Chemistry Curriculum Overview – Year 13 (Teacher A)

Sequencing of topics	What knowledge will students develop? (Including key terminology)	What skills will students develop? (Including literacy & numeracy)	Assessment opportunities	Homework opportunities	Personal development (Catholic Social Teaching, Cultural Capital, Cross-curricular, Careers)	Curriculum links
Autumn Term 1						
Optical Isomerism	○ Explain the cause of optical isomerism ○ Identify molecules that exhibit optical isomerism/that are optically active. ○ Draw pairs of optical isomers in 3D ○ Describe how enantiomers affect plane polarised light ○ Explain what a racemic mixture is, how they can be formed, and their effect on plane polarised light.	○ Make models of mirror image molecules of some chiral and non-chiral molecules to see if they are non-superimposable ○ Identify whether molecules exhibit optical isomerism, and where they do draw the two enantiomers in 3D ○ Understand how passing polarised light through a solution of sucrose affects the plane of the light ○ Use Molymod models to show how a racemic mixture is formed when ethanal reacts with HCN	○ AFL ○ Summative assessment ○ Formative assessment ○ CPAC skills assessment ○ Practical report writing	○ Research Task ○ Exam style questions ○ Write up of practical ○ Prepare a presentation ○ Flipped learning ○ Note making	○ **United in harmony** when we consider the wider uses drugs, medicines and plastics ○ **Grateful** for medicine ○ **Faith-filled and hopeful** when seeing beyond the naked eye and the advancements of medicine ○ **Discerning and joyful** at the possibilities of science and medicine ○ **Leading others in pursuit of justice** when planning and carrying out a practical ○ **Service and sacrifice** when we recognise the scientific work that has been done before us ○ **Dignity of the human person** when considering healthcare ○ **Courageous and resilient** when we consider how medicine were developed and new drugs are trialled	KS4/5 ○ Yr 9&12 Bonding ○ Yr 10 &11 ○ Organic ○ Yr 12 ○ Isomerism Oxidation of Alcohols to Aldehydes and Ketones

Aldehydes and ketones Carboxylic acids	○ Oxidation of aldehydes to carboxylic acids ○ Distinguish between aldehydes and ketones ○ Reduction of aldehydes and ketones ○ Write equations, know reagents and conditions and outline the mechanism for reaction of aldehydes and ketones with KCN and acid ○ Understand why reaction of aldehydes and ketones with KCN followed by acid can form a racemic mixture ○ Understand the hazards of using KCN	○ Write equations for the oxidation of aldehydes ○ Carry out test-tube reactions of Tollens' reagent and Fehling's solution to distinguish aldehydes and ketones; ○ Use water bath for heating; ◦ Write equations and mechanisms for the: reduction of aldehydes and ketones using $NaBH_4$ reaction of aldehydes and ketones with KCN followed by acid ○ Research why KCN/HCN are highly toxic			○ **Loving and compassionate** when we think about those who have suffered serious illness and The impact of our actions on our environment ○ **Care of God's creation** ○ **Dignity of God's people** ○ **Community and participation** ○ **Dignity in work** ○ **Solidarity** ○ **Personal** ○ **Cultural** ○ **Social** ○ **Art** ○ **History** ○ **Geography** **Maths** ○ **DT** ○ **Doctor** ○ **Analytical Chemist** ○ **Chemical Engineer** ○ **Environmental Chemist** ○ **Research Scientist** ○ **Patent Attorney** ○ **Veterinary scientist** ○ **Midwife/Nurse** ○ **Biomedical scientist** ○ **Dentist** ○ **Forensic Scientist** ○ **Nanotechnologist** ○ **Geoscientist** ○ **Food scientist** ○ **Pathologist** ○ **Pharmacist**	KS5 ○ Yr 12 ○ Nomenclature ○ Reaction mechanisms.

Autumn Term 2						
Carboxylic acids and derivatives	○ Draw the structure of and name carboxylic acids and esters ○ Know how carboxylic acids react with carbonates ○ Write equations for the reaction of carboxylic acids with alcohols to form esters ○ Know some common uses of esters ○ write equations for the hydrolysis of esters in acidic or alkaline conditions ○ Understand the structure of animals fats and vegetable oils ○ Know how soap and biodiesel are made and write equations for these reactions for specified fats/oils.	○ Draw and name carboxylic acids and esters ○ Write equations for, and make esters by reactions of alcohols with carboxylic acids in test tubes; or an ester could be collected and purified using a separating funnel and distillation - **Purify a liquid product, including use of separating funnel; Safely and carefully handle solids and liquids, including corrosive, irritant, flammable and toxic substances;** ○ Research uses of esters and the presence of esters in fruit ○ Write equations for the hydrolysis of given esters in acidic and alkaline conditions	○ AFL ○ Summative assessment ○ Formative assessment ○ CPAC skills assessment ○ Practical report writing	○ Research Task ○ Exam style questions ○ Write up of practical ○ Prepare a presentation ○ Flipped learning ○ Note making	○ **United in harmony** when we consider the wider uses drugs, medicines and plastics ○ **Grateful** for medicine ○ **Faith-filled and hopeful** when seeing beyond the naked eye and the advancements of medicine ○ **Discerning and joyful** at the possibilities of science and medicine ○ **Leading others in pursuit of justice** when planning and carrying out a practical ○ **Service and sacrifice** when we recognise the scientific work that has been done before us ○ **Dignity of the human person** when considering healthcare ○ **Courageous and resilient** when we consider how medicine were developed and new drugs are trialled ○ **Loving and compassionate** when we think about those who have suffered serious illness and The impact of our actions on our environment	KS5 ○ Yr 12 ○ Nomenclature ○ Reaction mechanisms ○ Oxidation of alcohols

		○ Make soap by hydrolysis of castor oil - ○ Preparation of biodiesel ○ Write equations for production of soap and/or biodiesel from specified fats/oils ○ Identify an unknown ester by determination of boiling point followed by hydrolysis and then purifying and finding the melting point of the carboxylic acid formed ○ Draw and name acid anhydrides, acyl chlorides and amides ○ Write equations and outline mechanisms for acylation reactions of water, alcohols, ammonia and amines with acyl chlorides and acid anhydrides.			○ **Care of God's creation** ○ **Dignity of God's people** ○ **Community and participation** ○ **Dignity in work** ○ **Solidarity** ○ **Personal** ○ **Cultural** ○ **Social** ○ **Art** ○ **History** ○ **Geography** ○ **PE** ○ **Maths** ○ **DT** ○ **Doctor** ○ **Analytical Chemist** ○ **Chemical Engineer** ○ **Environmental Chemist** ○ **Research Scientist** ○ **Patent Attorney** ○ **Nurse** ○ **Veterinary scientist** ○ **Midwife** ○ **Biomedical scientist** ○ **Dentist** ○ **Forensic Scientist** ○ **Nanotechnologist** ○ **Geoscientist** ○ **Food scientist** ○ **Pathologist** ○ **Pharmacist**	

Acylation	○ Draw the structure of and name acid anhydrides, acyl chlorides and amides ○ Identify the products of and write equations for acylation reactions of	○ Prepare, purify and test the purity of aspirin by melting point determination ○ Name a range of aromatic compounds with common functional groups ○ Draw enthalpy diagrams to show the relative stability of cyclohexane, cyclohexene, cyclohexa-1,4-diene, benzene and the theoretical cyclohexa-1,3,5-triene ○ Write equations (including for the formation of electrophiles) and mechanisms for nitration and Friedel-Crafts acylation reactions given the starting material and products ○ Carry out the preparation of				KS5 ○ Yr 12 ○ Nomenclature ○ Reaction mechanisms

	water, alcohols, ammonia and amines with acyl chlorides and acid anhydrides ○ Outline the mechanism for the acylation reactions of acyl chlorides ○ State advantages of using ethanoic anhydride rather than ethanoyl chloride in the production of aspirin ○ Prepare and purify an organic solid and test its purity. **Required practical 10 Preparation of: a pure organic solid and test of its purity • a pure organic liquid.**	methyl 3-nitrobenzoate by nitration of methyl benzoate, purification by recrystallisation and determination of melting point ○ Draw and name acid anhydrides, acyl chlorides and amides ○ Write equations and outline mechanisms for acylation reactions of water, alcohols, ammonia and amines with acyl chlorides and acid anhydrides demonstrated.				
Aromatic compounds -Bonding	○ Describe the structure of benzene and explain how delocalisation makes benzene more stable than the theoretical cyclohexa-1,3,5-triene ○ Use thermochemical evidence from enthalpies of hydrogenation to					

	account for this extra stability ○ Explain why benzene undergoes substitution reactions in preference to addition reactions.					
-Electrophilic substitution	○ Write equations and outline mechanisms for nitration and Friedel-Crafts acylation reactions of aromatic compounds. (including equations for the formation of electrophiles) ○ Understand the usefulness of nitration and Friedel-Crafts acylation reactions	○ Name a range of aromatic compounds with common functional groups ○ Draw enthalpy diagrams to show the relative stability of cyclohexane, cyclohexene, cyclohexa-1,4-diene, benzene and the theoretical cyclohexa-1,3,5-triene				

Spring Term 1						
Amines **Nucleophilic properties**	○ Write equations and give conditions for the: preparation of primary aliphatic amines from both halogenoalkanes and nitriles ○ Write equations and give conditions for the production of aromatic amines and identify their use in making dyes. ○ Place amines in order of base strength and explain this order. ○ Identify the various amines and quaternary ammonium salts formed when ammonia and amines react with halogenoalkanes ○ give the mechanism for reactions of ammonia	○ Identify reagents and conditions and write equations to make: specified primary aliphatic amines from halogenoalkanes and nitriles aromatic amines ○ Research the use of aromatic amines in making dyes ○ Given pairs of amines, students should identify the stronger base giving reasons for their choice	○ AFL ○ Summative assessment ○ Formative assessment ○ CPAC skills assessment ○ Practical report writing	○ Research Task ○ Exam style questions ○ Write up of practical ○ Prepare a presentation ○ Flipped learning ○ Note making	○ **United in harmony** when we consider the wider uses drugs, medicines and plastics ○ **Grateful** for medicine ○ **Faith-filled and hopeful** when seeing beyond the naked eye and the advancements of medicine ○ **Discerning and joyful** at the possibilities of science and medicine ○ **Leading others in pursuit of justice** when planning and carrying out a practical ○ **Service and sacrifice** when we recognise the scientific work that has been done before us ○ **Dignity of the human person** when considering healthcare ○ **Courageous and resilient** when we consider how medicine were developed and new drugs are trialled ○ **Loving and compassionate** when we think about those who have suffered serious illness and The impact of our actions on our environment	KS5 ○ Yr 12 ○ Nomenclature ○ Reaction mechanism. ○ Nucleophilic substitution

Condensation Polymers	and amines with halogenoalkanes ○ recognise the use of quaternary ammonium salts ○ identify the products of and write equations for acylation reactions of ammonia and amines with acyl chlorides and acid anhydrides ○ outline the mechanism for the acylation reactions ○ identify the repeating unit and linkages in polyesters and polyamides given the monomer(s) ○ identify monomer(s) needed the make a condensation polymer given the repeating unit ○ know the repeating units in Terylene, nylon 6,6 and Kevlar ○ know some uses of condensation polymers	○ Draw the structure of repeating units in polyesters and polyamides given the monomer(s) and vice versa ○ Students could make nylon 6,6 ○			○ **Care of God's creation** ○ **Dignity of God's people** ○ **Community and participation** ○ **Dignity in work** ○ **Solidarity** ○ **Personal** ○ **Cultural** ○ **Social** ○ **Art** ○ **History** ○ **Geography** ○ **PE** ○ **Maths** ○ **DT** ○ **Doctor** ○ **Analytical Chemist** ○ **Chemical Engineer** ○ **Environmental Chemist** ○ **Research Scientist** ○ **Patent Attorney** ○ **Nurse** ○ **Veterinary scientist** ○ **Midwife** ○ **Biomedical scientist** ○ **Dentist** ○ **Forensic Scientist** ○ **Nanotechnologist** ○ **Geoscientist** ○ **Food scientist** ○ **Pathologist** ○ **Pharmacist**	

Amino Acids, **Proteins**	○ Explain why polyalkenes cannot be hydrolysed and so are non-biodegradable ○ Explain why polyesters and polyamides can be hydrolysed and so are biodegradable ○ Evaluate the advantages and disadvantages of different methods of disposing of polymers. ○ Draw the structure of given amino acids in acidic solution, alkaline solution and as zwitterions. ○ Describe the primary, secondary and tertiary structure of proteins, including the importance of hydrogen bonds and S-S bonds ○ Draw the structure of peptides formed from amino acids	○ Students could each make a model of a monomer using Molymods and then students collectively join them together to make a long polymer chain ○ Create a summary table to compare and explain the biodegradability of different types of polymers ○ Research and summarise different methods of disposing of polymers, including recycling, considering advantages, disadvantages and sustainability ○ Draw structures ○ Differentiate between the four				**KS4/5** ○ **Yr 11& 12** ○ Forces between molecules ○ Covalent bonding ○ Polymers ○ Yr 12 ○ Nomenclature ○ Yr 13 ○ Carboxylic acids ○ Amines ○ Chromatography

Enzymes	○ Know that peptide link can be hydrolysed producing amino acids ○ Identify the amino acids given when a peptide is hydrolysed ○ Know that amino acids can be separated and identified by thin-layer chromatography, including the use of R_f values. ○ Explain that enzymes are proteins which act through a stereospecific active site that binds to a substrate ○ Explain how drugs, which can be designed with the aid of computers, can act to inhibit enzymes by blocking active sites, but that the correct enantiomer is required.	structures of proteins ○ Carry out some thin-layer chromatography of some amino acids to identify an unknown amino acid. ○ Make a 2D or 3D model of DNA using cut out components ○ Label a diagram of DNA to show the components and the hydrogen bonding between base pairs ○ sequence of diagrams showing DNA replication ○ Write notes to accompany a diagram showing the action of cisplatin ○ Evaluate the benefits and adverse effects of using drugs such as cisplatin				

DNA **Action of anti-cancer drugs**	○ Identify the components of DNA ○ Explain how the two DNA strands interact with hydrogen bonds between base pairs ○ Describe how DNA replicates in simple terms ○ Explain how the anti-cancer drug cisplatin prevents DNA replication Explain why some drugs can have adverse effects and appreciate the balance between benefits and adverse effects of any drug.					

Spring Term 2						
Chromatography	○ Describe the similarities and differences between thin-layer, column and gas chromatography ○ explain how chromatography works ○ Use retention times and R_f values to identify substances ○ Describe the use of mass spectroscopy to analyse substances separated by gas chromatography. ○ **Required practical 12** **Separation of species by thin-layer chromatography** ○ Using ^{1}H and ^{13}C NMR to deduce information about the structure of organic molecules.	○ Produce a summary to compare similarities and differences between thin-layer, column and gas chromatography ○ Separate mixtures and identify substances (eg amino acids) by thin-layer chromatography ○ Use retention time and R_f data to identify substances separated by chromatography ○ Predict the number, position, relative intensity and splitting of signals in the ^{1}H	○ AFL ○ Summative assessment ○ Formative assessment ○ CPAC skills assessment ○ Practical report writing	○ Research Task ○ Exam style questions ○ Write up of practical ○ Prepare a presentation ○ Flipped learning ○ Note making	○ **United in harmony** when we consider the wider uses drugs, medicines and plastics ○ **Grateful** for medicine ○ **Faith-filled and hopeful** when seeing beyond the naked eye and the advancements of medicine ○ **Discerning and joyful** at the possibilities of science and medicine ○ **Leading others in pursuit of justice** when planning and carrying out a practical ○ **Service and sacrifice** when we recognise the scientific work that has been done before us ○ **Dignity of the human person** when considering healthcare ○ **Courageous and resilient** when we consider how medicine were developed and new drugs are trialled ○ **Loving and compassionate** when we think about those who have suffered serious illness and	KS4/5 ○ Yr 11 Organic ○ Yr 12 Organic KS3 & KS4 ○ Chromatography

Proton NMR	○ Understand the use of TMS and suitable solvents ○ Understand the use of TMS and the δ scale for chemical shift ○ Understand the use of deuterated solvents or CCl_4 ○ Use the n+1 rule to deduce spin-spin splitting patterns of adjacent, non-equivalent protons in aliphatic compounds ○ Deduce the structure of compounds using ^1H NMR ○ Deduce structures including the number, position, relative intensity and splitting of signals	NMR spectrum of compounds			The impact of our actions on our environment ○ **Care of God's creation** ○ **Dignity of God's people** ○ **Community and participation** ○ **Dignity in work** ○ **Solidarity** ○ **Personal** ○ **Cultural** ○ **Social** ○ **Art** ○ **History** ○ **Maths** ○ **Analytical Chemist** ○ **Chemical Engineer** ○ **Environmental Chemist** ○ **Research Scientist** ○ **Patent Attorney** ○ **Midwife/Nurse** ○ **Biomedical scientist** ○ **Dentist** ○ **Forensic Scientist** ○ **Nanotechnologist** ○ **Geoscientist** ○ **Food scientist** ○ **Pharmacist**	

Summer Term 1						
Carbon -13 NMR **Organic Synthesis**	○ Using ^{13}C NMR to deduce information about the structure of organic molecules ○ Deduce the structure of compounds using ^{13}C NMR to deduce structures including the number and position of signals. ○ Devise synthetic routes, with up to four steps, to make specific organic compounds using the reactions in the specification ○ Explain why processes are designed to avoid solvents, non-hazardous starting materials and have steps with high atom economy.	○ Predict the number and position of signals in the ^{13}C NMR spectrum of compounds ○ Use data from NMR, and other analytical methods on the specification, to deduce the structure of compounds ○ Devise synthetic routes, including reaction conditions, to make organic compounds using reactions in the specification ○ Describe features of processes that improve sustainability	○ AFL ○ Summative assessment ○ Formative assessment ○ CPAC skills assessment ○ Practical report writing	○ Research Task ○ Exam style questions ○ Write up of practical ○ Prepare a presentation ○ Flipped learning ○ Note making	○ **United in harmony** when we consider the wider uses drugs, medicines and plastics ○ **Grateful** for medicine ○ **Faith-filled and hopeful** when seeing beyond the naked eye and the advancements of medicine ○ **Discerning and joyful** at the possibilities of science and medicine ○ **Leading others in pursuit of justice** when planning and carrying out a practical ○ **Service and sacrifice** when we recognise the scientific work that has been done before us ○ **Dignity of the human person** when considering healthcare ○ **Courageous and resilient** when we consider how medicine were developed and new drugs are trialled ○ **Loving and compassionate** when we think about those who have suffered serious illness and The impact of our actions on our environment	KS4/5 Yr 11 Organic Yr 12 Organic KS3 & KS4 Chromatography

					○ Care of God's creation ○ Dignity of God's people ○ Community and participation ○ Dignity in work ○ Solidarity ○ Personal ○ Cultural ○ Social ○ Art ○ History ○ Geography ○ PE ○ Maths ○ DT ○ Doctor ○ Analytical Chemist ○ Chemical Engineer ○ Environmental Chemist ○ Research Scientist ○ Patent Attorney ○ Nurse ○ Veterinary scientist ○ Midwife ○ Biomedical scientist ○ Dentist ○ Forensic Scientist ○ Nanotechnologist ○ Geoscientist ○ Food scientist ○ Pathologist ○ Pharmacist	

Practical skills

- Safely and carefully handle solids and liquids, including corrosive, irritant, flammable and toxic substances
- Use laboratory apparatus for a variety of experimental techniques including distillation and heating under reflux, including setting up glassware using retort stand and clamps;
- Use laboratory apparatus for a variety of experimental techniques including filtration, including use of fluted filter paper, or filtration under reduced pressure;
- Analyse, interpret and evaluate scientific information