Soch Badlo by MAK

Chemistry Chapter#11

SLO Questions

Q1. Why a chemical compound is diverse in nature?

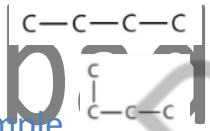
Ans. Due to the following reasons, chemical compound is diverse in nature:

- **Valency:** **"Valency is defined as the number of bonds formed by an atom. Valency is proportional to the number of valence shell electrons."**

Valency of Carbon is 04.

- **Catenation:** **"Self-linking ability of Carbon-atoms is called catenation."**

Carbon can form:

1. Long chains for example, 
2. Branched chains for example,
3. Rings for example, 

- **Formation of compounds:** Carbon forms different compounds of various size, shape, and structures.
- **Formation of bonds:** Carbon forms multiple bond:

  Single covalent bond C-C

  Double covalent bond C=C

  Triple covalent bond C≡C
- **Hydrocarbon:** Hydrocarbons often contain variable functional group. More than 20 million Chemical compounds exist in nature. 95% are known compounds of C.

Q2. Draw the homologous series for alkane.

Ans. **Homologous series:**

C-Atom	Name	Molecular Formula	Condensed formula
1	Methane	CH_4	CH_4
2	Ethane	C_2H_6	CH_3-CH_3
3	Propane	C_3H_8	$CH_3-CH_2-CH_3$
4	Butane	C_4H_{10}	$CH_3-CH_2-CH_2-CH_3$
5	Pentane	C_5H_{12}	$CH_3-CH_2-CH_2-CH_2-CH_3$
6	Hexane	C_6H_{14}	$CH_3-CH_2-CH_2-CH_2-CH_2-CH_3$
7	Heptane	C_7H_{16}	$CH_3-CH_2-CH_2CH_2-CH_2-CH_2-CH_3$
8	Octane	C_8H_{18}	$CH_3-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_3$
9	Nonane	C_9H_{20}	$CH_3-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_3$
10	Decane	$C_{10}H_{22}$	$CH_3-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_3$

Q3. Why rate of reaction of organic compounds is slow?

Ans. **Organic Compound: "Organic compounds are molecules that are made up of carbon covalently bonded to other atoms, most commonly hydrogen, oxygen, and nitrogen."**

Reasons:

1. Nature of Reactants: Organic molecules often have complex structures, with multiple bonds and functional groups that can hinder reaction progress.

2. Activation Energy: Many organic reactions have high activation energies, requiring significant energy input to initiate the reaction.

3. Steric Hindrance: Large or bulky groups attached to the reactants can obstruct the approach of reactants to each other, slowing down the reaction.

4. Solvent Effects: The solvent can influence the rate of reaction. Polar solvents, for example, can stabilize charged intermediates, affecting the reaction rate.

5. Reaction Conditions: Temperature, pressure, and the presence of catalysts can greatly affect the reaction rate. Inadequate conditions can slow down the reaction.

6. Reaction Mechanism: Some organic reactions proceed through several steps, each with its own rate, leading to an overall slower reaction.

Q4. Why Organic compounds have low melting and boiling point?

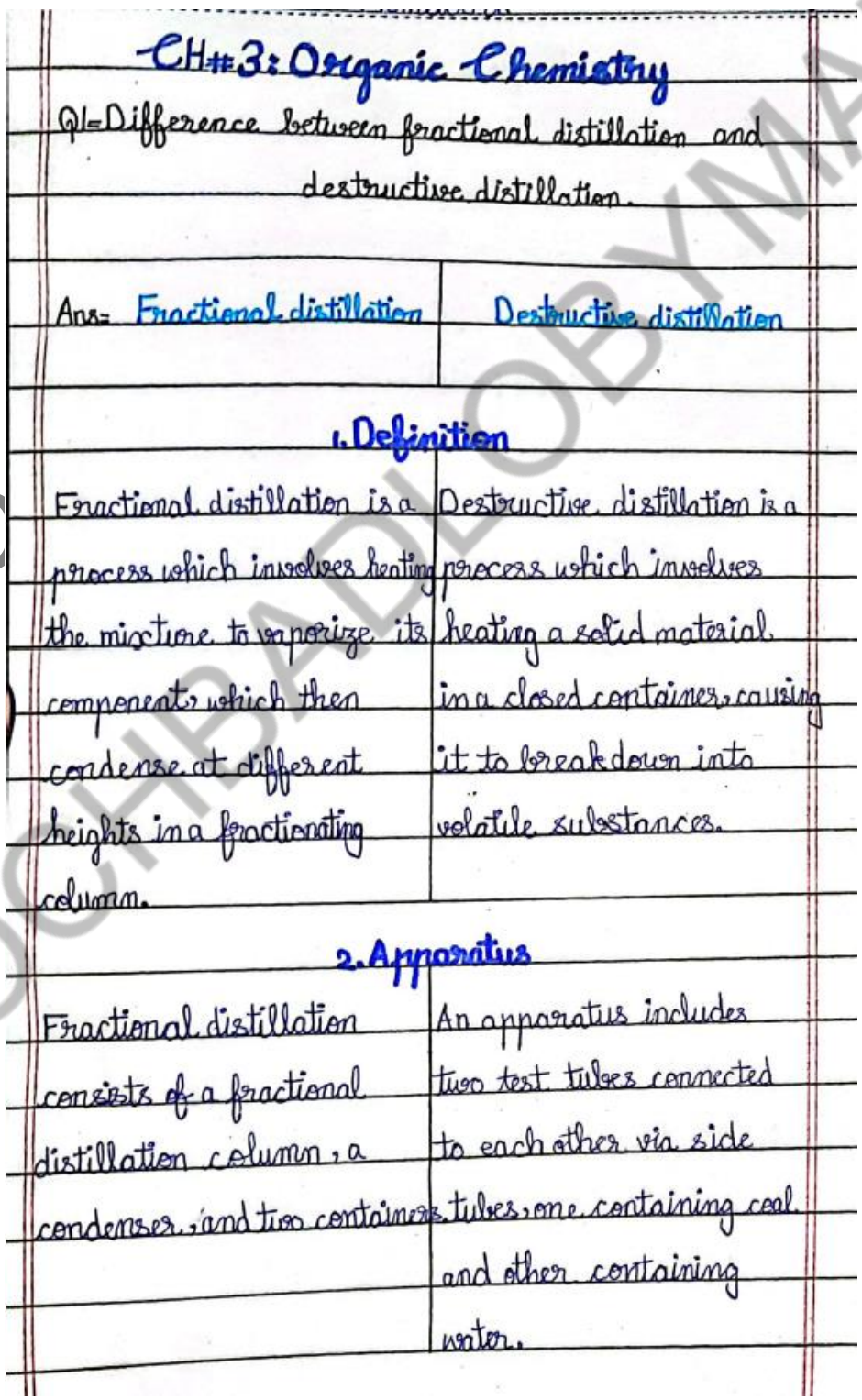
Ans. Generally organic compounds are volatile.

Volatile Organic Compounds:

"Volatile organic compounds are compounds that have a high vapor pressure and low water solubility."

Reason: The reason for this is that the attractive forces between organic molecules are relatively weak, meaning that it requires less energy to disrupt them. In other words, the energy required to break down the bonds between organic molecules is not that much, so the boiling and melting points of organic substances are low.

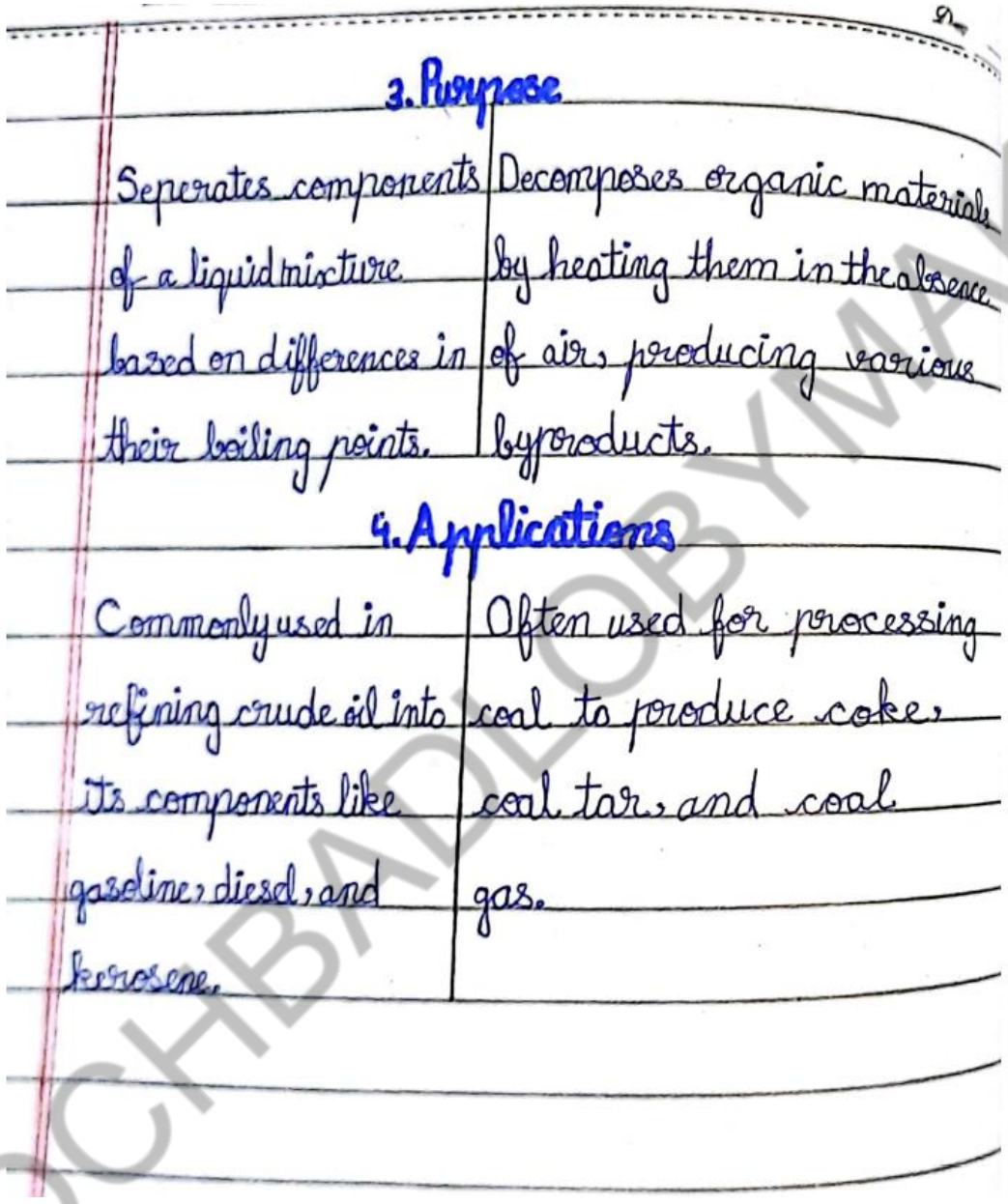
Q5. Differentiate between fractional distillation and destructive distillation.



CH#3: Organic Chemistry

Q1=Difference between fractional distillation and destructive distillation.

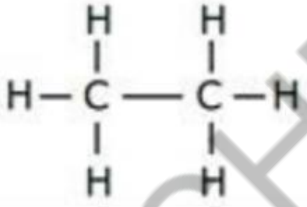
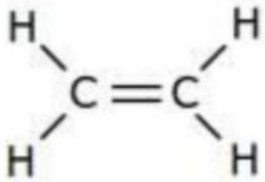
Ans= Fractional distillation	Destructive distillation
1. Definition	
Fractional distillation is a process which involves heating the mixture to vaporize its components, which then condense at different heights in a fractionating column.	Destructive distillation is a process which involves heating a solid material in a closed container, causing it to breakdown into volatile substances.
2. Apparatus	
Fractional distillation consists of a fractional distillation column, a condenser, and two containers.	An apparatus includes two test tubes connected to each other via side tubes, one containing coal and other containing water.



3. Purpose	
Seperates components of a liquid mixture based on differences in their boiling points.	Decomposes organic materials by heating them in the absence of air, producing various byproducts.
4. Applications	
Commonly used in refining crude oil into its components like gasoline, diesel, and kerosene.	Often used for processing coal to produce coke, coal tar, and coal gas.

Credit: Fatima Saeed

Q6. Differentiate between Alkanes, Alkenes and Alkynes.

Alkanes	Alkenes	Alkynes
Hydrocarbons containing single bonds only	Hydrocarbons containing at least one double bond	Hydrocarbons containing at least one triple bond
They are saturated compounds	They are unsaturated compounds	They are unsaturated compounds
General molecular formula: C_nH_{2n+2}	General molecular formula: C_nH_{2n}	General molecular formula: C_nH_{2n-2}
Less reactive because only single bonds are present	More reactive than alkanes due to the presence of a double bond	More reactive than alkanes due to the presence of triple bond
Favours substitution reaction	Favours addition reaction	Favours addition reaction
Eg: Ethane 	Eg: Ethene 	Eg: Ethyne 

Q7. Why organic compounds are non-polar/ inert?

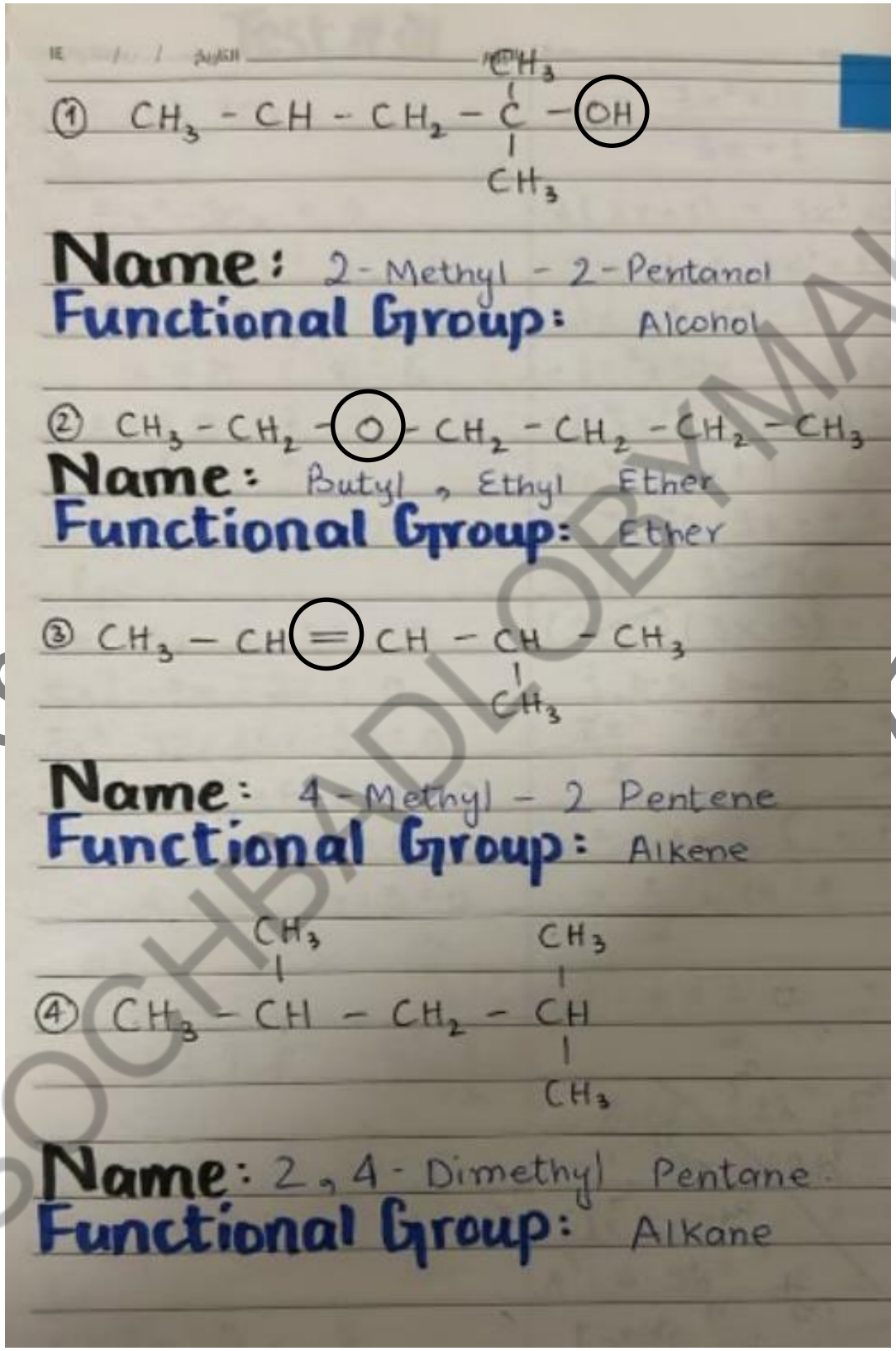
Ans. Many organic compounds, such as hydrocarbons (alkanes, alkenes, and alkynes), are nonpolar because

Reason:

they consist of carbon and hydrogen atoms with relatively similar electronegativities.

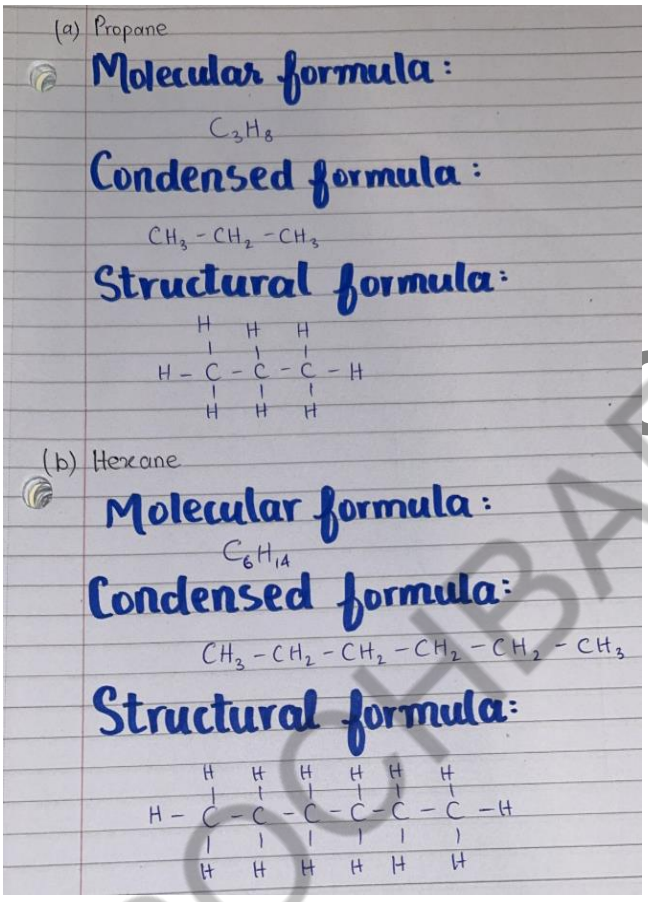
Example: Methane (CH_4), ethane (C_2H_6), and butane (C_4H_{10}) are non-polar (while some polar compounds are Ethanal, carboxylic acids, and ketones and Aldehydes) because they have symmetrical arrangements of C-H bonds, where the electronegativity difference is minimal, and the molecule as a whole does not have a dipole moment.

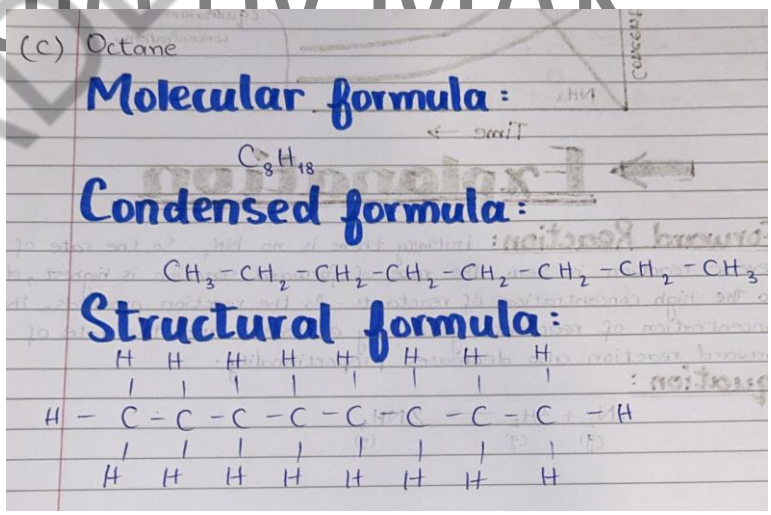
Q8. Encircle and identify the functional group in the following structures:



Q9. Write molecular, structural and condensed formula for the following:

a. Propane
b. Hexane
c. Octane





Q10. Write the reactivity order for alkane alkene and alkyne and argue why?

Ans. The reactivity order for alkanes, alkenes, and alkynes is generally:

Alkene > Alkyne > Alkane

Explanation:

1. Alkenes:

Structure: Alkenes have at least one carbon-carbon double bond (C=C).

Reason: Alkenes are most reactive because Alkenes have one sigma and one Pi bond which is electron rich and is easy to break. Thus, participates in reaction easily. Atoms can easily attack to react.

2. Alkynes:

Structure: Alkynes contain at least one carbon-carbon triple bond (C≡C).

Reason: Alkynes are less reactive than Alkenes because they have 2 Pi bonds due to which electron density is higher and it is difficult for atoms to attack and react with it in comparison to Alkene.

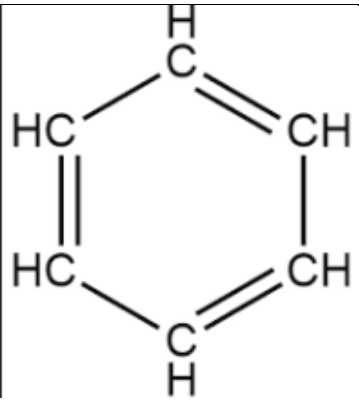
3. Alkanes:

Structure: Alkanes are hydrocarbons with C-C single bond.

Reason: Alkanes have sigma bond. They are unreactive due to the strong C-C and C-H bonds. Th are stable and thus do not participate in reactions.

Q11. Differentiate between open chain hydrocarbons and closed chain hydrocarbons.

Ans.

Open chain hydrocarbons	Closed chain hydrocarbons
Definition	
1. Open chain compounds contain an open chain of carbon atoms.	1. Organic compounds which contain rings of atoms are called closed chain compounds.
Second name	
2. They are also called Acyclic compounds.	2. They are also called cyclic compounds.
Types	
3. Open chain compounds may be either straight-chain or branched chain.	3. Closed chain compounds may be either homocyclic or heterocyclic compounds.
Examples	
4. $CH_3CH_2CH_2CH_3$	4 

Q12. Derive the next Homologue of:

a. Methane CH_4
b. Propane C_3H_8
c. Heptane C_7H_{18}

Ans. a. Adding CH_2 to Methane CH_4:

$CH_4 + CH_2 = C_2H_6$

C_2H_6: Ethane is the next homologue of Methane.

b. Adding CH_2 to Propane C_3H_8:

$C_3H_8 + CH_2 = C_4H_{10}$

C_4H_{10}: Butane is the next homologue of Propane.

c. Adding CH_2 to Heptane C_7H_{18}:

$C_7H_{18} + CH_2 = C_8H_{20}$

C_8H_{20}: Octane is the next homologue of Heptane.

Q13. Write general formula for the following functional groups:

a. Alkane
   C_nH_{2n+2}
b. Alkene
   C_nH_{2n}
c. Alkyne
   C_nH_{2n-2}
d. Alcohol
   $C_nH_{2n+1}OH$
e. Ether
   C_nH_{2n+2O}
f. Aldehyde
   C_nH_{2n+2}
g. Ketone
   $C_nH_{2n}O$
h. Amine
   RNH_2
i. Carboxylic acid
   $C_nH_{2n+1}COOH$
j. Ester
   RCOOR'

Q14. Draw structure of the following functional groups:

a. Alcohol
b. Aldehyde
c. Amine
d. Ester