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Year 13 Chemistry Curriculum Unit Overview

Year 13 A Level Chemistry Module 5: Physical Chemistry and Transition Elements Part of this topic will be reviewed in the first two weeks of September as some content is covered towards the end of year 12.				
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?**
Rate equations, orders of reaction, the rate determining step Equilibrium constants, Kc and Kp Acid–base equilibria including pH, Ka and buffer solutions Lattice enthalpy and Born–Haber cycles Entropy and free energy Electrochemical cells Redox chemistry Transition elements	**Knowledge** Orders, rate equations and rate constants; equilibrium; Kc , Kp and other constants; acids, bases and buffers; Brønsted–Lowry acids and bases; acid dissociation constant, Ka; buffer solutions; titration curves; lattice enthalpy; Born–Haber cycles; enthalpy and entropy; free energy change; redox; half equations; standard electrode potential; transition elements; ligands; complex ions; stereoisomerism; qualitative analysis. **Understanding** Rate of reaction, order, overall order, rate constant, half-life, rate-determining step; Arrhenius equation; exponential relationship between k and temperature; mole fraction and partial pressure; chemical equilibrium; Kc and Kp; qualitative effect of changing temperature; effect of a catalyst. Brønsted–Lowry acids and bases; the role of H+ in the reactions of acids; the acid dissociation constant, Ka, and pKa; expression for pH; ionic product of water, Kw; buffer solutions; titration curves; choice of indicators; lattice enthalpy; Born–Haber cycles; enthalpy change of solution and hydration; entropy as the dispersal of energy in a system; free energy change, ΔG; redox; oxidising and reducing agents; half equations and oxidation numbers; standard electrode and cell potential; feasibility of reactions; fuel cells. Properties of transition elements; multiple oxidation states; coloured ions; ligands and their reactions;	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.	The largely qualitative treatment of reaction rates and equilibria encountered in Module 3 is developed within a quantitative and graphical context. Learners also develop practical quantitative techniques involved in the determination of reaction rates and pH. Born–Haber cycles are used to illustrate the energy changes associated with ionic bonding. Entropy and free energy are introduced as concepts used to predict quantitatively the feasibility of chemical change. Redox introduced in Module 2 is developed further, including use of volumetric analysis for redox titrations and an introduction of electrochemistry and	OCR year 1 textbook OCR year 2 textbook OCR practical skills guide

	nature of complex ions; cis-platin as a drug; reactions, redox reactions including ionic equations, and the accompanying colour changes; disproportionation. **Skills** Deduction of orders from experimental data and a rate equation from orders; calculation of the rate constant, k, and related quantities including by graphical methods; investigate the reaction rates by the initial rates method and by continuous monitoring, including colorimetry; calculation of quantities at equilibrium; calculations of Kc and Kp, pH and buffers; measuring; calculation of the entropy; titration; measurement of cell potentials; qualitative analysis of ions.	Consistently produce accurate results from calculations and practical work. Critical reflection and evaluation of work produced, and steps taken to improve in future tasks.	electrode potentials. Transition elements provides learners with a deeper knowledge and understanding of the periodic table within the context of the transition elements including the role of ligands in complex ions, stereochemistry, precipitation, ligand substitution and redox reactions.	

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Year 13 A Level Chemistry Module 6: Organic Chemistry and Analysis Part of this topic will be reviewed in the first two weeks of September as some content is covered towards the end of year 12.				
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?**
Aromatic compounds Carboxylic acids and esters Organic nitrogen compounds: amines and amino acids Polymerisation: addition and condensation polymers Synthetic organic chemistry and further development of practical skills Modern analytical techniques in organic analysis.	**Knowledge** Aromatic compounds; electrophilic substitution reactions; phenols; carbonyl compounds, aldehydes and ketones; nucleophilic addition reactions; carboxylic acids and esters; amines; chirality; extending carbon chain length; organic synthesis; preparing organic compounds; chromatography; NMR spectroscopy; combined techniques. **Understanding** Kekulé and delocalised models of benzene; evidence for a delocalised model; naming aromatic compounds; mechanism for electrophilic substitution of aromatic compounds; Friedel–Crafts reactions; relative resistance to bromination of benzene; phenol and its reactions; substitution of phenol compared with benzene, directing effects, Oxidation of aldehydes; nucleophilic addition reactions of carbonyl compounds to form alcohols and hydroxynitriles; reduction of carbonyls; properties of carboxylic acids; esterification and hydrolysis acyl chlorides from $SOCl_2$; basicity and preparation of amines; amino acids, amides and chirality;	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.	Aromatic compounds, carbonyls and acids extends the range of functional groups encountered in Module 4. This includes aromatic compounds and the central role of delocalisation within the chemistry of arenes and phenols. Directing groups are also introduced, including their importance to organic synthesis. The important carbonyl compounds, aldehydes and ketones, and carboxylic acids are then studied. Nitrogen compounds, including amines, amides and amino acids and is new material. Chirality and optical isomerism are introduced. Condensation polymerisation is also introduced and compared with addition polymerisation, explored in year 12. The importance of carbon–carbon bond formation in organic synthesis is stressed and multi-stage synthetic routes towards an organic product are developed. A range of new practical skill are also introduced Analysis develops and complements the spectroscopic areas of organic chemistry previously encountered. This section demonstrates how analytical techniques introduced in Module 4 (IR spectroscopy, mass spectrometry and elemental analysis) may be used in combination with NMR spectroscopy to	OCR year 1 textbook OCR year 2 textbook OCR practical skills guide

	structures of primary and secondary amides; optical; condensation polymerisation to form polyesters and polyamides Extending carbon chain length; reaction of nitriles; route for organic synthesis; types of chromatography; principles of C13 and proton NMR spectroscopy; high resolution proton; use of TMS, and $CDCl_3$ and D_2O; combined techniques **Skills** Interpretation of unfamiliar electrophilic substitution reactions of aromatic compounds; 2,4-dinitrophenylhydrazine and other tests for carbonyls; use of melting point apparatus; preparation and purification of organic solids involving use of a range of; measurement of melting points; multi-stage synthetic routes TLC chromatograms in terms of Rf values; interpretation of gas chromatograms; use of IR and NMR spectroscopy to identify molecules.		provide evidence of structural features in molecules.	