Year 12 Chemistry Learning Journey

YEAR GROUP: 12 Learning map **SUBJECT: Chemistry**

When?	Knowledge	Understanding	Assessment
PC1 Atomic Structure **PC2 Amount of Substance**	**PC1 Atomic Structure** **Be able to:** • **Draw the structure of the atom and calculate information about protons, neutrons electrons, and mass numbers.** • **Be able to explain how a mass spectrometer works and carry out calculations relating to the mass spectrometer.** • **Write electronic configurations for structures.** • **Define ionisation energies and write equations for ionisation energies.** **PC2 Amount of Substance** **Be able to:** • **Calculate M_r and A_r** • **Calculate moles and use moles to calculate reacting masses, volumes and concentrations.** • **Use the ideal gas equation.** • **Calculate the empirical formula of compounds.** • **Carry out Titrations**	Students will carry out a range of practicals during the topic, some of which will be formally assessed for the practical endorsement qualification. **PC1 Atomic Structure** • Students report calculations to an appropriate number of significant figures, given raw data quoted to varying numbers of significant figures. • Students calculate weighted means eg calculation of an atomic mass based on supplied isotopic abundances. • Students interpret and analyse spectra. **PC2 Amount of Substance** • Students carry out calculations using numbers in standard and ordinary form eg using the Avogadro constant. • Students carry out calculations using the Avogadro constant. • Students report calculations to an appropriate number of significant figures, given raw data quoted to varying numbers of significant figures. Students understand that calculated results can only be reported to the limits of the least accurate measurement. • Students carry out calculations with the ideal gas equation, including rearranging the ideal gas equation to find unknown quantities. • Students could be asked to find the empirical formula of a metal oxide. • Students calculate percentage yields and atom economies of reactions. • Students determine uncertainty when two burette readings are used to calculate a titre value.	PC1 Atomic Structure Test (40 marks) PC2 Amount of Substance Test (40 marks)

	experimentally and use results to calculate concentrations.		
PC3 Bonding	**Be able to:** • **Describe the structure and bonding for ionic, covalent and metallic structures.** • **Describe different types of intermolecular forces and their strengths.** • **Draw and state the bond shapes and angles for different molecules.**	Students will carry out a range of practicals during the topic, some of which will be formally assessed for the practical endorsement qualification. **<u>PC3 Bonding</u>** • Students could be asked to find the type of structure of unknowns by experiment (eg to test solubility, conductivity and ease of melting). • Students could be given familiar and unfamiliar examples of species and asked to deduce the shape according to valence shell electron pair repulsion (VSEPR) principles.	PC3 Bonding Test (40 marks)
PC4 Energetics **OC1 + OC2 Intro to Organic Chemistry and Alkanes**	**<u>PC4: Energetics</u>** **Be able to:** • **Define Hess's law and create Hess cycles to calculate enthalpy changes.** • **Describe combustion and write combustion equations.** • **Measure experimentally and calculate enthalpy change and mean bond enthalpy.** **<u>OC1 + OC2 Intro to Organic Chemistry and Alkanes</u>** **Be able to:** • **Name organic**	Students will carry out a range of practicals during the topic, some of which will be formally assessed for the practical endorsement qualification. **<u>PC4: Energetics</u>** • Students understand that the correct units need to be used in $q = mc\Delta T$ • Students could be asked to find ΔH for a reaction by calorimetry • Students could be asked to find ΔH for a reaction using Hess's law and calorimetry, then present data in appropriate ways • Students understand that bond enthalpies are mean values across a range of compounds containing that bond. **<u>OC1 + OC2 Intro to Organic Chemistry and Alkanes</u>** • Student draw structural, displayed and skeletal formulas for given organic compounds • Students apply IUPAC rules for nomenclature to name organic compounds limited to chains and rings with up to six carbon atoms each	PC4 Energetics Test (40 marks) OC1 + OC2 Intro. to Organic Chemistry and Alkanes Test (40 marks)

	molecules and identify their functional groups. • **Identify different isomers including E/Z isomers.** • **Describe the process of fractional distillation and cracking.** • **Describe the products of combustion and write balanced equations.** • **Define free radical substitution and write equations for the steps involved.**	• Students apply IUPAC rules for nomenclature to draw the structure of an organic compound from the IUPAC name limited to chains and rings with up to six carbon atoms each. • Students could be given the structure of one isomer and asked to draw further isomers. Various representations could be used to give the opportunity to identify those that are isomeric. • Students understand the origin of E–Z isomerism. • Students draw different forms of isomers. • Students explain the economic reasons for cracking alkanes. • Students explain the free-radical substitution mechanism involving initiation, propagation and termination steps.	
PC5 Kinetics and PC6 Equilibrium **OC3 Halogenoalkanes**	**<u>PC5 + 6 Kinetics and equilibrium</u>** **Be able to:** • **Describe how changing temperature, concentration and pressure effect rate of reaction.** • **Draw and interpret Maxwell-boltzman distributions for different reaction conditions** • **Perform calculations using K_c and explain how K_c changes with temperature.** **<u>OC3 Halogenoalkanes</u>**	Students will carry out a range of practicals during the topic, some of which will be formally assessed for the practical endorsement qualification. **<u>PC5 + 6 Kinetics and equilibrium</u>** • Students investigate the effect of temperature on the rate of reaction of sodium thiosulfate and hydrochloric acid by an initial rate method. • Students investigate the effect of changing the concentration of acid on the rate of a reaction of calcium carbonate and hydrochloric acid by a continuous monitoring method. • Students carry out test-tube equilibrium shifts to show the effect of concentration and temperature. • Students estimate the effect of changing experimental parameters on a measurable value eg how the value of Kc would change with temperature, given different specified conditions. • Students calculate the concentration of a reagent at equilibrium. • Students calculate the value of an equilibrium constant Kc	PC5 + PC6 Kinetics and Equilibrium Test (40 marks) OC3 Halogenoalkanes Test (40 marks)

	Be able to: • **Describe and draw mechanisms for nucleophilic substitution and elimination reactions.** • **Prepare and purify a halogenoalkane.**	**OC3 Halogenoalkanes** • Students follow instructions when carrying out test-tube hydrolysis of halogenoalkanes to show their relative rates of reaction. • Students prepare a chloroalkane, purifying the product using a separating funnel and distillation. • Students outline the mechanisms of reactions. • Students use equations to explain how chlorine atoms catalyse decomposition of ozone.	
OC4 Alkenes	**Be able to:** • **Describe the reactions of alkenes including drawing mechanisms for electrophilic addition and elimination reactions.** • **Draw repeating untis of polymers and be able to describe the reactivity of different polymers.**	Students will carry out a range of practicals during the topic, some of which will be formally assessed for the practical endorsement qualification. **OC4 Alkenes** • Students outline the mechanisms for reactions • Students explain the formation of major and minor products by reference to the relative stabilities of primary, secondary and tertiary carbocation intermediates. • Students test organic compounds for unsaturation using bromine water and record their observations. • Students explain addition polymerisation.	OC4 Alkenes Test (40 marks)
PC7 Redox **OC5 Alcohols**	**PC7 Redox** **Be able to:** • **Write half equations assigning oxidation and reduction.** • **Write full balanced equations using oxidation states.** **OC5 Alcohols** **Be able to:** • **Carry out an experiment which oxidises alcohols and explain the oxidation of alcohols using reflux and**	Students will carry out a range of practicals during the topic, some of which will be formally assessed for the practical endorsement qualification. **PC7 Redox** • Students work out the oxidation state of an element in a compound or ion from the formula • Students write half-equations identifying the oxidation and reduction processes in redox reactions • Students combine half-equations to give an overall redox equation. **OC5 Alcohols** • Students outline the mechanism for the formation of an alcohol by the reaction of an alkene with steam in the presence of an acid catalyst. • Students carry out the preparation of an aldehyde by the	PC7 Redox Test (20 marks)

	distillation. • **Outline the mechanism of generating alcohols from alkenes.** • **Discuss how alcohols are produced industrially and their uses.**	oxidation of a primary alcohol. • Students carry out the preparation of a carboxylic acid by the oxidation of a primary alcohol. • Students outline the mechanism for the elimination of water from alcohols	
IC1 + IC2 Periodicity and group 2 **OC6 Organic Analysis**	**<u>IC1 + IC2 Periodicity and Group 2</u>** **Be able to:** • **Describe the term periodicity and the trends across the periods** • **Describe and explain trends in group 2** • **Describe and explain the reactions of Group 2 Metals.** **<u>OC6 Organic Analysis</u>** **Be able to:** • **Use IR and mass spectrometry to identify functional groups.**	Students will carry out a range of practicals during the topic, some of which will be formally assessed for the practical endorsement qualification. **<u>IC1 + IC2 Periodicity and Group 2</u>** • Students explain the trends in atomic radius and first ionisation energy • Students test the reactions of Mg–Ba with water and Mg with steam and record their results • Students test the solubility of Group 2 hydroxides by mixing solutions of soluble Group 2 salts with sodium hydroxide and record their results. • Students test the solubility of Group 2 sulfates by mixing solutions of soluble Group 2 salts with sulfuric acid and record their results. • Students test for sulfate ions using acidified barium chloride and record their results. **<u>OC6 Organic Analysis</u>** • Students carry out test-tube reactions in the specification to distinguish alcohols, aldehydes, alkenes and carboxylic acids. • Students should be able to use data in the Chemistry Data Sheet or Booklet to suggest possible structures for molecules.	Topic 3a: Quantitative Chemistry Test (40 marks)
IC3 Group 7	**<u>IC3 Group 7</u>** **Be able to:** • **Describe and explain the**	Students will carry out a range of practicals during the topic, some of which will be formally assessed for the practical endorsement qualification.	IC3 Group 7 Test (40 marks)

	properties in Group 7 • **Describe and explain the reactions of Group 7 elements including displacement reactions.**	**IC3 Group 7** • Students carry out test-tube reactions of solutions of the halogens with solutions containing their halide ions. • Students record observations from reactions of NaCl, NaBr and NaI with concentrated sulfuric acid. • Students carry out tests for halide ions using acidified silver nitrate, including the use of ammonia to distinguish the silver halides formed. •	