CHAPTER 12

HYDROCARBONS

MULTIPLE CHOICE QUESTIONS

1. **Which of the following is not a hydrocarbon?**
   (a) Methane (CH_4) (b) Ethane (C_2H_6) (c) Water (H_2O) (d) Ethyne (C_2H_2)
2. **Carbon has valency**
   (a) 3 (b) 4 (c) 5 (d) 6
3. **Which of the following property is not present in hydrocarbons?**
   (a) High melting point (b) Non-polar property
   (c) Solubility in non-polar solvent (d) Poor conductivity
4. **Hydrocarbons having high molecular mass are**
   (a) Gases (b) Liquid (c) Solids (d) All of these
5. **Hydrocarbons having double bond are**
   (a) Alkane (b) Alkene (c) Alkyne (d) Alkyl
6. **Methane forms natural gas about**
   (a) 84% (b) 85% (c) 86% (d) 87%
7. **The density of alkane increases with the increase of**
   (a) M.P (b) B.P (c) Molecular size (d) Bonds
8. **Which are the characteristics property of alkanes**
   (a) Displacement reactions (b) Double displacement reaction
   (c) Substitution reaction (d) Redox reaction
9. **Incomplete combustion of alkanes produce**
   (a) Carbon dioxide (b) Oxygen (c) Chlorine gas (d) Carbon monoxide
10. **Alkynes being more reactive than**
    (a) Alkanes (b) Alkenes (c) Both a & b (d) None of these
11. **Dehydrohalogenation of alkyl halides take place in the presence of**
    (a) Alcoholic KOH (b) Aqueous NaCl (c) Alcoholic NaCl (d) Aqueous KOH
12. **A solution of bromine in water having colour**
    (a) Dark brown (b) Purple (c) Red – brown (d) Voilet
13. **Traces of acetylene are present in coal gas about**
    (a) 0.06% (b) 0.07% (c) 0.08% (d) 0.09%
14. **What is the formula of methane**
    (a) CH_3 (b) CH_4 (c) CH_2 (d) C_2H_5
15. **Formula of nascent hydrogen is**
    (a) H_2 (b) [H] (c) H_3 (d) All of these
16. **Which of the following is not an organic solvent**
    (a) C_2H_5OH (b) $CHCl_3$ (c) CCl_4 (d) H_2O
17. **Methane is also called**
    (a) Marsh gas (b) Inert gas (c) Natural gas (d) Both (a) and (c)
18. **Alkenes is also called**
    (a) Paraffins (b) Olefins (c) Acetylenes (d) All of above
19. **Ethene reacts with H_2SO_4 at temperature of**
    (a) 150°C (b) 16°C (c) 180°C (d) 453 K

20. Banaspati Ghee is also called
(a) Vegetable oil (b) Margarine (c) Cooking oil (d) Coconut oil

21. Ethylene oxide is used as
(a) Anti-freezer (b) Solvent
(c) Fumigant (d) Poisonous mustard gas

22. Banana when riped produces gas
(a) Ethene (b) Methane (c) Noble gas (d) Oxygen gas

23. Addition of hydrogen is called
(a) Reduction (b) Oxidation (c) Redox (d) All of these

24. Which of the following is not a example of open chain hydrocarbon
(a) CH_4 (b) C_3H_8 (c) C_2H_6 (d) C_6H_6

25. Number of bonds present in methane
(a) 2 (b) 3 (c) 4 (d) 5

26. Which of the following is not a function of chloroform
(a) Solvent in rubber (b) Dry cleaning (c) Solvent in waxes (d) Anaesthesia

27. Which of the following has higher energy
(a) Alkane (b) Alkene (c) Alkyne (d) All of these

28. Which is used as Anti-freezer
(a) Di-ethyl ether (b) Ethyl alcohol (c) Ethylene oxide (d) Ethylene glycol

29. Alkanes are also called
(a) Paraffins (b) Olefins (c) Acetylenes (d) Acetaldehyde

30. Due to increase in molar mass which property increases
(a) B.P (b) M.P (c) Volatility (d) Both a & b

31. The compound having atleast one benzene ring are called
(a) Aromatics (b) Alkane (c) Alkene (d) Alkyne

32. What is the most necessary condition for the reaction of CH_4 with halogen?
(a) Catalyst (b) Pressure (c) Sunlight (d) High temperature

33. Glyoxal is oxidize into
(a) $KMnO_4$ (b) Glycol (c) Oxalic acid (d) Acetic acid

34. The example of rubbers are:
(a) Neoprene (b) Butadiene (c) Chloroprene (d) Furan

35. Which of the following is a synthetic fibre
(a) Nylon (b) Rayon (c) Polyesters (d) All of these

36. Detergents are the sodium salts of
(a) Sulphuric acid (b) Alkyl hydrogen sulphite
(c) Sodium carbonate (d) Cholestryl benezoate

37. Due to which property alkane are used a fuel
(a) Combustion (b) Halogenation (c) Oxidation (d) Reduction

38. Alcohol is soluble in water due to
(a) Hydrogen bonding (b) Lone pair of water
(c) Covalent bonding (d) All of above

39. **Which of the following is not alcohol**
(a) C_2H_5OH (b) C_3H_7OH (c) CH_3OH (d) $Ca(OH)_2$

40. **paraffins means**
(a) Highly reactive (b) Less reactive (c) Oil forming (d) None of these

41. **Number of bonds in propene is**
(a) 6 (b) 7 (c) 8 (d) 9

42. **Which compound is used for welding process**
(a) CH_4 (b) $KMnO_4$ (c) Acetylene (d) Ethylene

43. **Amorphous forms of carbons are**
(a) Coal (b) Charcoal (c) Carbon black (d) All of these

44. **Alkenes are insoluble in**
(a) Organic solvent (b) Alcohol (c) Water (H_2O) (d) Both b & c

45. **Which of the following does not occur free in nature**
(a) Ethylene (b) Acetylene (c) Propylene (d) Pentene

46. **The formula of oxalic acid is**
(a) $(COOH)_2$ (b) HCOOH (c) CH_3COOH (d) COOH

47. **Alkyne forms**
(a) Single bond (b) Double bond (c) Triple bond (d) Ionic bond

48. **Di-methyl acetylene is also called**
(a) Ethyne (b) Propyne (c) Butyne (d) Hexayne

49. **Which one of the following is a substitution reaction**
(a) Halogenation of alkane (b) Dehydration of alkane
(c) Hydrolysis of alkane (d) Hydrogenation

50. **Alkanes having carbon range are liquid**
(a) C_4 to C_6 (b) C_5 to C_{10} (c) C_8 to C_{10} (d) Both a & b

ANSWER KEY

1	c	14	b	27	c	40	b
2	b	15	b	28	d	41	d
3	a	16	d	29	a	42	c
4	c	17	d	30	d	43	d
5	b	18	b	31	a	44	d
6	b	19	d	32	c	45	b
7	c	20	b	33	c	46	a
8	c	21	c	34	d	47	c
9	d	22	a	35	d	48	c
10	c	23	a	36	b	49	a
11	a	24	d	37	a	50	d
12	c	25	c	38	a		
13	a	26	b	39	d		

SHORT QUESTION

INTRODUCTION OF HYDROCARBONS

Q.1 Why hydrocarbons are considered as parent organic compounds?

Ans. Hydrocarbons are those compounds which are made up of only carbon and hydrogen element. Hydrocarbons are regarded as the parent organic compounds since other organic compounds are considered to be derived from them by replacement of one or more hydrogen atoms by other atoms or group of atoms.

Q.2 What is the difference between a straight and a branched chain?

Ans.

Straight Chain	Branched Chain
Definition These are the compounds in which the first and the last carbon atom are not directly joined to each other and the whole carbon atoms are present in a straight chain. **Example:** $H_3C - CH_2 - CH_2 - CH_3$ (Straight chain) (n-butane)	**Definition** In these compounds the first and the last carbon atoms are not joined but these carbon atoms are not present in a straight chain. Instead they are present in branched form. **Example:** $CH_3 - CH - CH_3$ | CH_3 Branched Chain (n-butane)

Q.3 Give the general formulae of satuated and unsaturated hydrocarbons.

Ans.

(i) General Fromula of Saturated Hydrocarbons (Alkane):

Alkanes are saturated hydrocarbons and they contain single bonding between C–C and C–H.

General Formula: Their general formula is CnH_{2n+2}.

(ii) General Formula of Unsaturated Hydrocarbons (Alkene):

Alkenes are unsaturated hydrocarbons having double bond between C = C.

General formula: The general of alkenes is C_nH_{2n}.

(iii) General Formula of Unsaturated Hydrocarbons (Alkyne):

Alkynes are unsaturated hydrocarbon and having triple bond between $C \equiv C$.

General formula: The of alkynes is CnH_{2n-2}.

Q.4 Define unsaturated hydrocarbons with examples.

Ans. **Unsaturated Hydrocarbons:** The compounds in which two carbon atoms are linked by a double or a triple bond are called unsaturated hydrocarbons.

Unsaturated hydrocarbons with double bond are called as alkenes while with triple covalent bond are called as alkynes.

Example:

$H_2C = CH_2$ (Ethene)	$HC \equiv CH$ (Ethyne)
$H_3C - CH = CH_2$ (Propene)	$H_3C - C \equiv CH$ (Propyne)

ALKANES

Q.1 Which is the simplest alkane?

Ans. The simplest hydrocarbons are alkanes, while simplest alkane is methane having formula CH_4. Each hydrogen atom is bonded to carbon atom by single covalent bond.

Q.2 Give the structure of following compounds isopentane and isobutene.

Ans.

(i) Isopentane:

$$H_3C-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-CH_3$$

(ii) Isobutane:

$$H_3C-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3$$

Q.3 Why the burning of alkanes require sufficient supply of oxygen?

Ans. Alkanes undergoe incomplete compulsion in the limited supply oxygen. As a result carbon monoxide is produced which cause air pollution and contaminate the air as a poisonous gas.

Chemical Equation:

$$3CH_4 + 4O_2 \longrightarrow 2CO + C + 6H_2O$$

Q.4 What do you mean by halogenations? Give the reaction of methane with chlorine in bright sunlight.

Ans. Halogenation: A reaction in which one or more hydrogen atoms of a saturated compound are replaced with some other atoms like halogen atom is called halogenations.

Reaction of Methane with Chlorine in Bright Sunlight: In direct sunlight reaction is explosive and carbon is deposited.

Chemical Equation:

$$CH_4 + 2Cl_2 \xrightarrow[\text{Sunlight}]{\text{Bright}} C + 4HCl$$

ALKENES

Q.1 Why alkenes are reactive?

Ans. Alkenes are reactive compounds because the electrons of the double bond are easily available for reaction. These compounds have the tendency to react readily by adding other atoms become saturated compounds. As a result, the double bond is converted into a single bond that is more stable.

Q.2 How can you prepare propene from propyl alcohol?

Ans. Dehydration of Alcohols: Alcohols when dehydrated in the presence of a catalyst give alkene. The best procedure is to pass vapours of alcohol over heated alumina.

Chemical Equation:

$$CH_3-CH_2-\underset{\displaystyle OH}{\underset{|}{CH_2}} \xrightarrow[340\text{-}450^{o}C]{Al_2O_3} CH_3-CH=CH_2+H_2O$$

(Propyl alcohol)

Q.3 Give a test used to identify unsaturation of an organic compound.

Ans. Oxidation with $KMnO_4$: When unsaturated compounds oxidized with $KMnO_4$ the pink colour discharged.

Example:

(i) Reaction with Alkene:

$$3CH_2 = CH_2 + 2KMnO_4 + 4H_2O \longrightarrow 3H_2C(OH)-CH_2(OH) + 2MnO_2 + 2KOH$$

(ii) Reaction with Alkyne:

$$HC \equiv CH + 2KMnO_4 + 2H_2O \longrightarrow H-C(OH)-C(OH)-H + 2MnO_2 + 2KOH$$

This reaction is used to identify unsaturation of an organic compound.

Q.4 Give a few uses of ethene.

Ans. Uses of Ethene:

- For artificial ripening of fruits.
- As a general anaesthetic.
- Oxy-ethylene flame is used for welding purposes.
- Polythene is a plastic material used in packaging, toys, bags etc.

ALKYNES

Q.1 Why the alkynes are called acetylenes?

Ans. Definition: Alkynes are those hydrocarbons which have triple covalent bond among carbon atoms. The first member of alkyne series is known as acetylene. This is the simplest alkyn with molecular formula C_2H_2. Alkynes are also called acetylenes because it is the first member of the series.

Q.2 How is tetrabromoethane prepared from acetylene?

Ans. Preparation of Tetrabromoethane from Acetylene: Tetrabromoethane can be prepared by the addition of halogens to the acetylenes. When bromine water is added to acetylene, red brown colour of bromine water is discharged rapidly due to formation of colourless tetrabromoethane.

$$HC \equiv CH + 2Br_2 \longrightarrow H-C(Br)-C(Br)-H$$

(Acetylene) (Tetrabromoethane)

Q.3 How can you prepare acetylene from tetrachloroethane?

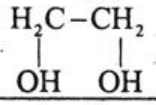
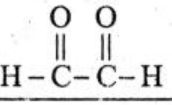
Ans. Preparation of Acetylene from Tetrachloroethane: Acetylene can be prepared by dehalogenation of tetrahalides or tetrachloroethane. When tetrachloroethane is heated with zinc dust. The elimination of halides takes place to form acetylene.

Chemical Equation:

$$H-C(Cl)-C(Cl)-H + 2Zn \xrightarrow[(Dust)]{Heat} HC \equiv CH + 2ZnCl_2$$

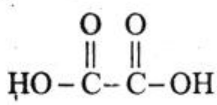
(Acetylene)

Q.4
Ans.

Glycol	Glyoxal
(i) The functional group is glycol is hydroxyl group.	(i) The functional group is glyoxal is a ketonic group.
(ii) The formula of a glycol is 	(ii) The formula of a glyoxal is 

Q.5 Write the formula of oxalic acid.

Ans. The formula of oxalic acid is $C_2H_2O_4$ or $(COOH)_2$.
Which can be also represented as



Oxalic Acid

LONG QUESTIONS

Q.1 Give the brief description for general introduction of hydrocarbons.

General Introduction of hydrocarbons

The simplest class of organic compounds is hydrocarbons (compounds consisting of only carbon and hydrogen elements). Carbon is the only element capable of forming stable, extended chains of atoms bonded through single, double, or triple bonds. Hydrocarbons are divided into four general classes, depending upon the nature of bonds present in the molecules. These are alkanes, alkenes, alkynes and aromatics. Each carbon atom of a hydrocarbon has four bonds.

Properties

Hydrocarbons are further classified as saturated and unsaturated. The members of these classes have different chemical properties because of different nature of bonds present in them. However, their physical properties are similar because of comparable electronegativities of carbon and hydrogen. Thus, they are almost non polar and insoluble in water. They dissolve readily in non polar solvents.

Physical state of hydrocarbons

They are gases or volatile liquids and their volatility decreases with the increase of molecular mass. That is the reason low molecular mass hydrocarbons are gases at room temperature, such as: CH_4 and C_2H_6. Moderate molecular mass hydrocarbons are liquids, such as, C_6H_{14}; while higher molecular mass hydrocarbons are solids.

Fossil fuels

Fossil fuels are hydrocarbons. They are not only major sources of energy but also are raw materials used to make thousands of consumer products. Hydrocarbons are the starting materials for the synthesis of organic chemicals of commercial importance. These chemicals are essential for making plastics, synthetic rubbers, synthetic fibres, and fertilizers, etc.

Q.2 What are hydrocarbon? Write down the types of hydrocarbon.

Hydrocarbon

Hydrocarbons are those compounds which are made up of only carbon and hydrogen. Hydrocarbon are regarded as the parent organic compound since other organic compound are considered to be derived from them by replacement of one more hydrogen atoms by other atoms or group of atoms.

Types of hydrocarbon

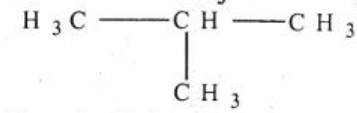
On the basis of structure, hydrocarbons are divided into two main classes.

Open chain or aliphatic hydrocarbons

These are compounds in which first and the last carbon atom are not join directly to each other. The open chain may be straight or branched.

Example; $H_3C–CH_2–CH_2–CH_3$

Straight chain (n-butane)



branched chain(isobutane)

Types of open chain hydrocarbons

Open chain hydrocarbons have been further subdivided into saturated and unsaturated hydrocarbons.

(a) Saturated hydrocarbons

Definition: The hydrocarbon in which all the four valencies of carbon atoms are fully satisfied (saturated) by single bonds with other carbon atoms and hydrogen atoms are called saturated hydrocarbons. Saturated hydrocarbons are also called alkanes.

General formula: The general formula of saturated hydrocarbons is C_nH_{2n+2}.

Note: An alkane is a hydrocarbon in which the carbon atoms are connected by only single covalent bond (there are no double or triple covalent bonds in alkanes).

Example:

CH_4	H_3C-CH_3	$H_3C-CH_2-CH_3$
Methane	Ethane	n – Propane

$H_3C—CH_2—CH_2—CH_3$

n – butane

(b) Unsaturated hydrocarbons

Definition: The hydrocarbons in which two carbon atoms are linked by a double or a triple bond are called unsaturated hydrocarbons.

Classification: These are classified into two groups

- Alkenes
- Alkynes

Alkenes

The compounds in which two carbon atoms are linked by a double bond are called alkenes.

Example: Ethene and propene. These compounds have general formula C_nH_{2n} and functional group >C = C<.

$H_2C=CH_2$	$H_3C–CH=CH_2$
Ethene	Propene

Alkynes: The hydrocarbons in which two carbon atoms are linked by a triple bond are called alkynes.

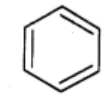
Example: Ethyne and propyne. They have general formula C_nH_{2n-2} and functional group–C≡C–.

$HC\equiv CH$	$H_3C–C\equiv CH$
Ethyne	Propyne

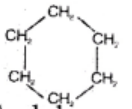
(ii) Closed chain or Cyclic hydrocarbons

Definition: Compounds having rings of carbon atoms in their molecules are called closed chain or cyclic hydrocarbons.

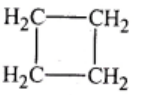
Example: Benzene (C_6H_6), cyclobutane and cyclohexane.



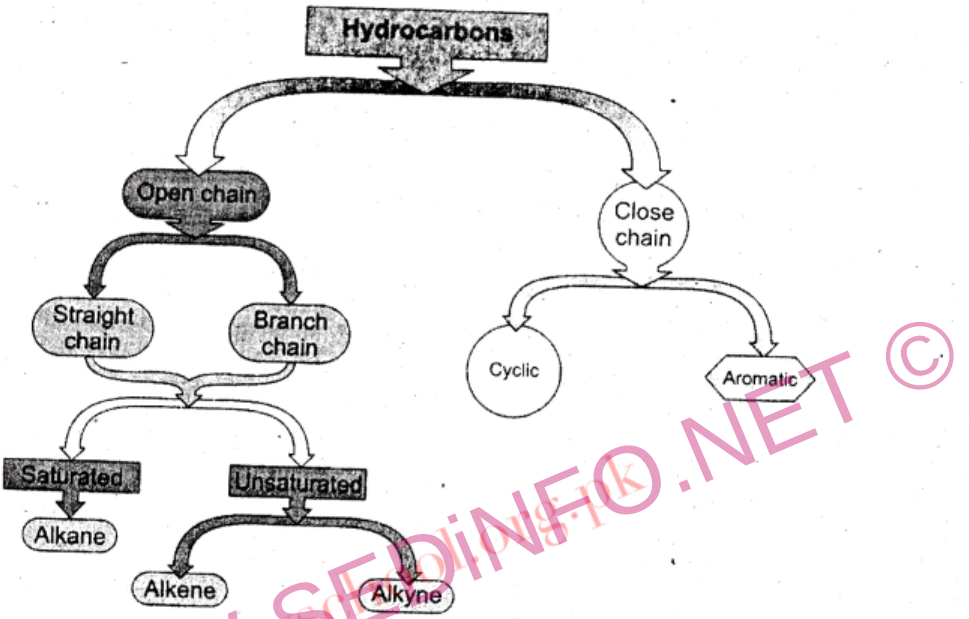
Benzene



Cyclohexane



Cyclobutane



Q.3 What are the alkanes? Give the sources of alkanes.

12.1 ALKANES

Introduction

The simplest hydrocarbons are alkanes. In these compounds all the bonds of carbon atoms are single that means valencies carbon atoms are saturated. Therefore, they are least reactive. That is the reason, alkanes are called paraffins (para means less, and affins means affinity or reactivity).

Sources of Alkanes

- The main sources of alkanes are petroleum and natural gas.
- Methane forms about 85% of natural gas.
- All the alkanes can be obtained commercially by the fractional distillation of crude petroleum.
- Marsh gas is obtained by the bacterial decay of vegetable matter contains mostly methane.
- Fuel gases obtained from coal gas contain alkanes in small amounts.
- Methane occurs in gobar gas, sewage gas and bio-gas which are formed by the decomposition of cattle dung, excreta and plant wastes.

Q.4 How alkanes can be prepared in laboratory?

12.1.1 Preparation of Alkanes

Alkanes form a series of homologous compounds. So, their methods of preparation and chemical properties are similar. There are many methods of preparation but only two methods are as follows.

12.1.1.1 Hydrogenation of Alkenes and Alkynes

Hydrogenation means addition of hydrogen in alkenes and alkynes. Alkenes and alkynes are unsaturated compound, so they have the capacity to add up atoms in them. This reaction is carried out in the presence of nickel catalyst at 250°C to 300 °C. However, in the presence of catalyst platinum or palladium, the reaction takes place at room temperature, such as:

$$H_2C{=}CH_2 + H_2 \xrightarrow[250 - 300\ ^oC]{Ni} H_3C{-}CH_3$$

$$HC{\equiv}CH + H_2 \xrightarrow[250 - 300\ ^oC]{Ni} H_2C{=}CH_2$$

$$H_2C{=}CH_2 + H_2 \xrightarrow[250 - 300\ ^oC]{Ni} H_3C{-}CH_3$$

12.1.1.2 Reduction of Alkyl Halides

Reduction means addition of nascent hydrogen. In fact, it is a replacement of a halogen atom with a hydrogen atom. This reaction takes place in the presence of Zn metal and HCl.

$$H_3C-Br + 2[H] \xrightarrow{Zn/dil.HCl} CH_4 + HBr$$

$$CH_3CH_2Br + 2[H] \xrightarrow{Zn/dil.HCl} CH_3-CH_3 + HBr$$

Q.5 Write down the physical properties of alkanes.

Physical Properties of Alkanes

(i) Alkanes form a homologous series of compounds of first four members of the series are gases. The alkanes consisting of C_5 to C_{10} are liquids while higher members of the series are solids.

(ii) They are nonpolar, therefore, they are insoluble in water but soluble in organic solvents.

(iii) The density of alkanes increases gradually with the increase of molecular size.

(iv) The melting and boiling points' of alkanes increase regularly with the increase of molecular sizes. This is because of increase of attractive forces between the molecules of alkanes.

(v) The alkanes become more viscous as their molecular sizes increase.

(vi) Alkanes become less flammable, i.e. more difficult to bum with the increase of molecular sizes.

Q.6 Write down the chemical properties of alkanes.

12.1.2 Chemical Reactions

Alkanes are least reactive compounds being saturated hydrocarbons. However, they give reactions at high temperatures. Here we will discuss only two reactions of alkanes.

12.1.2.1 Halogenation

Substitution

A reaction in which one or more hydrogen atoms of a saturated compound are replaced with some other atoms (halogen) is called a substitution reaction. These reactions are a characteristic property of alkanes.

Reaction with bright sunlight

Alkanes give only substitution reactions. Alkanes react fairly with halogens in diffused sunlight only. In dark there is no reaction. In direct sunlight, reaction is explosive and carbon deposited.

$$CH_4 + 2Cl_2 \xrightarrow{\text{bright sunlight}} C + 4HCl$$

Reaction with diffuse sunlight

In diffused sunlight, a series of reactions take place and at each step one hydrogen atom is substituted by halogen atoms, so that all the hydrogen atoms are substituted one by one by halogen atoms

$$CH_4 + Cl_2 \xrightarrow{\text{diffused sunlight}} CH_3Cl + HCl$$

$$CH_3Cl + Cl_2 \xrightarrow{\text{diffused sunlight}} CH_2Cl_2 + HCl$$

$$CH_2Cl_2 + Cl_2 \xrightarrow{\text{diffused sunlight}} CHCl_3 + HCl$$

$$CHCl_3 + Cl_2 \xrightarrow{\text{diffused sunlight}} CCl_4 + HCl$$

12.1.2.2 Combustion

Excess supply of oxygen

Alkanes burn in the presence of excess of air or oxygen to produce a lot of heat, carbon dioxide and water. This reaction takes place in automobile combustion engines, domestic heaters and cooking appliances. It is highly exothermic reaction and because of it alkanes are used as fuel.

$$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O + \text{Heat}$$

Limited supply of oxygen

In the limited supply of oxygen, there is incomplete combustion. As a result, carbon monoxide is produced that creates suffocation and causes death.

$$3CH_4 + 4O_2 \longrightarrow 2CO + C + \text{Heat}$$

Q.7 What are the uses of alkanes?

Uses of Methane and Ethane

(i) Natural gas that is chiefly methane is used as domestic fuel.

(ii) Compressed natural gas (CNG) is used as automobile fuel.

(iii) These gases are used in the manufacture of chemicals such as carbon black, methyl alcohol, ethyl alcohol, chloroform, carbon tetrachloride, formaldehyde and acetaldehyde. Carbon black is used in the manufacture of shoe polishes, printers ink and as filler in rubber industry.

(iv) Chloroform is used as a solvent for rubber, waxes, etc., and for anesthesia.

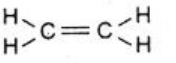
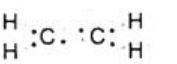
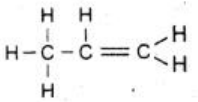
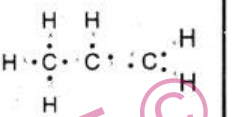
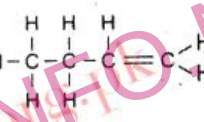
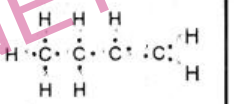
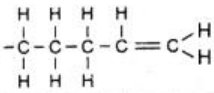
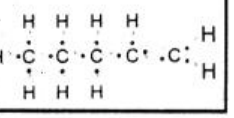
(v) Carbon tetrachloride is used as an industrial solvent and in dry cleaning.

12.2 ALKENES

Q.8 Define the alkenes. How alkenes can be prepared in laboratory?

Definition

The simplest alkene is ethene having formula C_2H_4. These compounds are also known as olefins (a Latin word meaning oil forming) because first members form oily products when react with halogens.

Name	Molecular formula	Condensed formula	Structural formula	Cross and dot formula
(i) Ethylene or ethene	C_2H_4	$H_2C = CH_2$		
(ii) Propylene or propene	C_3H_6	$H_3C - HC = CH_2$		
(iii) Butylene or butene	C_4H_8	$H_3C–H_2C–HC=CH_2$		
(iv) Pentene	C_5H_{10}	$H_3C–CH_2–CH_2CH=CH_2$		

12.2.1 Preparation of Alkenes

Alkenes are prepared by the removal of small atoms (H,OH,X) from the adjacent carbon atoms of the saturated compounds, so as to create a double bond between carbon atoms.

12.2.1.1 Dehydration of Alcohols

Dehydration is removal of water. Ethene is prepared by heating a mixture of ethanol and excess of concentrated sulphuric acid at 180°C. In first step, ethyl hydrogen sulphate is formed which decomposes on heating to produce ethane, which is collected over water.

$$H_3C—CH_2 - OH + H_2SO_4 \xrightarrow{180^\circ C} CH_3CH_2 - OSO_3H$$

$$CH_3CH_2 - OSO_3H \xrightarrow{heat} H_2C = CH_2 + H_2SO_4$$

12.2.1.2 Dehydrohalogenation of Alkyl halides

On heating, ethyl bromide with alcoholic KOH, ethene is formed, Removal of hydrogen and halogen takes place from adjacent carbon atoms to create a double bond.

$$H_3C—CH_2Br + KOH_{(alcoholic)} \longrightarrow H_2C=CH_2 + KBr + H_2O$$

Q.9 Write down the physical properties of alkenes.

Physical Properties of Alkenes

(i) The first member of the alkenes is ethene. It is a colourless gas with pleasant odour.

(ii) Alkenes are nonpolar, therefore, they are insoluble in water but soluble in organic solvents.

(iii) The first member of the series ethene is slightly less dense than air.

(iv) Alkenes are flammable hydrocarbons. On complete combustion, they form carbon dioxide and water with release of energy. However, their flame is smokier than alkanes having a similar number of carbon atoms.

(v) Their melting and boiling points gradually increase with the increase of molecular sizes of the compounds in the series.

Q.10 Write down the chemical properties of alkenes.

12.2.2 Chemical Reactions

Addition reactions are characteristic property of unsaturated compounds because the electrons of the double bond are easily available for reaction. These compounds have the tendency to react readily by adding other atoms. As a result, the double bond is converted into a single bond that is more stable.

Addition reaction

These are the reactions in which the products are formed by the addition of some reagents like H_2, Cl_2, etc., to an unsaturated organic compound. In the process, one of the bonds of a double bond gets broken and two new single bonds are formed.

12.2.2.1 Hydrogenation of Alkenes

Hydrogenation means addition of molecular hydrogen to an unsaturated hydrocarbon in the presence of a catalyst (Ni, Pt) to form saturated compound.

$$H_2C{=}CH_2 + H_2 \xrightarrow[250-300\ ^oC]{Ni} H_3C{-}CH_3$$

On industrial scale, this reaction is used to convert vegetable oil into margarine (Banaspati ghee)

$$\text{Oil} + H_2 \longrightarrow \text{Margarine (Banaspati ghee)}$$

12.2.2.2 Halogenation of Alkenes

Halogenation means addition of halogen like chlorine or bromine. Bromination of alkenes is very important reaction. When bromine water (a solution of bromine in water having red-brown colour) is added to ethene in an inert solvent like carbon tetrachloride, its colour is discharged at once.

$$H_2C{=}CH_2 + Br_2 \longrightarrow \underset{Br}{\overset{|}{H_2C}}{-}\underset{Br}{\overset{|}{CH_2}}$$

In the reaction, double bond of ethene is converted into a single bond bytl addition of a molecule of bromine. This reaction is used to identify the unsaturation of an organic compound.

12.2.2.3 Hydrohalogenation of Alkenes

Dry gaseous hydrogen halides (HI, HBr and HCl) react with alkenes produce alkyl halides.

$$H_2C{=}CH_2 + HX \longrightarrow H_3C{-}CH_2X$$

$$H_2C{=}CH_2 + HBr \longrightarrow H_3C{-}CH_2Br$$

The order of reactivity of hydrogen halides is HI > HBr > HCl.

12.2.2.4 Oxidation of Alkenes with $KMnO_4$

Alkenes decolourize the pink colour of acidified dilute solution of potassium permanganate because the double bond electrons react with MnO_4^- ion, which further goes on to form MnO_2 and of ethene glycol (l, 2–ethanediol). Such as there addition of two hydroxyl group at the double bond.

This reaction is also used to test the unsaturation in an organic compound.

Uses of Ethene (Ethylene)

$$3H_2C{=}CH_2 + 2KMnO_4 + 4H_2O \longrightarrow 3H_2\underset{OH}{C}-\underset{OH}{CH_2} + 2MnO_2 + 2KOH$$

Q.11 What are the uses of alkenes?

(i) For artificial ripening of fruits;

(ii) As a general anaesthetic;

(iii) Polythene is a plastic material used in packaging, toys, bags, etc; as a starting material for the manufacture of a large number compounds such as ethylene oxide, ethyl alcohol, ethylene glycol diethyl ether, etc.; ethylene oxide is used as a fumigant, ethylet.

Q.12 Define the alkynes. How alkynes can be prepared in laboratory?

12.3 ALKYNES

The simplest alkyne is acetylene, with molecular formula C2H2. Alkynes are also called acetylenes because of the name of the first member of the series is acetylene.

Molecular, condensed, structural and dot and cross formulae of a few alkynes

Name	Molecular formula	Condensed formula	Structural formula	Cross and dot formula
(i) Acetylene (ethyne)	C_2H_2	$HC \equiv CH$	$H-C \equiv C-H$	$H\cdot\overset{\times}{\underset{\times}{C}}::\overset{\cdot\times}{C}\cdot H$
(ii) Methyl Acetylene (propyne)	C_3H_4	$H_3C-C \equiv CH$	$H-\underset{H}{\overset{H}{C}}-C \equiv C-H$	$H\cdot\overset{H}{\underset{H}{\overset{\times}{C}}}\cdot C::C\cdot H$
(iii) Dimethyl Acetylene (butyne)	C_4H_6	$H_3C-C \equiv C-CH_3$	$H-\underset{H}{\overset{H}{C}}-C \equiv C-\underset{H}{\overset{H}{C}}-H$	$H\cdot\overset{H}{\underset{H}{\overset{\cdot}{C}}}\cdot C::C\cdot\overset{H}{\underset{H}{\overset{\cdot}{C}}}\cdot H$

12.3.1 Preparation of Alkynes

Alkynes are prepared by the following methods.

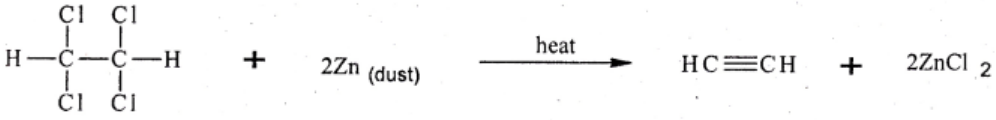
12.3.1.1 Dehydrohalogenation of Vicinal Dihalides

When a vicinal dihalide is heated with alcoholic KOH, two hydrogen along with two halogen atoms are removed from two adjacent carbon atoms with formation of a triple bond between the adjacent carbons.

$$H-\underset{H}{\overset{Cl}{C}}-\underset{Cl}{\overset{H}{C}}-H + 2KOH \xrightarrow[100^oC]{\text{Alcoholic}} \underset{\text{ethyne}}{HC \equiv CH} + 2KCl + 2H_2O$$

12.3.1.2. Dehalogenation of Tetrahalides

When alkyl tetrahalides are heated with Zinc dust, the elimination of halogen atoms takes place to form ethyne.



Q.13 Write down the physical properties of alkynes.

Physical Properties

(i) Alkynes also form a series of compounds. Its first member is acetylene is a colourless gas with faint garlic odour.

(ii) Acetylene is slightly soluble in water but soluble in organic solvents su as benzene, alcohol, acetone, ether, etc.

(iii) Acetylene is slightly lighter than air.

(iv) Alkynes are also flammable. They produce smokier flames than those of alkanes and alkenes.

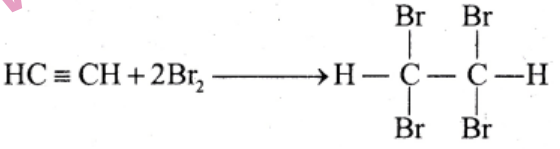
Q.14 Write down the chemical properties of alkynes.

12.2 CHEMICAL REACTION

Alkynes are reactive compounds because of presence of a triple bond. A triple bond consists of two weak bonds and a strong bond. When alkynes react with other substances, two weak bonds are readily broken one by one and addition takes place easily. The addition reactions of alkynes resemble to those of alkenes.

12.3.2.1 Addition of Halogen

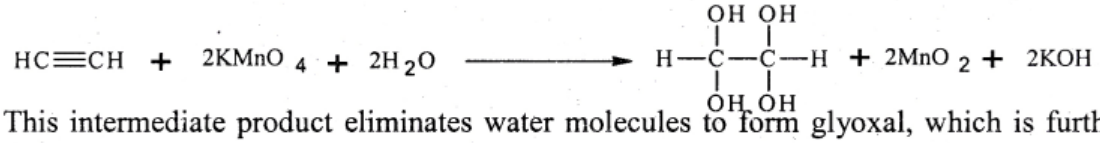
Chlorine and bromine adds to acetylene to form tetrachloroethane and tetrabromoe thane, respectively. When bromine water is added to acetylene, red brown colour of bromine water is discharged rapidly due to formation of colourless . tetrabromoethane.



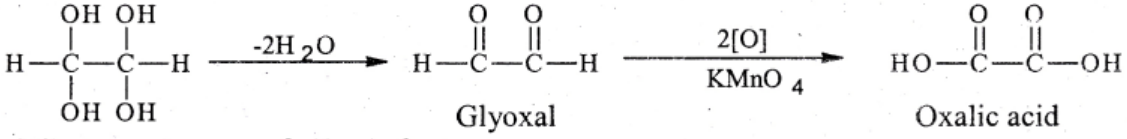
Tetrabromoethane

12.3.2.2 Oxidation with $KMnO_4$

Ethyne is oxidized by alkaline KMn04. And four hydroxyl groups add to the triple bond, such as:



This intermediate product eliminates water molecules to form glyoxal, which is further oxidized to form oxalic acid.



Glyoxal Oxalic acid

Q.15 What are the uses of alkynes?

Uses of Acetylene

(i) Acetylene produces oxy-acetylene flame with oxygen. It is a highly exothermic reaction. Heat released is used for welding purposes.

(ii) Acetylene is used to prepare other chemicals, such as alcohols, acetaldehyde and acids.
(iii) It is used for the ripening of fruits.
(iv) It is used for the manufacturing of polymer products like polyvinyl chloride, polyvinyl acetate and synthetic rubber like neoprene.
(v) It is polymerized to form benzene which is used as raw material to form a variety of organic compounds.

Q How hydrocarbon are used as a fuel

Hydrocarbons as Fuel

The main constituents of fuels (coal, petroleum and natural gas) are hydrocarbons. When hydrocarbons are burnt in air the reaction is called combustion. It is highly exothermic reaction, i.e. it produces a lot of heat. The basic combustion reaction is

$$CH_4 + O_2 \longrightarrow CO_2 + H_2O + \text{heat}$$

The heat energy thus produced is used to meet needs of energy in homes, transportation, as well as in industries.

Q.16 Write down the application of hydrocarbons.

Hydrocarbons as Feed Stock In Industry

Hydrocarbons are not only used as fuel in automobiles or industries, they are also act as raw materials in many industries.

(i) Petrochemical Industry

The organic compounds prepared from hydrocarbons (petroleum and natural gas) are called petrochemicals.

Example: Some of the important petrochemicals are methyl alcohol, ethyl alcohol, formic acid, chloroform, carbon tetrachloride, ethylene, butadiene, benzene, toluene, etc.

(ii) Plastic Industry

Hydrocarbons are used as raw materials for the preparation of a large variety of synthetic polymers, called plastics like polythene, polyester. These can be given any shape when soft, and on hardening make a durable article to be used in common life.

Example: Crockery items (cups, glass, jug, plates, spoons) furniture items (chair, table, stool) automobile parts, electric and sewages items and a lot of other household items.

(iii) Rubber industry

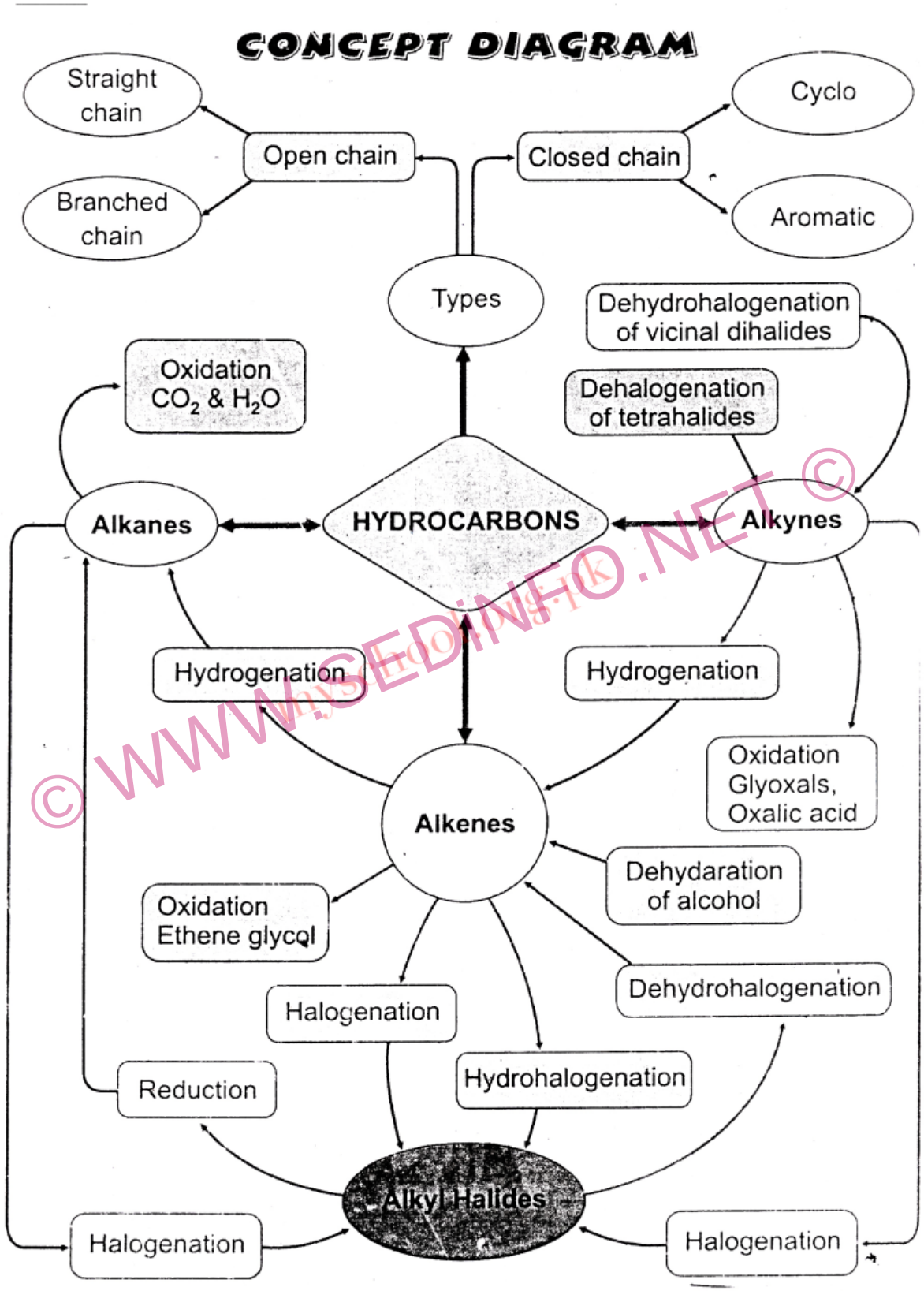
Hydrocarbons are used to prepare synthetic rubber. Such as acetylene is used to prepare butadiene rubber used for making footwear, tyres and toys. Similarly, a good quality rubber neoprene is prepared from chloroprene.

(iv) Synthetic fiber Industry

Hydrocarbons are used to prepare synthetic fibres like nylon, rayon, polyesters. These fibres have better qualities like greater strength, good elasticity, and resistance to wear and tear. So clothes made of synthetic fibres are long lasting than that of natural fibres.

(v) Synthetic detergents

Long chain hydrocarbons obtained from petroleum are used to make synthetic detergents and washing powders. These detergents are sodium salts of alkyl hydrogen sulphate. These detergents have better and stronger cleaning properties than that of soaps. They can be used even in hard water.



EXERCISE

MCQ'S

1. **Which one of these hydrocarbon molecules would have no effect on an aqueous solution of bromine?**

   (a) CH_4 (b) $C_{10}H_{20}$ (c) C_2H_4 (d) C_2H_2

2. **If an organic compound has 4 carbon atoms, all singly bonded, it will have the following characteristics except one**

   (a) it will be saturated hydrocarbon. (b) it will have 8 hydrogen atoms.

   (c) its name will be n-butane. (d) it will be least reactive.

3. **The reduction of alkyl halides takes place in the presence of**

   (a)Zn/HC*l* (b) Na/HC*l* (c) Mg/HC*l* (d) Cu/HC*l*

4. **Halogenation of methane does not produce which one of the following:**

   (a) carbon tetrachloride (b) chloroform (c) carbon black (d) chloromethane

5. **Incomplete combustion of alkanes produces**

   (a) carbon dioxide only (b) carbon monoxide only

   (c) carbon monoxide and carbon black (d) carbon dioxide and carbon black

6. **Alkenes are prepared from alcohols by a process called**

   (a) dehydrogenation (b) dehalogenation (c) dehydration (d) dehydrohalogenation

7. **Dehydrohalogenation takes place in the presence of**

   (a) NaOH aqueous (b) alcoholic KOH (c) aqueous KOH (d) alcoholic NaOH

8. **Oxidation of ethene with $KMnO_4$ produces**

   (a) oxalic acid (b) glyoxal (c) ethene glycol (d) propene glycol

9. **Which one of these is a saturated hydrocarbon?**

   (a) C_2H_4 (b) C_3H_6 (c) C_4H_8 (d) C_6H_{12}

10. **A hydrocarbon has molecular formula C_8H_{14}. What is the molecular formula of the next member of the same homologous series?**

    (a) C_9H_{18} (b) C_9H_{16} (c) C_9H_{20} (d) C_9H_{12}

11. **The molecular formulae of the first three members of the alkane hydrocarbons are CH_4 , C_2H_6 and C_3H_8. What is the molecular formula for the eighth alkane member, octane, which is found in petrol?**

    (a) C_8H_{12} (b) C_8H_{14} (c) C_8H_{18} (d) C_8H_{20}

12. **One of the hydrocarbons reacts with one mole of hydrogen to form a saturated hydrocarbon. What formula could be of the X?**

(a) C_3H_8 (b) C_6H_{12} (c) C_4H_{10} (d) C_7H_{16}

13. **Dehydration of alcohols can be carried out with**

(a) NaOH (b) KOH (c) H_2SO_4 (d) HCl

14. **The end product of oxidation of acetylene is**

(a) oxalic acid (b) glycol (c) glyoxal (d) none of these

15. **Dehalogenation of tetrahalides produces acetylene. Place in the presence of This reaction takes**

(a) sodium metal (b) zinc metal (c) magnesium metal (d) potassium metal

16. **Substitution reaction is the characteristics of**

(a) alkanes (b) alkenes (c) alkynes (d) none of these

17. **Halogenation of methane in the presence of diffused sunlight takes place**

(a) suddenly, only in one step (b) slowly in one step

(c) in a series of four steps (d) fastly in two steps

18. **Which one of the followings is a substitution reaction?**

(a) halogenation of alkynes (b) halogenation of alkenes

(c) halogenation of alkanes (d) bromination of alkenes

19. **The order of reactivity of hydrogen halides with alkenes is**

(a) HI > HBr (b) HBr > HI (c) HCl> HBr (d)HBr < HCl

20. **Oxidation of alkenes produce**

(a) glyoxal (b) oxalic acid (c) glycol (d) formic acid

ANSWER KEY

1	a	4	c	7	b	10	b	13	c	16	a	19	a
2	b	5	b	8	c	11	c	14	a	17	c	20	b
3	a	6	c	9	d	12	d	15	b	18	c	KIPS	

SHORT QUESTIONS

Q.1 Differentiate between saturated and unsaturated hydrocarbons.

Ans.

Saturated Hydrocarbons	Unsaturated hydrocarbons
• The compounds in which all the four valences of carbon atoms are fully satisfied by single bonds with other carbon atoms and hydrogen atoms is called saturated hydrocarbons.	• The compounds in which two carbon atoms are linked by a double or triple bond are called hydrocarbons.
• Saturated hydrocarbons are also called alkanes.	• Unsaturated hydrocarbons are also called alkenes (with double covalent bond) and alkynes (with triple covalent bond.)
• Their general formula is C_nH_{2n+2}.	• Their general formula is CaH_2n for alkene and CnH_{2n-2} for alkyne.
Example: CH_4 (Methane) $H_3C–CH_3$ (Ethane)	**Example:** $H_2C = CH_2$ (Ethene) $HC \equiv CH$ (Ethyne)

Q.2 A compound consisting of four carbon atoms has a triple bond in it. How many hydrogen atoms are present in it?

Ans. The name of this compound is 2-butyne and it has six hydrogen atoms in it.

Formula: $H_3C-C\equiv C-CH_3$ (2-butyne)

Q.3 Why the alkanes are called paraffins?

Ans. **Alkenes are paraffins:** Para means 'less' and affins means 'affinity' or reactivity.' Alkanes are least reactive compounds. That is the reason they are called as paraffins. Alkanes are the simplest hydrocarbons. In these compounds all the bonds of carbon atoms are single, that means carbon atoms are saturated hydrocarbons. Saturated hydrocarbons are the least reactive compounds.

Q.4 What do you know about hydrogenation of alkenes?

Ans. **Hydrogenation of Alkenes:** Hydrogenation means addition of molecular hydrogen to an unsaturated hydrocarbon in the presence of a catalyst (Ni, Pt) to form saturated compound.

Chemical Equations:

$$H_2C{=}CH_2 + H_2 \xrightarrow[250\text{-}300^0C]{Ni} H_3C\text{-}CH_3$$

On industrial scale this reaction is used to convert vegetable oil into margarine (ghee).

Q.5 How alkyl halides are reduced?

Ans. **Reduction of Alkyl Halides:** Reduction means addition of nascent hydrogen in alkyl halides. It is a replacement of a halogen atom with a hydrogen atom. This reaction takes place in the presence of Zn metal and HCl.

Chemical equations:

$$CH_3Br + 2[H] \xrightarrow{Zn/il.HCl} CH_4 + HBr$$

$$CH_3CH_2Br + 2[H] \xrightarrow{Zn/il.HCl} H_3C–CH_3 + HBr$$

Q.6 Why the alkanes are used as fuel?

Ans. **Alkanes as Fuels:** The main constituents of fuels (coal, petroleum and natural gas) when alkanes burnt in air the reaction takes place in the presence of Zn metal and HCl.

Chemical equation:

$$CH_4 + O_2 \longrightarrow CO_2 + H_2O + Heat$$

The heat energy thus product is used to meet needs of energy in homes, transportation as well as, industries. Alkanes are used as fuel because alkanes a highly flameable, their flame is less smokier and they produce lot of energy during burning

Q.7 How can you prepare ethene from alcohol and ethyl bromide?

Ans. **Preparation of Ethene from Alcohol:** Ethene can be prepared from alcohols by dehydration of alcohols. Dehydration is removal of water. Ethane is prepared by heating a mixture of ethanol and excess of concentrated H_2SO_4 at 180°C.

1st Step: In first step ethyl hydrogen sulphate is formed.

$$CH_3—CH_2OH + H_2SO_4 \longrightarrow CH_3CH_2—OSO_3H + H_2O$$

Second Step: Ethyl hydrogen sulphate is decomposed on heating produce ethane which is collected over water.

$$CH_3 - CH_2 - OSO_3H \xrightarrow{heat} CH_2 = CH_2 + H_2SO_4$$

Preparation of ethane from ethyle bromide

On heating ehtyle bromide with alcoholic KOH, ethene is formed

$$CH_3 - CH_2 - Br + KOH_{(alcohlic)} \longrightarrow CH_2 = CH_2 + H_2O + KBr$$

Q.8 Identify propane from propene with a chemical test.

Ans. For the identification of propane from propene, bromine water is added to propane and propene in an inert solvent like carbon tetrachloride. The colour of bromine water is discharged at once in presence of propene, but in the case of propane it will remain unaffected.

$$CH_3 - CH = CH_2 + Br_2 \longrightarrow CH_3 - \underset{Br}{CH} - \underset{Br}{CH_2}$$

Q.9 Why the alkenes are called olefins?

Ans. Alkene are those compounds which have carbon to carbon double covalent bond in them. The simplest alkene is ethane having formula C_2H_4. These compounds are also known as olefins because lower members of the series form oily products when reacts with halogens. Olefins is a Latin word which means oil forming. That is the reason for which they are also known as olefins.

Q.10 Why alkane can't be oxidized with $KMnO_4$ solution?

Ans. Oxidation with $KMnO_4$ is a special reaction which is used to test the unsatuaration in an organic compound. When alkanes oxidized with $KMnO_4$ there is no any reaction takes place because alkanes are paraffins and saturated compounds they are less reactive, don't have ability to oxidize $KMnO_4$. Saturated compounds do not give reaction with $KMnO_4$.

$$Alkane + KMnO_4 + H_2O \longrightarrow No\ reaction$$

Q.11 What are the addition reactions? Explain with an example.

Ans. **Addition Reactions:** These are the reactions in which the products are formed by the addition of some reagents like H_2, Cl_2 etc. to an unsaturated organic compound. In the process, one of the bonds of double bonds gets broken and two new single bonds are formed.

Example: Addition of molecular hydrogen to an unsaturated hydrocarbon in the presence of a catalyst (Ni, Pt) to form saturated compounds takes place.

$$H_2C = CH_2 - H_2 \xrightarrow[250\text{-}300^\circ]{Ni} H_3C - CH_3$$

Q.12 Justify that alkanes give substitution reactions.

Ans. Alkanes are least reactive compounds because they are saturated hydrocarbons. Alkanes give only substitution reactions. Substitution reaction is a reaction in which one or more hydrogen atoms of a saturated compound are replaced with some other atoms like halogen is called a substitution reaction. These reactions are a characteristic property of alkanes.

Example:

In diffused sunlight, a series of reactions take place and at each step one hydrogen atom is substituted by halogen atoms, so that all the hydrogen atoms are substituted one by one by halogen atoms

$$CH_4 + Cl_2 \xrightarrow{\text{diffused sunlight}} CH_3Cl + HCl$$

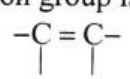
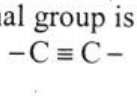
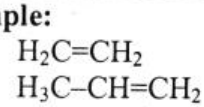
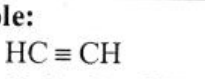
$$CH_3Cl + Cl_2 \xrightarrow{\text{diffused sunlight}} CH_2Cl_2 + HCl$$

$$CH_2Cl_2 + Cl_2 \xrightarrow{\text{diffused sunlight}} CHCl_3 + HCl$$

$$CHCl_3 + Cl_2 \xrightarrow{\text{diffused sunlight}} CCl_4 + HCl$$

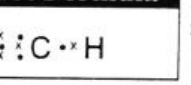
Q.13 Both, alkenes and alkynes are unsaturated hydrocarbons. State the one 'most significant difference between them.

Ans.

Alkenes	Alkynes
• The compounds in which tow carbon atoms are linked by a double bond are called alkenes.	• The compounds in which towo carbon atoms are linked by a Triple bond are called alkenes.
• Their function group is 	• Their functional group is 
Example:  (Ethene) (Propene)	**Example:**  (Ethyne) (Propyne)

Q.14 Write the molecular, dot and cross and structural formula of ethyne.

Ans.

Name	Molecular Formula	Structural Formula	Cross and dot Formula
Ethyne	C_2H_2	$H-C\equiv C-H$	

Q.15 Why hydrocarbons are soluble in organic solvents?

Ans. These are insoluble in polar solvent but soluble in organic solvents. It is the general rule of solubility that 'like dissolves like', hydrocarbons are non-polar in nature and organic solvents are also non-polar in nature. That is the reason for which hydrocarbons are soluble in organic solvents.

Example:

Petrol is dissolve in Karosine oil.

Q.16 Give the physical properties of alkanes.

Ans. Physical Properties of Alkanes:

- Alkanes form a homologous series of compounds of first four members of the series are gases. The alkanes consisting of C_5 to C_{10} are liquids while higher members of the series are solids.
- They are nonpolar, therefore, they are insoluble in water but soluble in organic solvents.
- The density of alkanes increases gradually with the increase of molecular size.
- The melting and boiling points' of alkanes increase regularly with the increase of molecular sizes. This is because of increase of attractive forces between the molecules of alkanes.
- The alkanes become more viscous as their molecular sizes increase.
- Alkanes become less flammable, i.e. more difficult to bum with the increase of molecular sizes.

Q.17 How can you identify ethane from ethene?

Ans. Identification of Ethane from Ethene: For the identification of ethane from ethane, bromine water is added to both ethane and ethane in the presence of an inert solvent like carbon tetrachloride. Ethene will give reaction with bromine water but ethane will not react will it.

Example:

(i) $H_2C{=}CH_2 + Br_2 \longrightarrow Br{-}CH_2{-}CH_2{-}Br$
(Ethene)

(ii) $H_3C{-}CH_3 + Br_2 \longrightarrow$ No reaction
(Ethene)

Bromination is an important reaction for checking of unsaturation in organic compounds.

Q.18 Why colour of bromine water discharges on addition of ethene in it?

Ans. In the reaction double bond of ethane is converted into a single bond by the addition of a molecule of bromine. So, ethane converted into a saturated compound, hence the colour of bromine water is discharge.

Example: $H_2C{=}CH_2 + Br_2 \longrightarrow Br{-}CH_2{-}CH_2{-}Br$

This reaction is used to identify the unsaturation of an organic compound.

Q.19 State one important use of each:

(i) Ethene **(ii)** Acetylene **(iii)** Chloroform **(iv)** Carbon tetrachloride

Ans.

(i) **Ethene:** Oxy-ethylene flame is used for welding purposes.

(ii) **Acetylene:** It is used for the manufacturing of polymer products like polyvinyl chloride, polyvinyl acetate and synthetic rubber like neoprene.

(iii) **Chloroform:** Chloroform is used as a solvent for rubber, waxes etc. and for anaesthesia.

iv) **Carbon Tetrachloride:** Carbon tetrachloride is used as an industrial solvent and in dry cleaning.

EXTENSIVE QUESTIONS

Q.1 **What types of reactions are given by alkanes? Explain with reference to halogenations of alkanes.**

Ans. See Questions No.

Q.2 **Alkanes are a source of heat. Explain it.**

Ans. See Questions No.

Q.3 **Prepare the following as directed:**

(a) ethane from ethene;

(b) acetylene from tetrahalide;

(c) carbon tetracholride from methane;

(d) ethylene glycol from ethane;

(e) 1,2-dibromoethane from etheneand

(f) glyoxal from acetylene

Ans. Do yourself

Q.4 **Explain the oxidation of acetylene.**

Ans. See Questions No.

Q.5 **Write balanced chemical equations for the following reactions. Also name the products that formed.**

(i) A mixture of ethyne and hydrogen is passed over heated nickel

(ii) Ethyne is treated with chlorine

(iii) Ethyne is burnt in air

(iv) Ethyne is passed through bromine water

Ans. Do your self

Q.6 **Explain briefly:**

(i) Why butane undergoes substitution reactions?

(ii) There are millions of organic compounds.

(iii) Acetylene undergoes addition reactions in two stages.

(iv) Alkynes are more reactive than alkanes. .

Ans. Do yourself