IB Organic Chemistry Cheat Sheet

by aila (ailawilliams) via cheatography.com/141978/cs/31141/

Alkanes

Methane	CH4
Ethane	C2H6
Propane	C3H8

and so on...

Alkanes are saturated hydrocarbons (only contain C-C bonds)
CnH2n+2

Alkenes

Ethene	C2H4
Propene	C3H6

Unsaturated hydrocarbons since they have at least one C=C double covalent bond
CnH2n

alcohols

The alcohols form a homologous series. The general formula for the alcohols is: CnH2n+1OH

> The alcohols' functional group is –OH. It is responsible for the alcohols' typical reactions. Don't confuse the –OH group with the hydroxide ion OH-.

Combustion of alcohols -> Alcohols completely combust in the presence of oxygen to form carbon dioxide and water.
ethanol + oxygen → carbon dioxide + water

> C2H5OH + 3O2 → 2CO2 + 3H2O

They combust incompletely when oxygen is scarce, producing water and either carbon monoxide or carbon (soot).

Methanol CH3OH
Ethanol C2H6OH
Propan-1-ol C3H7OH

Combustion of alkanes

Addition reactions of alkenes

Addition reactions occur when one molecule combines with another, forming one large molecule and no other products. The C=C functional group allows alkenes to undergo these reactions.

Example: Ethene reacts with bromine to form 1,2-dibromoethane:

> CH2=CH2 + Br2 → CH2BrCH2Br

Carboxylic acids

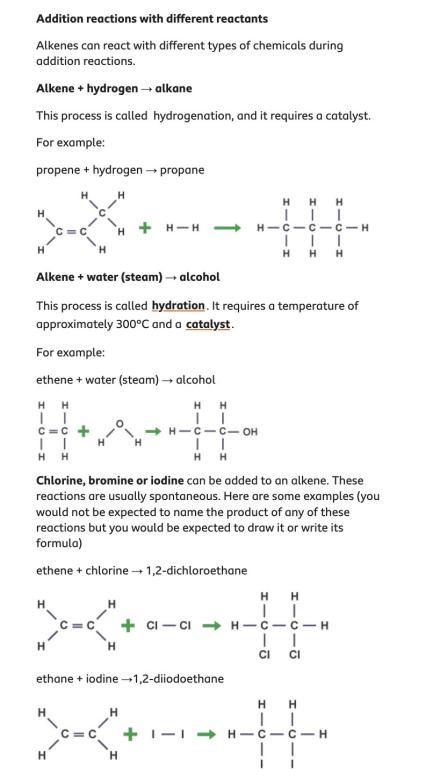
The general formula for carboxylic acid is CnH2nO2. The molecular formula is usually written with COOH functional group.

> The functional group in the carboxylic acids is the carboxyl group –COOH. It is responsible for the carboxylic acids' typical reactions. They are weak acids – vinegar is a dilute solution of ethanoic acid.

examples

> Methanoic acid: HCOOH, Ethanoic acid: CH3COOH, Propanoic acid C2H5COOH, Butanoic acid C3H7COOH

more:



Addition reactions with different reactants

Alkenes can react with different types of chemicals during addition reactions.

Alkene + hydrogen → alkane

This process is called hydrogenation, and it requires a catalyst.

For example:

propene + hydrogen → propane

Alkene + water (steam) → alcohol

This process is called **hydration**. It requires a temperature of approximately 300°C and a **catalyst**.

For example:

ethene + water (steam) → alcohol

Chlorine, bromine or iodine can be added to an alkene. These reactions are usually spontaneous. Here are some examples (you would not be expected to name the product of any of these reactions but you would be expected to draw it or write its formula)

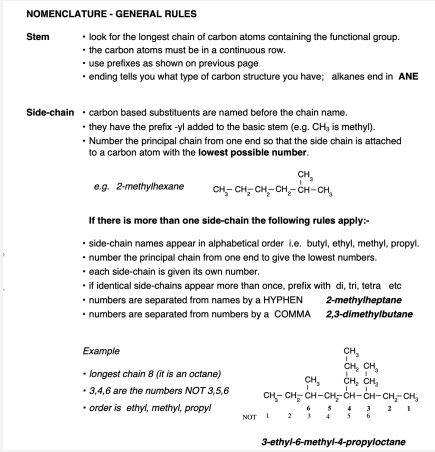
ethene + chlorine → 1,2-dichloroethane

ethane + iodine →1,2-diiodoethane

Incomplete Combustion

Incomplete combustion occurs when there is a limited supply of oxygen. Carbon (soot), carbon monoxide, and water are produced. Less energy is released, compared to complete combustion.

Nomenclature



NOMENCLATURE - GENERAL RULES

Stem
- look for the longest chain of carbon atoms containing the functional group.
- the carbon atoms must be in a continuous row.
- use prefixes as shown on previous page
- ending tells you what type of carbon structure you have; alkanes end in **ANE**

Side-chain
- carbon based substituents are named before the chain name.
- they have the prefix -yl added to the basic stem (e.g. CH_3 is methyl).
- Number the principal chain from one end so that the side chain is attached to a carbon atom with the **lowest possible number**.

e.g. 2-methylhexane

If there is more than one side-chain the following rules apply:-

- side-chain names appear in alphabetical order i.e. butyl, ethyl, methyl, propyl.
- number the principal chain from one end to give the lowest numbers.
- each side-chain is given its own number.
- if identical side-chains appear more than once, prefix with di, tri, tetra etc
- numbers are separated from names by a HYPHEN ***2-methylheptane***
- numbers are separated from numbers by a COMMA ***2,3-dimethylbutane***

Example

- *longest chain 8 (it is an octane)*
- *3,4,6 are the numbers NOT 3,5,6*
- *order is ethyl, methyl, propyl*

NOT

3-ethyl-5-methyl-4-propyloctane

Complete combustion

> Complete combustion occurs when there is a plentiful supply of oxygen. The carbon and hydrogen atoms react with oxygen in an exothermic reaction. Carbon dioxide and water are produced. The maximum amount of energy is given out.

in general:

> hydrocarbon + oxygen → carbon dioxide + water

example: propane + oxygen → carbon dioxide + water

> $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

By **aila** (ailawilliams)

cheatography.com/ailawilliams/

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