AS Chemistry –3.1.2 Amount of substance

West Kirby Grammar School

Learning about this topic is important because:
When chemists measure out an amount of a substance, they use an amount in moles. The mole is a useful quantity because one mole of a substance always contains the same number of entities of the substance. An amount in moles can be measured out by mass in grams, by volume in dm3 of a solution of known concentration and by volume in dm3 of a gas.

This builds on:
GCSE Quantitative Chemistry

This leads to:
3.3.1 Introduction to Organic Chemistry

We will learn:

- Define relative atomic mass (Ar)
- Define relative molecular mass (Mr)
- Using the Avogadro constant
- Using mass of substance, Mr , and amount in moles
- Using concentration, volume and amount of substance in a solution.
- The ideal gas equation pV = nRT with the variables in SI units. Students should be able to: use the equation in calculations.
- Calculate empirical formula from data giving composition by mass or percentage by mass
- Calculate molecular formula from the empirical formula and relative molecular mass.
- write balanced equations for reactions studied
- Balance equations for unfamiliar reactions when reactants and products are specified.
- Students should be able to use balanced equations to calculate:
  - Masses
  - Volumes of gases
  - Percentage yields
  - Percentage atom economies
  - Concentrations and volumes for reactions in solutions.

We will develop/practise skills including:

- Students carry out calculations using numbers in standard and ordinary form, eg using the Avogadro constant.
- Students carry out calculations using the Avogadro constant.
- Students report calculations to an appropriate number of significant figures, given raw data quoted to varying numbers of significant figures. Students understand that calculated results can only be reported to the limits of the least accurate measurement.
- Students could be asked to find the Mr of a volatile liquid.
- Students understand that the correct units need to be in pV = nRT.
- Students carry out calculations with the ideal gas equation, including rearranging the ideal gas equation to find unknown quantities.
- Students could be asked to find the empirical formula of a metal oxide.
- Students construct and/or balance equations using ratios. Students calculate percentage yields and atom economies of reactions.
- Students select appropriate titration data (ie identify outliers) in order to calculate mean titres. Students determine uncertainty when two burette readings are used to calculate a titre value.

Required practical 1 Make up a volumetric solution and carry out a simple acid–base titration.

Some of the vocabulary that we will use includes:

You could learn more about this topic by:
Detailed Notes - Topic 1.2. Amount of Substance - AQA Chemistry A-level (physicsandmathstutor.com)

AS Chemistry –3.1.2 Amount of substance

Relative atomic mass, Relative molecular mass, Avogadro constant, concentration, Volume, empirical formula, Yield, Solution.	AQA A-Level Chemistry - Amount of Substance Pt. 1 (moles, concentrations and masses) - YouTube AQA 1.2 Amount of Substance REVISION - YouTube
Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The key pieces of work in this topic are: End of topic Assessed Questions (Recall and Application) Assessed Homework	

A' Level Chemistry – Introduction to Organic Chemistry

West Kirby Grammar School

Learning about this topic is important because:
Organic chemistry is the study of the millions of covalent compounds of the element carbon. These structurally diverse compounds vary from naturally occurring petroleum fuels to DNA and the molecules in living systems. Organic compounds also demonstrate human ingenuity in the vast range of synthetic materials created by chemists. Many of these compounds are used as drugs, medicines and plastics. Organic compounds are named using the International Union of Pure and Applied Chemistry (IUPAC) system and the structure or formula of molecules can be represented in various different ways. Organic mechanisms are studied, which enable reactions to be explained. In the search for sustainable chemistry, for safer agrochemicals and for new materials to match the desire for new technology, chemistry plays the dominant role.

This builds on:
GCSE Chemistry Topic 7 - Organic Chemistry

This leads to:
All other topics in organic chemistry

We will learn:

- How to represent organic compounds using displayed formula, structural formula, molecular formula, skeletal formula and general formula
- How to name organic compounds using IUPAC rules.
- What an Isomer is and the different type of isomerism
- How to draw different structural isomers given a molecular formula.
- To apply the Cahn–Ingold–Prelog (CIP) priority to E- or Z- isomers
- How reactions of organic compounds can be explained using mechanisms.

We will develop/practise skills including:

Writing formula in a variety of different ways

Drawing organic compounds

Naming organic compounds

Some of the vocabulary that we will use includes:

Empirical formula	Isomer	Z-isomer
Molecular formula	Structural isomer	E-isomer
Structural formula	Position isomer	Homologous series
Displayed formula	Chain isomer	
Skeletal formula	Functional group isomer	
General formula	Stereoisomerism	

You could learn more about this topic by:
[Understanding the names of organic compounds (chemguide.co.uk)]
[The use of curly arrows to show electron movements in reaction mechanisms (chemguide.co.uk)]
[structural isomerism (chemguide.co.uk)]
[geometric (cis / trans) isomerism (chemguide.co.uk)]
[AQA Chemistry A-level Organic I Revision - PMT (physicsandmathstutor.com)]

A' Level Chemistry – Introduction to Organic Chemistry

	AQA A-Level Chemistry - Nomenclature - YouTube
Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The key pieces of work in this topic are: End of topic assessed question, retrieval questions, mini white boards, exercise questions, exam questions.	

A' Level Chemistry – 3.3.2 Alkanes

West Kirby Grammar School

Learning about this topic is important because:
Alkanes are the main constituent of crude oil, which is an important raw material for the chemical industry. Alkanes are also used as fuels and the environmental consequences of this use are considered in this section.

This builds on:
GCSE Chemistry Topic 7 - Organic Chemistry, GCSE Chemistry Topic 9 - Chemistry of The Atmosphere, A' level Chemistry 3.3.1 - Introduction to Organic Chemistry

This leads to:
3.3.3 Halogenoalkanes

We will learn:

- How hydrocarbons are separated from crude oil using fractional distillation.
- 2 different ways in which cracking can be performed, the different products from each method and the economic reasons for cracking
- The products of combustion, their environmental impact, and the different methods of reducing the amount of pollution emitted from combustions.
- How alkanes can form halogenoalkanes through a free radical substitution reaction.

We will develop/practise skills including:

Naming compounds.

Drawing Alkanes.

Writing equations for the initiation, propagation and termination steps of the free radical substitution mechanism using structural formula.

Evaluating advantages and disadvantages of different processes.

Some of the vocabulary that we will use includes:

Alkane	Halogenoalkane
Hydrocarbon	Free radical
Saturated	Initiation
Cracking	Propagation
Fractional distillation	Termination

You could learn more about this topic by:

AQA Chemistry A-level Organic I Revision - PMT (physicsandmathstutor.com)
Alkanes Menu (chemguide.co.uk)
AQA A-Level Chemistry - Fractional Distillation and Cracking - YouTube
AQA A-Level Chemistry - Halogenoalkane synthesis (free radical substitution) - YouTube

A' Level Chemistry – 3.3.2 Alkanes

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The key pieces of work in this topic are:

End of topic assessed question, retrieval questions, mini white boards, exercise questions, exam questions.

AS Chemistry – 3.3.3 Halogenoalkanes

West Kirby Grammar School

End of topic assessed question, retrieval questions, mini white boards, exercise questions, exam questions.Learning about this topic is important because:
Halogenoalkanes are much more reactive than alkanes. They have many uses, including as refrigerants, as solvents and in pharmaceuticals. The use of some halogenoalkanes has been restricted due to the effect of chlorofluorocarbons (CFCs) on the atmosphere.

This builds on:
GCSE – Organic Chemistry, AS – Introduction to Organic Chemistry, Alkanes

This leads to:
3.3.4 Alkenes

We will learn:	We will develop/practise skills including:
What are the properties of halogenoalkanes? Why do halogenoalkanes undergo nucleophilic substitution? What is a nucleophile? What is the mechanism for nucleophilic substitution? What is an electrophile? What is the mechanism for elimination? Which conditions favour Nu-sub / elimination? How can we predict the major / minor product in an elimination reaction? How do CFCs catalyse the breakdown of ozone in the atmosphere?	Naming halogenoalkanes using IUPAC nomenclature Outlining curly arrow mechanisms for nucleophilic substitution reactions of halogenoalkanes Outlining curly arrow mechanisms for elimination reactions of halogenoalkanes Predicting the products of reactions of halogenoalkanes given the reactants and reaction conditions
Some of the vocabulary that we will use includes: Halogenoalkane, nucleophile, electrophile, base, CFC, ozone, polar bond	You could learn more about this topic by: AQA A-Level Chemistry - Nucleophilic Substitution - YouTube AQA A-Level Chemistry - Elimination - YouTube

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The key pieces of work in this topic are:

End of topic assessed question, retrieval questions, mini white boards, exercise questions.

AS Chemistry – 3.3.4 Alkenes

West Kirby Grammar School

Learning about this topic is important because:
In alkenes, the high electron density of the carbon–carbon double bond leads to attack on these molecules by electrophiles. This section also covers the mechanism of addition to the double bond and introduces addition polymers, which are commercially important and have many uses in modern society.

This builds on:
GCSE – Organic Chemistry, AS – Introduction to Organic Chemistry, Alkanes, Halogenalkanes

This leads to:
3.3.5 Alcohols

We will learn:

Alkenes are unsaturated hydrocarbons.
Bonding in alkenes involves a double covalent bond, a centre of high electron density.
Describe the bonding in a C=C in terms of sigma bonds and pi bonds.
Outline and describe the electrophilic addition reactions of alkenes with HBr, H_2SO_4 and Br_2
Explain the use of bromine to test for unsaturation.
Explain the formation of major and minor products in addition reactions of unsymmetrical alkenes by reference to the relative stabilities of primary, secondary and tertiary carbocation intermediates.
How are addition polymers formed and how can we name them and draw the repeating unit and polymer structures.
Explain the properties of addition polymers in terms of intermolecular forces.

We will develop/practise skills including:

Naming alkenes using IUPAC nomenclature

Outlining curly arrow mechanisms for electrophilic addition reactions of alkenes

Predicting the products of reactions of alkenes given the reactants and reaction conditions

Test organic compounds for unsaturation using bromine water

Some of the vocabulary that we will use includes:

Alkene, Electrophilic addition, carbocation, electrophile, polar bond, electron density, Pi bond, Sigma bond

You could learn more about this topic by:
Alkenes

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The key pieces of work in this topic are:

End of topic assessed question, retrieval questions, mini white boards, exercise questions.

AS Chemistry – 3.3.5 Alcohols

West Kirby Grammar School

Learning about this topic is important because:
Alcohols have many scientific, medicinal and industrial uses. Ethanol is one such alcohol and it is produced using different methods, which are considered in this section. Ethanol can be used as a biofuel.

This builds on:
GCSE – Organic Chemistry, AS – Introduction to Organic Chemistry, Alkanes, Halogenoalkanes, Alkenes

This leads to:
3.3.5 Alcohols

We will learn:

Alcohols are produced industrially by hydration of alkenes in the presence of an acid catalyst.

Ethanol is produced industrially by fermentation of glucose. The conditions for this process.

Ethanol produced industrially by fermentation is separated by fractional distillation and can then be used as a biofuel.

The mechanism for the formation of an alcohol by the reaction of an alkene with steam in the presence of an acid catalyst

Alcohols are classified as primary, secondary and tertiary.

Primary alcohols can be oxidised to aldehydes which can be further oxidised to carboxylic acids. Secondary alcohols can be oxidised to ketones. Tertiary alcohols are not easily oxidised. Acidified potassium dichromate(VI) is a suitable oxidising agent.

Alkenes can be formed from alcohols by acid-catalysed elimination reactions.

We will develop/practise skills including:

Naming alcohols using IUPAC nomenclature

Outlining curly arrow mechanisms for electrophilic addition reactions of alkenes to form an alcohol

Predicting the products of reactions of alcohols given the reactants and reaction conditions

Write equations for these oxidation reactions (equations showing [O] as oxidant are acceptable)

Test organic compounds for the presence of aldehyde functional groups using tollens reagent or Fehling's solution

Use of distillation to obtain a pure organic product

Use of a separatory funnel for obtaining a pure organic liquid

Some of the vocabulary that we will use includes:

Alkene, Electrophilic addition, carbocation, electrophile, polar bond, electron density, Pi bond, Sigma bond

You could learn more about this topic by:
Alcohols

Uplearn

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The key pieces of work in this topic are:

End of topic assessed question, retrieval questions, mini white boards, exercise questions, REQUIRED PRACTICAL 5A AND 5B

AS Chemistry – 3.3.6 Organic Analysis

West Kirby Grammar School

Learning about this topic is important because:
Our understanding of organic molecules, their structure and the way they react, has been enhanced by organic analysis. This section considers some of the analytical techniques used by chemists, including test-tube reactions and spectroscopic techniques.

This builds on:
GCSE – Organic Chemistry, AS – Introduction to Organic Chemistry, Alkanes, Halogenalkanes, Alkenes, Alcohols

This leads to:
A2 Organic, 3.3.15 NMR

We will learn:

Tests for alcohol, aldehyde, alkene and carboxylic acid.

Mass spectrometry can be used to determine the molecular formula of a compound.

Bonds in a molecule absorb infrared radiation at characteristic wavenumbers.

'Fingerprinting' allows identification of a molecule by comparison of spectra.

The link between absorption of infrared radiation by bonds in CO_2, methane and water vapour and global warming.

We will develop/practise skills including:

How to identify the functional groups using reactions in the specification – REQUIRED PRACTICAL 6 (Tests for alcohol, aldehyde, alkene and carboxylic acid)

How to use precise atomic masses and the precise molecular mass to determine the molecular formula of a compound.

Using infrared spectra and the Chemistry Data Sheet or Booklet to identify particular bonds, and therefore functional groups, and also to identify impurities.

Some of the vocabulary that we will use includes:

Wavenumber Fehlings Tollens Infrared Spectroscopy Spectrometry

You could learn more about this topic by:
Organic Analysis

Uplearn

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The key pieces of work in this topic are:

End of topic assessed question, retrieval questions, mini white boards, exercise questions

A' Level Chemistry – 3.3.7 Optical Isomers

West Kirby Grammar School

Learning about this topic is important because:
Compounds that contain an asymmetric carbon atom form stereoisomers that differ in their effect on plane polarised light. This type of isomerism is called optical isomerism.

This builds on:
3.3.1 Introduction to Organic Chemistry, 3.3.13 Amino Acids, Proteins and DNA

This leads to:
3.3.8 Aldehydes & Ketones

We will learn:

- What is an optical isomer?
- How can we identify if an organic molecule has a chiral centre?
- What are enantiomers?
- What is a racemic mixtures?
- How can two enantiomers be distinguished using plane polarised light?
- Which reactions and mechanisms produce racemic and non-racemic mixtures of optical isomers?

We will develop/practise skills including:

Naming compounds.

Identifying Optical isomers

Drawing optical isomers as non-superimposable mirror images.

Predicting and explaining the formation of racemic or non-racemic mixtures based on the mechanism used.

Some of the vocabulary that we will use includes:

Optical isomer
Stereo isomerism
Enantiomer
Racemic
Plane-polarised light

You could learn more about this topic by:

AQA Chemistry A-level Organic II Revision - PMT (physicsandmathstutor.com)
AQA A-Level Chemistry - Optical Isomerism - YouTube

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The key pieces of work in this topic are:

End of topic assessed question, retrieval questions, mini white boards, exercise questions, exam questions.

A' Level Chemistry – 3.3.13 Amino Acids, Proteins and DNA

West Kirby Grammar School

Learning about this topic is important because:
Amino acids, proteins and DNA are the molecules of life. In this section, the structure and bonding in these molecules and the way they interact is studied. Drug action is also considered.

This builds on:
3.3.1 Introduction to Organic Chemistry, 3.3.6 Organic Analysis

This leads to:
3.3.7 Optical Isomers, 3.2.4 Transition Metals

We will learn:

- Amino acids have bothy acidic and basic properties including the formation of zwitter ions,
- Proteins are sequences of amino acids joined by peptide bonds.
- The types of bonding that leads to the primary, secondary and tertiary structures of proteins.
- Amino acids can be identified using thin-layer chromatography
- Enzymes act as biological catalysts with stereospecific active sites that bind to a substrate molecule.
- A nucleotide is made up from a phosphate ion bonded to 2-deoxyribose which is in turn bonded to one of the four bases adenine, cytosine, guanine and thymine.
- The Pt(II) complex cisplatin is used as an anticancer drug. Cisplatin prevents DNA replication in cancer cells by a ligand replacement reaction with DNA in which a bond is formed between platinum and a nitrogen atom on guanine.

We will develop/practise skills including:

Name and draw alpha, beta and gamma amino acids

Draw the structures of amino acids in acidic conditions, basic conditions and as zwitter ions.

Identify the bonding responsible for the primary, secondary and tertiary structures of proteins.

Calculate Rf values from chromatograms

Be able to draw the hydrogen bonds between complementary base pairs in a give strand of DNA.

Some of the vocabulary that we will use includes:

Amino acid	Nucleotide	Zwitter ion
Polymer	Base pair	Ligand

You could learn more about this topic by:
AQA Chemistry A-level Organic II Revision - PMT (physicsandmathstutor.com)

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion and giving you feedback in lots of different ways. The key pieces of work in this topic are:

A' Level Chemistry – 3.3.13 Amino Acids, Proteins and DNA

West Kirby Grammar School

End of topic assessed question, retrieval questions, mini white boards, exercise questions, exam questions.