



Methane - Marsh Gas.

Coal miner - Fire damp.

Source - Natural gas from petroleum well

Coal gas - upto 35%.

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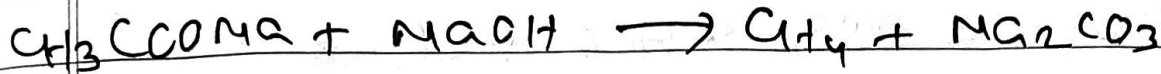
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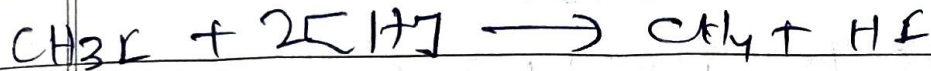
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Method of Preparation:-

① Heating sodium acetate with soda lime.



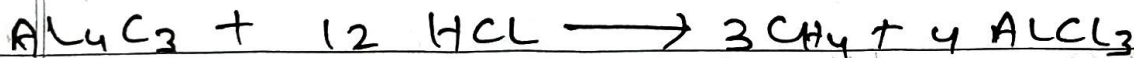
② Reduction of methyl iodide using nascent hydrogen, C from ethanol or zinc copper couple.



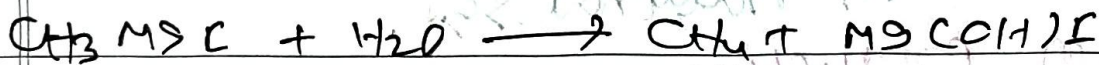
Zn-cu couple - zinc in a solution of ~~salt~~ copper sulphate.

→ Round bottom flask -  $\text{CH}_3\text{I} + 95\% \text{C}_2\text{H}_5\text{OH}$ .

③ By treatment with aluminium chloride with water or dilute acid.



④ By hydrolysis of methyl magnesium iodide.



→ use for small scale preparation.

large quantities from natural gas crude oil

or by recovery of remains of petroleum products.

Physical properties:-

1) colourless 2) Insoluble in water

3) Soluble in organic solvent like acetone, ethanol, ether and benzene.

CHEMICAL PROPERTIES:-

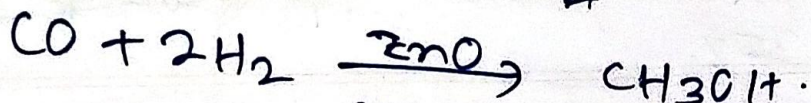
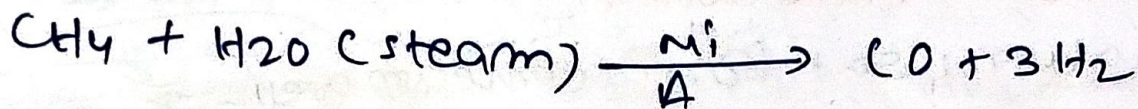


or ignition.

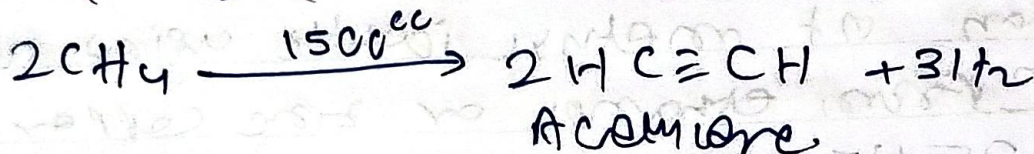
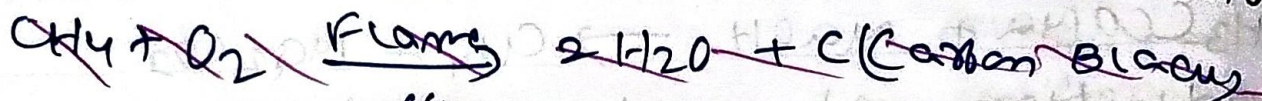
In presence of UV light or ignition,



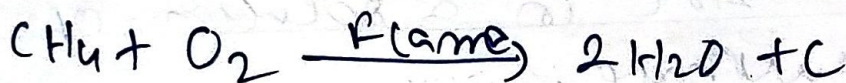
② when methane is treated with steam.



③ Heated in absence of air (or) oxygen at 1500°C



④ when burnt in limited supply of air



USES:-

1) domestic fuel 2) methanol

③ carbon black - printers ink, shoe polish, rubber tyre.

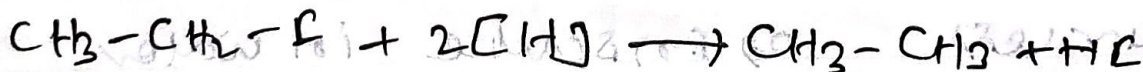
Ethane - 10-20% along with methane in natural gas.

Methods of Production:

① Heating sodium propionate with soda lime.

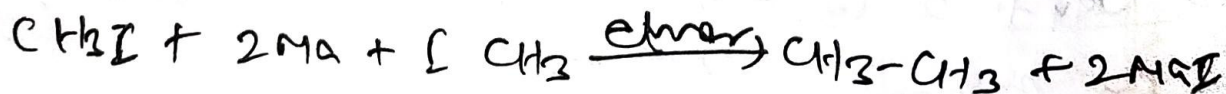


② Reduction of ethyl iodide, using nascent hydrogen



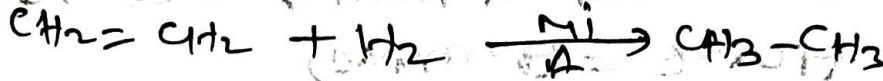
③ Wurtz-Fittig Reaction:

B) action of sodium metal on methyl iodide in dry ether solution.





④ By passing a mixture of ethylene and hydrogen over heated nickel catalyst.



CLASSMATE

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⑤ By hydrolysis of ethyl magnesium bromide

$$\text{CH}_3\text{CH}_2\text{MgBr} + \text{H}_2\text{O} \rightarrow \text{CH}_3 - \text{CH}_3 + \text{Mg}(\text{OH})\text{Br}$$

### Physical Properties: - (Page - 207)

1. Colourless gas 2. Sparingly soluble in water, but dissolve in organic solvent like ethanol, ether and benzene.

### Assignment - 01

- ① What is carbon black? Name 5 industries producing carbon black? Write industrial application.
- ② Write a short note on shoe polish? which include major industry, Brand, composition, manufacturing process.
- ③ Write a short note on Tyre industry? Raw material, composition, Brand, Type, Design parameter.
- ④ What is petroleum? Write a brief note on petroleum products country - Manufacture of natural gas, LPG.
- ⑤ Write a note on composition of petroleum countries available in different countries.
- ⑥ Explain petroleum derivatives.
- ⑦ Explain fractional distillation of petroleum.
- ⑧ Write the composition and uses of petroleum fraction.
- ⑨ Explain cracking with example.
- ⑩ Explain manufacture of synthetic petrol by using Bergius process and Fisher-Tropsch process.



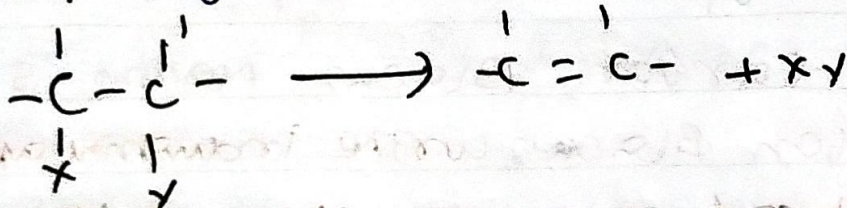
⑤ Alkene - carbon carbon double bond C=C

Latin - commonly known as olefins  
(oleum - oil, ficare = to make)

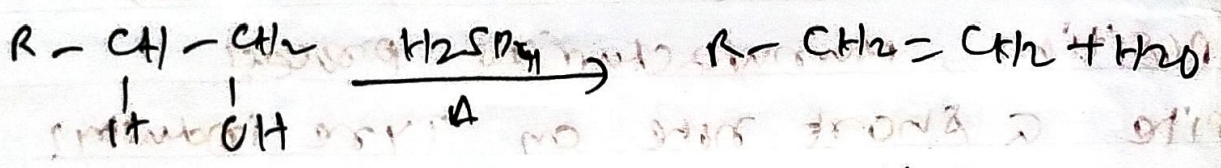
- Alkene they seldom occur in nature.
- Produced in large number by cracking of petroleum.

Method of preparation:

Preparation of alkene involves elimination of atoms or group from two adjacent carbon atoms.

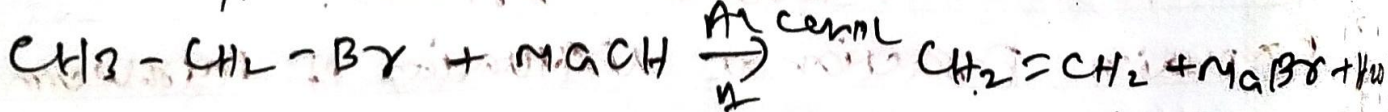
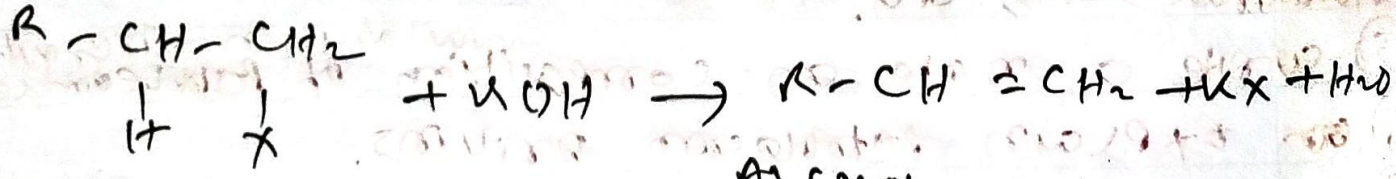


① Dehydration of alcohol.



The ease of dehydration of alcohol is  
3° alcohol > 2° alcohol > 1° alcohol.

② Dehydrohalogenation of Alkyl halide.



Alkyl halide is heated with an alcoholic solution of sodium (or) potassium hydroxide

\* Dehydration of alcohol may be brought by passing the alcohol vapour over heated aluminium (Al<sub>2</sub>O<sub>3</sub>) at 400°C. Other dehydrating agents - H<sub>2</sub>SO<sub>4</sub>/H<sub>3</sub>PO<sub>4</sub>



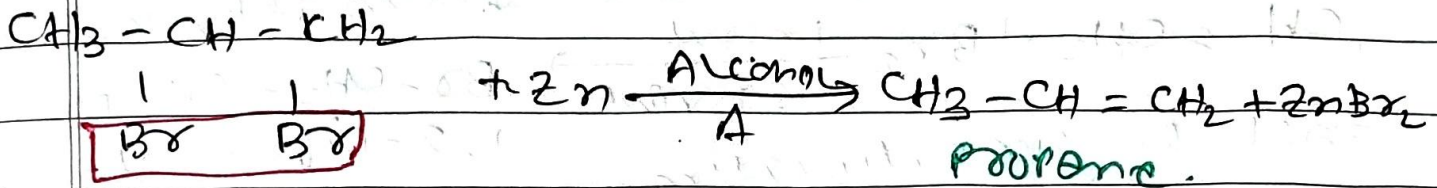
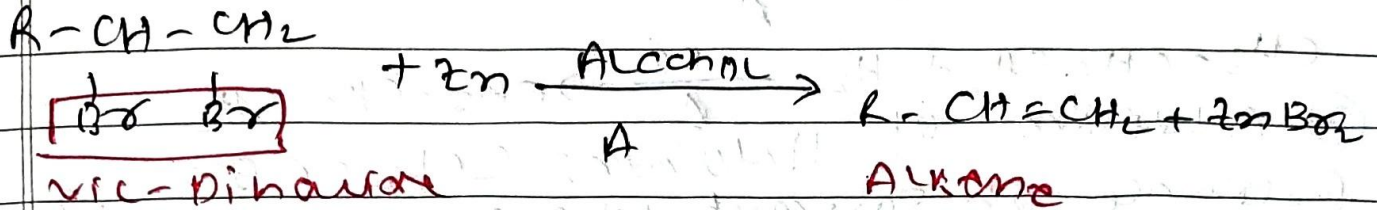
The ease of dehydrohalogenation of alkyl halide is  
 $3^\circ$  alkyl halide  $>$   $2^\circ$  alkyl halide  $>$   $1^\circ$  alkyl halide

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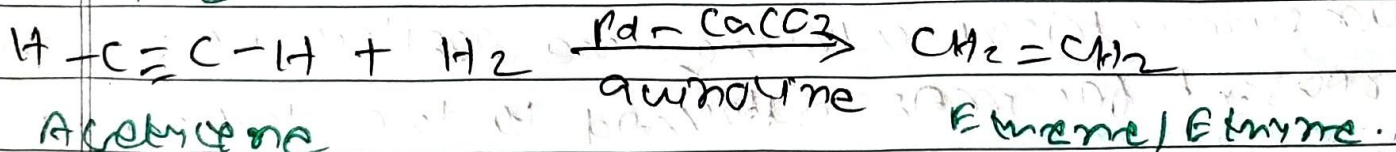
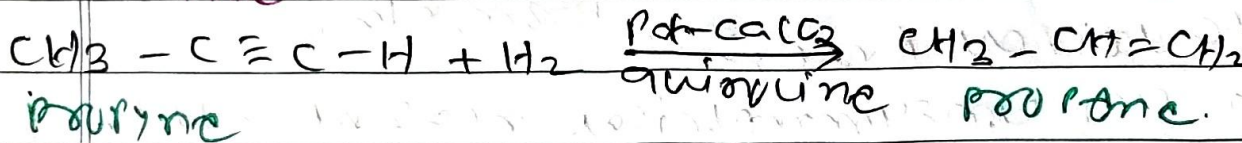
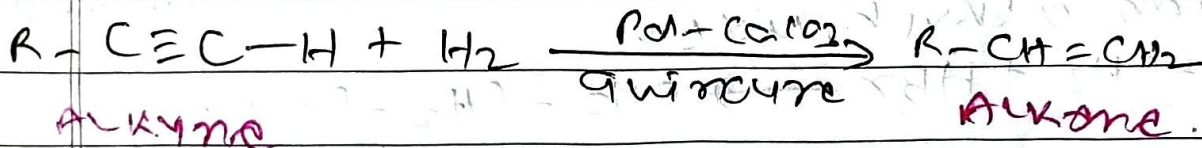
③ Dehalogenation of vicinal dihalide



1,2-Dibromopropane

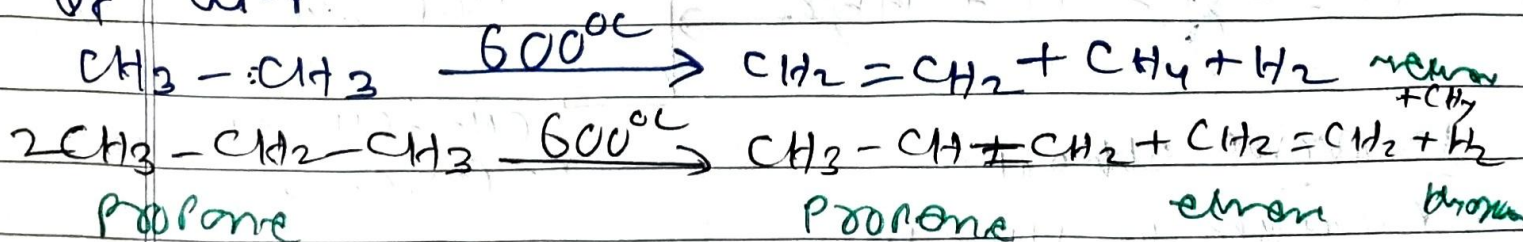
④ By controlled hydrohalogenation of Alkyne

Lindlar catalyst - Pd poisoned with  $CaCO_3$  plus quinoline.



⑤ By cracking of alkanes.

When alkane heated at  $500-800^\circ C$  in absence of air.



PHYSICAL PROPERTIES:

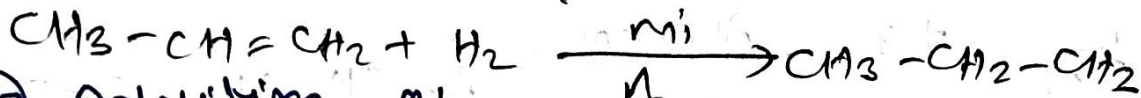
① L.A.T 3 are gas (ethane, propane, butane) at room temperature. 4 - liquid, 5 - solid. Colourless odourless. Insoluble in water, better solvent.



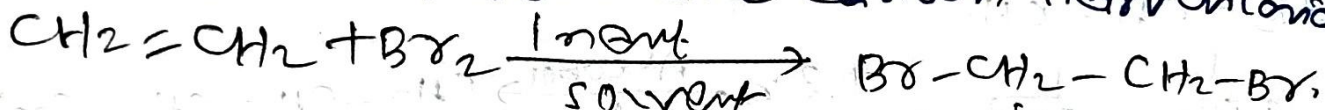
# 7) CHEMICAL PROPERTIES OF ALKENES :-

① Addition of hydrogen  $\rightarrow$  under pressure and in presence of Ni, Pt, Pd catalyst.

## Catalytic Hydrogenation :-



② Addition of Halogens ( $\text{Cl}_2$  or  $\text{Br}_2$ ) in presence of solvent like carbon tetrachloride

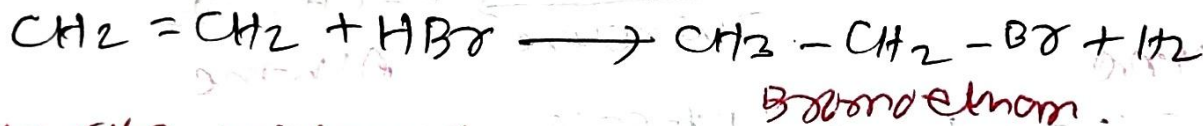


1, 2-Dibromo ethane.

Test of unsaturation  $\rightarrow$  Red colour of bromine is discharged or colourless dibromo compound.

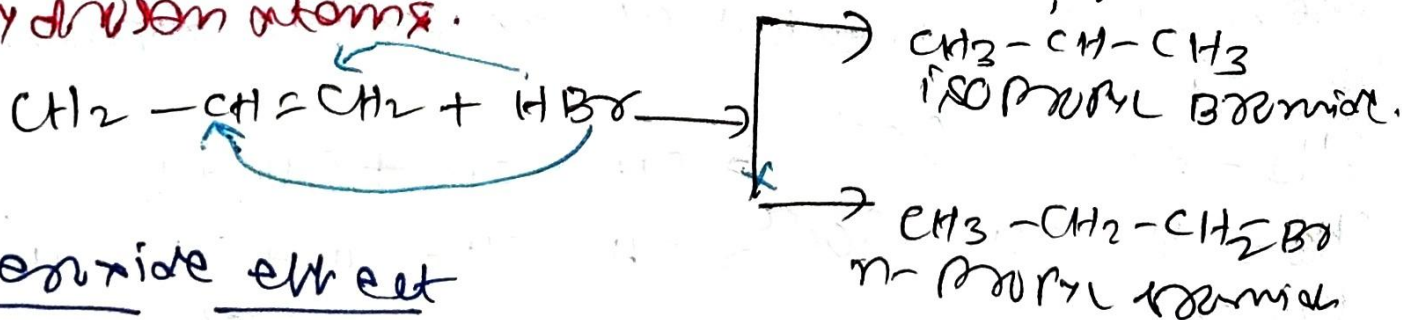
③ Addition of Halogen Acid :-

Alkene react with halogen acids ( $\text{HCl}$ ,  $\text{HBr}$ ,  $\text{HI}$ ) to form alkyl halide.



## Markovnikov's Rule

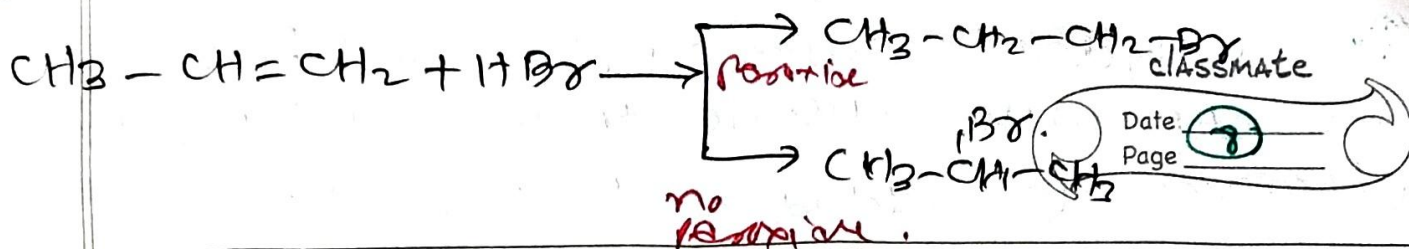
When an unsymmetrical reagent add to an unsymmetrical alkene, the positive part of the reagent becomes attached to the double bond carbon which bears the greatest number of hydrogen atoms.



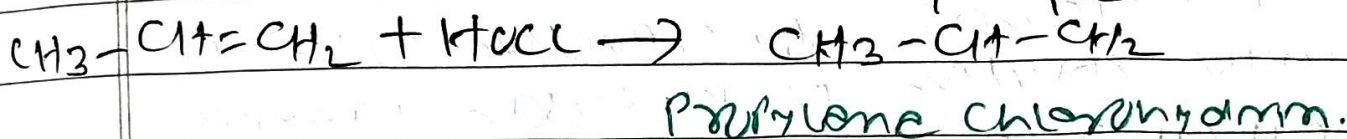
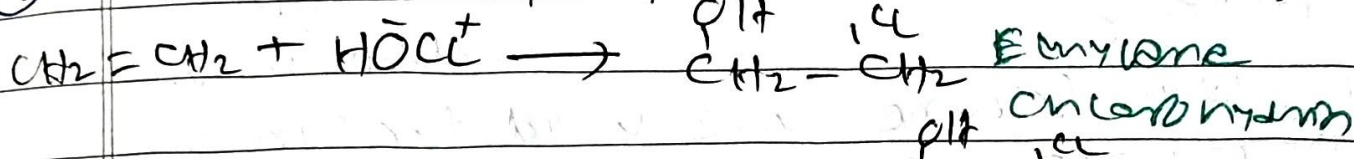
## Peroxide effect

Addition of  $\text{HBr}$  to unsymmetrical alkene in presence of organic peroxide ( $\text{R}-\text{O}-\text{O}-\text{R}$ ) takes a course opposite to Markovnikov's Rule known as peroxide effect or Anti-Markovnikov's Rule.

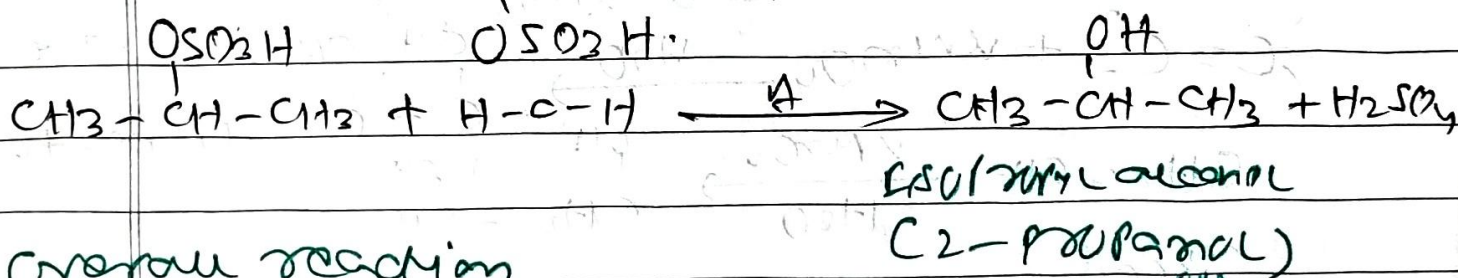
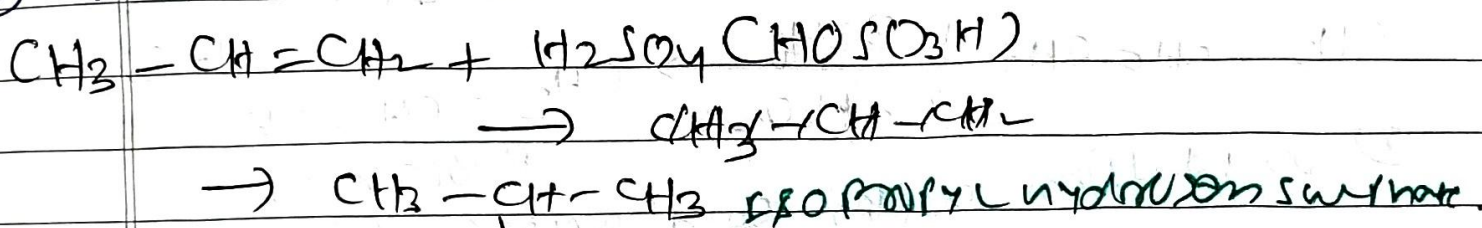




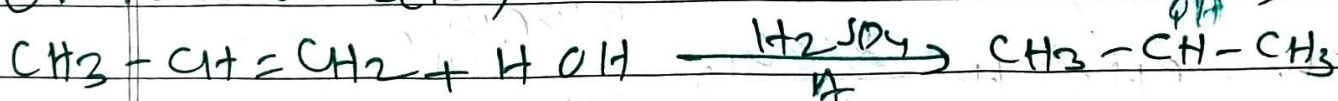
④ Addition of Hypohalous Acid (HOX)



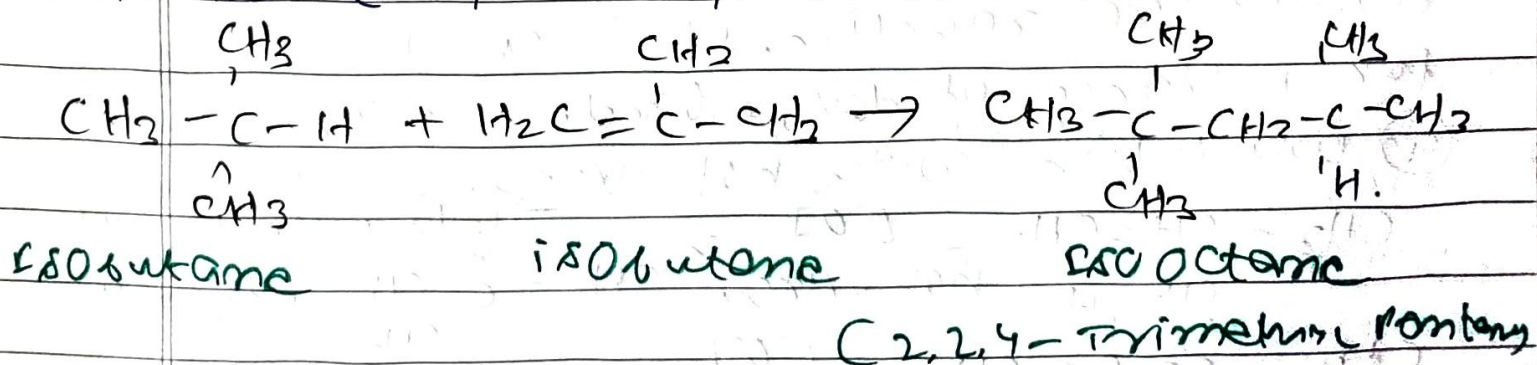
⑤ Addition of sulphuric acid (Hydration)



Overall reaction



⑥ Alkylation: Some alkanes added to alkene in presence of  $\text{H}_2\text{SO}_4$  or  $\text{HF}$ .

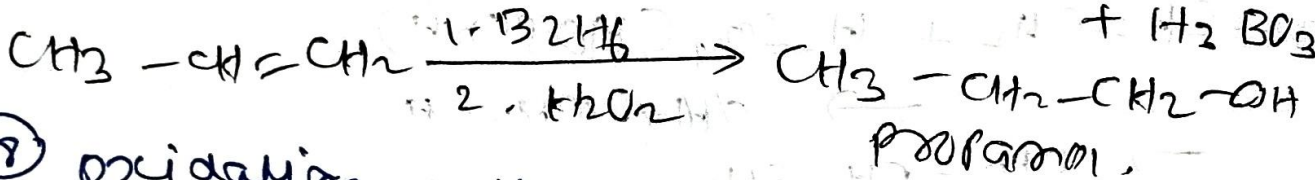
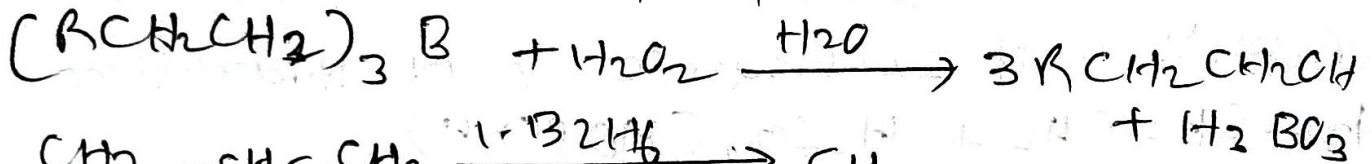




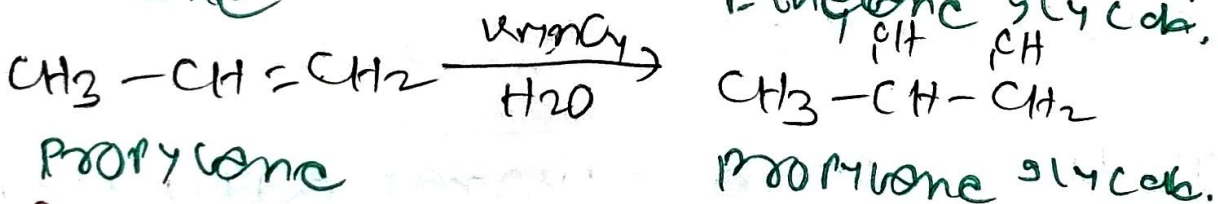
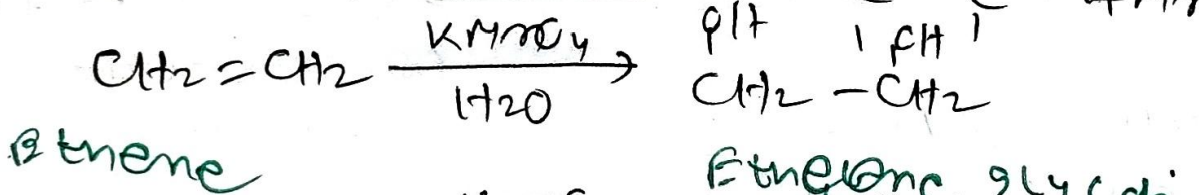
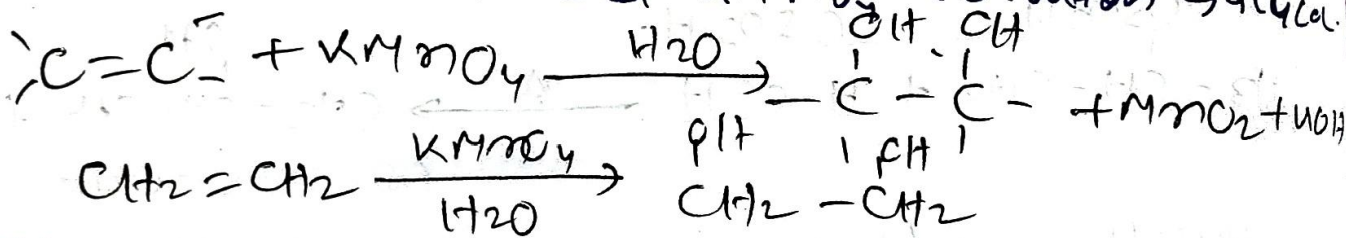
⑦ Hydroboration: Diborane ( $B_2H_6$ ) reacts with alkene to form trialkyl borane. Diborane is added as borane ( $BH_3$ )



Trialkyl borane are used for synthesis of primary alcohols by reaction with alkaline aqueous solution of hydrogen peroxide

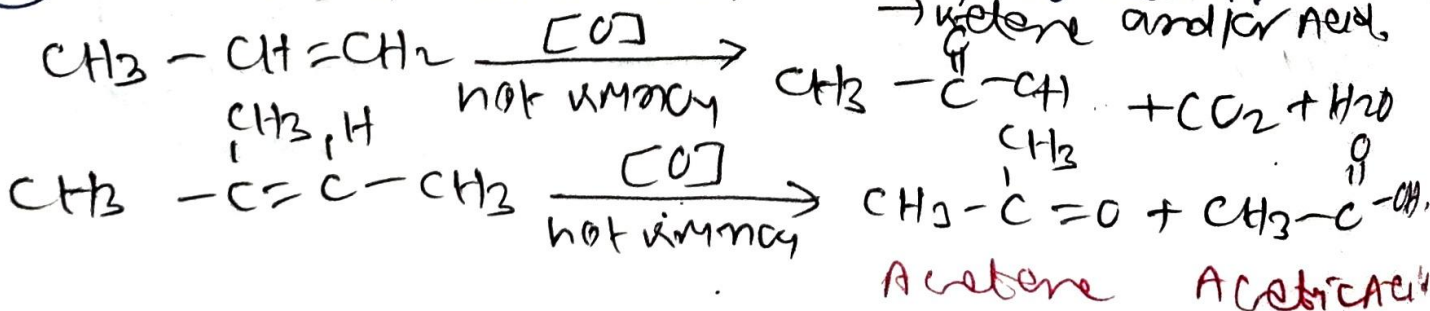


⑧ Oxidation with cold  $KMnO_4$  solution  $\rightarrow$  glycol



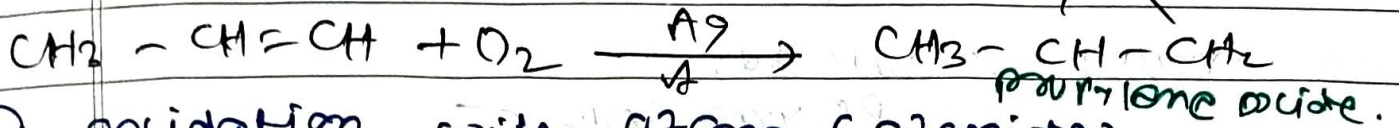
Bright purple colour of  $KMnO_4$  disappears during the reaction, it is used as a test for presence of double bond. (Baeyer's Test)

⑨ Oxidation with hot  $KMnO_4$  solution  $\rightarrow$  ketone and/or acid





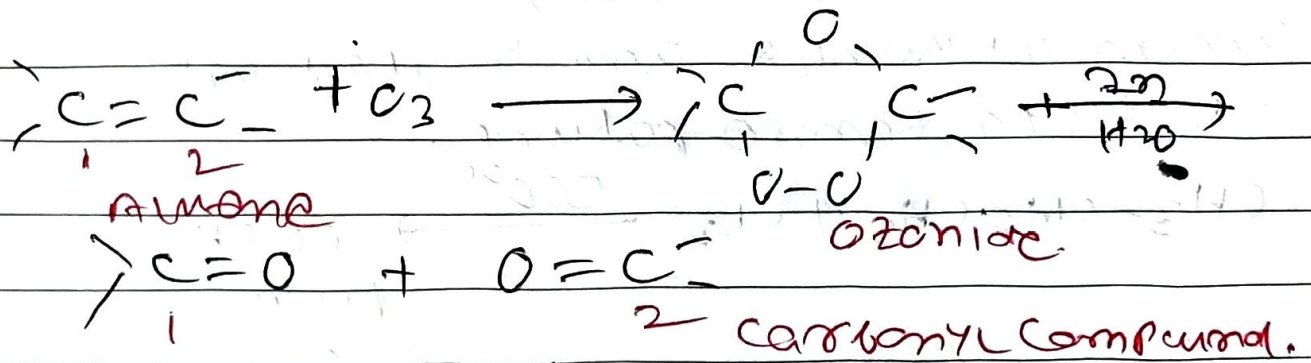
⑩ catalytic oxidation:- Alkene reacts with oxygen in presence of silver catalyst at 250-400°C to form epoxide.



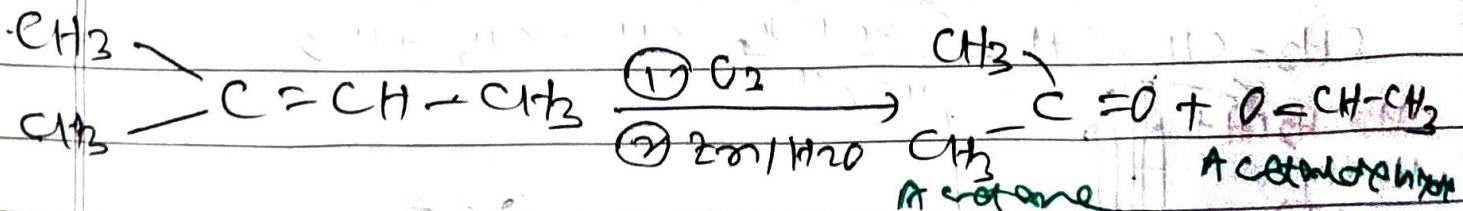
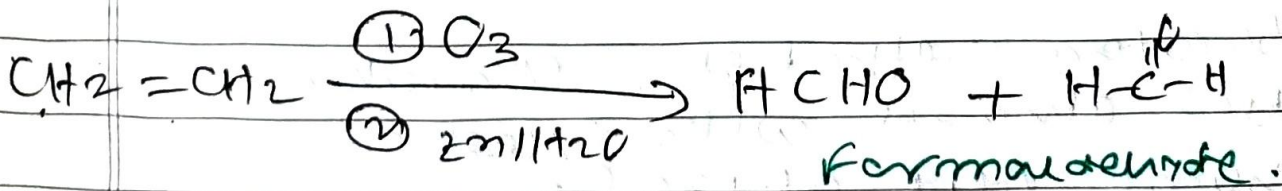
⑪ Oxidation with ozone (ozonide)

Ozone is passed through an alkene across the double bond to form ozonide. Ozonides are explosive compounds.

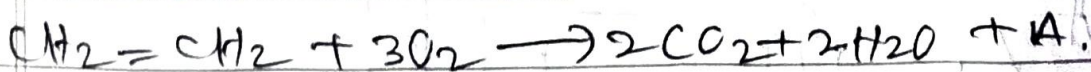
They are not isolated. on warming with zinc and water aldehyde, ketone.



The two step process of preparation of the ozonide and decomposition it to get carbonyl compound is called ozonolysis.

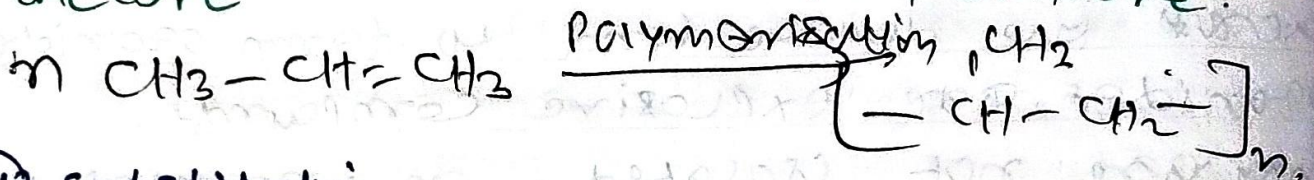
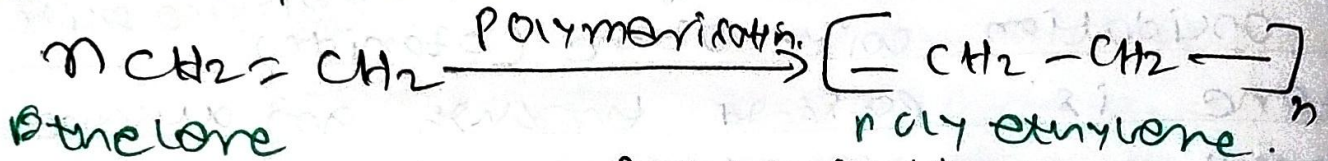


⑫ combustion reaction:



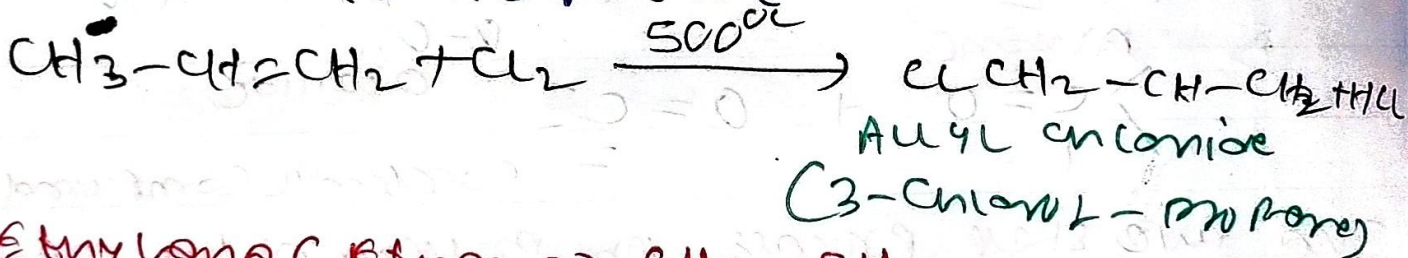


⑬ Polymerisation reaction (Addition Polymerisation)  
 These polymerisation reactions are catalysed by HF, H<sub>2</sub>SO<sub>4</sub> or organic peroxides. High temperature or high pressure are generally required.



⑭ substitution of alkane by halogen. (Allylic substitution)

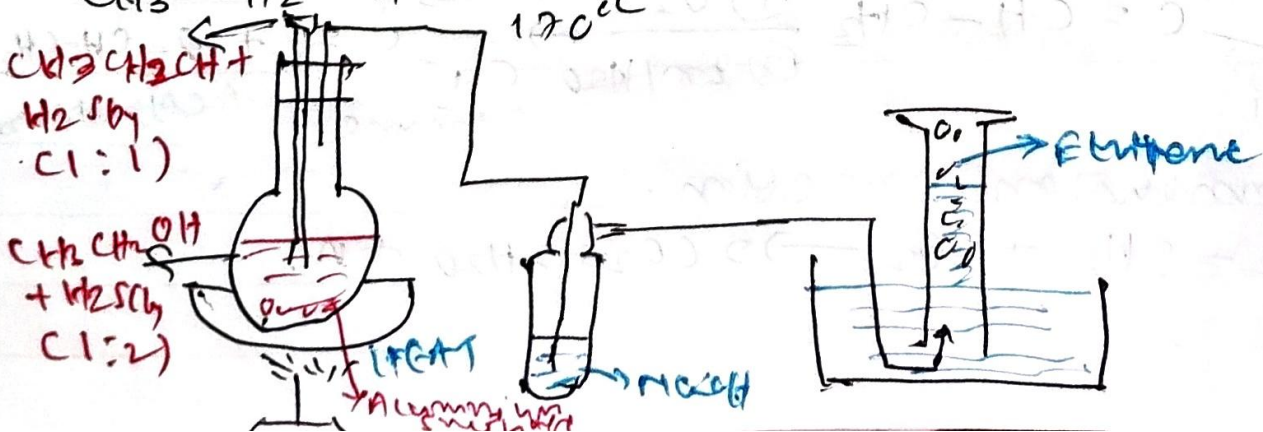
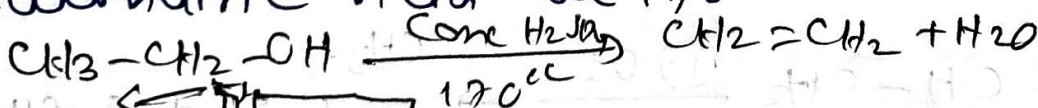
When alkanes are treated with Cl<sub>2</sub> or Br<sub>2</sub> at high temperature.



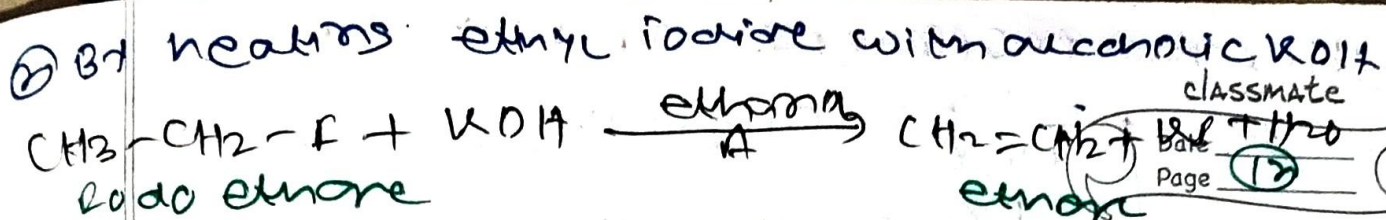
Ethylene (Ethene) CH<sub>2</sub>=CH<sub>2</sub>

source → large amount by cracking of petroleum.

⑮ Laboratory method of preparation: Heating ethanol with excess concentrated sulphuric acid at 170°C.

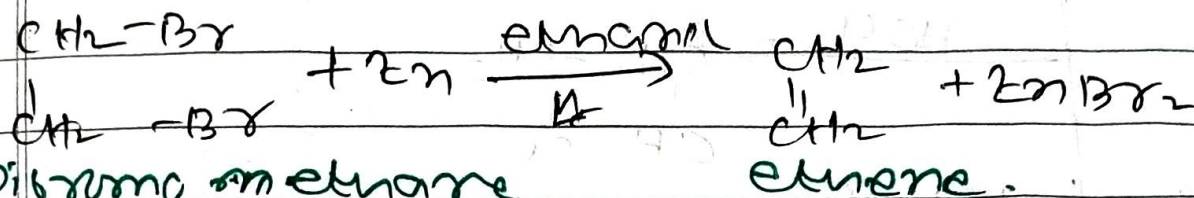




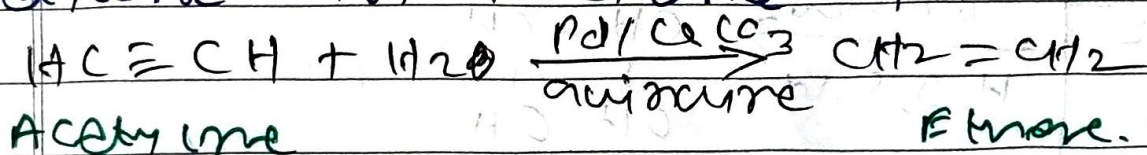


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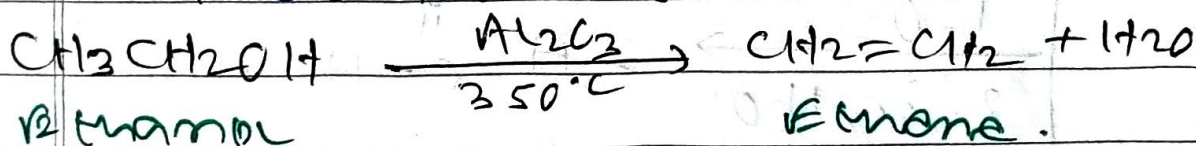
③ By heating 1,2-dibromoethane with zinc dust in ethanol



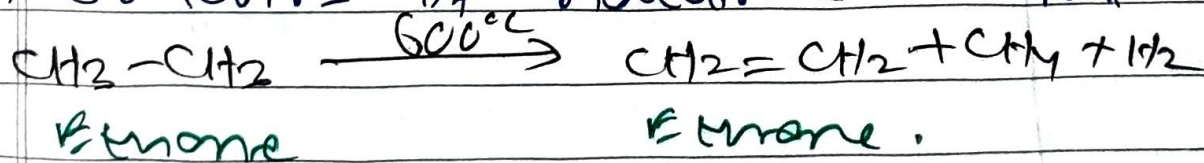
④ By controlled addition of hydrogen to acetylene in presence of Lindlar catalyst



⑤ By passing ethanol vapour over alumina catalyst at 350°C



⑥ By cracking of natural gas and petroleum.



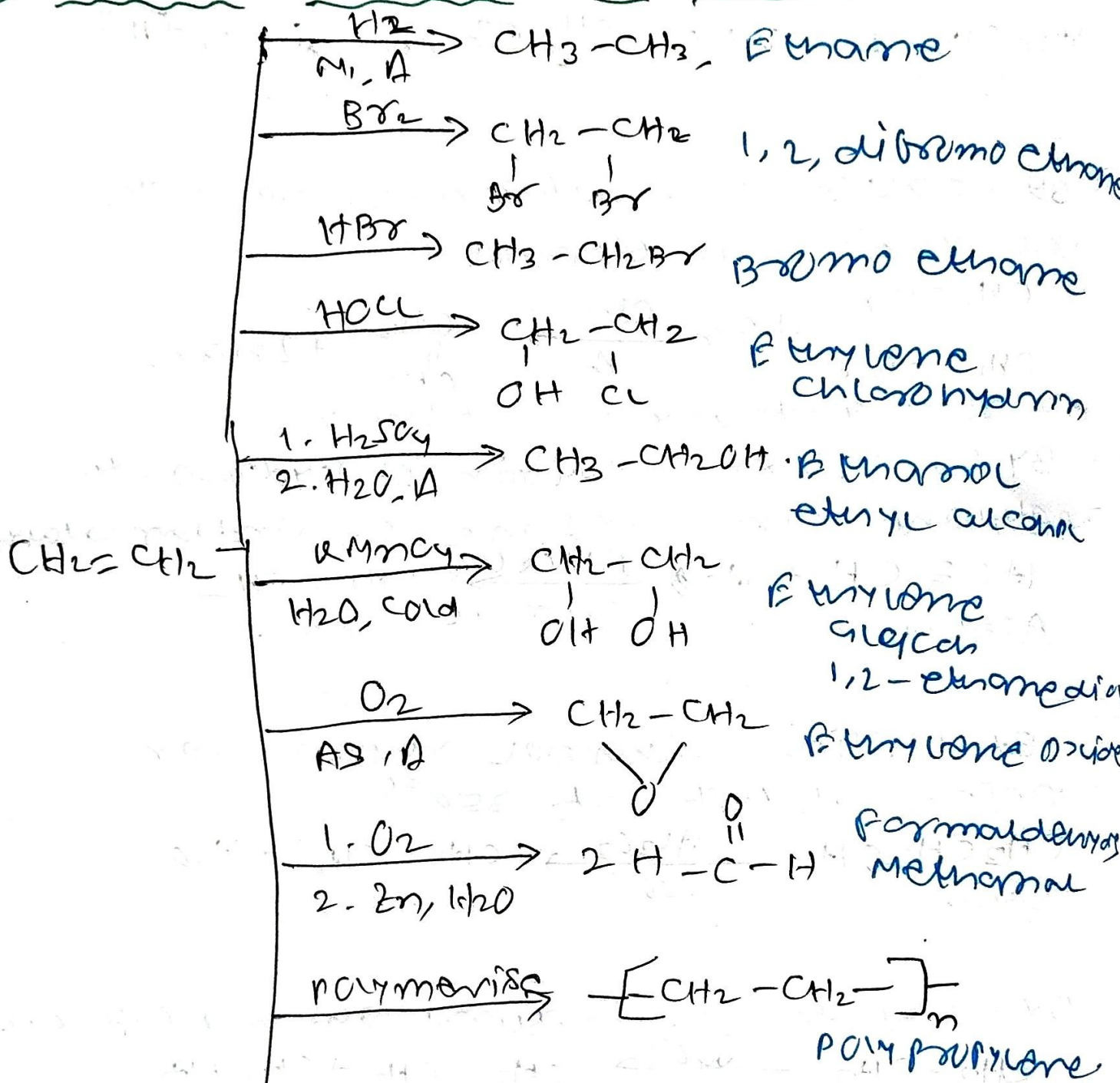
### PHYSICAL PROPERTIES:

1. colourless gas with sweet odour.
2. slightly soluble in water but easily soluble in organic solvent - ethanol, ether.

USES: - 1. used for manufacture of industrially important polymer like PVC, EPR (Ethylene polybutadiene rubber), SARAN, polyethylene. Floor tile, shoe sole, synthetic fiber, raincoat, pipes



13) CHEMICAL PROPERTIES OF ETHYLENE





## 2.3 Alkynes:-

Methods of preparation, properties and uses of acetylene.

- Alkynes are highly unsaturated as compared to alkene.

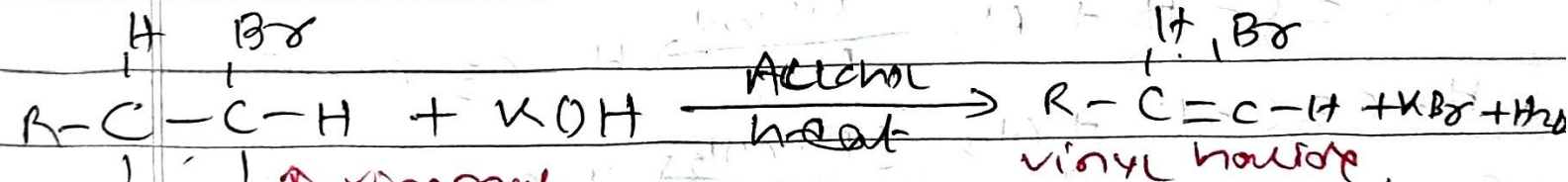
- First member is  $HC \equiv CH$ , ethyne, Acetylene.

### Method of preparation:-

① Dehydrohalogenation of vicinal dihalides: Compounds that contains halogen atoms on adjacent carbon atom are called **vicinal dihalide**.

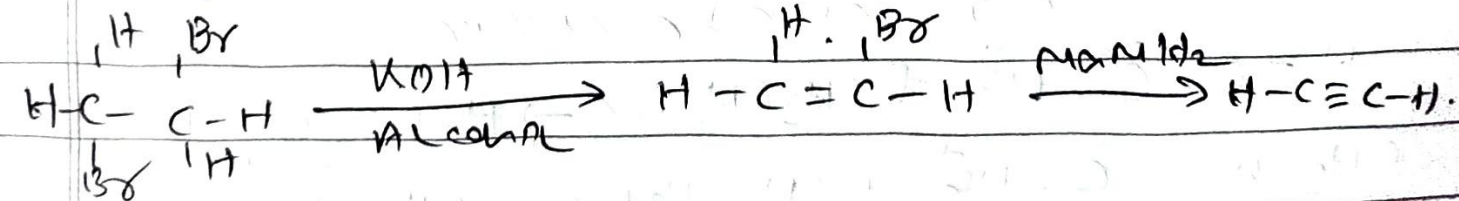
vicinal dihalide + Alcoholic KOH  $\rightarrow$  vinyl <sup>halide</sup> ~~amide~~.

vinyl halide + sodium amide  $\rightarrow$  Alkyne.

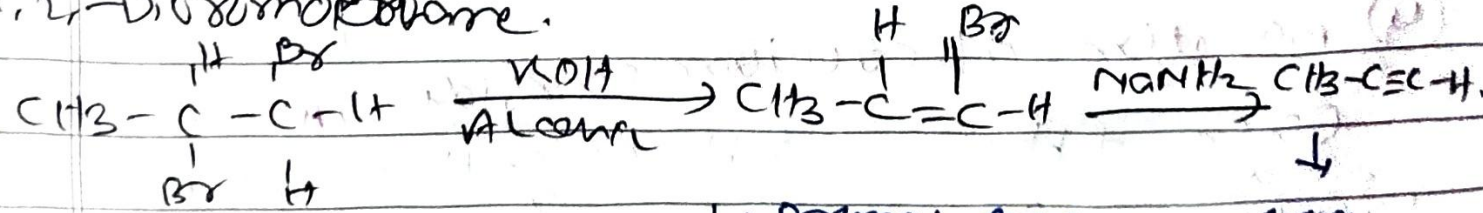


Halides are unreactive so a strong base

( $\text{NaNH}_2$ ) is used to remove 2nd  $\text{HBr}$ .



1,2-Dibromopropane.



1,2-dibromopropane 1-bromo-2-propane propyne.

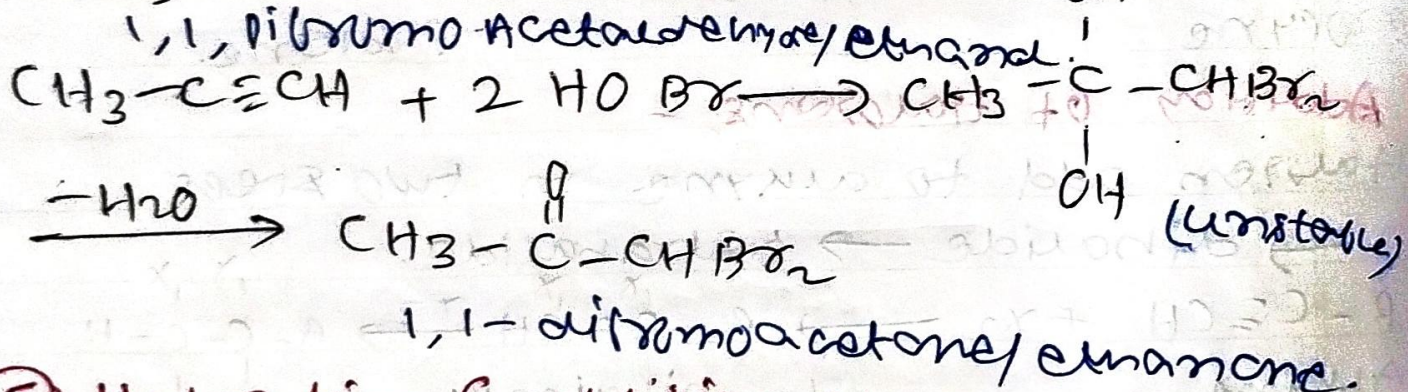
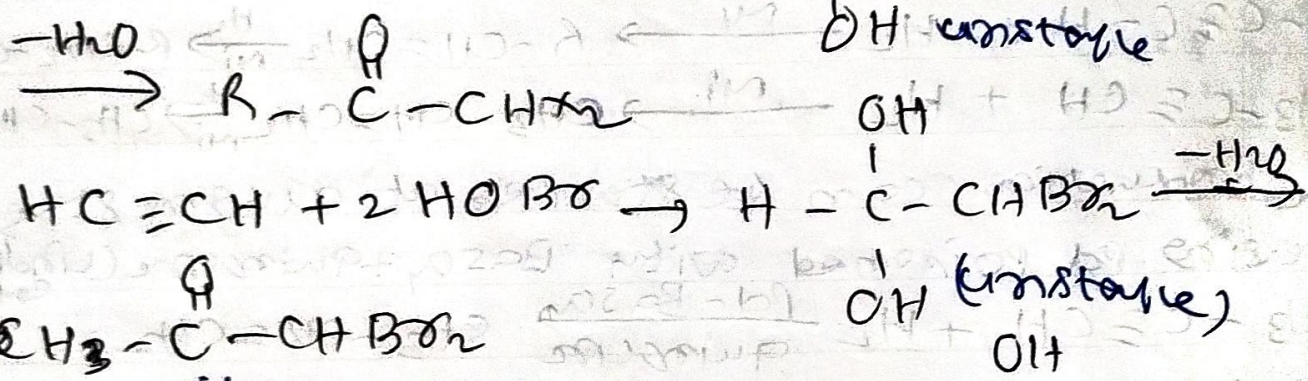
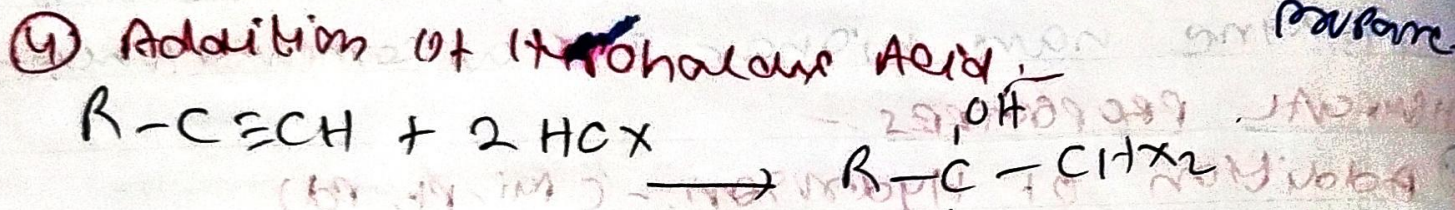
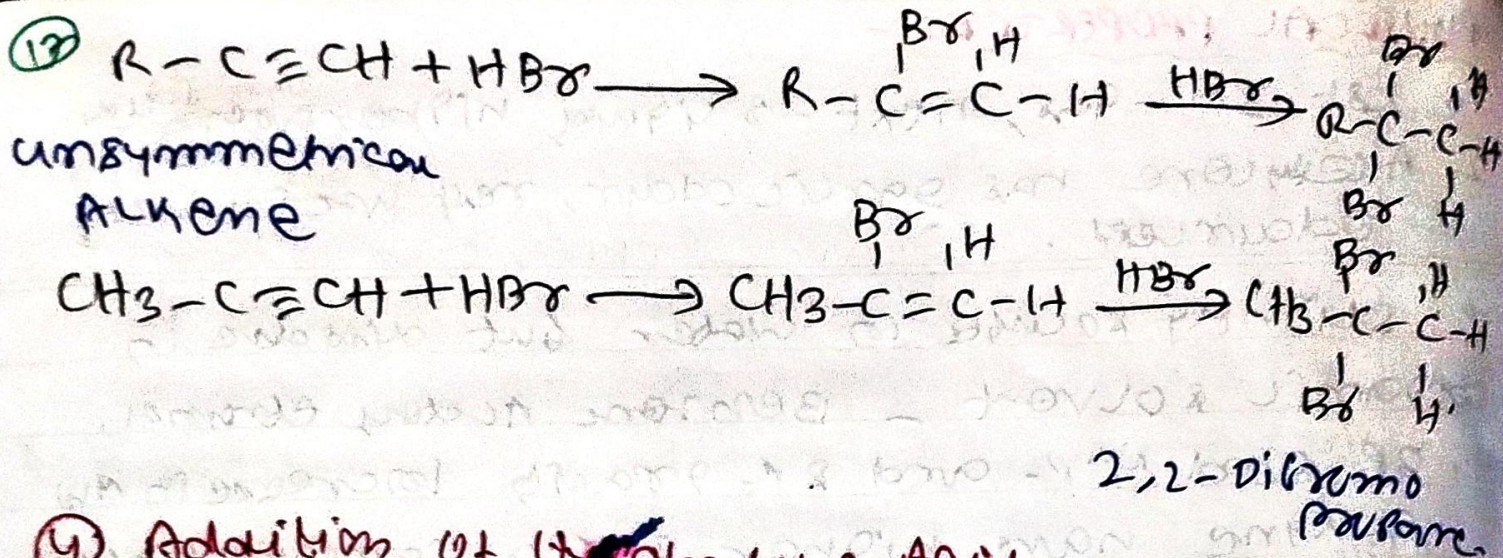




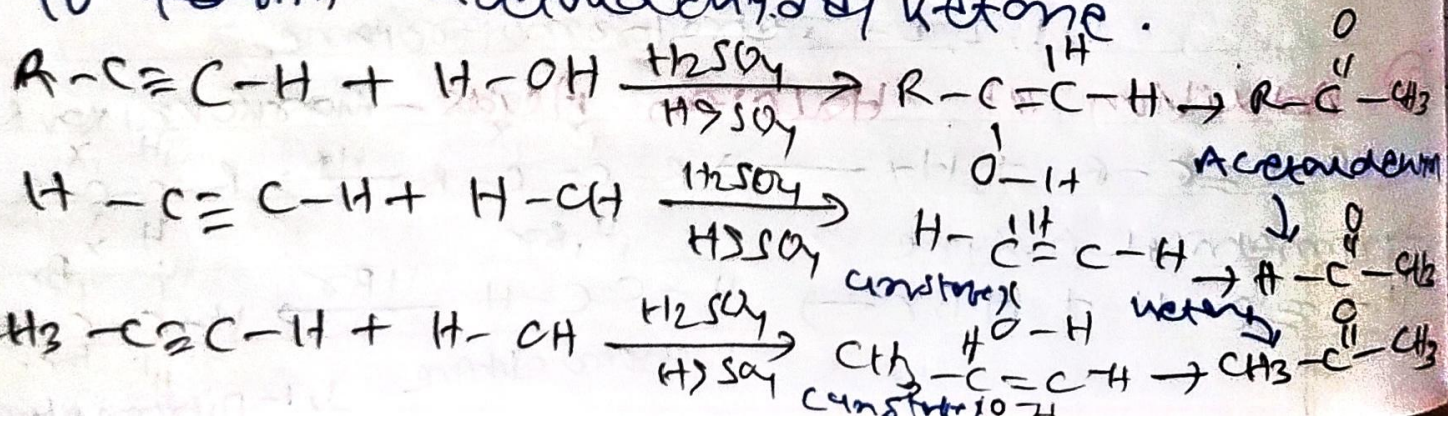






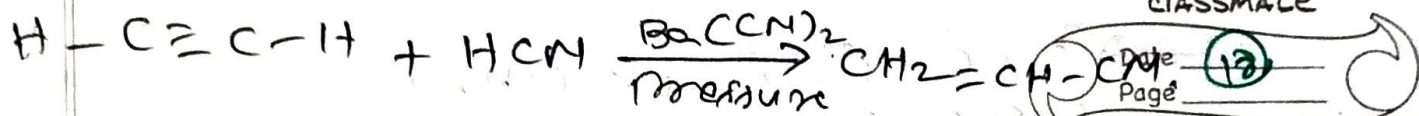


⑤ **Hydration** (Addition of water)  
 reacts with water in presence of mercuric sulphate and sulphuric acid to form aldehyde/ketone.





### ⑥ Addition of Hydrogen cyanide.



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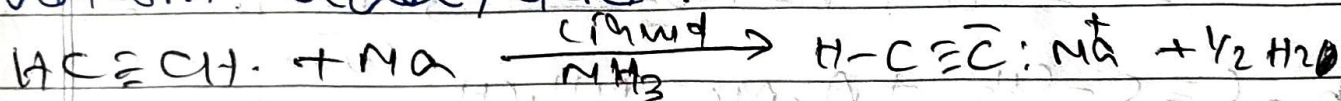
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React with HCN in presence of Barium cyanide as catalyst.

Acetylene yields vinyl cyanide or acrylonitrile from which synthetic fiber orlon is made.

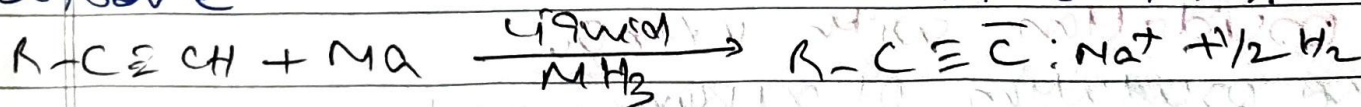
⑦ Salt Formation :-  $\text{C}\equiv\text{C}-\text{H}$  are acidic can be replaced by metal to form salts known as **Acetylides**.

⑧ Formation of Sodium Acetylides  
Acetylene or L-alkyne reacts with ~~soft~~ sodium with liquid ammonia or sodium amide ( $\text{NaNH}_2$ ) to form sodium acetylides.



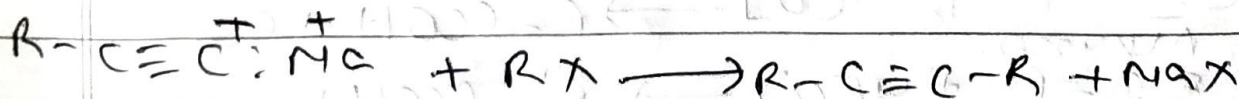
Acetylene

Sodium Acetylide



L-Alkyne

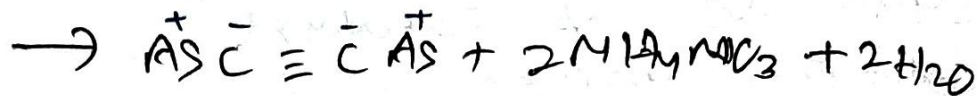
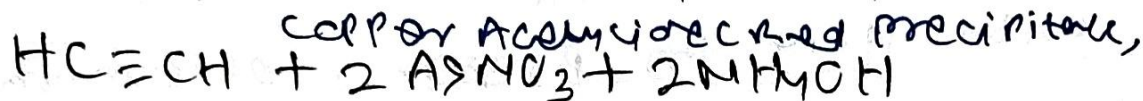
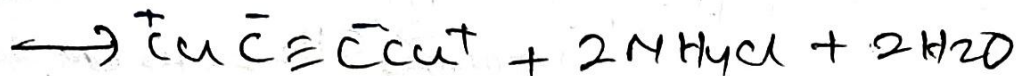
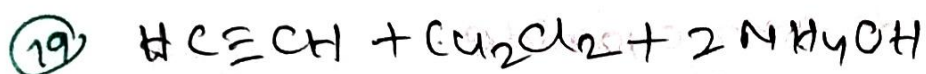
Sodium acetylides reacts with primary alkyl halide to yield higher alkynes.



⑨ Formation of copper and silver Acetylides :-

Acetylene and L-alkynes react with ammoniacal solution of cuprous chloride and silver nitrate to form acetylides of metals.





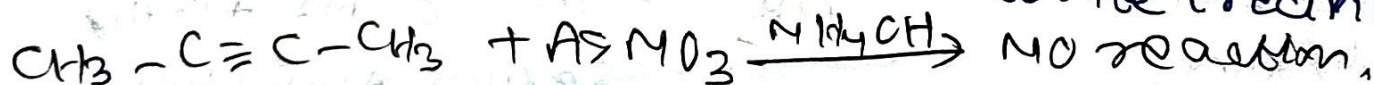
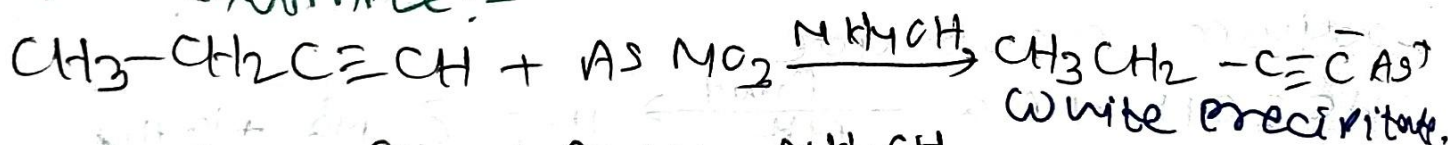
Silver acetylide (white precipitate)

Copper and Silver acetylides are very sensitive to shock when dry and may explode violently.

However they can be decomposed by acids ( $\text{HNO}_3$ ) to regenerate alkynes.

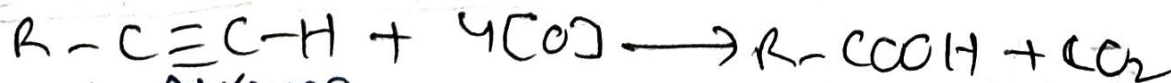
Since 2-alkynes do not form acetylides, this reaction may be used to distinguish 2-alkyne from 1-alkyne.

For example:-



### (B) Oxidation with $\text{KMnO}_4$

The oxidation of alkynes with alkaline potassium permanganate to form carboxylic acids and  $\text{CO}_2$ .



1-alkyne.



2-alkyne



propyne

acetic acid.

