Chemistry Autumn Term Year 12		***Curriculum Checkpoints: What do students know and what can they do?***				***YT Clips***	Further guidance
Summative Comment		**Developing**	**Securing**	**Mastering**	**Excelling**		
Halogenoalkanes	**Substantive Knowledge**	Draw and name halogenoalkanes. Explain why OH^-, CN^-, and NH_3 behave as nucleophiles. Understand the role of ozone in the atmosphere. Understand how chlorine free radicals can be formed in the atmosphere from compounds such as CFCs	Classify halogenoalkanes as primary, secondary or tertiaqry Understand the different roles of the OH^- ion in nucleophilic substitution and elimination reactions. Explain the relative rate of reaction of halogenoalkanes.	Understand the concurrent nature of elimination and substitution when halogenoalkanes react with OH^-. Deszcribe the conditions that favour elimination over nucleophilic substitution Understand the mechanism for the depletion of ozone by chlorine free radicals.	Explain why more than 1 isomer may be formed in elimination reactions	https://www.youtube.com/watch?v=T5Hh70pZTM4	https://www.physicsandmathstutor.com/pdf-pages/?pdf=https%3A%2F%2Fpmt.physicsandmathstutor.com%2Fdownload%2FChemistry%2FA-level%2FNotes%2FAQA%2FOrganic-I%2FDetailed%2F3.3.%2520Halogenoalkanes.pdf
Halogenoalkanes	**Disciplinary Knowledge**	.	Write equations and mechanisms for reactions of halogenoalkanes with OH^-, CN^- and NH_3.	Write equations and mechanisms for elimination reaction of halogenoalkanes using OH^-	Evaluate the role of chemists in the introduction of legislation to ban the use of CFCs and to find replacements.		

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	Substantive Knowledge	Students should know that: Alkanes are saturated hydrocarbons. Alkanes are used as fuels. Cracking involves breaking C–C bonds in alkanes. Petroleum is a mixture consisting mainly of alkane hydrocarbons that can be separated by fractional distillation.	Be able to recall the reaction of methane with chlorine. Know that combustion of alkanes and other organic compounds can be complete or incomplete. Students should know that: Thermal cracking takes place at high pressure and high temperature and produces a high percentage of alkenes (mechanism not required). Catalytic cracking takes place at a slight pressure, high temperature and in the presence of a zeolite catalyst and is used mainly to produce motor fuels and aromatic hydrocarbons (mechanism not required).	Students shouod be able to how the internal combustion engine produces a number of pollutants including NOx, CO, carbon and unburned hydrocarbons. And that these gaseous pollutants from internal combustion engines can be removed using catalytic converters and that combustion of hydrocarbons containing sulfur leads to sulfur dioxide that causes air pollution. Students should be able to explain the economic reasons for cracking alkanes.	Students should be able to explain this reaction as a free-radical substitution mechanism involving initiation, propagation and termination steps. Students should be able to explain why sulfur dioxide can be removed from flue gases using calcium oxide or calcium carbonate.	https://www.youtube.com/watch?v=D2Iz_oQT6wY https://www.youtube.com/watch?v=WI1IXNQnKao&t=840s https://www.youtube.com/watch?v=x_DS7Otdh-Q	https://www.savemyexams.co.uk/a-level/chemistry/aqa/17/revision-notes/3-organic-chemistry/3-2-alkanes/

	Disciplinary Knowledge	Be able to represent oragnic compounds using: • empirical formula • molecular formula • general formula • structural formula • displayed formula • skeletal formula.		PS 4.1 Know and understand how to use a wide range of experimental and practical instruments, equipment and techniques	PS 1.2 Apply scientific knowledge to practical contexts		
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	Substantive Knowledge	Students should be able to: • define the term structural isomer • draw the structures of chain, position and functional group isomers • define the term stereoisomer Know the characteristics of a homologous series, a series of compounds containing the same functional group. Know the IUPAC rules for nomenclature.	Able to apply IUPAC rules for nomenclature to name organic compounds limited to chains and rings with up to six carbon atoms each • draw the structural formulas of E and Z isomers • apply the CIP priority rules to E and Z isomers. Understand that reactions of organic compounds can be explained using mechanisms.	Understand that E–Z isomerism is a form of stereoisomerism and occurs as a result of restricted rotation about the planar carbon–carbon double bond. Know and apply the Cahn–Ingold–Prelog (CIP) priority rules.	Can successfully 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. Is able to extend their knowledge to make educated guesses for drawing and naming molecules in relevant situations	https://www.youtube.com/watch?v=Xsc05N7CgK0&list=PL9louNCPbCxVvlG1z0tSP1zbfyR8O1EMx	https://www.savemyexams.co.uk/a-level/chemistry/aqa/17/revision-notes/3-organic-chemistry/3-1-introduction-to-organic-chemistry/3-1-1-functional-groups/ https://chemrevise.files.wordpress.com/2021/02/3.1-revision-guide-introduction-organic-aqa.pdf
	Disciplinary Knowledge	Be able to represent oragnic compounds using: • empirical formula • molecular formula • general formula • structural formula • displayed formula • skeletal formula.	Know the rules for mechanisms: • the unpaired electron in a radical is represented by a dot • the use of curly arrows represents the movement of a pair of electrons (not required for radical mechanisms but balanced equations for the steps in a free-radical mechanism are) • the formation of a covalent bond is shown by a curly arrow that starts from a lone electron pair or from another covalent bond • the breaking of a covalent bond is shown by a curly arrow starting from the bond. Students should be able to outline mechanisms by drawing the structures of the species involved and curly arrows to represent the movement of electron pairs		Start to apply the idea that organic molecules can be interchangeable via reaction pathways to change functional groups		
Chemistry Autumn Term Year 12		***Curriculum Checkpoints: What do students know and what can they do?***				***YT Clips***	Further guidance
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	Substantive Knowledge	Know that reactions can only occur when collisions take place between particles having sufficient energy. Know that the sufficient energy is called the activation energy. Know the meaning of the term rate of reaction.	Be able to sketch the Maxwell–Boltzmann distribution of molecular energies in gases. Know the qualitative effect of temperature changes on the rate of reaction. Know the qualitative effect of changes in concentration on collision frequency. Know the qualitative effect of a change in the pressure of a gas on collision frequency. Know that a catalyst is a substance that increases the rate of a chemical reaction without being changed in chemical composition or amount. Know that catalysts work by providing an alternative reaction route of lower activation energy.	Students should be able to use the Maxwell–Boltzmann distribution to explain why a small temperature increase can lead to a large increase in rate. Students should be able to explain how a change in concentration or a change in pressure influences the rate of a reaction. Students should be able to use a Maxwell–Boltzmann distribution to help explain how a catalyst increases the rate of a reaction involving a gas	Students should be able to answer questions that are asked in reverse, i.e. the reation rate has increased when the temperature has increased, what does this tell us about enthalpy	https://www.youtube.com/watch?v=zNemcKsH9eo https://www.youtube.com/watch?v=agjmj3Vy9xA https://www.youtube.com/watch?v=7BY2IUoFUUQ https://www.youtube.com/watch?v=m_9bpZep1QM	https://www.savemyexams.co.uk/a-level/chemistry/aqa/17/revision-notes/1-physical-chemistry/1-7-kinetics/1-7-1-collision-theory/
	Disciplinary Knowledge	Students should be able to: • define the term activation energy • explain why most collisions do not lead to a reaction.	Required practical 3: Investigation of how the rate of a reaction changes with temperature. Students should be able to draw and interpret distribution curves for different temperatures.				
Chemistry Autumn Term Year 12 **Summative Comment**		***Curriculum Checkpoints: What do students know and what can they do?***				***YT Clips***	Further guidance
		Developing	**Securing**	**Mastering**	**Excelling**		
Energetics	**Substantive Knowledge**	List examples of exothermic and endothermic reactions. Define enthalpy change and standard conditions. Recall the equation $q = mc\Delta T$	Define standard enthalpy changes of combustion and formation.	Understand Hess's law.	Explain why most bond enthalpies are mean values.	https://www.youtube.com/watch?v=3CausYwwrFo	https://www.savemyexams.co.uk/a-level/chemistry/aqa/17/revision-notes/1-physical-chemistry/1-6-energetics/
Energetics	**Disciplinary Knowledge**	Draw enthalpy profile diagrams for exothermic and endothermic reactions.	Write balanced equations, including state symbols, to represent the changes shown by standard enthalpy of formation and combustion.	Calculate ΔH for reactions using calorimetry experiment data. Use Hess's law to calculate enthalpy changes using enthalpies of formation and combustion. Calculate enthalpy changes using mean bond enthalpies.	Plan, carry out and evaluate an investigation to determine ΔH for a reaction using Hess's law and calorimetry. Suggest reasons to explain why a value of ΔH determined experimentally is different from the data book value.		
Chemistry Autumn Term Year 12 **Summative Comment**		***Curriculum Checkpoints: What do students know and what can they do?***				***YT Clips***	Further guidance
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	Substantive Knowledge	Know that ionic bonding involves electrostatic attraction between oppositely charged ions in a lattice. Know that metallic bonding involves attraction between delocalised electrons and positive ions arranged in a lattice. Knwo that a single covalent bond contains a shared pair of electrons. Know the forces between molecules: • permanent dipole–dipole forces • induced dipole–dipole (van der Waals, dispersion, London) forces • hydrogen bonding.	Understand that multiple covalent bonds contain multiple pairs of electrons. Be able to idetify the four types of crystal structure: • ionic • metallic • macromolecular (giant covalent) • molecular. (Being able to use the following as examples: diamond, graphite, ice, iodine, magnesium, sodium chloride) Electronegativity as the power of an atom to attract the pair of electrons in a covalent bond. Understand that a co-ordinate (dative covalent) bond contains a shared pair of electrons with both electrons supplied by one atom.	Students should be able to predict the shape of covalent molecules following the rules (pairs of electrons as charge clouds that repel each other, pairs of electrons in the outer shell of atoms arrange themselves as far apart as possible to minimise repulsion, lone pair–lone pair repulsion is greater than lone pair–bond pair repulsion, which is greater than bond pair–bond pair repulsion) Students can explain the effect of electron pair repulsion on bond angles. Know that the electron distribution in a covalent bond between elements with different electronegativities will be unsymmetrical and understand how this produces a polar covalent bond, and may cause a molecule to have a permanent dipole.	Explain that the melting and boiling points of molecular substances are influenced by the strength of these intermolecular forces. Explain the importance of hydrogen bonding in the low density of ice and the anomalous boiling points of compounds.	https://www.youtube.com/watch?v=EBcaw8SA5kw https://www.youtube.com/watch?v=6EePsoVMO_4 https://www.youtube.com/watch?v=sB2G6t6kDn8 https://www.youtube.com/watch?v=Tz4gzoqxvCQ	https://www.savemyexams.co.uk/a-level/chemistry/aqa/17/revision-notes/1-physical-chemistry/1-4-types-of-bonding--properties/1-4-2-ionic-bonding/
	Disciplinary Knowledge	Students should be able to: • predict the charge on a simple ion using the position of the element in the Periodic Table • construct formulas for ionic compounds. PS 1.1 Solve problems set in practical contexts PS 1.2 Apply scientific knowledge to practical contexts	Students should be able to represent: • a covalent bond using a line • a co-ordinate bond using an arrow.	Use angles and shapes in regular 2D and 3D structures Students should be able to: • relate the melting point and conductivity of materials to the type of structure and the bonding present • explain the energy changes associated with changes of state • draw diagrams to represent these structures involving specified numbers of particles. • use partial charges to show that a bond is polar • explain why some molecules with polar bonds do not have a permanent dipole.	Students should be able to: • explain the existence of these forces between familiar and unfamiliar molecules • explain how melting and boiling points are influenced by these intermolecular forces.		
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Amount of Substance	**Substantive Knowledge**	Define relative atomic mass (A_r) and relative molecular mass (M_r) Predict the charge on a simple ion using the position of the element in the periodic table.	Define empirical formula and molecular formula.	Explain the difference between empirical and molecula formulas. Write ionic equations.	Give economic, ethical and environmental advantages for society and industry of processes with a high atom economy.	https://www.youtube.com/watch?v=UQV9tLkQI3k&list=PL9PUvQuP85prWovEbJFOGcYVXQoRPVuaz	https://www.savemyexams.co.uk/a-level/chemistry/aqa/17/revision-notes/1-physical-chemistry/1-2-formulae-equations--calculations/1-2-1-relative-atomic-mass--relative-molecular-mass/
Amount of Substance	**Disciplinary Knowledge**	Determine relative molecular mass (M_r) of a substance using relative atomic mass (A_r) values. Carry out calculations using mass of substance, M_r and amount in moles, and using concentration, volume and amount of substance in a solution. Write balanced equations for reactions studied. Make up a volumetric solution.	Carry out calculations using the Avogadro constant. Carry out calculations using the ideal gas equation. Calculate empirical formula from data giving composition by mass or percentage by mass. Balance equations for unfamiliar reactions. Carry out a simple acid-base titration.	Calculate molecular formula from the empirical formula and relative molecular mass. Use balanced equations to calculate masses, volumes of gases, percentag yields, percentage atom economies and concentrations and volumes for reactions in solutions.	Carry out calculations involving back titrations. Evaluate methods for making up volumetric solutions and simple titrations.		
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Atomic Structure	**Substantive Knowledge**	Recall the relative charge and mass of protons, neutrons and electrons. Describe the structure of an atom in terms of protons, neutrons and electrons. Define first ionisation energy.	Define atoms and ions in terms of numbers of protons, neutrons and electrons. Explain the existence of isotopes. Give the electron structure of of atoms up to Z = 36 in terms of s, p and d sub-shells.	Describe how a time of flight mass spectrometer works. Explain trends in first and successive ionisation energies across a period and down a group. Give the electron structure of of ions up to Z = 36 in terms of s, p and d sub-shells.	Explain why the electron configutration of Cu and Cr are different from what is expected. Explain how first and successive ionisation energies in Period 3 and in Group 2 give evidence for electron configuration in sub-shells and in shells.	https://www.youtube.com/watch?v=6jKTbT81jY8&list=PL9IouNCPbCxXqcP3rJvu4_IqOf1Z_fWDJ	https://www.savemyexams.co.uk/a-level/chemistry/aqa/17/revision-notes/1-physical-chemistry/1-1-atomic-structure/1-1-1-fundamental-particles/
Atomic Structure	**Disciplinary Knowledge**	Determine the number of fundamental particles in atoms and ions using mass number, atomic number and charge. Write equations for ionisation energy.	Identify elements and calculate relative atomic mass from mass spectroscopy data. Write equations for first and successive ionisation energies.	Find the relative formula mass of compounds from mass spectroscopy data. Use $KE = 1/2\ mv^2$ and $v = d/t$ to find unknown values.	Explain why diatomic elements produce 3 peaks on a mass spectrum, and predict the relative size of the peaks, given percentage abundance of its isotopes. Rearrange $KE = 1/2\ mv^2$ and $v = d/t$ to solve more complex calculations.		