West Kirby Grammar School

Curriculum Map – Year 13 – Chemistry (Teacher 2)

Topic Name	Term	Skills Developed	Link to NC Subject Content	Next link in curriculum	Other Notes
3.3.8 Aldehydes and Ketones	*Autumn 1*	**AT b, d and k** **PS 2.2** Students could carry out test-tube reactions of Tollens' reagent and Fehling's solution to distinguish aldehydes and ketones. **Students should be able to:** • write overall equations for reduction reactions using [H] as the reductant • outline the nucleophilic addition mechanism for reduction with $NaBH_4$,nucleophile shown as H^- • write overall equations for the formation of hydroxynitriles • outline the nucleophilic addition mechanism for the reaction with KCN followed by dilute acid • explain why nucleophilic addition reactions of KCN, followed by dilute acid, can produce a mixture of enantiomers.	Tollens' gives a silver mirror with aldehydes and Fehling's changes from blue to red/orange Reduction of aldehydes The nucleophilic addition reactions of carbonyl compounds with KCN, followed by dilute acid, to produce hydroxynitriles. Aldehydes and unsymmetrical ketones form mixtures of enantiomers when they react with KCN followed by dilute acid. The hazards of using KCN.	Organic Synthesis	Building on knowledge from AS Alcohols Unit

3.3.9 Carboxylic Acids and Derivatives	*Autumn 1*	**AT b, d, g and k** **PS 4.1** Students could make esters by reacting alcohols with carboxylic acids, purifying the product using a separating funnel and by distillation. **AT b, d, g, h and k** Students could identify an ester by measuring its boiling point, followed by hydrolysis to form the carboxylic acid, which is purified by recrystallisation, and determine its melting point. **AT b, c, d and k** Students could make soap. **AT b and k** Students could make biodiesel.	Esterification Reactions Ester Hydrolysis Alkaline hydrolysis of fats to give soap and glycerol. Biodiesel is produced by reacting vegetable oils with methanol in the presence of a catalyst.	Organic Synthesis	Carboxylic Acids met previously in AS Alcohols unit

3.3.9 Carboxylic Acids and Derivatives - Acylation	Autumn 2	**AT d and k** **PS 2.2** Students could record observations from reaction of ethanoyl chloride and ethanoic anhydride with water, ethanol, ammonia and phenylamine. **AT b, d, g and h** **PS 2.1, 2.3 and 4.1** Students could carry out the preparation of aspirin, purification by recrystallisation and determination of its melting point. Students could carry out the purification of impure benzoic acid and determination of its melting point.	The structures of: • acid anhydrides • acyl chlorides • amides. The nucleophilic addition–elimination reactions of water, alcohols, ammonia and primary amines with acyl chlorides and acid anhydrides. Industrial advantages of ethanoic anhydride over ethanoyl chloride in the manufacture of the drug aspirin. **Students should be able to** outline the mechanism of nucleophilic addition–elimination reactions of acyl chlorides with water, alcohols, ammonia and primary amines.	Organic Synthesis	**Required practical 10** Preparation of: -a pure organic solid and test of its purity -a pure organic liquid.

3.3.16 Chromatography	*Autumn 2*	**AT a, i and k** **PS 1.2, 3.2 and 4.1** Students could use thin-layer chromatography to identify analgesics. Students could use thin-layer chromatography to identify transition metal ions in a solution. **Students should be able to:** • calculate R_f values from a chromatogram • compare retention times and R_f values with standards to identify different substances.	Types of chromatography include: • thin-layer chromatography (TLC) • column chromatography (CC) • gas chromatography (GC) Retention times and R_f values are used to identify different substances.		**Required practical 12** Separation of species by thin-layer chromatography. Good to combine with Required Practical 10
3.3.10 Aromatic Chemistry	*Spring 1*	Students should be able to outline the electrophilic substitution mechanisms of: • nitration, including the generation of the nitronium ion • acylation using AlCl3 as a catalyst.	Bonding in a benzene ring Delocalisation and stability Electrophilic substitution Friedel–Crafts acylation reactions	Organic Synthesis	

3.3.11 Amines	*Spring 1*	Students should be able to explain the difference in base strength in terms of the availability of the lone pair of electrons on the N atom	Preparation of amines Aromatic amines and uses Amines as weak bases Amines are nucleophiles Mechanism of formation of primary, secondary, tertiary amines and quaternary ammonium salts. The nucleophilic addition–elimination reactions	3.3.14 Organic Synthesis	Builds on knowledge of nucleophilic substitution at AS
3.3.12 Polymers	*Spring 1*	**PS 1.2** Making nylon 6,6 **Students should be able to:** • draw the repeating unit from monomer structure(s) • draw the repeating unit from a section of the polymer chain • draw structure(s) of monomer(s) from a section of polymer • explain nature of intermolecular forces between molecules of condensation polymers	Condensation polymers reactions : • dicarboxylic acids and diols • dicarboxylic acids and diamines • amino acids. Polyalkenes are chemically inert and non-biodegradable Polyesters and polyamides can be broken down by hydrolysis and are biodegradable Advantages and disadvantages of different methods of disposal of polymers, including recycling		Link to Addition Polymers met in Year 12

3.3.14 Organic Synthesis	*Spring 2*	**Students should be able to:** • explain why chemists aim to design processes that do not require a solvent and that use non-hazardous starting materials • explain why chemists aim to design production methods with fewer steps that have a high percentage atom economy • use reactions in this specification to devise a synthesis, with up to four steps, for an organic compound.	The synthesis of an organic compound can involve several steps		Brings together knowledge of all organic reactions and uses of products
3.3.15 Nuclear Magnetic Resonance Spectroscopy	*Spring 2*	Students should be able to use data in the Chemistry Data Booklet to suggest possible structures for molecules. **Students should be able to:** • explain why TMS is a suitable substance to use as a standard • use ^{1}H NMR and ^{13}C NMR spectra and chemical shift data from the Chemistry Data Booklet to suggest possible structures or part structures for molecules	Interpretation of nuclear magnetic resonance (NMR) of ^{13}C or ^{1}H atoms in a molecule.		

		• use integration data from ^{1}H NMR spectra to determine the relative numbers of equivalent protons in the molecule • use the n+1 rule to deduce the spin–spin splitting patterns of adjacent, non-equivalent protons, limited to doublet, triplet and quartet formation in aliphatic compounds.			
3.1.12 Acids and Bases	*Spring 2 / Summer 1*	MS 0.4 - Students carry out pH calculations. MS 2.5 - Students could be given concentration values and asked to calculate pH or vice versa. **Students should be able to:** Convert concentration of hydrogen ions into pH and vice versa Calculate the pH of a solution of a strong acid from its concentration. Use K_w to calculate the pH of a strong base from its concentration. Perform calculations relating the pH of a weak acid to the concentration of the acid and the dissociation constant, K_a Convert K_a into p K_a and vice versa.	Brønsted–Lowry acid–base equilibria in aqueous solution Definition and determination of pH **The ionic product of water, Kw** $K_w = [H^+][OH^-]$ **Weak acids and bases Ka for weak acids** K_a is the dissociation constant for a weak acid. $pK_a = -\log_{10} K_a$		**Required practical 9** Investigate how pH changes when a weak acid reacts with a strong base and when a strong acid reacts with a weak base.

		Perform calculations for these titrations based on experimental results. Sketch and explain the shapes of typical pH curves Use pH curves to select an appropriate indicator. Explain qualitatively the action of acidic and basic buffers Calculate the pH of acidic buffer solutions.	**pH curves, titrations and indicators** Typical pH curves for acid–base titrations in all combinations of weak and strong monoprotic acids and bases. **Buffer action** A buffer solution maintains an approximately constant pH, despite dilution or addition of small amounts of acid or base. Acidic buffer solutions contain a weak acid and the salt of that weak acid. Basic buffer solutions contain a weak base and the salt of that weak base. Applications of buffer solutions.		