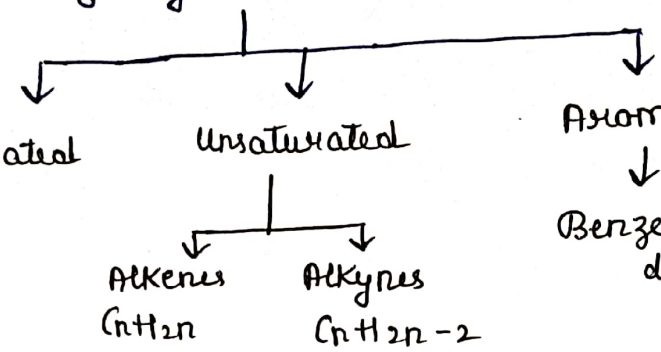
UNIT - 9 HYDROCARBON :-

→ Hydrocarbons are the compound of Hydrogen and Carbon only.

* Classification of Hydrocarbons



* ALKANES - They are the saturated open chain Hydrocarbons containing carbon - carbon single bond. C_nH_{2n+2}

eg:- fuel / Non reactive / saturated

↓

as they do not react with Acid / Base and other reagents k/a paraffins.

→ Natural Gas → CH_4 → (Ethane, Ethane)

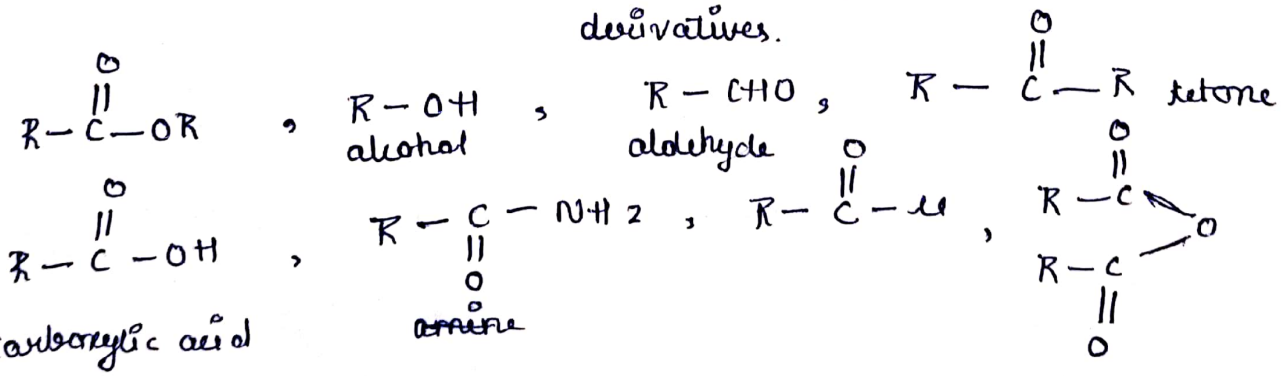
→ Petrol → octane ; Butane → LPG gas

→ Methane CH_4 k/a (Marsh gas) → found in Marshy area.

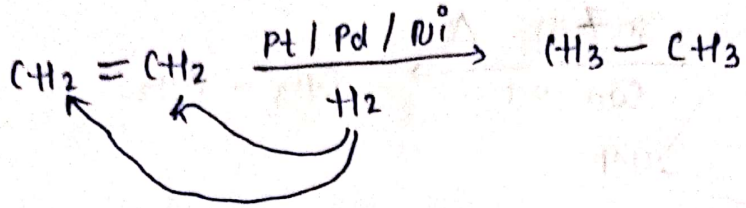
* Methods of Preparation of Alkanes :-

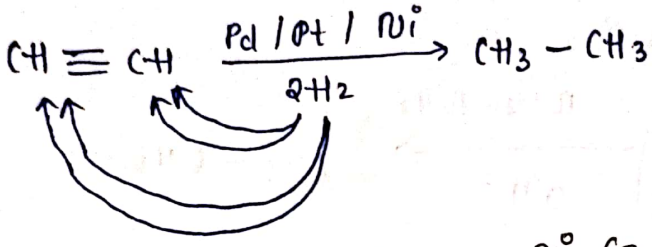
1. Reduction → i.1) Unsaturated Hydrocarbons, Alkenes & Alkynes.

i.2) Alcohol ; Aldehyde, Ketone, Acid & its derivatives.

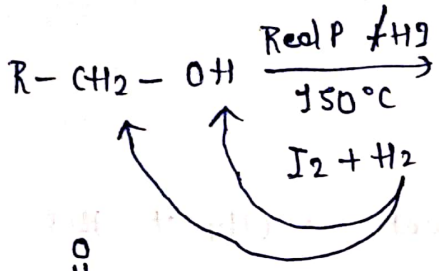


→ from unsaturated hydrocarbons - ALKENES & ALKYNES.

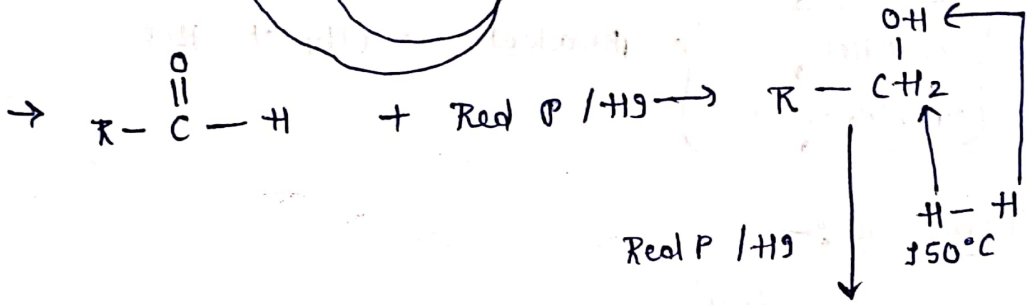


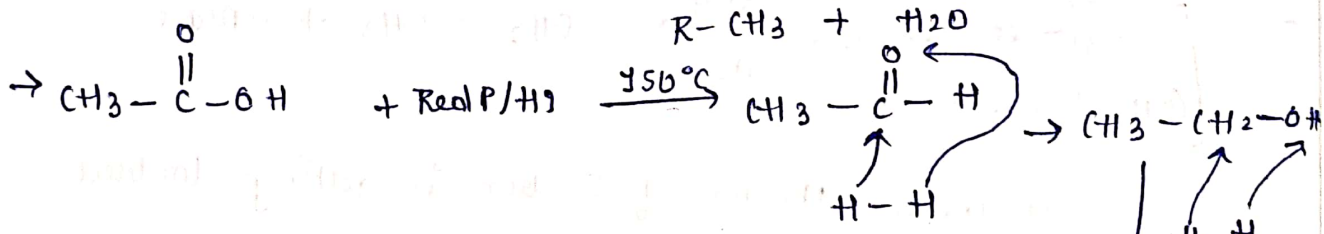


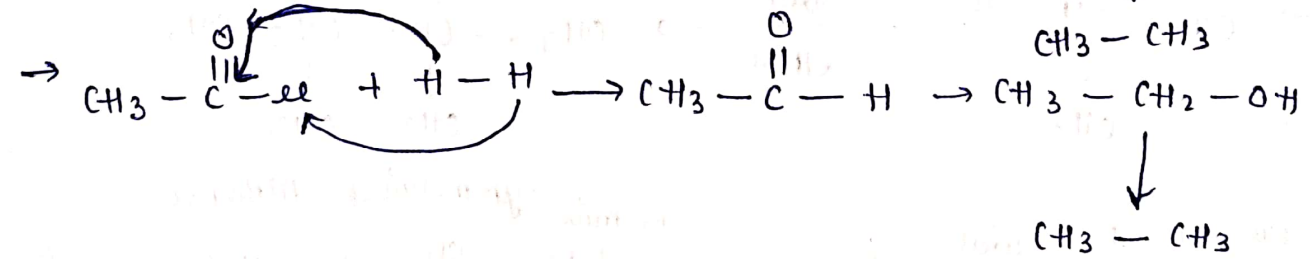
→ with the help of Raney Ni (Powder) → Al + Ni (3 : 1)

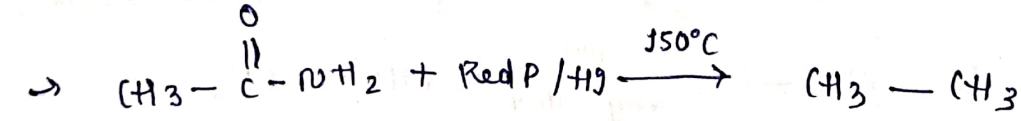


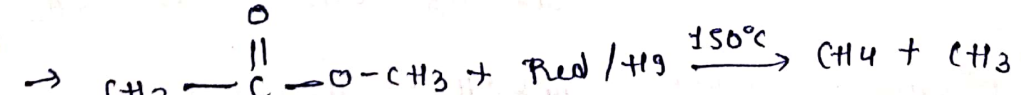
Red P → Red phosphorous



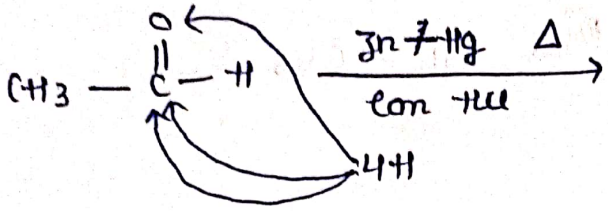




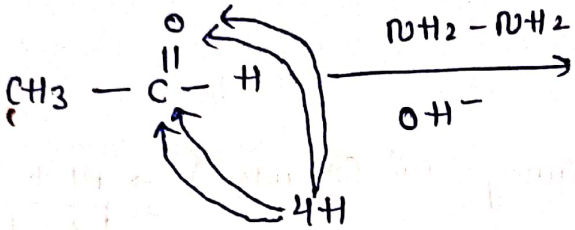




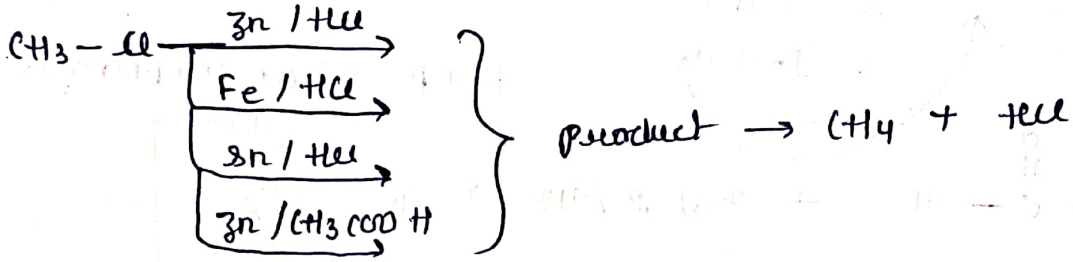
2) Clemmensen Reaction. ★



3) Wolf Kishner Reaction ★



4) from Halogens Reduction.



IN NCERT

5) WURTZ REACTION :-

→ $\boxed{\begin{matrix} CH_3 \\ (CH_3 \end{matrix} - Cl \quad \begin{matrix} \\ -Cl) \end{matrix}} + Na \xrightarrow[\text{ether}]{\text{dry}} CH_3 - CH_3 + 2NaCl$

It means the no. of carbon is getting doubled.

→ $CH_3 - \underset{\underset{CH_3}{|}}{CH} - Cl \xrightarrow[\text{ether}]{\text{dry}} CH_3 - \underset{\underset{CH_3}{|}}{CH} - \underset{\underset{CH_3}{|}}{CH} - CH_3$

Qu:- what will happen if we mix two different Halo alkanes ? symmetrical Alkanes

→ $CH_3 - Cl + Cl - CH_2 - CH_3 \xrightarrow[\text{dry ether}]{Na}$ i) $CH_3 - CH_3$

ii) $CH_3 - CH_2 - CH_2 - CH_3$

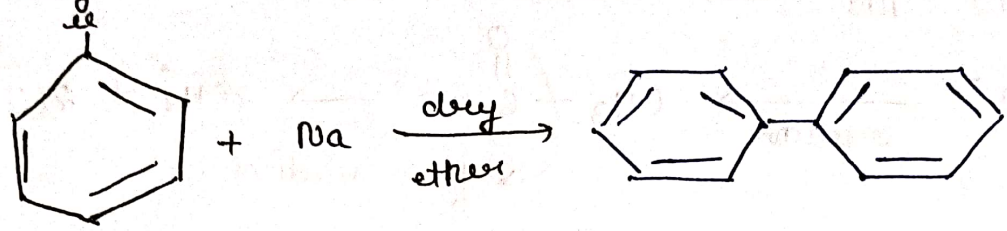
iii) $CH_3 - CH_2 - CH_3$

→ we get mixture of Alkanes which cannot be differentiate by distillation method.

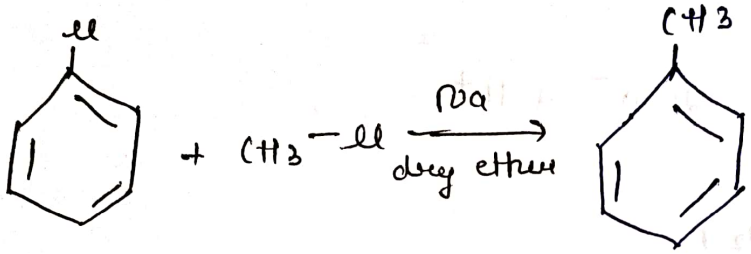
Imp Note :- Wurtz reaction is not good for unsymmetrical alkanes → only good for even no. alkanes

→ Methane cannot be prepared by Wurtz Rxn.

* Fittig Reaction -



* Wurtz & fittig Rxn -



3) From Carboxylic Acid – Alkane formation.

i) → Decarboxylation (निकालना) CO_2 का → Best method for making methane.

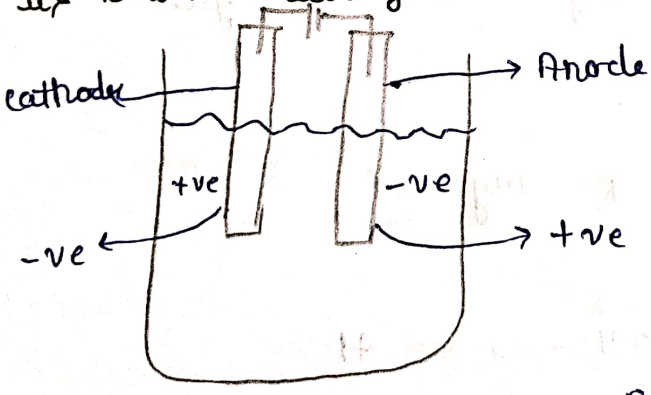
→ $CH_3COOH + NaOH \longrightarrow CH_3COO^- Na + H_2O$

sodium salt of Acid.

$$CH_3\boxed{COO^- Na^+ + NaOH} \xrightarrow[\Delta]{CaO} CH_4 + Na_2CO_3$$

Sodium ethanoate

ii) Kolbe's electrolytic method :-



I → double the carbon

II → (-2) in carbon

eg: 2C → 2×2 - 2

→ $CH_3 - CH_2 - COO^- Na^+ \xrightarrow{\text{Electrolysis}} CH_3 - CH_2 - CH_2 - CH_3 + 2CO_2 + 2NaOH + H_2$

Cathode → Hydrogen

Anode → Alkane.

Anode

$$CH_3 - COO^- \; Na^+ \longrightarrow CH_3COO^- + Na^+$$

$$2CH_3COO^- \xrightarrow[\text{remove}]{2e^-} CH_3 - \overset{O}{\overset{\|}{C}} - O^{\bullet} \longrightarrow 2CH_3^{\bullet} + 2CO_2$$

free radical.

$$2CH_3^{\bullet} \longrightarrow CH_3 - CH_3$$

Cathode

$$2H_2O \xrightarrow[\text{add}]{2e^-} 2OH^- + H^+$$

$$2H^+ \longrightarrow H_2 \uparrow$$

$$2OH^- + 2Na^+ \longrightarrow 2NaOH$$

→ Methane cannot be prepared by this ?

No double carbon present.

$$CH_3 - CH_2 - CH_2 - COO^- Na^+ \xrightarrow{\text{Electrolysis}} CH_3 - (CH_2)_4 - CH_3 + 2CO_2 + 2NaOH + H_2$$

→ NaOH from during the Rxn that's why PH always increases during kolbe's electrolysis.

4) From Grignard Reagent.

$$Mg + R - X \xrightarrow[\text{ether}]{\text{dry}} R - Mg - X$$

$$\underset{-\delta \; +\delta}{R - Mg - X} + \underset{+\delta \; -\delta}{H - OH} \longrightarrow R - H$$

Qw:- for making propane which grignard reagent is taken?

→ $CH_3-CH_2-\overset{-\delta}{CH_2}-\overset{+\delta}{Mg}-Br + \overset{+\delta}{H}-\overset{-\delta}{OH} \rightarrow \boxed{CH_3-CH_2-CH_2-H}$

→ $CH_3-Br + Mg \xrightarrow[\text{ether}]{\text{dry}} CH_3-Mg-Br \xrightarrow{H-OH}$ CH_4 (methane) + $Mg(OH)Br$

* PHYSICAL PROPERTIES :-

→ color → colorless

→ Taste → Tasteless

→ Smell → odourless → eg - Butane → LPG has smell added in it it is naturally odourless.

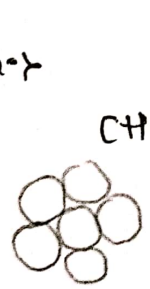
→ state → C_1-C_4 → gas C_5-C_{17} → liquid C_{18} - solid C_{17} & above - wax like solid

→ solubility → Non-polar water insoluble

→ Density $\propto$ Mw

→ M.P / B.P / F.b $\propto$ Mw $\propto \frac{1}{\text{Branching}}$

Qw:-



$CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-CH_3 < CH_3-\underset{\displaystyle CH_3}{\overset{|}{CH}}-CH_2-CH_3 < CH_3-CH_2-CH_2-CH_2-CH_3$

The small area of contact and therefore weak inter-molecular forces btw spherical molecules, which overcome at lower temperature

The van-der Waals forces increase with temp increase of the molecular size or the surface area of the molecule or the contact area of molecule.

Chemical properties

1) Substitution Rxn

Rxn with halogen

$CH_4 + Cl_2 \longrightarrow CH_3-Cl$
(excess)

$CH_4 + Cl_{2\,excess} \longrightarrow CCl_4$

$CH_4 + Cl_2 \longrightarrow CH_3Cl,\ CH_2Cl_2,\ CHCl_3,\ CCl_4,\ CH_3-CH_3,\ CH_3-CH_2Cl,$ ~~CH~~ $[Cl_2, H_2, +HCl]$

All possible products

$CH_4 + Cl_2 \longrightarrow$ Sunlight, UV, hν, heat fusion, 573-773K (heat)

2) Free radical substitution Rxn

3 step Rxn

1) Initiation

$Cl_2 \xrightarrow{h\nu} Cl-Cl \longrightarrow 2Cl^{\bullet}$

2) Propogation / Elongation

$2Cl^{\bullet} + CH_4 \longrightarrow CH_3^{\bullet} + H^{\bullet} + 2Cl^{\bullet}$

$CH_3^{\bullet} + 2Cl^{\bullet} \longrightarrow CH_2Cl^{\bullet} + H^{\bullet} + Cl^{\bullet}$

$CH_2Cl^{\bullet} + 2Cl^{\bullet} \longrightarrow CH_2Cl_2^{\bullet} + H^{\bullet} + Cl^{\bullet}$

$CH_2Cl_2^{\bullet} + 2Cl^{\bullet} \longrightarrow CCl_3^{\bullet} + H^{\bullet} + Cl^{\bullet}$

3) Termination

$CH_3^{\cdot} + {}^{\cdot}Cl \longrightarrow CH_3Cl$

$CH_2{}^{\cdot}Cl + {}^{\cdot}Cl \longrightarrow CHCl_2$

$CHCl_2 + {}^{\cdot}Cl \longrightarrow CHCl_3$

$CCl_3 + {}^{\cdot}Cl \longrightarrow CCl_4$

→ Important points

1) Reactivity order

$F_2 > Cl_2 > Br_2 > I_2$ reversible

2) Alkene

$3^\circ > 2^\circ > 1^\circ >$ methane

3) F_2 Rxn explosive ~~use can use must~~

F_2 in dark room

4) I_2 reversible that's why we use strong ox. agent

like HIO_3, HNO_3

$5HIO_3 + 5HI \quad \& \quad 2CH_4 + I_2 \rightleftharpoons CH_3I + HI$

$\hookrightarrow 3I_2 + 3H_2O$

II) Combusion → exothermic $\Delta H = -ve$

$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

$C_2H_6 + O_2 \longrightarrow 2CO_2 + 3H_2O$

$C_nH_{2n+2} + \left(\frac{3n+1}{2}\right)O_2 \longrightarrow nCO_2 + (n+1)H_2O$

→ Incomplete combusion.

$CH_4 + O_2 \xrightarrow[\text{com.}]{\text{incomplete}} C_{(s)} + 2H_2O$

* Controlled oxidation

Alkane $\xrightarrow[[O]]{\text{oxi}}$ Alcohol $\xrightarrow[[O]]{\text{oxi}}$ Aldehyde/ketone $\xrightarrow{[O]}$ Acid $\xrightarrow{[O]}$ $CO_2 + H_2O$

→ Cu / 573K / 300 atm → 1 times oxidation

→ CrO_3 / Mo_2O_3 Δ → 2 times oxidation

→ $KMnO_4$ / H^+ → 3 oxidation

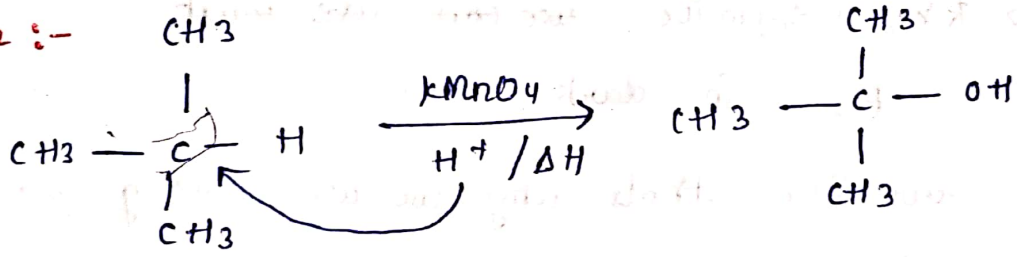
$(CH_3COO)_2Mn$

$$CH_4 \xrightarrow[300\ atm]{Cu\ 573K} CH_3-OH$$

$$CH_3-CH_3 \xrightarrow[300\ atm]{Mo_2O_3} CH_3-CHO$$

$$CH_3-CH_3 \xrightarrow[H^+/\Delta]{(CH_3COO)_2Mn} CH_3-COOH$$

exception :-



4) Isomerisation → carborcation

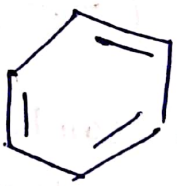
$$CH_3-CH_2-CH_2-CH_2-CH_3 \xrightarrow[HCl]{Anh.\ AlCl_3} CH_3-\underset{CH_3}{\overset{}{CH}}-CH_2-CH_3$$

$$\rightarrow CH_3-\underset{CH_3}{\overset{CH_3}{C}}-CH_3 \quad \text{major}$$

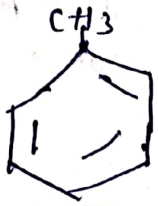
5) Aromatization / Deformation / reforming

→ Dehydrogenation

$$CH_3-(CH_2)_4-CH_3 \xrightarrow[10-20\ atm]{773K}$$



$$CH_3-(CH_2)_5-CH_3 \longrightarrow$$



6) Rxn with steam.

$$CH_4 + H_2O \xrightarrow[\Delta]{1273K} CO + 3H_2$$

industrial gas

7) Cracking / Pyrolysis (High calorific value)

$C_6H_{14} \xrightarrow{773K}$ $C_3H_6 + C_2H_4 + 2H_2$; $C_2H_4 + C_4H_{10}$; $C_2H_4 + C_4H_8 + H_2$

$C_{12}H_{26} \xrightarrow{973k} C_7H_{16} + C_5H_{10}$ + other product

* **ALKENES**

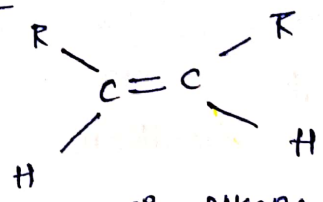
C_nH_{2n} → general formula

→ first member → C_2H_4 → 2C

olefins.

* **method of preparation :-**

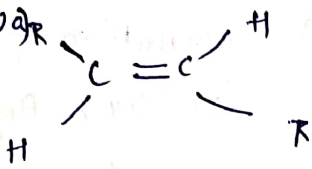
1) from Alkynes Lindlar catalyst

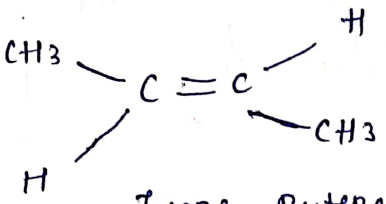
eg) $R-C\equiv C-R + H_2 \xrightarrow{Pd/C}$ 

Alkyne

cis Alkene

→ Birch Rxn

eg) $R-C\equiv C-R \xrightarrow[Na]{Li\ NH_3/Na}$ 

eg) $R-C\equiv C-CH_3 \xrightarrow[Na]{Li\ NH_3/Na}$ 

trans Butene.

2) from Haloalkanes – dehydrohalogenation

$CH_3-CH_2-CH-CH_3 \xrightarrow{Alc.\ KOH}$ $CH_3-CH=CH-CH_3$ (2 branch major)

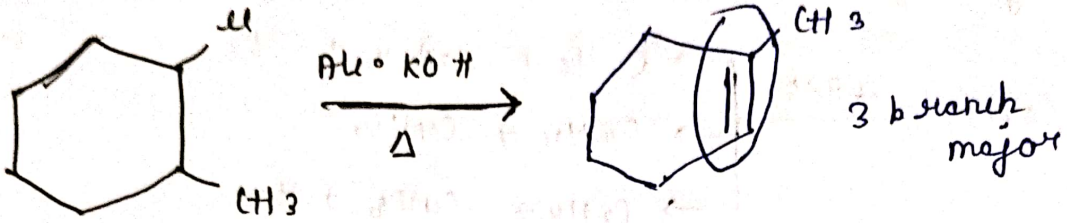
Setzeff Rule

$CH_3-CH_2-CH=CH_2$ (1 branch)

→ α, β elimination

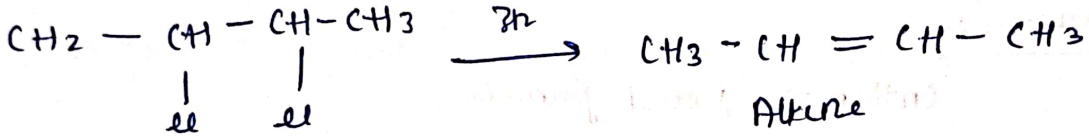
→ Alc. KOH → E-1 mechanism

→ setzeff Rule

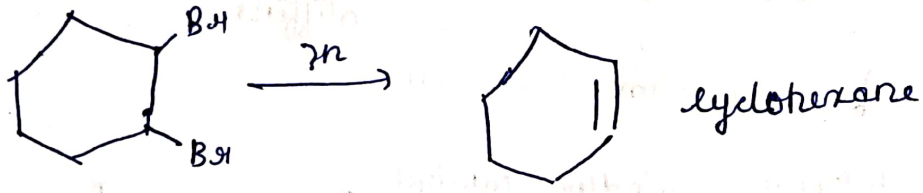


3 branch major

→ Rxn with Zn (vicinal Dihalide)



Alkene



cyclohexene

→ reactivity order

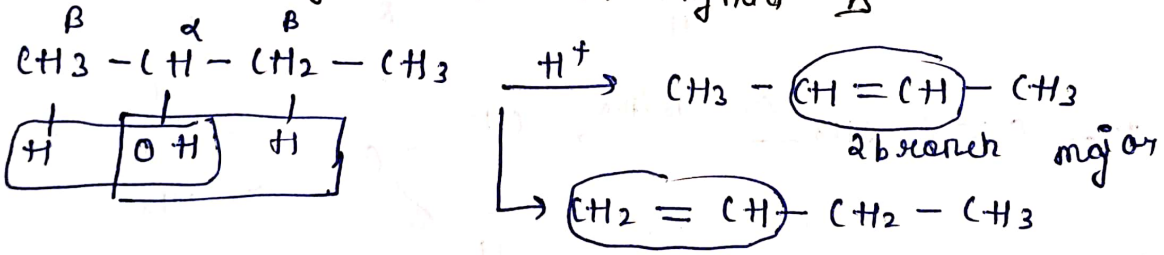
haloalkanes — R-I > R-Br > R-Cl > R-F

with respect to R

3° > 2° > 1°

3) Dehydration — α, β elimination, zetzeff rule, E1

→ reagent H_2SO_4 / Any Acid Δ



* Physical properties

1) Colourless
2) Tasteless
3) Odourless
4) State → $C_2 - C_3$ → gas

$C_4 - C_{14}$ → liquid

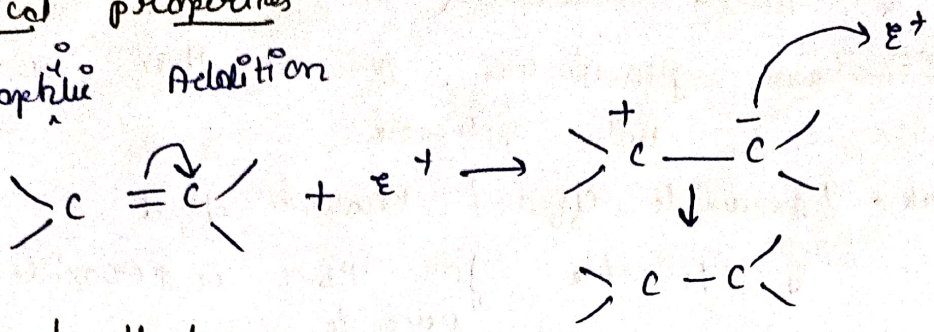
C_{15} & above are solid

→ polar → Insoluble in H_2O

→ BP / MP / FP α Mw α $\frac{1}{\text{branch}}$

* Chemical properties

→ Electrophilic Addition

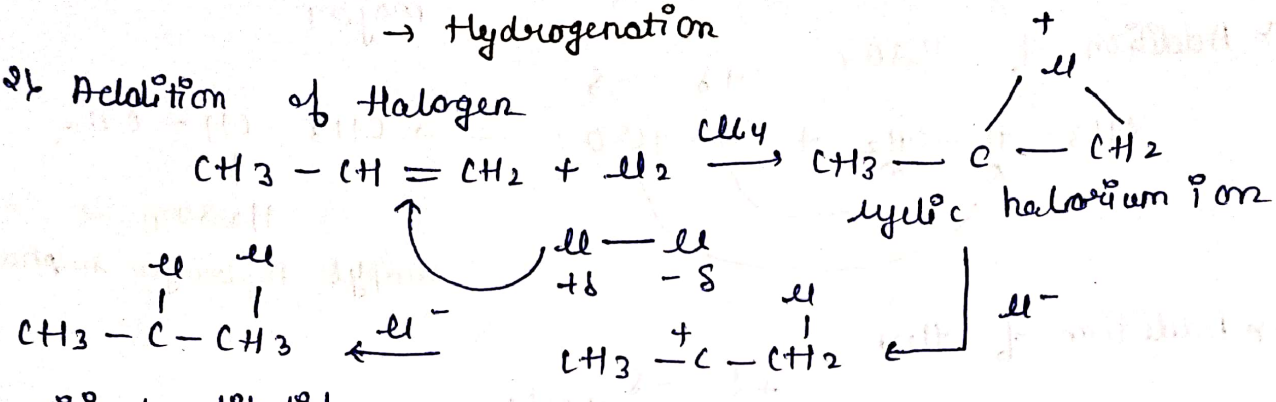


1) Addition of Hydrogen

$$CH_3-CH=CH \xrightarrow[H_2]{Pt/Pd/Ni} CH_3-CH_2-CH_3$$

→ Hydrogenation

2) Addition of Halogen



eg) $CH_2=CH_2 + Br_2 \xrightarrow{CCl_4}$ $CH_2(Br)-CH_2Br$

reddish orange → colourless

→ Test of unsaturity.

eg 2) $CH_3-C(CH_3)=CH_2 + HCl \longrightarrow CH_3-HC(CH_3)-CH_2Cl$ (↳ 1°CC)

intermediate → carbocation

$CH_3-C^+(CH_3)-CH_3$ (↳ 3°CC)

Markovnikov rule

→ Hydrohalogenation addition

→ HI > HBr > HCl > HF

$CH_3-C(Cl)(CH_3)-CH_3$ major

exp. of mark. addition ($-NO_2$, $-CCl_3$, $-CN$, $-CHO$)
any e⁻ withdrawl group are present then mark. addn
not applicable

* Antimark. / peroxide effect / kharash effect.
only applicable for HBr & peroxide

$$CH_3-CH=CH_2 + HBr \xrightarrow{\text{peroxide}} CH_3-\underset{Br}{CH}-CH_3$$

→ Intermediate CFR

$$\rightarrow CH_3-CH_2-CH_2-Br$$

major

4) Addition of H_2SO_4

$$CH_3-CH=CH_2 + H-HSO_4 \xrightarrow{\text{mark.}} CH_3-\underset{H_2SO_4}{CH}-CH_3$$

propyl hydrogen sulphate

5) Addition of H_2O

$$CH_3-CH=CH_2 + H-OH \xrightarrow{\text{mark.}} CH_3-\underset{OH}{CH}-CH_3$$

(major)

Hg^{+2}, H_2O

$$\rightarrow CH_3-CH_2-CH_2-OH$$

(minor)

6) Combustion

$$C_2H_4 + 3O_2 \longrightarrow 2CO_2 + 2H_2O$$

$$C_nH_{2n} + \frac{3n}{2}O_2 \rightarrow nCO_2 + nH_2O$$

7) oxidation

$$CH_3-CH=CH_2 + H-OH \xrightarrow[273\,K]{kmnO_4\ dil} CH_3-\underset{OH}{CH}-\underset{OH}{CH_2}$$

blue violet

[O]

$HO-OH$ peroxide

propan-1,2-diol

(Baeyers) Reagent

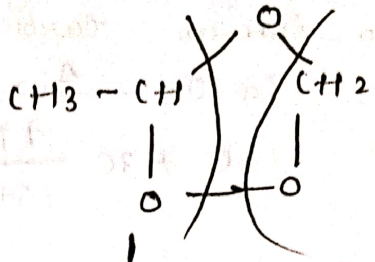
→ Test of unsaturation

8) Ozonolysis → Aldehyde / ketone

Imp

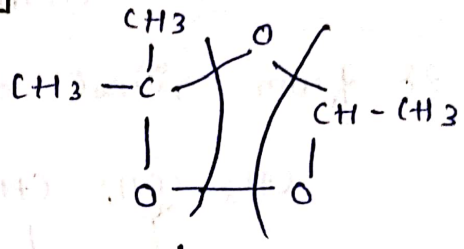
$O_3 \xrightarrow{Zn/H_2O}$

eg) $CH_3 - CH = CH_2 + O_3 \xrightarrow{Zn/H_2O}$



$HCHO + CH_3 - CHO$

eg) $CH_3 - \overset{CH_3}{\underset{|}{C}} = CH - CH_3 + O_3 \xrightarrow{Zn/H_2O}$



$CH_3 - \overset{O}{\overset{\|}{C}} - CH_3 + CH_3 - CHO$

Acetone — Acetaldehyde

9) polymerisation

$n\,CH_2 = CH_2 \xrightarrow[\text{catalyst}]{\text{Ziegler}} (CH_2 - CH_2)_n$

ethene — polyethene

high P, high Temp

→ sequence bottle, refrigerator dishes, toys, pipes, radio TV cabinets

$n\,CH_3 - CH = CH_2 \xrightarrow[\text{high P}]{\text{high T}} \left(\overset{CH_3}{\underset{|}{CH}} - CH_2\right)_n$

propene

→ milk covrates, plastic baskets, moulded articles

* ALKYNES

general formula → C_2H_{2n-2}

1st member → C_2H_2

Ripper fruit ← Acetylene gas

$CaC_2 + 2H_2O \longrightarrow Ca(OH)_2 + C_2H_2$

* Preparation

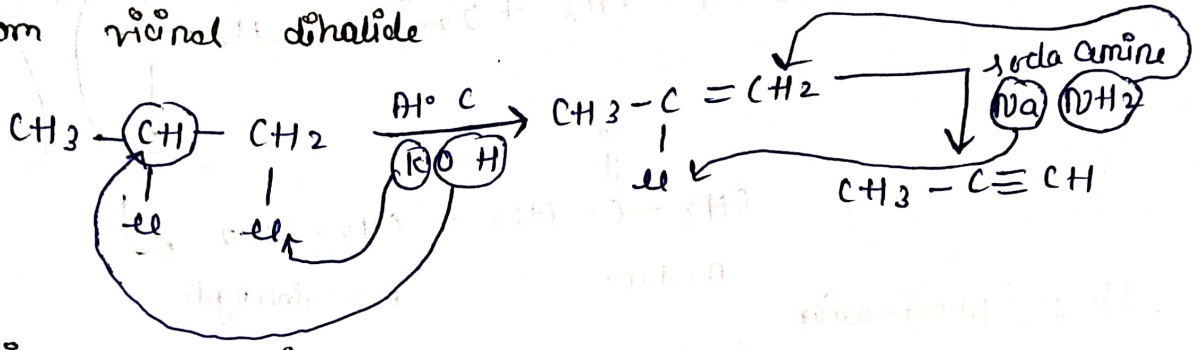
1) from calcium carbide

$CaCO_3 \xrightarrow{\Delta} CaO + CO_2$

$CaO + 3C \xrightarrow[1573K]{\uparrow Temp} CaC_2 + CO$

$CaC_2 + 2H_2O \longrightarrow Ca(OH)_2 + C_2H_5$

2) from vicinal dihalide



* Physical Properties

1) $C_1 \rightarrow C_3$ → Gas , $C_4 - C_8$ → liq , C_9 & above → solid
2) Tasteless
3) Odourless
4) Colourless
5) Density & Mw
6) solubility → non-polar
Benzene, CCl_4 soluble
7) MP / BP / FP & Mw & $\frac{1}{\text{branching}}$

* Chemical properties

Acidic effect → Alkyne are Acidic in nature

Due to the sp hy C

$CH_3 - CH_3$ — sp3 — EN = H

$CH_2 = CH_2$ — sp2 — EN = N

$CH \equiv CH$ — sp — EN = O

EN ↑

→ $CH_3 - C \equiv CH \longrightarrow CH_3 - C \equiv C^- + H^+$

Acid — Conj. base

Alkynes are Acidic in Nature

Acidity & $\frac{-I}{+I}$ & $\frac{-M}{+M}$

→ $CH_3-CH_3 < CH_2=CH_2 < CH \equiv CH$ Highly Acidic

→ $CH_3-C\equiv C-CH_3 < CH_3-C\equiv CH < CH\equiv CH$

0 Acidic hydrogen 2 Acidic hyd

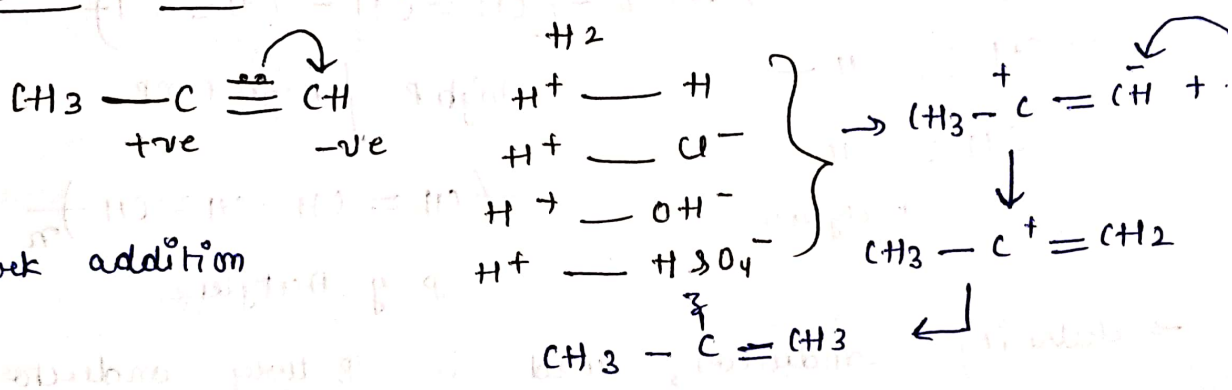
* WHAT Is Acid :-

Acid + Metal → salt + H_2

Acid + MOH → Salt + H_2O

Acid + MCO_3 → salt + H_2O + CO_2

2) Adolition Rxn

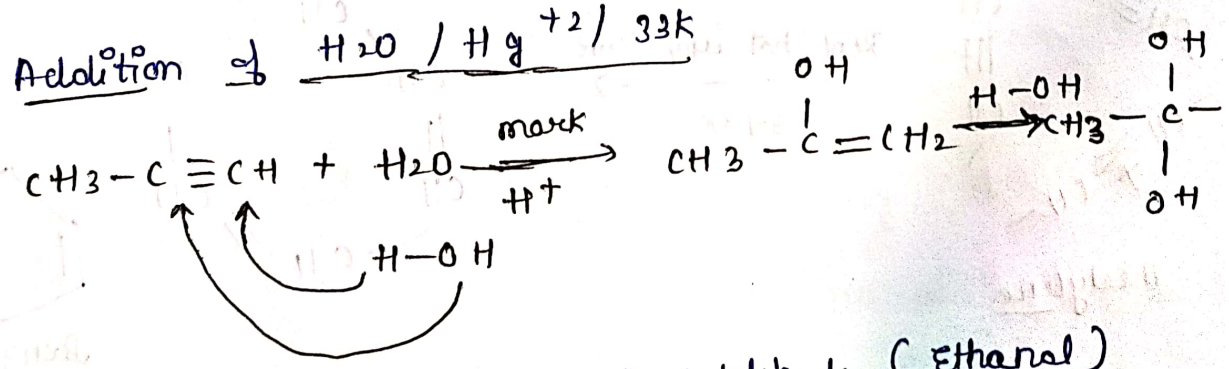


→ mark addition

eg 1) Adolition of Hydrogen

$CH\equiv CH + H_2 \xrightarrow[\Delta]{Pd/Pt/Ni} CH_2=CH_2 + H_2 \xrightarrow[\Delta]{Pt/Ni/Pd} CH_3-CH$

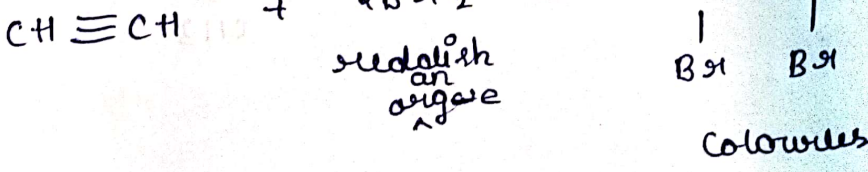
eg 2) Adolition of H_2O / Hg^{+2} / 33K



2 C → Adolition of H_2O → Acetalolehyde (Ethanal)

3C → greater C → Adolition of H_2O → Ketone

3) Test of unsaturity



4) Addition of HBr (Mark - HBr / peroxides (Anti mark))

$CH_3-C\equiv CH + HBr \longrightarrow CH_3-\underset{Br}{\overset{|}{C}}=CH_2$

mark

$CH_3-\underset{Br}{\overset{Br}{\overset{|}{\underset{|}{C}}}}-CH_3$

gem di halide

5) Polymerisation

5.1) linear polymerisation

$n(CH\equiv CH) \longrightarrow \text{-}(CH=CH-CH=CH)\text{-}_n$

$-CH\equiv CH-$

$-CH\equiv CH-$

Acetylene

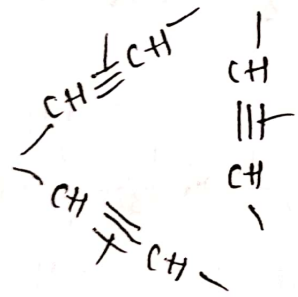
high P | high Temp

$\text{-}(CH=CH-CH=CH)\text{-}_n$

poly Acetylene

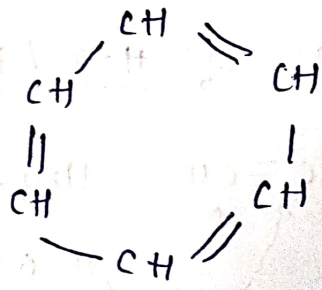
→ Electricity conductors, used in Battery conductors film

5.2) cyclic polymerisation



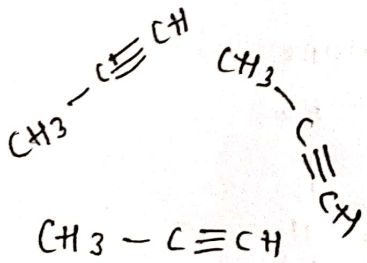
Red / hot iron tube

873K



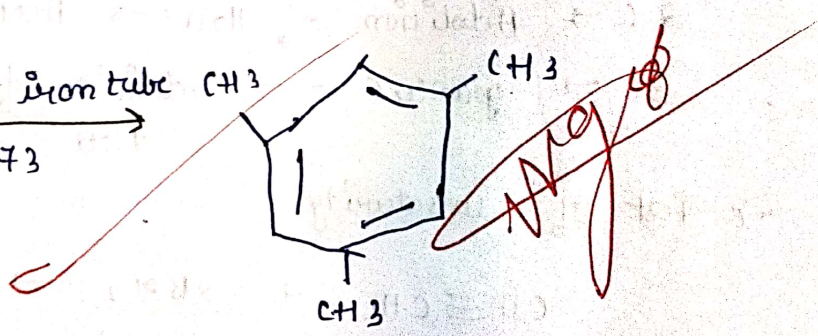
Acetylene

Benzene



red hot iron tube

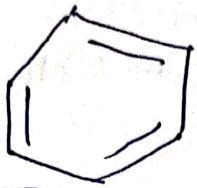
873



AROMATICITY

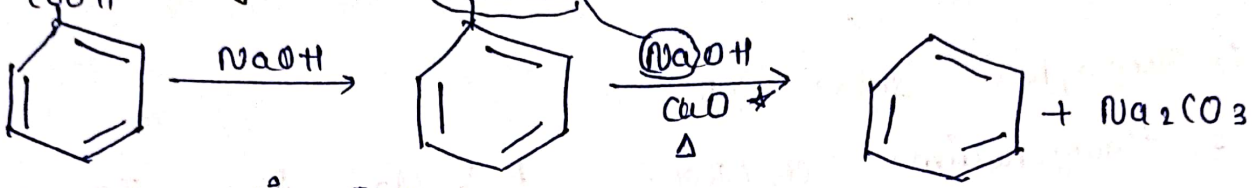
1. Cyclic
2. Planar
3. Resonic
4. Hückles Rule $(4n+2)\ \pi e^-$

→ sp²
→ highly e⁻ dense
→ hyb → sp²
→ C_6H_6



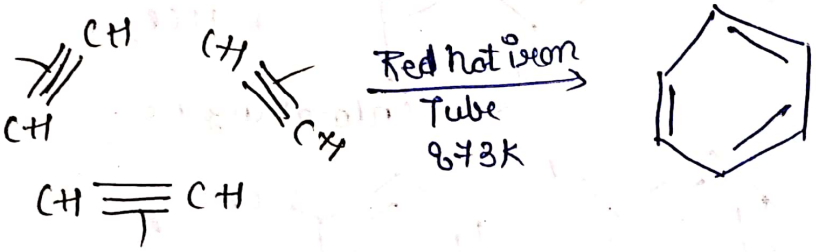
Method of Preparation

1. from carboxylic Acid

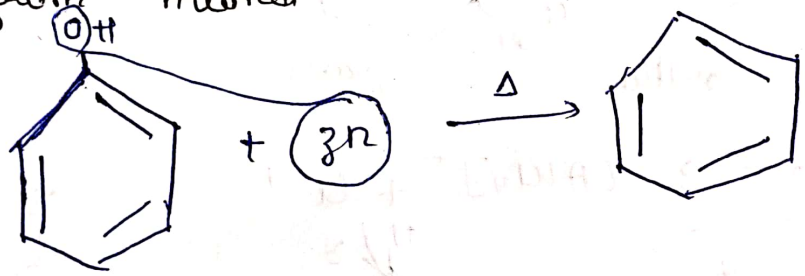


→ Decarboxylation Rxn

2. Cyclic Polymerisation.



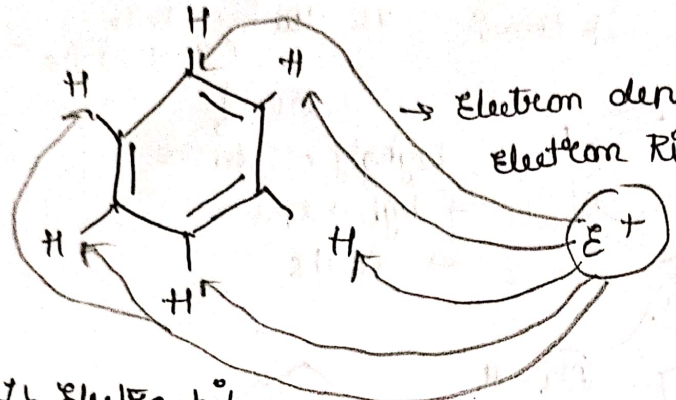
3. from Alcohol



* Physical Properties :-

- → liquid
- → colorless
- → characteristic aroma (odour)
- → Tasteless (Bitter in taste)
- → BP / MP / FP high
- → non-polar
- → It is good conductor heat
- → Density high
- → Burn with sooty flame

* Chemical Properties

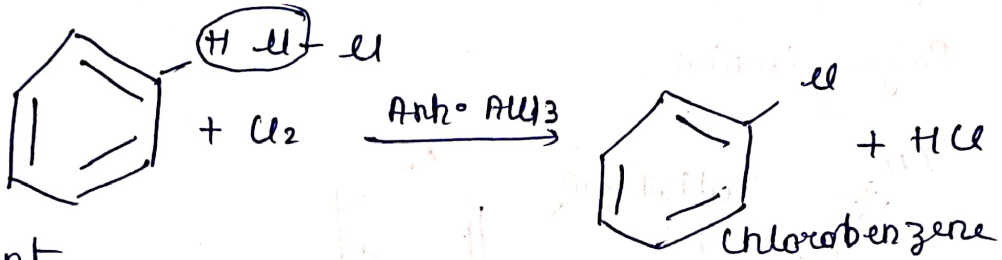


→ Electron dense
Electron Rich. specie

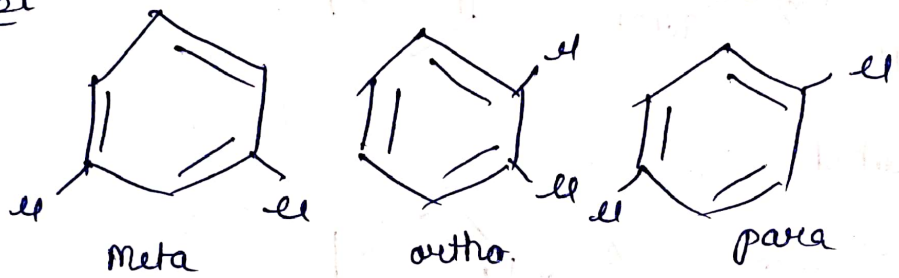
E +

1) Electrophilic Subs° RXN

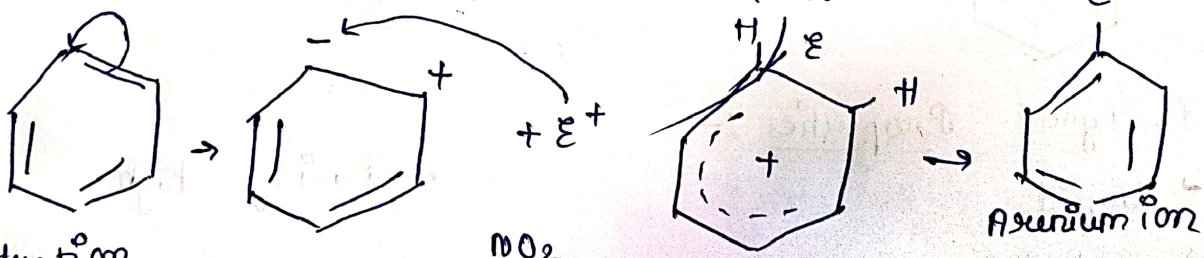
1) Halogenation Cl_2/BrH_2 $F_2 > Cl_2 > BrH_2 > I_2$



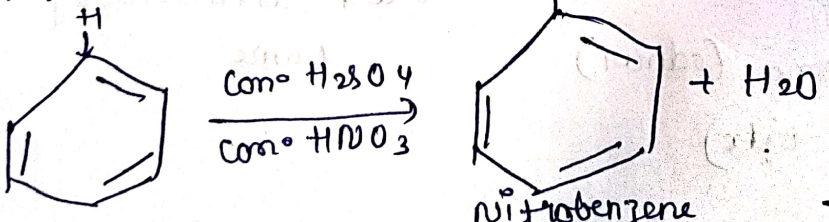
Concept



→ Anh° $AlCl_3 + Cl_2 \longrightarrow [AlCl_4]^- + Cl^+$



2) Nitration

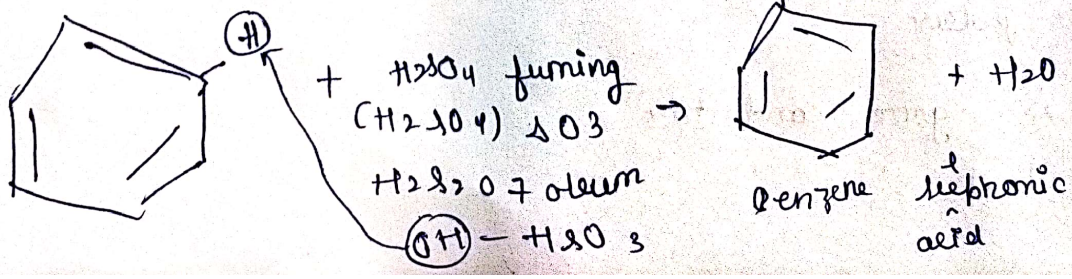


→ $E^+ \rightarrow NO_2^+$

$HO \xrightarrow{-H_2O} NO_2 \rightarrow NO_2^+$

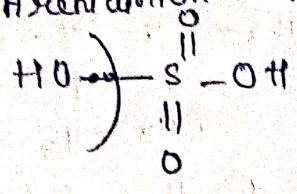
→ Intermediate Arenium ion

3) Sulphonation



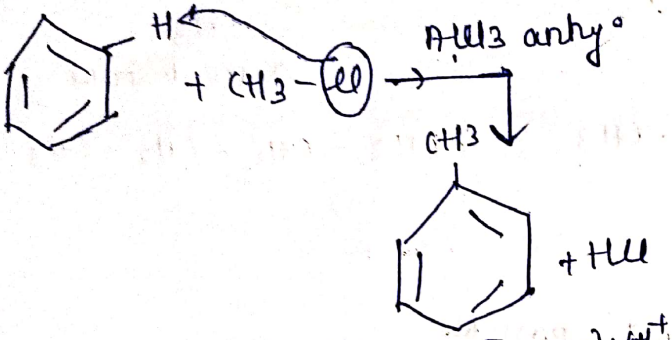
$E^+ \rightarrow HSO_3^+$

→ Arenium ion → intm°



4) Friedel Craft Anh° AlCl3

(A) F.C Alkylation

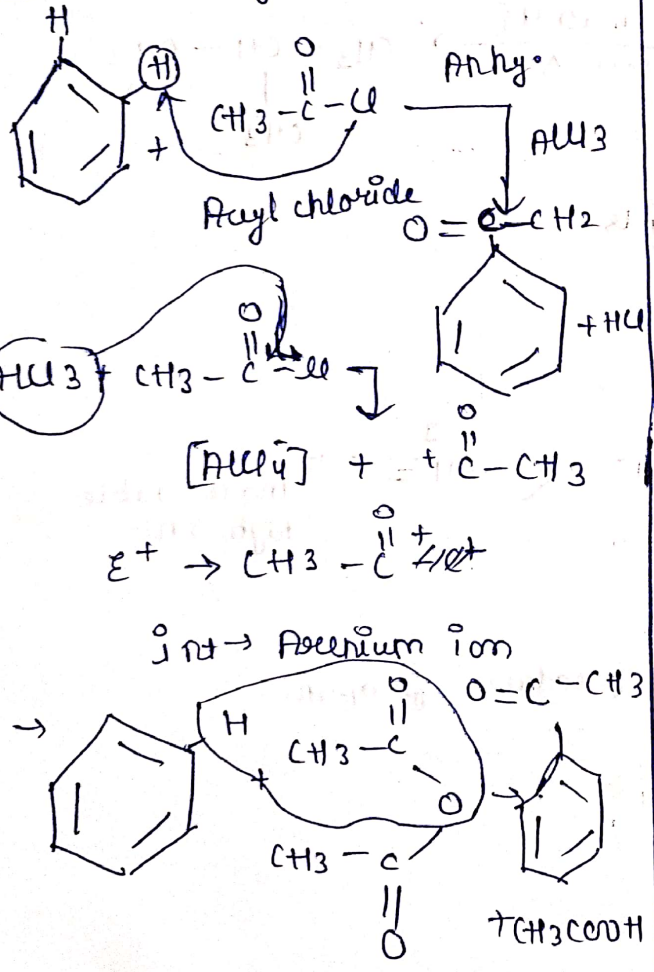


$CH_3-Cl + Anh\,AlCl_3 \rightarrow [AlCl_4^-] + CH_3^+$

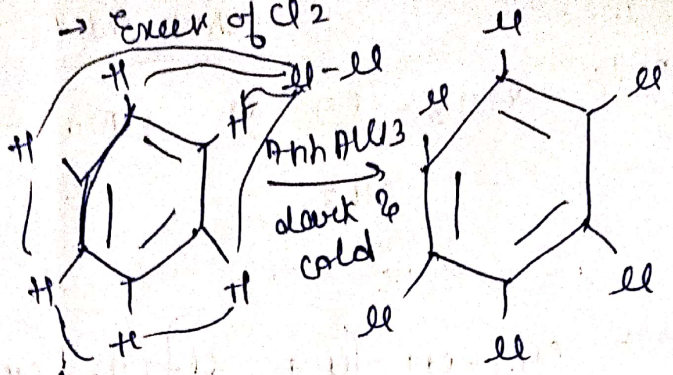
$E^+ \rightarrow CH_3^+$ $[AlCl_4^-] + H^+ \rightarrow AlCl_3 + HCl$

intermediate – Arenium ion

(B) F.C Acylation Rxn



→ Excess of Cl2



C_6H_6

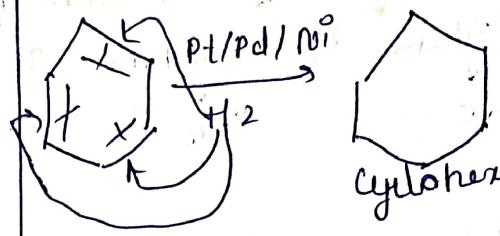
Hexa chloro benzene

2) combination Rxn

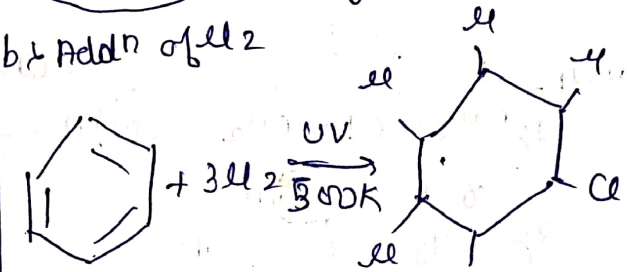
$C_6H_6 + \frac{15}{2}O_2 \rightarrow 6CO_2 + 3H_2O$

2) Addition Rxn

a) Addition of Hydrogen

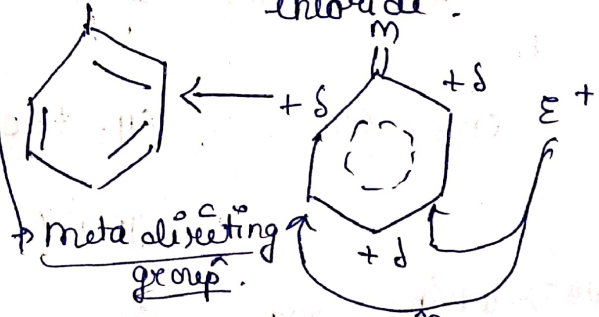


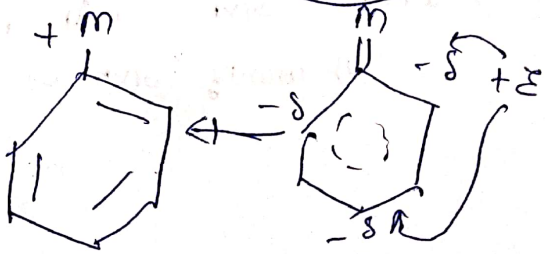
b) Addn of Cl2



Grammaxane $C_6H_6Cl_6$

BHC powder Benzene Hexa chloride.





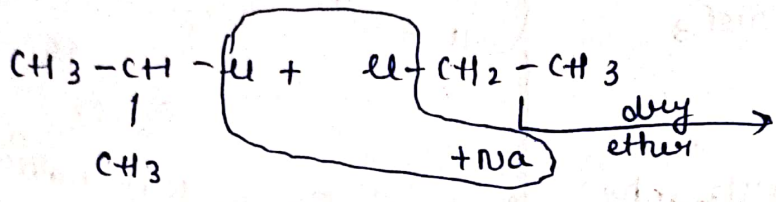
→ ortho, para directing group

DPP-01

Ans 1) $2CH_3-\underset{\underset{CH_3}{|}}{CH}-Cl + Na \xrightarrow{\text{dry ether}} \overset{1}{CH_3}-\overset{2}{\underset{\underset{CH_3}{|}}{CH}}-\overset{3}{\underset{\underset{CH_3}{|}}{CH}}-\overset{4}{CH_3}$

2,3 dimethyl butane

Ans 2)



1) $CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_3$

2-m butane

2) $CH_3-\underset{\underset{CH_3}{|}}{CH}-\underset{\underset{CH_3}{|}}{CH}-CH_3$

3) $CH_3-CH_2-CH_2-CH_3$

Ans 3) odd no° of carbon not possible

1) Ethane → 2C

2) Butane → 4C

3) Isobutane $CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_3$ ← not possible

4) Hexane → 6C

Ans 4)

1) $CH_3-CH-CH_2-\underset{CO_2}{COOH} \xrightarrow[\text{CaO } \Delta]{NaOH} CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_3$

2) $CH_3-\underset{\underset{CH_3}{|}}{\overset{CO_2}{\overset{\curvearrowleft}{C}}}-CH_3$ (COOH)

2 Acids

Ans 5) carbanion $\alpha \frac{-I}{+I}$

$CH_3-CH_2^- < CH_2=CH^- < \overset{-I}{CH\equiv C^-}$ more stable high EN

III > II > I

Ans 6) which rxn will not produce propane.

1) wurtz rxn ✓

Ans 7) $CH_3-CH(CH_3)-COOH \xrightarrow{CO_2} CH_3-CH(CH_3)-CH_3$ propane

Ans 8) $R-X + Mg \longrightarrow R-Mg-X$

$R^{-\delta}-Mg^{+\delta}-X$ with $R-NH-H$, $R-O^-H^+$, NH_2-H → $R-H$

all of the Above.

Ans 9) does not give alkane with $R-Mg-X$

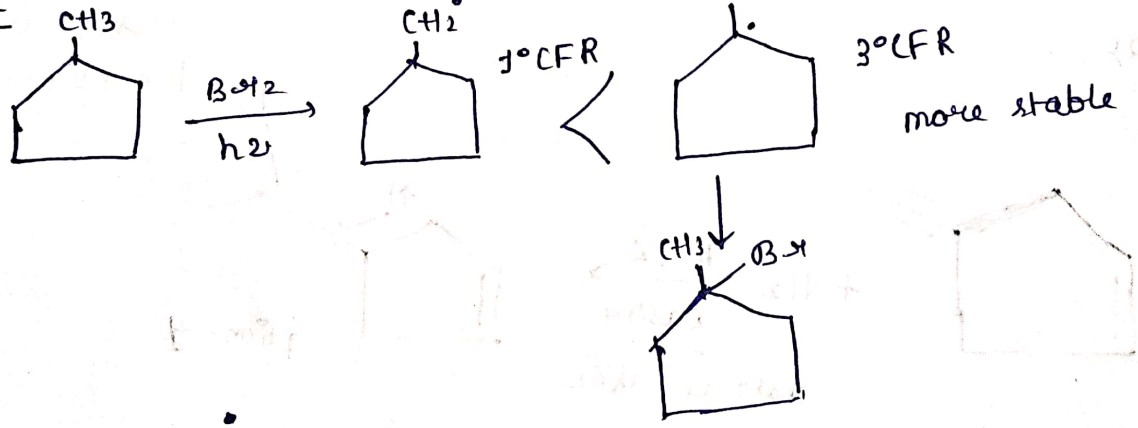
$R^{-\delta}-Mg^{+\delta}-X$ + $-O-H^+$ → H + neutral, non-polar no charge

$CH_3-COO^-H^+$

Ans 10) Reagent in Clemmensen H^+ reduction is Zn-Hg/HCl

DPP-02

Ans 1)



Ans 2) $CH_4 \longrightarrow CH_3^\bullet$

$CH_3CH_3 \longrightarrow CH_3CH_2^\bullet$ 1 + I

$CH_3-CH_2-CH_3 \longrightarrow CH_3-CH_2-CH_2^\bullet$ 2 + I

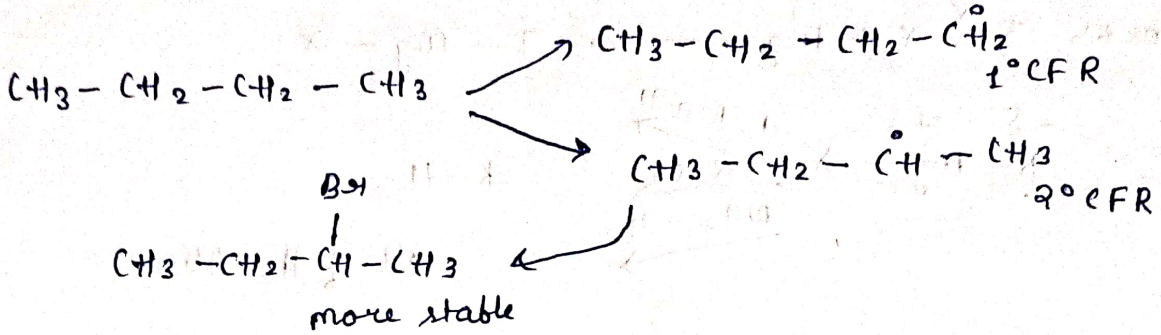
$CH_3-CH(CH_3)-CH_3 \longrightarrow CH_3-C^\bullet(CH_3)-CH_3$ 3°

Ans C) B) A)

Ans 3) $h\nu = F_2$ Fe / dark option-1

Ans 4) chain propogation ⟶ Flowline free radical

Ans 5)



Ans 6) 3° > 2° > 1° $F_2 > Cl_2 > Br_2 > I_2$

Ans 7) $C_2H_6 + Cl_2 \xrightarrow[\text{Light}]{h\nu} C_2H_5Cl + HCl$

Excess

If Cl in excess the Cl bonds will form then C_2H_6 is in excess.

Ans 8) Bromination to chlorination → At slower rate.

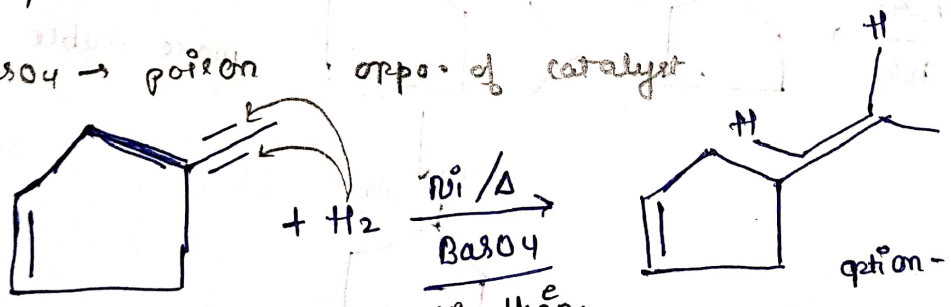
DPP-03

Ans 1) $R-X \xrightarrow[KOH]{Alc}$ β Hydrogen → elimination → Alkene formed

Ans 2)

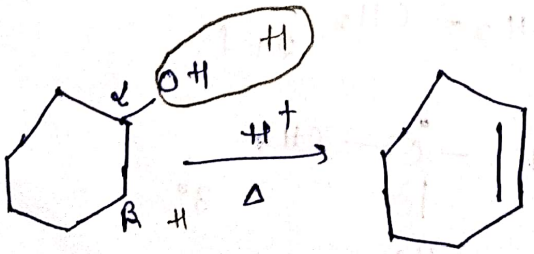
$BaSO_4$ - is $Na + NH_3$ - base.

$BaSO_4$ → poison : oppo. of catalyst.



Ans 3) $CH_3-CH_2-C\equiv C-CH_3 + H_2 \xrightarrow{Na + Liq.\ NH_3} CH_3-CH_2$ (H, CH_3)

Ans 4)



Ans 5) $CH_3-CH(CH_3)-CH(Cl)-CH_3 \xrightarrow[\Delta]{Alc.KOH}$

$CH_3-C(CH_3)=CH-CH_3$ (3 branch ↑ stable) major

$CH_2=C(CH_3)-CH_2-CH_3$ (1 branch ↓ stable)

$CH_3-CH=CH-CH_3$

Alkene

option - 2

Ans 6) $CH_3-CH(Br)-CH(Br)-CH_3 \xrightarrow[\Delta]{Zn}$

OPP - 04

Ans 1) $CH_2=CH_2 + Br_2 \longrightarrow CH_2(Br)-CH_2(Br)$

$CH_2=CH_2 \rightarrow CH_2(Br)-CH_2^+ \; Br^+$

EAR

option - 1

Ans 2) 1) $CH_3-CH(CH_3)-CH_2^+ \longrightarrow CH_3-C^+(CH_3)-CH_3$

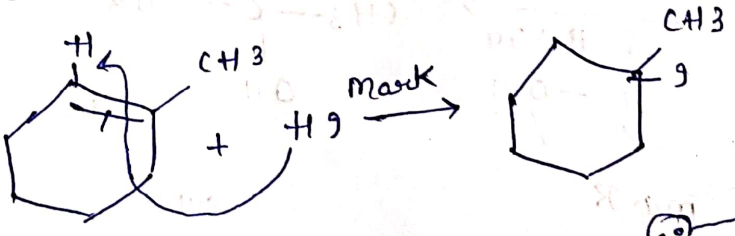
1° to 3°

2) $CH_3-CH_2-CH^+-CH_3$ ← not possible

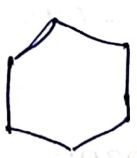
3) resonance.

Ans 3) carbocation

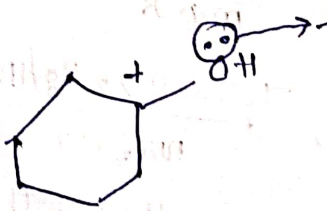
Ans 4)



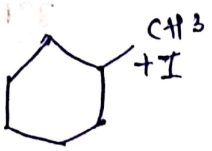
Ans 5) i)



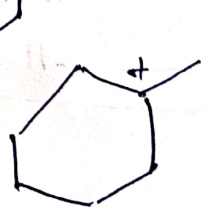
ii)



iii)



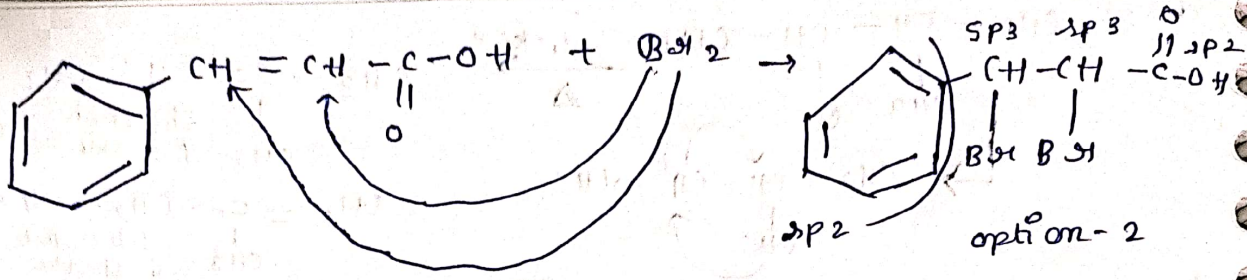
iv)



II > III > IV > I

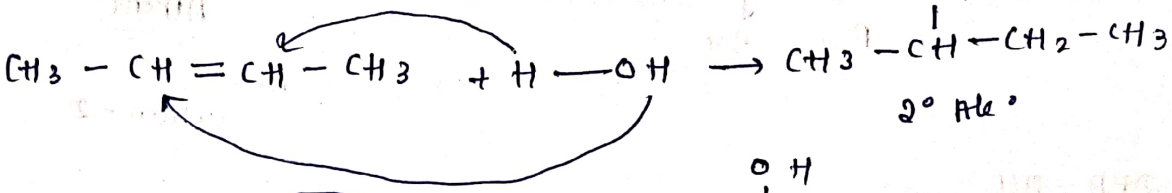
but in reality II > IV > III > I

Ans 6)

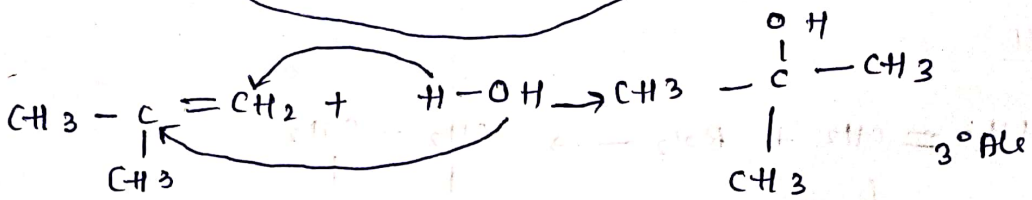


option - 2

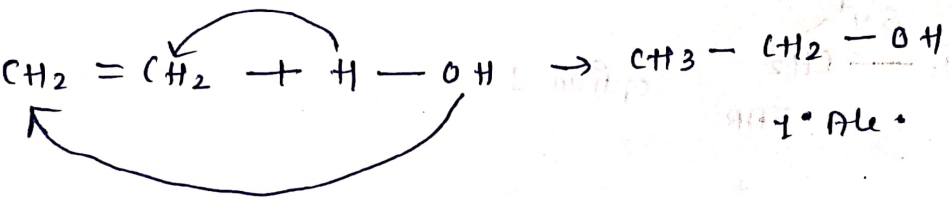
Ans 7) 1)



2)



3)

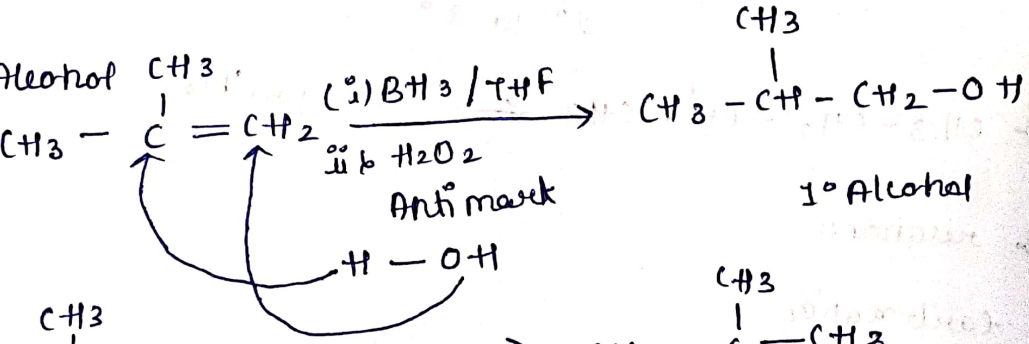


Ans 8) $CH_3 - CH_2 = CH_2 + HI \longrightarrow CH_3 - CHI - CH_3$.

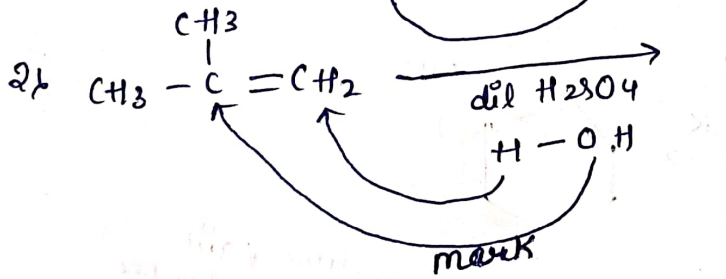
DPP-05

Ans 1) 1° Alcohol

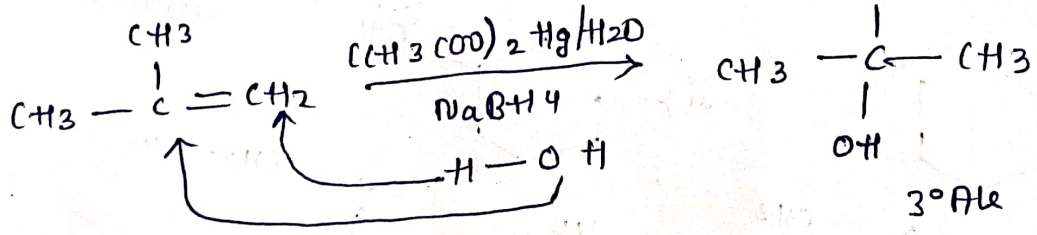
1)



2)

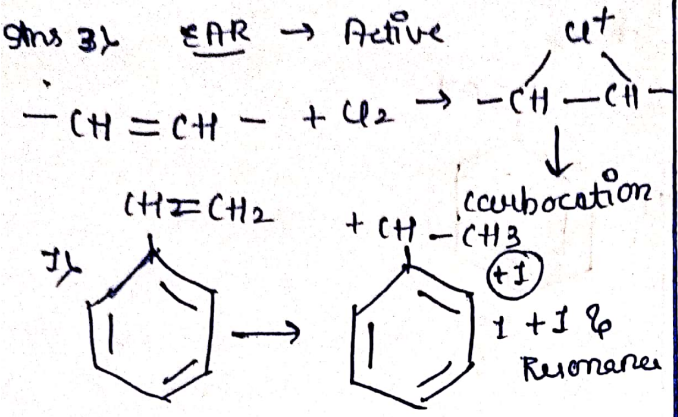


3)

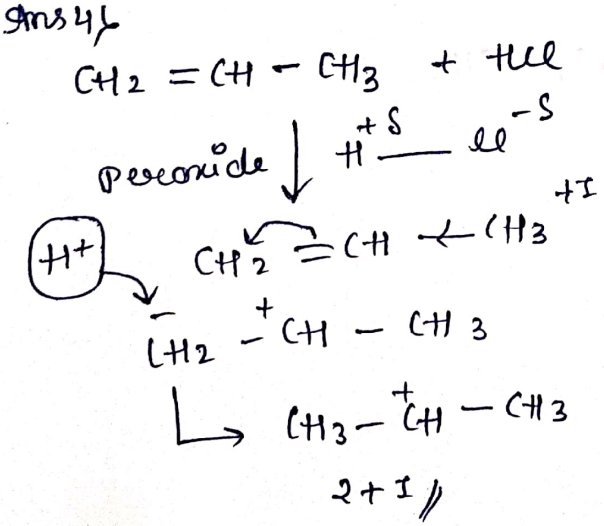


4) 3 & 4 both

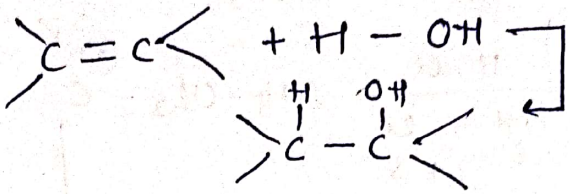
Ans 3) EAR → Active



Ans 4)



Ans 5)



→ EAR

⇒ Intermediate carbocation

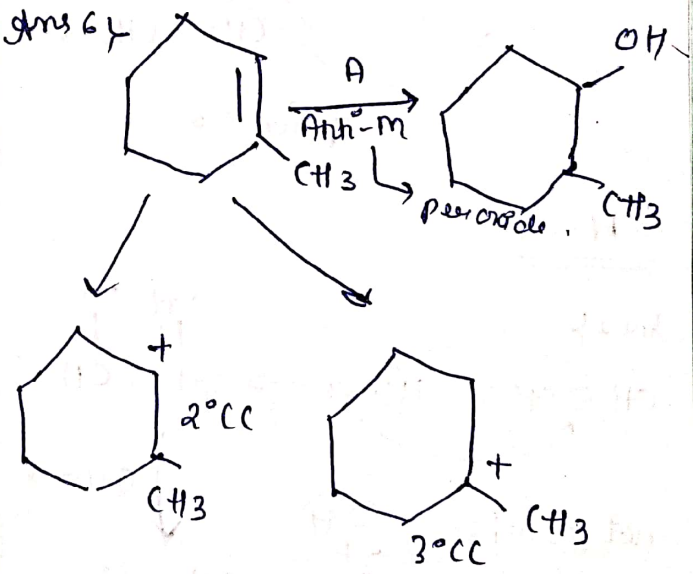
1) $CH_2 = CH_2 \longrightarrow CH_3 - \overset{+}{C}H_2$ I+I

2) $CH_2 = CH - CH_3 \longrightarrow CH_3 - \overset{+}{C}H - CH_3$ 2+I

3) $CH_2 = CH - CH_2 - CH_3 \rightarrow CH_3 - \overset{+}{C}H - CH_2 - CH_3$ 2°CC

4) $CH_2 = \underset{CH_3}{\overset{|}{C}} - CH_3 \longrightarrow CH_3 - \underset{CH_3}{\overset{|}{\overset{+}{C}}} - CH_3$ 3°CC

Ans 6)



1) $BH_3 / THF + H_2O_2 / \overset{\ominus}{O}H$

Ans 7) $CH_3-CH_2-\underset{\underset{CH_3}{|}}{C}=CH-CH_3$

$\xrightarrow{HOCl}$ $CH_3-CH_2-\overset{\overset{Cl}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH-CH_3$

$OH-Cl$ ($-\delta$ $+\delta$)

$CH_3-CH_2-\overset{\overset{Cl}{|}}{\underset{\underset{CH_3}{|}}{C}}-\overset{+}{C}H-CH_3$ — 2°CC

$CH_3-CH_2-\underset{\underset{CH_3}{|}}{\overset{+}{C}}-\underset{Cl}{\underset{|}{C}}H-CH_3$ — 3°CC major

$\xrightarrow{OH^-}$

$CH_3-CH_2-\underset{\underset{CH_3}{|}}{\overset{OH}{\overset{|}{C}}}-\underset{Cl}{\underset{|}{C}}H-CH_3$

Ans 8) propan-1-ol from propene

$CH_3-CH=CH_2 + H-OH \xrightarrow[\text{mark}]{\text{Anti}}$ $CH_3-CH_2-CH_2-OH$

option - 3

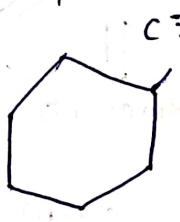
Ans 2)

Ans 3) $CH_3-C\equiv CH \xrightarrow[\text{mark}]{HCl}$

$CH_3-\underset{\underset{Cl}{|}}{\overset{\overset{Cl}{|}}{C}}-CH_3$

gem di halide

Ans 4)



Ans 5) CH

⊗ PP-06

Ans 1)

$CH\equiv CH + HOCl \rightarrow \underset{\underset{OH}{|}}{\overset{\overset{Cl}{|}}{CH}}=CH$

$\xrightarrow{OH-Cl}$

not possible

$OH-\underset{\underset{OH}{|}}{CH}-CH-CH_2$

$OCH-CH-Cl_2 + H_2O$