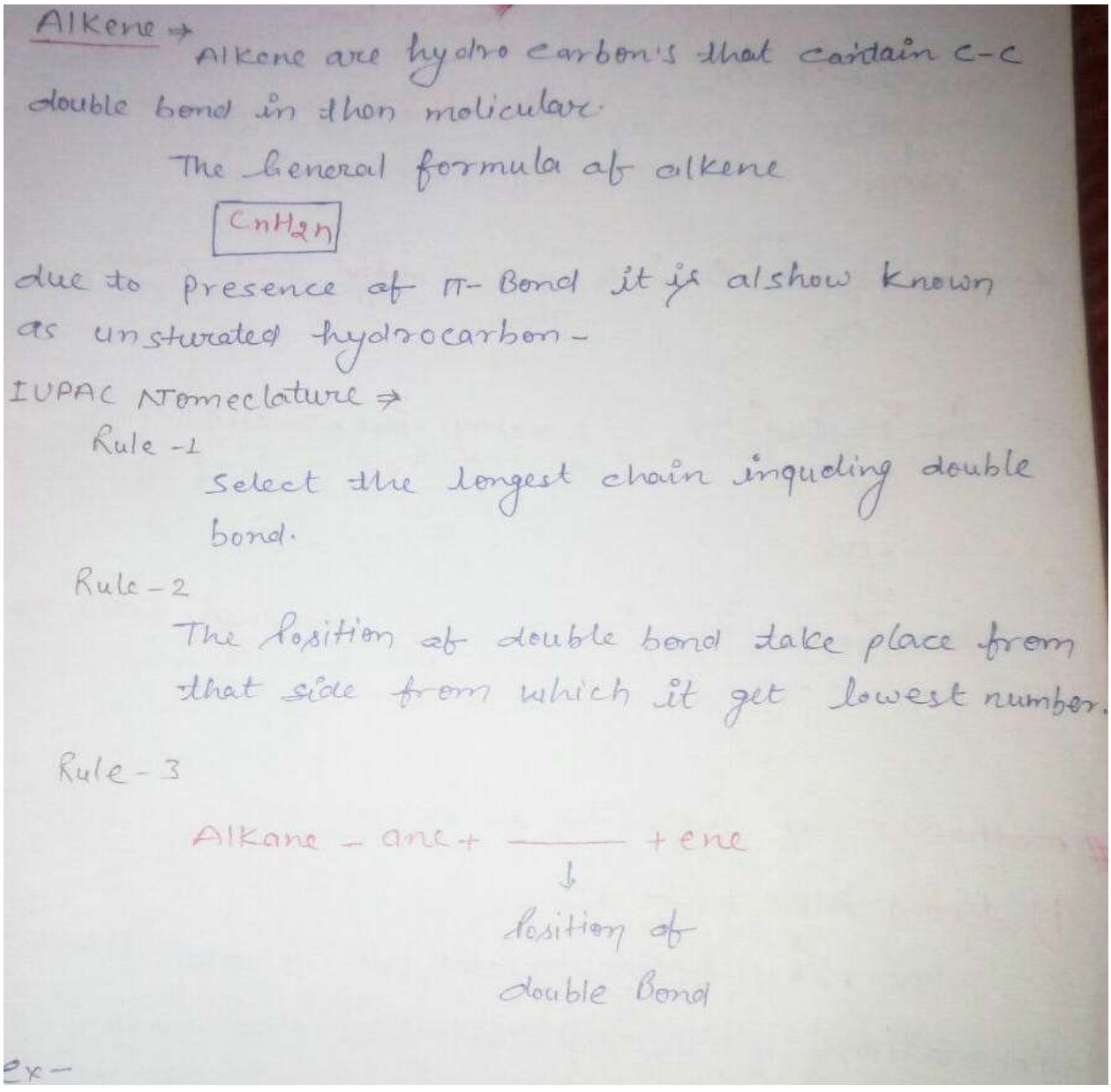
Alkenes, Cycloalkenes, Dienes and Alkynes



Alkene ⇒ Alkene are hydro carbon's that caidain C-C double bond in then molicular.

The General formula af alkene

C_nH_{2n}

due to presence af π- Bond it is alshow known as unsturated hydrocarbon-

IUPAC Nomeclature ⇒

Rule -1

Select the longest chain inquding double bond.

Rule - 2

The position af double bond take place from that side from which it get lowest number.

Rule - 3

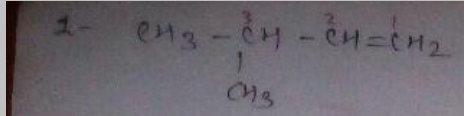
Alkane - ane + ——— + ene

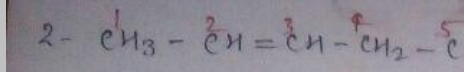
↓

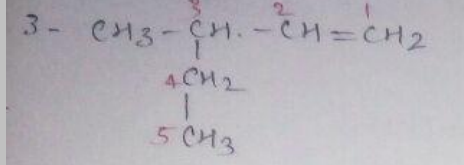
position af

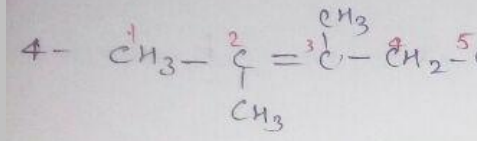
double Bond

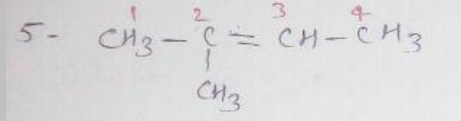
ex-

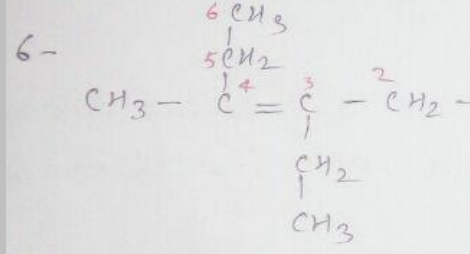
1-  3-di methyl butene

2-  ~~2,3-dimethyl Pent-2-ene~~ Pent-2-ene

3-  Pent-1-ene

4-  2,3 di methyl Pent-2-ene

5-  2-methyl but-2-ene

6-  3-ethyl, 4-methyl hex-3-ene

methods of Preparation of Alkene ⇒

i) From Alkyl Helide ⇒

When Alkyl helide treated with alcoholic KOH formation of Alkene will take place with removle of HX.

H - always remove from β-Position due to remoble of HX in this RXN, This RXN is alshow know as Di hydro helozination.

$$\overset{\beta}{C}H_3-\overset{\alpha}{C}H_2-Cl \xrightarrow[C_2H_5OH]{KOH}$$

$$CH_3-CH_2-Cl \longrightarrow H_2C=CH_2 + HCl \downarrow HX$$

Question

1- $$\overset{\beta}{C}H_3-\overset{\alpha}{C}H(Cl)-\overset{\beta}{C}H_3 \xrightarrow[C_2H_5OH]{KOH} CH_3-CH(Cl)-CH_3 \longrightarrow H_2C=CH-CH_3 + HCl$$

2- $$\overset{\beta}{C}H_3-\overset{\alpha}{C}H(Cl)-\overset{\beta}{C}H_2-CH_3 \xrightarrow[C_2H_5OH]{KOH}$$

Product -1

$$CH_3-CH(Cl)-CH_2-CH_3 \longrightarrow H_2C=CH-CH_2-CH_3 + HCl$$

Product - 2

$$CH_3-CH(Cl)-CH_2-CH_3 \longrightarrow CH_3-CH=CH-CH_3 + HCl$$

3- $$CH_3-\overset{CH_3}{\overset{|}{\overset{\beta}{C}}}H-\overset{\alpha}{C}H-\overset{\beta}{C}H_3 \xrightarrow[C_2H_5OH]{KOH}$$

Product -1

$$CH_3-C(CH_3)(H)-CH(Cl)-CH_3 \longrightarrow CH_3-C(CH_3)=CH-CH_3 + HCl$$

Product - 2

$$CH_3-CH(CH_3)-CH(Cl)-CH_2 \longrightarrow CH_3-CH(CH_3)-CH=CH_2 + HCl$$

When two or more two alkene are formed as a product, the major and minor product difined by the help of Saytzeff rule –

According to this Rule → The more substitute alkene will be major product.

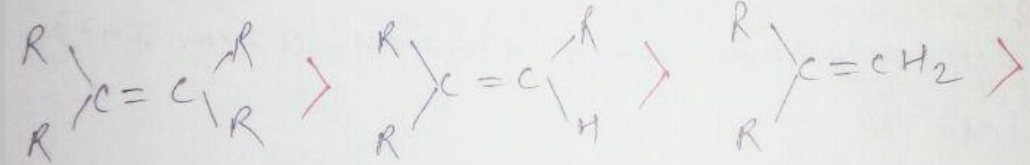
Ex- $CH_3-CH_2-CH=CH_2$ (+) $CH_3-CH=CH-CH_3$

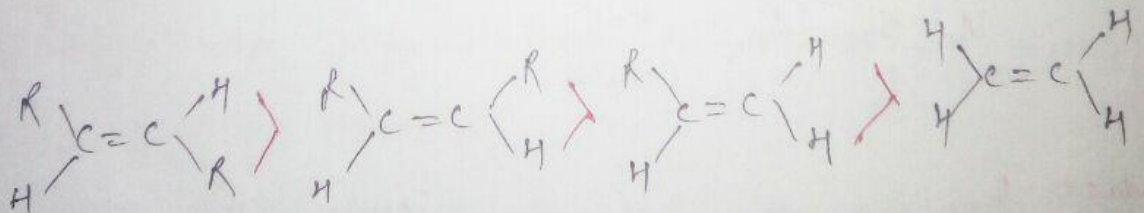
but-1-ene — minor

but-2-ene — Major

TRICK

The majority of Alkene also are disided by the help of following order.





Dicreasing order of majority.

IInd method

By Di-hydration of Alcohol ⇒

When alcohol is heated in the presence of conc. H_2SO_4, the formation of Alkene will take place. will elimination of H_2O (Water). due to removle of water molicule this rxn. is known as Di-hydration Rxn.

$$CH_3-CH_2-OH \xrightarrow[\Delta 443K]{Conc\ H_2SO_4}$$

STEP-1

$$H_2SO_4 \longrightarrow H^{\oplus} + HSO_4^{\ominus}$$

STEP-2

$$CH_3-CH_2-\ddot{O}-H + H^{\oplus} \longrightarrow CH_3-CH_2-\overset{\oplus}{O}\begin{matrix}H\\H\end{matrix} \longrightarrow CH_3-\overset{\oplus}{C}H_2 + H_2O$$

STEP-3

$$CH_2-\overset{\oplus}{C}H_2 + HSO_4^{\ominus} \longrightarrow H_2C=CH_2 + H_2SO_4$$

(H)

Question

$$H_3C-CH_2-CH_2-OH \xrightarrow[\Delta 443K]{Conc\ H_2SO_4}$$

STEP-1

$$H_2SO_4 \longrightarrow H^{\oplus} + HSO_4^{\ominus}$$

STEP-2

$$H_3C-CH_2-CH_2-\ddot{O}-H \longrightarrow CH_3-CH_2-CH_2-\overset{\oplus}{O}\begin{matrix}H\\H\end{matrix} \longrightarrow CH_3-CH_2-\overset{\oplus}{C}H_2 + H_2O$$

STEP-3

$$CH_3-\overset{\oplus}{C}H-CH_2 \longrightarrow CH_3-\overset{\oplus}{C}H-CH_3$$

(H)

STEP-4

$$CH_2-\overset{\oplus}{C}H-CH_3 + HSO_4^{\ominus} \longrightarrow H_2C=CH-CH_3 + H_2SO_4$$

(H)

Rules

$CH_3-\underset{\underset{OH}{|}}{CH}-CH_2-CH_3 \xrightarrow[\Delta\ 443K]{Con\ H_2SO_4}$

STEP-1

$H_2SO_4 \longrightarrow H^{\oplus} + HSO_4^{\ominus}$

STEP-2

$CH_3-\underset{\underset{H}{|}}{\overset{\overset{OH}{|}}{CH}}-CH_2-CH_3 \xrightarrow{H^{\oplus}} CH_3-\overset{\oplus}{CH}-CH_2-CH_3 + H_2O$

STEP-3

$CH_3-\overset{\oplus}{CH}-CH_2-CH_3 \xrightarrow{-HSO_4^{\ominus}} CH_2=CH-CH_2-CH_3 + H_2SO_4$

Product-1 $CH_2=CH-CH_2-CH_3 + H_2SO_4$ minor

Product-2 $CH_3-CH=CH-CH_3 - H_2SO_4$ major.

Question

$CH_3-\underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{CH}}-CH-CH_3 \xrightarrow[\Delta\ 443K]{Con\ H_2SO_4}$

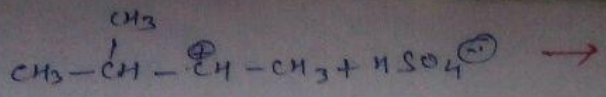
STEP 1

$H_2SO_4 \longrightarrow H^{\oplus} + HSO_4^{\ominus}$

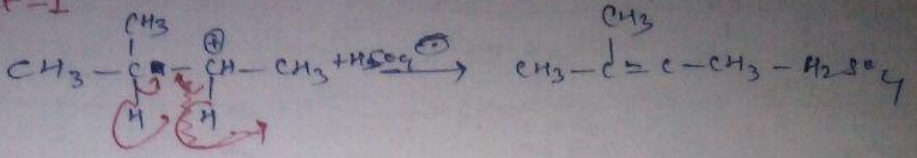
STEP-2

$CH_3-\underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{CH}}-CH-CH_3 + H^{\oplus} \longrightarrow CH_3-\overset{\overset{CH_3}{|}}{CH}-\overset{\oplus}{CH}-CH_3 + H_2O$

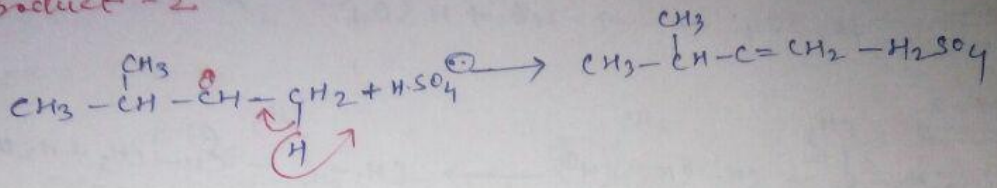
STEP-3



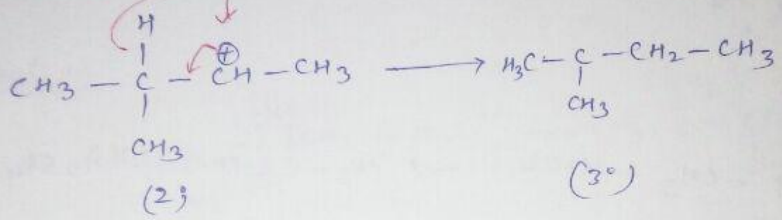
Product-1



Product-2



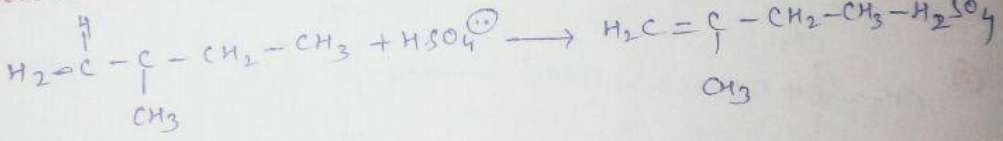
STEP-3



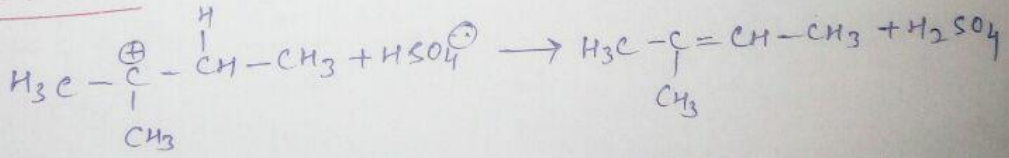
(2°) (3°)

STEP-4

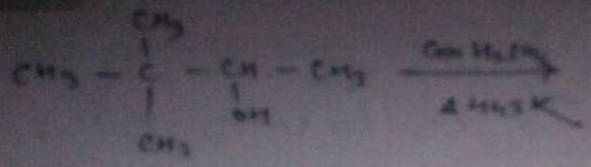
Product-1



Product 2

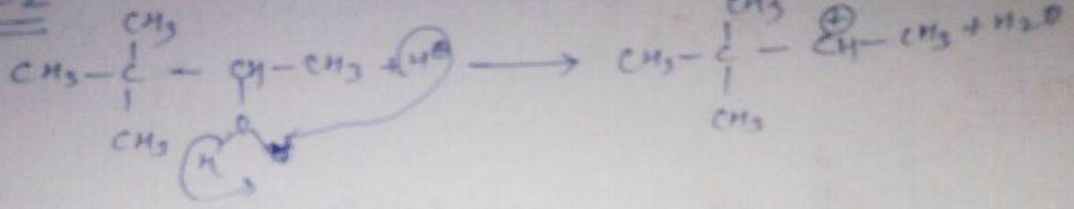


Equation



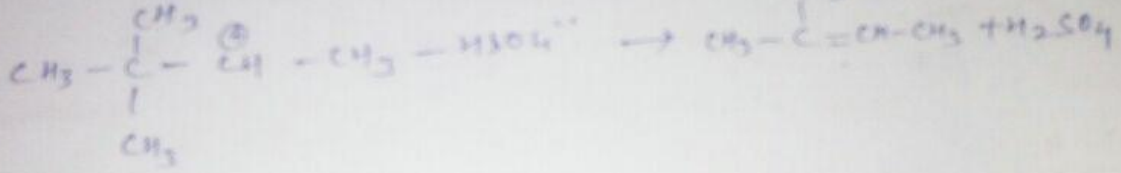
STEP 1

STEP-2

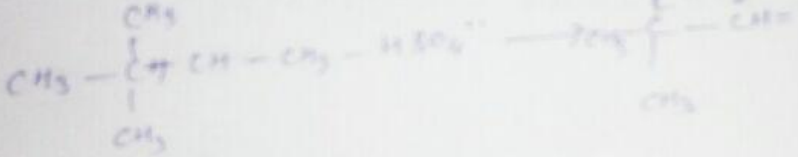


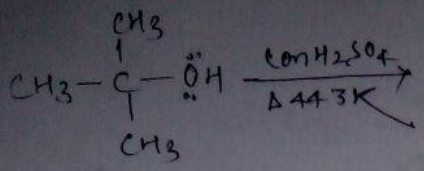
STEP-3

(1)



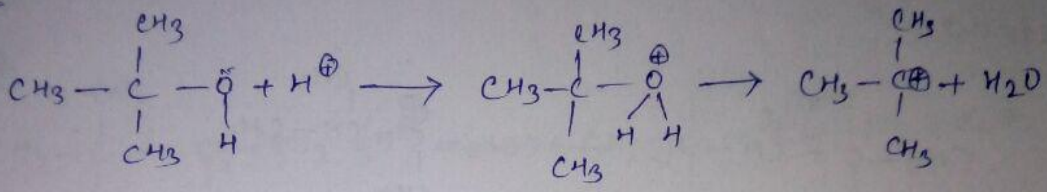
(2)



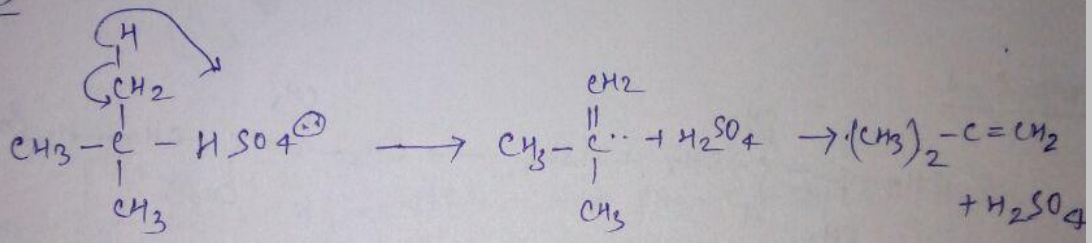


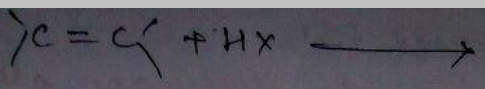
STEP-1

STEP-2

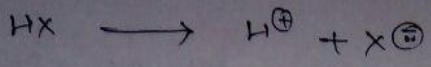


STEP-3

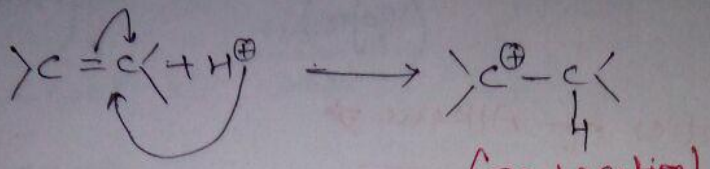




STEP-1



STEP-2

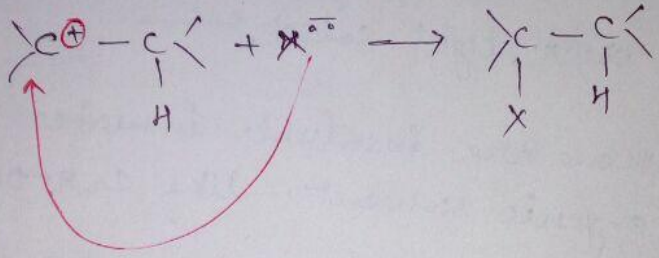


(carbocation)

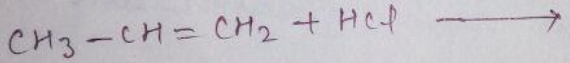
STEP-3

Carbocation rearrangment

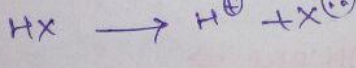
STEP 4



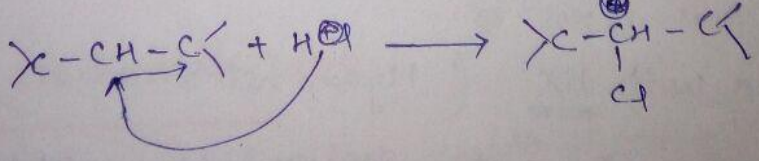
Question ⇒



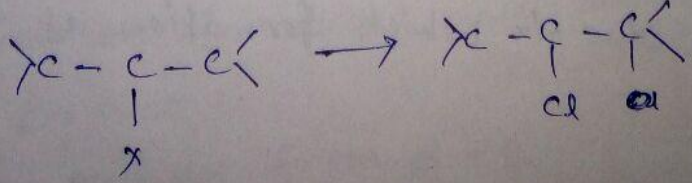
STEP-1



STEP-2



STEP-3

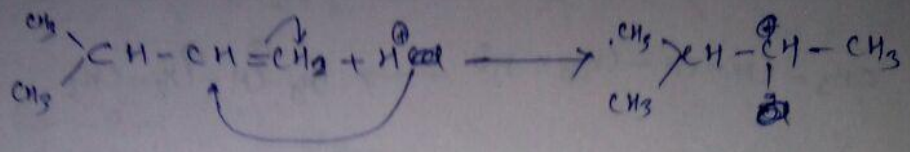


i) $CH_3-\underset{CH_3}{CH}-CH=CH_2 + HCl \longrightarrow$

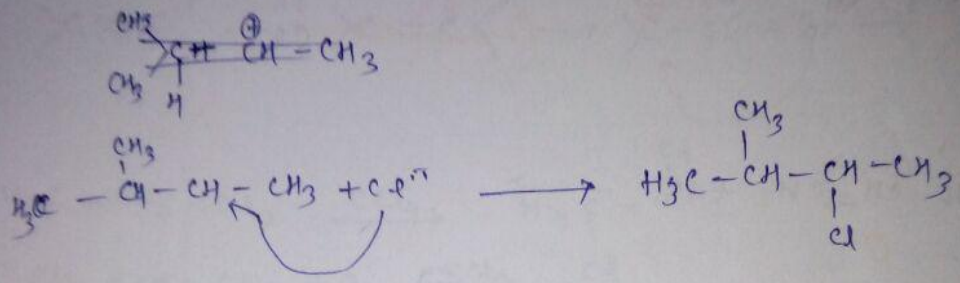
STEP-1

$HCl \longrightarrow H^{\oplus} + Cl^{\ominus}$

STEP-2



STEP-3

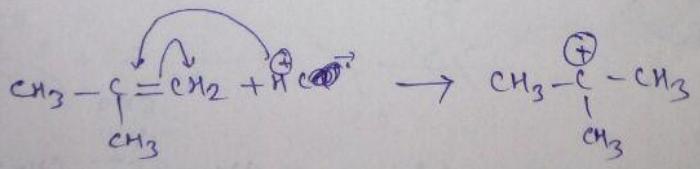


2) $CH_3-\underset{CH_3}{\overset{CH_3}{C}}=CH_2 + HCl \longrightarrow$

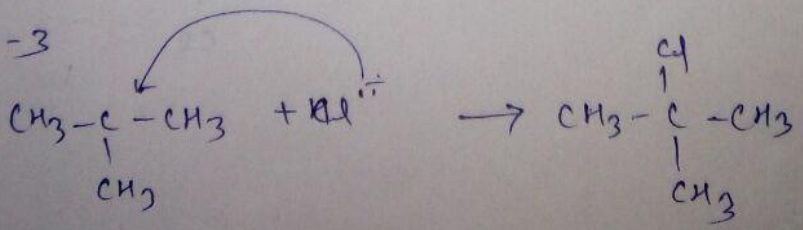
STEP-1

$HCl \longrightarrow H^{\oplus} + Cl^{\ominus}$

STEP-2



STEP-3



मार्कोनिकॉफ रूल = $\overset{\oplus}{H}Cl^{\ominus}$ +ve Part = max H-atom पर जुड़ेगा

मॉडर्न मॉकोनिकॉफ रूल = $\overset{\oplus}{H}Cl^{\ominus}$ -ve Part = Alkene के stable कार्बन के साथ जुड़ेगा

$$CH_3-CH=CH_2 + \overset{\oplus}{H}Cl^{\ominus} \longrightarrow CH_3-\overset{Cl}{\underset{|}{C}}H-CH_3$$

⇒ Limitation of markovnikov Rule ⇒

1) Markovnikov of Rule invalid for that Alkene which have a tendency to form stable carbo cation by a rearrangement Rule.

Ex- According to markovnikov Rule

$$CH_3-\overset{CH_3}{\underset{|}{C}}H-CH=CH_2 + HCl \longrightarrow CH_3-\overset{CH_3}{\underset{|}{C}}H-\underset{Cl}{\underset{|}{C}}H-CH_3$$

Wrong Answer.

By mechanism ⇒

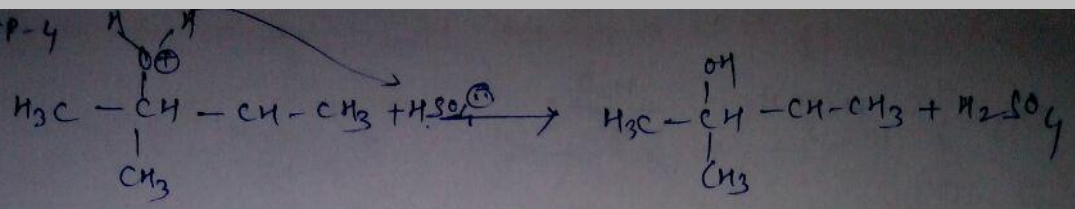
$$CH_3-\overset{CH_3}{\underset{|}{C}}H-CH=CH_2 + HCl \longrightarrow CH_3-\overset{CH_3}{\underset{Cl}{\underset{|}{C}}}-CH_2-CH_3$$

(Right Answer)

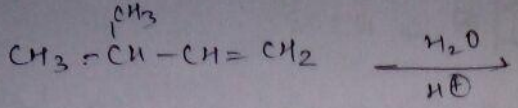
#Modified Markovnikov of Rule ⇒ Rule :-

When Alkene react with Polar compound, The -ve part of polar compound, Attached that carbon of Alkene which have a tendency to formed stable carbo cation.

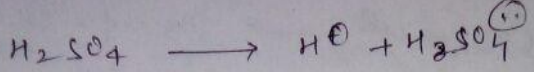
STEP-4



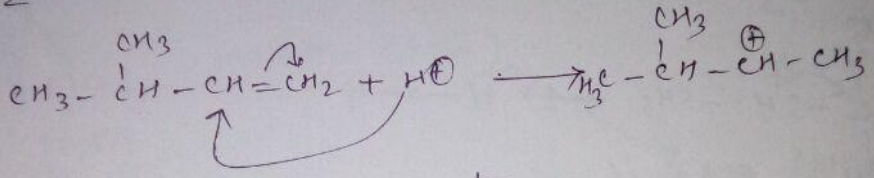
Ques



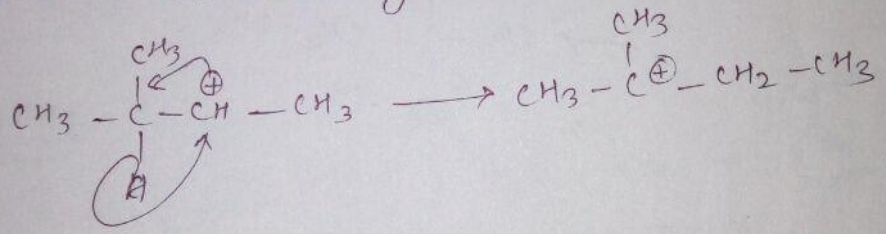
STEP-1



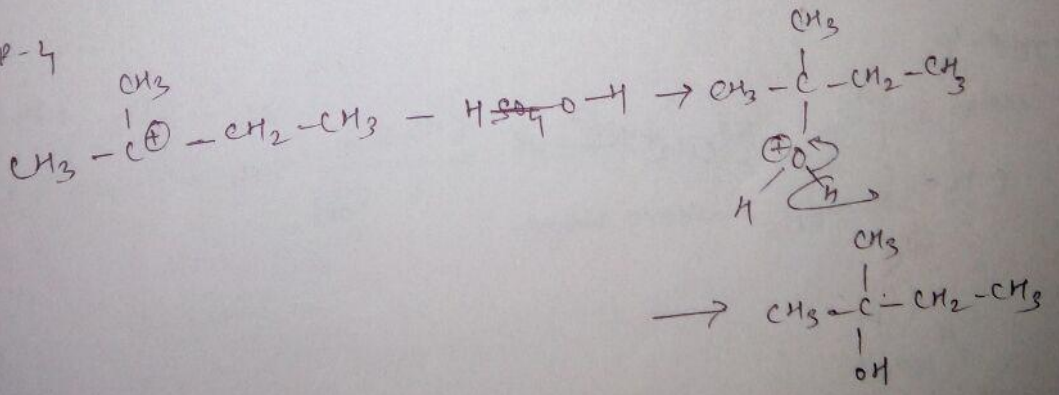
STEP-2

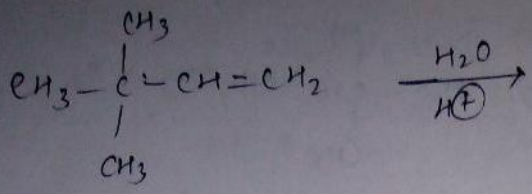


Carbocation rearrangment

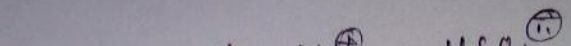


STEP-4

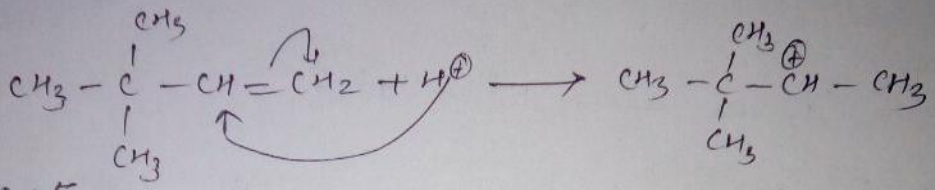




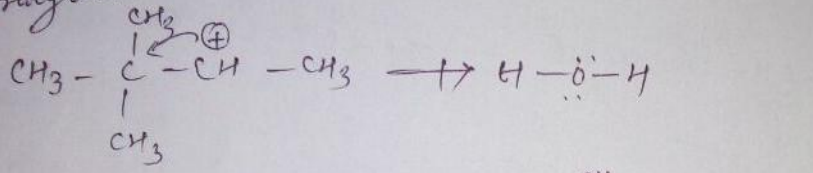
STEP-1

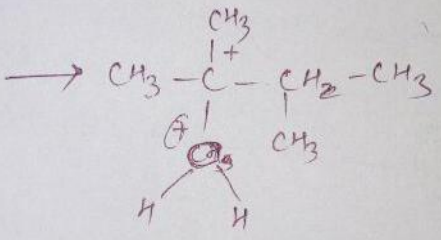


STEP-2

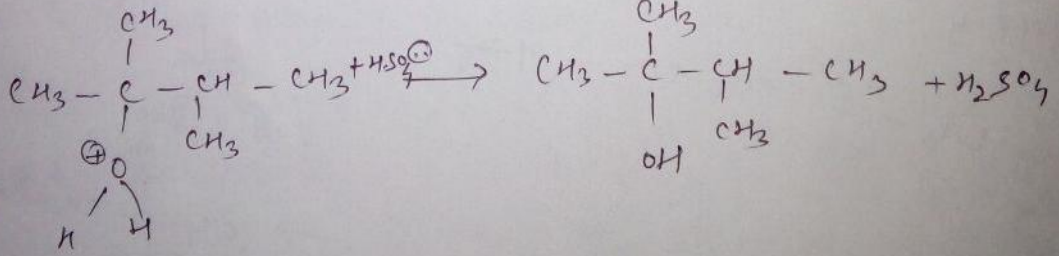


rearrangement

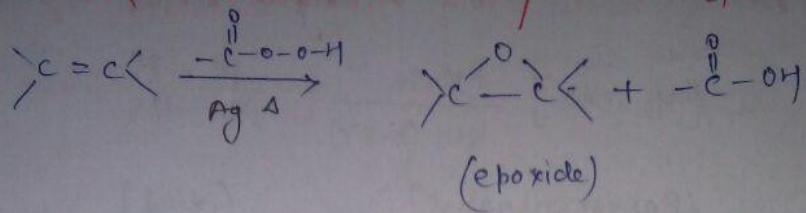




STEP-4



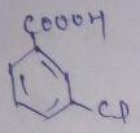
Rxn of Alkene with Peroxy acid ⇒ Epoxidation Rxn

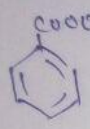


(epoxide)

1) CH_3COOOH → (Peracitic acid)

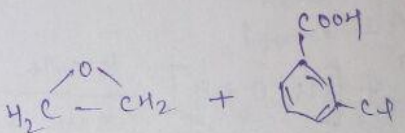
2) $F_3C \cdot COOOH$ → (Trifluoro Peracitic acid)

3)  → (m- CPBA)

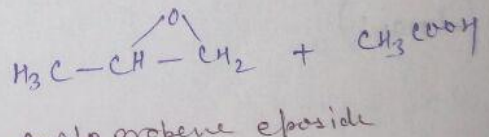
4)  → (Per benzoic acid)

(meta- Chloro Per Benzoic acid)

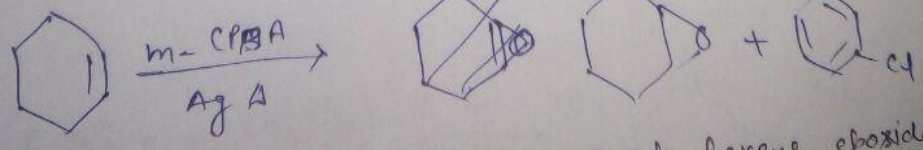
Question

① $H_2C=CH_2 \xrightarrow{m\text{-}CPBA}$ 

ethene epoxide

② $H_3C-CH=CH_2 \xrightarrow[Ag\ \Delta]{CH_3COOH}$ 

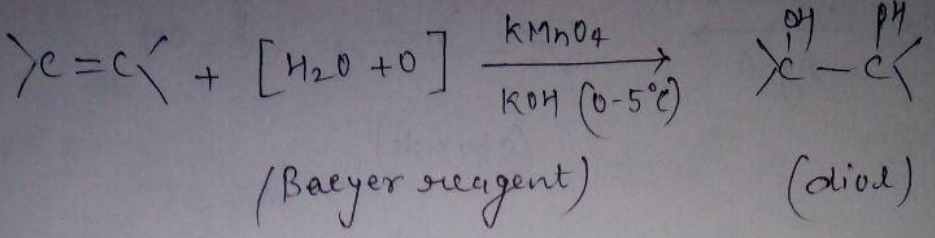
~~cyclo~~ propene epoxide

③ 

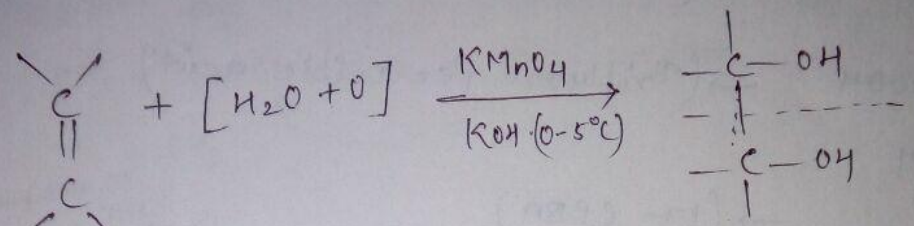
cyclo hexene epoxide

imp

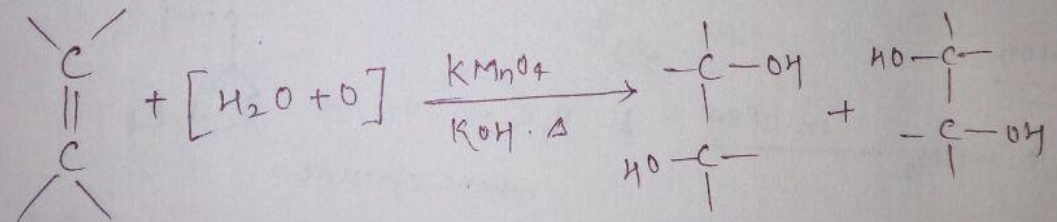
Rxn of Alkene with Cold Alkaline ~~KMnO4~~ $KMnO_4$ ⇒



(Baeyer reagent) (diol)



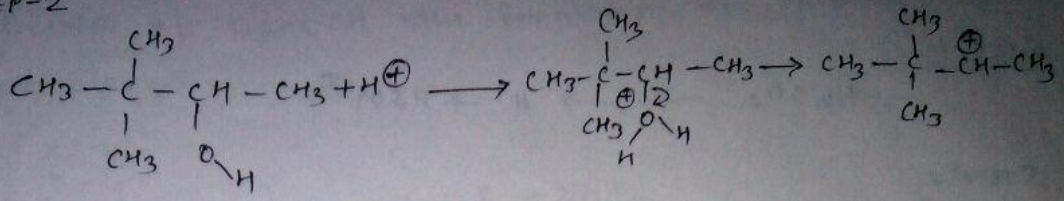
(Cis) (meso compound)



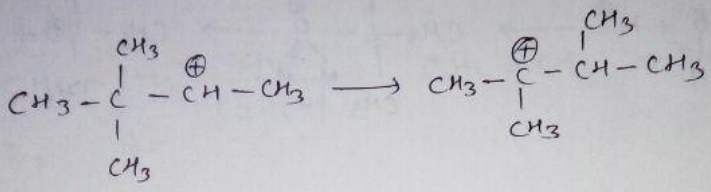
(trans) (Racemic mixture)

STEP-1

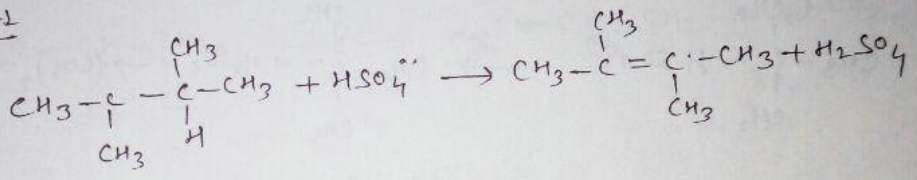
STEP-2

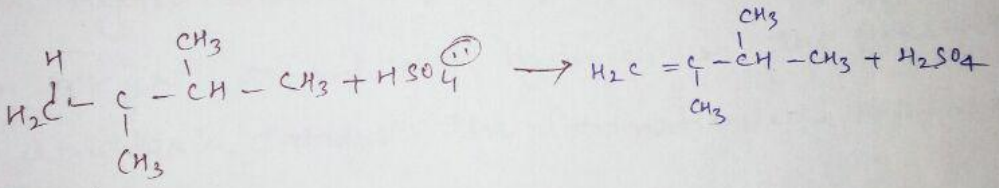


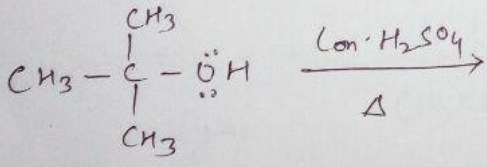
STEP-3



Product -1







From Vicinal Dihelide ⇒ (Zn dust) at 300°C

When Vicinal Di helide react with Zn in the Presence of C_2H_5OH the formation of Alkene will take place.

$$-\overset{X}{\underset{|}{C}}-\overset{X}{\underset{|}{C}}- \xrightarrow[\Delta\ C_2H_5OH]{Zn} -C=C- + ZnX_2$$

1) $CH_2(Br)-CH_2(Br) \xrightarrow[C_2H_5OH]{Zn\,\Delta} CH_2=CH_2 + ZnBr_2$

2) $H_3C-CH(Cl)-CH_2(Cl) \xrightarrow[C_2H_5OH]{Zn\,\Delta} H_2C=CH-CH_2 + ZnCl_2$

from Hydrozenation of Alkyne ⇒

When Alkyne react with Hydrogen in the presence of Lindlar's catalyst the formation of Alkene will take place.

$$-C\equiv C- + H_2 \xrightarrow[(CH_3COO)_2Pb]{Pd\text{-}CaCO_3} -CH=CH-$$

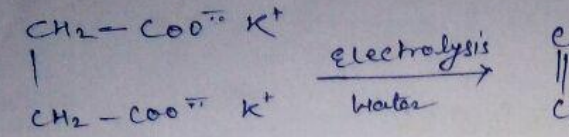
Alkyne → Alkene

(Lindlar's Catalyst)

1) $HC\equiv CH + H_2 \xrightarrow[(CH_3COO)_2Pb]{Pd\text{-}CaCO_3} CH_2=CH_2$

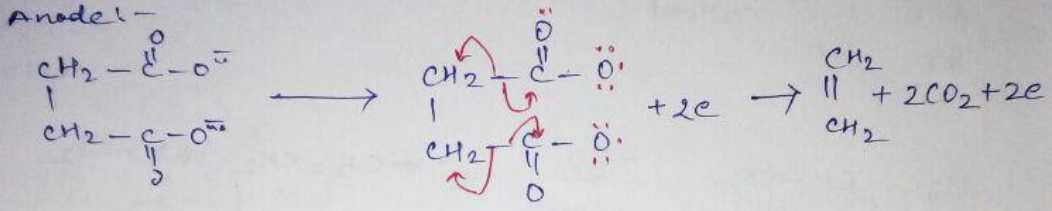
2) $H_3C-C\equiv CH + H_2 \xrightarrow[(CH_3COO)_2Pb]{Pd-CaCO_3} H_3C-CH=CH_2$

Kolbe Electrolyses



Pot. Succinate

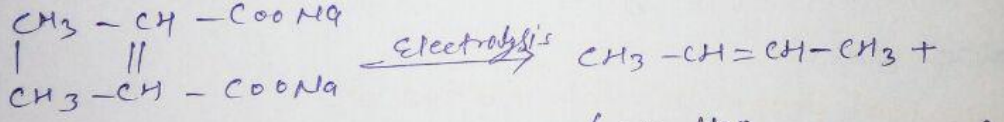
Anode :-



Cathod :

$2K^+ + 2e \longrightarrow 2K$

$2K + 2H_2O \longrightarrow 2KOH + H_2$



Hoffmann Elemination Rxn

When floro alkane heated with Alcoholic KOH, The formation of alkene will take place with HF By Product.

H - alway remove from β - C

If two or more then two different β-C are present the mixture of Alkene will form

and less substituted alkene will be major product. which is against saytzaff rule.
Such type of elemenition of Haffmann elemination.

$$CH_3-\underset{\underset{F}{|}}{CH}-CH_2-CH_3 \xrightarrow[C_2H_5OH]{KOH\ \Delta} \underset{\text{(Major)}}{CH_2=CH-CH_2-CH_3} + \underset{\text{(Minor)}}{CH_3-CH=CH-CH_3} + HF$$

Physical Properties of Alkene ⇒

1) ethene, propene, But-1-ene and but-2-ene are gases at room tempreture. and C-NO- 5 to 18 are liqued at room tempreture and above then 18-C are wax light solid.

2) All the Alkene are insoluble in water but highly soluble in orgenic solvent. like C_2H_5OH, CCl_4, ether.

3) B.P ∝ Molicular weight.
If molicular weight same greater the branch Smaller will we the B.P.

Chemical properties of Alkene ⇒

1) ADDITION RXN ⇒

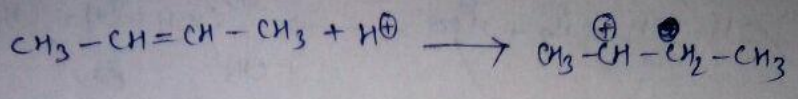
a) RXN with HX (Hydrohelozination)

when alkene treated with HX the addition RXN take place due to which formation of helo alkane occure.

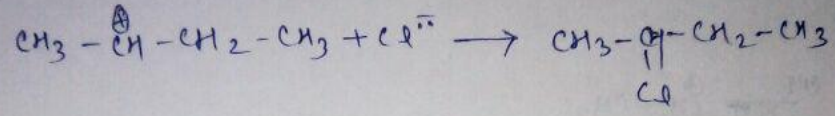
3) $CH_3-CH=CH-CH_3 + HCl \longrightarrow$

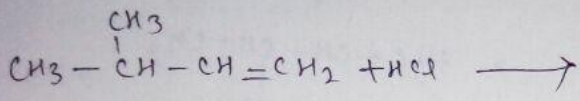
STEP-1 $HCl \longrightarrow H^{\oplus} + Cl^{\ominus}$

STEP-2

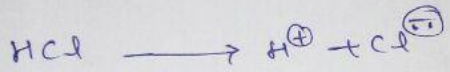


STEP-3

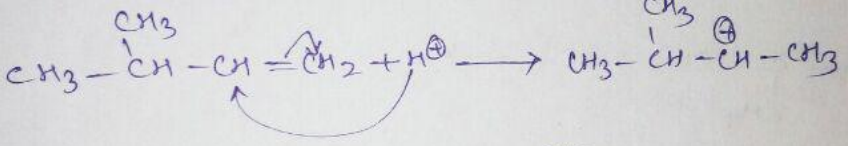


(i) 

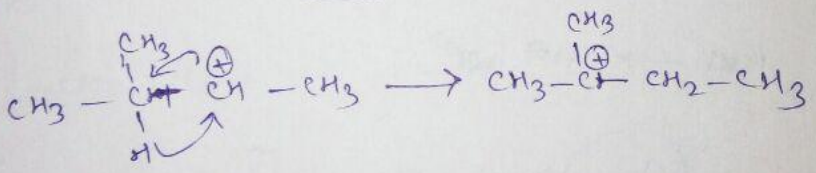
STEP-1



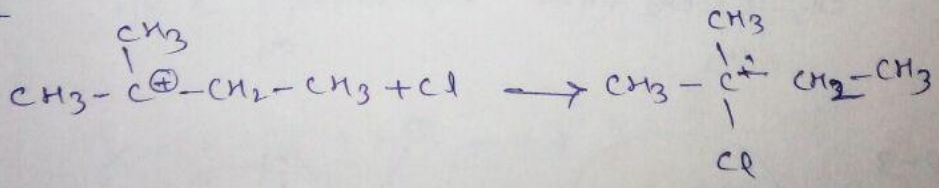
STEP-2



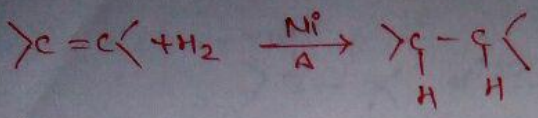
STEP-3



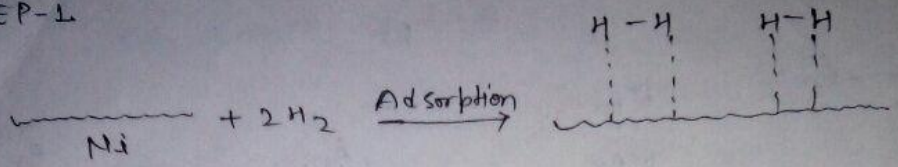
STEP-4



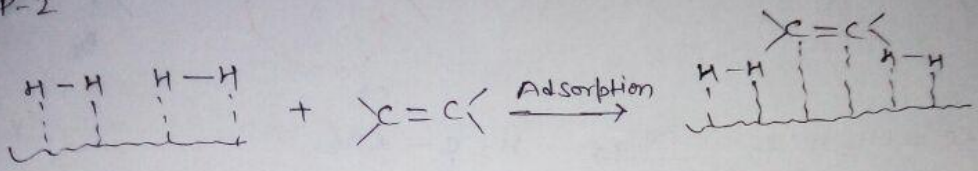
Hydrozination Rxn



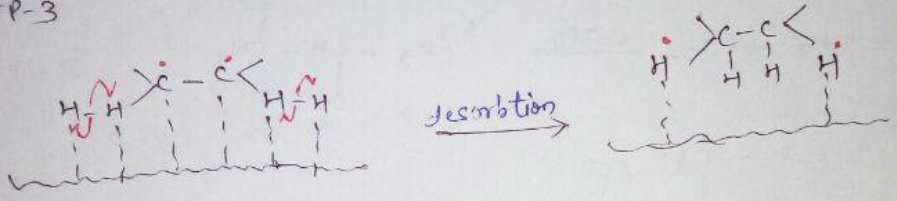
STEP-1

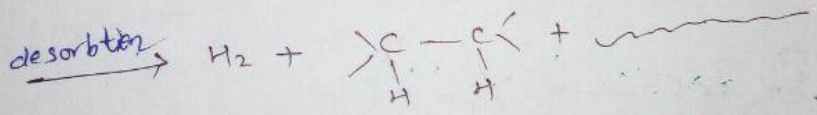


STEP-2



STEP-3





Markovnikov Rxn मारकोनिकोफ अभिक्रिया

Mar

According to markavnekov of Rule any Polar Compound when react with, Alkene, the +ve Part of ~~Alkene~~ Polar comp. attach with that double bonded Carbon atom which have greater no. of Hydrogen atom.

Rxn of Alkene with HBr, In the ...
of Peroxide ⇒

$$>C=C< + HBr \xrightarrow{H_2O_2}$$

STEP-1 $H-\ddot{O}-\ddot{O}-H \longrightarrow 2H-\ddot{O}\cdot$

STEP-2 $H-\ddot{O}\cdot + H-Br \longrightarrow H_2O + Br\cdot$

STEP-3 $>C=C< + Br\cdot \longrightarrow >C\cdot-C< + >C(Br)-C\cdot<$

STEP-4 $>C\cdot-C(Br)< + H-Br \longrightarrow >C(H)-C(Br)< + Br\cdot$

STEP-5 $H-O-H + Br\cdot \longrightarrow HBr + OH$

STEP-6 $HO\cdot + \cdot OH \longrightarrow H_2O_2$

$CH_3-CH=CH_2 + HBr \xrightarrow{H_2O_2}$

STEP-1 $H-\ddot{O}-\ddot{O}-H \longrightarrow 2H-\ddot{O}\cdot$

STEP-2 $H-O + H-Br \longrightarrow H_2O + Br\cdot$

STEP-3 $CH_3-CH=CH_2 + Br\cdot \longrightarrow CH_3-\dot{C}H-CH_2(Br) + CH_3-CH(Br)-\dot{C}H_2$

major minor

Product-1

STEP-4 $CH_3-\dot{C}H-CH_2(Br) + H-Br \longrightarrow CH_3-CH_2-CH_2-Br$

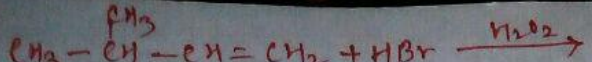
major

Product-2

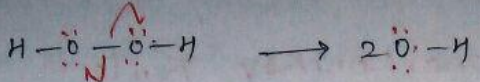
STEP-5 $CH_3-CH(Br)-\dot{C}H_2 + H-Br \longrightarrow CH_3-CH(Br)-CH_3 + Br\cdot$

minor.

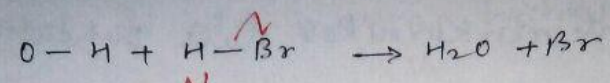
STEP-6 $\cdot\ddot{O}H + \cdot\ddot{O}H \longrightarrow H_2O_2$



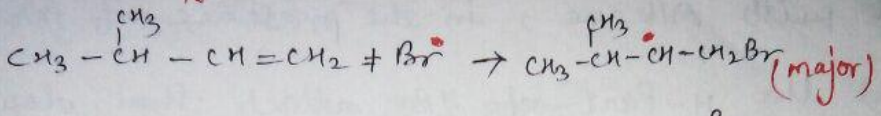
STEP-1

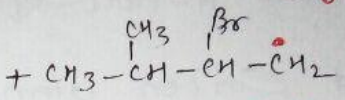


STEP-2



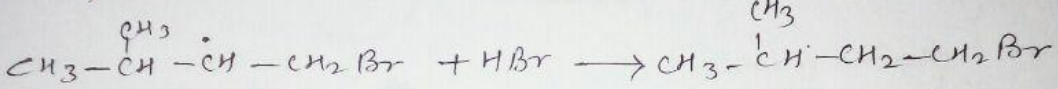
STEP-3



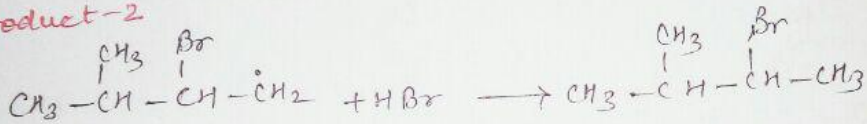


~~Product-1~~

STEP-4



Product-2



STEP-5

STEP-6

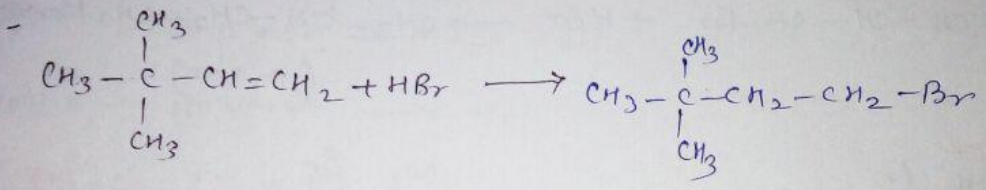
NOTE (1)

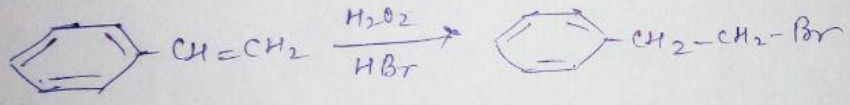
In this RXN HF, HCl, HI not used Because their electronegativity different too large.

2→ This Rxn is also known as Kharash effect. which followed Anti markonikov Rule -

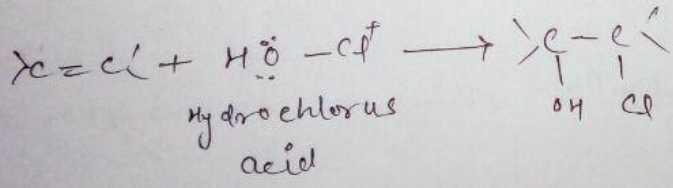
According to Anti markovnikov Rule when HBr React with Alkene, in the presence of Peroxide (H_2O_2) the H-Part of HBr attach that double bonded Carbon atom in which less number of Hydrozane are present.

Ex-

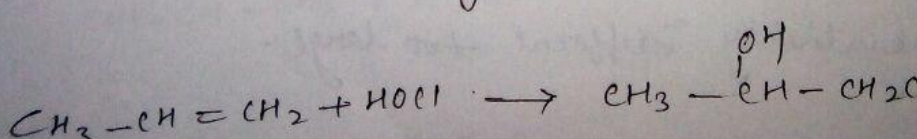




Reaction with HOCl →

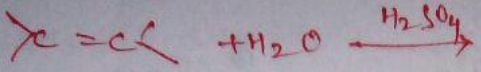


Add $H\ddot{O}\overset{+}{C}l$ according to Markovnikov Rule

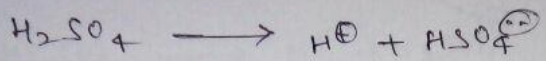


Rxn with water ⇒

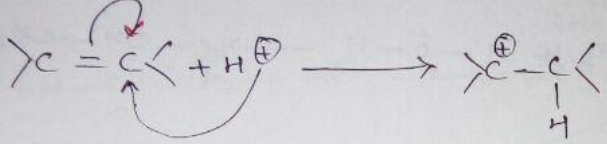
When alkene react with water in the presence of an acid, formation of Alcohal will take place. This rxn is also know as hydration Rxn-



STEP-1



STEP-2

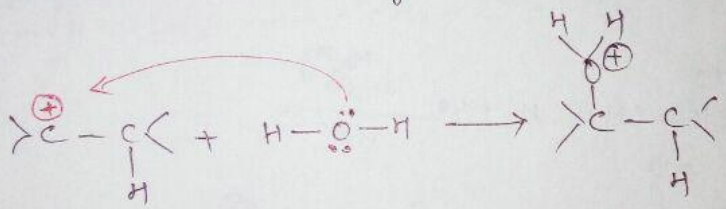


(Carbocation)

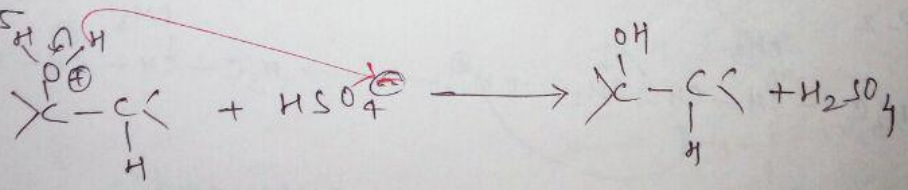
STEP-3

Carbocation rearrangement

STEP-4



STEP-5



Question

$CH_3-CH=CH_2 + H_2O \xrightarrow{H_2SO_4}$

STEP-1

$H_2SO_4 \longrightarrow H^{\oplus} + HSO_4^{\ominus}$

STEP-2

$H_3C-CH=CH_2 + H^{\oplus} \longrightarrow H_3C-\overset{\oplus}{C}H-CH_3$

STEP-3

$H_3C-\overset{\oplus}{C}H-CH_3 + H-\ddot{O}-H \longrightarrow H_3C-\overset{\oplus}{O}(H)-CH-CH_2$

STEP-4

$H_3C-\overset{\oplus}{O}(H)-CH-CH_3 + HSO_4^{\ominus} \longrightarrow H_3C-\underset{H}{\overset{OH}{C}}-CH_3 + H_2SO_4$

Question

$CH_3-\underset{CH_3}{CH}-CH=CH_2 + H_2O \xrightarrow[H^{\oplus}]{H_2SO_4}$

STEP-1

$H_2SO_4 \longrightarrow H^{\oplus} + HSO_4^{\ominus}$

STEP-2

$H_3C-\underset{CH_3}{CH}-CH=CH_2 + H^{\oplus} \longrightarrow H_3C-\underset{CH_3}{CH}-\overset{\oplus}{C}H-CH_3$

STEP-3 Carbocation rearrangement

$H_3C-\overset{\oplus}{C}H-\underset{CH_3}{CH}-CH_3 - H-\ddot{O}-H \longrightarrow H_3C-\overset{\oplus}{O}(H)-CH-\underset{CH_3}{CH}-CH_3$

STEP-4

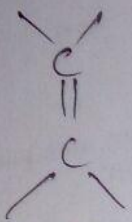
$H_3C-\overset{\oplus}{C}H-\underset{CH_3}{CH}-CH_3 + HSO_4^{\ominus} \longrightarrow$

imp

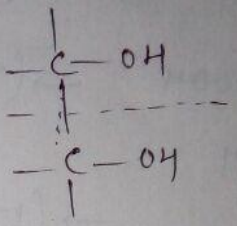
Rxn of Alkene with Cold Alkaline ~~KMnO4~~ $KMnO_4$ ⇒

$$>C=C< + [H_2O + O] \xrightarrow[KOH\ (0\text{-}5^\circ C)]{KMnO_4} >\overset{OH}{C}-\overset{OH}{C}<$$

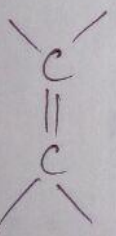
(Baeyer reagent) (diol)



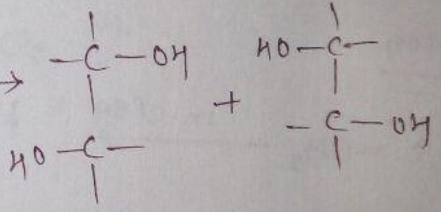
$$+ [H_2O + O] \xrightarrow[KOH\ (0\text{-}5^\circ C)]{KMnO_4}$$



(Cis) (meso compound)



$$+ [H_2O + O] \xrightarrow[KOH \cdot \Delta]{KMnO_4}$$



(trans) (Racemic mixture)

$NaBH_4$
Sodo boron hydride

$(H_3C-\overset{O}{\overset{\|}{C}}-O)_2 Hg$ (OAc)

$(OAc)_2 Hg$


(THF Tetrea Hydro furone)

$CH_3-CH=CH_2 \xrightarrow[(ii)\ NaBH_4-OH^-]{(i)\ (OAc)_2Hg-THF} A \longrightarrow B$

(A) $\xrightarrow{(OAc)_2Hg-THF}$ $H_3C-\underset{OH}{CH}-\underset{HgOAc}{CH_2}$

(B) $\xrightarrow{NaBH_4-OH^-}$ $H_3C-\underset{OH}{CH}-\underset{H}{CH_2}$

$CH_3-\overset{CH_3}{\overset{|}{C}}=CH_2 \xrightarrow[(ii)\ NaBH_4-OH^-]{(i)\ (OAc)_2Hg-THF} A \longrightarrow B$

Product

$CH_3-\overset{CH_3}{\overset{|}{C}}=CH_2 \xrightarrow{(i)\ (OAc)_2Hg-THF}$ $H_3C-\underset{OH}{\overset{CH_3}{\overset{|}{C}}}-\underset{HgOAc}{CH_2}$ (A)

(A) $\xrightarrow{(ii)\ NaBH_4-OH^-}$ $CH_3-\underset{OH}{\overset{CH_3}{\overset{|}{C}}}-\underset{H}{CH_2}$ (B)

Polymerization of Alkene ⇒

When Alkene combined it shell at a high temperature, from a meero molecule, this process is know as polymerization Rxn.

The compound which is used for polymerization is know as monomer and the meero molecule is known as polymer.

The process of polymerization go through following steps ⇒

$$n\ CH_2=CH_2 \xrightarrow[\Delta]{\text{Polymerization}} \text{-}(CH_2-CH_2)\text{-}_n$$

(ethene) (polyethene)

STEP-1 Chain initation ⇒

$$R-\ddot{O}-\ddot{O}-R \longrightarrow 2R-\ddot{O}\cdot$$

$$R-\dot{O} + CH_2=CH_2 \longrightarrow R-O-CH_2-\dot{C}H_2$$

STEP-2 Chain Propagation ⇒

$$R-O-CH_2-\dot{C}H_2 + CH_2=CH_2 \longrightarrow R-O-CH_2-CH_2-\dot{C}H_2-\dot{C}H_2$$

$$R-O-CH_2-CH_2-CH_2-\dot{C}H_2 + \overset{(n-2)}{CH_2=CH_2} \longrightarrow R-O\text{-}(CH_2-CH_2)\text{-}_{n-1}CH_2-\dot{C}H$$

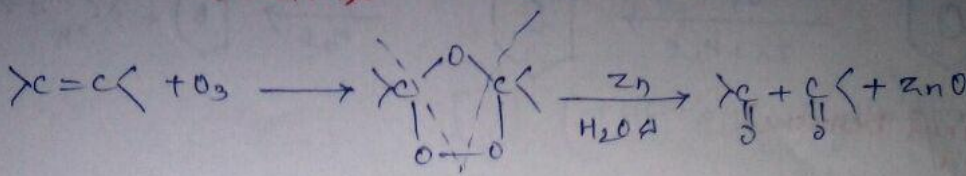
⇒ Chain termination ⇒

$$R-O\text{-}(CH_2-CH_2)\text{-}_{n-1}CH_2-\dot{C}H_2 + \dot{O}-R \longrightarrow R-O\text{-}(CH_2-CH_2)\text{-}_n OR$$

Ozonolysis of Alkene ⇒

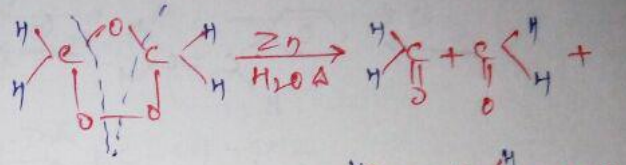
$>C=C<$ $\xrightarrow[(ii)\ Zn+H_2O]{(i)\ O_3}$

NOTE → • Terminal Alkene का ozonolysis से formaldehyde बनता है।
• Cyclic molecule का ozonolysis से dicarbonyle compound बनता है।



(Ozonoide)

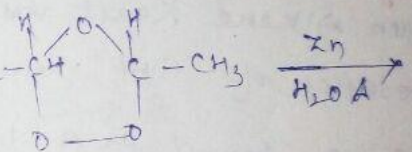
i) $H_2C=CH_2$ $\xrightarrow[(ii)\ Zn+H_2O]{(i)\ O_3}$

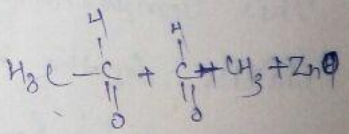


$HCHO$
(formaldehyde)

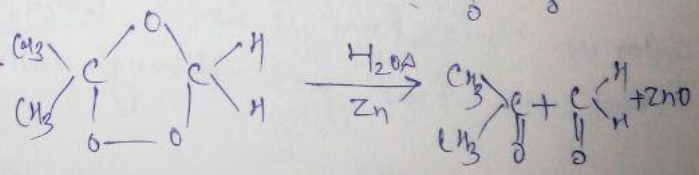
Question

$CH_3-CH=CH-CH_3$ $\xrightarrow[(ii)\ Zn+H_2O]{(i)\ O_3}$

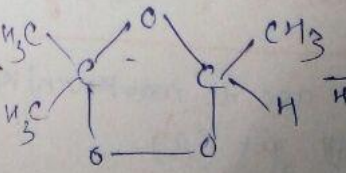


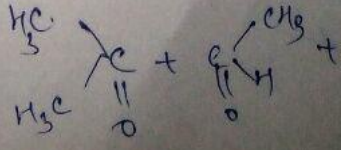


i) $(CH_3)_2C=CH_2$ $\xrightarrow[②\ H_2O+Zn]{①\ O_3}$

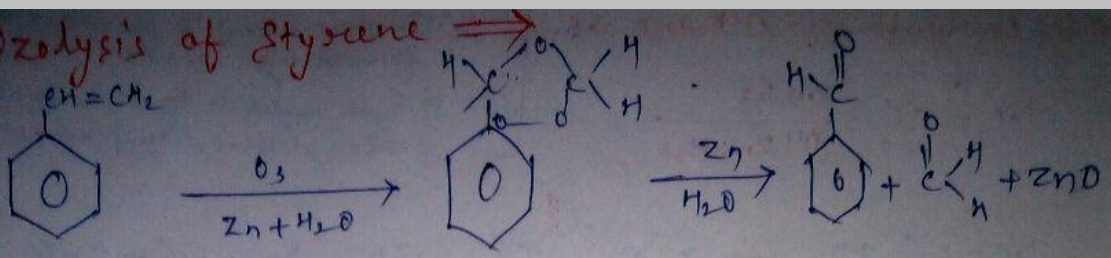


ii) $(CH_3)_2C=CH(CH_3)$ $\xrightarrow[②\ H_2O+Zn]{①\ O_3}$



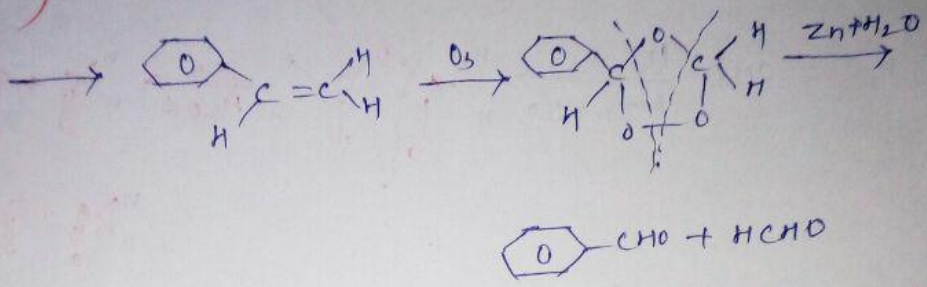


Ozolysis of Styrene



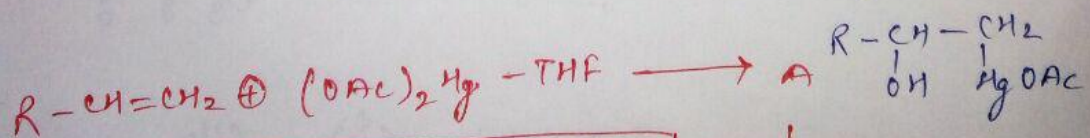
(Vinyl Benzene)

(Styrene)

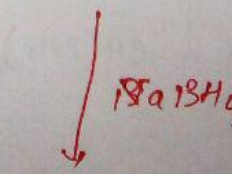


Oxymercuration - demercuration Rxn (OM-DM Rxn) (v. imp)

When Alkene React with mercuric acitad in the presence of THF Solvent a compound A will form. This Compound to A when further React with $NaBH_4$ in the presence of Base, Compound B will form. This Rxn is know OM-DM Rxn and the Rxn goes thorough following way.



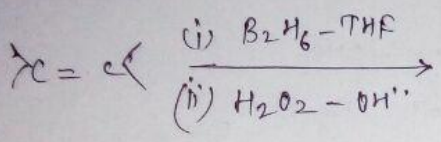
Add HOH acc to markovnikov Rule we will get (B)

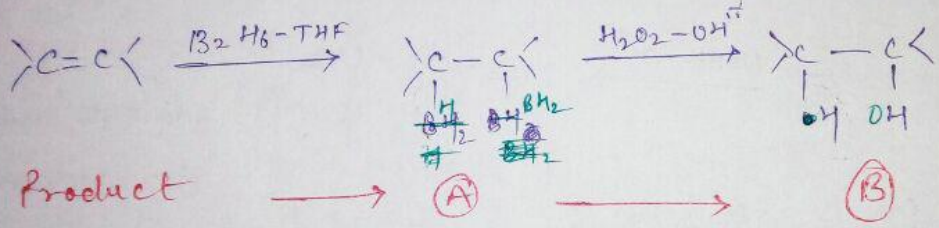


Toxic

#Hydro Boration Oxidation method ⇒

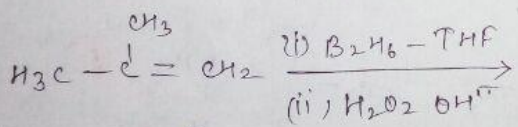
When Alkene React with di Borane in the Presence of THF, The compound A will form and this compound further react with Hydrogen Per Oxide (H_2O_2) in the Presence of Base, Compound B. This Rxn is Know as Hydro Boration Oxidation Rmethod ⇒

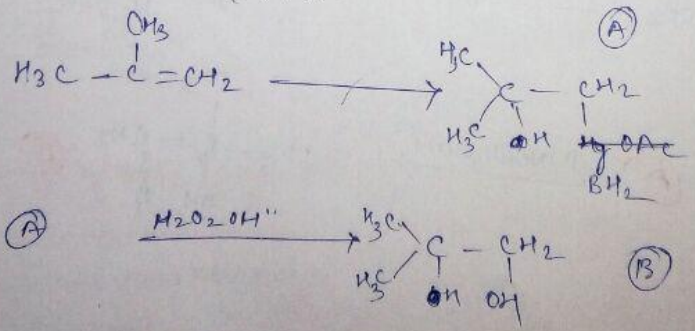




Product ⟶ (A) ⟶ (B)

Question





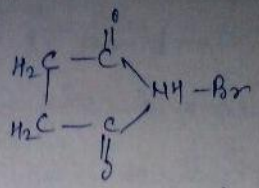
Rxn of Alkene with N-Bromo succinimide ⇒ NBS

sp^3 – से H- हटता है

↓

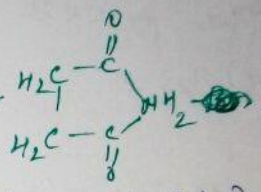
allylic

NBS



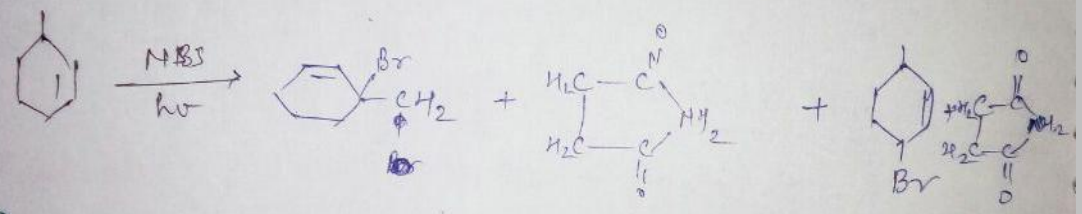
When Alkene treated with NBS in the presence of sunlight the hydrogen of Allylic carbon a substitute by Br, an formation of Allyl Bromide will take place.

$$H_3C-CH=CH_2 \xrightarrow[h\nu]{NBS} H_2C(Br)-CH=CH_2 +$$



(Succinimide)

i)



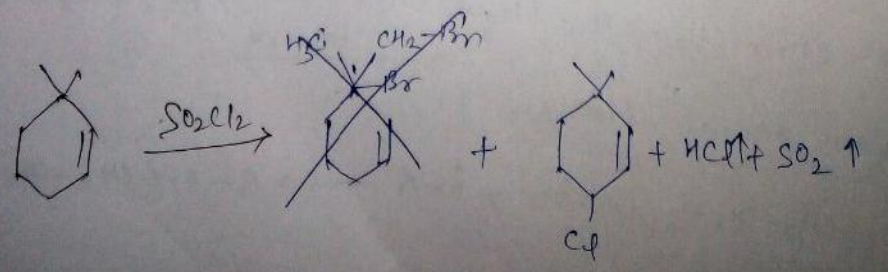
⇒ Rxn with SO_2Cl_2 (Thionyl chloride $SOCl_2$)

↓

(Sulphuryl chloride)

$$H_3C-CH=CH_2 \xrightarrow{SO_2Cl_2} CH_2(Cl)-CH=CH_2 + HCl\uparrow + SO_2\uparrow$$

)

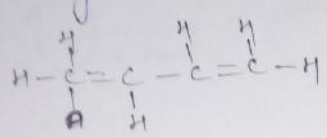
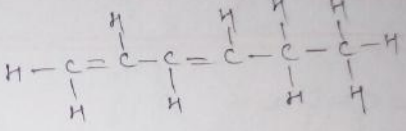


Dienes (Open 2-double Bond)

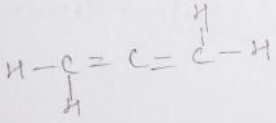
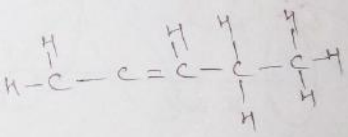
These are open chain Alkene in which two double bonds are present.

There are three types of Dienes –

i) Conjugated Dienes ⇒ Such type of Dienes in which two double Bond are separated By a single Bond.

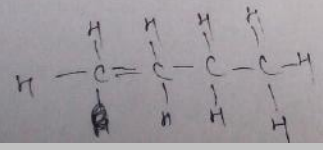
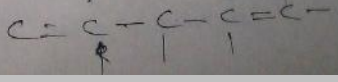
Ex-  , 

ii) Substitute Dienes ⇒ Such Types of Dienes in which Two double bond are connected on by a single carbon.

Ex- i)  (ii) 

iii) NOTE Such Type of Dienes are also known as Allenes.

iii) Non-Conjugated Dienes ⇒ (Isolated Dienes) Such Type of Dienes in two double Bond are separated are more then one single Bond.

Ex-  

Nomeclature of Dienes ⇒

i) $H_2\overset{4}{C}=\overset{3}{CH}-\overset{2}{CH}=\overset{1}{CH_2}$ ⇒ Buta-1,3-diene

(1,3)

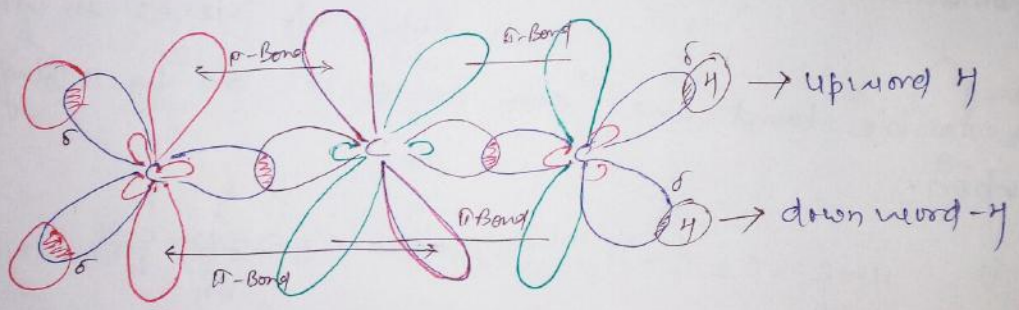
ii) $H_2\overset{1}{C}=\overset{2}{CH}-\overset{3}{CH}=\overset{4}{CH}-\overset{5}{CH_3}$ ⇒ Penta-1,3 Diene

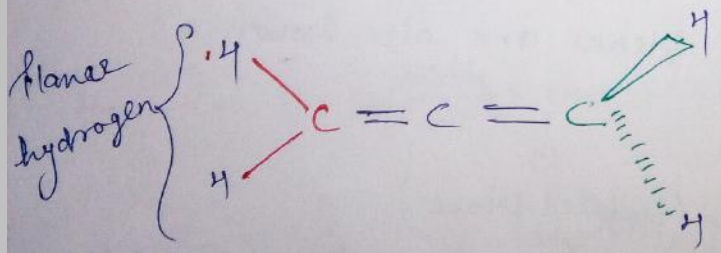
(1,3)

Structure of Allenes ⇒

$H_2C=C=CH_2$

Sp^2 Sp^2 Sp^2



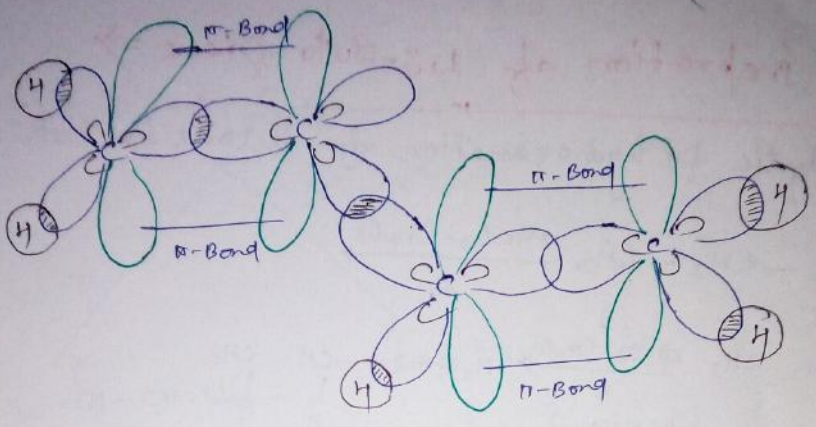


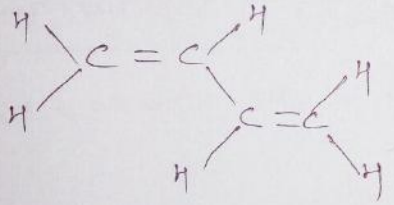
Structure of Conjugating Dienes ⇒

$H_2C = CH - CH = CH_2$

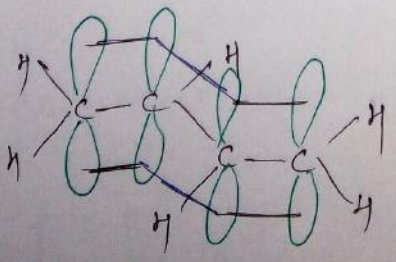
sp^2 sp^2 sp^2 sp^2

(All plane of symmetry)





Due to all an hybrit orbital ~~or~~ in same plane, the process of conjugation will also take place.



$H_2C = CH - CH = CH_2 \longleftrightarrow H_2\overset{\oplus}{C} - CH = CH - \ddot{C}H_2$

Due to conjugation C–C Bond order lie b/w single Bond and double Bond order.

Hence in buta Diene the Bond length ~~will~~ b/w C–C will be 1.34 Å

Method of Prepration of 1,3-Buta Diene ⇒

I

i) By Catalytic Di hydrozination of butane ⇒

$$CH_3-CH_2-CH_2-CH_3 \xrightarrow[\Delta]{Al_2O_3-Cr_2O_3}$$

$$H_2C(H)-CH(H)-CH_2-CH_3 \xrightarrow[\Delta]{Al_2O_3-Cr_2O_3} H_2C=CH-CH(H)-CH_2(H)$$

$$\xrightarrow[\Delta]{Cr_2O_3-Al_2O_3} H_2C=CH-CH=CH_2$$

1,3-Buta Diene -

Method - 2

from Butane 1,3 Diol ⇒

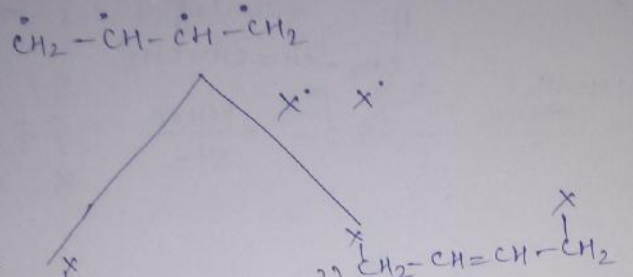
$$H_2C(OH)-CH(H)-CH(OH)-CH_2(H) \xrightarrow{Con\ H_2SO_4} CH_2=CH-CH=CH_2$$

Chemical properties of 1,3-Buta Diene =>

1) Addition Rxn

$$H_2C=CH-CH=CH_2 + X_2 \xrightarrow{CCl_4}$$

($X = Cl, Br$)



1) $CH_2(X)-CH(X)-CH=CH_2$

1,2 Product

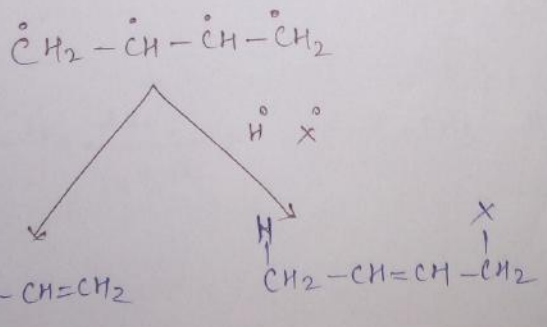
2) $CH_2(X)-CH=CH-CH_2(X)$

1,4 Product

ii) Rxn with (HX) :→

$$H_2C=CH-CH=CH_2 + H-X \xrightarrow{\Delta}$$

($X = Cl, Br$)



$CH_2(H)-CH(X)-CH=CH_2$

OR

$CH_2(X)-CH(H)-CH=CH_2$

4-Chlorobutene

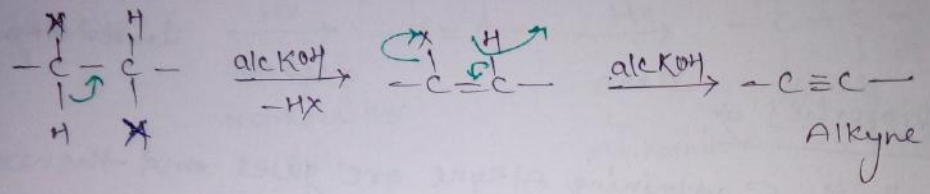
$CH_2(H)-CH=CH-CH_2(X)$

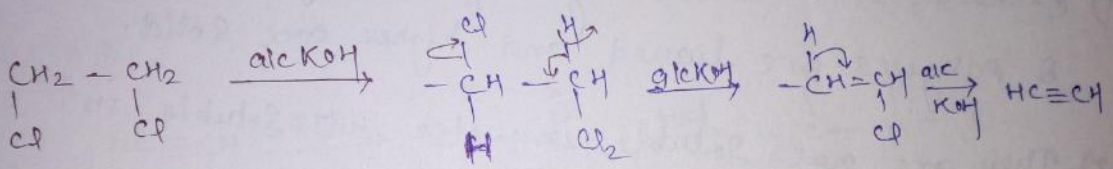
Alkynes ⇒

Alkynes are hydrocarbon in which c & c has triple (≡) Bond. The general formula of Alkyene C_nH_{2n-2}.

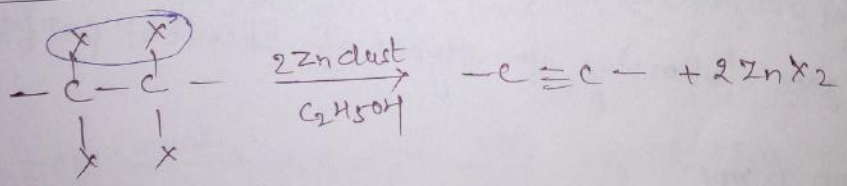
#Method of prepration of Alkyne ⇒

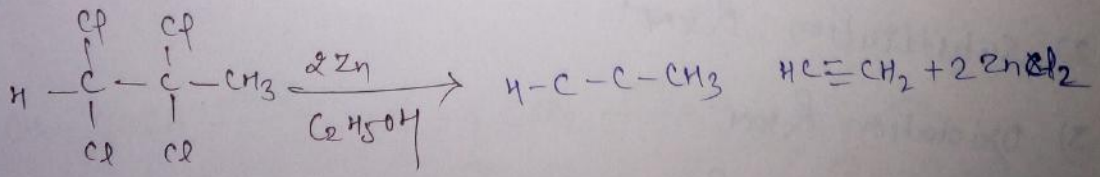
from 1,2-Di helides ⇒





(ii) From Tetra helide ⇒





⇒ From Lower Alkyen ⇒

$$2H-C\equiv C-H \xrightarrow{Na} 2HC\equiv C^{-}\,Na^{+} + H_2$$

$$HC\equiv C^{-}\,Na^{+} + X-R \longrightarrow HC\equiv C-R + NaX \quad \text{higher Alkyen}$$

$$H-C\equiv C-H + 2Na \longrightarrow Na^{+}\,{}^{-}C\equiv C^{-}\,Na^{+} + H_2\uparrow$$

$$R-X + Na^{+}\,{}^{-}C\equiv C^{-}\,Na^{+} + X-R \longrightarrow R-C\equiv C-R + 2NaX$$

lower Alkyne

Physical properties ⇒

1) C-no. 2, 3, 4 Containing Alkyne are gases and the next 8 Alkynes are liqued and higher are solid.

2) They are not soluble in water but soluble in orgenic solvent.

3) Chemical properties ⇒

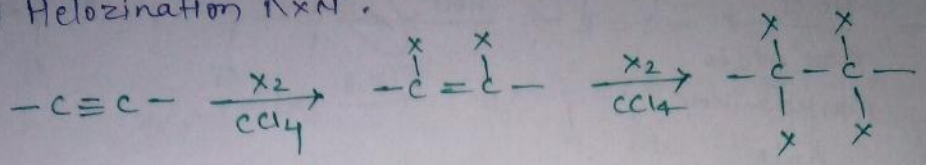
4) Alkyne give following 4 types of chemical property

1) Addition RxN
2) Substitution RxN
3) Oxidation RxN
4) Polymerization RxN

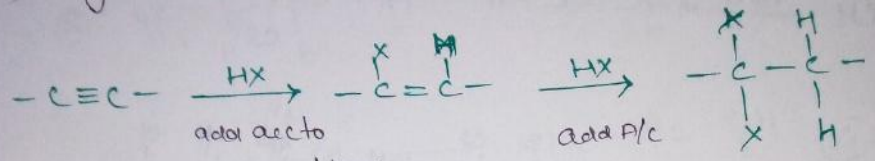
1) Addition Rxn ⇒

i) Hydrozination Rxn.

ii) Helozination Rxn.



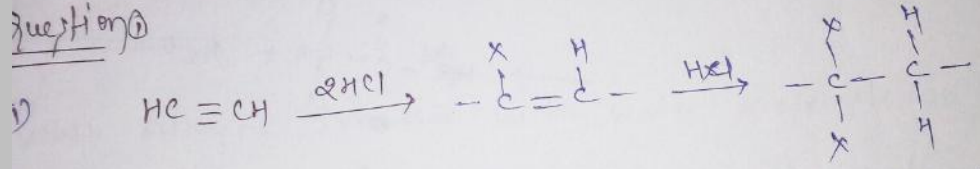
iii) Hydro helozination Rxn

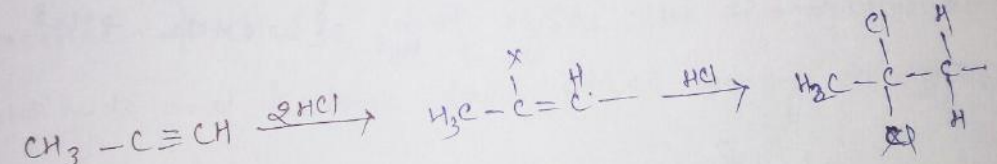


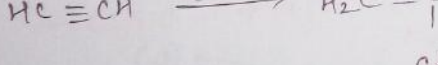
add acc to markovnikov Rule

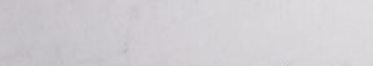
add P/c to markovnikov Rule.

Question ①

i) 

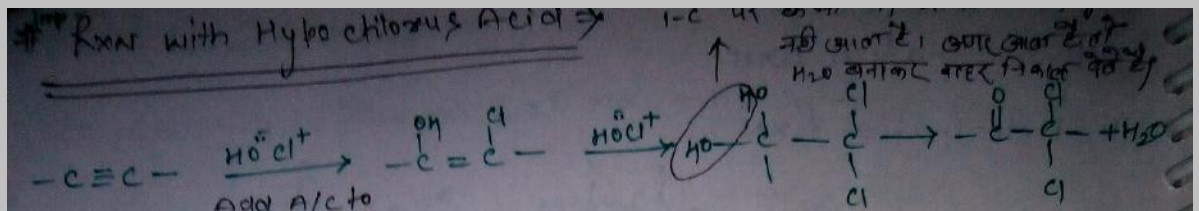


ii) 

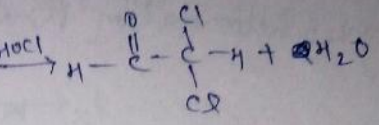


2)

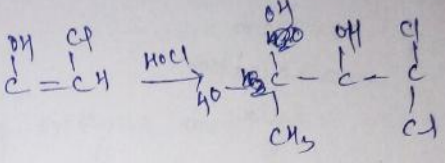
Rxn with Hypochlorous Acid ⇒

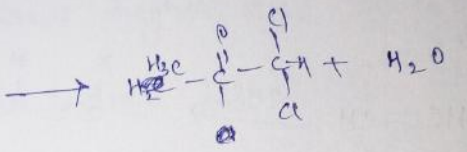


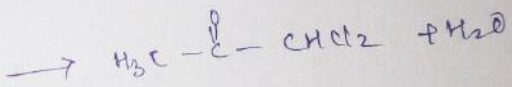
1) $HC \equiv CH \xrightarrow{HOCl} \xrightarrow{HOCl}$



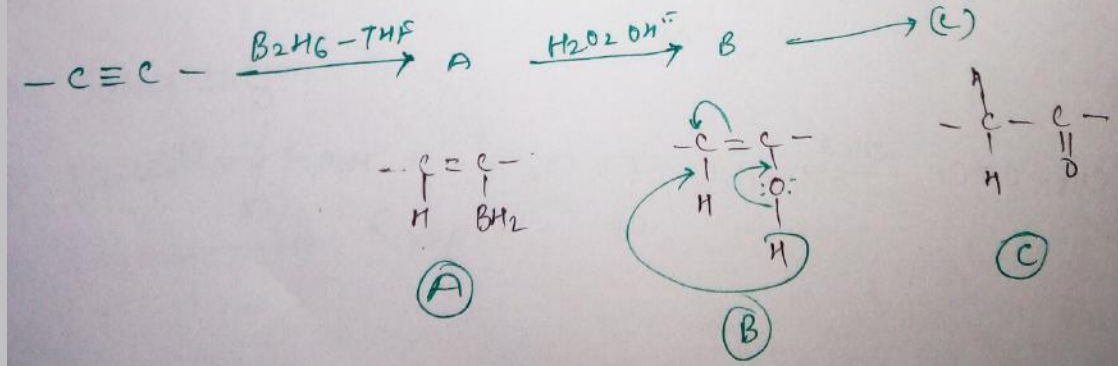
2) $H_3C-C\equiv CH \xrightarrow{HOCl}$



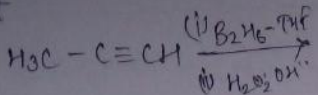


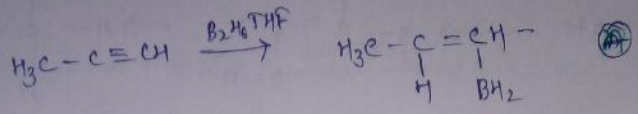


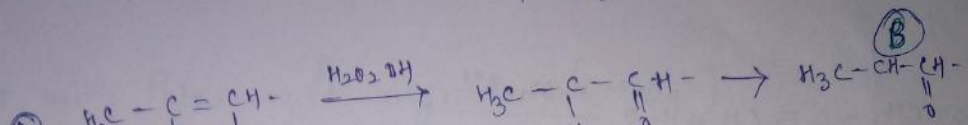
Hydro Boration Rxn ⇒

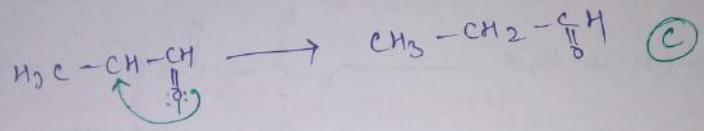


Question



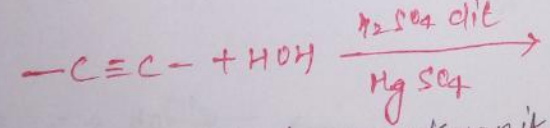




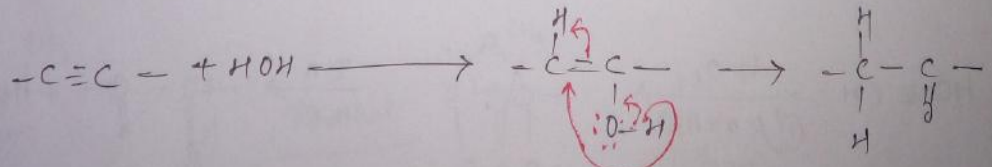


#Hydration ⇒

When Alkyne treated with water molecule in the presence of H_2SO_4 and $HgSO_4$ the formation of Aldihyde and ketone take place during the process of tautomerism –



Add HOH a/c to markovnikov rule



Question

$H_3C-C\equiv CH \xrightarrow[(ii)\ H_2O_2, OH^-]{(i)\ B_2H_6\text{-}THF}$

$H_3C-C\equiv CH \xrightarrow{B_2H_6\,THF}$ $H_3C-\underset{H}{\overset{|}{C}}=\underset{BH_2}{\overset{|}{CH}}-$ (A)

(A) $H_3C-\underset{H}{\overset{|}{C}}=\underset{BH_2}{\overset{|}{CH}}- \xrightarrow{H_2O_2,\,OH^-} H_3C-\underset{H}{\overset{|}{C}}-\underset{O}{\overset{\|}{CH}}- \longrightarrow H_3C-\underset{}{\overset{(B)}{CH}}-\underset{O}{\overset{\|}{CH}}-$

$H_3C-CH-\underset{O}{\overset{\|}{CH}} \longrightarrow CH_3-CH_2-\underset{O}{\overset{\|}{C}}H$ (C)

*Hydration ⇒

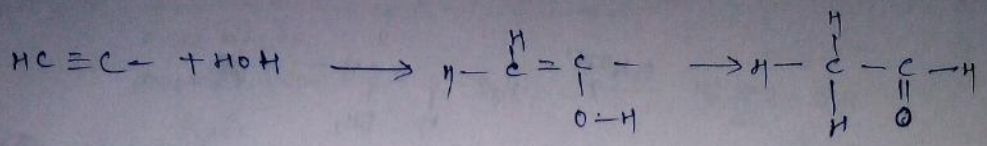
When Alkyne treated with water molecule in the presence of H_2SO_4 and $HgSO_4$ the formation of Aldihyde and ketone take place during the process of touto merism –

$-C\equiv C- + HOH \xrightarrow[HgSO_4]{H_2SO_4\ dil}$

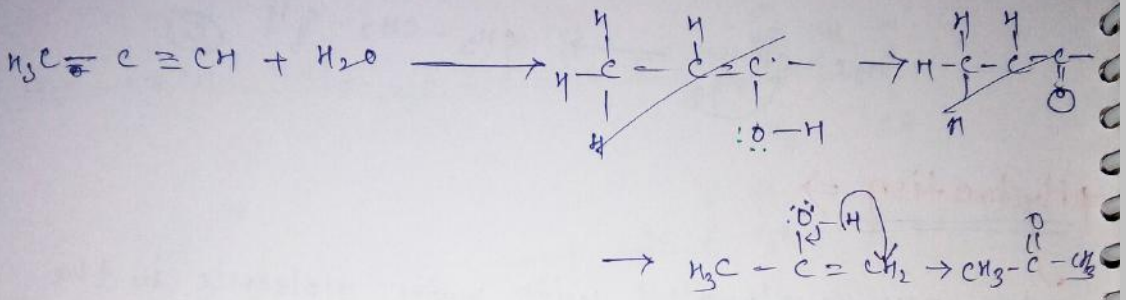
Add HOH a/c to markovnikov rule

$-C\equiv C- + HOH \longrightarrow -\underset{}{\overset{H}{C}}=\underset{:O-H}{\overset{|}{C}}- \longrightarrow -\underset{H}{\overset{H}{C}}-\underset{}{\overset{|}{C}}-$

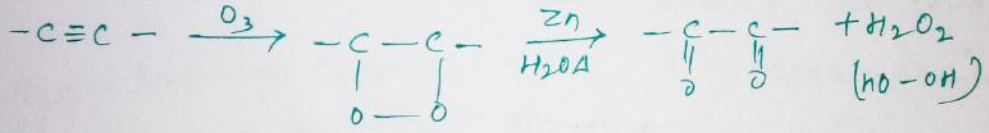
① $HC \equiv CH + H_2O \xrightarrow[Hg^{+2}]{H_2SO_4\ dil}$

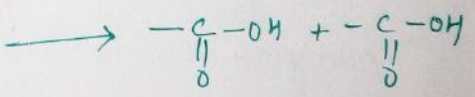


② $CH_3 - C \equiv CH + H_2O \xrightarrow[Hg^{+2}]{H_2SO_4\ dil}$

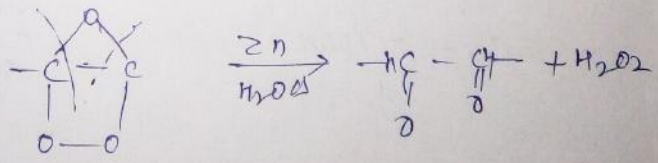


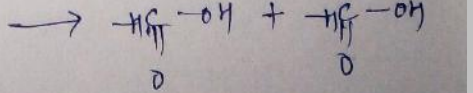
Ozonolysis of Alkyne ⇒ (Oxidation Rxn)





$HC \equiv CH \xrightarrow[(ii)\ Zn + H_2O]{(i)\ O_3}$





Rxn with Na metal — Na - Metal

$$2H-C\equiv C-H + 2Na \xrightarrow{Liq\ NH_3} 2H-C\equiv C^{\ominus}\ Na^{\oplus} + H_2\uparrow$$

$$2R-C\equiv C-H + 2Na \xrightarrow{Liq\ NH_3} 2R-C\equiv C^{\ominus}\ Na^{\oplus} + H_2\uparrow$$

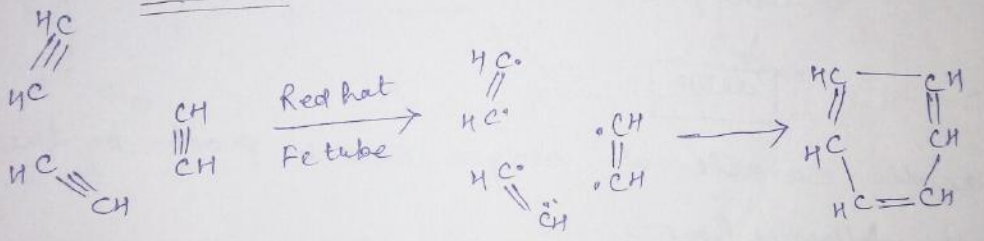
Rxn with Potesium per megnate → ($KMnO_4$)

$$R-C\equiv C-H \xrightarrow{KMnO_4} R-COOH + CO_2$$

$$R-C\equiv C-R \xrightarrow[OH^{\ominus}]{MnO_4} 2R-COOH$$

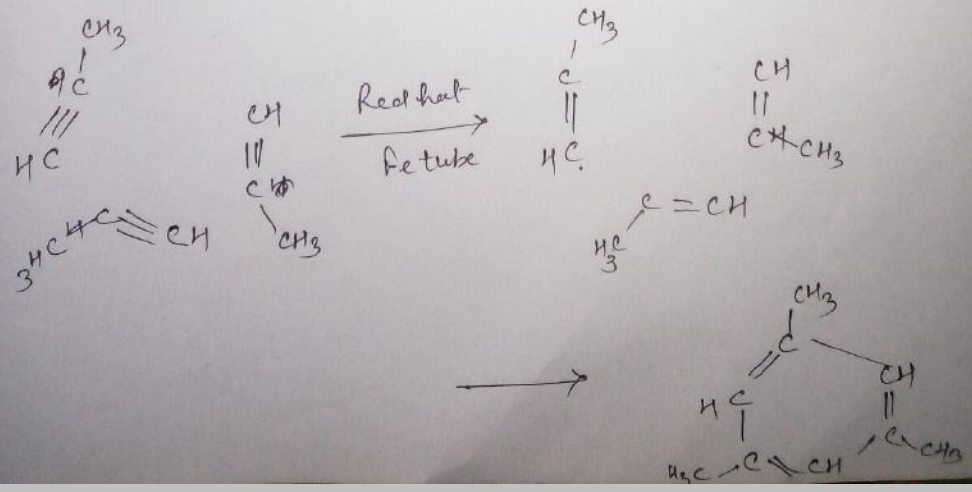
Polymerization Rxn of Alkyne →

$3HC\equiv CH$



Benzene.

Propine $3C\equiv CH$



#Acidity of Alkyne ⇒

$H-C \equiv C-H$

sp sp

↓

$S = 50\%$

↓

greater the s% character greater the negative

↓

C–H polar bond

↓

δ^- δ^+

C – H

↓

Can give $H^{\oplus}$ ion

↓

acidic

The acidic caracter of Alkyne can be proof by the help of following Rxn -

$$2H-C\equiv C-H + 2Na \xrightarrow{liq\ NH_3} 2H-C\equiv C^{\ominus}\ Na^{\oplus} + H_2\uparrow$$

Diels Alder Reaction ⇒

When 1,3 Buta Dine Combined with Alkene Drivative at high tempreture the formation of Cyclic Alkene will take ~~acted~~ place.