

CHAPTER
8

ALIPHATIC HYDROCARBONS

MULTIPLE CHOICE QUESTIONS

- Preparation of vegetable ghee involves:**
(a) Halogenation (b) Hydrogenation
(c) Hydroxylation (d) Dehydrogenation
- Which type of reactions are given by alkanes:**
(a) Polymerization (b) Elimination
(c) Addition (d) Substitution
- The most reactive hydrocarbon is:**
(a) Ethene (b) Acetylene
(c) Heptane (d) Ethane
- Formula of chloroform is:**
(a) CH_3Cl (b) CCl_4
(c) CH_2Cl_2 (d) CHCl_3
- Cycloalkanes and Alkenes contain which general formula:**
(a) $\text{C}_n\text{H}_{2n+2}$ (b) C_nH_{2n}
(c) $\text{C}_n\text{H}_{2n-2}$ (d) C_nH_n
- Which of the following is not alicyclic:**
(a) Cyclohexene (b) Cyclobutane
(c) Toluene (d) Cyclopentene
- Unsaturated nature of alkene can be detected by:**
(a) Decolorization of red Br_2 water in CCl_4
(b) Decolorization of pink colour of KMnO_4 solution
(c) Ozonolysis
(d) All

8. The addition of unsymmetrical reagent to an unsymmetrical alkene is in accordance with the rule:
- (a) Hund's rule (b) Markownikov's rule
(c) Pauli's exclusion principle (d) Aufbau principle
9. Vicinal dihalides on treatment with Zn-dust give:
- (a) Alkenes (b) Alkynes
(c) Alkanes (d) All of them
10. Formula of Lindler's catalyst is:
- (a) $\text{Pb}(\text{BaSO}_4) / \text{Quinoline}$ (b) $\text{Ba}(\text{PbSO}_4) / \text{Quinoline}$
(c) $\text{Pd}(\text{BaSO}_3) / \text{Quinoline}$ (d) $\text{Pd}(\text{BaSO}_4) / \text{Quinoline}$
11. Synthetic rubber is made by the polymerization of:
- (a) Chloroform (b) Acetylene
(c) Divinyl acetylene (d) Chloroprene
12. Ammonical solution of silver nitrate reacts with:
- (a) 2-pentyne (b) Ethene
(c) 2-butyne (d) Ethyne
13. Polymerization of acetylene forms:
- (a) Propane (b) Butane
(c) Benzene (d) Naphthalene
14. The number of xylene isomers is:
- (a) 2 (b) 3
(c) 4 (d) 5
15. Number of acidic hydrogens present in 1-butyne is:
- (a) 1 (b) 2
(c) 3 (d) 4
16. Chemically Baeyer's reagent is:
- (a) 1% alkaline KMnO_4 (b) 1% acidic KMnO_4
(c) 15% alkaline KMnO_4 (d) 2% alkaline KMnO_4
17. Which of the following gases is used for artificial ripening of fruits:
- (a) Ethene (b) Ethyne
(c) Methane (d) Both (a) and (b)

18. Hydroxylation of alkene can be carried out by:
(a) Alkaline KMnO_4 (b) O_3
(c) H_2SO_4 (d) $\text{K}_2\text{Cr}_2\text{O}_7$
19. Acetylene has a characteristic smell resembling that of:
(a) Rotten egg (b) Garlic
(c) Spicy like (d) None of the above
20. When ethylene ozonide is treated with Zn-dust we get:
(a) Ethanal (b) Methanal
(c) Methanol (d) Ethanol

answers

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

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SOLVED EXERCISE

Q.1 Fill in the blanks:

- (i) Ozone reacts with ethene to form _____.
- (ii) Lindlar's catalyst is used for _____ of alkynes.
- (iii) Divinyl acetylene is a _____ of acetylene.
- (iv) Vicinal dihalides have two halogens on _____ carbon atoms.
- (v) Ethyne is acidic in character because of _____ hybridization.
- (vi) Halohydrins are formed due to addition of _____ in ethene.
- (vii) Ethylene glycol is produced when _____ reacts with cold alkaline KMnO_4 solution.
- (viii) Mustard gas is a highly boiling _____.
- (ix) Ethyne has _____ like odour.
- (x) Ethyne is obtained by the reaction of _____ with calcium carbide.

answers

(i)	ozonide	(ii)	partial hydrogenation	(iii)	polymer
(iv)	adjacent	(v)	sp	(vi)	hypohalous acid HOX
(vii)	ethene	(viii)	liquid	(ix)	garlic
(x)	water				

Q.2 Indicate True or False:

- (i) Addition of HX to unsymmetrical alkanes takes place according to Markownikov's rule.
- (ii) Methane reacts with bromine water and its colour is discharged.
- (iii) Mustard gas is a blistering agent.
- (iv) Methane is also called marsh gas.

- (a) Chloroform (b) Acetylene
 (c) Divinylacetylene (d) Chloroprene
- (vii) β - β' -dichloroethyl sulphide is commonly known as:
 (a) Mustard gas (b) Laughing gas
 (c) Phosgene gas (d) Bio-gas
- (viii) When methane reacts with Cl_2 in the presence of diffused light the products obtained are:
 (a) Chloroform only
 (b) Carbon tetrachloride only
 (c) Chloromethane and dichloromethane
 (d) Mixture of (a), (b), (c)
- (ix) Which one of the following gases is used for artificial ripening of fruits:
 (a) Ethene (b) Ethyne
 (c) Methane (d) Both (a) and (b)

answers

(i)	(b)	(ii)	(d)	(iii)	(b)	(iv)	(c)	(v)	(b)
(vi)	(d)	(vii)	(a)	(viii)	(d)	(ix)	(d)		

Q.4 Write the structural formula for each of the following compounds:

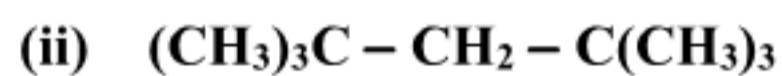
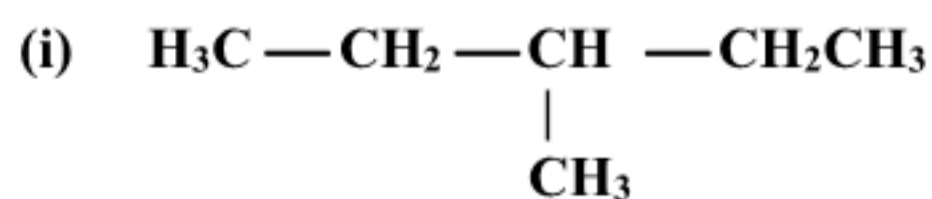
- (i) 2-methylpropane (ii) Neopentane
 (iii) 3-ethylpentane (iv) 4-ethyl-3, 4-dimethylheptane
 (v) 2, 2, 3, 4-tetramethylpentane (vi) 2, 2, 3, 4-tetramethylpentane
 (vii) 2, 2-dimethylbutane (viii) 2, 2-dimethylpropane

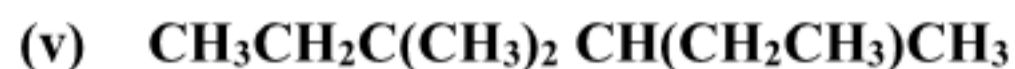
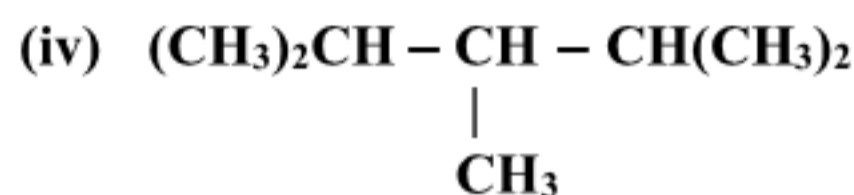
Ans.

Compound Name	Structural Formula
(i) 2-methylpropane	$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3 - \text{CH} - \text{CH}_3 \end{array}$
(ii) Neopentane	$\begin{array}{c} \text{CH}_3 \\ \\ \text{C} \\ \end{array}$


- (iii) 3-ethylpentane
- $$\begin{array}{c} \text{CH}_3 - \text{C} - \text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$$
- (iv) 4-ethyl-3, 4-dimethylheptane
- $$\begin{array}{c} \text{C}_2\text{H}_5 \\ | \\ \text{CH}_3 - \text{CH}_2 - \text{CH} - \text{CH}_2 - \text{CH}_3 \\ | \quad | \\ \text{CH}_3 \quad \text{C}_2\text{H}_5 \\ | \quad | \\ \text{CH}_3 - \text{CH}_2 - \text{CH} - \text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \\ | \quad | \\ \text{CH}_3 \quad \text{CH}_3 \end{array}$$
- (v) 2, 2, 3, 4-tetramethylpentane
- $$\begin{array}{c} \text{CH}_3 \quad \text{CH}_3 \\ | \quad | \\ \text{CH}_3 - \text{C} - \text{CH} - \text{CH} - \text{CH}_3 \\ | \quad | \\ \text{CH}_3 \quad \text{CH}_3 \end{array}$$
- (vi) 4-iso-propylheptane
- $$\begin{array}{c} \text{CH}_3 - \text{CH} - \text{CH}_3 \\ | \\ \text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \end{array}$$
- (vii) 2, 2-dimethyl butane
- $$\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3 - \text{C} - \text{CH}_2 - \text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$$
- (viii) 2, 2-dimethylpropane
- $$\begin{array}{c} \text{CH}_3 \\ | \\ \text{H}_3\text{C} - \text{C} - \text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$$

Q.5 Write down names of the following compounds according to IUPAC system:





Ans.

Compound	IUPAC Name
(i) $\text{H}_3\text{C} - \text{CH}_2 - \underset{\text{CH}_3}{\text{CH}} - \text{CH}_2\text{CH}_3$	3-methylpentane
(ii) $(\text{CH}_3)_3\text{C} - \text{CH}_2 - \text{C}(\text{CH}_3)_3$	2, 2, 4, 4-tetramethylpentane
(iii) 	2, 4-dimethylpentane
(iv) $(\text{CH}_3)_2\text{CH} - \underset{\text{CH}_3}{\text{CH}} - \text{CH}(\text{CH}_3)_2$	2, 3, 4-trimethylpentane
(v) $\text{CH}_3\text{CH}_2\text{C}(\text{CH}_3)_2\text{CH}(\text{CH}_2\text{CH}_3)\text{CH}_3$	3, 3, 4-trimethylhexane
(vi) $(\text{CH}_3\text{CH}_2)_3\text{CH}$	3-ethylpentane
(vii) $\text{CH}_3\text{C}(\text{CH}_3)_2(\text{CH}_2)_2\text{CH}_3$	2, 2-dimethylpentane
(viii) $(\text{C}_6\text{H}_5)_3\text{CH}$	triphenylmethane

Q.6 What are the rules for naming alkanes? Explain with suitable examples.

Ans. Detailed question. See text book.

Q.7 (a) Write down the structural formulas for all the isomeric hexanes and name them according to IUPAC system.

(b) The following names are incorrect. Give the correct IUPAC names:

(i) 4-methylpentane **(ii)** 3, 5, 5-trimethylhexane

(iii) 2-methy-3-ethylbutane

Ans.

(a) The isomeric forms of hexanes and their IUPAC names are as follows:

$\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$ Hexane

$\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \underset{\text{CH}_3}{\text{CH}} - \text{CH}_3$ 2-methylpentane

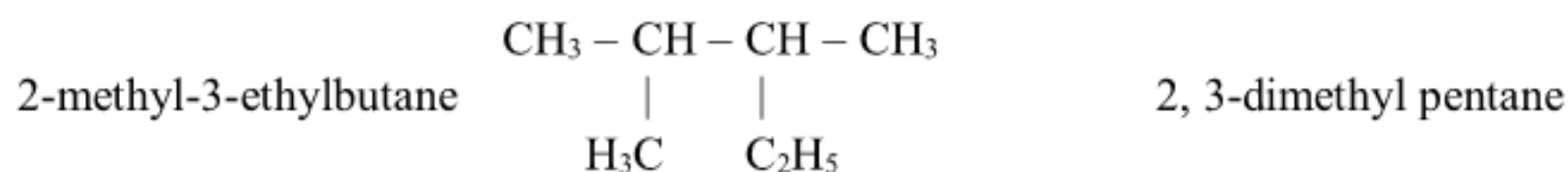
$\text{CH}_3 - \text{CH}_2 - \underset{\text{CH}_3}{\text{CH}} - \text{CH}_2 - \text{CH}_3$ 3-methylpentane

$\text{CH}_3 - \text{CH}_2 - \underset{\text{CH}_3}{\underset{\text{CH}_3}{\text{C}}} - \text{CH}_3$ 2, 2-dimethylbutane

$\text{CH}_3 - \underset{\text{H}_3\text{C}}{\text{CH}} - \underset{\text{CH}_3}{\text{CH}} - \text{CH}_3$ 2, 3-dimethylbutane

(b) Correct names:

Given Name	Structure	Correct Name
4-methylpentane	$\text{CH}_3 - \underset{\text{CH}_3}{\text{CH}} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$	2-methyl pentane
3, 5, 5-trimethylhexane	$\text{CH}_3 - \text{CH}_2 - \underset{\text{CH}_3}{\text{CH}} - \text{CH}_2 - \underset{\text{CH}_3}{\overset{\text{CH}_3}{\text{C}}} - \text{CH}_3$	2, 2, 4-trimethyl hexane

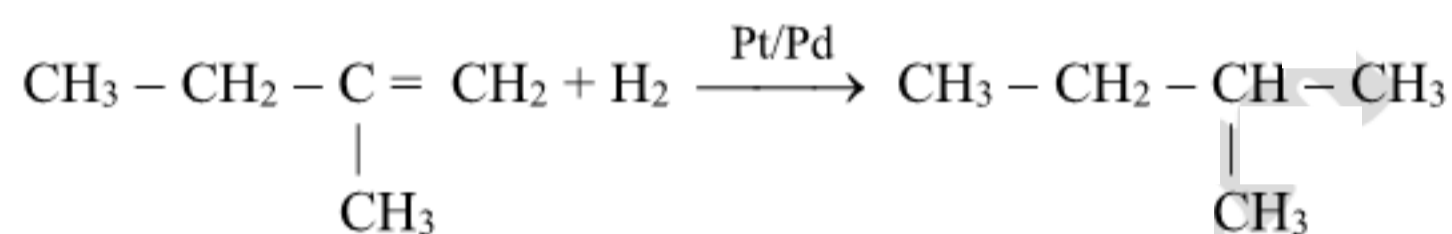


- Q.8** (a) Explain why alkanes are less reactive than alkenes? What is the effect of branching on the melting point of alkanes?
- (b) Three different alkanes yield 2-methylbutane when they are hydrogenated in the presence of a metal catalyst. Give their structures and write equations for the reactions involved.

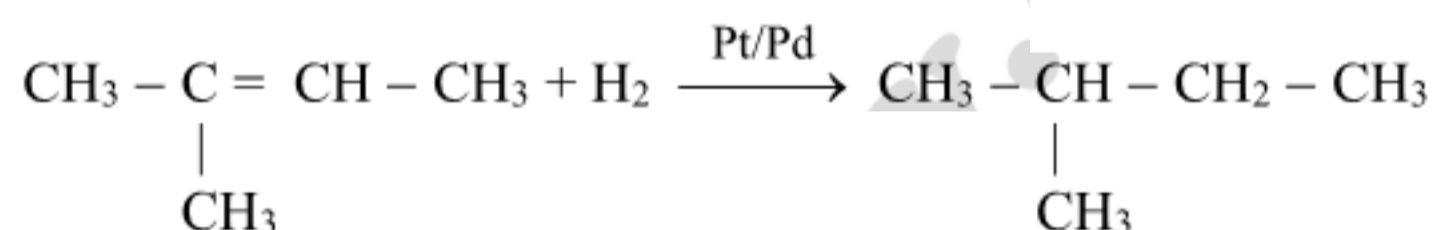
Ans.

(a) Descriptive question. Consult text book for details.

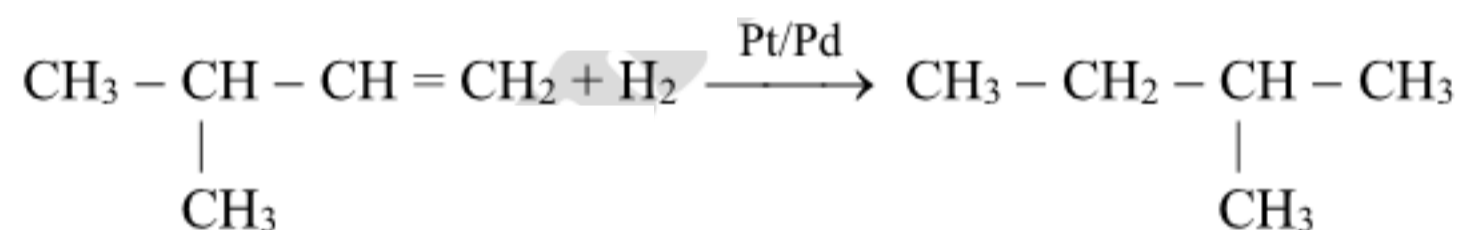
(b) (i) **2-methyl-1-butene:**



(ii) **2-methyl-2-butene:**



(iii) **3-methyl-1-butene:**

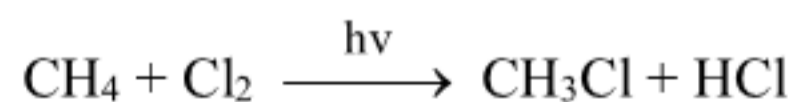


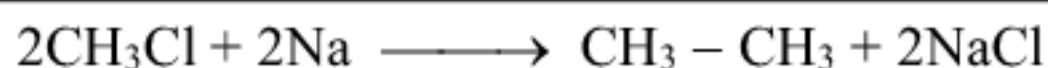
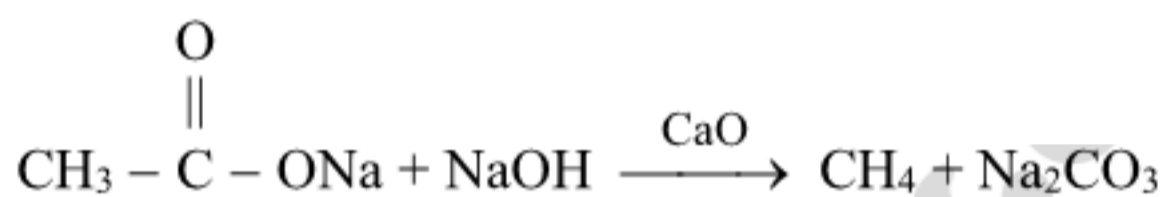
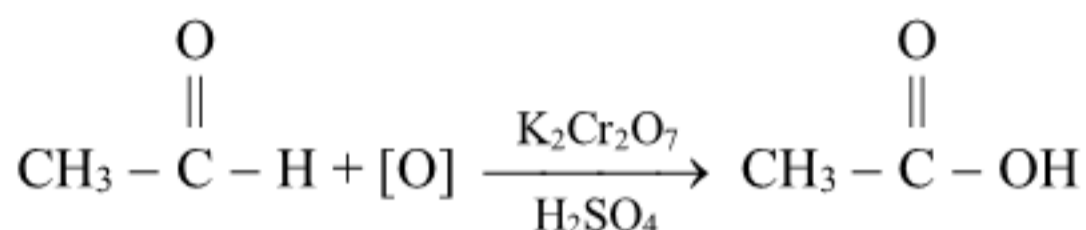
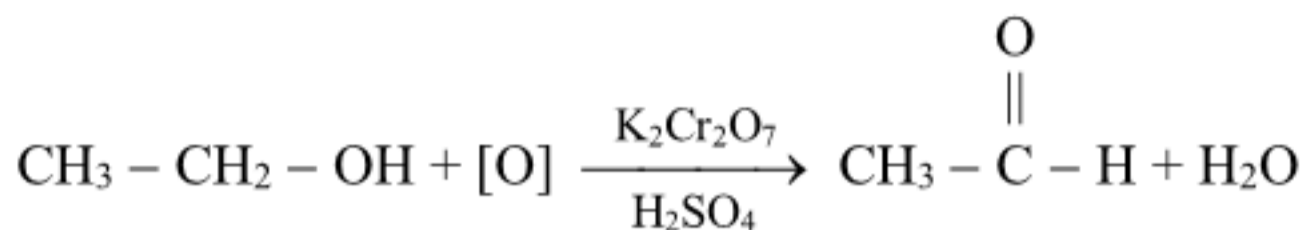
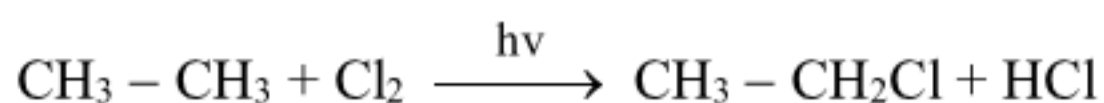
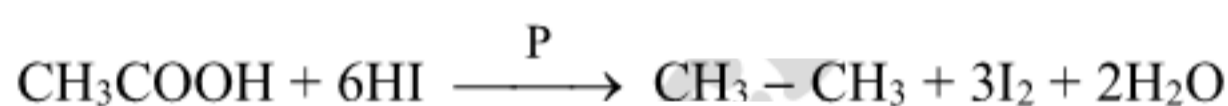
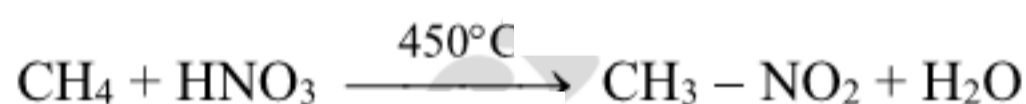
- Q.9** (a) Out line the methods available for the preparation of alkanes.
- (b) How will you bring about the following conversions?
- (i) Methane to ethane (ii) Ethane to methane
- (iii) Acetic acid to ethane (iv) Methane to nitromethane

Ans.

(a) Descriptive question. Consult text book for details.

(b) (i) **Methane into ethane:**



**(ii) Ethane into methane:****(iii) Acetic acid to ethane:****(iv) Methane to nitromethane:**

- Q.10 (a) What is meant by octane number? Why does a high octane fuel has a less tendency to knock in an automobile engine?**
- (b) Explain free radical mechanism for the reaction of chlorine with methane in the presence of sunlight.**

Ans.

- (a) (i) Octane Number:** It is defined as; the percentage of branched chain hydrocarbon, iso-octane, in gasoline fraction of petroleum is known as octane number.
- (ii) Less Tendency to Knock:** High octane fuel has less tendency to knock because it contains 100% isooctane.
- (b)** Descriptive question. Consult text book for details.

Q.11 (a) Write structural formulas for each of the following compounds:

- | | |
|-------------------------|---------------------------------------|
| (i) Isobutylene | (ii) 2, 3, 4, 4-tetramethyl-2-pentene |
| (iii) 2, 5-heptadiene | (iv) 4, 5-dimethyl-2-hexene |
| (v) Vinylacetylene | (vi) 1, 3-pentadiene |
| (vii) 1-butyne | (viii) 3-n-propyl-1, 4-pentadiene |
| (ix) Vinyl bromide | (x) But-1-en-3-yne |
| (xi) 4-methyl-2-pentyne | (xii) Iso-pentane |

(b) Name the following compounds by IUPAC system:

- (i) $\text{H}_3\text{C} - \text{CH} = \text{CH}(\text{CH}_2)_2\text{CH}_3$
- (ii) $(\text{CH}_3)_2\text{C} = \text{CH}_2$
- (iii) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \underset{\text{CH}(\text{CH}_3)_2}{\text{C}} = \text{CH}_2$
- (iv) $\text{CH}_2 = \text{CH} - \text{CH} = \text{CH}_2$
- (v) $\text{CH}_2 = \underset{\text{C}_2\text{H}_5}{\text{C}} - \text{CH}_2\text{CH}_2\text{CH}_3$
- (vi) $\text{CH} \equiv \text{C} - \text{CH}_3$
- (vii) $\text{CH}_3 - \text{C} \equiv \text{C} - \text{CH}_3$
- (viii) $\text{CH}_2 = \text{CH} - \text{C} \equiv \text{C} - \text{CH} = \text{CH}_2$
- (ix) $\text{CH} \equiv \text{C} - \text{CH} = \text{CH} - \text{C} \equiv \text{CH}$
- (x) $\text{CH}_2 = \text{CH} - \text{C} \equiv \text{CH}$

Ans.

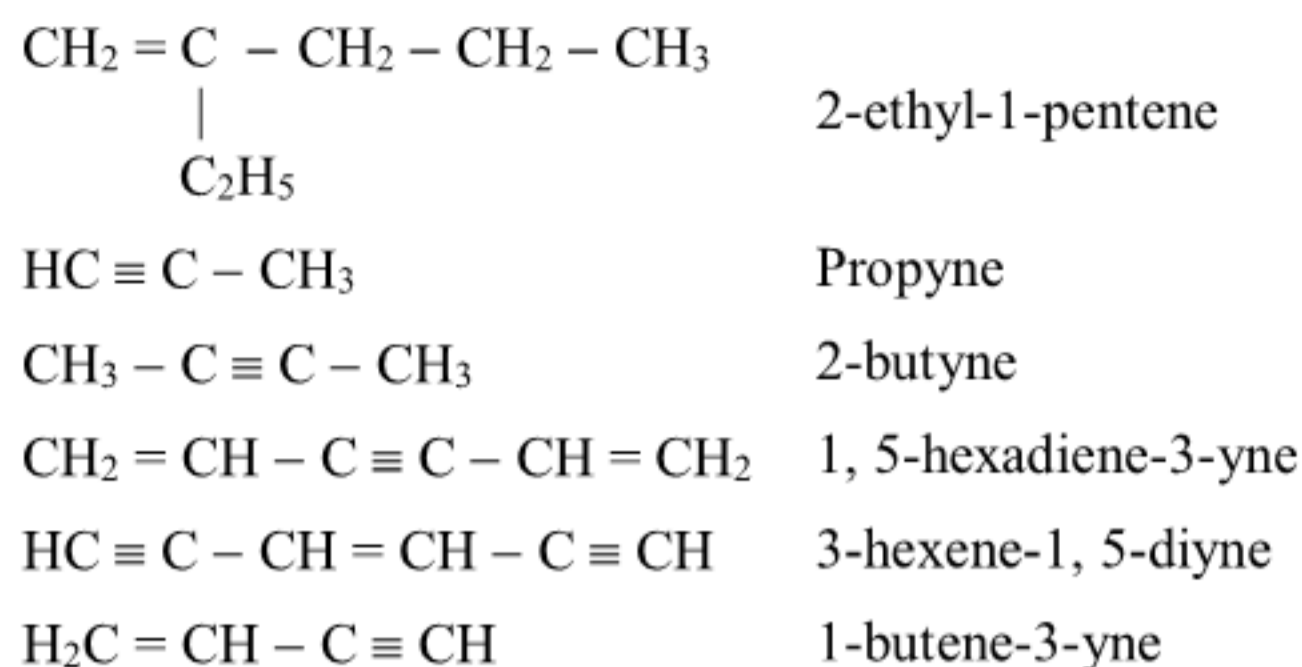
(a)

Name	Structural Formulas
Isobutylene	$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3 - \text{C} = \text{CH}_2 \end{array}$

2, 3, 4, 4-tetramethyl-2-pentene	$\begin{array}{ccccccc} & & & & \text{CH}_3 & & \\ & & & & & & \\ \text{CH}_3 & - & \text{CH} = & \text{C} - & \text{C} - & \text{CH}_3 & \\ & & & & & & \\ & \text{H}_3\text{C} & & \text{CH}_3 & \text{CH}_3 & & \end{array}$
2, 5-heptadiene	$\text{H}_3\text{C} - \text{CH} = \text{CH} - \text{CH}_2 - \text{CH} = \text{CH} - \text{CH}_3$
4, 5-dimethyl-2-hexene	$\begin{array}{ccccccc} & & & & & & \\ & & & & & & \\ \text{CH}_3 & - & \text{CH} = & \text{CH} - & \text{CH} - & \text{CH}_3 & \\ & & & & & & \\ & & & & \text{CH}_3 & \text{CH}_3 & \end{array}$
Vinyl acetylene	$\text{CH}_2 = \text{CH} - \text{C} \equiv \text{CH}$
1, 3-pentadiene	$\text{CH}_2 = \text{CH} - \text{CH} = \text{CH} - \text{CH}_3$
1-butyne	$\text{CH} \equiv \text{C} - \text{CH}_2 - \text{CH}_3$
3-n propyl-1, 4-pentadiene	$\begin{array}{ccccccc} & & & & & & \\ & & & & & & \\ \text{CH}_2 & = & \text{CH} - & \text{CH} - & \text{CH} = & \text{CH}_2 & \\ & & & & & & \\ & & & & \text{CH}_2 - \text{CH}_2 - & \text{CH}_3 & \end{array}$
Vinyl bromide	$\text{CH}_2 = \text{CH} - \text{Br}$
But-1-en-3-yne	$\text{HC} \equiv \text{C} - \text{CH} = \text{CH}_2$
4-methyl-2-pentyne	$\begin{array}{ccccccc} & & & & & & \\ & & & & & & \\ \text{CH}_3 & - & \text{C} \equiv & \text{C} - & \text{CH} - & \text{CH}_3 & \\ & & & & & & \\ & & & & \text{CH}_3 & & \end{array}$
Isopentane	$\begin{array}{ccccccc} & & & & & & \\ & & & & & & \\ \text{CH}_3 & - & \text{CH}_2 - & \text{CH} - & \text{CH}_3 & & \\ & & & & & & \\ & & & \text{CH}_3 & & & \end{array}$

(b)

Compounds	IUPAC Name
$\text{CH}_3 - \text{CH} = \text{CH}(\text{CH}_2)_2\text{CH}_3$	2-hexene
$(\text{CH}_3)_2\text{C} \equiv \text{CH}_2$	2-methyl-1-propene
$\begin{array}{ccccccc} & & & & & & \\ & & & & & & \\ \text{CH}_3 & - & \text{CH}_2 - & \text{CH} - & \text{C} = & \text{CH}_2 & \\ & & & & & & \\ & & & & \text{CH} & & \\ & & & & / \quad \backslash & & \\ & & & & \text{H}_3\text{C} \quad \text{CH}_3 & & \end{array}$	2-isopropyl-1-pentene
$\text{CH}_2 = \text{CH} - \text{CH} = \text{CH}_2$	1, 4-butadiene



- Q.12 (a) Describe different methods for the preparation of alkenes. How would you establish that ethylene contains a double bond?**
- (b) Give structure formulas of the alkenes expected to form by the dehydrohalogenation of the following compounds with a strong base:**
- (i) 1-chloropentane (ii) 2-chloro-3-methylbutane
(iii) 1-chloro-2, 2-dimethyl propa

Ans.

- (a)** Descriptive question. Consult text book.

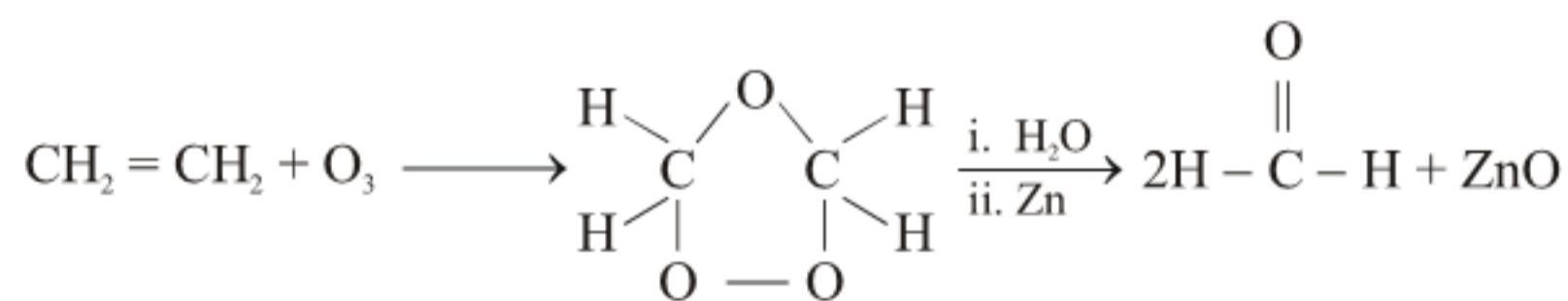
“Ethylene contains double bond” it can be established by following reactions:

- (i) Baeyer’s test (ii) Ozonolysis
- (i) Baeyer’s Tests:** Reaction with Baeyer’s reagent i.e., 1% alkaline solution of KMnO_4

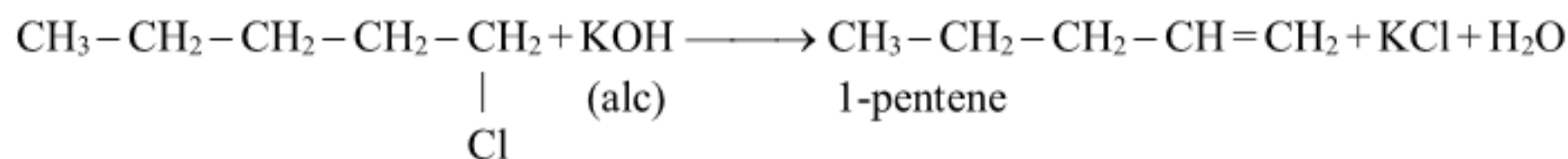
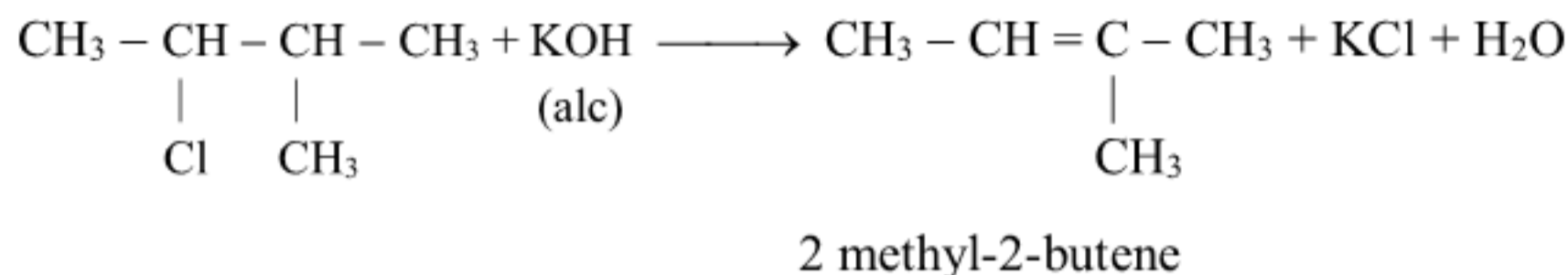
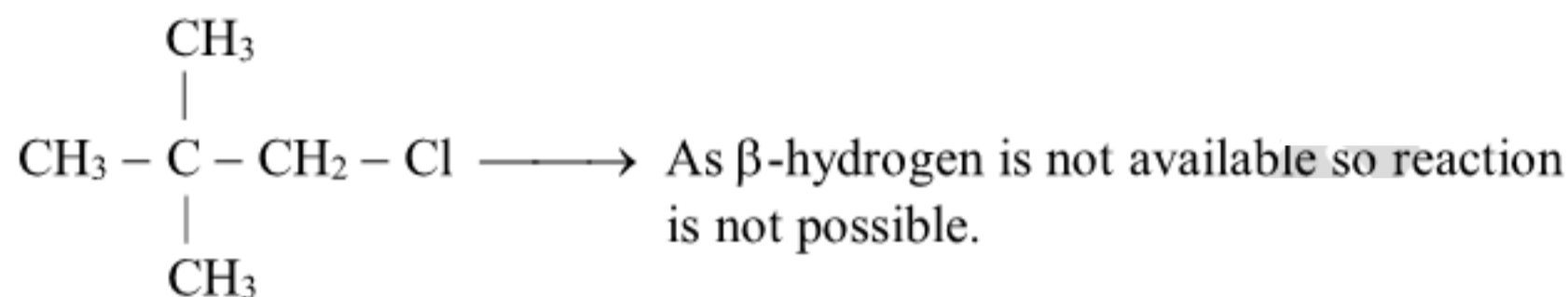


Result: Discharging of the colour of KMnO_4 confirms the presence of double bond.

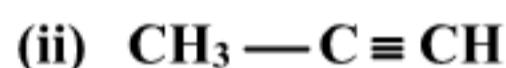
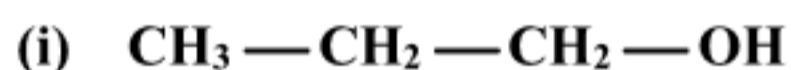
- (ii) Ozonolysis:**



- (b)**

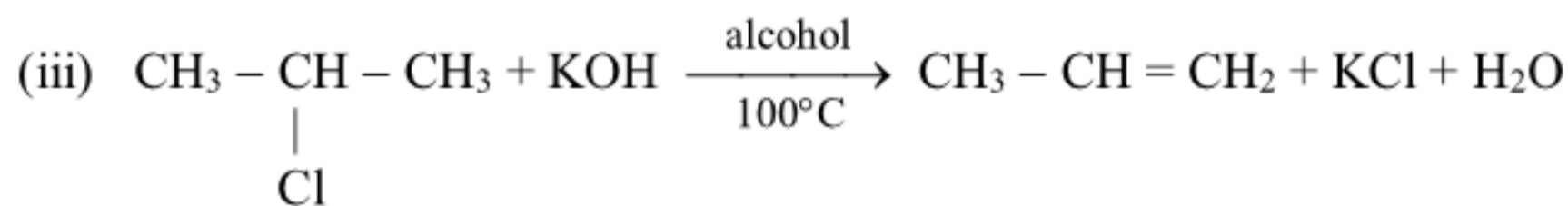
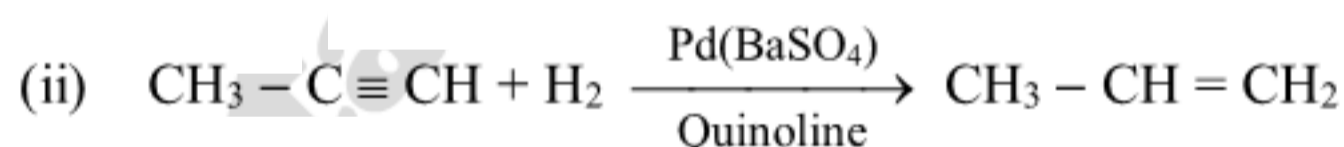
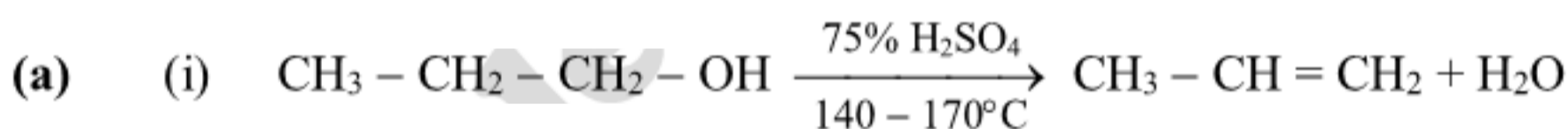
(i) 1-Chloropentane:**(ii) 2-chloro-3-methyl butane:****(iii) 1-chloro-2, 2-dimethyl propane:**

Q.13 (a) Write down chemical equations for the preparation of propene from the following compounds:

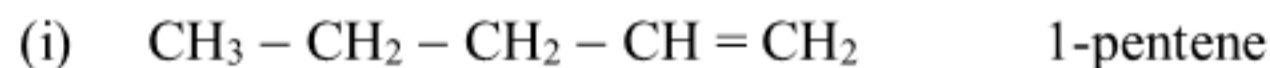


(b) Write skeleton formula showing only the arrangement of carbon atoms for all the possible alkenes of the molecular formula C_5H_{10} .

Ans.



(b) Possible structures of alkenes having molecular formula C_5H_{10} are as following:



- (iii) $\text{CH}_3 - \text{CH}_2 - \underset{\text{CH}_3}{\text{C}} = \text{CH}_2$ 2-methyl-1-butene
- (iv) $\text{CH}_3 - \underset{\text{CH}_3}{\text{CH}} - \text{CH} = \text{CH}_2$ 3-methyl-1-butene
- (v) $\text{CH}_3 - \text{CH} = \underset{\text{CH}_3}{\text{C}} - \text{CH}_3$ 2-methyl-2-butene

- Q.14** (a) How may ethene be converted into ethyl alcohol?
 (b) Starting from ethene, outline the reactions for the preparation of following compounds:
 (i) 1, 2-ethyldibromide (ii) Ethyne
 (iii) Ethane (iv) Ethylene glycol
 (c) How will you bring about the following conversions:
 (i) 1-butene to 1-butyne (ii) 1-propanol to $\text{CH}_3 - \text{CH} - \text{CH}_2\text{Cl}$

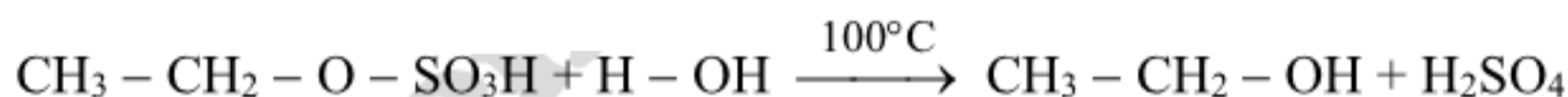
Ans.

(a) Ethene may be converted into ethyl alcohol by two steps:

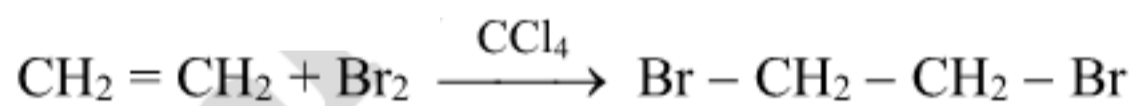
(i) **Addition of H_2SO_4 :**



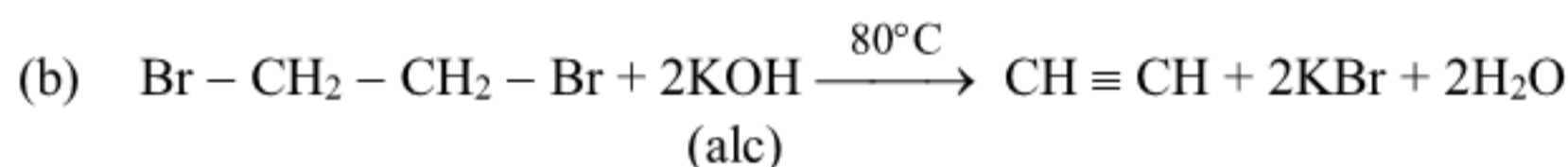
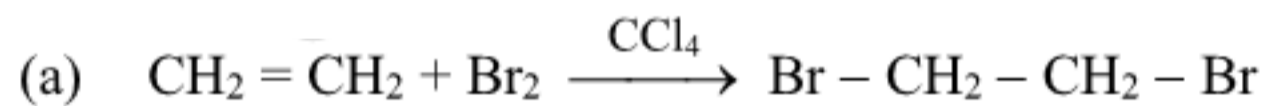
(ii) **Hydration:**



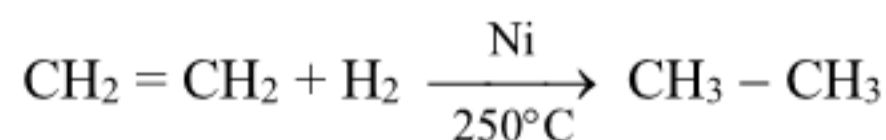
(b) (i) **Ethylene dibromide:**



(ii) **Ethyne:**

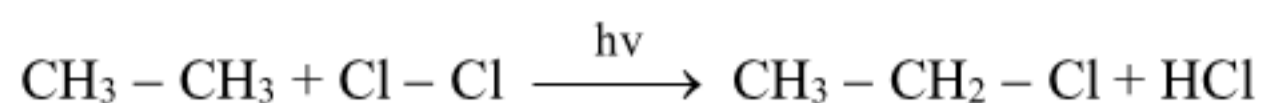


(iii) **Ethane:**

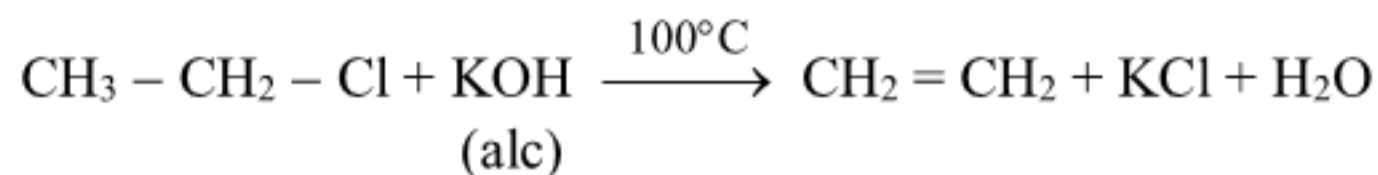


Ethane \longrightarrow Ethene

(i) **Halogenation in the presence of sunlight:**



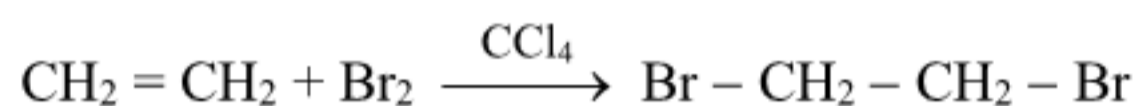
(ii) **Dehydrohalogenation:**



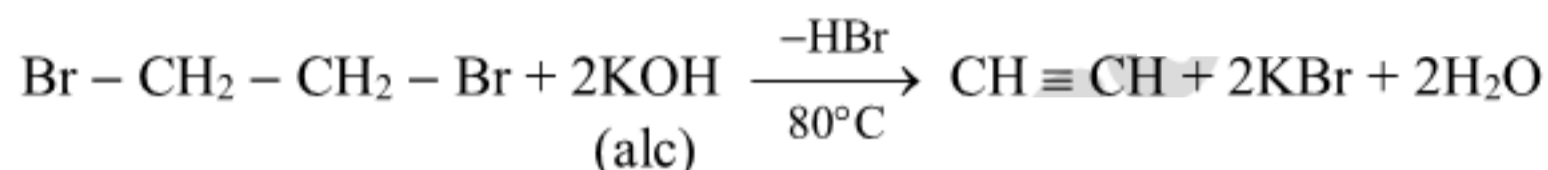
Second Step:

Ethene \longrightarrow Ethyne

(i) **Addition of halogen:**

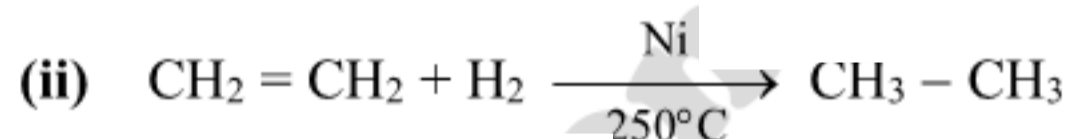
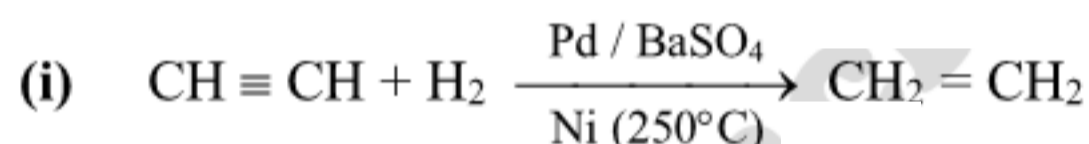


(ii) **Dehydrohalogenation:**



Third Step:

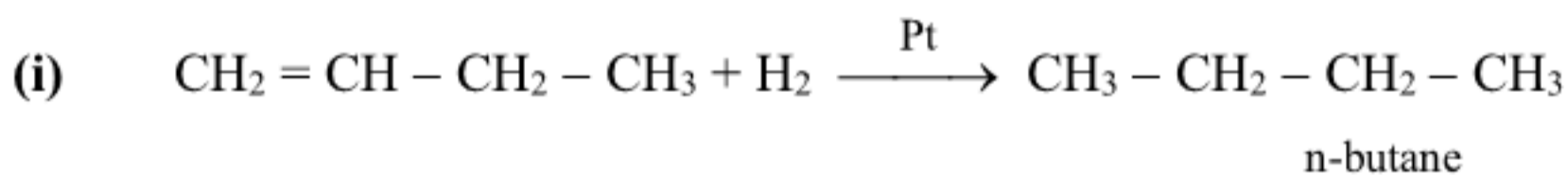
Ethyne \longrightarrow Ethane



Q.16 Write down structural formulas for the products that are formed when 1-butene will react with the following reagents:

- | | |
|---|--------------------------------------|
| (i) H_2, Pt | (ii) Br_3 in CCl_4 |
| (iii) Cold dil. KMnO_4/OH | (iv) HBr |
| (v) O_2 in the presence of Ag | (vi) HOCl |
| (vii) dil. H_2SO_4 | |

Ans.



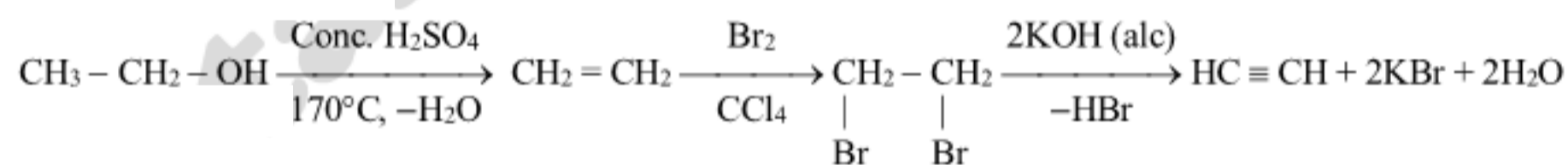
- (ii) $\text{CH}_2 = \text{CH} - \text{CH}_2 - \text{CH}_3 + \text{Br}_2 \xrightarrow{\text{CCl}_4} \begin{array}{c} \text{CH}_2 - \text{CH} - \text{CH}_2 - \text{CH}_3 \\ | \quad | \\ \text{Br} \quad \text{Br} \end{array}$ 1-2-dibromobutane
- (iii) $3\text{CH}_2 = \text{CH} - \text{CH}_2 - \text{CH}_3 + 2\text{KMnO}_4 + 4\text{H}_2\text{O} \longrightarrow \begin{array}{c} 3\text{CH}_2 - \text{CH} - \text{CH}_2 - \text{CH}_3 \\ | \quad | \\ \text{OH} \quad \text{OH} \end{array} + 2\text{MnO}_2 + 2\text{KOH}$
- (iv) $\text{CH}_2 = \text{CH} - \text{CH}_2 - \text{CH}_3 + \text{HBr} \longrightarrow \begin{array}{c} \text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CH}_3 \\ | \\ \text{Br} \end{array}$ 2-bromobutane
- (v) $\text{CH}_3 - \text{CH}_2 - \text{CH} = \text{CH}_2 + \frac{1}{2} \text{O}_2 \xrightarrow[300^\circ\text{C}]{\text{Ag}} \begin{array}{c} \text{CH}_3 - \text{CH}_2 - \text{CH} - \text{CH}_2 \\ \quad \quad \quad \diagdown \quad / \\ \quad \quad \quad \text{O} \end{array}$ Butylene oxide
- (vi) $\text{CH}_3 - \text{CH}_2 - \text{CH} = \text{CH}_2 + \text{HOCl} \longrightarrow \begin{array}{c} \text{CH}_3 - \text{CH}_2 - \text{CH} - \text{CH}_2 \\ | \quad | \\ \text{OH} \quad \text{Cl} \end{array}$ 1-chloro-2-butanol
- (vii) $\text{CH}_3 - \text{CH}_2 - \text{CH} = \text{CH}_2 + \text{H}_2\text{SO}_4 \longrightarrow \begin{array}{c} \text{CH}_3 - \text{CH}_2 - \text{CH} - \text{CH}_3 \\ | \\ \text{O} - \text{SO}_3\text{H} \end{array}$

Q.17 In the following reactions, identify each lettered product:

- (i) Ethyl alcohol $\xrightarrow{\text{Conc. H}_2\text{SO}_4}$ A $\xrightarrow{\text{Br}_2}$ B $\xrightarrow[\text{KOH}]{\text{alcoholic}}$ C
- (ii) Propene $\xrightarrow{\text{Br}_2}$ D $\xrightarrow[\text{KOH}]{\text{alcoholic}}$ E $\xrightarrow{\text{HCN}}$ F

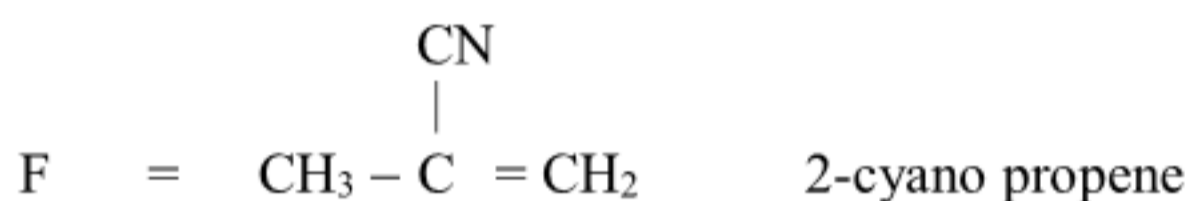
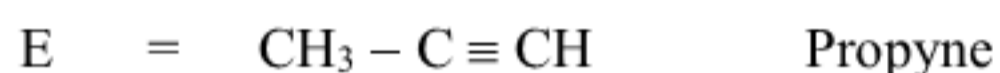
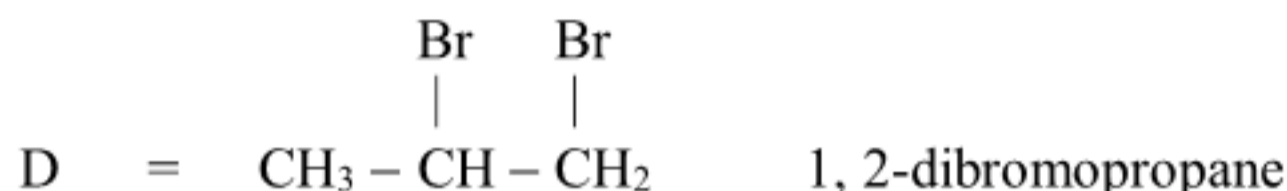
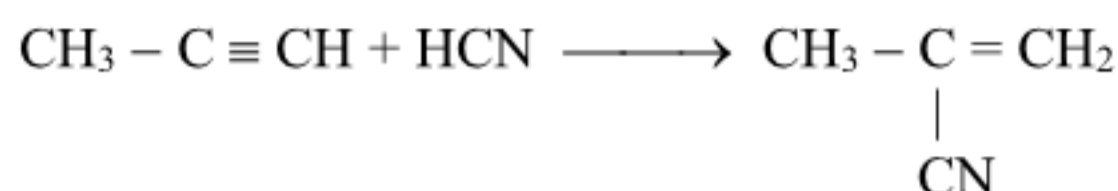
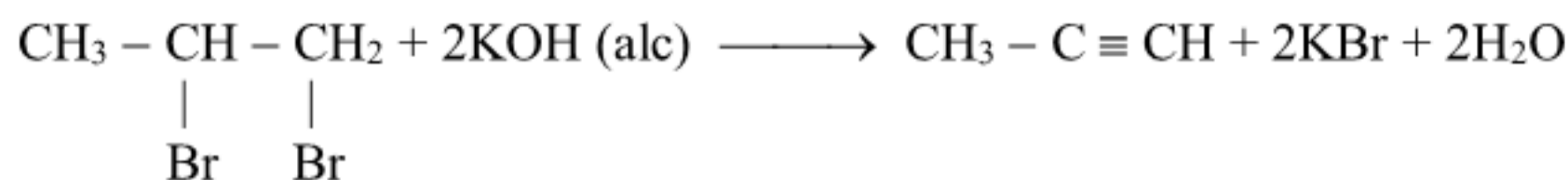
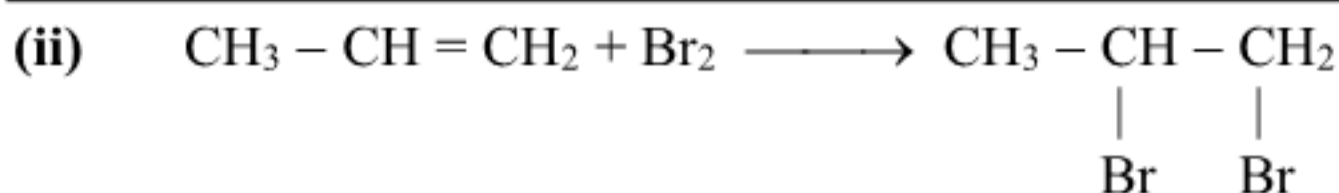
Ans.

(i) **Reactions Involved:**



Products:

- A = Ethene
 B = 1, 2 dibromoethane
 C = Ethyne



Q.18 After an ozonolysis experiment, the only product obtained was acetaldehyde, CH_3CHO . Can you guess the structural formula of this compound.

Ans. The only product of acetaldehyde can be obtained by the ozonolysis of 2-butene.

Structural formula: $\text{CH}_3 - \text{CH} = \text{CH} - \text{CH}_3$

Q.19 (a) The addition of sulphuric acid to an alkene obeys Markownikov's rule. Predict the structures of the alcohols obtained by the addition of the acid to the following compounds:

(i) Propene

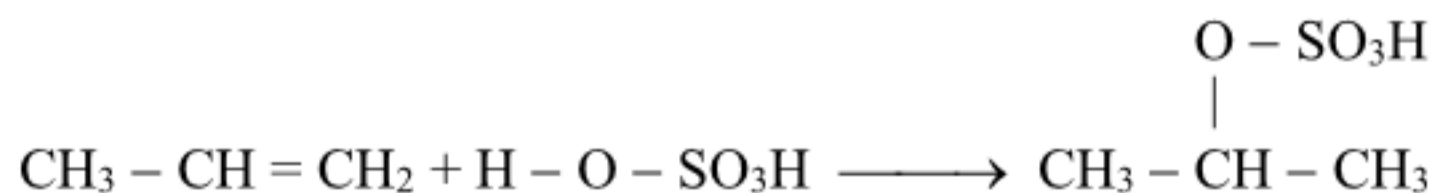
(ii) 1-butene

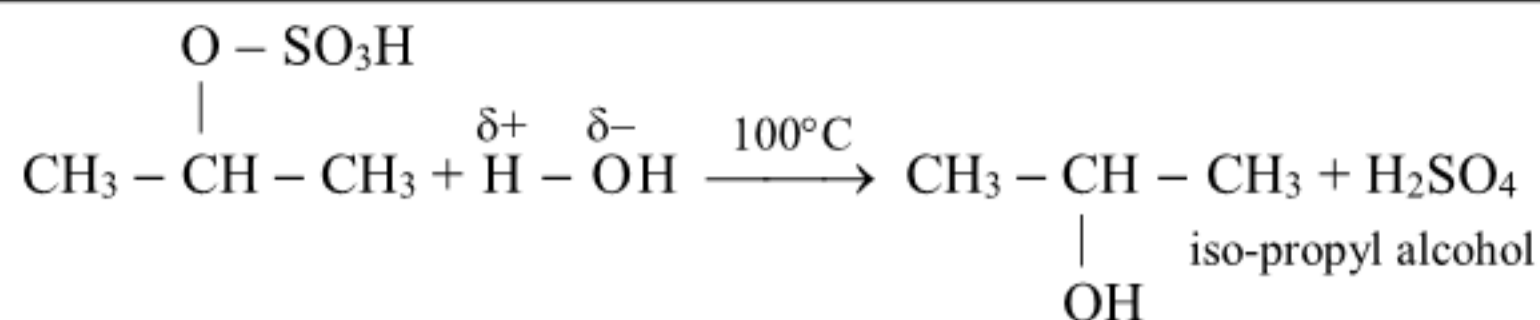
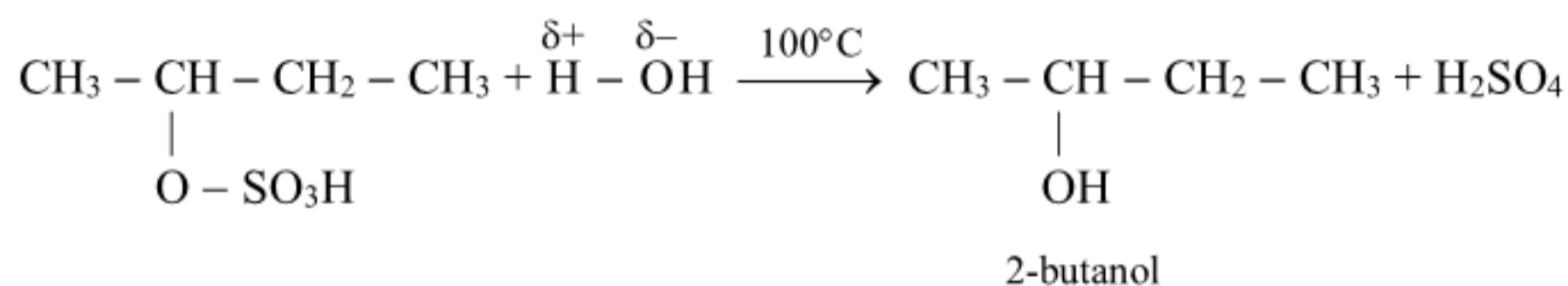
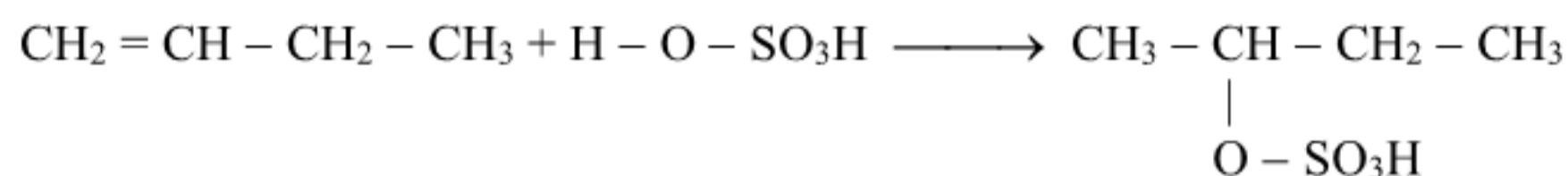
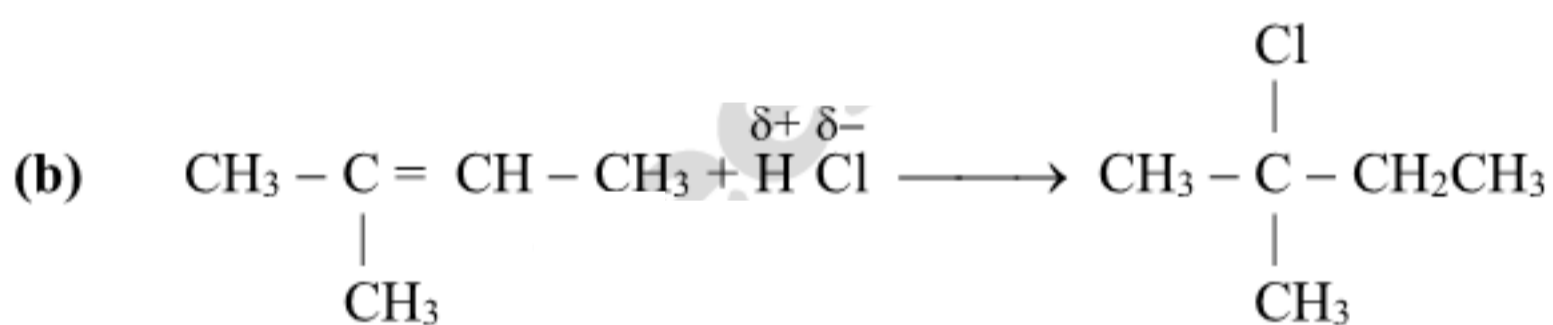
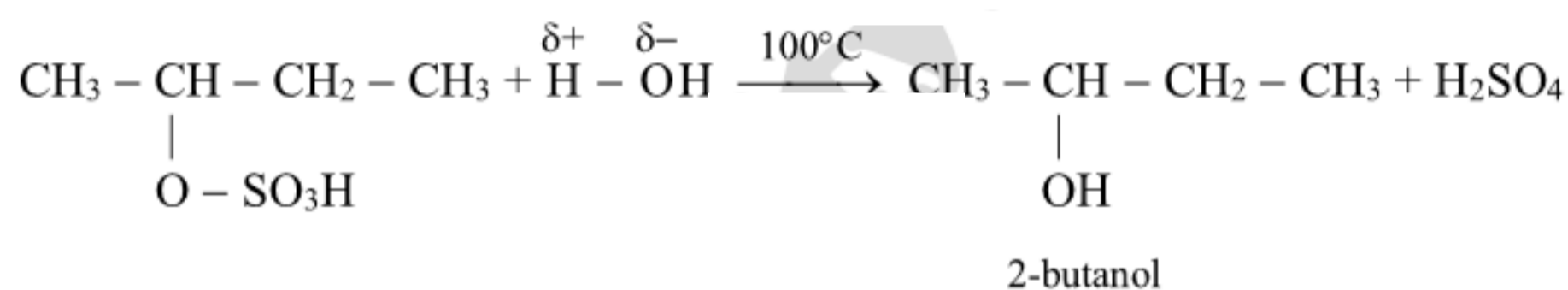
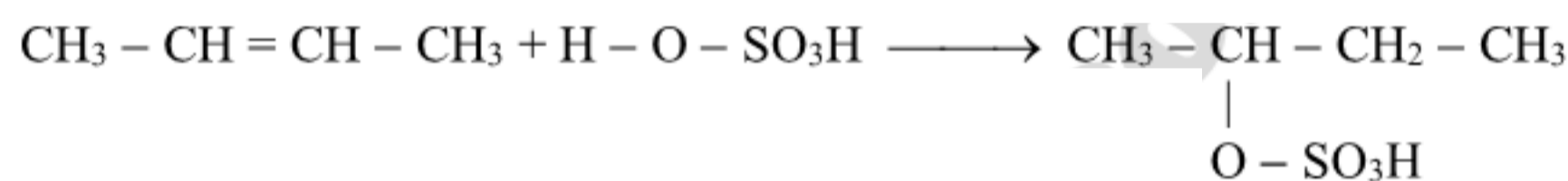
(iii) 2-butene

(b) Predict the most likely product of the addition of hydrogen chloride to 2-methyl 2-butene. Explain the formation of this product.

Ans.

(a) (i) Propene:



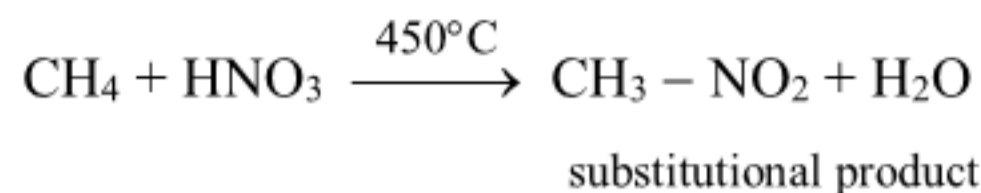
**(ii) 1-butene:****(iii) 2-butene:**

As 2-methyl-2-butene is an unsymmetrical compound and H-Cl is an unsymmetrical reagent so, the addition will be according to Markownikov's rule and the product will be 2-chloro-2 methyl butane.

Q.20 Why are some hydrocarbons called saturated and others unsaturated? What type of reactions are characteristics of them?

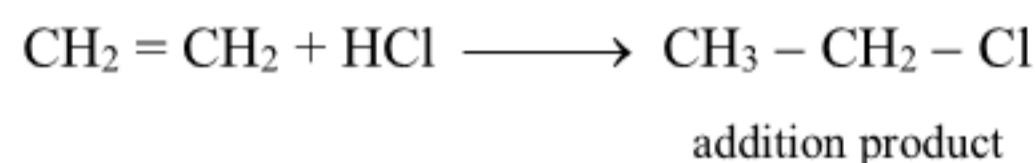
Ans. **Saturated Hydrocarbons:** If all the valencies of the carbon atoms in a molecule are fully satisfied and these cannot further take up any more hydrogen or other atom then this compound is named as saturated hydrocarbon.

Type of Reactions: Saturated hydrocarbons give substitution reactions. e.g.,



Unsaturated Hydrocarbons: If in the compounds of carbon and hydrogen all the four valencies of carbon atom are not fully utilized and they contain either a double or a triple bond then these are called as unsaturated hydrocarbons.

Types of Reactions: Unsaturated hydrocarbons give addition reactions. e.g.,



- Q.21** (a) Describe methods for the preparation of ethyne.
 (b) How does ethyne react with:
 (i) Hydrogen (ii) Halogen acid
 (iii) Alkaline KMnO_4 (iv) 10% H_2SO_4 in the presence of HgSO_4
 (v) Ammonical cuprous chloride
 (c) Mention some important uses of methane, ethene and ethyne.

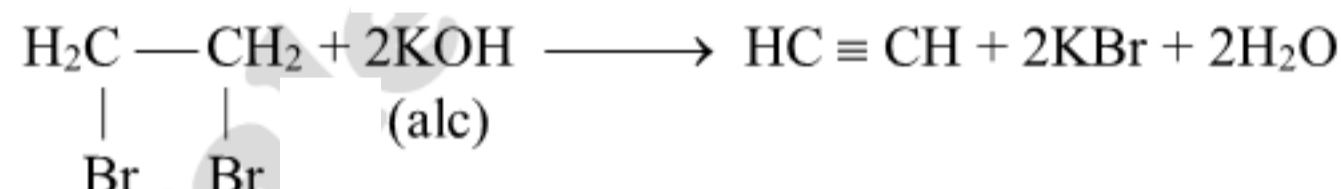
Ans.

(a) **Preparation of Ethyne:**

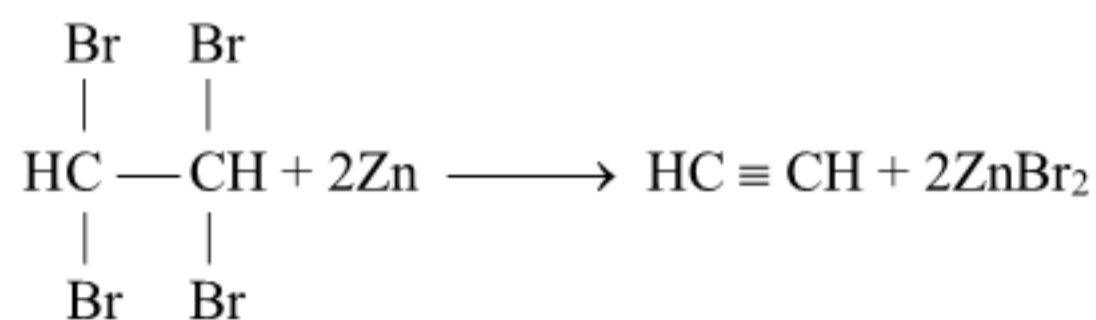
(i) Hydrolysis of calcium carbide (industrial method):



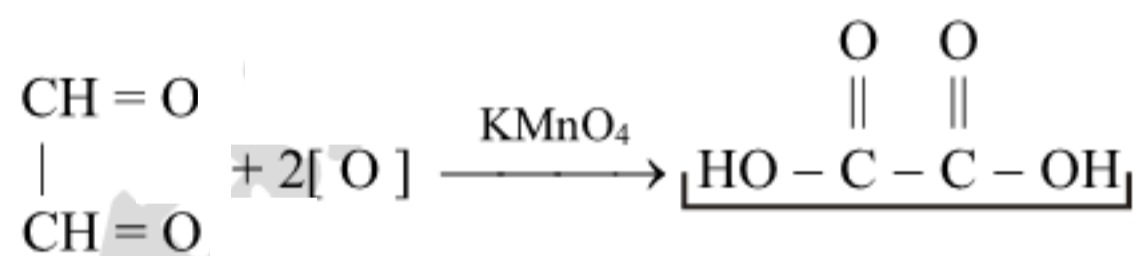
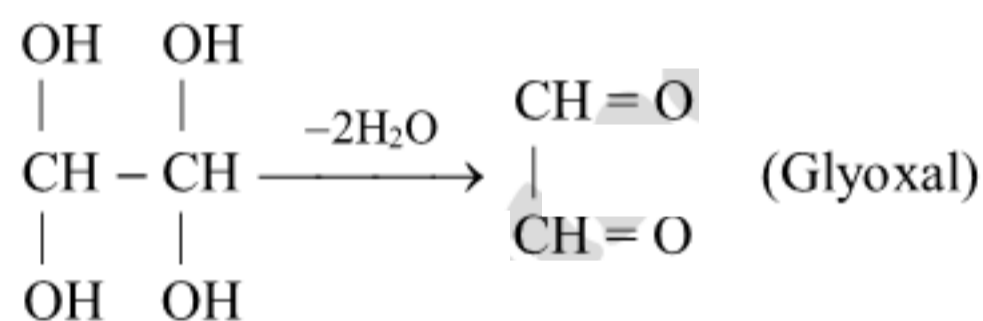
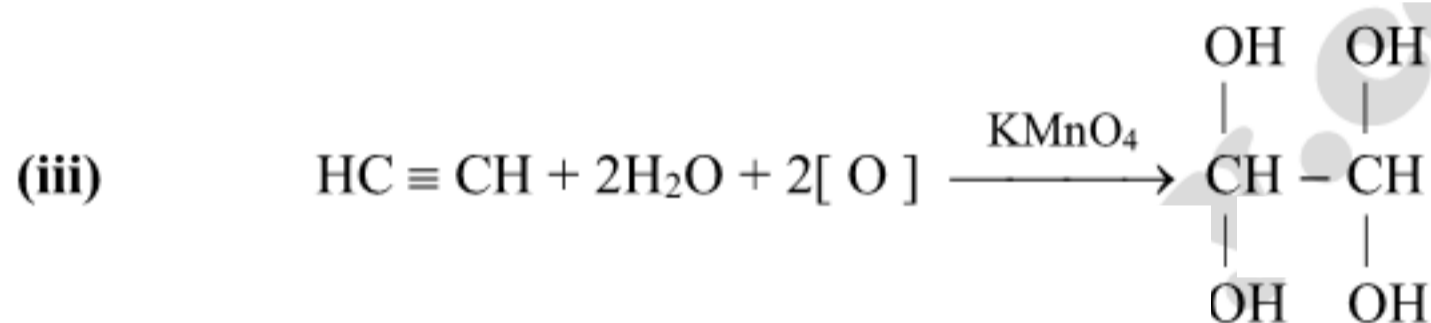
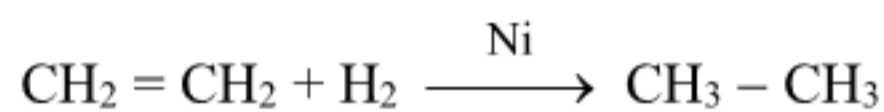
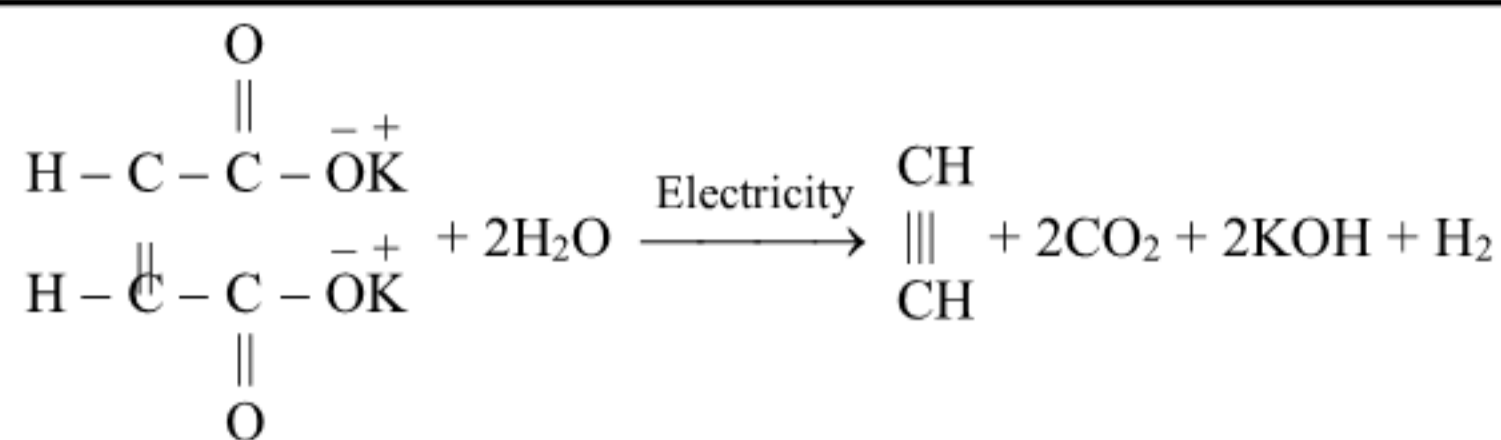
(ii) Dehydrohalogenation of vicinal dihalides:



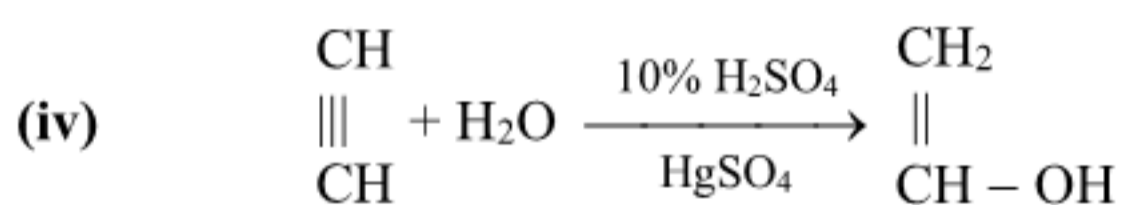
(iii) **Dehalogenation of Tetrahalides:**



(iv) **Kolbe's Method:**



Oxalic acid



**(c) Important Uses:*****Uses of Methane:***

- (i) For the preparation of chloroform and carbon tetrachloride.
- (ii) Methane is important constituent of natural gas.
- (iii) For the industrial preparation of CH_3OH , HCHO , HCOOH .
- (iv) Methane is used in the preparation of carbon-black used in paints, automobile tyres and printing inks.
- (v) By cracking of methane, H_2 is produced which is used in fertilizers and for the hydrogenation of vegetable oil

Uses of Ethene:

- (i) Artificial ripening of fruits.
- (ii) As an anaesthetic.
- (iii) In the preparation of mustard gas.
- (iv) In the preparation of polyethylene

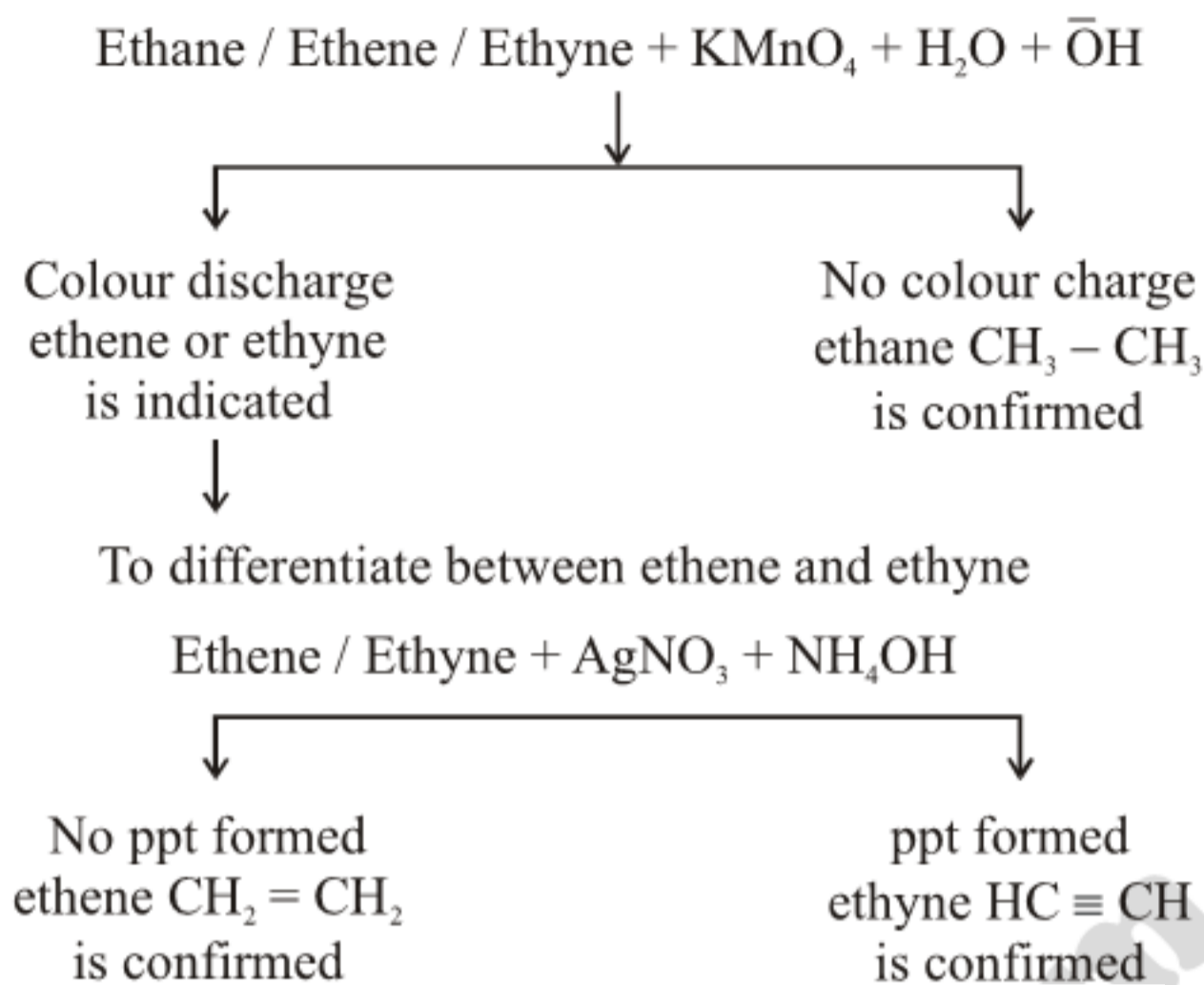
Uses of Ethyne:

- (i) Oxy-acetylene flame ($2800 - 3000^\circ\text{C}$) is used for welding.
- (ii) For artificial ripening of fruits.
- (iii) For the preparation of acetaldehyde, ethanol and acetic acid.
- (iv) It is used in the preparation of PVC, Neoprene rubber, Orlon.
- (v) It is used in the preparation of $\text{C}_2\text{H}_2\text{Cl}_4$ which is used in varnishes, resins, rubber

Q.22 Describe how you could distinguish ethane, ethene and ethyne from one another by means of chemical reactions.

Ans. We can distinguish between saturated and unsaturated hydrocarbons by means of a chemical test called as Baeyer's test.

BAEYER'S TEST



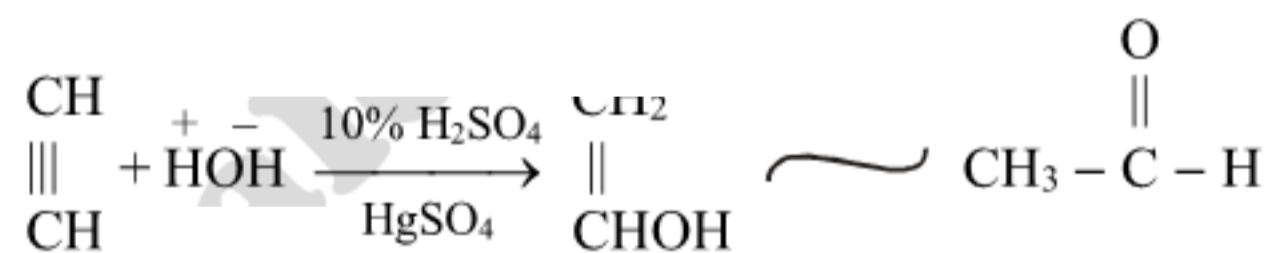
Q.23 (a) How will you synthesize the following compounds starting from ethyne:

- | | |
|---|--|
| <p>(i) Acetaldehyde</p> <p>(iii) Chloroprene</p> <p>(v) Oxalic acid</p> <p>(vii) Ethane</p> | <p>(ii) Benzene</p> <p>(iv) Glyoxal</p> <p>(vi) Acrylonitrile</p> <p>(viii) Methyl nitrile</p> |
|---|--|

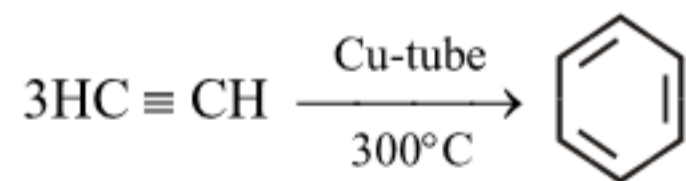
(b) Write a note on the acidity of ethyne.

Ans.

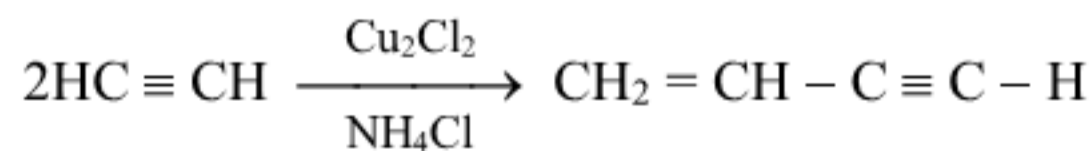
(a) (i) Acetaldehyde

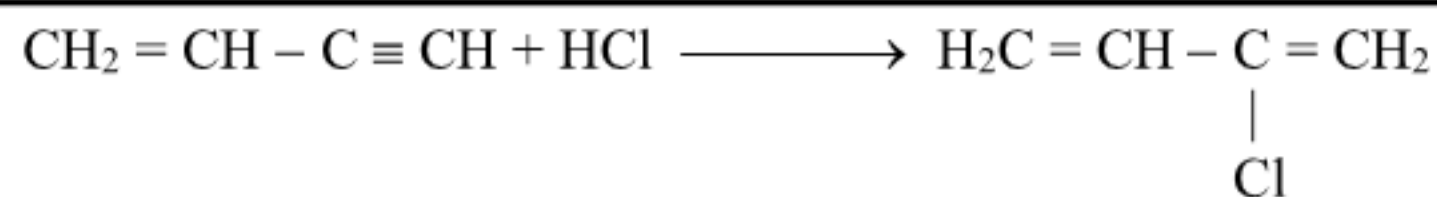


(ii) Benzene:

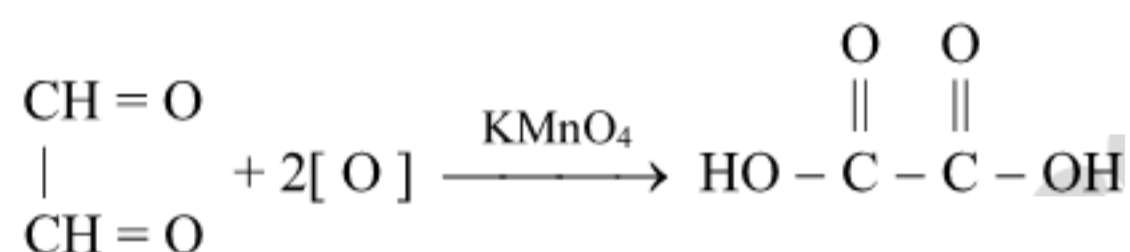
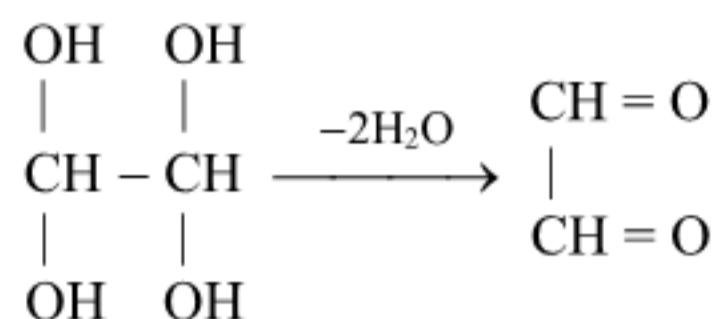
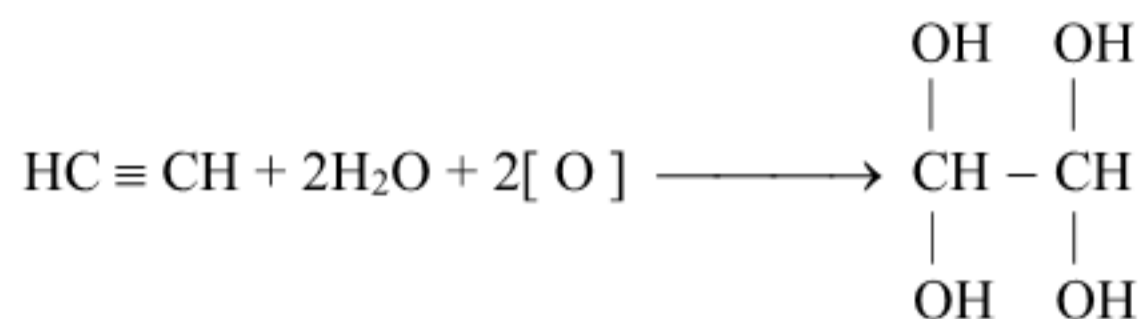


(iii) Chlorperene:

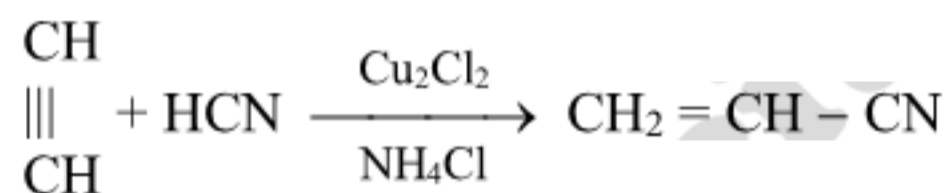




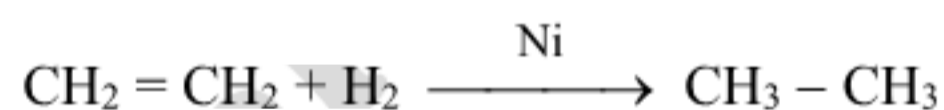
(iv) **Glyoxal:**



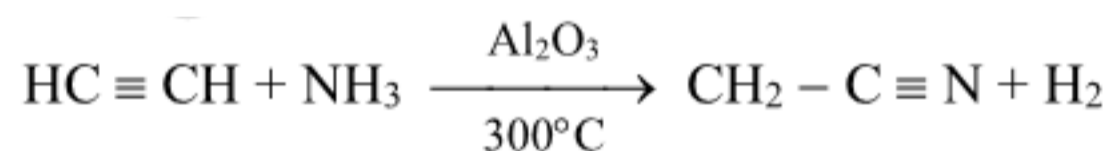
(v) **Acrylonitrile:**



(vi) **Ethane:**



(vii) **Methyl Nitrile:**



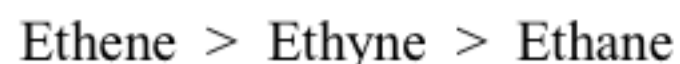
(b) Consult the text book.

Q.24 (a) Compare the reactivity of ethane, ethene and ethyne.

(b) Compare the physical properties of alkanes, alkenes and alkynes.

Ans.

- (a) The general decreasing reactivity order of ethane, ethene and ethyne is as follow:



Reasons: A π -bond in **ethene** is not only weak but its electrons are more exposed to an attack by an electrophilic reagent. Both these facts make the ethene a very reactive compound. **Ethyne** although contain 2π -bonds but it is less reactive than ethene towards electrophilic reagents. This is because the bond distance between the two triple bonded carbon atoms is very short and hence π -electrons are not easily available to be attacked by electrophilic reagents. Ethyne is, however more reactive than ethene towards nucleophilic reagents. **Ethane** have no π -electrons so, it is much less reactive than ethene or ethyne.

- (b) (i) **Physical State:**

Alkanes: Alkanes containing upto 4 carbon atoms are gases while pentane to heptadecane (C_5 to C_{17}) are liquids. The higher members from C_{18} to onwards are waxy solids.

Alkenes: First 3 members of alkenes are gases while C_5 to C_{15} are liquids and higher members are solids.

Alkynes: The first 3 members of alkynes are gases. Next 8 members C_5 to C_{12} are liquid and higher members are solids.

- (ii) **Characteristics:**

Alkanes: All alkanes are colourless and odourless.

Alkenes: They have characteristic smell.

Alkynes: They are colourless, odourless, except acetylene which has garlic like odour.

- (iii) **Polarity and Solubility:**

Alkanes: They are non-polar or very weakly polar and are insoluble in polar solvents like water but soluble in non-polar solvents like benzene etc.

Alkenes: They show weakly polar properties because of sp^2 hybridization. They are insoluble in H_2O but soluble in alcohol.

Alkynes: They are non-polar and dissolve readily in non-polar solvents like ether, benzene, etc.

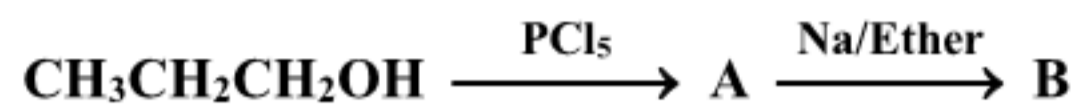
- (iv) **Physical Constants:**

The compound 1-butyne has acidic hydrogen and can be replaced by metal forming alkynides. 2-butyne has no acidic hydrogen and do not form white ppt. So, only 1-butyne can give white ppt. with ammonical silver nitrate.

The possible structure is:

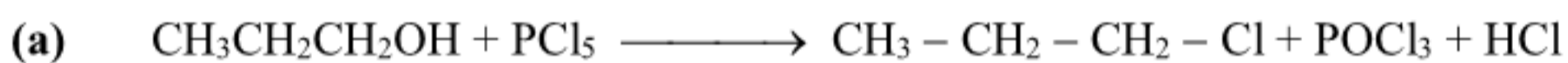


Q.27 (a) Identify A and B:



(b) Give the general mechanism of electrophilic addition reactions of alkenes.

Ans.



(n-hexane)



(b) Descriptive question. Consult text book for details.

DO YOU KNOW?

1. Alkanes are also called paraffins.
2. Alkenes are also called olefines.
3. $C_{20}H_{42}$ is called eicosane.
4. $C_{11}H_{24}$ is called undecane.
5. $C_{12}H_{26}$ is called dodecane.
6. $C_{16}H_{34}$ is called hexadecane.
7. $C_{100}H_{202}$ is called hectane.
8. Wurtz's reaction is used for lengthening the carbon chain.
9. The boiling point of branched chain alkanes are less than straight chain hydrocarbons.
10. Kolbe's method is used for the preparation of alkanes, alkenes, alkynes.
11. Raney Nickel has high surface area and is more reactive.
12. Bayer's test is used for the identification of double bond.
13. Mustard gas is highly boiling liquid. It is used as vesicant (blistering agent).
14. 1-butyne reacts with ammonical $AgNO_3$ but 2-butyne does not react.
15. Acetylene was prepared accidentally by an American Chemist named Willson.
16. Ethyne has garlic like odour.
17. Methane is also called marsh gas.