SUBJECT	Chemistry	KEY STAGE –	5	SUMMARY CURRICULUM PLAN

Subject content (What will be covered)	As a result, what students should know /understood	What students should be able to do (application/skills developed)	By when (Half term 1 > 6)
Module 2: Foundations in Chemistry – Atoms, compounds, molecules and equations	The structure of atoms, how atomic weights are determined and formula masses calculated The formula of common ions How to balance equations	Calculate the numbers of subatomic particles in atoms and ions Calculate relative atomic, molecular and formula masses Recall the formula of common ions Write and balance familiar and unfamiliar equations	Yr 12 HT 1
Module 2: Foundations in Chemistry – Amount of substance	Understand the terms 'amount of substance, mole, Avogadro constant, molar mass, molar gas volume' How to calculate water of crystallisation and empirical formula How to calculate amount of substance, in mol, from mass, gas volume and solution volume The ideal gas equation How to calculate yield and atom economy	Calculate empirical formula, molecular formula, number of atoms/molecules in a substance, percentage yield and atom economy Perform calculations involving moles and mass, volume of gas or volume of solution Use the ideal gas equation to calculate pressure, volume or temperature	Yr 12 HT 1
Module 2: Foundations in Chemistry – Acid-base and redox reactions	The formulas of common acids and bases What makes and acid strong or weak in terms of relative dissociations How to carry out acid-base titrations The rules for assigning oxidation numbers How to interpret oxidation numbers in unfamiliar reactions	Recall the formulas of common acids and alkalis and write balanced equations for the reactions of these Perform titrations and use results to calculate unknown concentrations Assign oxidation numbers to elements using Roman numerals or oxidation number rules Use oxidation numbers to describe reactions as redox reactions and identify oxidising or reducing agents	Yr 12 HT 1
Module 2: Foundations in Chemistry – Electrons, bonding and structure	The shapes of orbitals around atoms and how they fill How to write electronic configurations for atoms and ions	Recall the shapes of orbitals in atoms Write electronic configurations for atoms and ions of the first 36 elements Work out the shapes of molecules and their bond angles from the number of pairs of electrons Draw '*dot-and-*	Yr 12 HT 1

	How ionic and covalent bonds/structures occur and the effects of these structures have on their properties The shapes of, and bong angles in, molecules and ions How intermolecular forces arise and how the effect the properties of compounds	*cross'* diagrams for ionic and simple covalent compounds (including formation of dative covalent bonds) Explain the physical properties of simple covalent, giant covalent and ionic compounds Explain how intermolecular forces arise and how they affect physical properties of compounds	
Module 3: Periodic Table and Energy – The periodic table and periodicity	How the periodic table is arranged and how this relates to electronic configuration and group classification The changes in ionisation energy across a period or down a group and successive ionisation energies of an atom How periodicity affect structure of substances and physical properties	Explain the link between the periodic table and electronic configuration Explain the trends in first and successive ionisation energies. Explain the arrangement of ions and electrons in metallic bonding and use this to explain the physical properties across period 2 and 3.	Yr 12 HT 2 (teacher 1)
Module 3: Periodic Table and Energy – Group 2 and the halogens	The reactions of group 2 elements with water, oxygen and acids The trend in reactivity down group 2 and 7 The reactions of group 2 oxides with water and the uses of group 2 compounds How the boiling point changes down group 7 Disproportionation reactions of chlorine and the use of chlorine to treat water Precipitation reactions of the halides *SMSC – ethical implications of mass addition of additives to drinking water*	Explain why the reactivity of group 2 and 7 decreases down the group in terms of ionisation energies Describe the reactions of group 2 oxides with water and how the pH of resulting solutions changes down the group. Give uses of $Mg(OH)_2$, $Ca(OH)_2$ and $CaCO_3$ Explain the trend in boiling point down group 7 Explain the term disproportionation and write equations for disproportionation reactions of chlorine Describe the risks and benefits of the use of chlorine for water treatment	Yr 12 HT 2 (teacher 1)
Module 3: Periodic Table and Energy – Qualitative analysis	Test tube scale techniques to identify unknown compounds	Describe how to carry out and identify CO_3^{2-}, SO_4^{2-}, Cl^-, Br^-, I^- and NH_4^+ ions	Yr 12 HT 3 (teacher 1)
Module 3: Periodic Table and Energy – Enthalpy changes	Endothermic and exothermic reactions, including their enthalpy profiles Meanings of the terms; activiation energy, standard conditions and states, enthalpy change	Construct enthalpy profile diagrams and use them to explain the term activation energy Use average bond enthalpies to calculate enthalpy changes	Yr 12 HT 3/4 (teacher 1)

	of formation ,combustion, reaction and neutralisation, bond enthalpy Hess' law for indirect enthalpy calculations Methods for direct enthalpy calculations	Describe techniques to determine enthalpy changes directly and indirectly. Use Hess' law for construction of enthalpy cycles and calculations of enthalpies of reaction from enthalpy changes of combustion or formation	
Module 3: Periodic Table and Energy – Reaction rates and equilibrium (qualitative)	Factors that affect rates of reaction Calculating rates of reaction from graphs The role of catalysts in reactions Techniques to measure reaction rates How to represent reactions and changes to reactions on Boltzmann distribution diagrams The effect of changes of conditions on a dynamic equilibrium, including the relevance to industrial processes *CIAG – importance of chemical engineers when scaling up reactions for mass production*	Explain how concentration, pressure and temperature affect reaction rates Calculate the rate of a reaction from graphical data Explain the role of catalysts in reactions and their advantages Describe how reaction rates can be monitored and investigated Draw a Boltzmann distributions and use it to explain changes to reaction rates with temperature and addition of catalysts Explain how the position of a dynamic equilibrium moves to minimise changes on it and why this is important in industry	Yr 12 HT 4/5 (teacher 1)
Module 4: Core Organic Chemistry – Basic concepts	The different ways of representing molecules The meaning of the terms used to describe functional groups How isomers occur	Draw organic molecules and write the various types of formulae Explain the meanings of the terms used to describe functional groups in organic molecules Explain the formation of and identify structural isomers	Yr 12 HT 2 (teacher 2)
Module 4: Core Organic Chemistry – Hydrocarbons	The structure and bonding in alkanes and Alkenes How properties vary with chain length in organic compounds The reactions of alkanes and alkenes and how they differ, including the formation of polymers The formation of stereoisomers in in alkenes *SMSC – moral implications of the different methods for disposing of polymers*	Draw and describe the overlap of orbitals in pi and sigma bonds Describe and explain the change in boiling point with chain length Draw curly arrow mechanisms for some reactions of alkanes and alkenes Explain the formation and identify stereoisomers of alkenes	Yr 12 HT 2 (teacher 2)
Module 4: Core Organic Chemistry	How the solubility and volatility of alcohols varies with chain length and compared to alkanes	Explain the change in volatility with reference to hydrogen bonding	Yr 12 HT 3 (teacher 2)

– Alcohols and haloalkanes	How to classify alcohols The reactions of alcohols and haloalkanes How halogen radicals are formed and affect the atmosphere *SMSC – importance of assessing environmental impact of scientific discoveries eg long term damage from CFCs*	Classify alcohols as primary, secondary or tertiary Recall the reagents and conditions necessary for the reactions of alcohols and haloalkanes Recall the radical equations for representing destruction of the ozone layer	
Module 4: Core Organic Chemistry – Organic synthesis	How to set up Quickfit apparatus Methods for purifying organic compounds Synthetic routes for the preparation of organic compounds	Set up Quickfit apparatus for distillation and reflux Devise two-stage synthetic processes by applying the transformation of functional groups studied	Yr 12 HT 3/4 (teacher 2)
Module 4: Core Organic Chemistry – Analytical techniques (IR and MS)	How IR spectra are formed and the identification of some organic functional groups How mass spectra is used to identify molecular mass	Explain how bond vibrations cause IR spectra and how this is used to monitor pollution Use IR spectra to identify the functional groups studied Analyse mass spectra to identify molecular mass and structures from fragmentations patterns	Yr 12 HT 4/5 (teacher 2)
Module 5: Physical chemistry and transition elements – Rates equilibrium and pH	How to follow and measure rates of reaction Writing rate equations from rate-concentration graphs Calculating the equilibrium constant Identifying conjugate acid-base pairs Calculating pH for acids and bases Calculations involving buffers	Carry out reactions to follow rates of reactions Calculate rate constants, identifying the order reactants from graphical results Perform calculations involving equilibrium constants and use the results to explain changes to position of equilibrium Perform calculations to calculate the pH of acids and bases and the pH of buffer solutions	Yr 13 HT 1 (Teacher 1)
Module 5: Physical chemistry and transition elements – Energy	Use of Born-Haber cycles to calculate lattice enthalpy How lattice enthalpy and enthalpy of hydration are affected by the ions present Calculations involving entropy and Gibb's free energy How electrons are transferred in cells and how EMF affects feasibility of reactions The use of hydrogen in fuel cells	Construct Born-Haber cycles involving ionisation energies or hydration enthalpies and use these to calculate lattice enthalpy Explain the difference in size of lattice enthalpy and enthalpy of hydration for different ions Perform calculations for entropy and free energy Write cell equations and calculate cell potential from electrode potentials Describe the use of hydrogen as a fuel and the limitations of fuel cells	Yr 12 HT6 (Teacher 1) Yr 13 HT2

Module 5: Physical chemistry and transition elements – Transition elements	How to identify transition metals from the colours of their ions The changes that take place during ligand exchange reactions, including the formation of isomers and associating colour changes How to perform redox titrations and analyse the results to identify unknowns	Perform precipitation reactions and identify transition metal ions from the results Draw complex ions showing the bonding of the ligands, including monodentate, bidentate ligands and their isomers Identify the complex ions present from the colours of solutions Carry out redox titrations and calculate concentrations and/or % composition from their results	Yr 12 HT6 (Teacher 2) Yr 13 HT1
Module 6: Organic chemistry and analysis – aromatic compounds, carbonyls and acids	The structure of benzene and its reactions Reactivity of alkenes, benzene and phenol Structure and reactions of carbonyls, carboxylic acids and esters Amines and their reactions	Describe the structures studied in terms of orbitals and recall products and conditions for reactions Draw mechanisms for substitution reactions of benzene and reduction of carbonyls	Yr 13 HT 2 (Teacher 2)
Module 6: Organic chemistry and analysis – Nitrogen compounds, polymers and synthesis	The basicity and reactions of amines and amides Structure of amino acids and polypeptides Condensation and addition polymerisation Breakdown of polymers Synthesis of aliphatic and aromatic compounds Chirality of pharmaceuticals How carbon-carbon bonds are formed *SMSC & CIAG – implications of synthesising optically pure drugs*	Draw polymers from monomers and vice versa Use knowledge of chemical reactions to complete reaction pathways for the synthesis of organic compounds	HT 3 (Teacher 2)
Module 6: Organic chemistry and analysis – Analysis	Use of chromatography for separation and identification Analysis of Carbon-13 and proton NMR to identify structures of compounds	Calculate R_f values for TLC and use retention time and GC-MS to identify molecules Analyse splitting patterns and chemical shifts of NMR spectra to assist with identifying structures of organic compounds.	HT 3 (Teacher 1)
Revision	Revision of all topics for final exams		Yr 13 HT 4/5