CHAPTER 12

HYDROCARBONS

MULTIPLE CHOICE QUESTIONS

Q.No.1 Encircle the correct option from the given multiple choices.

Introduction

(1) The _____ percentage of energy used to sustain our way of life comes fro fossil fuels.

(a) 85% (b) 95% (c) 90% (d) 80%

(2) The concentration of carbon dioxide in the atmosphere has increased upto 20% b the end of

(a) 18^{th} century (b) 19^{th} century (c) 17^{th} century (d) 20^{th} century

(3) The every year production of CO_2 released in atmosphere is

(a) 255 millions tons (b) 25 billions tons (c) 22 million tons (d) 15 billions tons

(4) The ammonia of CO_2 production by combustion of fossil fuel every year is

(a) 21 billion (b) 25 millions tons (c) 22 billion tons (d) 15 billion tons

(5) The amount of CO_2 removed by plants per year is

(a) 15 billion tons (b) 22 billion tons (c) 10 billion tons (d) 20 billion tons

Alkanes

(6) The general formula of alkane is

(a) CnH_{2n+1} (b) CnH_{2n+2} (c) C_nH_{2n} (d) C_nH_{2n-1}

Method of preparation of alkanes

(7) Which of these following is used as catalyst for hydrogenation of alkene and alkyne

(a) Ni (b) Fe (c) Al_2O_3 (d) Zn

(8) The reduction of alky halide take place in presence of

(a) Zn/HCl (b) $KMnO_4$ (c) H_2 (d) None of these

(9) Which of the following is used to extract vegetable oil from corn, Soya beans, Cotto seed etc.

(a) Hexane (b) Heptane (c) Carbon terachlride (d) Methanol

Properties of Alkanes

(10) The reaction of an alkane and halogen is _____ reaction.

(a) Addition reaction (b) Hydrogenation reaction
(c) Substitution reaction (d) Hydration reaction

(11) Which of the following react explosively with methane

(a) F_2 (b) Cl_2 (c) I_2 (d) Br_2

(12) Which of the following is the chemical formula of chloroform

(a) CH_2Cl_2 (b) $CHCl_3$ (c) CH_3Cl (d) CCl_4

(13) **The incomplete combustion of methane produced**
(a) CO (b) C (c) CO_2 (d) Both (a) and (b)

(14) **The lighter alkanes are widely used as fuel. This is because**
(a) Their combustion can be controlled
(b) They produce large amount of heat per gram
(c) They are cheap and readily variable
(d) All of these

Alkenes

(15) **The general formula of alkene is**
(a) C_nH_{2n} (b) C_nH_{2n-2} (c) CnH_{2n+1} (d) C_nH_{2n-1}

Preparation of alkenes

(16) **Alcohol dehydrates when their vapours are passed over heated_____**
(a) Galena (b) Iron pyrite (c) Alumina (d) Feldspar

(17) **Which of the following acid is used as dehydrating agent**
(a) HCl(Conc.) (b) HNO_3(Conc.) (c) H_2SO_4(Conc.) (d) CH_3COOH

Properties of alkenes

(18) **In liquid member of alkene the number of carbon atoms ranges from _____.**
(a) C_5—C_{10} (b) C_5–C_{15} (c) C_6—C_{12} (d) C_1—C_{18}

Alkynes

(19) **The general formula for alkyne is**
(a) C_nH_{2n} (b) C_nH_{2n-2} (c) C_nH_{2n-1} (d) C_nH_{2n+1}

Properites of alkynes

(20) **Ethyne has _____ odour.**
(a) Odourless (b) Pungent (c) Foul odour (d) Garlic like

(21) **Which of the following is used as raw material for the preparation of oxalic acid**
(a) Ethyne (b) Propene (c) Ethane (d) Propyne

(22) **Which of the following can be used as solvent for grease, oil and other organic substances**
(a) Dichloromethane (b) Trichloromethane
(c) Tetrachloromethane (d) All of these

Interesting information

(23) **Which is used as antifreeze in auto mobile radiator**
(a) Dry ice (b) Glyoxal (c) Ammonia (d) Ethylene glycol

(24) **Repining fruits and vegetable give off_____ gas which helps in further repining**
(a) Acetylene (b) Ethylene (c) Ethane (d) Propyne

(25) The amount of ethene is used for ripening of 1kg of tomatoes for 24 hours is
(a) 25mg (b) 0.6mg (c) 0.1mg (d) 2mg

(26) The temperature of oxyacetylene flame is
(a) 200°C (b) 2000°C (c) 3000°C (d) 6000°C

(27) Which of the following has carcinogenic effects at high concentrations
(a) CCl_4 (b) $CHCl_3$ (c) CH_3COCH_3 (d) H_2O

(28) Which molecule contain carbon, carbon double bond
(a) Ethane (b) Ethene (c) Ethyne (d) Ethanol

(29) Which product is obtained when methyl chloride is reduced
(a) Ethane (b) Ethene (c) Methane (d) Ethyne

(30) By dehydration, we mean the removal of
(a) H_2 (b) H_2O (c) Halogen (d) Hydrogen hallide

(31) Ethene and ethyne can be differentiated by
(a) Hydrogenation
(b) Bromine water
(c) Dilute aqueous solution of alkaline $KMnO_4$
(d) Hydrohalogenation

(32) Which is used for dehydrohalogenation
(a) Br_2 water (b) Con. H_2SO_4 (c) Al_2O_3 (d) Alcoholic $KMnO_4$

(33) Which process produces an alkane
(a) Combustion (b) Hydration (c) Dehydration (d) Hydrogenation

(34) _____ does not react with aqueous solution of Bromine
(a) C_2H_6 (b) C_2H_4 (c) C_2H_2 (d) C_3H_6

(35) Oxidation of ethene with $KMnO_4$ produces
(a) Glyoxal (b) Ethane glycol (c) Alcohol (d) Oxalic acid

(36) Which of the following hydrocarbon react with one mole of hydrogen
(a) Ethene (b) Ethyne (c) Propyne (d) Ethane

(37) Alkane are also called
(a) Paraffin (b) Olefins (c) Alkylradical (d) None of these

ANSWER KEY

Q.	Ans.	Q.	Ans.	Q.	Ans.	Q.	Ans.
1	c	11	b	21	c	31	c
2	d	12	b	22	d	32	b
3	b	13	d	23	d	33	d
4	c	14	d	24	a	34	a
5	a	15	a	25	c	35	b
6	b	16	c	26	c	36	a
7	a	17	c	27	a	37	a
8	a	18	b	28	b		
9	a	19	b	29	c		
10	c	20	d	30	b		

TOPICAL SHORT QUESTIONS

Q.2 Answer these questions. Answer to each part should not exceed three to four lines.

Introduction

Q.1 What are hydrocarbon?

Ans: The organic compounds which contain only two elements, carbon and hydrogen are called hydrocarbon.

e.g. Ethane (C_2H_6), Ethyne (C_2H_2), Ethene (C_2H_4)

Q.2 Why hydrocarbons are important for us?

Ans: Hydrocarbons are important for us because about 90% of the energy used to attain our way of life comes from fossil fuels. Hydrocarbons are used as raw material for thousands of important industrial product. These products are plastics, synthetic rubber, synthetic fibres, medicine and fertilizers etc.

Alkanes

Q.3 What are alkanes? Give examples.

Ans: Allkane are saturated hydrocarbon in which valancy of carbon is fully satisfied by four single covalent bonds. These compounds are highly stable and less reactive.

General Formula: C_nH_{2n+2}

Examples:

CH_4 Methane

C_2H_6 Ethane

C_4H_{10} Butane

Properties of alkanes

Q.4 Define substitution reaction.

Ans: The reaction is which a specie (an atom group of atoms) displaces an other atom or groups of atoms from a compound is called substitution reaction.

e.g. $Zn + 2HCl \longrightarrow ZnCl_2 + H_2$

Q.5 What is hydrogenation? Give example

Ans: Addition of hydrogen to an unsaturated compounds is called hydrogenation

Conditions for Hydrogenation

- Hydrogenation take place in presence of finely divided "Ni" as a catalyst at high temperature 200–300°C. **OR**
- Hydrogenation can also take place in the presence of "Pt" or "Pd "as a catalyst at room temperature.

Example:

$$CH_2=CH_2+H_2 \xrightarrow[200\text{-}300^\circ C]{Ni} CH_3—CH_3$$

$$CH\equiv CH+2H_2 \xrightarrow[200\text{-}300^\circ C]{Ni} CH_3—CH_3$$

Q.6 How reductions of alkyl halide takes place?

Ans: Reduction of alkyl halide takes place when alkyl halide are treated with Zinc in presence of an aqueous acid (e.g $HCl_{(dil)}$ or $CH_3COOH_{(dil)}$) an alkane is produced.

Equation

$$CH_3—Cl + 2[H] \xrightarrow{Zn/HCl} CH_4 + HCl$$

Q.7 Write four physical properties of alkane?

Ans: The physical properties of alkane are

(i) Alkane molecules are essentially non polar.
(ii) Alkane are insoluble in water
(iii) Alkane are less dense than water
(iv) The alkane are odourless and colourless

Q.8 What is meant by halogenation of alkane? Give example

Ans: The substitution of one or more hydrogen of alkane by halogen is called halogenation of alkanes.

Example:

$$CH_4 + Cl_2 \xrightarrow[\text{sunlight}]{\text{diffused}} CH_3—Cl + HCl$$

Chloromethane

$$CH_3—Cl + Cl_2 \xrightarrow[\text{Sun light}]{\text{Diffused}} CH_2Cl_2 + HCl$$

Dichloromethane

$$CH_2Cl_2 + Cl_2 \xrightarrow[\text{Sun light}]{\text{Diffused}} CHCl_3 + HCl$$

Trichloromethane (Chloroform)

$$CHCl_3 + Cl_2 \xrightarrow[\text{Sun light}]{\text{Diffused}} CCl_4 + HCl$$

Carbon tetrachloride **Or** Tetrachloromethane

Q.9 Why lighter alkanes are widely used as fuel?

Ans: The lighter alkanes are widely used as fuel.

This is because

(i) Their combustion can be controlled
(ii) They produce large amount of heat per gram
(iii) They are cheap and readily available

Q.10 Write uses of Methane?

Ans: Methane is used

(i) As domestic fuel (Sui gas)
(ii) As a fuel for automobiles (CNG)
(iii) To manufacture fertilizers (Urea)

Alkenes

Q.11 What are alkenes? Give examples.

Ans: Alkanes are unsaturated hydrocarbon in which carbon—carbon double bond is present. These compounds are highly reactive

General Formula

C_nH_{2n}

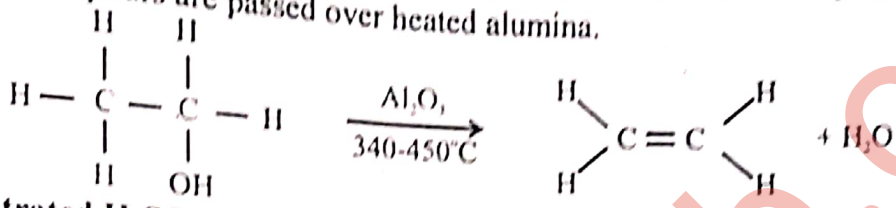
$CH_2 = CH_2$ Ethene

$CH_2 = CH—CH_3$ Propene

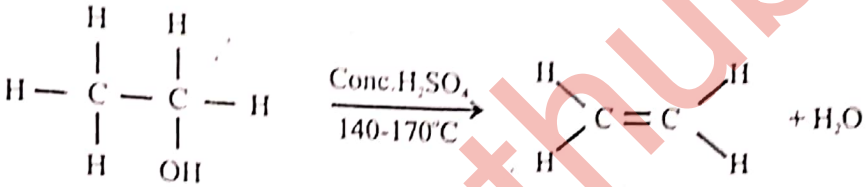
Preparation of alkenes

Q.12 What is meant by dehydration and how dehydration of alcohol take place?

Ans: Dehydration means loss of water. It is the process in which water is removed is compounds during a chemical process. Dehydration of Alcohol takes place: When their vapours are passed over heated alumina.



(ii) Concentrated H_2SO_4 is used for dehydration



Q.13 What is meant by dehydrohalogenation of alkyl halide

Ans: De-hydrohalogenation:

The removal or loss of hydrogen halide is called dehydrohalogenation.

De-hydrohalogenation of Alkyl halide:

Dehydrohalogenation of alkyl halide takes place when alkyl halide are heated with alcoholic KOH.

$$CH_3 - CH_2 - Cl + KOH \xrightarrow[KOH]{\text{Alcohol}} CH_2 = CH_2 + KCl + H_2O$$

Properties of alkenes

Q.14 How axidation of alkene takes place?

Ans: Oxdation of Alkene take place when an alkene is treated with dilute alkaline solution of $KMnO_4$. In this way two hydroxyl groups our occur across the double bond. The pink colour of KMnO4 is discharged during the reaction

$$3CH_2 = CH_2 + 2KMnO_4 + 4H_2O \longrightarrow \underset{\begin{array}{cc}|&|\\OH&OH\end{array}}{CH_2 - CH_2} + 2MnO_2 + 2KOH$$

Ethylene glycol

Q.15 Write the physical properties of alkenes.

Ans: (i) Alkenes are unsaturated hydrocarbons.

(ii) First three members i.e. ethane, propane and butane are gases while C_5–C_{15} members are liquids and the higher members are solids.

(iii) They are insoluble in water but soluble in organic solvents such as alcohol etc.

Alkynes

Q.16 What are Alkyne? Give example:

Ans: The hydrocarbons which have at least one carbon – carbon triple bind are called alkyne. These compounds are highly reactive and show addition reaction instead of substation reaction

General Formula: C_nH_{2n-2}

Example:

$CH \equiv CH$
Ethyne

$CH \equiv C - CH_3$
Propyne

Properties of alkynes

Q.17 How oxidation of alkyne takes place?

Ans: Oxidation of alkyne takes place in prescence of strong alkaline solution of $KMnO_4$.The Four hydroxyl groups occur across the triple bond.

Equation:

$$CH \equiv CH + KMnO_4 + H_2O \rightarrow \underset{\underset{OH\ OH}{|\quad|}}{\overset{\overset{OH\ OH}{|\quad|}}{HC-C-H}} + MnO_2 + H_2O$$

$$\underset{\underset{OH\ OH}{|\quad|}}{\overset{\overset{OH\ OH}{|\quad|}}{H-C-C-H}} \xrightarrow{-2H_2O} \underset{\underset{O\ O}{\|\quad\|}}{\overset{\overset{O\ O}{\|\quad\|}}{H-C-C-H}}$$

Glyanal

$$\underset{\underset{O\ O}{\|\quad\|}}{\overset{\overset{O\ O}{\|\quad\|}}{H-C-C-H}} \xrightarrow{+2[O]} \underset{\underset{O\ O}{\|\quad\|}}{\overset{\overset{O\ O}{\|\quad\|}}{HO-C-C-OH}}$$

oxalic acid

Q.18 Write three uses of acetylene?

Ans: Acetylene is used

(i) **in oxyacetylene torch for welding and cutting metals.**

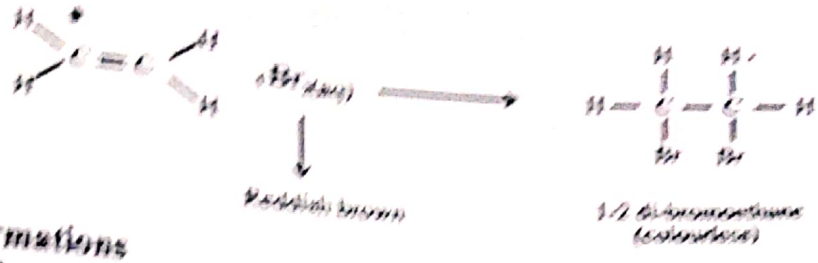
(ii) For ripening of fruits

(iii) For the manufacture of polyvinyl acetate (PVA), polyvinyl chloride (PVC), polyvinyl ether and rubber.

Q.19 How you can differentiate ethene form ethane?

Ans: Ethane is saturated hydrocarbon it can not show bromine water test. While ethane is an unsaturated compound and when it is treated with ethane its reddish brow colour disappeared. This is the simple test for the presence of unsaturation.

Equation:



Interesting Informations

Q.20 What is the role of alkenes and alkynes (i.e. ethane and ethyne) in our daily life

Ans: Alkenes are starting materials for the synthesis of many valuable materials, especially polymers. Some alkenes and alkynes serve as starting materials for synthesis. For instance ethane and ethyne are used to synthesize a number of polymers. Polymers are made from smaller molecules such as ethane. Look around you, you will find polymers every where. Our clothes, carpets, curtains, towels, sheets, floor tiles, furniture, toys etc. Are polymers made from ethane and ethyne. Even in car. , the dash board, seats, tyres, floor mat, ceiling, are also made of polymers. Hydrocarbons are also used as raw materials for the synthesis of synthetic rubber, plastic, films, adhesives, drugs and days. In the field of medicine, body replacement parts are made from polymers. In future we will have artificial bones that can stimulate bone growth. We can also expect to have artificial lungs as well as artificial hearts. Industries are day and night busy in synthesizing marvellous new products is.

Q.21 Is there anything that can replace petroleum as raw material for making plastics and other polymers?

Ans: Yes, alkenes and alkynes i.e. ethane and ethyne can replace petroleum as how material for making plastics and other polymers.

Millions of compounds exist. To understand, recognize and classify these compounds, systematic naming of organic compounds is necessary. Organic chemists began in the last century to devise a system of naming organic compounds that depends on their structure. An international body, the international Union of pure and Applied chemistry (IUPAC, pronounced "eye-you-pac") constantly reviews the rules for naming organic compounds. IUPAC system of naming organic compounds is based on the following principle.

Q.22 What do you know about oxy-acetylene torches

Ans: Acetylene is used in oxy-acetylene torches for cutting and welding metals. Such torches can produced temperature as high as 3000°C

Q.23 Discuss that hydrocarbons are the major source of energy.

Ans: Natural gas, petroleum and coal are important sources of hydrocarbons. These hydrocarbons are major sources of energy. When they burn in air a highly exothermic reaction occurs. This reaction is called combustion reaction

Example:

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

We use hydrocarbons as fuel to meet energy needs in homes, industries, motor vehicles and power generation.

Q.24 What are the uses of halogenated hydrocarbons

Ans: Many halogenated hydrocarbons have important commercial uses. Methyl chloride is a gas at room temperature. Dichloromethane, trichloromethane and tetra chloromethane are liquids. These three liquids can be used as solvents for grease, oils and other organic substances. Chloroform is used as an anaesthetic. Tetrachloromethane has carcinogenic effects at high concentration.

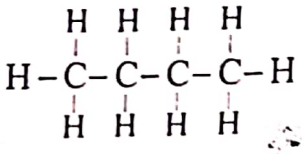
SELF ASSESSMENT EXERCISES

12.1

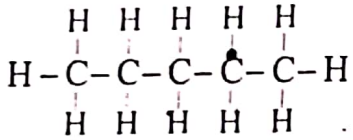
Write structural formulas for,

Ans:

(a) Butane



(b) Pentane

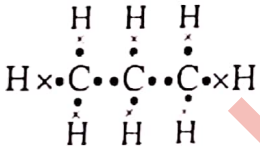


12.2

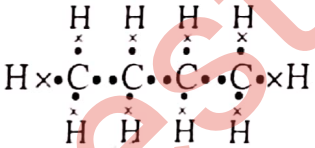
Draw electron dot and cross structures for the following,

Ans:

(a) Propane:



(b) Butane:



12.3

Complete the following reactions

(i) $CH_3 - CH = CH_2 + H_2 \xrightarrow[200\text{-}300^\circ C]{Ni}$

(ii) $CH_3 - C \equiv CH + 2H_2 \xrightarrow[200\text{-}300^\circ C]{Ni}$

Ans:

(i) $CH_3 - CH = CH_2 + H_2 \xrightarrow[200\text{-}300^\circ C]{Ni} CH_3 - CH_2 - CH_3$

(ii) $CH_3 - C \equiv CH + 2H_2 \xrightarrow[200\text{-}300^\circ C]{Ni} CH_3 - CH = CH_2 + 2H_2 \xrightarrow[200\text{-}300^\circ C]{Ni} CH_3 - CH_2 - CH_3$

12.4

Complete the following reaction

(a)
$$CH_3 - \underset{\displaystyle Cl}{\underset{|}{CH_2}} + 2[H] \xrightarrow[HCl_{(aq)}]{Zn}$$

(b)
$$CH_3 - \underset{\displaystyle Cl}{\underset{|}{CH}} - CH_3 + 2[H] \xrightarrow[H_2SO_{4(aq)}]{Zn}$$

Ans:

(a) $CH_3-\underset{\underset{Cl}{|}}{CH_2}+2[H]\xrightarrow[HCl_{(aq)}]{Zn}CH_3-CH_3+HCl$

(b) $CH_3-\underset{\underset{Cl}{|}}{CH}-CH_3+2[H]\xrightarrow[H_2SO_{4(aq)}]{Zn}CH_3-CH_2-CH_3+HCl$

12.5

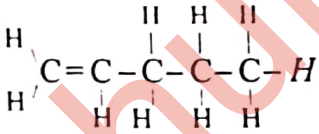
Draw structural formulas for the following compounds.

(a) 1–Pentene **(b) 2–Pentene**

Ans:

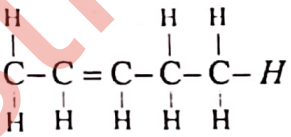
(a) 1-pentene

$$\overset{1}{C}-\overset{2}{C}-\overset{3}{C}-\overset{4}{C}-\overset{5}{C}$$
$$C=C-C-C-C\rightarrow$$



(b) 2-pentene

$$\overset{1}{C}-\overset{2}{C}-\overset{3}{C}-\overset{4}{C}-\overset{5}{C}$$
$$C-C=C-C-C\rightarrow$$



12.6

Complete the following reactions

(a) $CH_3-\underset{\underset{OH}{|}}{CH_2}-CH_2\xrightarrow[170^\circ C]{Conc.H_2SO_4}$

(b) $CH_3-\underset{\underset{Br}{|}}{CH_2}-CH_2+KOH\xrightarrow{Alcohol}$

Ans:

(a) $CH_3-\underset{\underset{OH}{|}}{CH_2}-CH_2\xrightarrow[170^\circ C]{Conc.H_2SO_4}CH_3-CH=CH_2+H_2O$

(b) $CH_3-\underset{\underset{Br}{|}}{CH_2}-CH_2+KOH\xrightarrow{Alcohol}CH_3CH=CH_2+KBr+H_2O$

12.7

Complete the following reactions

(i) $CH_3-CH=CH_2+Br_2\longrightarrow$

(ii) $3CH_3-CH=CH_2+2KMnO_4+H_2O\longrightarrow$

(iii) $CH_3-CH=CH_2+Cl_2\longrightarrow$

Ans:

(i) $$CH_3-CH=CH_2+Br_2\longrightarrow CH_3-\underset{Br}{\underset{|}{CH}}-\underset{Br}{\underset{|}{CH_2}}$$

(ii) $$3CH_3-CH=CH_2+2KMnO_4+H_2O\longrightarrow 3CH_3-\underset{OH}{\underset{|}{CH}}-\underset{OH}{\underset{|}{CH_2}}+2MnO_2=2KOH$$

(iii) $$CH_3-CH=CH_2+Cl_2\longrightarrow CH_3-\underset{Cl}{\underset{|}{CH}}-\underset{Cl}{\underset{|}{CH_2}}$$

12.8

Write chemical reaction of ethyne and bomine. Why this reaction is used to identify the un-saturation in a molecule?

$$HC\equiv CH+Br_{2(aq)}\longrightarrow A\xrightarrow{Br_2}B$$

Ans:

$$CH\equiv CH+Br_2\rightarrow \underset{Br}{\underset{|}{CH}}=\underset{Br}{\underset{|}{CH}}\xrightarrow{Br_2}H-\overset{Br}{\overset{|}{\underset{Br}{\underset{|}{C}}}}-\overset{Br}{\overset{|}{\underset{Br}{\underset{|}{C}}}}-H$$

(1, 2di-bromo ethane) (Tetra bromo ethane)

Reaction of use of Br_2 to test un-saturation:-

Bromine is reddish-brown liquid. When bromine water is added to an alkene or alkyne the reddish-brown colour disappears. Due to this decolourization of solution in un-saturated compound we used this reaction to identify the un-saturation of molecule.

12.9

Complete the following reaction

$CH\equiv CH+Br_2\longrightarrow$

$CH\equiv CH+Cl_2\longrightarrow$

Ans:

$$CH\equiv CH+Br_2\rightarrow \underset{Br}{\underset{|}{CH}}=\underset{Br}{\underset{|}{CH}}\xrightarrow{Br_2}H-\overset{Br}{\overset{|}{\underset{Br}{\underset{|}{C}}}}-\overset{Br}{\overset{|}{\underset{Br}{\underset{|}{C}}}}-H$$

(1, 2di-bromo ethane) (Tetra bromo ethane)

$$CH\equiv CH+Cl_2\rightarrow \underset{Cl}{\underset{|}{CH}}=\underset{Cl}{\underset{|}{CH}}\xrightarrow{Cl_2}H-\overset{Cl}{\overset{|}{\underset{Cl}{\underset{|}{C}}}}-\overset{Cl}{\overset{|}{\underset{Cl}{\underset{|}{C}}}}-H$$

(1, 2di-chloro ethane) (Tetra chloro ethane)

LONG QUESTION

Q.1 How we prepare alkanes?

Ans. General Methods pf Preparations of Alkanes

(i) By Hydrogenation of alkenes and alkeynes

Addition of hydrogen molecule across carbon-carbon multiple-bonds is called hydrogenation. Hydrogenation takes place in presence of finally divided nickel at 200-300°C and high pressure. Hydrogenation can also be done in presence of Pt or Pd at room temperature.

Alkynes add two molecules of hydrogen. Why?

$$CH_3\text{-}CH{=}CH_2 \xrightarrow[200\text{-}300^\circ C]{Ni} CH_3\text{-}CH_2\text{-}CH_3$$

$$CH_3\text{-}CH \equiv CH \xrightarrow[200\text{-}300^\circ C]{Ni} CH_3\text{-}CH{=}CH_2 + 2H_2 \xrightarrow[200\text{-}300^\circ C]{Ni} CH_3\text{-}CH_2\text{-}CH_3$$

(ii) By the reduction of alkyl halides

When an alkyl halide is treated with Zn in presence of an aqueous acid, an alkane is produced. Usually aqueous solution of CH_3 or CH_3COOH is used.

$$CH_3\text{-}Cl + 2[H] \xrightarrow{Zn/HCl_{(aq)}} CH_4 + HCl$$

Zn reacts with aqueous acid to liberate atomic hydrogen called nascent hydrogen. Nascent hydrogen reduces alkyl halide. Addition of nascent hydrpgen is called reduction.

Q.2 Write the chemical properties of alkanes.

Ans. Halogenation:

Although unreactive towards ionic substances, alkanes readily react with halogens in sunlight. The reaction of an alkane and a halogen is a substitution reaction. In this, reaction a halogen atom substitutes for one more of the hydrogen atoms of an alkane.

For examples the reaction of methane and chlorine in diffused sunlight occurs as follows.

$$CH_{4(g)} + Cl_2 \xrightarrow[\text{sunlight}]{\text{diffused}} CH_3Cl_{(g)} + HCl_{(g)}$$

Chloromethane

$$CH_3Cl(g) + Cl_{2(g)} \xrightarrow[\text{sunlight}]{\text{diffused}} CH_2Cl_{2(g)} + HCl_{(g)}$$

Dichloromethane

$$CH_2Cl_2(g) + Cl_{2(g)} \xrightarrow[\text{sunlight}]{\text{diffused}} CHCl_{3(g)} + HCl_{(g)}$$

Trichloromethane

(Chloroform)

$$CHCl_{3(g)} + Cl_{2(g)} \xrightarrow[\text{sunlight}]{\text{diffused}} CCl_{4(g)} + HCl_{(g)}$$

Tetrachloromathene

(carbon tetrachloride)

$$3CH_2{=}CH_2 + 2KMnO_4 \longrightarrow \underset{\text{Ethylene Glycol}}{3CH_2(OH)-CH_2(OH)} + 2MnO_2 + 2KOH$$

Ethene

Ethylene glycol is used as an anti-freeze.

Q.5 How we prepare alkynes?

Ans. General Methods Of Preparation Of Alkynes

(i) By Dehydrohalogenations of Vicinal Dihalides

A vicinal dihalide has two halogen atoms on adjacent carbon atoms. Which is vicinal dichloride?

$CH_3-CH(Cl)-Cl$ or $CH_2(Cl)-CH_2(Cl)$

Vicinal dihalide on treatment with alcoholic potassium hydroxide eliminates two molecules of hydrogen halides from adjacent carbon atoms. Removal of two molecules forms a triple a=bond between two carbon atoms. Reaction occurs in two steps.

$$\underset{\text{1,2 Dichloroethane (Vicinal dihalide)}}{CH_2(Cl)-CH_2(Cl)} + KOH \xrightarrow{\text{Alcohol}} \underset{\text{Vinylchloride}}{CH(Cl)=CH_2} + KCl + H_2O$$

$$CH_2(Cl)-CH_2(Cl) + KOH \xrightarrow{\text{Alcohol}} CH \equiv CH + KCl + H_2O$$

(ii) By Dehalogenation Of Tetrahalides

Tetra halides on treatment with Zn dust undergo dehalogenation forming an alkyne.

$$\underset{\text{1,1,2,2-Tetrachloroethane}}{H-C(Cl)_2-C(Cl)_2-H} + Zn \xrightarrow{\text{heat}} \underset{\text{1,2-Dichloroethene}}{HC(Cl)=CH(Cl)} + ZnCl_2$$

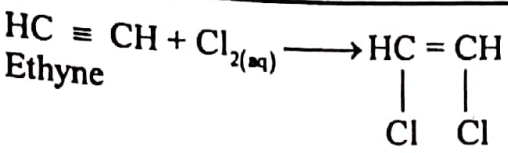
$$HC(Cl)=CH(Cl) + Zn \longrightarrow \underset{\text{Ethyne}}{HC \equiv CH} + ZnCl_2$$

Q.6 Write the chemical properties of alkynes.

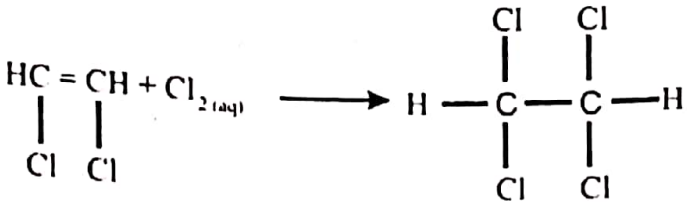
Ans. Alkynes also undergo addition reactions like alkene.

(i) Addition of halogens:

Alkynes add two molecules of halogens.



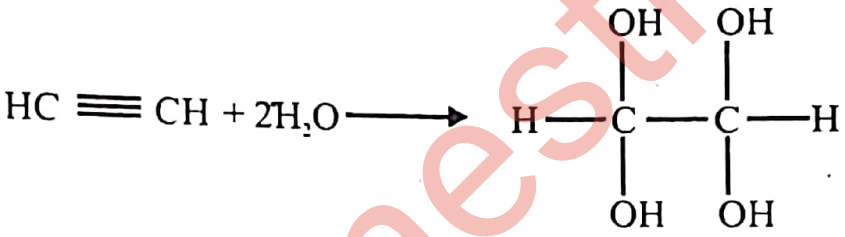
1,2 - Dichlorethene



Tetrachloroethane

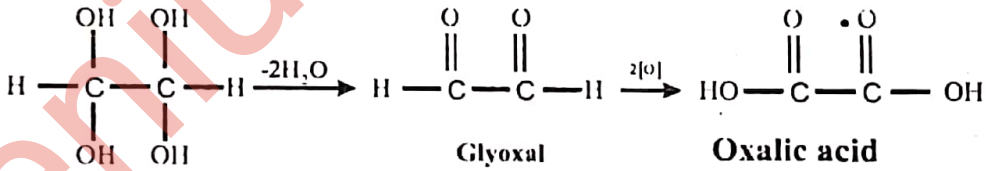
(ii) Reaction with $KMnO_4$

Alkynes do not react with dilute alkaline aqueous solution of $KMnO_4$. however, they are oxidized by strong alkaline solution of $MKnO_4$ to give oxalic acid. First four hydroxyl groups add across the triple bond.



Tetrahydroxyethane

Tetrahydoxy ethane is unstable compound; it loses two water molecules to form glyoxal which oxidizes to oxalic acid.



REVIEW QUESTIONS FROM TEXT BOOK

Q. 1 Encircle the correct answer

(i) Which molecule contains a carbon-carbon double bond?

(a) Ethane (b) Ethene

(c) Ethyne (d) Ethyl alcohol

(ii) Which product is obtained when chloromethane (or methyl chloride) is reduced

(a) Ethane (b) Ehene

(c) Mehtane (d) Ethylene

(iii) Which reacts explosively with methane?

(a) F_2 (b) Cl_2

(c) Br_2 (d) I_2

(iv) By dehydration we mean, the removal of

(a) Hydrogen (b) Water

(c) Halogen (d) Hydrogen halide

(v) Ethane and ethyne can be differentiated by

(a) Hydrogenation (b) Bromine water

(c) Dilute alkaline aqueous solution of $KMnO_4$

(d) Hydrohalogenation

(vi) Which is used for dehydrohalogenation?

(a) Br_2 water (b) Conc. H_2SO_4

(c) Al_2O_3 (d) Alcoholic KOH

(vii) Which substance reacts with $KMnO_4$ to produced oxalic acid?

(a) Ehatne (b) Ethene

(c) Ethyne (d) Ethyle alcohol

(viii) The reduction of alkyl halides takes place in presence of

(a) A_2lO_3 at 350°C (b) Conc. H_2SO_4 at 170°C

(c) Zn + Dust (d) Zn + HCl

(ix) Which process produces an alkane?

(a) Combustion (b) Hydration

(c) Dehydration (d) Hydrogenation

(x) Does not react with aqueous solution of bromine

(a) C_2H_6 (b) C_2H_4 (c) C_2H_2 (d) C_3H_6

ANSWER KEY

Q.	Ans.	Q.	Ans.	Q.	Ans.	Q.	Ans
1	b	4	b	7	c	10	a
2	c	5	c	8	d		
3	a	6	d	9	d		

SHORT QUESTIONS

Give short answers

Q.1

(i) Give three examples of unsaturated hydrocarbons.

Ans: **Alkenes:-**

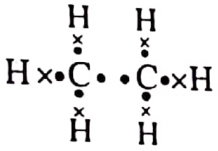
1. Ethane (C_2H_4)
2. Propene (C_3H_6)
3. Butene (C_4H_8)

Alkynes:-

1. Ethyne (C_2H_4)
2. Propyne (C_3H_4)
3. Butyne (C_4H_6)

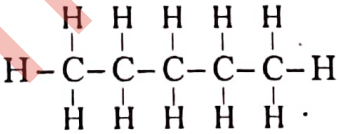
(ii) Draw electron dot and cross structure for ethene.

Ans:

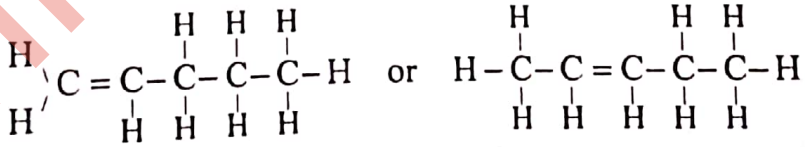


(iii) Draw structural formulas of an alkane, an alkene and and alkyne containing five carbon atoms

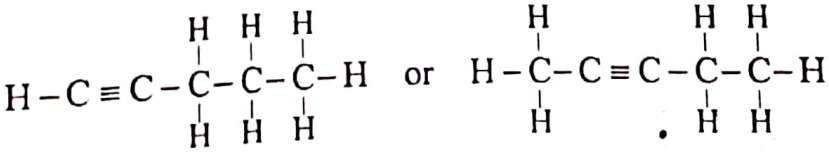
Ans: **Structure of Alkane having five carbon (pentane) C_5H_{12}**



Structure of Alkene having five carbon (Pentene) C_5H_{10}

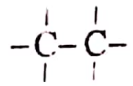
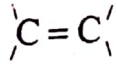
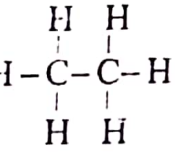
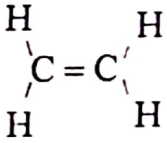


Structure of alkynes having five carbons (pentyne) C_5H_8



(iv) **How can you differentiate ethane from ethane?**

Ans:

Ethane	Ethene
(a) Having carbon carbon single bond 	(a) Having carbon carbon double bond 
(b) Show substitution reactions.	(b) Show addition reactions
(c) Saturated hydrocarbon.	(c) Unsaturated hydrocarbon
(d) Its formula is C_2H_6	(d) Its formed is C_2H_4
(e) Structural formula is 	(e) Structural formula 

(v) **What do you mean by dehydration reaction? Give one example**

Ans: See answer in prepration of alkenes.

Q.2 How can we convert

(i) **Ethene into ethane**

(ii) **Methane into carbontetrachloride**

(iii) **Ethene into glycol**

(iv) **Ethyl chloride into ethane**

(v) **Ethyl bromide into ethene**

Ans:

(i) See in hydrogenation of alkenes.
(ii) See in halogenation of alkenes.
(iii) See the reaction of alkenes with $KMnO_4$
(iv) See in prepration of alkanes (Reduction of alkyl halide)
(v) When ethyl bromide reacts with alcoholic KOH then it is converted into ethane

$$CH_3-\underset{Br}{CH_2}+KOH \xrightarrow{\text{alcohol}} CH_2=CH_2+KBr+H_2O$$

Q.3 Write a chemical equation to show the preparation of an alkane from an alkene and an alkyne

Ans: See preparation of alkanes (hydrogenation)

Q.4 Write a chemical equation to show the preparation of ethane from dehydration of an alcohol and dehydrohalogenation of alkyl halides.

Ans: See preparation of alkenes (L.Q)

Q.5 Write a chemical equation to show the preparation of ethyne from dehylogenation of 1,2-dihalide and a tetrahalide.

Ans: See preparation of alkenes (L.Q)

Q.6 Write chemical equations showing reaction of $KMnO_4$ with ethane and ethyne.

Ans: See chemical reactions of alkenes and alkynes with $KMnO_4$(L.Q)

Q.7 Write chemical equations showing reaction of $KMnO_4$ with ethane and ethyne.

Ans: See question answers.

Q.8 List some industrial uses of ethane and ethyne.

Ans: See short question answers.

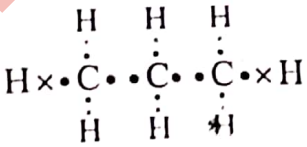
Q.9 Explain why a systematic method of naming chemical compounds is necessary

Ans: Systematic names of organic compounds are also known as IUPAC names of organic compounds. These names indicate the number of carbon atoms present in the organic compounds. We can easily recognize organic compound by its systematic name because a systematic name has two parts. One is the stem which tells the no. of carbon atoms in a chain and other is suffix which tells the class of compound. For this reason systematic method of naming of chemical compounds is necessary.

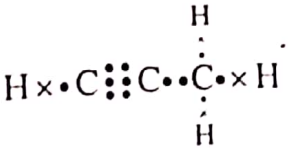
Q.10 Draw electron dot and cross structure for

(a) propane **(b) propyne** **(c) Propene**

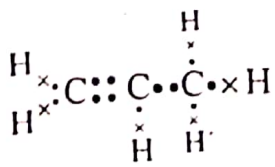
Ans: **(a)**



(b)



(c)



THINK-TANK

Q.11 Write chemical equations for the preparation of propene

(a) $CH_3-CH_2-CH_2-OH \xrightarrow{H_2SO_4}$

(b) $CH_3-C\equiv CH+H_2 \xrightarrow[200\text{-}300^\circ C]{Ni}$

Ans: (a) $CH_3-CH_2-CH_2-OH \xrightarrow{H_2SO_4} CH_3-CH=CH_2+H_2O$

(b) $CH_3-C\equiv CH+H_2 \xrightarrow[200-300^\circ C]{Ni} CH_3-CH=CH_2$

Q.12 Write down structural formulas for the products which are formed when 1-butene is reacted with

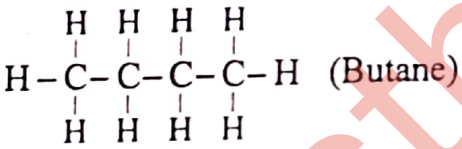
(a) $H_2 \setminus Ni$

(b) **Dilute alkaline aqueous $KMnO_4$ solution**

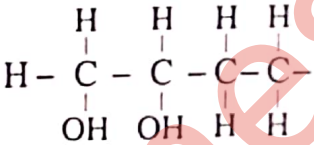
(c) **Bromine water**

(d) **Chlorine**

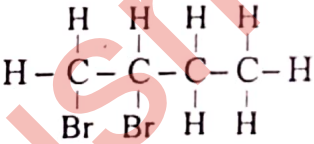
Ans: (a)


(Butane)

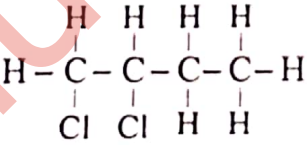
(b)


(1,2-dibromo butane)

(c)


(1,2-dibromo butane)

(d)


(1,2-dichloro butane)

Q.13 Identify A, B, C, D in the following reactions.

(i) $\text{Propene} \xrightarrow{Br_2} A \xrightarrow[KOH]{\text{alcohol}} B$

(ii) $\text{Ethylalcohol} \xrightarrow{Conc.H_2SO_4} C \xrightarrow{Br_2} D$

Ans: (i) $CH_2=CH-CH_3 \longrightarrow CH_2-CH-CH_3 \xrightarrow[KOH]{Alcohol} CH\equiv C-CH_3$

In this reaction A is 1, 2-dibromopropane and B is 1-propene

(ii) $CH_3-\underset{OH}{CH_2} \xrightarrow{Conc.H_2SO_4} CH_2=CH_2 \xrightarrow{Br_2} \underset{Br}{CH_2}-\underset{Br}{CH_2}$

In this reaction C is ethene and D is 1,2 dibromo ethane

Q.14 How can you convert ethane into ethane?

Ans: See in prepration of alkanes.

Q.15 You are given two flammable liquid hydrocarbons. One of them is an alkene and the other is an alkane. How would you find out which is which?

Ans: For identification of these two flammable liquid hydrocarbons we use bromine water test. If the reddish brown colour of bromine disappears after adding bromine into that liquid hydrocarbon then the compound in alkene. If the colour of bromine remains unchanged then compound belongs to alkane.

Q.16 How many possible products are there when chlorine reacts with ethane? Draw them all.

Ans: Six products are produced in diffused sunlight and one in direct sunlight.

Direct sun light:

$$CH_3-CH_3+3Cl_2 \xrightarrow[\text{sunlight}]{\text{Direct}} C+6HCl$$

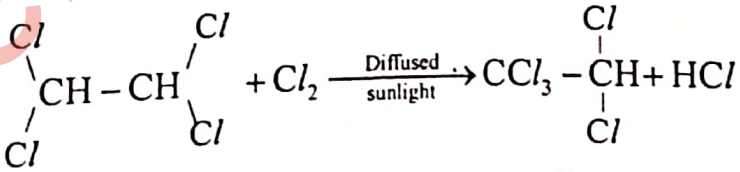
Diffused Sun light:

$$CH_3-CH_3+Cl_2 \xrightarrow[\text{sunlight}]{\text{Diffused}} CH_3-CH_2-Cl+HCl$$

$$CH_3-CH_2-Cl+Cl_2 \xrightarrow[\text{sunlight}]{\text{Diffused}} \underset{Cl}{CH_2}-CH_2-Cl+HCl$$

$$\underset{Cl}{CH_2}-\underset{Cl}{CH_2}+Cl_2 \xrightarrow[\text{sunlight}]{\text{Diffused}} \underset{Cl}{CH_2}-\underset{Cl}{CH}+HCl$$

$$\underset{Cl}{CH_2}-\underset{Cl}{CH}+Cl_2 \xrightarrow[\text{sunlight}]{\text{Diffused}} \underset{Cl}{CH}-\underset{Cl}{CH}+HCl$$



$$CH_3-\underset{Cl}{CH}+Cl_2 \xrightarrow[\text{sunlight}]{\text{Diffused}} Cl_3C-CCl_3+HCl$$