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Biototechnology، وإنتاج وتربية خاصة - علوم].
شركة بيوتكنولوجي - باعات عمدة - لجنة 1
أساسيات الكيمياء العضوية Basic Organic Chemistry
نقاء مختبر وبساطة

1. KEKULE'S PRINCIPLE :

1.1 Carbon C has four valencies.

1.2 Carbon can make a large chain with addition of other carbons.

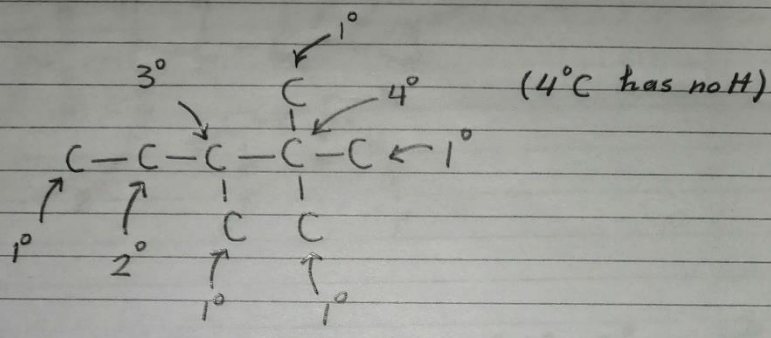
1.3 A carbon atom can share 2, 4 or 6 electrons with other carbons. It thus, can form single, double or triple bond.

1.4 For a carbon atom, it is not possible to make more than 3 bonds with adjacent carbon atom because a carbon atom completes its octet from overlapping which consists directional property.

2. THE FOUR VALENCES OF CARBON :

| Structure | σ bond | π bond | hybridisation | shape | bond angle |
|--|---------------|------------|---------------|-----------------------------|------------------|
| $\begin{array}{c} \\ -C- \\ \end{array}$ | 4 | — | sp^3 | tetrahedral (non planar) | $109^{\circ}28'$ |
| $\begin{array}{c} \\ -C= \\ \end{array}$ | 3 | 1 | sp^2 | Planar (trigonal) | 120° |
| $-C\equiv$ | 2 | 2 | sp | linear | 180° |
| $=C=$ | 2 | 2 | sp | linear | 180° |

3. CLASSIFICATION OF CARBON :

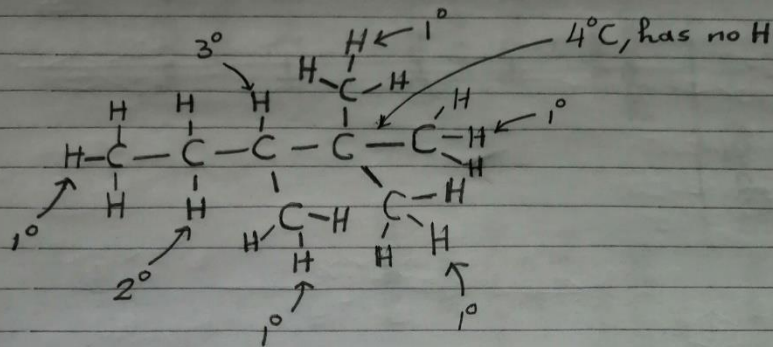


1° the primary carbon atom is directly attached with one carbon atom.

The carbon which is directly attached with two, three and four carbon atoms are known as secondary (2°), tertiary (3°) and quaternary (4°) carbon atom, respectively.

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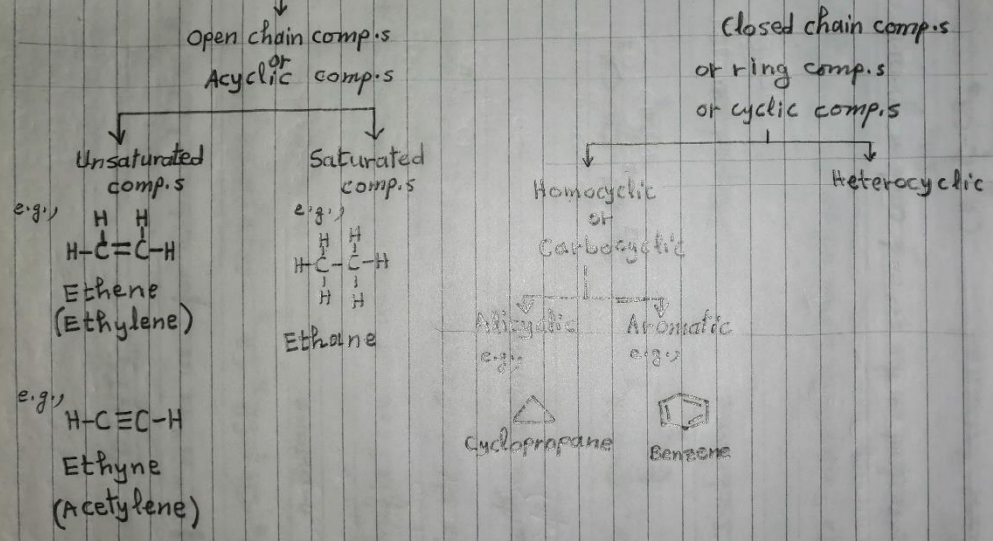
4. CLASSIFICATION OF HYDROGEN:



Hydrogen atoms bonded with 1° , 2° or 3° carbon atoms are named as primary (1°), secondary (2°) or tertiary (3°) hydrogen atom, respectively.

d 5

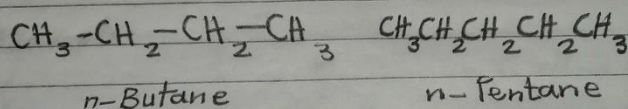
5. Organic Compounds



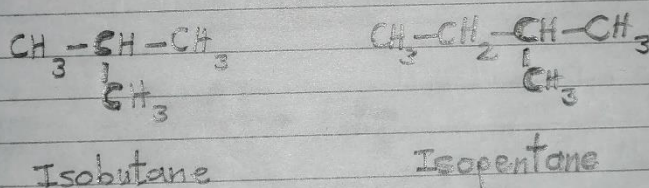
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6. SPECIAL POINTS:

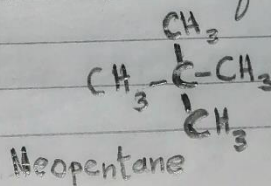
6.1 Prefix "n" is used for unbranched C chain.



6.2 Prefix "iso" is used when one methyl group is attached on the second carbon from either terminal.



6.3 Prefix "neo" is used when two methyl groups are attached on the second carbon from either terminal.



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7. Alkanes:

General Formula: C_nH_{2n+2}

Examples:

CH_4

Methane



C-H, 6 sigma bond,
single, covalent & nonpolar bond

Molecular Formula

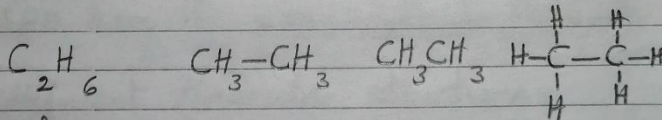
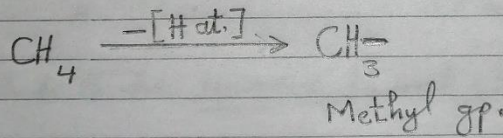
molecular structure

Chemical properties &

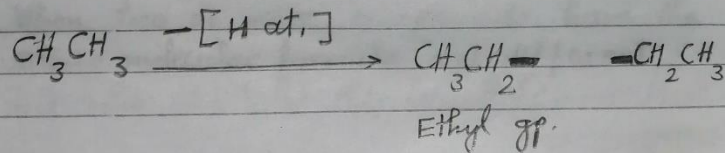
Type & number of atoms:

Type, number of atoms & bonds

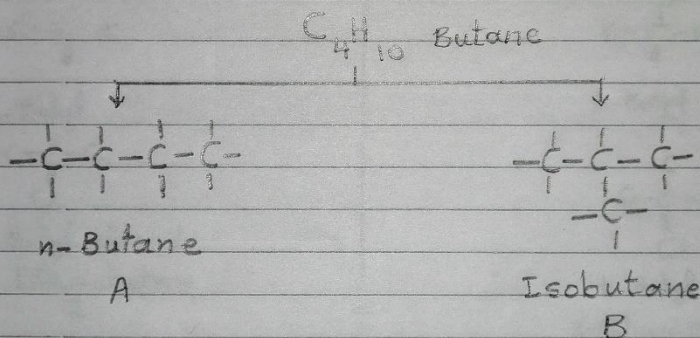
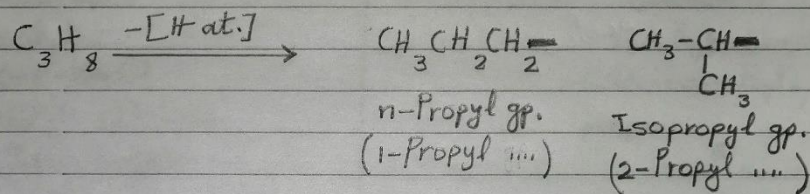
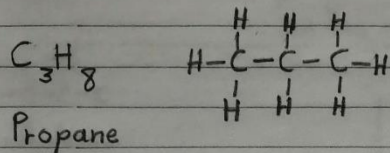
many of the physical properties.



Ethane



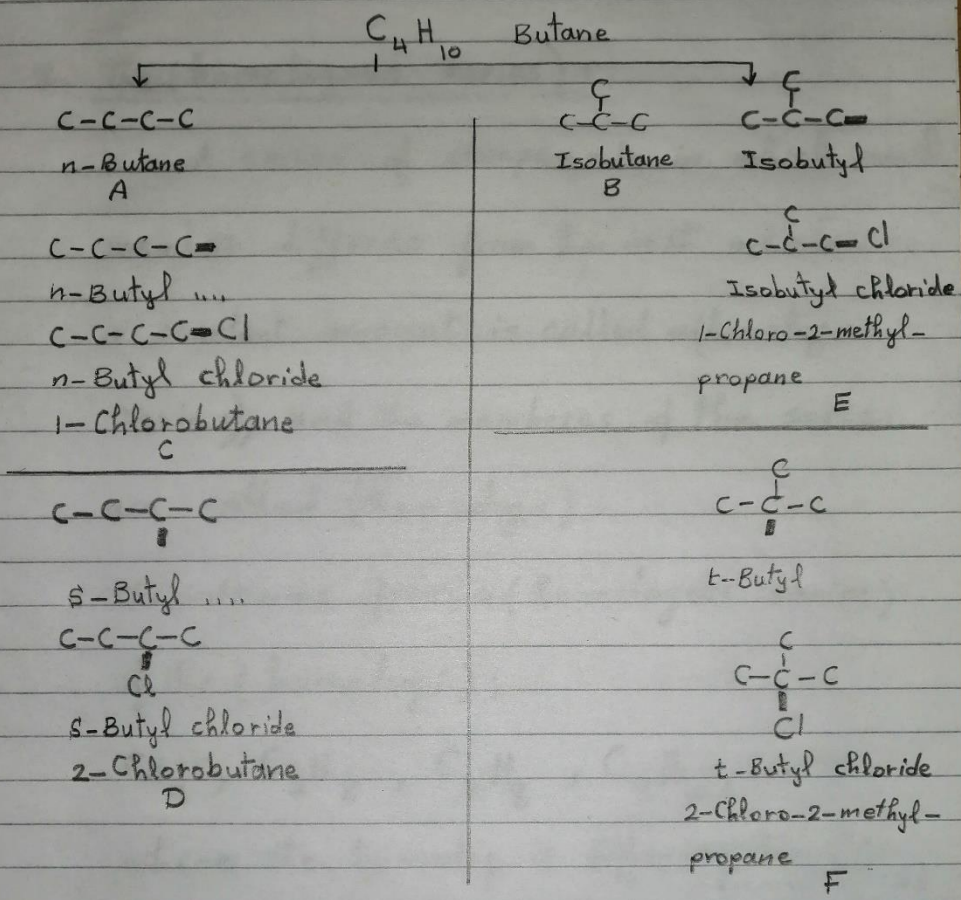
8^h



A & B are isomers to each other

A & B have the same Molecular Formula and different Molecular structure.

When two or more compounds have the same molecular formula and different molecular structures, this is called (isomerism).

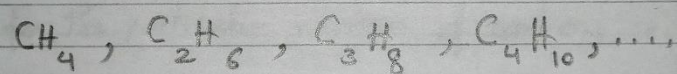


A & B : the same molecular formula (C_4H_{10}) & different molecular structure, i.e., isomers.
 C, D, E, F, the same molecular formula (C_4H_9Cl) & different molecular structure, i.e., isomers.

8. The (homologous series):

A series of compounds in which each member differs from the next member by a constant amount is called a (homologous series), and the members of the series are called (homologs).

The alkanes form a (homologous series) of the (homologs);



where the homolog is differing by (CH_2) unit from its next homolog.

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ii. Homologous series of alkanes:

| | | | | |
|---------------------------|---------|------------------------------|---------|----------------|
| CH_4 | methane | C_5H_{12} | pentane | } Greek Prefix |
| C_2H_6 | ethane | C_6H_{14} | hexane | |
| C_3H_8 | propane | C_7H_{16} | heptane | |
| C_4H_{10} | butane | C_8H_{18} | octane | |
| | | C_9H_{20} | nonane | |
| | | $\text{C}_{10}\text{H}_{22}$ | decane | |

Except for the first four members of the family, the name is derived from the Greek prefix for the particular number of carbons in the alkane.

5 penta, 6 hexa, 7 hept, 8 octane, 9 nona, 10 deca and so on.

12. Physical Properties of n-Alkanes :

12.1 State (or form) :

The first four comp.s are gases :

methane CH_4 , ethane C_2H_6 , propane C_3H_8

and n-butane C_4H_{10} .

The comp.s of $\text{C}_5 - \text{C}_{16}$ are liquids.

The comp.s of $\geq \text{C}_{17}$ are solids.

12.2 Colour (color) :

The gases are colourless.

The liquids are colourless.

The solids are white.

12.3 Odour :

All the n-alkanes have odour.

The gases have the strongest odour.

The liquids have medium odour.

The solids have, relatively, the weakest odour.

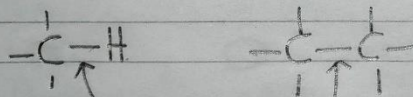
12.4 Polarity:

All the hydrocarbons (n-alkanes) are

composed of "non polar = nonpolar =

apolar عزب اكتسب [a polar ولـ]

bonds of the type:



single covalent
non polar bond

thus, the hydrocarbons (n-alkanes) are
non polar molecules.

12.5 Solubility;

Remember the important rule of :

Like Dissolves Like

Solubility in nonpolar solvents:

Non polar solvents dissolves the hydrocarbons

(n-alkanes) as they are alike in nonpolarity,

e.g., Benzene, cyclohexane, the liquid

hydrocarbons, e.g., n-C₅ - C₈ alkanes,

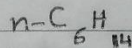
ether.



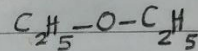
Benzene
nonpolar



Cyclohexane
nonpolar



n-Hexane
nonpolar



Ether
Ethyl ether
Diethyl ether
nonpolar

12.6 Solubility in polar solvents:

As hydrocarbons (n-alkanes) are nonpolar comp's;

and water (H_2O , $\overset{\delta-}{O} \overset{\delta+}{H} - \overset{\delta-}{O} - \overset{\delta+}{H}$ $\delta-\delta+$) is

a highly (strongly) polar solvent, they do not dissolve each other. This, also, agrees with the rule of Like Dissolves Like.

If a hydrocarbon (n-alkane) and water are brought together in a test tube, they will not mix, and the upper layer will be the hydrocarbon and the lower layer will be the water.

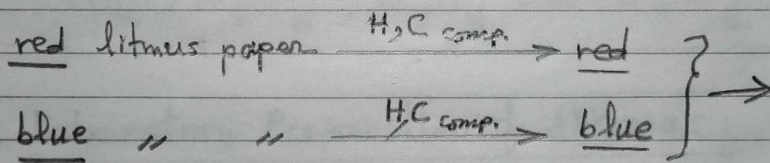
12.7 Density:

In general, the hydrocarbons (n-alkanes)

have densities lesser than the density of water.

12.8 Effect on Litmus Paper :

As the hydrocarbons (n-alkanes) do not have either acidic (H^+) or basic (OH^-) functional groups, they do not affect the litmus paper, i.e., hydrocarbons (n-alkanes) are neutral to litmus paper



$\therefore H_2C = \text{neutral.}$

12.9 Flammability :

All the hydrocarbons (n-alkanes) are flammable.

10. Industrial Sources :

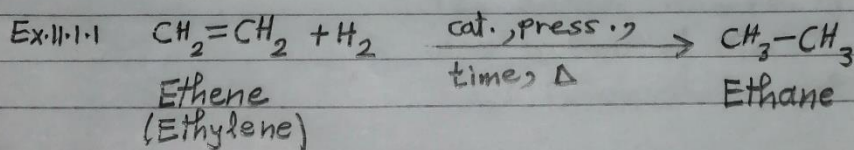
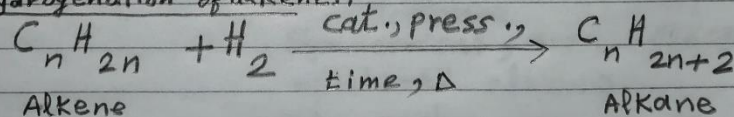
Petroleum is the principal source of the alkanes.

The Natural Gas is, also, a major source of the first four alkanes



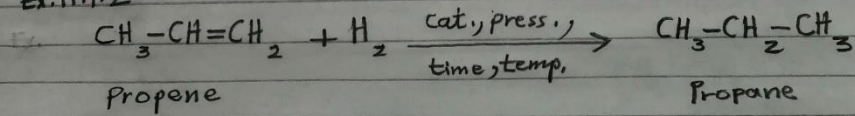
11. Laboratory Preparation of Alkanes :

11.1 Hydrogenation of alkenes :



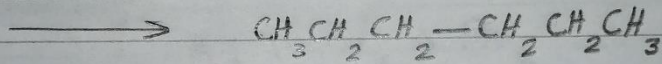
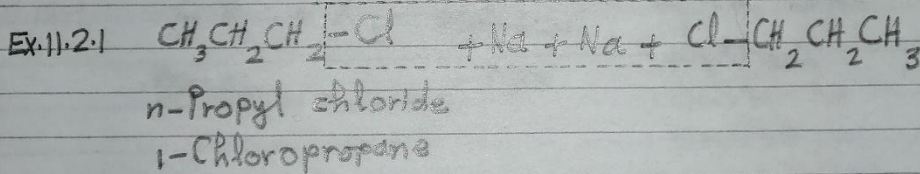
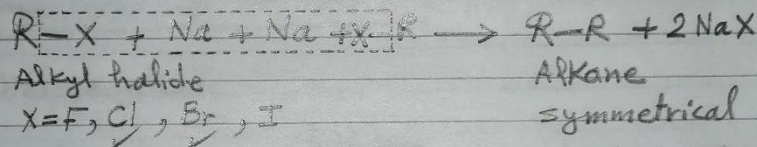
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Ex. 11.1.2



11.2 Wurtz Reaction:

This reaction is limited to the synthesis of symmetrical alkane R-R.

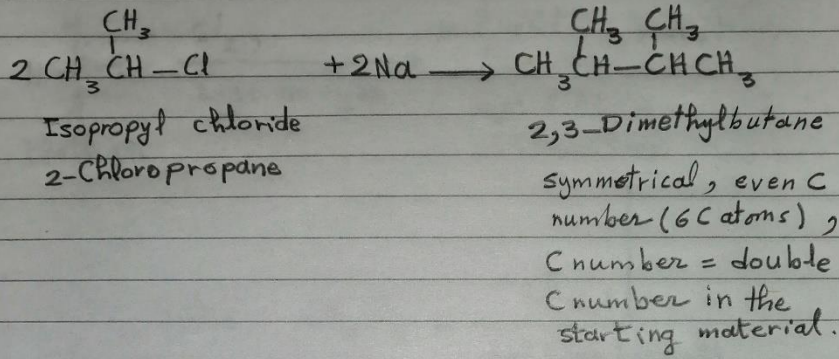


n-Hexane

Symmetrical, even carbon numbered alkane.

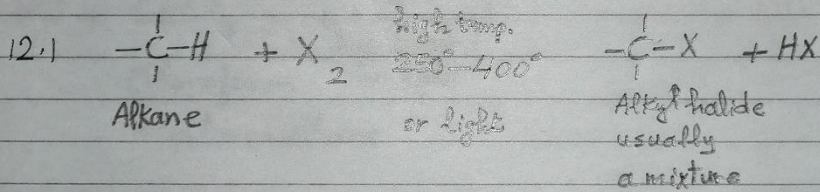
The carbon number is double that of the alkyl halide (starting material).

Ex. 11.2.2

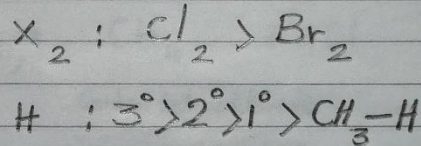


12. Reactions of Alkanes:

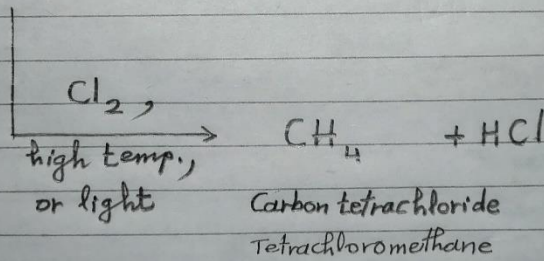
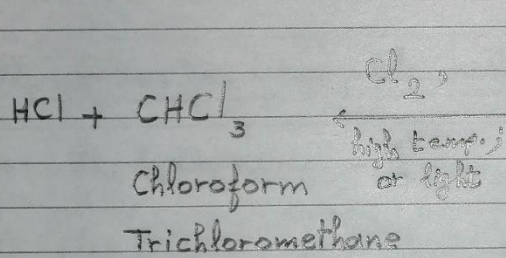
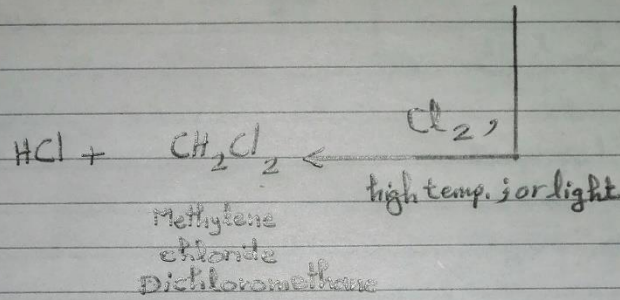
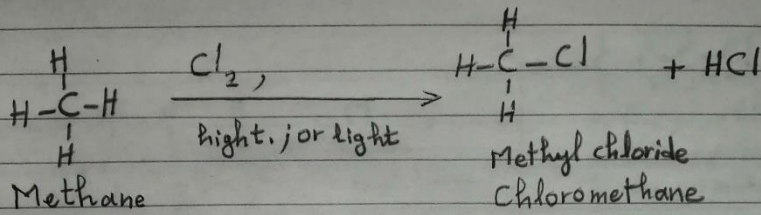
Halogenation:



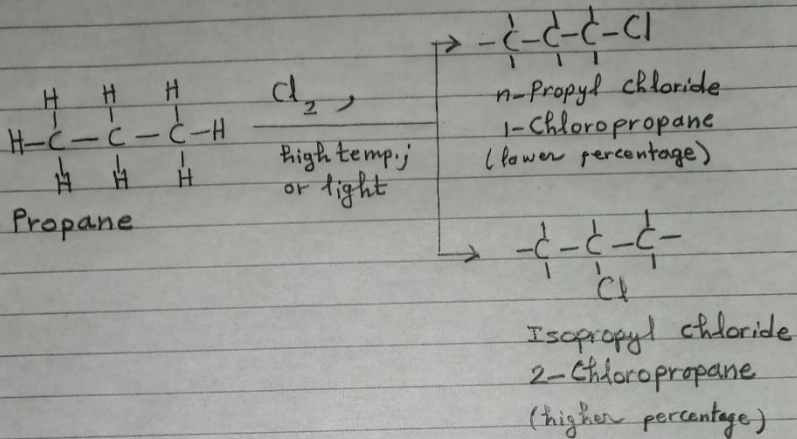
Reactivity:



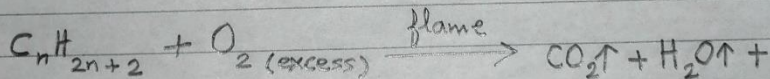
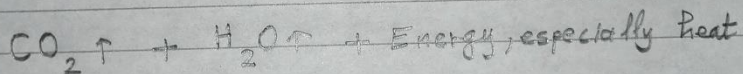
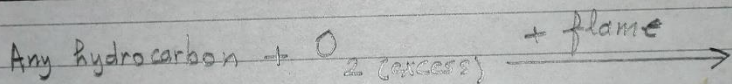
Ex. 12.1.1



Ex. 12.1.2



12.2 Combustion (complete oxidation):



Energy, especially heat.

Ex. 12.2.1

