Definitions and Concepts for Edexcel Chemistry A-level

Topic 6: Organic Chemistry 1

Hydrocarbon: A compound exclusively consisting of hydrogen and carbon atoms.

Homologous series: Series of organic compounds with the same functional group and general formula. Consecutive members of a series differ by $-CH_2$.

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

Addition: Joining two or more molecules together to form a larger molecule. *Hydration* is the addition of a H_2O molecule. *Halogenation* involves the addition of a halogen. *Hydrogenation* is the addition of H_2. *Electrophilic addition* describes all the above examples.

Polymerisation: Joining together lots of simple molecules (monomers) to form a giant molecule (a polymer).

Repeating unit: A simplest pattern (group of elements bonded together) of the polymer that, upon translation, reproduces the whole structure.

Elimination: When a small group of atoms breaks away from a larger molecule to form a C=C bond.

Substitution: When one species is replaced by another.

Hydrolysis: Breaking bonds in a molecule by reaction with H_2O.

Dehydration: Reaction in which water is eliminated from a starting material.

Saturated: Refers to a compound with all the C-C bonds being single bonds.

Heterolytic fission: The process of breaking a covalent within a molecule leading to the formation of ions. Upon bond breaking, one atom receives the electron pair and becomes a negatively charged ion. Other atom becomes a cation, e.g.

$$Br\text{-}Br \longrightarrow Br^{+} + Br^{-}$$

Homolytic fission: The process of breaking a covalent within a molecule leading to the formation of radicals. Upon bond breaking, each atom receives one electron from the bonding pair and both atoms become radicals, e.g.

$$Br\text{-}Br \longrightarrow Br\cdot + Br\cdot$$

Radicals: A species with an unpaired electron. Represented in mechanisms by a single dot.

Free radical substitution: Photochemical reaction (requires UV light) between halogens and alkanes to form halogenoalkanes. *Initiation* is the process of forming the radicals from a molecule by homolytic fission. *Propagation* is the formation of a new radical and a new molecule from some radical and other molecule. *Termination* concludes the mechanism and is the process of two radicals joining together to form a molecule. Polysubstitution (multiple substitution) is often a problem.

Stereoisomerism: Occurs when two double bonded carbon atoms each have two different atoms or groups attached to them. Includes *E/Z* isomerism and cis/trans isomerism. This is a consequence of a restricted rotation around the C=C double bond.

Structural isomerism: Occurs when species have the same molecular formula, but a different structural formula, e.g. C_6H_{12} can be ascribed to hex-1-ene, but also to 2-methylpent-1-ene.

Saturated hydrocarbons: Hydrocarbons which contain only single (sigma) bonds between carbon atoms.

Unsaturated hydrocarbons: Hydrocarbons which contain at least one carbon-carbon double bond.

Cracking: Breaking long chain alkanes into smaller, more useful hydrocarbons. Helps to convert low demand hydrocarbons into more highly demanded ones.

Reforming: Processing of straight chain hydrocarbons into branched chain alkanes and cyclic hydrocarbons for efficient combustion. Done so there's no knocking.

Knocking: Alkanes explode of their own accord when the fuel/air mixture in an engine is compressed.

Complete combustion: Produces fully oxidised products (e.g. CO_2) as opposed to *incomplete combustion* (produces CO).

Catalytic Converters: Get rid of pollutants in cars by using platinum catalyst to convert them to harmless gases, e.g. $2NO + CO \rightarrow N_2 + CO_2$.

Biofuels: Fuels made from living matter over a short period of time. e.g. biodiesel made by refining renewable fats and oils such as vegetable oil.

Recycling: Conversion of a waste from polymer into other useful materials.

Incinerator: A device for converting polymer waste into energy.

Feedstock: For conversion of polymer waste into compounds that can be used to synthesise new polymers.

Biodegradable: Refers to a polymer that can be decomposed by microbes. Usually has polar groups (e.g. ester, amide).

Electrophile: Electron pair acceptor in an organic mechanism. Attracted to areas with lot of electrons/high negative charge.

Nucleophile: Electron pair donors in an organic mechanism. Attracted to electron-deficient areas.

Electron releasing group: A group that releases the electrons towards the atom it is joined to.

Carbocation: A carbon atom bearing a positive charge.

Markovnikoff's rule: *Weak statement* - when adding a hydrogen halide to an unsymmetrical alkene, the major product is formed from hydrogen adding to the carbon with more hydrogens, and halide adding to the carbon with fewer hydrogens.

Strong statement - The major product of an electrophilic addition to the unsymmetrical alkene results from a reaction proceeding *via* the most stable carbocationic intermediate (stability increases in the order: primary<secondary<tertiary).

Distillation with addition: Performing the reaction under distillation conditions whilst adding one of the reagents. The product distills off as it forms in case of oxidation of an alcohol to an aldehyde.

Solvent extraction: A method for separating a compound from a mixture by causing it to move to another solvent.

Fractional distillation: A distillation that utilises a fractionating column (packed glass beads that provide a surface for the vapour to condense and evaporate again). Used to separate liquids of similar boiling points.