Unit 13: Hydrocarbons

BOOK BACK

31. Give IUPAC names for the following compounds

1) $CH_3–CH=CH–CH=CH–C\equiv C–CH_3$ Octa-4,6-diene-3-yne

2) $CH_3– \underset{\underset{CH_3}{|}}{\overset{\overset{C_2H_5}{|}}{C}} – C \equiv C – CH_3$ 4,5,5- trimethylhepta-2-yne

3) $(CH_3)_3 C – C \equiv C – CH\ (CH_3)_2$ 2,2,5 – trimethyl hex-3-yne

CH_3

4) ethyl isopropyl acetylene

$CH_3\ CH_2 – C \equiv C – CH\ (CH_3)_2$ 2 – methyl hex-3-yne

5) $CH \equiv C – C \equiv C – C \equiv CH$ 1,3,5- Hexa triyne

32. Identify the compound A, B, C and D in the following series of reactions

i) $\mathbf{CH_3 – CH_2–Br}$

$\xrightarrow{\text{alc. KOH}}$

$\xrightarrow[\text{i) } O_3 \text{ ii) } Zn/H_2O]{\mathbf{Cl_2 / CCl_4}}$

A **B**

$\xrightarrow[\text{D}]{NaNH_2}$

C **D**

A – $CH_2 = CH_2$ – Ethene

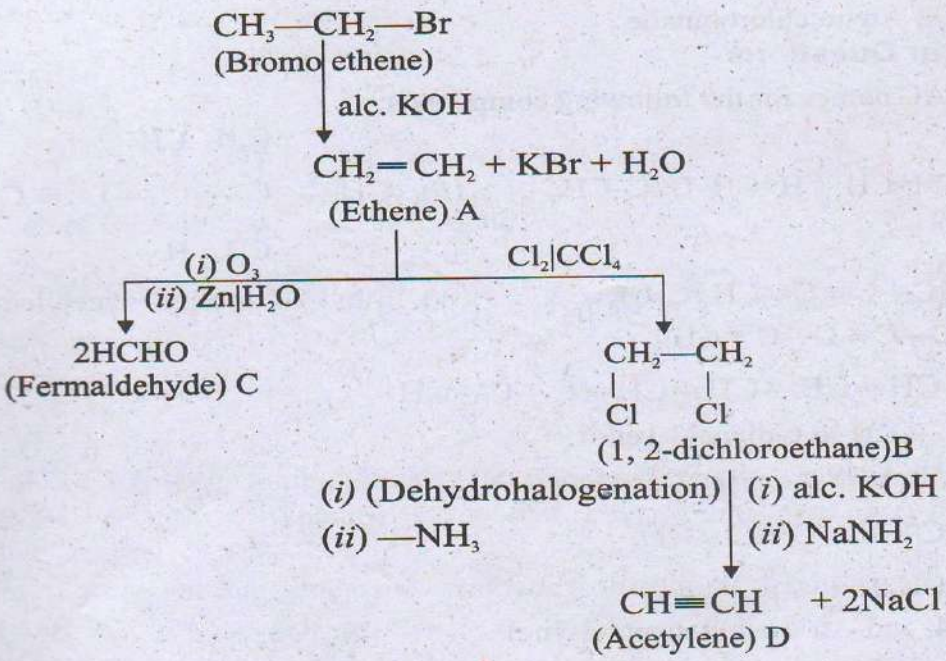
B – $CH_2 – CH_2$ - 1, 2 – dichloro ethane

Cl Cl

C – HCHO - Formaldehyde

D – $CH \equiv CH$ - Acetylane

Ans.



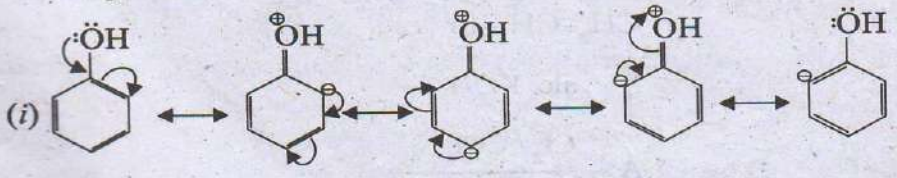
A	Ethene	$CH_2 = CH_2$
B	1, 2-dichloroethane	CH_2CH_2 | | Cl Cl
C	Formaldehyde	HCHO
D	Acetylene	$CH \equiv CH$

33. Write a short note on ortho-para directors in aromatic electrophilic substitution reactions?

Ans. The group which increases the electron density at *ortho* and *para* positions of the ring are known as ortho-para directors.

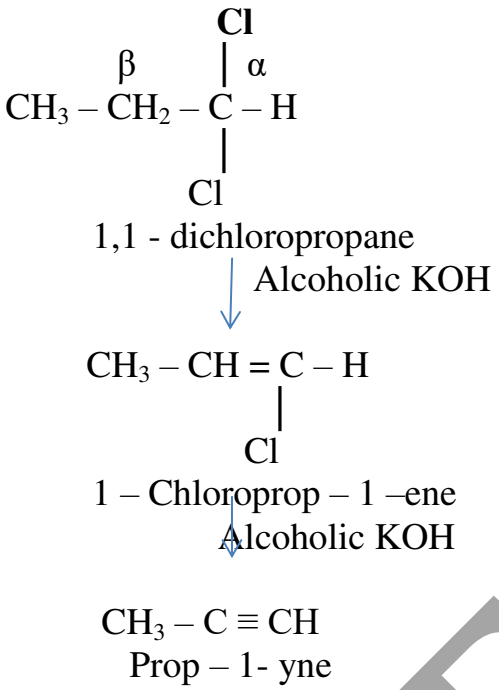
Example, —OH, —NH_2, —NHR, —CH_3, —OCH_3 etc.

Let us consider the directive influences of phenolic (–OH) group. Phenol is the resonance hybrid of following structure.



In these resonance structures the negative charge residue is present on *ortho* and *para* positions of the ring structure. Therefore the electron density at *ortho* and *para* positions increases as compared to the *meta* position, thus phenolic group activities the benzene ring for electrophilic attack at *ortho* and *para* positions and hence –OH group is an ortho-para director and an activator.

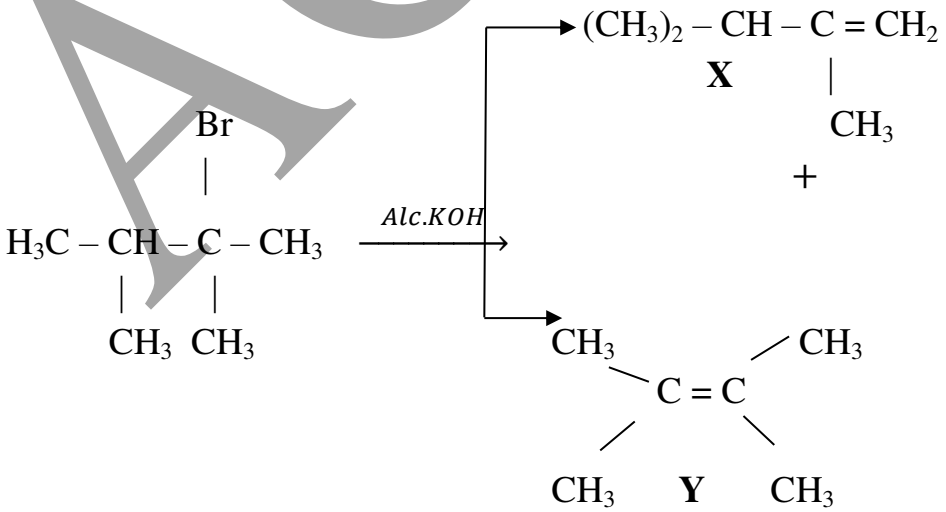
33. How is propyne prepared from an alkyenedihalide ?



34. An alkylhalide with molecular formula $C_6H_{13}Br$ on dehydro halogenation gave two isomeric alkenes X and Y with molecular formula C_6H_{12}. On reductive ozonolysis, X and Y gave fourcompounds CH_3COCH_3, CH_3CHO, CH_3CH_2CHO and $(CH_3)_2$ CHCHO. Find the alkylhalide.

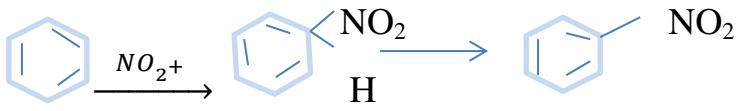
(i) The alkyl halide with molecular formula $C_6H_{13}Br$ is bromohexane (2 – Bromo – 2, 3-dimethyl butane)

(ii) $C_6H_{13}Be$ on dehydro halogenation gives two isomeric alkenes 2,3 – dimethyl – 1-butane (X) and 2,3 – dimethyl – 2 – butene (y)



(iii) X and Y on reductive ozonolysis gave four compounds CH_3COCH_3, CH_3CHO, CH_3CH_2CHO and $(CH_3)_2$ CHCHO

35. Describe the mechanism of Nitration of benzene.



36. How does Huckel rule help to decide the aromatic character of a compound.

A compound may be aromatic, if it obeys Huckel rules

(i) The molecule must be co-planner

(ii) Complete delocalization of π electron in the ring.

(iii) Presence of (4n +2) π electrons in the ring where n is an integer(n = 0,1,2…..)

Eg:

Benzene

(i) The benzene is a planner molecule

(ii) It has six deloclaised π electrons

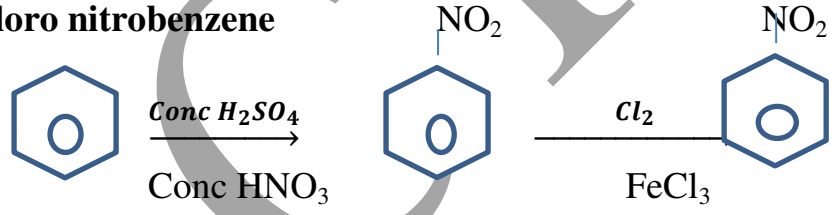
(iii) 4n + 2 = 6; 4n = 6 -2; 4n= 4; n = 1

It obeys Huckel's (4n + 2) π electron rule with n = 1 hence , benzene is aromatic

37. Suggest the route for the preparation of the following from benzene.

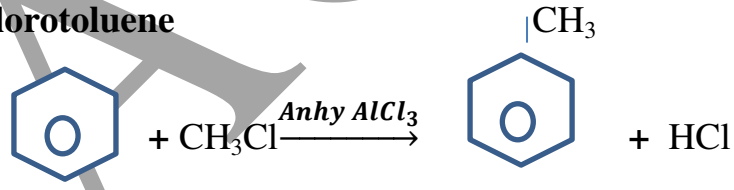
1) 3 – chloro nitrobenzene 2) 4 – chlorotoluene 3) Bromobenzene 4) m - dinitro benzene

1) 3 – chloro nitrobenzene



Benzene nitrobenzene 3- Chloronitro benzene

2) 4 – chlorotoluene

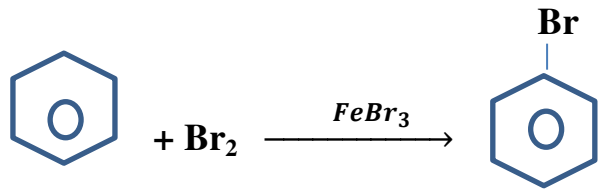


Benzene **Toluene**

Toluene

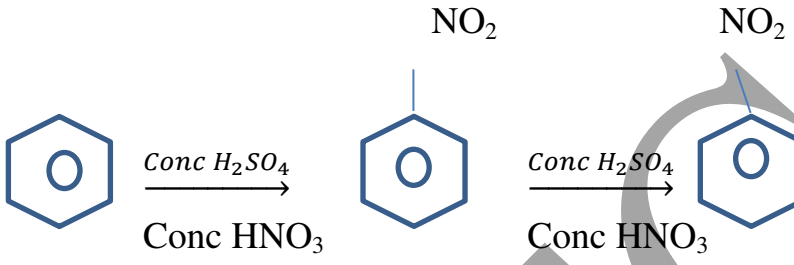
4 – Chloro toluene

3) Bromo benzene



Benzene **Bromo benzene**

4) m - dinitro benzene



Benzene Nitro benzene m – dinitro benzene

38. Suggest a simple chemical test to distinguish propane and propene.

Test to distinguish propane and propene

(i) Alkenes (propene) decolorize Br_2/H_2O where as alkanes (propane) does not unergo this reaction.

(ii) De – colorization of acidified $KMnO_4$, propene de-colorises acidified $KMnO_4$ whereas propane does not.

Both test for unsalunation.

39. What happens when isobutylene is treated with acidified potassium permanganate ?

(i) Ethyl chloride to ethane

$$CH_3CH_2Cl \xrightarrow[Zn/\ HCl]{[H]} CH_3 - CH_3 + HCl$$

Ethyl chloride

Alkyl halides when reduced gives the corresponding alkanes.

(ii) $CH_3CH_2Cl + CH_3CH_2Cl + \xrightarrow{2Na} CH_3CH_2 - CH_2CH_3 + 2NaCl$

Ethyl chloride Dry ether Butane

This reaction is called wurtz reaction. Haloalkanes react with sodium metal in dry ether to give higher alkenes.

(iii) $CH_2(Br) - CH_2(Br) \xrightarrow{Zn/C_2H_5OH} CH_2 = CH_2 + ZnBr_2$

Ethene

1,2 – di bromo ethane

(iv) $CaC_2 + \xrightarrow{H_2O} CH \equiv CH + Ca(OH)_2$

Calcium carbide Ethyne

$$CH_3 - C = CH_2 \xrightarrow{KMnO_4} CH_3 - \underset{OH}{\overset{CH_3}{C}} - \underset{OH}{CH_2}$$

2-Methyl -1-propene

40. How will you convert ethyl chloride in to i) ethane ii) n – butane

(i) Ethyl Chloride → Ethane:

$$CH_3 - CH_2 - Cl \xrightarrow{[H]} CH_3 - CH_3 + HCl$$

Ethyl Chloride Zn/ HCl Ethane

(ii) Ethyl Chloride → n – Butane (Wurtz reaction):

$$CH_3 - CH_2 - Cl + 2Na + Cl - CH_2 - CH_3 \xrightarrow{Dry\ Ether} CH_3 - CH_2 - CH_2 - CH_3 + 2NaBr$$

Ethyl chloride n – Butane

41. Describe the conformers of n - butane.

Conformations Of n – Butane: n – butane may be considered as a derivative of ethane, as one hydrogen on each carbon is replaced by a methyl group

Eclipsed Conformation: In this conformation, the distance between the two methyl group is minimum. So there is maximum repulsion between them and it is the least stable conformer.

Anti or Staggered form: In this conformation, the distance between the two methyl groups is maximum. So there is minimum repulsion between them and it is the most stable conformer

42. Write the chemical equations for combustion of propane.

Propane burns in excess of oxygen to form water and carbon di oxide.

$$CH_3CH_2CH_3 + 5O_2 \rightarrow 3CO_2 + 4H_2O$$

Propane

43. Explain Markownikoff's rule with suitable example.

Markovikoff's rule: " When an unsymmetrical alkene reacts with hydrogen halide, the hydrogen adds to the carbon that has more number of hydrogen and halogen add to the carbon having fewer hydrogen".

Eg: Addition HBr to unsymmetrical alkene: In the addition of hydrogen halide to an unsymmetrical alkene, two products are obtained.

$$CH_3 = CH - CH_2 + HBr$$

Propane

$$CH_3 - \underset{Br}{CH} - CH_3 \qquad CH_3 - CH_2 - CH_2 - Br$$

1- Bromo Propane

Br (minor product)

2 – Bromo propane
(major product)

44. What happens when ethylene is passed through cold dilute alkaline potassium permanganate.

Ethene reacts with cold alk KMnO4 (Balyer's regent to give ethane 1,2 – diol

$CH_2 = CH_2 + H_2O$

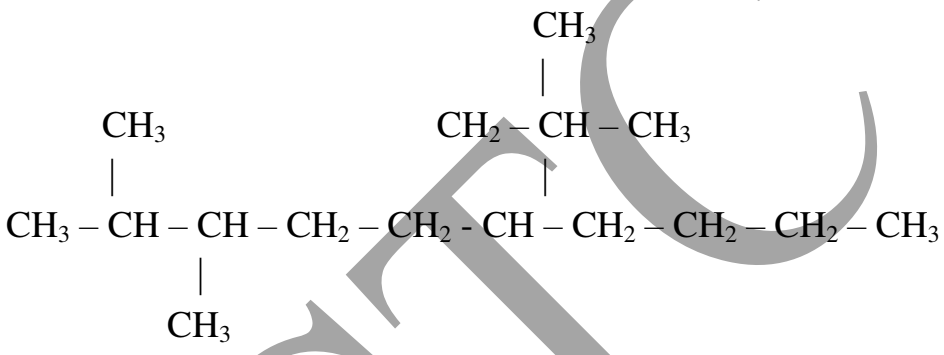
[O] ↓ Cold dil. $KMnO_4$
273K

$CH_2 – CH_2$
| | + $MnO_2 \downarrow$
OH OH dark brown

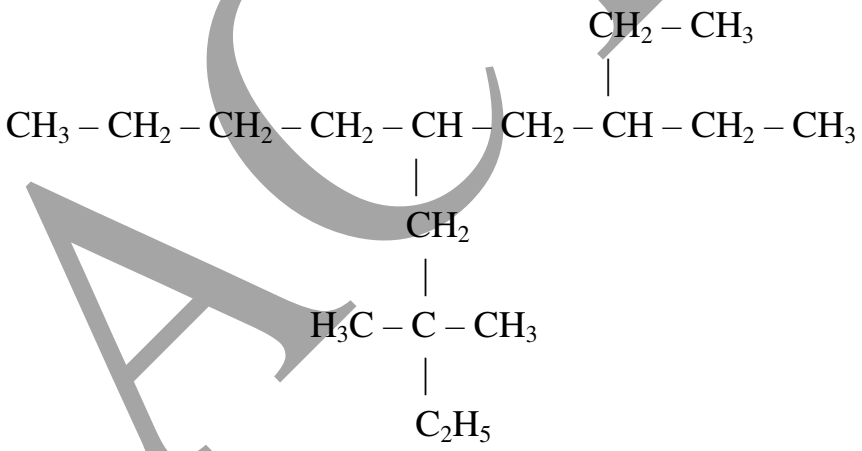
Ethane – 1, 2 - diol

45. Write the structures of folowing alkanes.

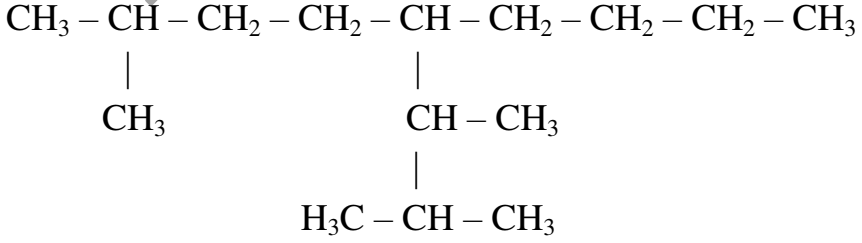
1) 2, 3 – Dimethyl – 6 – (2 – methyl propyl) decane



2) 5 – (2 – Ethyl butyl) – 3, 3 – dimethyldecane



3) 5 – (1, 2 – Dimethyl propyl) – 2 – methylnonane



46. How will you prepare propane from a sodium salt of fatty acid ?

$$CH_3CH_2CH_2COONa + NaOH \xrightarrow{CaO} CH_3CH_2\,CH_3 + Na_2CO_3$$

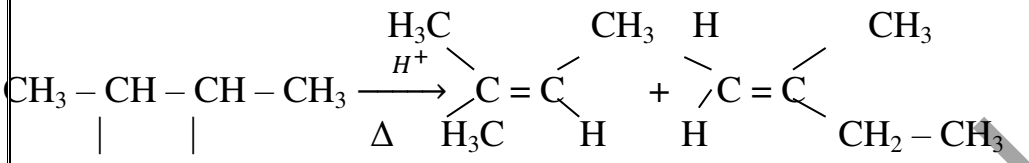
Sodium salt of butanaic acid Δ Propane

Heating sodium salt of butanoic acid (Sodium butanoate) with soda lime gives propane.

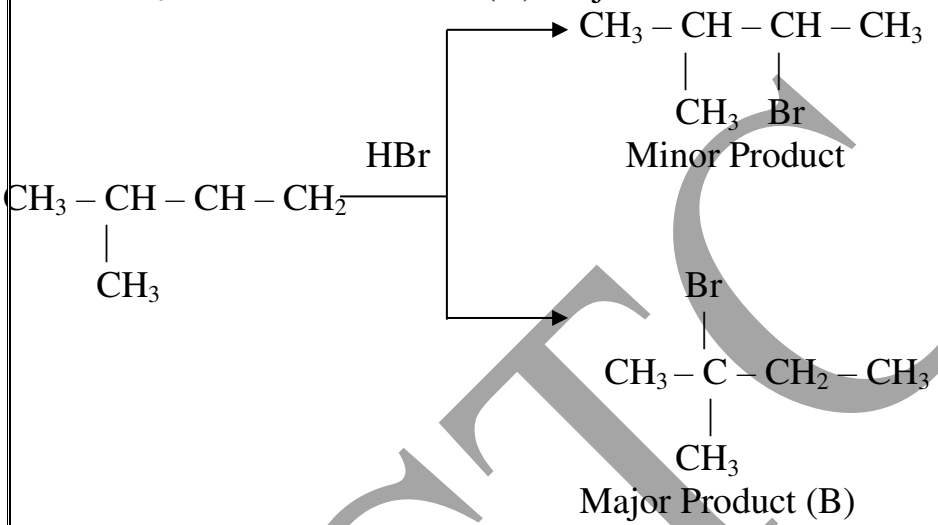
47. $CH_3 - CH(CH_3) - CH(OH) - CH_3$

$\downarrow$ H^+/heat

(A) major product $\xrightarrow{HBr}$ **(B) major product** **Identify A and B**



(A) Major Product Minor Product



Minor Product

Major Product (B)

48. Complete the following :

Lindlar Catalyst

i) 2 – butyne $\longrightarrow$

$$CH_3 - C \equiv C - CH_3 + H_2 \xrightarrow{Lindlar} CH_3 - CH = CH - CH_3$$

2 – Butyne Catalyst 2 – Butene

Lindlar catalyst consist of pd deposited on $CaCO_3$ and then poisoned by lead on sulphur.

I_2

ii) $CH_2 = CH_2$ $\longrightarrow$

Zn/C_2H_5OH

$$CH2 = CH2 \xrightarrow{I_2} [CH_2 - CH_2] \xrightarrow{I_2} CH_2 = CH_2$$

(I, I) ethene

iii) $CH_2 - CH_2$ $\longrightarrow$

Br Br

$CH_2 - CH_2 \xrightarrow{Zn\ /\ C_2H_5OH} CH_2 - CH\text{-}ZnBr$

Br Br Br

1,2 – Dibromoethane

$CH_2 = CH_2 + ZnBr_2$

ethene

iv) $\mathbf{CaC_2 \xrightarrow{H_2O} CH \equiv CH + Ca(OH)_2}$

$CaC_2 \xrightarrow{H_2O} CH \equiv CH + Ca(OH)_2$

Calcium Carbride ethyne

49. How will you distinguish 1 – butyne and 2 – butyne?

An alkyne shows acidic nature only if it contains terminal hydrogen.

$CH_3 - CH_2 - C \equiv CH + 2AgNO_3 + 2NH_4OH \rightarrow CH_3 - CH_2 - C \equiv C - Ag + 2NH_4NO_3 + 2H_2O$

1 – butyne Silver butynide

$CH_3 - C \equiv C - CH_3 + 2AgNO_3 + 2NH_4OH \rightarrow$ No Reaction due to absence of acidic hydrogen