

Yr 12 (KS5)	Topic Area	Key knowledge/skills (what <u>has</u> to be learnt)	Examples of key compulsory practicals for students	Resources/support at home
1 - Physical Chemistry	1.1 Atomic structure	<p>Mass number (A) and atomic number (Z) - application to determine the number of fundamental particles in atoms and ions.</p> <p>Use of Time of Flight (ToF) mass spectrometry to measure atomic and molecular masses. Interpretation of mass spectra.</p> <p>Determination of the electronic arrangements in atoms and ions using the s,p,d,f nomenclature.</p> <p>Definition of first ionisation energy. Explain how ionisation energies give evidence of structure of shells and subshells.</p>	Determination of a formula from a simple combustion of Magnesium.	<p>Kerboodle on-line textbook and resources</p> <p>Google classroom</p> <p>Cognito A Level Chemistry past papers.</p> <p>Knockhardy Powerpoints</p> <p>www.mrerintoul.co.uk videos</p> <p>Savemyexams past papers & notes.</p> <p>AQA past papers</p>
	1.2 Amount of substance	<p>Define relative atomic mass (A_r), relative molecular mass (M_r), the mole and the Avogadro number, empirical formula and molecular formula.</p> <p>Use of the above, with balanced equations, in a variety of examples of calculations.</p> <p>Statement and use of the ideal gas equation.</p>	Required practical 1: Making a standard solution and carrying out an acid - base titration. Skills a,d,e,f,k	<p>Kerboodle online textbook and resources</p> <p>Google classroom</p> <p>Cognito A Level Chemistry past papers.</p> <p>Knockhardy Powerpoints</p> <p>www.mrerintoul.co.uk videos</p> <p>Savemyexams past papers & notes.</p> <p>AQA past papers</p>
	1.3 Bonding	Explain the nature of ionic, covalent and metallic bonding.		<p>Kerboodle online textbook and resources</p> <p>Google classroom</p>

	<p>Describe the structure and bonding in a range of substances and explain how they influence their physical properties.</p> <p>Describe the nature of Hydrogen bonding, dipole attractions and Van der Waals forces between simple molecules.</p> <p>Deduce the shape of simple molecules of the form AB_x using electron pair repulsion theory.</p>		<p>Cognito A Level Chemistry past papers. Knockhardy Powerpoints www.mrerintoul.co.uk videos Savemyexams past papers & notes. AQA past papers</p>
1.4 Energetics	<p>Define standard enthalpy of formation ($\Delta_f H^\ominus$) and standard enthalpy of combustion ($\Delta_c H^\ominus$), and standard conditions.</p> <p>Describe calorimetry and use the equation $q = mc\Delta T$ to determine energy transferred.</p> <p>State and use Hess' Law.</p> <p>Define mean bond enthalpy and use them to calculate enthalpy changes.</p>	Required practical 2: Determination of an enthalpy change. Skills a,d,k	<p>Kerboodle online textbook and resources Google classroom</p> <p>Cognito A Level Chemistry past papers. Knockhardy Powerpoints www.mrerintoul.co.uk videos Savemyexams past papers & notes. AQA past papers</p>
1.5 Kinetics	<p>Explain the factors affecting rates of reaction using collision theory.</p> <p>Draw a Maxwell-Boltzmann distribution of molecular energies and understand how they change with temperature.</p> <p>Use Maxwell-Boltzmann distributions to explain the effect of changes in temperature and the use of catalysts on rates of reaction.</p>	Required practical 3: Investigating the effect of temperature changes on rate of reaction. Skills a,b,k	<p>Kerboodle online textbook and resources Google classroom Cognito A Level Chemistry past papers. Knockhardy Powerpoints www.mrerintoul.co.uk videos Savemyexams past papers & notes. AQA past papers</p>
1.6 Equilibria	<p>Describe the characteristics of a dynamic equilibrium.</p>	Determination of an equilibrium constant using ethanol and ethanoic acid and sodium hydroxide titration.	<p>Kerboodle online textbook and resources Google classroom</p>

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		<p>Use Le Chatelier's principle to predict the effect of changes to the conditions in an equilibrium system.</p> <p>Deduce the expression for the equilibrium constant, K_c for a reaction. Perform calculations involving K_c.</p>		<p>Cognito A Level Chemistry past papers. Knockhardy Powerpoints www.mrerintoul.co.uk videos Savemyexams past papers & notes. AQA past papers</p>
	1.7 Oxidation, Reduction and redox equations	<p>Define the terms oxidation and reduction in terms of electrons.</p> <p>Determine the oxidation state of an element in molecules and ions.</p> <p>Construct ionic half equations for oxidation and reduction processes and combine them to give an overall equation (and the reverse process)</p>	Iron tablet and $KMnO_4$ titration.	<p>Kerboodle online textbook and resources Google classroom Cognito A Level Chemistry past papers. Knockhardy Powerpoints www.mrerintoul.co.uk videos Savemyexams past papers & notes. AQA past papers</p>
2 - Inorganic Chemistry	2.1 Periodicity	<p>Classify elements using s p d f notation.</p> <p>Describe and explain the trends in atomic radius, first ionisation energy and melting point for the elements in period 3 (Na - Ar).</p>		<p>Cognito A Level Chemistry past papers. Knockhardy Powerpoints www.mrerintoul.co.uk videos Savemyexams past papers & notes. AQA past papers</p>
	2.2 Group 2; the alkaline earth metals	<p>Describe and explain the trends in atomic radius, first ionisation energy and melting point for the elements.</p> <p>Describe the reactions of the elements with water.</p>		<p>Cognito A Level Chemistry past papers. Knockhardy Powerpoints www.mrerintoul.co.uk videos Savemyexams past papers & notes. AQA past papers</p>

		<p>Describe and explain the trends in the solubilities of the hydroxides and the sulphates of the elements.</p> <p>Describe the uses of specific compounds of elements in group 2.</p>		
	2.3 Group 7; the halogens	<p>Describe and explain the trends in electronegativity and boiling point.</p> <p>Describe and explain the trends in the oxidising ability of the elements and the reducing ability of the halide ions (including the reactions of halide ions with concentrated sulfuric acid).</p> <p>Describe the test for halide ions.</p> <p>Describe some uses of chlorine and chlorate(I).</p>	<p>Required Practical 4: test tube reactions to identify certain cations and anions.</p> <p>Skills d,k</p>	<p>Cognito A Level Chemistry past papers.</p> <p>Knockhardy Powerpoints</p> <p>www.mrerintoul.co.uk videos</p> <p>Savemyexams past papers & notes.</p> <p>AQA past papers</p>
3 - Organic Chemistry	3.1 introduction to organic chemistry	<p>Use a variety of methods to represent organic molecules.</p> <p>Understand the concepts of functional group and homologous series. Know the general formulas for alkanes, alkenes, halogenoalkanes and alcohols.</p> <p>Use the IUPAC system to name and draw simple inorganic molecules.</p> <p>Define the term structural isomer and draw isomers of simple inorganic molecules.</p>		<p>Cognito A Level Chemistry past papers.</p> <p>Knockhardy Powerpoints</p> <p>www.mrerintoul.co.uk videos</p> <p>Savemyexams past papers & notes.</p> <p>AQA past papers</p>

	<p>3.2 Alkanes</p>	<p>State that crude oil is a mixture composed mainly of alkanes.</p> <p>Describe the trends in properties as the chain length increases.</p> <p>Describe and explain the fractional distillation of oil.</p> <p>Describe the process of cracking and the differences between catalytic cracking and thermal cracking.</p> <p>Know that alkanes are used as fuels and describe complete and incomplete combustion.</p> <p>Explain how combustion produces pollutants and how smoke of these are dealt with.</p> <p>Explain the steps in the free radical substitution reaction mechanism between alkanes and halogens.</p>	<p>Fractional distillation</p> <p>Cracking and testing for the products using Bromine water or KMnO_4</p> <p>Combustion of a Hydrocarbon and identifying the products using chemical tests.</p>	<p>Cognito A Level Chemistry past papers.</p> <p>Knockhardy Powerpoints www.mrerintoul.co.uk videos</p> <p>Savemyexams past papers & notes.</p> <p>AQA past papers</p>
	<p>3.2 Halogenoalkanes</p>	<p>Explain that halogenoalkanes are hydrocarbons substituted with halogen atoms, and that they can be classified as primary, secondary and tertiary.</p> <p>Describe and explain that halogenoalkanes can undergo nucleophilic substitution reactions.</p> <p>Use curly arrows to draw the mechanisms of nucleophilic substitution reactions.</p>	<p>Alkane plus Bromine water or KMnO_4</p>	<p>Cognito A Level Chemistry past papers.</p> <p>Knockhardy Powerpoints www.mrerintoul.co.uk videos</p> <p>Savemyexams past papers & notes.</p> <p>AQA past papers</p>

		<p>Describe and explain that halogenoalkanes can undergo elimination reactions.</p> <p>Use curly arrows to draw the mechanisms of elimination reactions.</p> <p>Explain how elimination reactions and nucleophilic substitution reactions compete and the conditions that influence which reaction occurs.</p> <p>Describe and explain the role of CFCs in the depletion of the ozone layer, and the steps taken to limit this process</p>		
	3.4 Alkenes	<p>State that alkenes are hydrocarbons with carbon - carbon double bonds.</p> <p>Explain how the presence of the double bond can lead to E/Z isomerism. Explain the meaning of the term stereoisomerism.</p> <p>Use curly arrows to draw the mechanism for electrophilic addition reactions, and explain how the stability of carbocation intermediates influences the outcome of these reactions.</p> <p>Describe and explain the formation of addition polymers and their uses.</p>		<p>Cognito A Level Chemistry past papers.</p> <p>Knockhardy Powerpoints www.mrerintoul.co.uk videos Savemyexams past papers & notes. AQA past papers</p>
	3.5 Alcohols	<p>Explain that alcohols are hydrocarbons substituted with a hydroxyl group, and that they can be classified as primary, secondary and tertiary.</p>	<p>Required practical 5: distillation of a product from a reaction (cyclohexanol to cyclohexene).</p> <p>Skills b,d,k</p>	

		<p>Describe the industrial production of alcohols, particularly ethanol, from direct synthesis and fermentation.</p> <p>Describe and explain the oxidation of alcohols and the different outcomes depending on whether the alcohol is primary, secondary and tertiary.</p> <p>Describe the elimination reactions of alcohols to form alkenes, including the mechanism.</p>	<p>Oxidation of Primary and Secondary alcohols and testing the products using pH, Benedicts & Tollens.</p>	
	3.6 Organic analysis	<p>Explain how a variety of functional groups can be identified using test tube reactions.</p> <p>Explain how high resolution mass spectrometry can be used to determine the identity of a molecule.</p> <p>Use infrared spectra to identify groups in molecules. Explain how the fingerprint region can be used to determine the identity of a molecule.</p>		
Yr 13 (KS5)	1.8 Thermodynamics	<p>Define the different enthalpy changes involved in the formation of an ionic substance.</p> <p>Construct and use Born-Haber cycles to determine a variety of enthalpy changes.</p> <p>Describe how theoretical models can be used to predict values for lattice enthalpies and</p>		<p>Kerboodle online textbook and resources</p> <p>Google classroom</p> <p>Cognito A Level Chemistry past papers.</p> <p>Knockhardy Powerpoints</p> <p>www.mrerintoul.co.uk videos</p> <p>Savemyexams past papers & notes.</p> <p>AQA past papers</p>

		<p>explain why they do not always match experimental values.</p> <p>Describe the concept of entropy. Use the Gibbs free energy equation ($\Delta G = T - \Delta S$) to predict the feasibility of a reaction, and determine the temperature at which a reaction becomes feasible.</p>		
	1.9 Rate equations	<p>Explain the meaning of the terms rate constant and order of reaction and half life.</p> <p>Use rate equations of the form $\text{rate} = k[A]^x[Y]^y$ to perform calculations.</p> <p>Understand how the Arrhenius equation can be used to determine a value for an activation energy by plotting values of $\ln k$ against $1/T$.</p> <p>Describe how rate equations can be used to explain reaction mechanisms with more than one step. Explain the meaning of rate determining step.</p>	<p>Required practical 7a: Determination of a rate equation using a clock method.</p> <p>Required practical 7b: Determination of a rate equation using a continuous monitoring method.</p> <p>Determination of an activation energy.</p> <p>Skills a,k,l</p> <p>Independent Planning task here.</p>	<p>Kerboodle online textbook and resources</p> <p>Google classroom</p> <p>Cognito A Level Chemistry past papers.</p> <p>Knockhardy Powerpoints</p> <p>www.mrerintoul.co.uk videos</p> <p>Savemyexams past papers & notes.</p> <p>AQA past papers</p>
	1.10 Equilibrium constant K_p	<p>Explain the terms mole fraction and partial pressure for equilibrium mixtures involving gases.</p> <p>Deduce the expression for the equilibrium constant, K_p for a reaction. Perform calculations involving K_p.</p>		<p>Kerboodle online textbook and resources</p> <p>Google classroom</p> <p>Cognito A Level Chemistry past papers.</p> <p>Knockhardy Powerpoints</p> <p>www.mrerintoul.co.uk videos</p> <p>Savemyexams past papers & notes.</p> <p>AQA past papers</p>

	<p>1.11 Electrode potentials and electrochemical cells</p>	<p>Describe a hydrogen half cell.</p> <p>Define standard electrode potential.</p> <p>Explain how half cells can be combined.</p> <p>Use standard electrode potentials to predict the direction of a cell reaction, and its EMF.</p> <p>Use the IUPAC convention for the representation of cells.</p>	<p>Required practical 8: Measuring the EMF of a cell.</p> <p>Skills j,k</p> <p>Fruit Cells</p>	<p>Kerboodle online textbook and resources</p> <p>Google classroom</p> <p>Cognito A Level Chemistry past papers.</p> <p>Knockhardy Powerpoints</p> <p>www.mrerintoul.co.uk videos</p> <p>Savemyexams past papers & notes.</p> <p>AQA past papers</p>
	<p>1.12 Acids and bases</p>	<p>Define acid and base in terms of the Brønsted-Lowry theory.</p> <p>Define the terms pH and K_w, and use them to perform calculations involving strong acids and bases.</p> <p>Define the acid dissociation constant, K_a and the base dissociation constant, K_b.</p> <p>Carry out calculations involving weak acids and bases using K_a and K_b.</p> <p>Sketch and explain the shapes of pH curves. Use understanding of pH curves to select a suitable indicator for a titration.</p>	<p>Required practical 9: Investigate pH changes when strong and weak acids and bases are titrated.</p> <p>Skills a,c,d,k</p> <p>Data logging and Analysis</p>	<p>Kerboodle online textbook and resources</p> <p>Google classroom</p> <p>Cognito A Level Chemistry past papers.</p> <p>Knockhardy Powerpoints</p> <p>www.mrerintoul.co.uk videos</p> <p>Savemyexams past papers & notes.</p> <p>AQA past papers</p>

<p>2 - Inorganic Chemistry</p>	<p>2.3 Properties of period 3 elements and their oxides</p>	<p>Describe and explain the reactions of the elements with water.</p> <p>Describe and explain the trends in the reactions of the elements with oxygen.</p> <p>Describe and explain the trends in the reactions of the oxides with water, acids and bases.</p>	<p>Period 3 elements and oxides with water</p> <p>Reactions of oxides with acids & alkalis</p>	
	<p>2.4 Transition metals</p>	<p>Describe the characteristic properties of transition metals.</p> <p>Describe and explain the formation of complex ions. Define the terms ligand and coordination number.</p> <p>Describe and explain ligand exchange reactions.</p> <p>Explain the meaning of bidentate, multidentate ligands, and the chelate effect.</p> <p>Describe the shapes of common complex ions and isomerism in complex ions.</p> <p>Explain why some complex ions are coloured. Describe simple colorimetry</p> <p>Explain how transition metals can exhibit variable oxidation states.</p> <p>Describe and explain how transition metals and their compounds can be used as either heterogenous and homogenous catalysts, with examples.</p>	<p>Ligand substitutions reactions and stability, including concentration/ formula determining using Colorimeter.</p>	<p>Cognito A Level Chemistry past papers. Knockhardy Powerpoints www.mrerintoul.co.uk videos Savemyexams past papers & notes. AQA past papers</p>

	2.6 Reactions of ions in aqueous solution	Describe the formation of certain metal-aqua ions. Explain the acidity of some metal-aqua ions. Describe the reactions of certain ions of iron copper and aluminium.	Required practical 11: Simple test tube reactions to identify transition metals in aqueous solution. Skills b,d,k	
3 - Organic Chemistry	3.7 Optical Isomerism	Explain how molecules can exhibit optical isomerism. Identify an asymmetric carbon atom in a molecule. Explain how enantiomers can be distinguished. Explain the properties of a racemic mixture.	Annased / caraway seeds Observe Optical Isomers using Polarised filters.	Cognito A Level Chemistry past papers. Knockhardy Powerpoints www.mrerintoul.co.uk videos Savemyexams past papers & notes. AQA past papers
	3.8 Aldehydes and Ketones	Describe how aldehydes and ketones are formed from the relevant alcohol and can be reduced to that alcohol. Explain that aldehydes can be oxidised to carboxylic acids. Describe and explain how aldehydes and ketones can be distinguished using Fehling's and Tollen's tests. Use curly arrows to show the nucleophilic addition mechanism of aldehydes and ketones with hydride ions and cyanide ions.		
	3.9 Carboxylic acids and derivatives	Know the structures of carboxylic acids, esters, acid anhydrides, acyl chlorides and amides. Know the structures of oils and fats and their uses.	Make Esters	Cognito A Level Chemistry past papers. Knockhardy Powerpoints www.mrerintoul.co.uk videos Savemyexams past papers & notes.

		Use curly arrows to describe the nucleophilic addition-elimination mechanisms of the reactions of acyl chlorides with water, alcohols, ammonia and primary amines (acylation)		AQA past papers
	3.10 Aromatic chemistry	Describe and explain the evidence for the structure of benzene. Use curly arrows to show the electrophilic substitution mechanism for the reactions of benzene with nitrating mixture and acylating mixture.	Required practical 10a: preparation of an organic solid, including melting point determination. Required practical 10b: preparation of an organic liquid (esterification). preparation of a benzene derivative (including recrystallization). Skills a,b,d,g,h,k	Cognito A Level Chemistry past papers. Knockhardy Powerpoints www.mrerintoul.co.uk videos Savemyexams past papers & notes. AQA past papers
	3.11 Amines	Explain that amines are substances formed when one or more of the hydrogen atoms in ammonia are replaced by alkyl groups. Describe the formation of aliphatic amines from ammonia and aromatic amines from nitro benzenes. Explain how amines act as weak bases. Explain how amines can react as nucleophiles.		
	3.12 Polymers	Describe the difference between addition and condensation polymers. Draw repeating units from a length of polymer or the reverse. Compare the biodegradability of addition and condensation polymers.		

	3.13 Amino acids, proteins and DNA	<p>Describe and explain the formation of zwitterions.</p> <p>Describe and explain the formation of polypeptides and proteins from amino acids.</p> <p>The primary, secondary and tertiary structure of proteins.</p> <p>The hydrolysis of proteins to form amino acids.</p> <p>State that enzymes are proteins and explain their catalytic action and stereospecificity.</p> <p>Describe the structure of DNA as a polymer of complementary strands in a double helix.</p> <p>Explain the action of cisplatin as an anti cancer drug.</p>		<p>Cognito A Level Chemistry past papers.</p> <p>Knockhardy Powerpoints</p> <p>www.mrerintoul.co.uk videos</p> <p>Savemyexams past papers & notes.</p> <p>AQA past papers</p>
	3.14 Organic synthesis	<p>Describe and explain the synthesis of a range of organic molecules using reactions learned in this specification.</p> <p>Explain the implications of yield and atom economy in designing a synthesis.</p>		
	3.15 Nuclear magnetic resonance spectroscopy (NMR)	<p>Explain that ^{13}C and ^1H atoms' absorbance of radio frequency radiation can give information about their positions in a molecule.</p> <p>Explain the use of TMS and deuterated solvents in NMR.</p> <p>Interpret NMR spectra.</p>		

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		Explain how splitting patterns and chemical shift can be used to determine the structure of simpler molecules.		
	3.16 Chromatography	Explain and describe a range of chromatographic techniques. Calculate and interpret R_f values from chromatograms.	Required practical 12: Thin layer chromatography (TLC). Skills i,k	Cognito A Level Chemistry past papers. Knockhardy Powerpoints www.mrerintoul.co.uk videos Savemyexams past papers & notes. AQA past papers