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Year 12 Chemistry Curriculum Unit Overview

Year 12 A Level Chemistry Module 1: Development of Practical Skills in Chemistry				
What are we learning?	**What knowledge, understanding and skills will we gain?**	**What does mastery look like?**	**How does this build on prior learning?**	**What additional resources are available?**
Independent thinking The use and application of scientific methods and practices Researching and referencing Use of instruments and equipment	**Knowledge** Selection of appropriate equipment; safe methods of working; identification and reduction of errors (random and systematic); calculation of uncertainties; problem solving; approaches to research; referencing systems; record keeping. **Understanding** Students will understand how to use a wide range of laboratory equipment to safely carry out relevant practical work in order to obtain accurate and reproducible results. **Skills** a) use of appropriate apparatus to record a range of measurements b) use of a water bath or electric heater or sand bath for heating c) measurement of pH d) use of laboratory apparatus for a variety of experimental techniques including titration, distillation and heating under reflux, qualitative tests for ions and organic functional groups and filtration e) use of a volumetric flask, including accurate technique for making up a standard solution f) use of acid–base indicators g) purification of a solid product by recrystallisation and a liquid product, including use of a separating funnel h) use of melting point apparatus i) use of thin layer or paper chromatography j) setting up of electrochemical cells and measuring voltages k) safely and carefully handling solids and liquids, including corrosive, irritant, flammable and toxic substances measurement of rates of reaction by at least two different methods.	The ability to work entirely independently when carrying out practical work. To work with a high level of safely, ensuring the health and safety of self and peers by carefully considering the hazards and risks associated with the task. The ability to design robust investigations alone or as part of a student team without teacher input. Consistently produce accurate results. Critical reflection and evaluation of results produced, and steps taken to improve in future tasks.	Further develops the practical skills acquired in GCSE Science / Chemistry from both the general practical activities and specifically from the Required Practicals	OCR year 1 textbook OCR year 2 textbook OCR practical skills guide

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Year 12 A Level Chemistry Module 2: Foundations of Chemistry				
What are we learning?	**What knowledge, understanding and skills will we gain?**	**What does mastery look like?**	**How does this build on prior learning?**	**What additional resources are available?**
Atomic structure Quantitative chemistry: formulae, equations, amount of substance and the mole Reactions of acids Oxidation number and redox reactions Bonding and structure	**Knowledge** - The number of electrons that can fill the first four shells and relate this to the Periodic Table; ionic bonding as electrostatic attraction between positive and negative ions; 'dot-and cross' diagrams; electronegativity; types of bonding and intermolecular forces; shapes of molecules **Understanding** - Atomic orbitals, can hold up to two electrons, with opposite spins; the shapes of s- and p-orbitals; the number of orbitals making up s-, p- and d-sub-shells; for the first three shells and the 4s and 4p orbitals. Reasons for solid structures of giant ionic lattices; the effect of structure and bonding on the physical properties of ionic compounds; covalent bond are strong electrostatic attraction between a shared pair of electrons and the nuclei of the bonded atoms. Electronegativity as the ability of an atom to attract the bonding electrons in a covalent bond; explain polar bonds and permanent dipoles within molecules and of polar molecules with an overall dipole. Intermolecular forces are based on permanent dipole–dipole interactions and induced dipole– dipole interactions; hydrogen bonding is intermolecular bonding between molecules containing N, O or F and the H atom of –NH, –OH or HF Including the role of lone pairs. The solid structures of simple molecular lattices, as covalently bonded molecules attracted by intermolecular forces; explanation of the effect of structure and bonding on the physical properties of covalent compounds with simple molecular lattice structures **Skills** - Deduction of the electron configurations of atoms and ions using various sources of information; construction of 'dot-and cross; diagrams of molecules and ions to describe single, multiple and dative covalent bonding; the use of electron pair repulsion to explain the following shapes of molecules and ions: linear, non-linear, trigonal planar, pyramidal, tetrahedral and octahedral	The ability to work entirely independently when carrying out calculations. Extensive understanding of the Periodic Table and how it is related to electron structure. Flawless application chemical knowledge to solve problems. Comprehensive understanding of the manipulation of equations, both chemical and mathematical. Consistently produce accurate results from calculations. Critical reflection and evaluation of work produced, and steps taken to improve in future tasks.	This module builds directly from GCSE Science, starting with basic atomic structure and isotopes. Important basic chemical skills are developed: writing chemical formulae, constructing equations and calculating chemical quantities using the concept of amount of substance. The role of acids, bases and salts in chemistry is developed in the context of neutralisation reactions. Redox reactions are studied within the context of oxidation number and electron transfer. The idea of atomic orbitals is developed to give a deeper understanding of electron configurations linked to the periodic table. The role of electrons bonding is studied in much greater depth than at GCSE and includes, including an explanation of polarity and intermolecular forces.	OCR year 1 textbook OCR year 2 textbook OCR practical skills guide

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Year 12 A Level Chemistry Module 3: The periodic table and Energy				
What are we learning?	**What knowledge, understanding and skills will we gain?**	**What does mastery look like?**	**How does this build on prior learning?**	**What additional resources are available?**
The periodic table: periodic and group properties Enthalpy changes and their determination Rates of reaction Reversible reactions and chemical equilibrium Consideration of energy and yield in improving sustainability.	**Knowledge** - Periodicity; Group 2; the halogens; characteristic reactions of halide ions; tests for ions; enthalpy changes; activation energy; exothermic (∆H, negative) and endothermic (∆H, positive) reactions; enthalpy profile diagrams; average bond enthalpy; Hess' law; reaction rates; role of a catalyst; homogeneous and heterogeneous catalysts; Boltzmann distribution. **Understanding** - The Periodic Table as the arrangement of elements increasing atomic; trends in first ionisation energy; types of bonding and how it affects properties; explanation of physical properties of giant metallic and giant covalent lattices; melting points across Periods 2 and 3; Group 2; relative reactivities of the Group 2 elements Mg → Ba; trend in reactivity in terms of the first and second ionisation energies; physical properties the halogens; trend in the boiling points in terms of induced dipole–dipole interactions; trend in reactivity of the halogens; disproportionation; reactions of halide ions; tests for ions. Enthalpy changes; exothermic (∆H, -ve) or endothermic (∆H, +ve); activation energy; standard conditions and states; enthalpy change of reaction, formation and neutralisation; Hess' law Reaction rates; collision theory; effect of concentration, including the pressure of gases; the role of a catalyst; homogeneous and heterogeneous catalysts; Boltzmann distribution and activation energy; catalytic behaviour **Skills** - Testing for ions; enthalpy calculations; constructing Hess cycles; construction of enthalpy profile diagrams; determination of enthalpy changes directly from experimental results; calculation of reaction rate from the gradients of graphs; the techniques and procedures used to investigate reaction rates.	The ability to work entirely independently when carrying out calculations. Extensive understanding of the Periodic Table and how it is related to electron structure. Flawless application chemical knowledge to solve problems. Comprehensive understanding of the manipulation of equations, both chemical and mathematical. Consistently produce accurate results from calculations and practical work. Critical reflection and evaluation of work produced, and steps taken to improve in future tasks.	Periodic trends builds on GCSE to give understanding of structure, bonding and properties of Groups 2 and 7. An understanding of redox reactions is developed further. Analysis of unknown ionic compounds using simple test-tube tests is introduced. Enthalpy changes, their uses and determination from experimental results, including enthalpy cycles, extends the simple ideas from GCSE. Rate of reaction, activation energy, the Boltzmann distribution and catalysis are given a mathematical dimension. Reversible reactions are then studied and calculations relating to equilibrium are introduced.	OCR year 1 textbook OCR year 2 textbook OCR practical skills guide

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Year 12 A Level Chemistry Module 4: Core Organic Chemistry				
What are we learning?	**What knowledge, understanding and skills will we gain?**	**What does mastery look like?**	**How does this build on prior learning?**	**What additional resources are available?**
Nomenclature and formula representation Functional groups, organic reactions and isomerism Aliphatic hydrocarbons, alcohols and haloalkanes Organic practical skills and organic synthesis Instrumental analytical techniques to provide evidence of structural features in molecules.	**Knowledge** Concepts of organic chemistry; homologous series; structural isomers; bond fission; properties of alkanes; properties of alkenes; addition reactions of alkenes; polymers; properties and reactions of alcohols; haloalkanes; concerns from use of organohalogens; infrared spectroscopy; mass spectrometry. **Understanding** IUPAC rules of nomenclature; general, structural displayed and skeletal formula; homologous series; functional groups; aliphatic, aromatic and alicyclic compounds; saturated and unsaturated; isomers; free radical substitution; properties of alkanes; reactions of alkanes; properties of alkenes; reactions of alkenes; E/Z isomerism; Cahn–Ingold–Prelog priority; electrophile; electrophilic addition; Markownikoff's rule; addition polymerisation; biodegradable and photodegradable polymers. Properties of alcohols; primary, secondary and tertiary alcohols; combustion of alcohols; oxidation of alcohols by an oxidising agent to form aldehydes, ketones and carboxylic acids; dehydration of alcohols; hydrolysis of haloalkanes; nucleophiles; nucleophilic substitution; trend in the rates of hydrolysis of primary; CFCs in the upper atmosphere; elemental analysis, infrared spectroscopy and a mass spectrometry to identify the molecules **Skills** Deducing the structure of molecules from names and vice versa; use of Quickfit glassware; reflux and distillation; preparation and purification of an organic liquid; two-stage synthetic routes for preparing organic compounds.	The ability to work entirely independently when carrying out calculations. Extensive understanding of the Periodic Table and how it is related to electron structure. Flawless application chemical knowledge to solve problems. Comprehensive understanding of the manipulation of equations, both chemical and mathematical. Consistently produce accurate results from calculations. Critical reflection and evaluation of work produced, and steps taken to improve in future tasks.	Basic concepts and hydrocarbons is fundamental to the study of organic chemistry later in the topic and build on Module 2. Various types of structures used routinely in organic chemistry, nomenclature, and the important concepts of homologous series, functional groups, isomerism and reaction mechanisms using curly arrows are introduced. The initial ideas are then developed within the context of the hydrocarbons: alkanes and alkenes. Alcohols, haloalkanes and analysis introduces two further functional groups and considers the importance of polarity and bond enthalpy to organic reactions. The important techniques of infrared spectroscopy and mass spectrometry are used to illustrate instrumental analysis as a valuable tool for identifying organic compounds and form the basis further study in Module 6	OCR year 1 textbook OCR year 2 textbook OCR practical skills guide