OCR (B) Chemistry A-level

Storyline 5: What's in a Medicine?

Definitions and Concepts

Definitions and Concepts for OCR (B) Chemistry A-level

What's in a Medicine?

Organic Functional Groups

Acid anhydride: A compound with the functional group R-(CO)O(CO)-R'.

Aldehyde: A compound containing the -CHO functional group at the end of an alkyl chain. Aldehydes can be oxidised to carboxylic acids using $Cr_2O_7^{2-}$/ H^+.

Carboxylic acid: An organic compound containing the -COOH functional group. Carboxylic acids can be formed from the oxidation of primary alcohols using $Cr_2O_7^{2-}/H^+$ and reflux conditions.

Ester: A compound containing the R-COO-R' functional group (where R and R' are alkyl groups). Formed by the condensation reaction between an alcohol and a carboxylic acid.

Ether: A compound with the functional group R–O–R′.

Homologous series: A series of compounds with the same functional group and similar chemical properties. For example, all alkanes belong to the same homologous series.

Ketone: An organic compound containing the C=O functional group in the middle of an alkyl chain. Ketones can be formed by the oxidation of a secondary alcohol.

Phenol: Phenol has an aromatic ring with an OH group attached. A weak acid that reacts with NaOH but not carbonates. Phenol can undergo electrophilic substitution reactions more easily than benzene as the lone pair in the p-orbital of oxygen is donated into the π system of phenol, increasing its electron density. As a result of this electron donation, phenol is more susceptible to electrophilic attack than benzene.

Primary alcohol: An alcohol in which the -OH is attached to a primary carbon atom (i.e. RCH_2OH). Primary alcohols can be oxidised to form either an aldehyde or a carboxylic acid, depending on the conditions.

Secondary alcohol: An alcohol in which the -OH is attached to a secondary carbon atom (i.e. R_2CHOH). Secondary alcohols can be oxidised under reflux with $Cr_2O_7^{2-}/H^+$ to form a ketone.

Tertiary alcohol: An alcohol in which the -OH is attached to a tertiary carbon atom (i.e. R_3COH). Tertiary alcohols cannot be oxidised.

Organic Reactions

Acid: Compounds that release H^+ ions in aqueous solution. Common acids include: HCl, H_2SO_4, HNO_3 and CH_3COOH.

Dehydration: A reaction that involves a loss of water from the reacting molecules. It is the reverse reaction of hydration.

Distillation: A technique in which a liquid is heated then the vapour is cooled and collected in a separate flask to the original reaction mixture.

Esterification: The process of making esters. Esters can be made by a reaction between carboxylic acids and alcohols in the presence of an acid catalyst or by a reaction between acid anhydrides and alcohols.

Filtration under reduced pressure: A technique used to separate and dry an organic solid. A Büchner funnel is inserted into the top of a side-arm flask and a vacuum is applied. The solution is poured onto filter paper in the Büchner funnel so that the solid product can be separated.

Functional group: An atom/group of atoms responsible for the characteristic reactions of a compound.

Green chemistry: An area of science which has the aim of being sustainable and limiting the use or production of hazardous substances.

Halogenoalkanes: An organic compound containing a halogen atom (F/Cl/Br/I) bonded to an alkyl chain. Haloalkanes can be formed from alcohols via a substitution reaction with halide ions in the presence of acid.

Melting point apparatus: A piece of apparatus used to determine the melting point of a sample. The recorded melting point range is compared with known values to determine whether the sample is pure.

Oxidation: The loss of electrons leading to an increase in oxidation number.

Quickfit apparatus: Glassware that easily fits together in a variety of arrangements.

Recrystallisation: A technique used to purify an organic solid. The sample is dissolved in the minimum volume of hot solvent and filtered. The filtrate is then cooled before being filtered under reduced pressure. The purified solid will collect on the filter paper in the Büchner funnel.

Reflux: The continual boiling and condensing of a reaction mixture. This is to ensure that the reaction goes to completion. During reflux, the condenser must be positioned vertically.

Separating funnel: A piece of apparatus that is used to purify an organic liquid by removing the organic layer from an aqueous layer. Allows liquids with different densities to be separated.

Substitution: A reaction in which one atom/group of atoms replaces another.

Synthetic route: A series of steps that are followed to make a specific compound.

Thin Layer Chromatography (TLC): A technique used to separate mixtures. The stationary phase is a thin layer of alumina or silica fixed to a metal or glass plate. The plate is dotted with the mixture and placed in a beaker of solvent which is allowed to travel up the plate. The mixture separates due to the components having different solubilities in the mobile phase.

Reaction Mechanism

Elimination: A type of reaction in which two atoms/groups of atoms are removed from a molecule.

Modern Analytical Techniques

Elemental analysis: A sample is analysed to determine the proportion of elements that make up the compound present. This is done by converting a known amount of an unknown sample into simple known compounds.

Fragment ions: Smaller ions formed when an unstable molecular ion breaks down during mass spectrometry.

Fragmentation: During mass spectrometry, unstable molecular ions break down into smaller fragments.

Functional group: The atom/group of atoms responsible for the characteristic reactions of a particular compound.

Infrared radiation: A type of electromagnetic radiation that is absorbed by covalent bonds, causing them to vibrate at a specific frequency.

Infrared spectroscopy: A technique used to identify particular bonds and functional groups within a molecule. This technique has been used to link global warming with increased energy usage as atmospheric gases containing C=O, O-H and C-H bonds (such as CO_2, H_2O and CH_4) show distinct peaks on IR spectra.

Mass spectrometry: A technique used to identify compounds and determine their relative molecular mass.

Molecular formula: The total number of atoms of each element in the compound.

Molecular ion peak: The peak on a mass spectrum with the highest m/z value, used to determine molecular mass of a compound.

M^{+1} peak: A small peak on a mass spectrum caused by the presence of a small proportion of carbon-13.

M/Z ratio: The mass to charge ratio on a mass spectrum.