

Year: 12

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Content	<u>Atomic Structure</u>	<u>Amount of Substance</u>	<u>Alkenes</u>	<u>Analytical Techniques</u>	<u>Equilibrium</u>	<u>Aldehydes and Ketones</u>
Knowledge	<p>Content:</p> <ul style="list-style-type: none"> - Fundamental Particles - Isotopes - Mass number and atomic number - Electron Arrangement - Mass Spectrometer - Ionisation <p>Knowledge:</p> <ul style="list-style-type: none"> - Describe the properties of subatomic particles - Determine the number of subatomic particles - Explain the existence of isotopes - Understanding the principles of mass spectroscopy - Know the electron configuration for elements up to Z=36 - Explain how ionisation changes as we go across periods and down groups 	<p>See Autumn 1 for content and knowledge</p> <p><u>Introduction to Organic Chemistry</u></p> <p>Content:</p> <ul style="list-style-type: none"> - Formulae - Nomenclature - Isomers <p>Knowledge:</p> <ul style="list-style-type: none"> - Define common formulae - Explain the term functional group - Explain how to name chemicals - Explain structural isomerism <p><u>Alkanes</u></p> <p>Content:</p> <ul style="list-style-type: none"> - Alkanes - Fractional distillation - Cracking - Combustion - Formation of Halogenoalkanes 	<p>Content:</p> <ul style="list-style-type: none"> - Alkenes - Electrophilic addition mechanism - Addition polymers <p>Knowledge:</p> <ul style="list-style-type: none"> - The properties of alkenes - How to test for Alkenes - Outlining the mechanism for alkenes - How addition polymers are formed - Naming of Polymers <p><u>Alcohols</u></p> <p>Content:</p> <ul style="list-style-type: none"> - Alcohols - Ethanol Production - Reactions of Alcohols <p>Knowledge:</p> <ul style="list-style-type: none"> - Describe properties of alcohols - Classifying alcohols - Describe 	<p>Content:</p> <ul style="list-style-type: none"> - Test tube reactions - Mass spectroscopy - Infrared Spectroscopy <p>Knowledge:</p> <ul style="list-style-type: none"> - Identify functional groups using chemical tests - Understand how high resolution mass spectrometry works - Understand how infrared spectroscopy works <p><u>Required Practical</u></p> <ul style="list-style-type: none"> - Identify alcohols, aldehydes, ketones and carboxylic acids <p><u>Energetics</u></p> <p>Content:</p> <ul style="list-style-type: none"> - Endo and Exothermic Reactions 	<p>Content:</p> <ul style="list-style-type: none"> - Dynamic Equilibrium - Le Chatelier's principle - Compromise conditions - Equilibrium Constant <p>Knowledge:</p> <ul style="list-style-type: none"> - Define dynamic equilibrium - Explain the role of a catalyst - Explain compromise conditions - Perform calculations of KC <p><u>Group 2</u></p> <p>Content:</p> <ul style="list-style-type: none"> - Physical Properties - Chemical Properties <p>Knowledge:</p> <ul style="list-style-type: none"> - Explain the trends in ionisation energy and atomic radii - Explain the melting point in 	<p>Content:</p> <ul style="list-style-type: none"> - Aldehydes and Ketones - Oxidation of Aldehydes and Ketones - Nucleophilic Addition - Optical Isomers <p>Knowledge:</p> <ul style="list-style-type: none"> - Be able to name common aldehydes and ketones - Be able to write oxidation and reduction equations - State reagents required for nucleophilic addition - Know the dangers of KCN - Be able to identify chiral carbons - Explain what a racemic mixture is - Be able to draw optical isomers <p><u>Thermodynamics</u></p>

<ul style="list-style-type: none"> - Ideal Gas Equation - Calculating Masses - Titrations - Formulae - Percentage Yield - Atom Economy <p>Knowledge:</p> <ul style="list-style-type: none"> - Carrying out calculations using moles - Calculating concentration - Recall and use Ideal Gas Law - Writing balanced and ionic equations - Calculating masses and volumes from balanced equations - Calculating empirical and molecular formulae - Calculating percentage yield - Calculating atom economy <p>Required Practical:</p> <ul style="list-style-type: none"> - Making a standard solution and carrying out a titration <p>Bonding</p> <p>Content:</p> <ul style="list-style-type: none"> - Ionic - Covalent - Shapes of molecules - Intermolecular Forces - Metallic Bonding <p>Knowledge:</p> <ul style="list-style-type: none"> - Know the formulae 	<ul style="list-style-type: none"> - Describe the properties of alkanes - Explain how to separate crude oil - Describe the problem of fuels and how we can overcome them - Describe free-radical Substitution <p>Haloalkanes</p> <p>Content:</p> <ul style="list-style-type: none"> - Halogenoalkanes - Nucleophilic Substitution - Elimination reactions <p>Knowledge:</p> <ul style="list-style-type: none"> - Explain why haloalkanes are polar - Understand the nucleophilic substitution mechanism - Explain why the carbon halogen bond can influence the rate of reaction - Explain the role of the reagents in the mechanisms - Outline the elimination mechanism 	<p>fermentation</p> <ul style="list-style-type: none"> - Describe elimination mechanisms <p>Required Practical</p> <ul style="list-style-type: none"> - Distillation of cyclohexanol to cyclohexene <p>Kinetics</p> <p>Content:</p> <ul style="list-style-type: none"> - Collision Theory - Maxwell Boltzmann distribution - Catalysts <p>Knowledge:</p> <ul style="list-style-type: none"> - Explain collision theory - Understand how different factors affect the rate of reaction - Draw distribution curves - Understand how a catalyst works <p>Required Practical:</p> <ul style="list-style-type: none"> - Measuring the rate of a reaction 	<ul style="list-style-type: none"> - Enthalpy - Hess' law - Enthalpy of Combustion - Bond Enthalpies <p>Knowledge:</p> <ul style="list-style-type: none"> - Identifying reactions as exothermic or endothermic - Knowing the standard conditions for enthalpy - Calculate the overall energy change - Explain why mean energies differ from experimental values - Calculate the overall energy change of a reaction - Perform Hess Cycle calculations <p>Required Practical</p> <ul style="list-style-type: none"> - Measuring the enthalpy change of solutions in the lab. <p>Redox</p> <p>Content:</p> <ul style="list-style-type: none"> - Oxidation and Reduction - Oxidation States - Redox Equations <p>Knowledge:</p> <ul style="list-style-type: none"> - Able to calculate the 	<p>relation to bonding</p> <ul style="list-style-type: none"> - Know the reaction of group 2 with water - Know the trends in solubility of hydroxides and sulphates - Explain some common uses of group 2 compounds <p>Group 7</p> <p>Content:</p> <ul style="list-style-type: none"> - Halogens - Chemical reactions of halogens - Reactions of Halide ions - Uses of chlorine <p>Knowledge:</p> <ul style="list-style-type: none"> - Explain the trends in electronegativity - Recall some common reactions of chlorine - Understand the use of chlorine in water treatment - Know the trend in reducing ability of halide ions - Know the trend of silver halides in ammonia <p>Required Practical</p> <ul style="list-style-type: none"> - Carry out 	<p>Content:</p> <ul style="list-style-type: none"> - Enthalpy Change - Born-Haber Cycle - Enthalpy of Solutions - Entropy - Gibbs Free Energy <p>Knowledge:</p> <ul style="list-style-type: none"> - Be able to define key words - Be able to construct Born-Haber cycles - Be able to calculate enthalpies of solutions - Be able to illustrate entropy change in terms of physical and chemical changes - Be able to calculate entropy changes from absolute entropy values - Explain that feasibility of a reaction is due to enthalpy and entropy change - Be able to use Gibbs Free Energy equation
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	<ul style="list-style-type: none"> - of common ions - Construct ionic Formulae - Draw and describe structures of giant ionic lattices - Define and representing covalent bonding - Explaining the shapes of molecules - Explain how intermolecular forces affect melting and boiling points - Describe and explain metallic bonding 			<ul style="list-style-type: none"> - oxidation state of an element - Write and combine half equations 	<p>simple test tube reactions to identify negative ions</p> <p><u>Periodicity</u></p> <p>Content:</p> <ul style="list-style-type: none"> - The periodic table - Trends in properties - Ionisation Energies <p>Knowledge:</p> <ul style="list-style-type: none"> - Classify elements in the periodic table based on proton number - Know the trends in atomic radius - 	
Skills	<ul style="list-style-type: none"> • Appreciate how the atomic model has changed over time • Interpret simple spectra from mass spectroscopy • Confidently rearrange $n=m/mr$ • Confidently rearrange ideal gas law • Balance equations for unfamiliar reactions • Predicting charges of ions • Relating structure and melting point to compounds structure and bonding • Assessing risks in practicals • Recording data 	<ul style="list-style-type: none"> • Identification of common functional groups • Naming common compounds • Evaluate the uses of crude oil as a fuel • Representing free radical substitution as a mechanism • Evaluate the use of CFCs in refrigerants 	<ul style="list-style-type: none"> • Identification of the major and minor products in electrophilic addition • Naming polymers • Justifying the conditions used in fermentation of ethanol • Write equations that support the fermentation of ethanol as being carbon neutral and evaluate them • Interpreting distribution curves • Assessing risks in practicals • Recording data 	<ul style="list-style-type: none"> • Interpret an infrared spectrum • Interpret a mass spectrum • Understanding Hess Cycles • Writing unfamiliar half equations • Working safely • Planning a practical • Assessing risks in practicals • Recording Data • Data Analysis 	<ul style="list-style-type: none"> • Predict the changes on the position of equilibrium with changes in conditions • Working safely • Planning a practical • Assessing risks • Recording data • Data analysis 	<ul style="list-style-type: none"> • Comparing lattice enthalpies from Born-Haber cycles with those from calculations • Understanding the concept of increasing disorder • Be able to relate Gibbs Free Energy to $Y = mx + c$ • Application of nucleophilic addition mechanism to different reactions • Appreciate why mixtures of enantiomers

	<ul style="list-style-type: none"> Analysis of experimental data 		<ul style="list-style-type: none"> in tables Analysis of experimental data Working safely 			are formed from unsymmetrical aldehydes and ketones
Key Questions	<p>Why are the elements arranged in a specific order in the periodic table?</p> <p>Why do different materials have different properties?</p>	<p>Why is crude oil important for industry?</p> <p>How do Chemists calculate the correct concentrations of chemicals?</p> <p>What has caused the Ozone hole?</p>	<p>How has the discovery of alkenes changed the way we package goods?</p> <p>What are the many different ways we can produce ethanol?</p>	<p>How do we identify unknown compounds in outer space?</p> <p>How do we know what chemicals to use in our boilers and internal engines?</p>	<p>Why is it important that we can control the conditions in industrial processes?</p> <p>What is the importance of group 2 in medicine?</p> <p>How does chlorine help keep our drinking water safe?</p>	<p>Why are some compounds stable and other compounds unstable?</p>
Assessment	<p>Baseline Assessment</p> <p>End of Topic Assessments</p> <p>CPACs from Practicals</p>	<p>End of Topic Assessments</p>	<p>End of Topic Assessments</p> <p>CPACs from Practicals</p>	<p>End of Topic Assessments</p> <p>CPACs from Practicals</p>	<p>End of Topic Assessments</p> <p>CPACs from Practicals</p>	<p>End of Topic Assessments</p> <p>CPACs from Practicals</p> <p>UCAS Exam</p>
Literacy/numeracy/SMSC/Character	<p>Numeracy:</p> <ul style="list-style-type: none"> Rearranging equations Using standard form Proportionality Conversion between units Reading scales Recording data Percentages Interpreting graphical data Data analysis Balancing equations Calculating uncertainties Significant figures <p>Keywords: mass number, atomic number, ions, model, ionisation, electron spray, ion drift, mass spectrum, shells, energy levels, mole, ideal gas law, standard solution, </p>	<p>Numeracy:</p> <ul style="list-style-type: none"> Rearranging calculations Calculating empirical formulae Balancing equations Interpreting data from tables <p>Keywords: Skeletal, structural, roots, functional groups, chain, isomers, positional, nomenclature, distillation, cracking, thermal, incomplete, complete, combustion, free radical, initiation, propagation, termination, </p>	<p>Numeracy:</p> <ul style="list-style-type: none"> Balancing equations Drawing and plotting graphs Data Analysis Interpreting graphical data Recording Data Reading Scales Unit conversions <p>Keywords: ethanol, fermentation, biofuel, combustion, elimination, oxidation, aldehyde, ketone, isomer, electrophile, addition, carbocation, inductive, activation energy, </p>	<p>Numeracy:</p> <ul style="list-style-type: none"> Rearranging calculations Balancing half equations Calculating oxidation states of elements and ions Recording Data Conversion of units Reading Scales Analysing experimental data Significant figures Plotting graphs Extrapolating graphs <p>Keywords: oxidation, oxidising agent, reduction, reducing agent, redox reaction, oxidation state, </p>	<p>Numeracy:</p> <ul style="list-style-type: none"> Rearranging and substitution Convert between units Use of two equations simultaneously Reading Scales Recording Data in table Data analysis Balancing equations Significant figures <p>Keywords: equilibrium, dynamic, equilibrium constant, alkaline, halogen, displacement, disproportionate, ionic</p> <p>SMSC:</p> <ul style="list-style-type: none"> Appreciate that society 	<p>Numeracy:</p> <ul style="list-style-type: none"> Calculating lattice enthalpies Calculating enthalpy change of solutions Calculating entropy change Rearranging Gibbs Free Energy equation Using $y = mx + c$ <p>Keywords: enthalpy, formation, ionisation, atomisation, bond enthalpy, electron affinity, lattice enthalpy, hydration, chiral, enantiomer, optical superimposable, racemic</p> <p>SMSC</p>

	<p>indicators, empirical, molecular, theoretical, electrostatic, macromolecule, polarisation</p> <p>SMSC:</p> <ul style="list-style-type: none"> - Exploring the history of the atom and how the modern atom came about. - Appreciate the ethical and environmental advantages for society and industry to develop chemical processes with a high atom economy - Working together to produce a standard solution and complete a titration 	<p>enthalpy, nucleophiles, substitution, elimination</p> <p>SMSC:</p> <ul style="list-style-type: none"> - Appreciate the results of research by different groups in the scientific community providing evidence for legislation to ban the use of CFCs as refrigerants and solvents 	<p>transition state, catalysts, adsorption, desorption</p> <p>SMSC:</p> <ul style="list-style-type: none"> - Working together to distill a product - Appreciating how the properties of polymers have changed over time - Evaluate the environmental issues of biofuel use 	<p>fingerprint region, exothermic, endothermic, Enthalpy change, formation, combustion, specific heat capacity, calorimeter, bond dissociation energy, mean bond energy,</p> <p>SMSC:</p> <ul style="list-style-type: none"> - Appreciate the links between absorption of infrared by carbon dioxide and water vapour and global warming - Working together to investigate enthalpy change of solutions - Working together to identify functional groups 	<p>assesses the advantages and disadvantages when deciding if chemicals should be added to water supplies</p> <ul style="list-style-type: none"> - Appreciate the benefits to health of water treatment outweigh its toxic effects - Working together to carry out a practical 	<ul style="list-style-type: none"> - Understanding the importance of a risk assessment for KCN reactions
Enrichment opportunities and futures	<p>Visiting UCL for Science Lectures Summer Fayre at Royal Institute of Chemistry Royal Institution Videos Anaesthesia Heritage Centre Wellcome collection</p>					