Caroline Chisholm School
Ambition Confidence Success
Everyone Every Lesson Every Opportunity

Year 12 Chemistry Curriculum

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
Topic 1 Atomic Structure and the Periodic Table (Term 1)	1. know the structure of an atom in terms of electrons, protons and neutrons 2. know the relative mass and relative charge of protons, neutrons and electrons 3. know what is meant by the terms 'atomic (proton) number' and 'mass number' 4. be able to determine the number of each type of sub-atomic particle in an atom, molecule or ion from the atomic (proton) number and mass number	1. Structure of an atom 2. Relative masses and relative charges of particles 3. Atomic number and mass number 4. Calculating the number of particles in an atom 5. Isotopes 6. Definition of relative atomic mass and relative isotopic mass 7. Calculating relative formula mass and relative molecular mass from relative atomic masses	Assessments: Year 12 – A level Prior and Current knowledge test – 45 min assessment. End Of Topic 1 assessment – 30 min assessment made up of exam questions.	• Understand and use the symbol = • Change the subject of an equation • Use an appropriate number of significant figures. • Find arithmetic means. • Use calculators to find and use logarithmic functions – A level only.	1. Analysing, 2. Linking, 3. Meta-thinking, 4. Creating and 5. Realising. Atomic Structure to ionisation energies – HPL focus LINKING Mass Spectrometry data to structure of the Atom and looking at emission spectra – HPL ABSTRACTION	Students should have prior knowledge of: ● Atomic structure ● Isotopes ● Ions ● Relative atomic mass ● Relative formula mass and relative molecular mass ● Simple covalent molecules ● Atomic (proton) number ● Electronic configurations ● Formation of ions from atoms ● Groups and periods ● Repeating patterns in first ionisation energy across different periods. Homework: • REVISION FOR EOT ASSESSMENT- HPL FOCUS –

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	5. understand the term 'isotopes' 6. be able to define the terms 'relative isotopic mass' and 'relative atomic mass', based on the 12C scale 7. understand the terms 'relative molecular mass' and 'relative formula mass', including calculating these values from relative atomic masses Definitions of these terms will not be expected. The term 'relative formula mass' should be used for compounds with giant structures. 8. be able to analyse and interpret data from mass	8. The mass spectrometer 9. Calculating relative atomic mass and relative molecular mass from mass spectrometry 10. s-, p- and d-orbitals 11. The number of electrons in orbitals, subshells and shells 12. Electronic configurations of atoms given the atomic number, Z, up to Z = 36 13. Atomic emission spectra, ionisation energy, and evidence for shells and subshells		• Plot two variables from experimental or other data.		HARD WORKING - PRACTICE • GENERAL HOMEWORK AND INDEPENDENT STUDY: Variety of different exam questions and independent study of concepts learnt in class. Homework: • 2 sets of exam questions for each topic - This will develop metathinking strategy planning and linking connection finding HPL skills

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	spectrometry to calculate relative atomic mass from relative abundance of isotopes and vice versa 9. be able to predict the mass spectra, including relative peak heights, for diatomic molecules, including chlorine 10. understand how mass spectrometry can be used to determine the relative molecular mass of a molecule Limited to the m/z value for the molecular ion, M+, giving the relative molecular mass of the molecule. 11. be able to define the terms 'first	14. Trends in first ionisation energy across a period and down a group in the Periodic Table 15. Groups, periods and blocks in the Periodic Table 16. Charge on ions formed from sand p-block elements 17. Electronic configurations of ions formed from 18. s- and p-block elements up to Z = 36 19. Atomic radius 20. Trends in first ionisation energy				

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	ionisation energy' and 'successive ionisation energies' 12. understand how ionisation energies are influenced by the number of protons, the electron shielding and the electron sub-shell from which the electron is removed 13. understand reasons for the general increase in first ionisation energy across a period 14. understand reasons for the decrease in first ionisation energy down a group 15. understand how ideas about electronic	21. Melting and boiling temperatures				

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	configuration developed from: i the fact that atomic emission spectra provide evidence for the existence of quantum shells ii the fact that successive ionisation energies provide evidence for the existence of quantum shells and the group to which the element belongs iii the fact that the first ionisation energy of successive elements provides evidence for electron sub-shells 16. know the number of electrons that can fill the first four quantum shells 17. know that an orbital is a region					

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	within an atom that can hold up to two electrons with opposite spins 18. know the shape of an s-orbital and a p-orbital 19. know the number of electrons that occupy s, p and d-subshells 20. know that electrons fill subshells singly, before pairing up, and that two electrons in the same orbital must have opposite spins 21. be able to predict the electronic configurations, using 1s notation and electronsin-boxes notation, of: i atoms, given the atomic					

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	number, Z, up to Z = 36 ii ions, given the atomic number, Z, and the ionic charge, for s and p block ions only, up to Z = 36 22. know that elements can be classified as s, p and d-block elements 23. understand that electronic configuration determines the chemical properties of an element 24. understand periodicity in terms of a repeating pattern across different periods 25. understand reasons for the trends in the following properties					

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	of the elements from periods 2 and 3 of the Periodic Table: i the melting and boiling temperatures of the elements, based on given data, in terms of structure and bonding ii ionisation energy based on given data or recall of the plots of ionisation energy versus atomic number 26. be able to illustrate periodicity using data, including electronic configurations, atomic radii, melting and boiling temperatures and first ionisation energies					
Topic 2 Chemical Bonding and Structure	1. know that ionic bonding is the strong electrostatic	1. Physical properties of metals	Assessments:	• Plot two variables from	1. Analysing, 2. Linking, 3. Meta-thinking, 4. Creating and	Students should have prior knowledge of:

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(Term 1)	attraction between oppositely charged ions 2. understand the effects that ionic radius and ionic charge have on the strength of ionic bonding 3. understand the formation of ions in terms of electron loss or gain 4. be able to draw electronic configuration diagrams of cations and anions using dot-and-cross diagrams 5. understand reasons for the trends in ionic radii down a group and for a set of	2. Metallic bonding 3. Ionic bonding 4. Strength of ionic bonds 5. Physical properties of ionic compounds 6. Evidence for the existence of ions 7. Formation of ions 8. Trends in ionic radii 9. Formation of covalent bonds and the relationship between covalent bond length and strength 10. Electronegativity 11. Bond polarity	End Of Topic 2 assessment – 30 min assessment made up of exam questions	experimental or other data. • Understand and use the symbol >	5. Realising.	● Atomic structure ● Covalent bonding ● Dot-and-cross diagrams ● Displayed formulae ● Shapes of simple molecules ●Electronegativity ● Polar bonds ● Shapes of molecules ● Polar and non-polar molecules ● Intermolecular forces ● Ionic bonding ● Metallic bonding ● Bonding and structure • REVISION FOR EOT ASSESSMENT-HPL FOCUS – HARD WORKING – PRACTICE • INDEPENDENT STUDY: Section 2.3 Physical Properties Related to Structure

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	isoelectronic ions, e.g. N^{3-} to Al^{3+} 6. understand that the physical properties of ionic compounds and the migration of ions provide evidence for the existence of ions 7. know that a covalent bond is the strong electrostatic attraction between two nuclei and the shared pair of electrons between them 8. be able to draw dot-and-cross diagrams to show electrons in covalent substances, including: i molecules with single, double and triple bonds	12. Dot-and-cross diagrams and displayed formulae for simple covalent molecules 13. Dative covalent (coordinate) bonds 14. Dot-and-cross diagrams involving dative covalent bonds 15. Electron pair repulsion (EPR) theory 16. Shapes and bond angles in molecules with no lone pairs of electrons around the central atom 17. Shapes and bond angles in molecules containing one or			Shapes of Molecules and how it's linked to the properties of certain molecules – HPL focus – Linking and Meta-thinking	and Bonding – Meta thinking (intellectual confidence) • GENERAL HOMEWORK AND INDEPENDENT STUDY: Variety of different exam questions and independent study of concepts learnt in class.

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	ii species exhibiting dative covalent (coordinate) bonding, including Al2Cl6 and ammonium ion 9. understand the relationship between bond lengths and bond strengths for covalent bonds 10. understand that the shape of a simple molecule or ion is determined by the repulsion between the electron pairs that surround a central atom 11. understand reasons for the shapes of, and bond angles in, simple molecules and ions with up to six outer pairs of electrons	more instances of multiple bonds 18. Shapes and bond angles in molecules and ions with lone pairs of electrons around the central atom 19. Determining whether a molecule is polar or non-polar 20. Demonstration involving polar and nonpolar molecules 21. Practice questions 22. London forces (instantaneous dipole– induced dipole) 23. Intermolecular forces due to permanent dipoles				

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	(any combination of bonding pairs and lone pairs) Examples should include $BeCl_2$, BCl_3, CH_4, NH_3, NH_4^+, H_2O, CO_2, $PCl_5(g)$ and $SF_6(g)$ and related molecules and ions; as well as simple organic molecules in this specification. 12. be able to predict the shapes of, and bond angles in, simple molecules and ions analogous to those specified above using electron-pair repulsion theory 13. know that electronegativity is the ability of an atom to attract the bonding electrons in a covalent bond	24. Hydrogen bonds 25. Boiling temperatures of alkanes, alcohols and hydrogen halides 26. Anomalous properties of water 27. Choosing suitable solvents 28. Metallic lattices and giant ionic lattices 29. Giant covalent lattices 30. Molecular lattices 31. Revise types of bonding and structure				

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	14. know that ionic and covalent bonding are the extremes of a continuum of bonding type and that electronegativity differences lead to bond polarity in bonds and molecules 15. understand that molecules with polar bonds may not be polar molecules and be able to predict whether or not a given molecule is likely to be polar 16. understand the nature of intermolecular forces resulting from the following interactions:	32. Investigate two white solids 33. Predicting physical properties				

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	i London forces (instantaneous dipole – induced dipole) ii permanent dipoles iii hydrogen bonds 17. understand the interactions in molecules, such as H_2O, liquid NH_3 and liquid HF, which give rise to hydrogen bonding 18. understand the following anomalous properties of water resulting from hydrogen bonding: i its relatively high melting temperature and boiling temperature ii the density of ice compared to that of water 19. be able to predict the presence of					Homework: Research Project on a Compound of your choice – Presentation of your finding – HPL Focus ACPs- Linking- Big picture thinking and seeing alternative perspectives. VAAs – Empathetic - Confident

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	hydrogen bonding in molecules analogous to those mentioned above 20. understand, in terms of intermolecular forces, physical properties shown by materials, including: i the trends in boiling temperatures of alkanes with increasing chain length ii the effect of branching in the carbon chain on the boiling temperatures of alkanes iii the relatively low volatility (higher boiling temperatures) of alcohols compared to alkanes with a similar number of electrons				Research Project on a Compound of your choice – Presentation of your finding – HPL Focus ACPs- Linking- Big picture thinking and	

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	iv the trends in boiling temperatures of the hydrogen halides, HF to HI 21. understand factors that influence the choice of solvents, including: i water, to dissolve some ionic compounds, in terms of the hydration of the ions ii water, to dissolve simple alcohols, in terms of hydrogen bonding iii water, as a poor solvent for compounds (to include polar molecules such as halogenoalkanes), in terms of inability to form hydrogen bonds iv non-aqueous solvents, for				seeing alternative perspectives. VAAs – Empathetic - Confident	

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	compounds that have similar intermolecular forces to those in the solvent 22. know that metallic bonding is the strong electrostatic attraction between metal ions and the delocalised electrons 23. know that giant lattices are present in: i ionic solids (giant ionic lattices) ii covalently bonded solids, such as diamond, graphite and silicon(IV) oxide (giant covalent lattices) iii solid metals (giant metallic lattices)					

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	24. know that the structure of covalently bonded substances such as iodine, I2, and ice, H2O, is simple molecular 25. know the different structures formed by carbon atoms, including graphite, diamond and graphene 26. be able to predict the type of structure and bonding present in a substance from numerical data and/or other information 27. be able to predict the physical properties of a substance, including melting and boiling temperature,					

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	electrical conductivity and solubility in water, in terms of: i the types of particle present (atoms, molecules, ions, electrons) ii the structure of the substance iii the type of bonding and the presence of intermolecular forces, where relevant					
Topic 5 Formulae Equations and Amounts of Substances (TERM 1 & Term 2)	1. know that the mole (mol) is the unit for amount of a substance 2. be able to use the Avogadro constant, L, (6.02 × 1023 mol-1) in calculations 3. know that the molar mass of a substance is the	1. Empirical formulae 2. Experiment to determine an empirical formula 3. Calculation practice 4. The ideal gas equation	Assessments: End Of Topic 5 assessment – 30 min assessment made up of exam questions	• Use ratios, fractions and percentages. • Use an appropriate number of significant figures.	1. Analysing, 2. Linking, 3. Meta-thinking, 4. Creating and 5. Realising. Empirical Formula – meta thinking- strategy planning	Links to prior learning: ● Chemical formulae ● Relative atomic mass (Ar) ● Relative molecular mass (Mr) ● Empirical formulae ● Molecular formulae ● Relative formula mass, Mr ● Formation of ions ● Formulae and balanced equations ●

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	mass per mole of the substance in g mol-1 4. know what is meant by the terms 'empirical formula' and 'molecular formula' 5. be able to use experimental data to calculate i. empirical formulae ii. molecular formulae including the use of pV = nRT for gases and volatile liquids Calculations of empirical formula may involve composition by mass or percentage composition by mass data. 6. be able to write balanced full and ionic equations, including state	5. Measuring the molar volume of a gas 6. Definitions of the mole and molar mass 7. Calculating amount of substance 8. The Avogadro constant and calculating number of particles 9. Deducing chemical formulae 10. Writing equations from descriptions 11. Ionic equations 12. Practical involving the		• Substitute numerical values into algebraic equations using appropriate units for physical quantities. • Recognise and make use of appropriate units in calculation. • Recognise and use expressions in decimal and ordinary form. • Find arithmetic means.	Writing Chemical Equations – Analysis – precision.	Amount of substance, Mr and molar mass ● Balancing equations ● Reacting mass calculations ● Molar mass of a gas (Core Practical 1) Homework: • REVISION FOR EOT ASSESSMENT-HPL FOCUS – HARD WORKING - PRACTICE • GENERAL HOMEWORK AND INDEPENDENT STUDY: • Variety of different exam questions and independent study of concepts learnt in class.

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	symbols, for chemical reactions 7. be able to calculate amounts of substances (in mol) in reactions involving mass, volume of gas, volume of solution and concentration These calculations may involve reactants and/or products. 8. be able to calculate reacting masses from chemical equations, and vice versa, using the concepts of amount of substance and molar mass 9. be able to calculate reacting volumes of gases from chemical equations, and vice	oxidation of magnesium 13. Analysis of data from practical 14. Practise reacting mass calculations 15. Calculations involving reacting volumes of gases 16. Calculations involving molar volumes of gases 17. Practical work and analysis of results 18. Unit conversions involving kg, g, cm3 and dm3 19. Calculations involving mass concentration or molar concentration		• Recognise and use expressions in decimal and ordinary form . • Identify uncertainties in measurements and use simple techniques to determine uncertainty when data are combined • Plot two variables from experimental or other data		• To read up on Core Practical prior to Day of CP

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	versa, using the concepts of amount of substance 10. be able to calculate reacting volumes of gases from chemical equations, and vice versa, using the concepts of molar volume of gases CORE PRACTICAL 1: Measure the molar volume of a gas 11. be able to calculate solution concentrations, in mol dm-3 and g dm-3, including simple acid-base titrations using a range of acids, alkalis and indicators The use of both phenolphthalein and methyl orange as	20. Mole calculations involving concentrations 21. Using a balance and volumetric flask 22. Practical to make a standard solution of sulfamic acid 23. Reflection about the details of the method used 24. Practising using the burette 25. Practical to titrate aqueous sodium hydroxide against standard aqueous sulfamic acid	CORE PRACTICAL 1 MOLAR VOLUME OF A GAS CORE PRACTICAL 2 – PREPARATION OF A STANDARD SOLUTION CORE PRACTICAL 3 – FINDING THE CONCENTRATION		Core Practicals – ACPs – Analysing – Complex and multistep problem solving VAAs – Agile – Enquiring & Hard working – Practice.	

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	indicators will be expected. **CORE PRACTICAL 2: Prepare a standard solution from a solid acid and use it to find the concentration of a solution of sodium hydroxide** **CORE PRACTICAL 3: Find the concentration of a solution of hydrochloric acid** 12. be able to: i calculate measurement uncertainties and measurement errors in experimental results ii comment on sources of error in experimental procedures	26. Notes about titration and choice of indicator 27. Calculating a mean titre 28. Calculating a concentration from titration data 29. Titration to find the concentration of a solution of hydrochloric acid 30. Accuracy and precision in measurements 31. Errors and uncertainties 32. Identifying sources of error, and reducing percentage error and uncertainty 33. Practical activity				

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	13. understand how to minimise the percentage error and percentage uncertainty in experiments involving measurements 14. be able to calculate percentage yields and percentage atom economies using chemical equations and experimental results molar mass of the desired product Atom economy of a reaction = × 100% sum of the molar masses of all products 15. be able to relate ionic and full equations, with state symbols, to	34. Calculating percentage yield 35.Calculating atom economy 36. Halogen displacement reactions 37. Displacement involving metals and solutions of metal compounds 38. Displacement involving metals and metal oxides 39. Modelling precipitation reactions 40. Precipitation reactions 41. Using experimental data				

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	observations from simple test tube reactions, to include: i displacement reactions ii reactions of acids iii precipitation reactions 16. understand risks and hazards in practical procedures and suggest appropriate precautions where necessary	to determine a balanced equation 42. Acids as substances producing H+ ions 43. Reactions of hydrochloric acid 44. Writing equations to model the reactions of acids				
Topic 6 Organic Chemistry (Term 2 & 3)	**Topic 6A: Introduction to organic chemistry** 12. know that a hydrocarbon is a compound of hydrogen and carbon only 13. be able to represent organic	1. Alkanes as hydrocarbons 2. Names, molecular formulae and empirical formulae of unbranched alkanes (C1 to C10) 3. Structural, displayed and skeletal formulae of	**Assessments**: End Of Topic 6 assessment – 30 min assessment made up of exam questions	Plot two variables from experimental or other data	**1. Analysing, 2. Linking, 3. Meta-thinking, 4. Creating and 5. Realising.**	**Links to Prior Learning:** ● Covalent bonding ● Simple molecules ● Molecular formulae ● Nomenclature and formulae of alkanes and alcohols ● Chain isomers ● Position isomers

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	molecules using empirical formulae, molecular formulae, general formulae, structural formulae, displayed formulae and skeletal formulae 14. know what is meant by the terms 'homologous series' and 'functional group' 15. be able to name compounds relevant to this specification using the rules of International Union of Pure and Applied Chemistry (IUPAC) nomenclature Students will be expected to know prefixes for compounds up to C10	unbranched alkanes (C1 to C10) 4. Structural (chain) isomers of alkanes 5. Functional groups and homologous series 6. Structural, displayed and skeletal formulae of alkenes (C1 to C10) 7. E-Z isomers of alkenes 8. Names, molecular formulae and empirical formulae of alcohols 9. Structural, displayed and skeletal formulae of alcohols (C1 to C10)			Using knowledge of Structure of Organic Compounds and linking to their behaviour in mechanisms – ACPs –	● Organic chemicals and hydrocarbons ● Nomenclature and formulae of alkanes ● Nomenclature and formulae of alkanes and alkenes ● Features of homologous series ● Formulae of alkanes ● Balancing equations ● Alkanes as fuels ● Pollutants from using fuels ● Balancing equations ● Covalent bonding ● Structure of alkanes ● Chlorination of methane ● Nomenclature of organic compounds ● Hydrogenation of alkenes

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	16. be able to classify reactions as addition, elimination, substitution, oxidation, reduction, hydrolysis or polymerisation 17. understand the term 'structural isomerism' and determine the possible structural, displayed and skeletal formulae of an organic molecule, given its molecular formula 18. understand the term 'stereoisomerism', as illustrated by E/Z isomerism (including cis-trans isomerism where two of the substituent groups are the same)	10. Structural (position) isomers of alcohols 11. Fractional distillation 12. Cracking 13. Reforming 14. Combustion 15. Acidic oxides 16. Catalytic converters 17. Definition of carbon neutral 18. Biodiesel and bioalcohols 19. Internet research and presentation 20. Bromination of cyclohexane practical			Linking -generalisation and Analysing – Complex and Multi-step problem solving VAAs – Empathetic – confidence	● Electrophilic addition and alkenes ● Electronegativity ● Permanent dipoles ● Names and structures of organic compounds ● Naming and classifying halogenoalkanes ● Hydrolysis and nucleophilic substitution with hydroxide ions ● Precipitation reactions of aqueous halide ions with aqueous silver nitrate ● Nomenclature and structure of alcohols ● Reactions of alcohols with oxygen in air, halogenating agents and concentrated phosphoric acid ● Reactions of alcohols

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	Topic 6B: Alkanes 19. know the general formula for alkanes 20. know that alkanes and cycloalkanes are saturated hydrocarbons 21. understand that alkane fuels are obtained from the fractional distillation, cracking and reforming of crude oil Reforming is described as the processing of straight-chain hydrocarbons into branched-chain alkanes and cyclic hydrocarbons for efficient combustion. 22. know that pollutants, including	21. Mechanism for the chlorination of methane 22. Further substitution, the reactions of other alkanes, and the reactions of alkanes with other halogens 23. Alkenes, their general formula and the nature of the C=C bond 24. Testing for unsaturation 25. The reaction of hydrogen with alkenes and the hardening of vegetable oils to produce margarine 26. Electrophiles and the mechanism for electrophilic				● Oxidation of ethanol under distillation or reflux conditions Homework: • REVISION FOR EOT ASSESSMENT-HPL FOCUS – HARD WORKING - PRACTICE • GENERAL HOMEWORK AND INDEPENDENT STUDY: Variety of different exam questions and independent study of concepts learnt in class. To read up on Core Practical prior to Day of CP

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	carbon monoxide, oxides of nitrogen and sulfur, carbon particulates and unburned hydrocarbons, are formed during the combustion of alkane fuels **Topic 6C: Alkenes** 23. know the general formula for alkenes 24. know that alkenes and cycloalkenes are unsaturated hydrocarbons 25. understand the bonding in alkenes in terms of σ- and π-bonds 26. know what is meant by the term 'electrophile'	addition of hydrogen halides to alkenes 27. Addition reactions involving alkenes and halogens or steam 28. The mechanism for electrophilic addition of alkenes with halogens 29. Electrophilic addition between hydrogen halides and unsymmetrical alkenes 30. Making a diol 31. Diols forming from alkenes 32. Monomers, addition polymers and repeat units				

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	27. understand the addition reactions of alkenes with: i hydrogen, in the presence of a nickel catalyst, to form an alkane Knowledge of the application of this reaction to the manufacture of margarine by catalytic hydrogenation of unsaturated vegetable oils is expected. ii halogens to produce dihalogenoalkanes iii hydrogen halides to produce halogenoalkanes iv steam, in the presence of an acid catalyst, to produce alcohols v potassium manganate(VII), in acid conditions, to	33. Biodegradable polymers 34. Polymer waste separation and disposal 35. Naming and classifying halogenoalkanes 36. Hydrolysis reactions 37. The mechanism of the nucleophilic substitution reaction between primary halogenoalkanes and aqueous potassium hydroxide 38. Investigating rates of hydrolysis of some primary halogenoalkanes				

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	oxidise the double bond and produce a diol 28. understand that heterolytic bond fission of a covalent bond results in the formation of ions 29. understand the mechanism of the electrophilic addition reactions between alkenes and: i halogens ii hydrogen halides, including addition to unsymmetrical alkenes iii other given binary compounds Use of the curly arrow notation is expected – curly arrows should start from either a bond or from a lone pair of electrons. Knowledge	39. Investigating rates of hydrolysis of some bromoalkanes 40. Analysing and explaining the results from the practical activities 41. Reactions of halogenoalkanes with cyanide ions and excess ammonia 42. Mechanism for the reaction of halogenoalkanes with excess ammonia and the role of ammonia as a nucleophile and as a base 43. The reaction of halogenoalkanes with ethanolic potassium	CORE PRACTICAL 4 HYDROLYSIS OF HALOGENOALKANE		Organic Core Practicals – ACPs – Analysing – Complex and multistep problem solving VAAs – Agile – Enquiring & Hard working – Practice.	

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	of the relative stability of primary, secondary and tertiary carbocation intermediates is expected. 30. know the qualitative test for a C=C double bond using bromine or bromine water 31. know that alkenes form polymers through addition polymerisation Be able to identify the repeat unit of an addition polymer given the monomer, and vice versa. 32. know that waste polymers can be separated into specific types of polymer for: i recycling	hydroxide and the role of the hydroxide ion as a base rather than as a nucleophile 44. Naming and classifying alcohols 45. The combustion of alcohols 46. Reactions of alcohols with halogenating agents and concentrated phosphoric acid **Practical 11: The oxidation of ethanol** 47. Testing products of oxidation of ethanol 48. Reflux and distillation				

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	ii incineration to release energy iii use as a feedstock for cracking 33. understand, in terms of the use of energy and resources over the life cycle of polymer products, that chemists can contribute to the more sustainable use of materials 34. understand how chemists limit the problems caused by polymer disposal by: i developing biodegradable polymers ii removing toxic waste gases caused by incineration of plastics	Practical 12: Chlorination of 2-methylpropan-2-ol using concentrated hydrochloric acid – the reaction Practical 12: separating and purifying the product. Practical 12: testing the product				

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	Topic 6D: Halogenoalkanes 35. know that halogenoalkanes can be classified as primary, secondary or tertiary 36. understand what is meant by the term 'nucleophile' 37. understand the reactions of halogenoalkanes with: i aqueous potassium hydroxide to produce alcohols (where the hydroxide ion acts as a nucleophile) ii aqueous silver nitrate in ethanol (where water acts as a nucleophile) iii potassium cyanide to produce nitriles		CORE PRACTICAL 5 OXIDATION OF ALCOHOLS CORE PRACTICAL 6 CHLORINATION OF 2-METHYL PROPAN-2-OL WITH			

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	(where the cyanide ion acts as a nucleophile) Students should know this as an example of increasing the length of the carbon chain. iv ammonia to produce primary amines (where the ammonia molecule acts as a nucleophile) v ethanolic potassium hydroxide to produce alkenes (where the hydroxide ion acts as a base) 38. understand that experimental observations and data can be used to compare the relative rates of hydrolysis of: i primary, secondary and tertiary halogenoalkanes ii chloro-, bromo-, and iodoalkanes		CONCENTRATED ACID			

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	using aqueous silver nitrate in ethanol CORE PRACTICAL 4: Investigation of the rates of hydrolysis of some halogenoalkanes 39. know the trend in reactivity of primary, secondary and tertiary halogenoalkanes 40. understand, in terms of bond enthalpy, the trend in reactivity of chloro-, bromo-, and iodoalkanes 41. understand the mechanisms of the nucleophilic substitution reactions between primary halogenoalkanes and:					

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	i aqueous potassium hydroxide ii ammonia Topic 6E: Alcohols 42. know that alcohols can be classified as primary, secondary or tertiary 43. understand the reactions of alcohols with: i oxygen in air (combustion) ii halogenating agents: • PCl5 to produce chloroalkanes • 50% concentrated sulfuric acid and potassium bromide to produce bromoalkanes • red phosphorus and iodine to produce iodoalkanes iii potassium dichromate(VI) in dilute sulfuric acid to					

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	oxidise primary alcohols to aldehydes (including a test for the aldehyde using Benedict's/Fehling's solution) and carboxylic acids, and secondary alcohols to ketones In equations, the oxidising agent can be represented as [O]. iv concentrated phosphoric acid to form alkenes by elimination Descriptions of the mechanisms of these reactions are not expected. 44. understand the following techniques used in the preparation and purification of a				Problems with plastics – ACPs Linking – Big picture thinking and VAAs Empathetic - concerns for the society.	

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	liquid organic compound: i heating under reflux ii extraction with a solvent in a separating funnel iii distillation iv drying with an anhydrous salt v boiling temperature determination CORE PRACTICAL 5: The oxidation of ethanol CORE PRACTICAL 6: Chlorination of 2-methylpropan-2-ol using concentrated hydrochloric acid					
Topic 3 Redox Reactions (TERM 3)	1. know what is meant by the term 'oxidation number' 2. be able to calculate the	1. Demonstrate redox reactions 2. Identifying oxidation and reduction	Assessments: End Of Topic 3 assessment – 30 min assessment	Solve algebraic equations	1. Analysing, 2. Linking, 3. Meta-thinking, 4. Creating and 5. Realising.	Link to prior learning: ● Atomic structure ● Formation of ions ● Ionic equations

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	oxidation number of elements in compounds and ions The use of oxidation numbers in peroxides and metal hydrides is expected. 3. understand oxidation and reduction in terms of electron transfer and changes in oxidation number, applied to reactions of s- and p-block elements 4. understand oxidation and reduction in terms of electron loss or electron gain 5. know that oxidising agents gain electrons	3. Rules for working out oxidation number 4. Determining oxidation number in compounds 5. Determining oxidation number in ions 6. Naming compounds and ions 7. Oxidation and reduction in terms of change in oxidation number 8. Combining half-equations 9. Using oxidation numbers to balance equations	made up of exam questions		Assigning oxidation number - analysing - critical or logical thinking Nomenclature - analysing precision	● Oxidation and reduction in terms of electron transfer ● Oxidising agents and reducing agents ● Determining oxidation numbers Homework: • REVISION FOR EOT ASSESSMENT-HPL FOCUS – HARD WORKING - PRACTICE • GENERAL HOMEWORK AND INDEPENDENT STUDY: Variety of different exam questions and independent study of concepts learnt in class.

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	6. know that reducing agents lose electrons 7. understand that a disproportionation reaction involves an element in a single species being simultaneously oxidised and reduced 8. know that oxidation number is a useful concept in terms of the classification of reactions as redox and as disproportionation 9. be able to indicate the oxidation number of an element in a compound or ion, using a Roman numeral					

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	10. be able to write formulae given oxidation numbers 11. understand that metals, in general, form positive ions by loss of electrons with an increase in oxidation number 12. understand that non-metals, in general, form negative ions by gain of electrons with a decrease in oxidation number 13. be able to write ionic half-equations and use them to construct full ionic equations					
Topic 7: Modern Analytical Techniques I TERM 4	**Topic 7A: Mass spectrometry**	1. Determining Mr from the molecular ion peak	**Assessments:** End Of Topic 7 assessment – 30	Translate information between	**1. Analysing, 2. Linking, 3. Meta-thinking, 4. Creating and 5. Realising.**	**Links to prior learning:** ● Ar and Mr values from mass spectrometry

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	1. be able to use data from a mass spectrometer to: i determine the relative molecular mass of an organic compound from the molecular ion peak ii suggest possible structures of a simple organic compound from the m/z of the molecular ion and fragmentation patterns Topic 7B: Infrared (IR) spectroscopy 2. be able to use data from infrared spectra to deduce functional groups present in organic compounds and to predict infrared absorptions, given wavenumber data, due to familiar	2. Fragmentation 3. Deducing structures from the m/z ratios of the molecular ion and fragmentation patterns 4. The origin of infrared absorption spectra 5. Characteristic absorptions and identifying functional groups 6. Deducing the presence or absence of functional groups and predicting absorptions from structure	min assessment made up of exam questions CORE PRACTICAL 7 ANALYSIS OF SOME UNKNOWN INORGANIC AND ORGANIC COMPOUNDS	graphical, numerical and algebraic forms	Analysing infrared data and identifying unknowns – ACPs Analysing – critical and logical thinking VAAs-Hardworking - Practice. Core Practicals – ACPs – Analysing – Complex and multistep problem solving	● Predicting mass spectra for diatomic molecules ● Formation of radicals ● Covalent bonding ● Deducing structures from the m/z ratios of the molecular ion and fragmentation patterns Homework: • REVISION FOR EOT ASSESSMENT-HPL FOCUS – HARD WORKING - PRACTICE • GENERAL HOMEWORK AND INDEPENDENT STUDY: Variety of different exam questions and independent study

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	functional groups, including: i C–H stretching absorption in alkanes, alkenes and aldehydes ii C=C stretching absorption in alkenes iii O–H stretching absorption in alcohols iv C=O stretching absorption in aldehydes and ketones v C=O stretching absorption and the broad O-H stretching absorption in carboxylic acids vi N–H stretching absorption in amines CORE PRACTICAL 7: Analysis of some inorganic and organic unknowns				VAAs – Agile – Enquiring & Hard working – Practice.	of concepts learnt in class. To read up on Core Practical prior to Day of CP

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
Topic 8: Energetics I (TERM 4)	1. know that standard conditions are 100 kPa and a specified temperature, usually 298 K 2. know that the enthalpy change is the heat energy change measured at constant pressure 3. be able to construct and interpret enthalpy level diagrams showing an enthalpy change, including appropriate signs for exothermic and endothermic reactions Activation energy is not shown in enthalpy level diagrams but it is shown in reaction profile diagrams.	1. Observing exothermic and endothermic reactions 2. Enthalpy and enthalpy changes 3. Enthalpy level diagrams 4. Specific heat capacity and standard enthalpy change of combustion 5. Measuring an enthalpy change of combustion 6. Analysis and evaluation of the practical activity 7. Standard enthalpy change of neutralisation	Assessments End Of Topic 8 assessment – 30 min assessment made up of exam questions CORE PRACTICAL 8 HESS' LAW	• Translate information between graphical, numerical and algebraic forms • Recognise and make use of appropriate units in calculations • Identify uncertainties in measurements and use simple techniques to determine uncertainty when data are combined • Substitute numerical	1. Analysing, 2. Linking, 3. Meta-thinking, 4. Creating and 5. Realising. Core Practicals – ACPs – Analysing – Complex and multistep problem solving VAAs – Agile – Enquiring & Hard working – Practice.	Links to prior learning: ● Exothermic and endothermic reactions ● Mole calculations ● Exothermic and endothermic reactions ● Enthalpy changes ● Enthalpy level diagrams ● Measuring an enthalpy change of reaction ● Measuring an enthalpy change of combustion ● Reactions of acids and alkalis ● Measuring an enthalpy change ● Standard enthalpies of reaction, combustion and neutralisation Homework: • REVISION FOR EOT ASSESSMENT-HPL FOCUS – HARD

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	4. be able to define standard enthalpy change of: i reaction ii formation iii combustion iv neutralisation 5. understand experiments to measure enthalpy changes in terms of: i processing results using the expression: energy transferred = mass x specific heat capacity × temperature change ($Q=mc\Delta T$) ii evaluating sources of error and assumptions made in the experiments Students will need to consider experiments where: o substances are mixed in an insulated	8. Measuring an enthalpy change of neutralisation 9. Analysis and evaluation of the practical activity 10. Standard enthalpy change of formation 11. Hess's Law 12. Determining the enthalpy change of a reaction using Hess's Law 13. Bond enthalpy and mean bond enthalpy 14. Calculating enthalpy change of reaction using mean bond enthalpy data		values into algebraic equations using appropriate units for physical quantities Solve algebraic equations	Hess' law - meta thinking - strategy planning	WORKING - PRACTICE • GENERAL HOMEWORK AND INDEPENDENT STUDY: Variety of different exam questions and independent study of concepts learnt in class. To read up on Core Practical prior to Day of CP

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	container and the temperature change is measured o enthalpy of combustion is measured, such as using a series of alcohols in a spirit burner o the enthalpy change cannot be measured directly. 6. be able to calculate enthalpy changes in kJ mol-1 from given experimental results Both a sign and units are expected in the final answer. 7. be able to construct enthalpy cycles using Hess's Law	15. Calculating mean bond enthalpies from enthalpy changes of reaction				

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	8. be able to calculate enthalpy changes from data using Hess's Law CORE PRACTICAL 8: To determine the enthalpy change of a reaction using Hess's Law 9. know what is meant by the terms 'bond enthalpy' and 'mean bond enthalpy' 10. be able to calculate an enthalpy change of reaction using mean bond enthalpies and explain the limitations of this method of calculation 11. be able to calculate mean bond				Energy level diagram - linking connection finding	

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	enthalpies from enthalpy changes of reaction					
Topic 4 Inorganic Chemistry and the Periodic Table	1. understand reasons for the trend in ionisation energy down Group 2 2. understand reasons for the trend in reactivity of the Group 2 elements down the group 3. know the reactions of the elements Mg to Ba in Group 2 with oxygen, chlorine and water 4. know the reactions of the oxides of Group 2 elements with water and dilute acid, and their hydroxides with dilute acid	1. Trends in ionisation energy and reactivity down Group 2 2. Reactions of Group 2 elements with oxygen, chlorine and water 3. Reactions of Group 2 oxides with water and trends in the solubility of Group 2 hydroxides 4. Trends in the solubility of Group 2 sulfates and the use of barium nitrate solution to test for the presence of sulfate ions 5. Reactions of Group 2 oxides and	Assessments: End Of Topic 4 assessment – 30 min assessment made up of exam questions	• Plot two variables from experimental or other data.	1. Analysing, 2. Linking, 3. Meta-thinking, 4. Creating and 5. Realising. Reactions with oxygen - linking - generalisation trends in solubilities of Group 2 hydroxides - linking - big picture thinking	Link to prior learning: ● Ionisation energy ● Trends in first ionisation energy ● Trend in reactivity of Group 2 elements ● Reactions of Group 2 elements with oxygen, chlorine and water ● Trends in reactivity of Group 2 elements ● Reactions of Group 2 elements with oxygen, chlorine and water ● Trends in thermal stability of Group 1 and 2 nitrates ● Ionisation ● Thermal decomposition of Group 1 and 2 nitrates and carbonates

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	5. know the trends in solubility of the hydroxides and sulfates of Group 2 elements 6. understand reasons for the trends in thermal stability of the nitrates and the carbonates of the elements in Groups 1 and 2 in terms of the size and charge of the cations involved 7. understand the formation of characteristic flame colours by Group 1 and 2 compounds in terms of electron transitions Students will be expected to know the flame colours for Groups 1 and 2 compounds.	hydroxides with acids 6. Factors affecting the thermal stability of Group 1 and 2 nitrates 7. Trends in the thermal stability of Group 1 and 2 nitrates 8. Thermal decomposition of a metal carbonate 9. Trends in the thermal stability of Group 1 and 2 carbonates 10. Thermal decomposition of calcium carbonate 11. Flame tests for Group 1 and 2 cations				● Physical properties of elements from Periods 2 and 3 ● Electronegativity ● London forces ● Simple molecular structure ● Trends in Group 2 ● Oxidation numbers ● Redox reactions ● Trends in Group 7 ● Oxidation numbers ● Redox reactions ● Reactions of halogens with metals, halide compounds and alkalis ● Reactions of halogens with metals, halide compounds and alkalis ● Halides as reducing agents Homework: • REVISION FOR EOT ASSESSMENT- HPL FOCUS – HARD

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	8. understand experimental procedures to show: i patterns in thermal decomposition of Group 1 and 2 nitrates and carbonates ii flame colours in compounds of Group 1 and 2 elements 9. understand reasons for the trends in melting and boiling temperatures, physical state at room temperature, and electronegativity for Group 7 elements 10. understand reasons for the trend in reactivity of Group 7 elements down the group	12. Flame test colours 13. Trends in melting and boiling temperatures down Group 7 14. State changes 15. Electronegativity and reactivity down Group 7 16. Reactions of halogens with Group 1 and 2 elements 17. Halogen displacement reactions 18. Reactions of chlorine				WORKING - PRACTICE • GENERAL HOMEWORK AND INDEPENDENT STUDY: Variety of different exam questions and independent study of concepts learnt in class.

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	11. understand the trend in reactivity of Group 7 elements in terms of the redox reactions of Cl2, Br2 and I2 with halide ions in aqueous solution, followed by the addition of an organic solvent 12. understand, in terms of changes in oxidation number, the following reactions of the halogens: i oxidation reactions with Group 1 and 2 metals ii the disproportionation reaction of chlorine with water and the use of chlorine in water treatment iii the disproportionation reaction of chlorine	19. The reactions of halides with sulfuric acid 20. Testing for halide ions in solution 21. Modelling the reactions 22. Acidity and reactions of hydrogen halides with ammonia				

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	with cold, dilute aqueous sodium hydroxide to form bleach iv the disproportionation reaction of chlorine with hot alkali v reactions analogous to those specified above 13. understand the following reactions: i solid Group 1 halides with concentrated sulfuric acid, to illustrate the trend in reducing ability of the hydrogen halides ii precipitation reactions of the aqueous anions Cl–, Br– and I– with aqueous silver nitrate solution, followed by aqueous ammonia solution					

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	iii hydrogen halides with ammonia and with water (to produce acids) 14. be able to make predictions about fluorine and astatine and their compounds, in terms of knowledge of trends in halogen chemistry 15. know reactions, including ionic equations where appropriate, for identifying: i carbonate ions, CO_3^{2-} , and hydrogencarbonate ions, HCO_3^-, using an aqueous acid to form carbon dioxide ii sulfate ions, SO_4^{2-} , using acidified barium chloride solution					

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	iii ammonium ions, NH_4^+, using sodium hydroxide solution and warming to form ammonia Tests for halide ions and for the ions of Group 1 and 2 metals are also required, but are covered elsewhere in this Topic.					
Topic 9: Kinetics I (TERM 5)	1. understand, in terms of collision theory, the effect of a change in concentration, temperature, pressure and surface area on the rate of a chemical reaction 2. understand that reactions only take place when collisions take place with sufficient energy, known as activation energy	1. Reaction profiles, activation energy and catalysts 2. Collision theory and factors affecting rate of reaction 3. Measuring the rate of a reaction 4. Rate of reaction and surface area 5. Rate of reaction and concentration	Assessments: End Of Topic 9 assessment – 30 min assessment made up of exam questions	Plot two variables from experimental or other data	1. Analysing, 2. Linking, 3. Meta-thinking, 4. Creating and 5. Realising. Understanding Rates of reaction and studying reaction profiles and Maxwell Boltzmann distribution curves VAAs- Hard working – Resilience and Practice.	Links to prior learning: ● Enthalpy level diagrams ● Rate of reaction and collision theory ● Activation energy and catalysts ● Rate of reaction and collisions ● Factors affecting the rate of reaction ● Maxwell–Boltzmann distribution ● Rate of reaction and collisions ● Activation energy and catalysts

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	3. be able to calculate the rate of a reaction from: i data showing the time taken for reaction ii the gradient of a suitable graph, by drawing a tangent, either for initial rate, or at a time, t 4. understand qualitatively, in terms of the Maxwell-Boltzmann distribution of molecular energies, how changes in temperature affect the rate of a reaction 5. understand the role of catalysts in providing alternative reaction routes of lower activation energy	6. Rate of reaction and pressure 7. Rate of reaction and temperature 8. Analysis of practical activity results 9. Evaluation of the investigation and its results 10. The Maxwell–Boltzmann distribution 11. Maxwell–Boltzmann curves at different temperatures, and link to reaction rate 12. Collisions in solution 13. Practice questions				● Factors affecting the rate of reaction Homework: • REVISION FOR EOT ASSESSMENT-HPL FOCUS – HARD WORKING – PRACTICE • GENERAL HOMEWORK AND INDEPENDENT STUDY: Variety of different exam questions and independent study of concepts learnt in class.

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	6. be able to draw the reaction profiles for uncatalysed and catalysed reactions 7. be able to interpret the action of a catalyst in terms of a qualitative understanding of the Maxwell-Boltzmann distribution of molecular energies 8. understand the use of a solid (heterogeneous) catalyst for industrial reactions, in the gas phase, in terms of providing a surface for the reaction 9. understand the economic benefits of the use of catalysts in industrial reactions					
Topic 10: Equilibrium I TERM 5	1. know that many reactions are readily reversible and that they can reach a	1. Reversible reactions and dynamic equilibria	Assessments:	• Change the subject of an equation	1. Analysing, 2. Linking, 3. Meta-thinking, 4. Creating and 5. Realising.	Links to prior learning: ● Rate of reaction ● Reversible reactions

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	state of dynamic equilibrium in which: i the rate of the forward reaction is equal to the rate of the backward reaction ii the concentrations of reactants and products remain constant 2. be able to predict and justify the qualitative effect of a change in temperature, concentration or pressure on a homogeneous system in equilibrium 3. evaluate data to explain the necessity, for many industrial processes, to reach a compromise between the yield	2. Investigating a reversible reaction 3. Effects of imposing a change 4. Homogeneous systems and Kc 5. Heterogeneous systems and Kc 6. Practising deducing expressions for Kc 7. Calculating Kc (for A level students only) 8. Haber process 9. Contact process 10. Research about reversible industrial reactions	End Of Topic 10 assessment – 30 min assessment made up of exam questions		Understanding Rates of reaction and studying reaction profiles and Maxwell Boltzmann distribution curves VAAs- Hard working – Resilience and Practice.	● Dynamic equilibria ● Homogeneous and heterogeneous systems ● Expressions for Kc Homework: • REVISION FOR EOT ASSESSMENT -HPL FOCUS – HARD WORKING - PRACTICE • Variety of different exam questions and independent study of concepts learnt in class.

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	and the rate of reaction 4. be able to deduce an expression for Kc , for homogeneous and heterogeneous systems, in terms of equilibrium concentrations					