Chemistry – Year 13 Organic Chemistry Curriculum

	Content (Intent)	Links to prior learning	Skills and Assessment (Implementation)	Expected Learning Outcomes (Impact)
Term 1	**Nomenclature and Isomerism** • Naming organic compounds • Reactions of the carbonyl group • Optically active compounds • Aldehydes • Ketones • Carboxylic acids • Acylation	Nomenclature and Isomerism from Y12, oxidation of alcohols from Y12, RP5 and 6 from Y12	Skills: Practical Skills – RP 10A and B Maths skills – calculating % yield and atom economy. Visualisation of molecules in 3D space Assessment: End of topic test covering content from this topic and previous topics. Test includes multiple choice, structured, closed short answer, and open response questions	• define the terms Optical isomerism, chirality, chiral centre, enantiomers, racemic mixture (racemate). • draw the structural formulas and displayed formulas of enantiomers • understand how racemic mixtures (racemates) are formed and why they are optically inactive. • write overall equations for reduction reactions using [H] as the reductant • outline the nucleophilic addition mechanism for reduction reactions with NaBH4 (the nucleophile should be shown as H–) • write overall equations for the formation of hydroxynitriles using HCN • 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 • describe the structures, properties, uses and reactions of carboxylic acids, esters, acyl chlorides and acid anhydrides • outline the nucleophilic addition elimination reaction for acyl chlorides or acid anhydrides with a variety of nucleophiles

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Term 2	**Aromatic chemistry** • physical properties, structure and bonding and reactions of arenes	Alkenes topic from Y12	Practical Skills – RP 10A and B Maths skills – calculating % yield and atom economy. Angles, bond enthalpy calculations Assessment: End of topic test covering content from this topic and previous topics. Test includes multiple choice, structured, closed short answer, and open response questions	• Describe and explain the nature of the bonding in a benzene ring, • use thermochemical evidence from enthalpies of hydrogenation to account for this extra stability • explain why substitution reactions occur in preference to addition reactions • outline the electrophilic substitution mechanisms of nitration, including the generation of the nitronium ion and acylation using $AlCl_3$ as a catalyst
	Amines • Classification, preparation, uses and properties of aromatic and aliphatic amines	Nucleophilic substitution reaction from halogenoalkanes topic in Y12	Maths skills – calculating % yield and atom economy. Assessment: End of topic test covering content from this topic and previous topics. Test includes multiple choice, structured, closed short answer, and open response questions	• Compare the synthesis of primary aliphatic amines by the reaction of ammonia with halogenoalkanes to the reduction of nitriles. • Describe the synthesis of Aromatic amines by the reduction of nitro compounds • Describe the sues of aliphatic and aromatic amines and related compounds • explain the difference in base strength in terms of the availability of the lone pair of electrons on the N atom • outline the mechanism of the nucleophilic substitution reactions of ammonia and amines with halogenoalkanes to form primary, secondary, tertiary amines and quaternary ammonium salts • outline the mechanism of the nucleophilic addition–elimination reactions of ammonia and primary amines with acyl chlorides

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	Content (Intent)	Links to prior learning	Skills and Assessment (Implementation)	Expected Learning Outcomes (Impact)
Term 3	**Polymerisation** • formation and uses of polyesters and polyamides • comparison of addition and condensation polymers	Addition polymerisation in Y12 alkenes topic Condensation polymerisation in Y11 separate science course	Maths skills – representation of repeating units Assessment: End of topic test covering content from this topic and previous topics. Test includes multiple choice, structured, closed short answer, and open response questions	• describe the formation and uses of polyesters and polyamides • draw the repeating unit from monomer structure(s) • draw the repeating unit from a section of the polymer chain • draw the structure(s) of the monomer(s) from a section of the polymer • explain the nature of the intermolecular forces between molecules of condensation polymers • explain why polyesters and polyamides can be hydrolysed but polyalkenes cannot.
	Amino acids, Proteins and DNA • structure of amino acids at different pH • peptides, polypeptides and proteins • Enzymes • DNA • The action of anti cancer drugs	Stereoisomerism, amines and carboxylic acids covered previously in Y13, amino acids protein and DNA in Y11 separate science course	Maths skills – calculating Rf values Assessment: End of topic test covering content from this topic and previous topics. Test includes multiple choice, structured, closed short answer, and open response questions	• draw the structures of amino acids as zwitterions and the ions formed from amino acids in solutions of different pH • draw the structure of a peptide formed from up to three amino acids • draw the structure of the amino acids formed by hydrolysis of a peptide • identify primary, secondary and tertiary structures in diagrams • explain how these structures are maintained by hydrogen bonding and S–S bonds • calculate Rf values from a chromatogram • explain why a stereospecific active site can only bond to one enantiomeric form of a substrate or drug • Describe and explain the structure of DNA • use the data sheet to illustrate the structure of DNA • explain why cisplatin prevents DNA replication • explain why such drugs can have adverse effects.

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	Content (Intent)	Links to prior learning	Skills and Assessment (Implementation)	Expected Learning Outcomes (Impact)
	Synthesis and analysis Synthetic routes Organic analysis	Y12 analysis topic, all Y12 and 13 organic chemistry topics	Practical Skills – RP 10A and B Maths skills – calculating % yield and atom economy. Assessment: End of topic test covering content from this topic and previous topics. Test includes multiple choice, structured, closed short answer, and open response questions	• 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
Term 4	**Structure determination** NMR spectroscopy	Y12 analysis topic, all Y12 and 13 organic chemistry topics	Maths skills – interpreting data from spectra, use of the n+1 rule to determine splitting patterns Assessment: End of topic test covering content from this topic and previous topics. Test includes multiple choice, structured, closed short answer, and open response questions	• 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 • 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
	Chromatography	C12 topic in Y11	Maths skills – calculating Rf values Practical skills - RP 12 - Separation of species by thin-layer chromatography. Assessment:	• describe and explain how different types of chromatography can be used to separate and identify the components in a mixture. Including thin-layer chromatography (TLC), column chromatography (CC) and gas chromatography (GC)

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			End of topic test covering content from this topic and previous topics. Test includes multiple choice, structured, closed short answer, and open response questions	• describe and explain how separation depends on the balance between solubility in the moving phase and retention by the stationary phase. • describe and explain how retention times and Rf values are used to identify different substances. • calculate Rf values from a chromatogram • compare retention times and Rf values with standards to identify different substances.
Term 5	Revision	Consolidates the learning from terms 1-4.		To consolidate their knowledge and understanding of the course content and exam skills.

Resources and/or activities to support learning

Resource	Where to find it	Why?
Textbook	Kerboodle: www.kerboodle.com	Use for research, to consolidate class work, complete summary questions
CGP student books	CGP A level chemistry Student book – available to order through the school at the start of each academic year	Use for research, to consolidate class work, complete summary questions
Chemistry hand book	You should have a copy of this – ask you teacher if you don't	Useful course information, study tips, revision tips, opportunities to reflect on your progress
Practical guide	You should have a copy of this in your practical folder – ask you teacher if you don't	Use to prepare for and review methods for required practicals which will be assessed in end of topic assessments and papers
Teacher powerpoints, worksheets and exam question packs	Teams	Use to consolidate class work, complete homework tasks and questions
AQA website	http://www.aqa.org.uk/subjects/science/as-and-a-level/chemistry-7404-7405	specification, past papers and mark schemes
Physics and Maths tutor	AQA A-level Chemistry Revision - PMT (physicsandmathstutor.com)	It saves you time making your own revision notes. Answering questions allows you to apply what you have learned and identify gaps in your knowledge. Also has notes, flash cards, questions and videos for the required practicals

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Chem guide	www.chemguide.co.uk	very detailed explanation of all parts of the course with some excellent summary questions and answers. This is not specific to AQA so it contains some things you don't need to know, but it's a really good palce to start if you are looking for good explanations of the content
Chem revise	www.chemrevise.org	Online revision guides for all chapters
A level chemistry.co.uk	www.alevelchemistry.co.uk	Notes, exercises, tests and "exam papers"
Org Chem 101	www.orgchem101.com	You can generate quizzes to test yourself on naming compounds (note that the prefix "n" is added for "normal" straight chain molecules, which is not required at A level) and mechanisms