

CAIE Chemistry A-level

14: Hydrocarbons Definitions

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Definitions and Concepts for CAIE Chemistry A-level Hydrocarbons

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. *Electrophilic addition* describes all the above examples.

Addition polymerisation: The formation of a long chain molecule when many monomers join together (the polymer is the only product).

Alkane: A homologous series of saturated hydrocarbons with the general formula $\text{C}_n\text{H}_{2n+2}$.

Alkene: A homologous series of unsaturated hydrocarbons with the general formula C_nH_{2n} .

Catalyst: A substance that speeds up the rate of a reaction without being used up.

Carbocation: A compound containing a carbon atom bearing a positive charge.

Combustion: A reaction in which the carbon and hydrogen within fuels are oxidised to release energy and to produce carbon dioxide and water.

Combustion of alkanes: A reaction which releases energy. During combustion, the carbon and hydrogen in the fuels are oxidised. Alkanes can undergo complete or incomplete combustion. Water and carbon dioxide are the only products of complete combustion, whereas carbon monoxide and carbon particulates can be produced in incomplete combustion.

Complete combustion: When a compound is burnt in an excess of oxygen. When alkanes are completely combusted, the only products are water and carbon dioxide.

Cracking: The process of breaking long-chain alkanes into smaller, more useful hydrocarbons. Helps to convert low demand hydrocarbons into more ones in higher demand.

Crude oil: A finite resource found in rocks. It is the remains of ancient biomass consisting mainly of plankton buried in mud. Most of the compounds in crude oil are hydrocarbons.

Dehydration: A type of reaction which involves the loss of water.

Diol: A molecule with two alcohol functional groups.

Electrophile: A species that can accept electrons in a reaction, to form a chemical bond. Electrophiles are attracted to areas with a lot of electrons/high negative charge.





Electrophilic addition: A reaction where a π bond is broken and two new σ bonds form due to the addition of an electrophile.

Elimination: A reaction in which a molecule loses atoms or groups of atoms to form a C=C bond.

Free radical: A species with an unpaired electron. These are represented in mechanisms by a single dot.

Free radical substitution: A photochemical reaction between halogens and alkanes to form halogenoalkanes. The reaction requires UV light and involves three stages: initiation, propagation and termination. Initiation creates a radical species. Propagation involves a series of chain reactions where free radicals bond to molecules to form new free radicals. Termination involves the reaction of free radicals with other free radicals to form new molecules.

Hydrogenation: A reaction between H_2 and another substance, this often reduces or saturates a compound. These reactions usually require a catalyst like nickel.

Hydrolysis: A reaction in which a molecule is broken down by its reaction with water.

Incomplete combustion: When a compound is burnt in a limited supply of oxygen. When alkanes are incompletely combusted water, carbon monoxide, carbon particulates and some carbon dioxide may be produced.

Initiation step: The first step in a radical substitution mechanism, involving the formation of the radicals.

Mechanism: A step by step sequence of reactions that occur during a chemical change when reactants are converted to products. Mechanisms show the movement of electrons during the reaction, represented by curly arrows.

Nucleophile: An atom or molecule that donates an electron pair to form a covalent bond. Attracted to electron-deficient areas.

Oxidation: Loss of electron(s) leading to an increase in oxidation number.

Polar bond: A covalent bond in which there is an unequal distribution of the electrons between the two atoms due to the differing electronegativities of the bonding atoms. One atom will have a partial positive charge while the other will have a partial negative charge.

Polymerisation: The process of making a polymer from its monomers. There are two types: addition polymerisation and condensation polymerisation.





Primary carbocation: A molecule in which the carbon with the positive charge is only attached to one alkyl group. This is the least stable carbocation.

Propagation step: Propagation involves a series of chain reactions where free radicals react with molecules to form new free radicals.

Secondary carbocation: A molecule in which the carbon with the positive charge is attached to two alkyl groups. This is more stable than a primary carbocation but less stable than a tertiary carbocation.

Termination: The final steps in a radical substitution mechanism in which two radicals react together to form a species that only contains paired electrons.

Tertiary carbocation: A molecule in which the carbon with the positive charge is attached to three alkyl groups. This is the most stable type of carbocation.

The inductive effect: The result of having electron-withdrawing or electron-donating groups, resulting in the polarisation of a bond.

