Curriculum Map Year 12 – Chemistry

Topic Name	Term	Content / skills developed with link to NC / exam board subject content (if applicable)	Reflection on previous learning	Progress to future learning	Global Citizenship links	Qatar National Identity links
Amount of Substances	Term 1	• Understand the terms atom, element, ion, molecule, compound, empirical formula, and molecular formula • Understand how calculations are performed using Avogadro constant • Understand the terms: relative atomic mass, relative molecular mass, relative formula, mass, molar mass, parts per million • Understand how to use experimental data to calculate empirical and molecular formulae	IGCSE Atomic Structure IGCSE Chemical formulae, equations, and calculations	AS atomic structure	prepare for future challenges with open-mindedness and respect. **PRIDE** **Independence and Dedication**	**Sustainability**: responsibility and creativity. **Conscious thinking** about my **Actions**
Amount of Substances - Calculating amounts of substance in equations using moles	Term 1	• Understand to use chemical equations to calculate reacting masses and vice versa using the concept of amount of substance and molar mass • Understand how to calculate volumes of gases and vice versa • Understand how to determine a formula or confirm an equation by experiment, including evaluation of the data CORE PRACTICAL 1	IGCSE Atomic Structure IGCSE Chemical formulae, equations, and calculations	AS atomic structure	prepare for future challenges with open-mindedness and respect. **PRIDE** **Independence and Dedication**	**Sustainability**: responsibility and creativity. **Conscious thinking** about my **Actions**

Amount of substances -	Term 1	• Understand how to calculate the concentration of a solution in mol dm−3and g dm−3 • Understand how to calculate percentage yields and percentage atom economies (by mass) in laboratory and industrial • Understand how to processes use chemical equations and experimental results • Understand how to relate ionic and full equations, with state symbols, to observations from simple test tube experiments.	iGCSE Atomic Structure IGCSE Chemical formulae, equations, and calculations	AS atomic structure		
Atomic Structure and the Periodic Table – Mass Spectrometry	Term 1	• Understand the structure of an atom in terms of electrons, protons, and neutrons • Know the relative mass and charge of protons, neutrons, and electrons • Understand what is meant by the terms 'atomic (proton) number' and 'mass number' • Understand the term 'isotope' • Understand the basic principles of a mass spectrometer	IGCSE – Atomic Structure IGCSE – Periodic table IGCSE – Ionic bonding	AS – Organic chemistry, alcohols, halogenoalkanes, and spectra A2 – Spectroscopy	prepare for future challenges with open-mindedness and respect. **PRIDE** **Independence and Dedication**	**Sustainability**: responsibility and creativity. **Conscious thinking** about my **Actions**
Atomic Structure and the Periodic Table – Ionisation energy and electron orbitals	Term 1	• Understand how to define first, second and third ionisation energies and understand that all ionisation energies are endothermic • Understand that an orbital is a region within an atom that can	IGCSE – Atomic Structure IGCSE – Periodic table IGCSE – Ionic bonding	AS- chemistry of groups 1, 2 and 7 elements	prepare for future challenges with open-mindedness and respect. **PRIDE**	**Sustainability**: responsibility and creativity. **Conscious thinking** about my **Actions**

		hold up to two electrons with opposite spins. • Understand how ionisation energies are influenced by the number of protons in the nucleus, the electron shielding and the sub-shell from which the electron is removed • Understand how to represent data, in a graphical form (including the use of logarithms of first ionisation energy on a graph) for elements 1 to 36 • Understand where the ideas about electronic configuration were developed from • Understand how to describe the shape of sand p orbitals • Understand that orbitals in sub-shells: i) each take a single electron before pairing up ii) pair up with two electrons of opposite spin			**Independence and Dedication**	
Atomic Structure – Electronic configuration and the periodic table	Term 1	• Predict the electronic configurations, using 1s notation and electrons-in -boxes notation, of first 36 atoms and ions • Understand that electronic configuration determines the chemical properties of an element	IGCSE – Atomic Structure IGCSE – Periodic table IGCSE – Ionic bonding	AS- chemistry of groups 1, 2 and 7 elements	prepare for future challenges with open-mindedness and respect. **PRIDE** **Independence and Dedication**	**Sustainability**: responsibility and creativity. **Conscious thinking** about my **Actions**

		• Understand that the Periodic Table is divided into blocks, such as s, p, and d • Understand how to represent data, in a graphical form (including the use of logarithms of first ionisation energy on a graph) for elements 1 to 36 • Explain: i the trends in melting and boiling temperatures of the elements of Periods 2 and 3 of the Periodic Table ii the general increase and the specific trends in ionisation energy of the elements across Periods 2 and 3 of the Periodic Table iii the decrease in first ionisation energy down a group				
Bonding and Structure – Ionic bonding	Term 1	• Understand and interpret evidence for the existence of ions, limited to physical properties of ionic compounds, • Understand electron density maps and migration of ions • Describe the formation of ions in terms of loss or gain of electrons • Understand the effects of ionic radius and ionic charge on the strength of ionic bonding • Understand reasons for the trends in ionic radii down a	IGCSE – Atomic Structure IGCSE – Periodic table IGCSE – Ionic bonding		prepare for future challenges with open-mindedness and respect. **PRIDE** **Independence and Dedication**	**Sustainability**: responsibility and creativity. **Conscious thinking** about my **Actions**

		group in the Periodic Table, and for a set of isoelectronic ions, e.g. N^{3-} to Al^{3+}				
Bonding and Structure – covalent bonding	Term 1	• Understand that covalent bonding is the strong electrostatic attraction between two nuclei and the shared pair of electrons between them, based on evidence. • Understand how to draw dot-and-cross diagrams to show electrons in simple covalent substances. • Understand how to discuss the different structures formed by giant lattices of carbon atoms, including graphite, diamond and graphene, and the application of these • Understand the meaning of the term electronegativity as applied to atoms in a covalent bond • Be able to distinguish between polar bonds and polar molecules and predict whether a given molecule is likely to be polar	IGCSE – Atomic Structure IGCSE – Periodic table IGCSE – Ionic bonding IGCSE – covalent bonding		prepare for future challenges with open-mindedness and respect. **PRIDE** **Independence and Dedication**	**Sustainability**: responsibility and creativity. **Conscious thinking** about my **Actions**
Bonding and Structure – Shapes of molecules and metallic bonding	Term 1	• Understand the principles of the electron-pair repulsion theory, used to interpret, and predict the shapes of simple molecules and ions • Understand the terms 'bond length' and 'bond angle'	IGCSE – Periodic table IGCSE – Ionic bonding IGCSE – metallic bonding			

		• Understand and explain the shapes of, and bond angles in, $BeCl_2$, BCl_3, CH_4, $NH_{3,}$ NH^{4+}, H2O, CO2, gaseous PCl_5, SF_6 and C2H4 • Understand and apply the electron-pair repulsion theory to predict the shapes of, and bond angles in other molecules and ions • Understand that metals consist of giant lattices of metal ions in a sea of delocalised electrons • Understand that metallic bonding is the strong electrostatic attraction between metal ions and the delocalised electrons				
Introduction to organic chemistry - Alkanes	Term 1	• Understand the concepts of homologous series and functional group • Understand how to apply the rules of IUPAC nomenclature • Understand key organic chemistry terminology and reactions such as addition, substitution, oxidation, reduction, or polymerisation • Understand the general formula of alkanes and cycloalkanes • Understand the term 'structural isomerism' and be able to draw the structural	IGCSE organic chemistry – crude oil and alkanes	Year 13 – Further organic chemistry Halogenoalkanes	prepare for future challenges.	**Conscious thinking** about my **Actions**

		isomers of organic molecules, given their molecular formula • Understand combustions and effects of burning hydrocarbons for complete and incomplete combustion • Understand the reasons for developing alternative fuels in terms of sustainability and reducing emissions, • Understand how to apply the concept of carbon neutrality to different fuels, such as petrol, bioethanol, and hydrogen				
Introduction to organic chemistry – reaction of alkanes	Term 1	• Understand the reactions of alkanes with i) oxygen in the air (combustion) ii) halogens • Understand the mechanism of the free radical substitution reaction between an alkane and a halogen • Understand the difference between hazard and risk • Understand the hazards associated with organic compounds and why it is necessary to carry out risk assessments when dealing with potentially hazardous materials • Understand ways by which risks can be reduced and reactions can be carried out safely, for example	IGCSE organic chemistry – crude oil and alkanes	Year 13 – Further organic chemistry Halogenoalkanes		

Alkenes	Term 1	• Understand the general formula of alkenes and understand that alkenes and cycloalkenes are hydrocarbons which are unsaturated (have a carbon-carbon double bond which consists of a σ and a πbond) • Understand geometric isomerism in terms of restricted rotation around a C=C double bond and the nature of the substituents on the carbon atoms • Understand the E-Z naming system for geometric isomers and why it is necessary to use this when the cis-and trans- naming system breaks down • Understand the different reactions of alkenes • Understand the qualitative test for a C=C double bond using bromine or bromine water • Understand the mechanism (including diagrams), giving evidence where possible of the electrophilic addition of bromine and hydrogen bromide to ethane and the electrophilic addition of hydrogen bromide to propene • Understand the addition polymerisation of alkenes and draw the repeat unit given the monomer, and vice versa	IGCSE organic chemistry – alkenes IGCSE organic chemistry – polymers	Year 13 – Further organic chemistry	prepare for future challenges with open-mindedness and respect.	**Sustainability**: responsibility and creativity my **Actions**

		• Understand the disposal of polymers				
Intermolecular Forces	Term 1	• Understand the nature of the following intermolecular forces; London forces, permanent dipole- permanent dipole and hydrogen bonds • Understand the interactions in molecules, such as H_2O, liquid NH_3 and liquid HF, which give rise to hydrogen bonding • Understand the anomalous properties of water resulting from hydrogen bonding • Predict the presence of hydrogen bonding in molecules analogous to those mentioned above • Understand, in terms of intermolecular forces, physical properties shown by substances • Understand factors that influence the choice of solvents	IGCSE – bonding	Year 13 – Further organic chemistry Halogenoalkanes	Developing skills for the future.	**Sustainability:** self-esteem and participation
Energetics	Term 2	• Understand that the enthalpy change, ΔH, is the heat energy change measured at constant pressure and that standard conditions are 100 kPa and a specified temperature, usually 298 K • Understand how to construct and interpret enthalpy level diagrams showing exothermic	IGCSE energetics IGCSE rates of reactions	Year 13 topic 12 – entropy and energetics	prepare for future challenges. **PRIDE** **Independence and Dedication**	**Sustainability**: responsibility and creativity my **Actions**

		and endothermic enthalpy changes • Understand key terminology for energetics • Understand how to use experimental data to calculate energy transferred in a reaction and enthalpy change of a reaction • Understand Hess's law • Understand how to evaluate the results obtained from experiments and comment on sources of error and uncertainty and any assumptions made in the experiments. • Understand enthalpy changes • Core practical 2				
Redox Reactions	Term 2	• Understand what is meant by the term 'oxidation number' and understand the rules for assigning oxidation numbers • Understand how to calculate the oxidation number of elements in compounds and ions, including in peroxides and metal hydrides • Understand how to indicate the oxidation number of an element in a compound or an ion, using a Roman numeral • Understand oxidation and reduction in terms of electron transfer and changes in	AS - Atomic structure IGCSE – ionic bonding IGCSE – Physical chemistry	A2 – Redox Equilibria	prepare for future challenges. **PRIDE: Responsibility** **and Engagement**	participation & creativity

		oxidation number, and the application of these ideas to reactions of s-block and p-block elements • Understand that a disproportionation reaction involves an element in a single species being simultaneously oxidised and reduced • Understand how negative and positive ions are formed • Understand how to write ionic half-equations and use them to construct full ionic equations				
Chemistry of groups 1 and 2 elements	Term 2	• Understand reasons for the trend in ionisation energy down Groups 1 and 2 • Understand reasons for the trend in reactivity of the elements down Group 1 (Li to K) and Group 2 (Mg to Ba) • Understand the reactions of the elements of Group 1 (Li to K) and Group 2 (Mg to Ba) with oxygen, chlorine, and water • Understand reactions of group 1 and 2 element oxides and hydroxides with dilute acid • Understand the trends in solubility of the hydroxides and sulfates of Group 2 elements • Understand the reasons for the trends in thermal stability of	IGCSE Periodic table IGCSE – alkali metals IGCSE reactivity series	A2 – Transition metals	prepare for future challenges with open-mindedness and respect **Pride** **Responsibility &** **Independence.**	**Conscious thinking** about my **Actions**

		the nitrates and the carbonates of the elements in Groups 1 and 2 in terms of the size and charge of the cations involved • Understand the formation of characteristic flame colours by Group 1 and 2 compounds in terms of electron transitions • Understand reactions, including ionic equations where appropriate • Understand how to calculate solution concentrations, in mol dm-3and g dm-3, including simple acid-base titrations using indicators Core practical 3 & 4				
Chemistry of group 7 elements	Term 2	• Understand reasons for the trends for Group 7 elements in physical properties, electronegativity, reactivity down the group • Understand the trend in reactivity of Group 7 elements in terms of the redox reactions of Cl_2, Br_2 and I_2 with halide ions in aqueous solution • Understand the following reactions: precipitation reactions of the aqueous anions Cl-, Br-and I-with aqueous silver nitrate solution, and the solubility of the precipitates in aqueous ammonia solutions	IGCSE periodic table IGCSE halogens IGCSE reactivity series	A2 – Transition metals	Developing skills for the future. **Pride** **Responsibility**	my **Actions,** my **Family and** my **Environment**

		• Understanding redox reactions of group 7 elements • Understand in terms of oxidation number the reactions of various halogens • Understanding a range of reactions of group 7 elements				
Introduction to Kinetics	Term 2	• Understand that reactions only take place when collisions have sufficient energy, known as the activation energy • Understand how to calculate the rate of a reaction from given data • Understand qualitatively in terms of, the Maxwell-Boltzmann distribution of molecular energies how changes in temperature affect the rate of a reaction • Understand the role of catalysts in providing alternative reaction routes of lower activation energy • Understand how to draw the reaction profiles for uncatalysed and catalysed reactions including the energy level of the intermediate formed with the catalyst • Understand the use of catalysts in industry to make processes more sustainable by using less energy and/or higher atom economy	IGCSE rates of reaction IGCSE reversible reactions and equilibria	A2 Kinetics	Developing skills for the future. **Pride** **Responsibility**	**Conscious thinking** about my **Actions** and my future

		• Understand how to interpret the action of a catalyst in terms of a qualitative understanding of the Maxwell-Boltzmann distribution of molecular energies				
Introduction to Equilibria	Term 2	• Understand that many reactions are readily reversible and that they can reach a state of dynamic equilibrium • Understand how to predict and justify the qualitative effects of changes of temperature, pressure, and concentration on the position of equilibrium in a homogeneous system • Understand how to evaluate data to explain the necessity, for many industrial processes, to reach a compromise between the yield and the rate of reaction	IGCSE rates of reaction IGCSE reversible reactions and equilibria	A2 chemical equilibria A2 Acid-base equilibria	Developing skills for the future. **Pride** **Responsibility**	**Conscious thinking** about my **Actions** and my future
Organic Chemistry – Halogenoalkanes	Term 2	• Understand how to classify reactions (including those in Unit 1) as addition, elimination, substitution, oxidation, reduction, hydrolysis, or polymerisation • Understand the concept of a reaction mechanism • Understand that heterolytic bond breaking results in species that are electrophiles or nucleophiles	IGCSE Organic chemistry alkanes AS Introduction to organic chemistry	A2 Organic synthesis		

		• Understand the nomenclature of halogenoalkanes and be able to draw their structural, displayed, and skeletal formulae • Understand the distinction between primary, secondary, and tertiary halogenoalkanes • Understand different reactions of halogenoalkanes • Core practical 5 and 6				
Organic Chemistry - Alcohols	Term 2	• Understand the nomenclature of alcohols and be able to draw their structural, displayed, and skeletal formulae • Understand the reactions of alcohols with various reactions • Understand what alcohols potassium dichromate (VI) in dilute sulfuric acid can oxidise • Understand, the techniques in the preparation and purification of a liquid organic compound	IGCSE organic chemistry - alcohols	A2 – organic chemistry and organic synthesis	prepare for future challenges with open-mindedness	**Sustainability**: responsibility and creativity **Conscious thinking** about my **Actions** and my future and my family
Organic Chemistry – Mass Spectra and IR	Term 2	• Understand how to interpret data from mass spectra to suggest possible structures of simple organic compounds using the m / z of the molecular ion and fragmentation patterns • Understand to use infrared spectra, or data from infrared	IGCSE organic chemistry AS – Mass spectrometry	A2 – Organic chemistry and organic synthesis	prepare for future challenges**.** **PRIDE: Responsibility and Engagement**	**Conscious thinking** about my **Actions** and my future

		spectra, to deduce functional groups present in organic compounds, and predict infrared absorptions, due to familiar functional groups • Core practical 8				