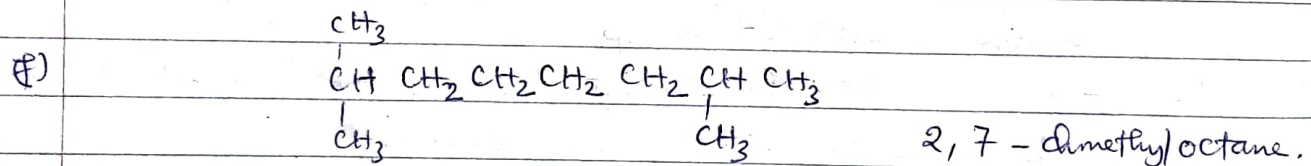
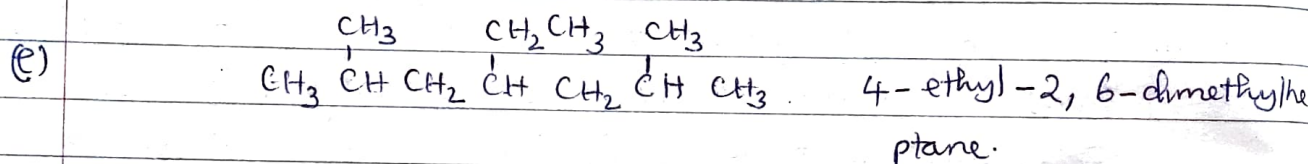
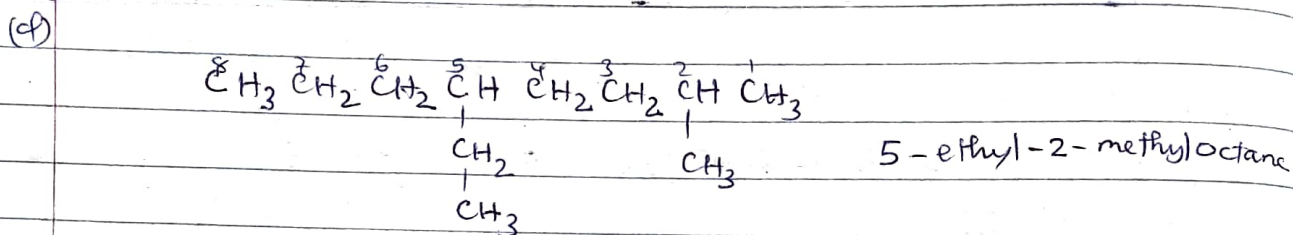
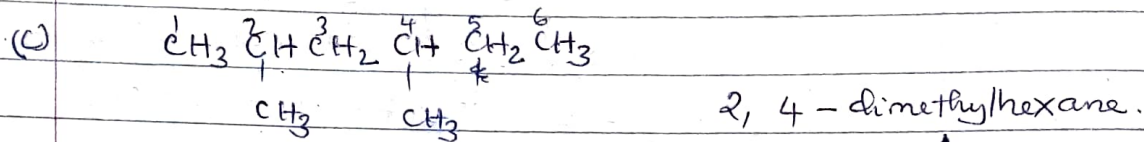
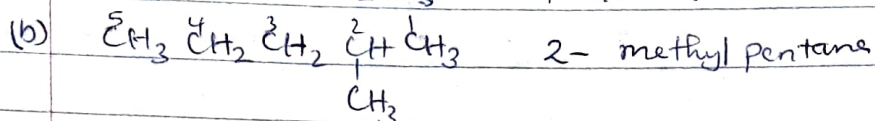
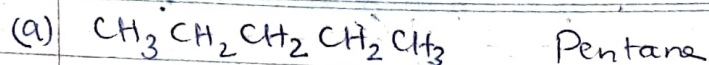


EXAMPLES



ISOMERISM IN ALKANES

Isomerism is the existence of the compounds with the same molecular formula but different structural formulae.

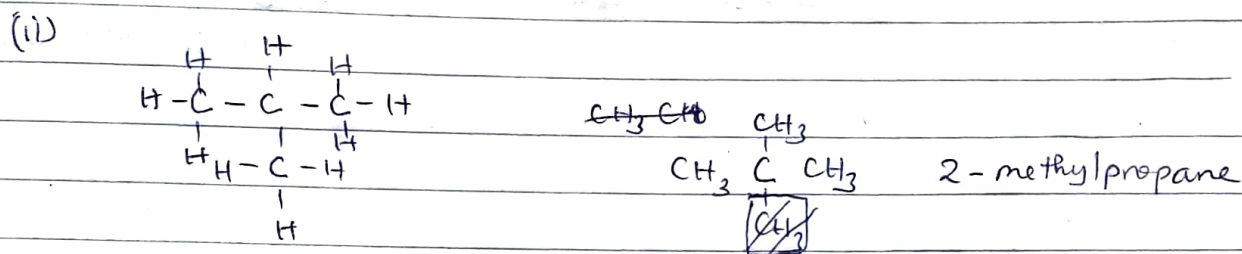
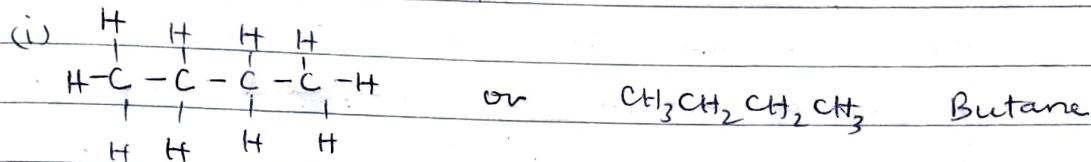
Isomers are compounds with the same molecular formula but different structural formulae.

- ⇒ Isomers have
- (1) different physical properties because they have different molecular structures.
 - (2) Have the same chemical properties because they belong to the same homologous series.

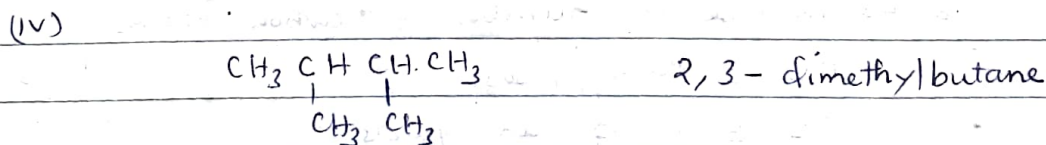
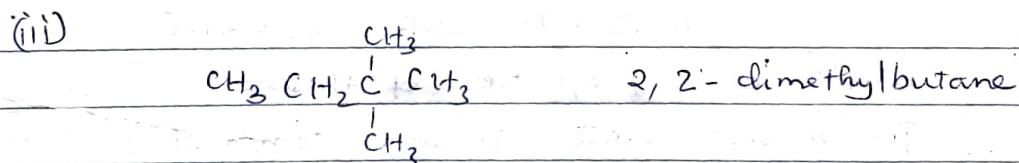
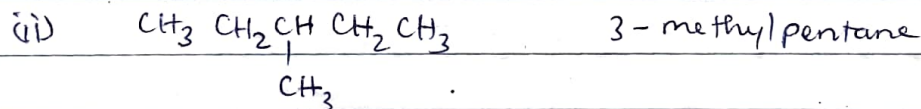
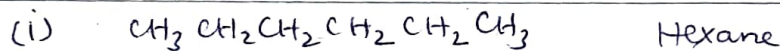
Rules

1 Crack one carbon atom from the longest chain and attach it to the remaining chain but not in a terminal point

(a) Isomers of Butane C_4H_{10}

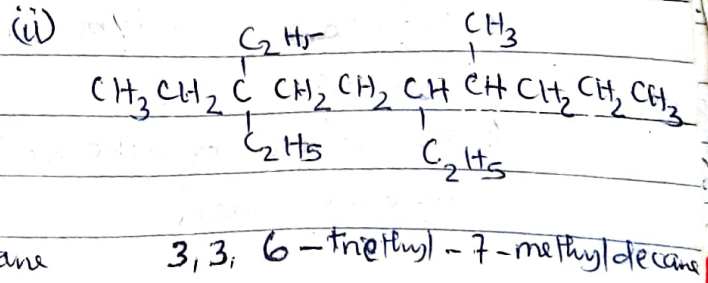
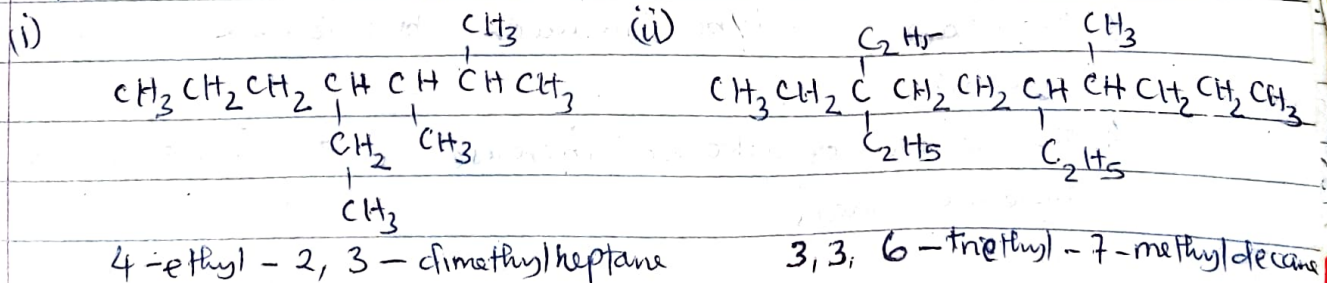


(b) Isomers of hexane.



EXERCISE

Name the following organic compounds

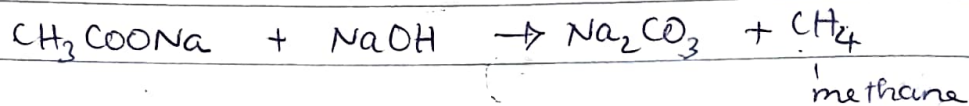


PREPARATION OF ALKANE

The Laboratory Preparation of Methane

Methane in the laboratory is prepared by heating sodium ethanoate (CH_3COONa) and sodium hydroxide (NaOH) in a hard test tube.

- The gas is collected by downward displacement of water



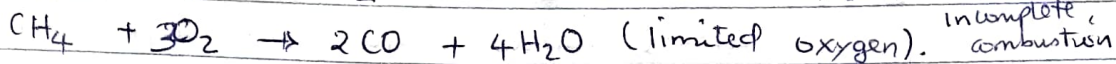
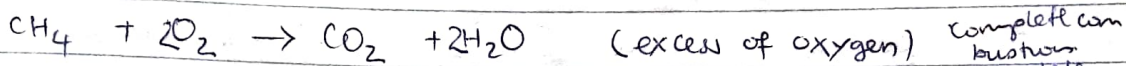
PROPERTIES OF ALKANE

(a) Physical Properties of Alkane

- 1 The physical state at room temperature changes according to the increase in number of carbon atoms.
 - $n = 1$ to 4 are gases
 - $n = 5$ to 17 are liquids
 - $n > 17$ are soft solids.
- 2 The MP and BP increase with increase in relative molecular mass
- 3 They are insoluble in water but soluble in non-polar solvents
- 4 The density of alkanes increase with increase in relative molecular mass.

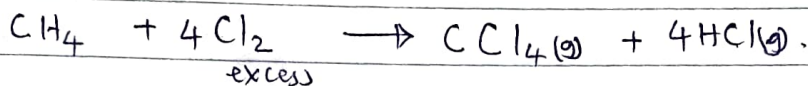
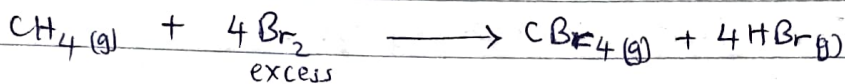
(b) Chemical Properties of Alkanes

1 Combustion

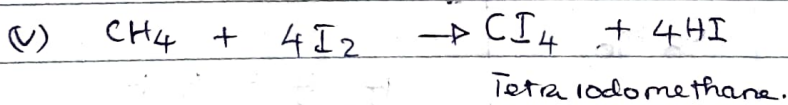
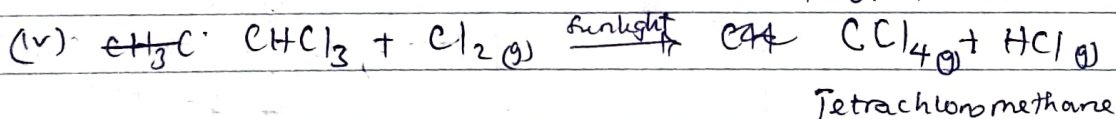
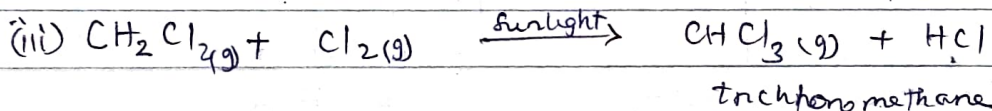
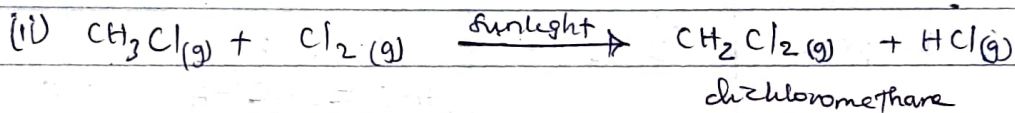
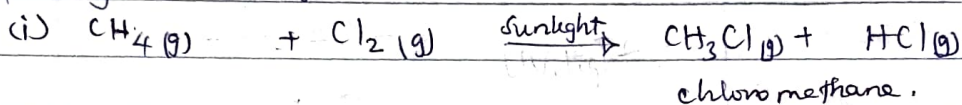


2 Alkanes undergo substitution reaction with halogens

Alkanes react with halogens by substitution reaction in the presence of sunlight/ultraviolet radiation (UV)



Reactions take place in stages; with one chlorine/bromine atom replacing a hydrogen atom in methane at each stage.



Substitution reaction is one in atom or a group of atoms in a compound is replaced by other atoms.

Uses of Alkanes

- 1 Alkanes are used as fuels.
- 2 Higher alkanes are used as solvents.
- 3 Alkanes are used to manufacture other organic compounds like alcohols

ALKENES

Alkenes are ^{unsaturated hydrocarbons with a general formula of C_nH_{2n}} members of a homologous series of general formula C_nH_{2n} where $n \geq 2$

- All alkene names end up with suffix -ene.
- They contain a double bond at least in one of the carbon to carbon bond. $-C=C-$ This is their functional group
- The first member of the family in alkenes is ethene as this contains two carbons.

Homologous series		structural formulae	
Name	Formula	Open structure	Condensed structure
1 Ethene	C_2H_4	$\begin{array}{c} H-C=C-H \\ \quad \\ H \quad H \end{array}$	CH_2CH_2
2 Propene	C_3H_6	$\begin{array}{c} \quad \quad H \\ H-C=C-C-H \\ \quad \quad \\ H \quad H \quad H \end{array}$	CH_2CHCH_3
3 Butene	C_4H_8	$\begin{array}{c} \quad H \quad H \quad H \quad H \\ H-C=C-C-C-H \\ \quad \quad \\ H \quad H \quad H \end{array}$	$CH_2CHCH_2CH_3$
4 Pentene	C_5H_{10}	$\begin{array}{c} \quad H \quad H \quad H \quad H \quad H \\ H-C=C-C-C-C-H \\ \quad \quad \\ H \quad H \quad H \end{array}$	$CH_2CHCH_2CH_2CH_3$

NOMENCLATURE OF ALKENES

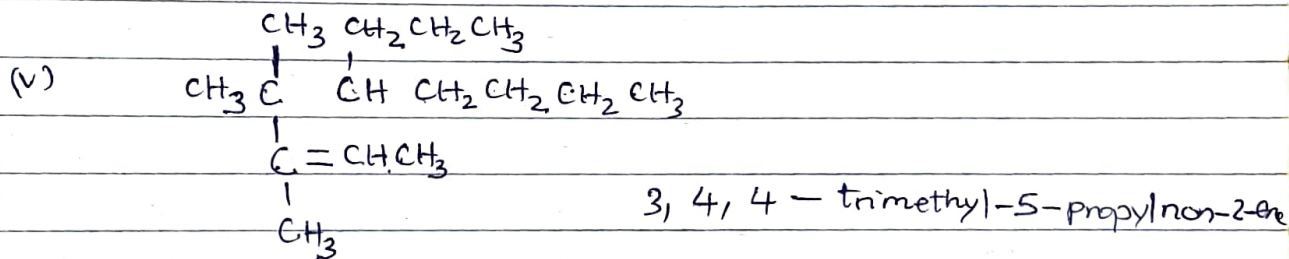
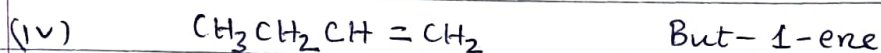
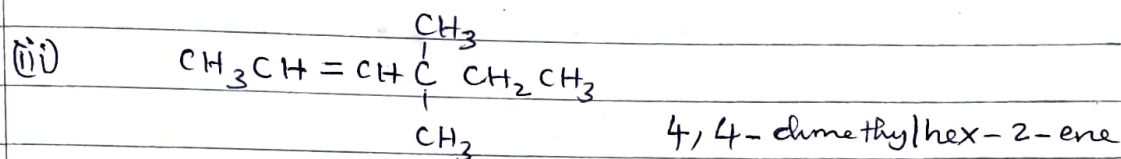
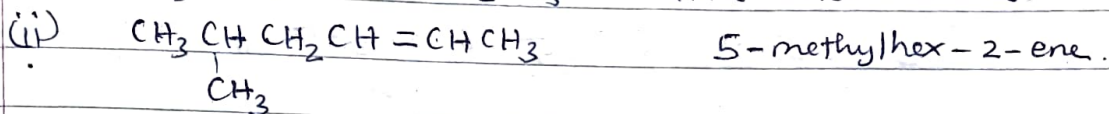
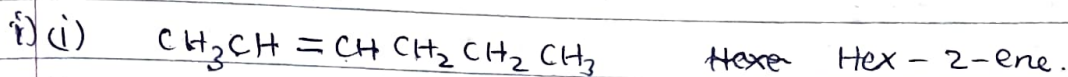
Rules

- 1 Select the longest continuous chain that contains both carbon atoms of the double bonds.
- 2 Number the carbon atoms of the parent chain starting from the end nearer to the double bond

3 Show the position of the double bond using the number of the first carbon of the double bond.

4 Other rules of nomenclature for alkanes apply.

EXAMPLES.



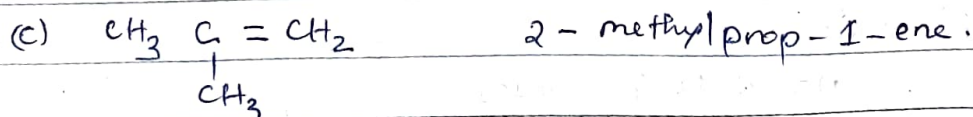
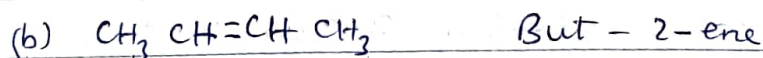
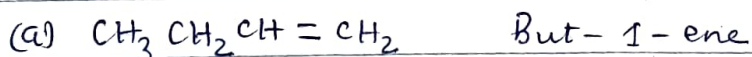
ISOMERISM IN ALKENES.

Isomerism in alkenes is due to

(i) The position of the double bond - positional isomers

(ii) The presence of a substituent - branch isomer.

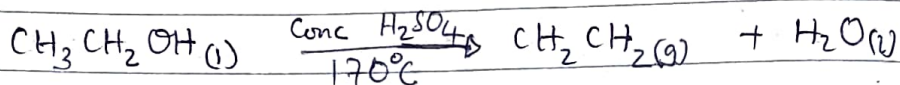
Example



PREPARATION OF ALKENES

Laboratory Preparation of Ethene

Ethene can be prepared in the laboratory by heating a mixture of ethanol and concentrated sulphuric acid. Concentrated sulphuric acid dehydrates ethanol at $160^{\circ} - 180^{\circ}\text{C}$ to give ethene.



Ethene can also be prepared in the laboratory by dehydrating ethanol using aluminium oxide



PROPERTIES OF ETHENE / ALKENE

- 1 They are slightly soluble in water
- 2 It is colourless gas with a faint smell.
- 3 Melting and boiling points increase as carbon chain increase.
- 4 As the number of carbon atoms increase in the chain the physical state changes from gaseous to liquid to soft solid.

$n = 2$ to 4 gases

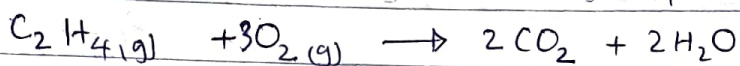
$n = 5$ to 15 liquids.

$n \geq 15$ are soft solids (wax).

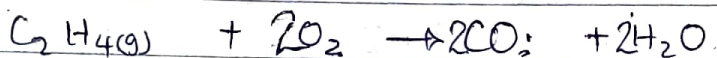
Chemical Properties

1 Combustion reaction

Burns in excess oxygen to form carbon dioxide and water



In limited air - carbon monoxide forms.



2 Addition reaction

Addition reaction is the reaction in which atoms or group of atoms are added to each carbon atom of a carbon-carbon double or triple bond to form a single product.

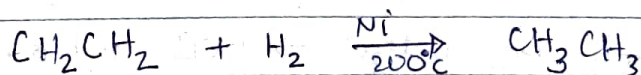
OR

Addition reaction is the one in which one molecule is added to another to form a single product.

(i) Hydrogenation

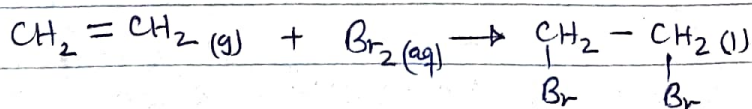
Hydrogenation is the addition of hydrogen to the unsaturated hydrocarbon to form saturated hydrocarbon.

Alkenes react with hydrogen at 200°C in the presence of nickel catalyst to form alkanes.

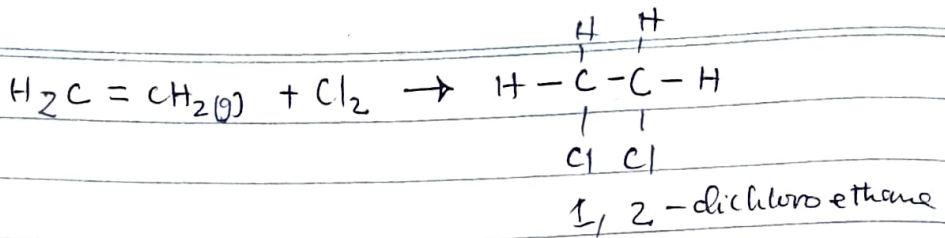


(ii) Halogenation

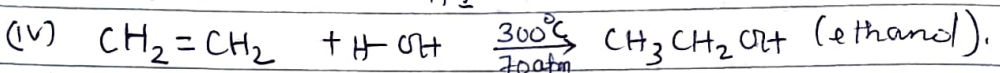
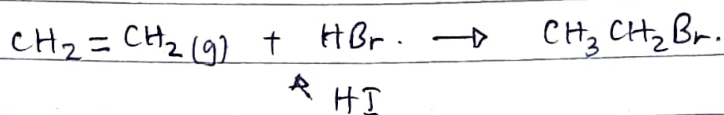
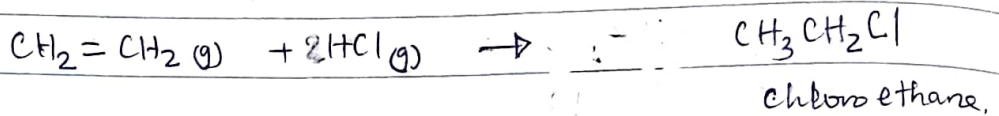
Addition of halogens to alkenes.



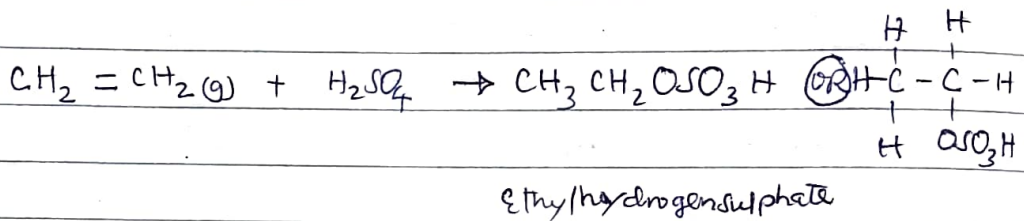
1, 2-dibromoethane.



(ii) Reaction with hydrogen halides.

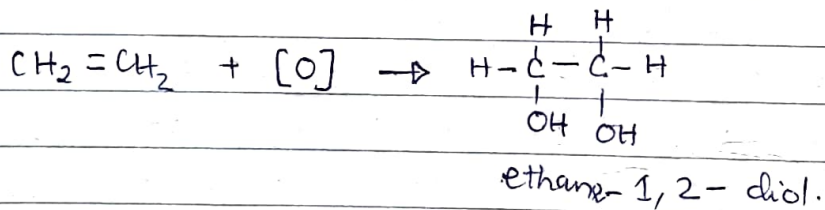


(v) Reaction with sulphuric acid

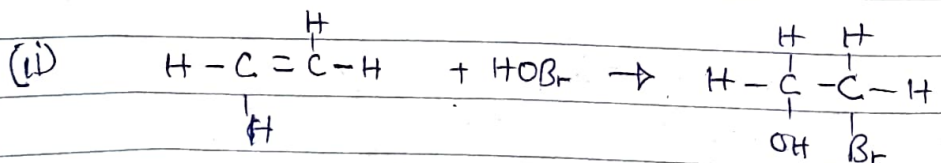
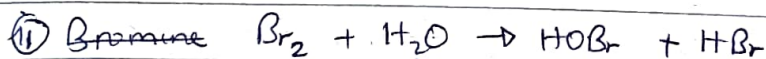


3 Oxidation

Alkenes are oxidized to alkanol by oxidizing agents like $\text{K}_2\text{Cr}_2\text{O}_7$ or KMnO_4



(i) with bromine water



Bromine water decolorized in the process.

Chemical test of Alkenes: Silver

- It is used in the manufacture of ethanol
- It is used in the ripening of fruits
- It is used in the manufacture of plastic (synthetic polymer)
- It is used in preparing other chemicals

ALKYNES

Alkynes are unsaturated hydrocarbons with a general formula of $C_n H_{2n-2}$, where $n \geq 2$ or above.

- They contain a triple bond at least in one of the carbon to carbon bond.

- Their functional group is $-C \equiv C-$

- Their names end up with the suffix $-yne$.

1st member is ethyne. (acetylene).

	Name	Formula	open structure	Condensed structure
1	Ethyne	$C_2 H_2$	$H-C \equiv C-H$	$CHCH$
2	Propyne	$C_3 H_4$	$H-C \equiv C-\overset{\overset{H}{ }}{C}-H$	$CHCCH_3$
3	Butyne	$C_4 H_6$	$H-C \equiv C-\overset{\overset{H}{ }}{\overset{H}{ }}{C}-\overset{\overset{H}{ }}{C}-H$	$CHCCH_2CH_3$
4	Pentyne	$C_5 H_8$	$H-C \equiv C-\overset{\overset{H}{ }}{\overset{H}{ }}{\overset{H}{ }}{C}-\overset{\overset{H}{ }}{C}-\overset{\overset{H}{ }}{C}-H$	$CHCCH_2CH_2CH_3$

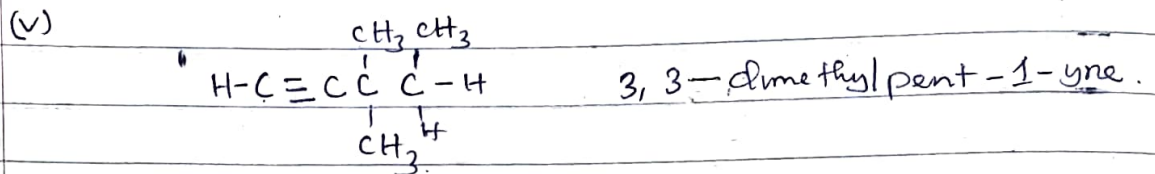
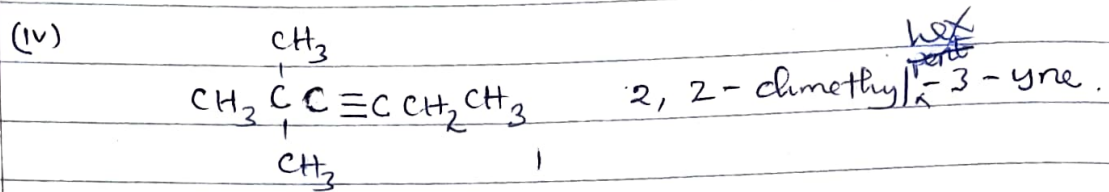
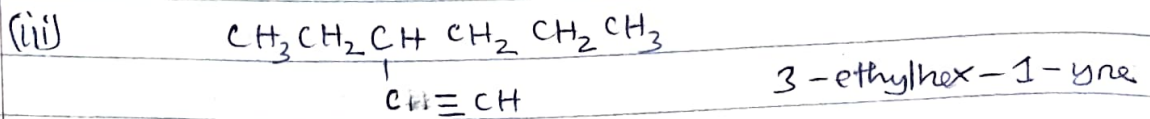
Nomenclature of Alkynes

- 1 Select the longest continuous chain that contains both carbon atoms of the triple bond
- 2 Number the carbon atoms of the parent chain starting from the end nearer to the triple bond.
- 3 Show the position of the triple bond using the number of first carbon of the triple bond.
- 4 Other rules of nomenclature for alkanes apply. The suffix $-ane$ is replaced by $-yne$.

Examples

(i) $CH \equiv CCH_3$ propyne

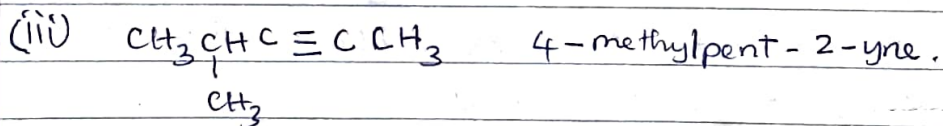
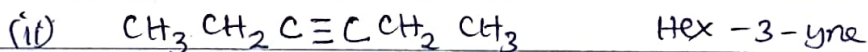
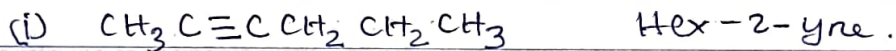
(ii) $C_2 H_2$ ethyne.



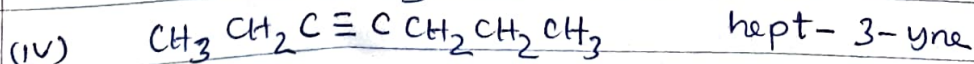
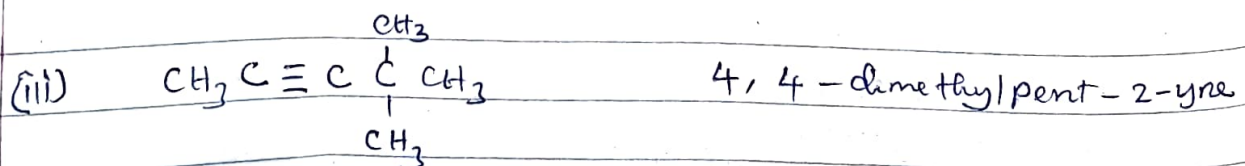
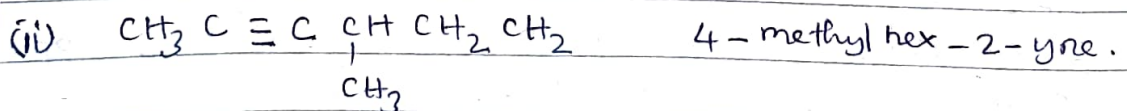
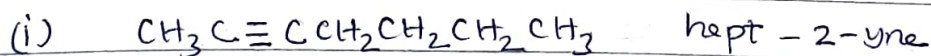
Isomerism in Alkynes.

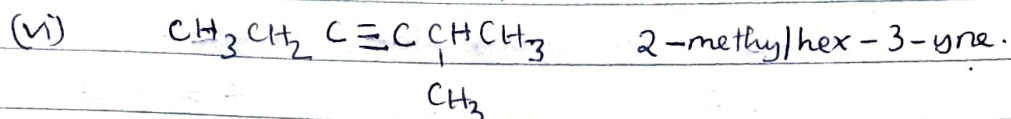
- 1 Varying position of triple bond — positional isomer
- 2 Branching — presence of substituent — Branch isomer / chain isomer

1 Hexyne



2 Heptyne

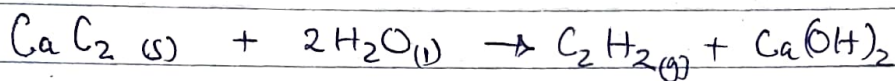




PREPARATION OF ALKYNES.

Laboratory Preparation of Ethyne

Ethyne can be prepared in the laboratory by the action of water on calcium carbide (CaC_2).



The function of sand is to absorb heat to avoid cracking of the round bottomed flask since the reaction is exothermic.

PROPERTIES OF ALKYNES

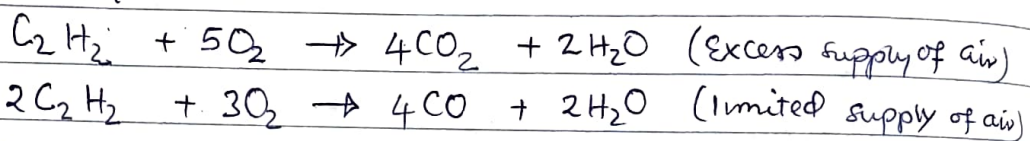
- 1 The physical states of alkynes change with increase of number of carbon.

Alkynes with carbon atoms $n=2$ to 4 are gases
 $n=5$ to 13 are liquids
 $n \geq 13$ are soft solids (wax)

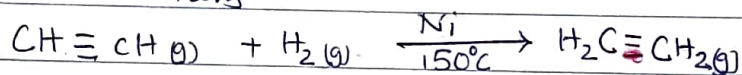
- 2 Alkynes are insoluble in water (polar solvent) and soluble in non-polar solvents
- 3 The Melting and Boiling Points increase as the molecular mass increase.
- 4 The density of alkynes increase with the increase in molecular mass.

(b) Chemical Properties.

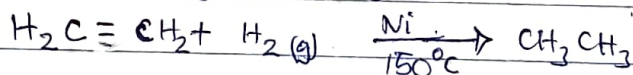
1 Combustion



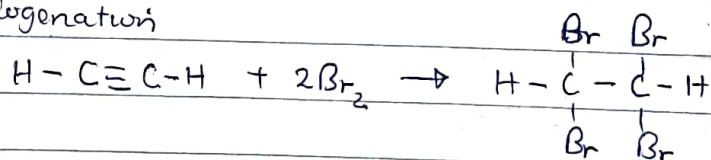
2 Addition reactions



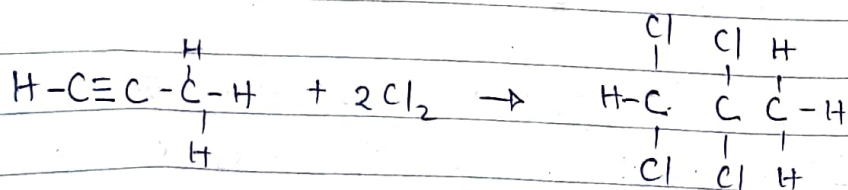
Further hydrogenation gives alkanes



(ii) Halogenation



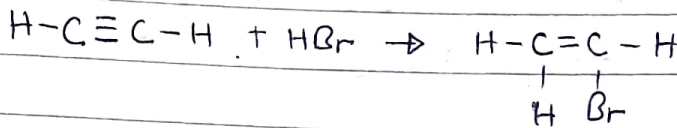
1,1,2,2-tetrabromoethane.



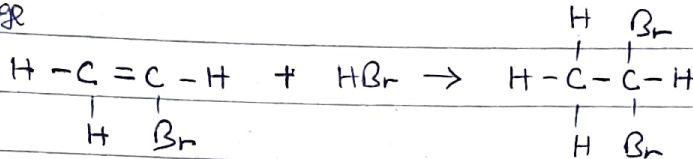
1,1,2,2-tetrachloropropane

(ii) Reaction with hydrogen halides (HX)

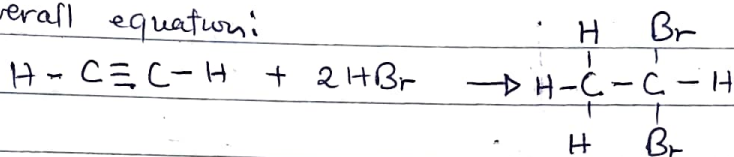
1st stage.



2nd stage

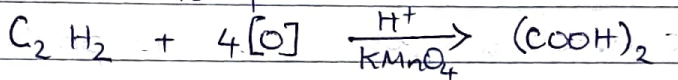


Overall equation:



1, 1-dibromoethane.

3 Ethyne oxidises to produce oxalic acid



POLYMERISATION

The process by which small molecules (called monomers) join together to form larger molecules (Polymers).

OR

Polymerization is a process of reacting monomer molecules together in a chemical reaction to form long chain - - -

Generally there are two types of polymerization.

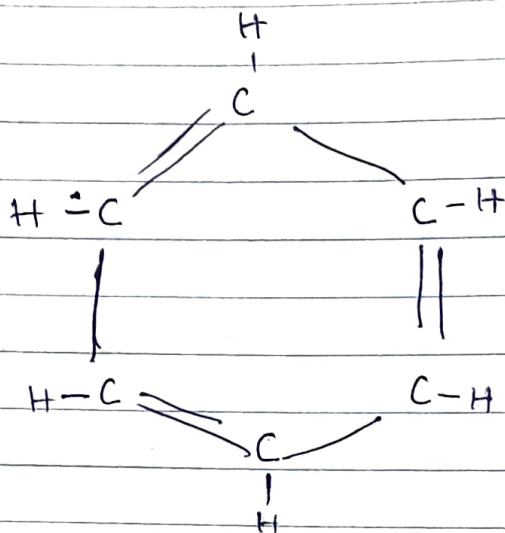
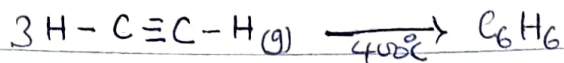
(i) addition polymerization - the monomers add to one another in such a way that the polymer contains all the atoms of the starting monomers.

(ii) Condensation polymerization - These polymerizations often occur with loss of a small molecule such as water

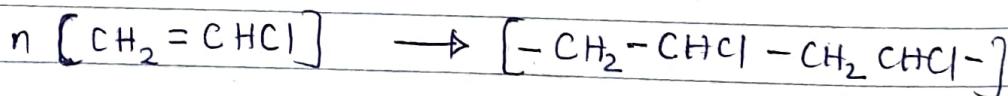
Uses of alkynes
- Ethyne producing luminous flame
- Ethyne is used in lamps
- Flame used for metal cutting & welding
- Some alkynes are used to make plastics.
- Synthetic rubber

Polymerisation of Ethyne

When ethyne is passed through a copper tube which is heated to about 400°C it polymerises to form benzene C_6H_6 .



Also chloroethene polymerises to produce a very long carbon chain compound. This compound is called Polyvinylchloride (PVC).



Unsaturated by
Polymerization, Examples of Synthetic (artificial) polymers.

Ethene

Polymer	Monomer	Use
Polyethene	Ethene	- Making containers eg. plastic bowls and dust bins. - Used as wrapping materials.
Polyvinyl chloride (PVC)	chloroethene	- Making rain coats. - Electrical insulation. - Making pipes and films.
Polystyrene	Styrene	- Making household items such as combs, plastic cups & a lining in refrigerators.