

	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	Content: <ul style="list-style-type: none"> - Fundamental Particles - Isotopes - Mass number and atomic number - Electron Arrangement - Mass Spectrometer - Ionisation Knowledge: <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 	See Autumn 1 for content and knowledge <u>Introduction to Organic Chemistry</u> Content: <ul style="list-style-type: none"> - Formulae - Nomenclature - Isomers Knowledge: <ul style="list-style-type: none"> - Define common formulae - Explain the term functional group - Explain how to name chemicals - Explain structural isomerism 	Content: <ul style="list-style-type: none"> - Alkenes - Electrophilic addition mechanism - Addition polymers Knowledge: <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 	Content: <ul style="list-style-type: none"> - Test tube reactions - Mass spectroscopy - Infrared Spectroscopy Knowledge: <ul style="list-style-type: none"> - Identify functional groups using chemical tests - Understand how high resolution mass spectrometry works - Understand how infrared spectroscopy works 	Content: <ul style="list-style-type: none"> - Dynamic Equilibrium - Le Chatelier's principle - Compromise conditions - Equilibrium Constant Knowledge: <ul style="list-style-type: none"> - Define dynamic equilibrium - Explain the role of a catalyst - Explain compromise conditions - Perform calculations of KC 	Content: <ul style="list-style-type: none"> - Aldehydes and Ketones - Oxidation of Aldehydes and Ketones - Nucleophilic Addition - Optical Isomers Knowledge: <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
	<u>Amount of Substance</u>	<u>Alkanes</u>	<u>Alcohols</u>	<u>Required Practical</u>	<u>Group 2</u>	
	Content: <ul style="list-style-type: none"> - Moles - Ideal Gas Equation - Calculating Masses 	Content: <ul style="list-style-type: none"> - Alkanes - Fractional distillation - Cracking - Combustion - Formation of Halogenoalkanes Knowledge: <ul style="list-style-type: none"> - Describe the 	Content: <ul style="list-style-type: none"> - Alcohols - Ethanol Production - Reactions of Alcohols Knowledge: <ul style="list-style-type: none"> - Describe properties of alcohols - Classifying alcohols - Describe fermentation - Describe 	Identify alcohols, aldehydes, ketones and carboxylic acids	Content: <ul style="list-style-type: none"> - Physical Properties - Chemical Properties Knowledge: <ul style="list-style-type: none"> - Explain the trends in ionisation energy and atomic radii - Explain the melting point in relation to bonding - Know the 	
				<u>Energetics</u>		<u>Thermodynamics</u>
				Content: <ul style="list-style-type: none"> - Endo and Exothermic Reactions - Enthalpy - Hess' law - Enthalpy of 		Content: <ul style="list-style-type: none"> - Enthalpy Change

<ul style="list-style-type: none"> - 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 of common ions - Construct ionic Formulae - Draw and describe structures of giant ionic lattices 	<ul style="list-style-type: none"> - 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>properties of alkanes</p> <ul style="list-style-type: none"> - 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>elimination mechanisms</p> <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 	<p>Combustion</p> <ul style="list-style-type: none"> - 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 oxidation state of an element - Write and combine half equations 	<p>reaction of group 2 with water</p> <ul style="list-style-type: none"> - 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 simple test tube reactions to identify negative ions <p>Periodicity</p> <p>Content:</p>	<ul style="list-style-type: none"> - 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"> - 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"> - 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 • Analysis of experimental 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 in tables • Analysis of experimental data • Working safely 	<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 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</p>	<p>Why is crude oil important for industry?</p> <p>How do Chemists calculate the correct</p>	<p>How has the discovery of alkenes changed the way we package goods?</p> <p>What are the many</p>	<p>How do we identify unknown compounds in outer space?</p> <p>How do we know what</p>	<p>Why is it important that we can control the conditions in industrial processes?</p> <p>What is the importance of</p>	<p>Why are some compounds stable and other compounds unstable?</p>

	have different properties?	concentrations of chemicals? What has caused the Ozone hole?	different ways we can produce ethanol?	chemicals to use in our boilers and internal engines?	group 2 in medicine? How does chlorine help keep our drinking water safe?	
Assessment	Baseline Assessment End of Topic Assessments CPACs from Practicals	End of Topic Assessments	End of Topic Assessments CPACs from Practicals	End of Topic Assessments CPACs from Practicals	End of Topic Assessments CPACs from Practicals	End of Topic Assessments CPACs from Practicals UCAS Exam
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, 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 	<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, branched, polarity, distillation, cracking, thermal, incomplete, complete, combustion, free radical, initiation, propagation, termination, 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>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, 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>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, 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 	<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 assesses the advantages and disadvantages when deciding if chemicals should be added to water supplies - Appreciate the benefits to health of water treatment outweigh its toxic effects - Working together to carry out a practical 	<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> <ul style="list-style-type: none"> - Understanding the importance of a risk assessment for KCN reactions

	produce a standard solution and complete a titration			- Working together to investigate enthalpy change of solutions - Working together to identify functional groups		
Enrichment opportunities and futures	Visiting UCL for Science Lectures Summer Fayre at Royal Institute of Chemistry Royal Institution Videos Anaesthesia Heritage Centre Wellcome collection					