in Chemistry

CPAC		CPAC		CPAC	
Use of evaporation to determine the formula of a hydrated salt Make a standard solution Use of titration to determine the concentration of an unknown acid or alkali	Use qualitative tests to identify unknown compounds	Determine an enthalpy change of combustion Determine an enthalpy change of reaction indirectly	Oxidise alcohols to carboxylic acids Purify organic liquids Identify organic unknowns Carry out risk assessments	Determine orders of reaction from continuous methods Determine orders of reaction from initial rates methods	
CIAG		CIAG		CIAG	
Analytical chemist Laboratory technician Cosmetic chemist Science communicator	Process chemist Metallurgist Jeweller	Structural engineer Atmospheric chemist Environmental scientist	Agricultural engineer Law enforcement	Pharmacologist	Anaesthesiologist

Key Stage 5 CHEMISTRY: Year 13

Overall Curriculum Goals – Develop extended and sustained chemical literacy and understanding through investigation of organic reactions and physical properties of matter					
Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
PHYSICAL CHEMISTRY <ul style="list-style-type: none"> Explain what is meant by the terms acid and base Calculate the pH of a strong acid Use K_a to calculate the pH of a weak acid Use the ionic product of water to calculate pH of bases Explain how buffers work Calculate the pH of buffer solutions Explain the role of buffers in the body Construct titration curves in neutralisation reactions Select appropriate indicators for titrations ORGANIC CHEMISTRY <ul style="list-style-type: none"> Explain oxidation and reduction reactions of carbonyls Describe how to identify unknown functional groups using qualitative tests Explain the solubility and reactions of carboxylic acids Explain how to produce esters from carboxylic acids or acid anhydrides 	PHYSICAL CHEMISTRY <ul style="list-style-type: none"> Explain what is meant by the term lattice enthalpy Develop Born-Haber cycles to show enthalpy changes Calculate enthalpy changes using Born-Haber cycles Explain the effect of ionic size and charge on enthalpy values Explain what is meant by the terms entropy and free energy Calculate the change in entropy in a reaction Calculate the change in free energy in a reaction Comment on the feasibility of a reaction Construct redox equations Explain what is meant by the term electrode potential Calculate cell potentials from given data Predict feasibility of reactions using electrode potential data Determine oxidising power using electrode potential data Explain how storage and fuel cells work 	PHYSICAL CHEMISTRY <ul style="list-style-type: none"> Explain what is meant by the term transition element Explain how complexes are formed from transition element ions and ligands Explain the idea of denticity Explain stereoisomerism in transition element complexes Describe precipitation reactions of transition elements Describe ligand substitution reactions of transition elements Describe how to interconvert transition element species' oxidation number Explain how to perform a redox titration Describe how to use qualitative analysis to identify unknown ions ORGANIC CHEMISTRY <ul style="list-style-type: none"> Explain how thin layer chromatography works Explain how gas chromatography works Comment on the type and abundance of chemicals in a TLC/GC analysis 	Mock exams Practical skills revision	Targeted revision based on feedback from mock exams	

<ul style="list-style-type: none"> Determine products of acidic and alkaline hydrolysis of esters Describe the formation and reactions of acyl chlorides Using naming conventions to name amines Explain how to prepare amines Explain the reactions of amino acids Explain what is meant by optical isomerism Construct 3-D diagrams of optical isomers Explain how to produce and name amides 	ORGANIC CHEMISTRY <ul style="list-style-type: none"> Explain how to produce polyesters and polyamides Explain acidic and alkaline hydrolysis of polyesters and polyamides Explain the formation and reactions of nitriles Explain the importance of C-C bond formation in organic synthesis Construct three-step organic synthesis pathways to reach a desired product 	<ul style="list-style-type: none"> Describe what is meant by NMR Explain why a reference compound is required Identify chemical environments in a molecule Predict carbon and hydrogen NMR spectra of a given molecule Analyse carbon and hydrogen spectra to identify molecules Explain and use the n+1 rule Analyse a combination of infrared spectroscopy, mass spectrometry and NMR to identify unknown molecules 			
Key Vocabulary/Concepts/Ideas		Key Vocabulary/Concepts/Ideas		Key Vocabulary/Concepts/Ideas	
<p>pH Buffers Ionic product of water Titration curve</p> <p>Carbonyl Carboxylic acid Acid anhydride Acyl chloride Ester Amine Amide Optical isomerism</p>	<p>Lattice enthalpy Enthalpy of atomisation Electron affinity Enthalpy of hydration Enthalpy of solution Entropy Free Energy</p> <p>Polyester Polyamide Nitrile</p>	<p>Transition element Ligand Complex Stereoisomerism Mono-/Bi-/Multi-dentate Redox titration</p> <p>TLC GC NMR Chemical environment Splitting</p>			
Assessment		Assessment		Assessment	
<ul style="list-style-type: none"> Rates and Equilibrium Test Acids and Bases Progress Assignment and Check Buffers Progress Assignment and Check Carbonyls Progress Assignment and Check 	<ul style="list-style-type: none"> Acids, Bases and Buffers Test Carbonyls, Amines and Amides Test Enthalpy and Entropy Progress Assignment and Check 	<ul style="list-style-type: none"> Pre-mock Exam Organic Synthesis Progress Assignment and Check Transition Elements Progress Assignment and Check NMR Progress Assignment and Check 	<ul style="list-style-type: none"> Mock Exam 1 – Inorganic Chemistry Mock Exam 2 – Organic Chemistry 	<ul style="list-style-type: none"> GCE Paper 1 – Inorganic Chemistry GCE Paper 2 – Organic Chemistry GCE Paper 3 – Unified Chemistry 	
CPAC		CPAC		CPAC	
<p>Identifying solutions using pH Identifying organic unknowns</p>	<p>Synthesis and purification of benzoic acid</p>	<p>Redox titration using manganate and iron species Redox titration using iodine and thiosulfate species Planning, preparation and implementing practical procedures</p>			
CIAG		CIAG		CIAG	

Perfumer Pathologist Doctor	Polymer scientist Medicinal chemist Patent lawyer	Forensic scientist Pyrotechnician MRI technician			
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