Science Department - Year 13 Chemistry

Shirley High Curriculum Map

The course helps to bring the subject to life and inspire students to achieve more. It is a teacher-friendly specification based on extensive research and engagement with the teaching community. The course is designed to be straightforward and accessible so that the delivery is tailored to suit the needs of the students. We aim to encourage learners to apply the basic skills acquired in the previous year. At this stage students are to a large extent responsible for their own learning and should be confident in discussing ideas, innovative and engaged. They should be able to apply the concepts learnt to world issues.

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
	Theme/Topic/Skill:	Theme/Topic/Skill:	Theme/Topic/Skill:	Theme/Topic/Skill:	Theme/Topic/Skill:	Theme/Topic/Skill:
	Module 5 (Physical chemistry): Equilibrium, Module 6 (Organic Chemistry): Carbonyl compounds	Module 5: Acids, bases and pH; Buffers and neutralisation Module 6: Amines, amino acids and polymers	Module 5: Enthalpy and Entropy; Redox and electrode potential Module 6: Organic synthesis; Chromatography	Module 5: Transition Elements and Revision of Physical and Inorganic chemistry Module 6: Spectroscopy and Revision of Organic Chemistry	Revision and practice	External exams
Why now?	Appreciation of industrial reactions/ maths skills development. Organic chemistry in development of important compounds (e.g. medicine)	Importance of pH in chemical and biological processes; Development of organic materials and links between chemistry and biology	Prediction of the feasibility of reactions. Development of organic materials and importance of chemical analysis in different industries	The importance of complex ions in chemical and biological systems; use of chemical analysis in different industries		
Fundamental Concepts	Chemical equilibrium and Equilibrium constant Carbonyl compounds, carboxylic acids and derivatives	Bronsted-Lowry acids and bases, dissociation constant, buffers and neutralisation; Amines, amino acids , optical isomers; polymers	Lattice enthalpy; enthalpy changes; Entropy; Free energy; Redox; electrode potential; C-C bond formation; Synthetic routes; chromatography	d-block elements in terms of electronic configuration properties and formation of complex ions; NMR, IR and Mass Spectroscopy		
Students will…	Demonstrate knowledge, understanding and application of: - Expressions and calculations for K_c and K_p for homogeneous and heterogeneous equilibria, including determination of units; calculation of quantities present at equilibrium; - Application of K_c and K_p to other equilibrium constants - Nomenclature and reactions of aldehydes and ketones – nucleophilic addition and reactions and mechanisms. - Qualitative analysis to identify and distinguish between carbonyl compounds - Properties and reactions of carboxylic acids; esterification and ester hydrolysis; formation and use of acyl chlorides.	Demonstrate knowledge, understanding and application of: - Bronsted Lowry model, conjugate acid-base pairs, monobasic, dibasic and tribasic acids; strong and weak acids; pH and strong acids. - acid dissociation constant (K_a) and converting between K_a & pK_a; calculating pH and pK_a and limitations of such calculations. - pH and strong bases; - Buffer solutions & application; - neutralisation and pH curves - Properties, preparation and reactions of amines; - Structure and properties of amino acids and their reactions; - Optical isomers, chirality; - condensation polymers: polyesters & polyamides; hydrolysis of condensation polymers	Demonstrate knowledge, understanding and application of: - Calculation of Lattice enthalpy and use of Born -Haber cycles; - enthalpy changes in solution; enthalpy cycles related to hydration; - factors affecting lattice and hydration enthalpy; - Calculation of entropy changes; Free Energy, Gibbs' equation; - Use of redox equations and half equations; interpretation and prediction of reactions involving electron transfer; - Procedures of Redox titrations; calculations involving electrode potential; - Use of C-C bond formation in increasing length of carbon chain; formation of nitriles including mechanisms; F-C Alkylation and acylation; - Description of further organic practical techniques and synthetic routes; Description of chromatography techniques	Demonstrate knowledge, understanding and application of: - d-block elements (electronic configuration and variable oxidation states). - formation of dative bonds between ions and ligands in the formation of complex ions. ligand substitution reactions and precipitation reactions - cis trans and optical isomerism - redox reactions and accompanying colour changes and their use in qualitative analysis - the use of C13 and proton NMR spectroscopy in making predictions of possible structures for an unknown molecule - Deduction of the structure of organic compounds from a combination of techniques (MS, IR, NMR and elemental analysis)		
Language for Life (Key terms /Vocabulary)	Equilibrium constant; Homogeneous, heterogeneous; Mole fractions, partial pressure, Nucleophilic, hydrolysis	Conjugate acid-base pairs; approximations; stereoisomerism, chirality, enantiomers	Lattice enthalpy, ionisation energy, hydration, feasibility, electrochemical cells; cell potentials	Complex ions, ligand, bidentate , spin-spin coupling, proton exchange		
Extended writing Opportunities	Description of qualitative analysis to identify and distinguish between carbonyl compounds; Description of synthesis, purification and analysis of aspirin PAG write-up	Description of titration procedure and the use of buffer solutions;	Description of redox titration procedures; Description of Qualitative analysis for unknown organic and inorganic groups;	Description of the properties of transition metals and the use of qualitative analysis to identify specific elements		
Maths Across the Curriculum	changing subject of equation; use of algebraic equations; (calculations involving equilibrium constants)	Finding logarithms and their inverse (pH and H+ calculations); Visualising and representing 2 -D and 3-D structures (isomerism)	Finding arithmetic means (titrations); calculation of entropy, free energy; Calculation of R_f values in chromatography	Using angles and shapes in regular 2-D and 3-D structures (predicting shapes of bonds and angles in complex ions) Translating information between graphical, numerical and algebraic forms (interpreting and analysing spectra)		
Links to careers/ aspirations	Chemist; research scientist; pharmaceuticals; engineering, manufacturing; environmental science; Food industry, etc.	Chemist; research scientist; pharmaceuticals; engineering, manufacturing; environmental science; Food industry, etc	Chemist; research scientist; pharmaceuticals; engineering, manufacturing; environmental science; Food industry, etc	Chemist; research scientist; pharmaceuticals; engineering, manufacturing; environmental science; Food industry, etc		
Cultural Capital						
Practical Application of Skills: Module 1: Development of Practical Skills in Chemistry	Determination of quantities present in a mixture at equilibrium. Reactions of carbonyl compounds; Practicals to demonstrate acidic nature of carboxylic acids, e.g. reaction with metals, carbonates and bases. Synthesis and hydrolysis of esters (PAG 6 and 7)	Measurement of pH of a range of strong and weak acids and strong bases. Investigations of buffer behaviour. Production of pH titration curves. (PAG11) Synthesis and hydrolysis of polymers (Making Nylon 6-6)	Determination of enthalpy change of solution; Investigation of an endothermic reaction in terms of entropy (PAG 3); Redox titrations. Measurement of cell potentials. (PAG 8); Synthesis of an organic solid. (PAG 6); TLC; Qualitative analysis of organic functional groups. (PAG 7)	Reactions of transition elements: • ligand substitution • precipitation • redox reactions catalytic behaviour Qualitative analysis of inorganic ions. (PAG 4)		