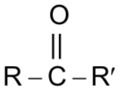
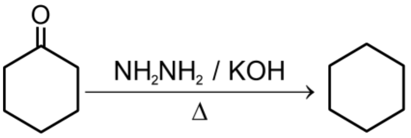
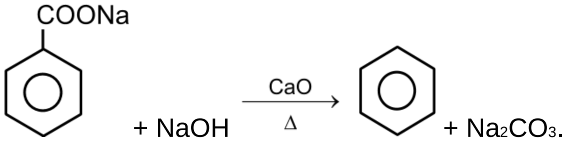
ABC-1 (Hydrocarbon)

(A) ALKANE

Alkanes are saturated hydrocarbons. The general formula of alkanes is C_nH_{2n+2}. Alkanes are also known as **paraffin's**.

Preparation of alkanes (6-Methods)		
1	**Catalytic hydrogenation of alkenes & alkynes** **Note :** At room temperature benzene does not react by this reaction.	(a) $R–CH=CH–R + H_2 \xrightarrow[\text{Pt or Pd}]{\text{Ni or}} R–CH_2–CH_2–R$ (b) $R–C≡C–R + 2H_2 \xrightarrow[\text{Pt or Pd}]{\text{Ni or}} R–CH_2–CH_2–R$
2.	**Clemmensen's Reduction : [Zn-Hg/Conc.HCl]** It is used to prepare alkanes from carbonyl compounds (Aldehydes and ketones) **Note :** Avoid this reaction if compounds have alcohol, ether, alkene or alkyne functional group and no change in these functional groups is desired.	**(a)** $R – CHO \xrightarrow[\Delta]{\text{Zn−Hg/conc. HCl}} RCH_3 + H_2O$ **(b)**  $R-\overset{\overset{\displaystyle O}{\parallel}}{C}-R' \xrightarrow[\Delta]{\text{Zn−Hg/conc. HCl}} RCH_2R' + H_2O$
3.	**Wolff-kishner reduction [NH_2NH_2 / KOH] :** It is used to prepare alkanes from carbonyl compounds (Aldehydes and ketones) **Note :** Avoid this reaction if compounds have halide, acid halide, anhydride or ester functional group and no change in these functional groups is desired.	**(a)** $CH_3CH_2CHO \xrightarrow[\Delta]{NH_2NH_2\ /\ KOH} CH_3CH_2CH_3$ **(b)** 
4.	**Decarboxylation of carboxylic acid by sodalime :** Mixture of NaOH + CaO is known as soda lime. (We can take RCOOH as well as RCOONa)	**(a)** $CH_3COOH + NaOH \xrightarrow[\Delta]{CaO} CH_4 + Na_2CO_3$. **(b)** 
5.	**Wurtz Reaction :** The coupling of alkyl halides upon treatment with sodium metal in dry ether to yield alkanes is called Wurtz reaction. **Note-1:** CH_4 can not be prepared by this method. **Note-2:** This is not a good method for the preparation of alkanes having odd number of carbon atoms.	**(a)** $2R – X + 2Na \xrightarrow{\text{dry ether}} \underset{\text{Symmetrical alkane}}{R – R} + 2NaX$ **(b)** $2CH_3Cl \xrightarrow[\text{dry ether}]{Na} CH_3—CH_3$
6.	**Correy-House synthesis :** Both symmetrical and unsymmetrical alkanes can prepare by this method. $\underset{(1°,\ 2°,\ 3°)}{R—X} \xrightarrow{2Li} \overset{-\ +}{RLi} \xrightarrow{CuI} \underset{\substack{\text{Lithium dialkyl cuprate}\\\text{(Gilman's reagent)}}}{R_2CuLi} \xrightarrow[1°>2°]{R'–X} R– R'$	**(a)** $\underset{(1°,\ 2°,\ 3°)}{R—X} \xrightarrow{2Li} \xrightarrow{CuI} \xrightarrow[1°>2°]{R'–X} R–R'$ **(b)** $CH_3Cl \xrightarrow{2Li} \xrightarrow{CuI} \xrightarrow{CH_3CH_2Cl} CH_3CH_2CH_3$ **(c)** $(CH_3CH_2)_2CuLi \xrightarrow{CH_3CH_2Cl} CH_3CH_2CH_2CH_3$

Chemical reactions of alkanes (2-Reactions)

1. Photochemical halogenation:

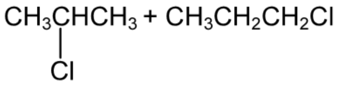
General Reaction: $$R-H + X_2 \xrightarrow[\text{or high temp.}]{h\nu\text{ (sun light)}} R-X + HX$$

(X = Cl, Br)

Reactivity of $X_2 = F_2 > Cl_2 > Br_2$

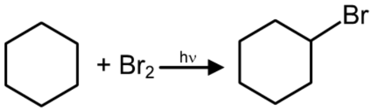
Ex. $CH_3-CH_2-H + Cl_2 \xrightarrow{h\nu} CH_3-CH_2-Cl + HCl$

Ex. $CH_3CH_2CH_3 + Cl_2 \xrightarrow{h\nu}$



$$CH_3\underset{\substack{|\\ Cl}}{C}HCH_3 + CH_3CH_2CH_2Cl$$

Ex.



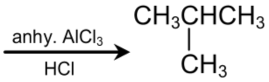
$$+ Br_2 \xrightarrow{h\nu}$$

(Note- No halogenation at phenylic, vinylic and bridge head carbon)

2. Isomerisation of alkanes:

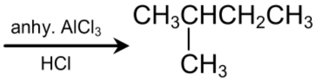
Isomerisation is a process by which straight chain alkanes converted into branched alkanes in presence of anhydrous aluminum chloride($AlCl_3$) and HCl gas (quaternary carbon can not be generated by this method).

Ex. $CH_3CH_2CH_2CH_3$



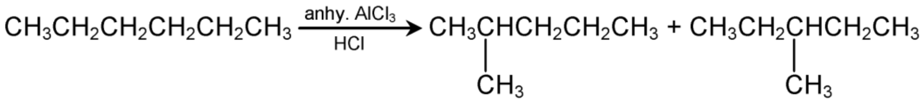
$$\xrightarrow[HCl]{\text{anhy. }AlCl_3} CH_3\underset{\substack{|\\ CH_3}}{C}HCH_3$$

Ex. $CH_3CH_2CH_2CH_2CH_3$



$$\xrightarrow[HCl]{\text{anhy. }AlCl_3} CH_3\underset{\substack{|\\ CH_3}}{C}HCH_2CH_3$$

Ex.

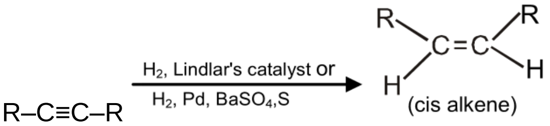
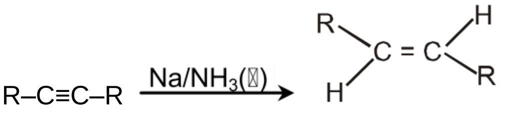
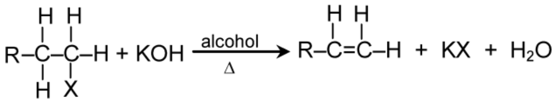


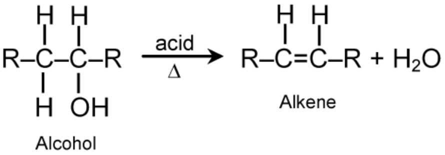
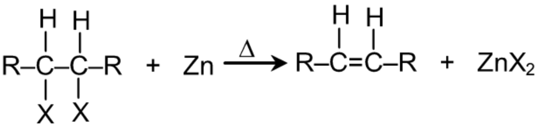
$$CH_3CH_2CH_2CH_2CH_2CH_3 \xrightarrow[HCl]{\text{anhy. }AlCl_3} CH_3\underset{\substack{|\\ CH_3}}{C}HCH_2CH_2CH_3 + CH_3CH_2\underset{\substack{|\\ CH_3}}{C}HCH_2CH_3$$

n-Hexane 2-Methylpentane 3-Methylpentane

(B) ALKENE

The alkenes are unsaturated hydrocarbons that contain one double bond (C=C). They have the general formula C_nH_{2n}.Alkenes are also known as **olefins**.

Preparation of alkenes (4-Methods)		
1.	**Partial reduction of alkyne:** (a) Lindlar's catalyst : [H_2/Pd, $CaCO_3$, quinoline] (b) Rossenmund catalyst : [H_2/Pd, $BaSO_4$, quinoline] (c) Birch reduction [Na or Li/NH_3 (liq.)] (Birch reduction is not observed on terminal alkynes)	 $R-C\equiv C-R \xrightarrow[H_2,\ Pd,\ BaSO_4,S]{H_2,\text{ Lindlar's catalyst or}}$ R(H)C=C(R)(H) (cis alkene)  $R-C\equiv C-R \xrightarrow{Na/NH_3(l)}$ R(H)C=C(H)(R) (Trans alkene)
2.	**Dehydrohalogenation of alkyl halides**: Dehydrohalogenation is the elimination of a hydrogen and a halogen from an alkyl halide to form an alkene. [both H and X remove from adjacent positions]	 $R-\underset{\substack{|\\ H}}{\overset{\substack{H\\ |}}{C}}-\underset{\substack{|\\ X}}{\overset{\substack{H\\ |}}{C}}-H + KOH \xrightarrow[\Delta]{\text{alcohol}} R-\overset{\substack{H\\ |}}{C}=\overset{\substack{H\\ |}}{C}-H + KX + H_2O$ More stable alkene is the major product generally. It is also known as **Saytzeff** alkene.

	Rate of dehydrohalogenation of alkyl halides : 3° > 2° > 1°	(Trans alkene is always prefer if possible)
3.	**Dehydration of alcohols:** An alcohol is converted into an alkene by **dehydration: (***elimination of a water molecule).* It is generally carried out in either of two ways: (a) By heating the alcohol with conc. sulfuric acid. (b) By passing the alcohol vapour over a catalyst Al_2O_3 (alumina) at high temperature. Rate of dehydration of alcohols: 3° > 2° > 1°	 $R-\overset{H}{\underset{H}{C}}-\overset{H}{\underset{OH}{C}}-R \xrightarrow[\Delta]{acid} R-\overset{H}{C}=\overset{H}{C}-R + H_2O$ Alcohol Alkene More stable alkene is the major product generally.
4.	**Dehalogenation of vicinal dihalides:** Dehalogenation of vicinal dihalides can be carried out by zinc in presence of acetic acid.	 $R-\overset{H}{\underset{X}{C}}-\overset{H}{\underset{X}{C}}-R + Zn \xrightarrow{\Delta} R-\overset{H}{C}=\overset{H}{C}-R + ZnX_2$

Chemical reactions of alkenes [6-Reactions] :

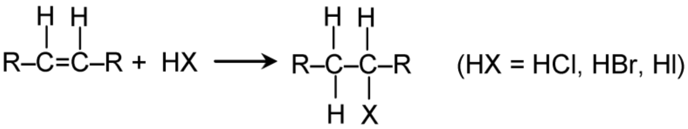
Markovnikov's rule : The rule states that the negative part of the attacking species add on the carbon atom containing less number of hydrogen atom and positive part add on the carbon atom containing more number of hydrogen atoms.

1. Addition of hydrogen halides (Hydrohalogenation)

An alkene reacts with conc. hydrogen chloride, hydrogen bromide, or hydrogen iodide to give the corresponding alkyl halide.

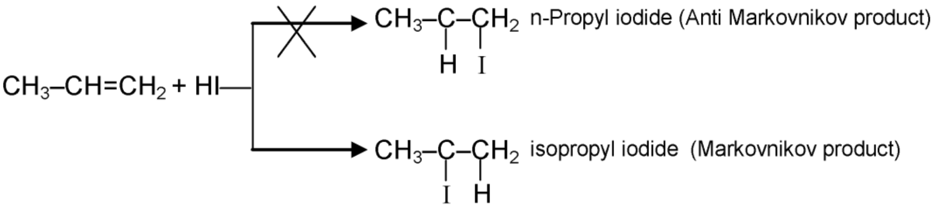
Major Product : According to Markovnikov's rule.

General Reaction:

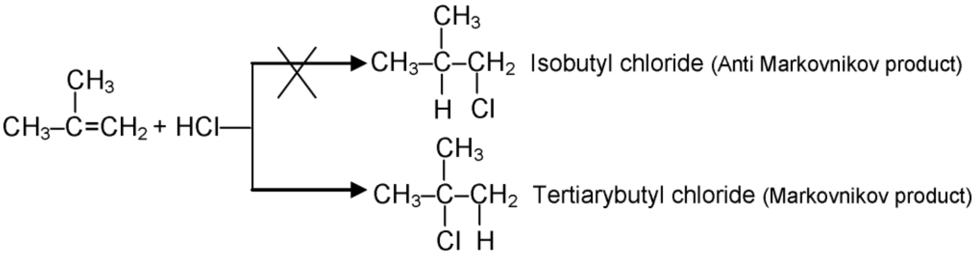


$$R-\overset{H}{C}=\overset{H}{C}-R + HX \longrightarrow R-\overset{H}{\underset{H}{C}}-\overset{H}{\underset{X}{C}}-R \quad (HX = HCl, HBr, HI)$$

Examples:



$$CH_3-CH=CH_2 + HI \begin{cases} \cancel{\longrightarrow} CH_3-\underset{H}{C}-\underset{I}{C}H_2 & \text{n-Propyl iodide (Anti Markovnikov product)} \\ \longrightarrow CH_3-\underset{I}{C}-\underset{H}{C}H_2 & \text{isopropyl iodide (Markovnikov product)} \end{cases}$$

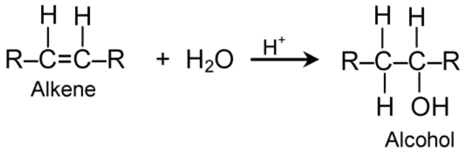


$$CH_3-\overset{CH_3}{C}=CH_2 + HCl \begin{cases} \cancel{\longrightarrow} CH_3-\overset{CH_3}{\underset{H}{C}}-\underset{Cl}{C}H_2 & \text{Isobutyl chloride (Anti Markovnikov product)} \\ \longrightarrow CH_3-\overset{CH_3}{\underset{Cl}{C}}-\underset{H}{C}H_2 & \text{Tertiarybutyl chloride (Markovnikov product)} \end{cases}$$

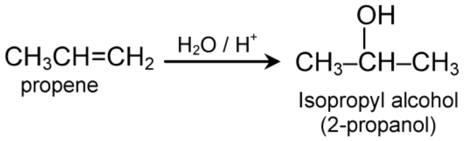
2. Addition of water (Hydration)

Alkenes add water in the presence of an acid to give alcohols. The addition takes place according to **Markovnikov rule.**

General Reaction:


$$R-\overset{H}{C}=\overset{H}{C}-R + H_2O \xrightarrow{H^+} R-\underset{H}{\overset{H}{C}}-\underset{OH}{\overset{H}{C}}-R$$

Example:

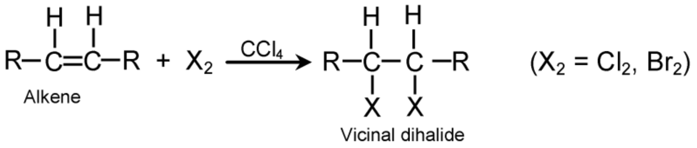

$$CH_3CH=CH_2 \xrightarrow{H_2O / H^+} CH_3-\overset{OH}{CH}-CH_3$$

3. Addition of halogens (Halogenation)

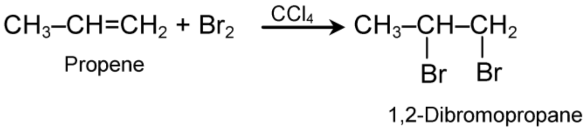
Halogen add to alkenes to form vicinal dihalides. This reaction is the best method for preparing vicinal dihalides. The reaction is carried out in an inert solvent like carbon tetrachloride.

Reaction with F_2 is very tremendous while with I_2 it is very slow and reversible.

General Reaction:


$$R-\overset{H}{C}=\overset{H}{C}-R + X_2 \xrightarrow{CCl_4} R-\underset{X}{\overset{H}{C}}-\underset{X}{\overset{H}{C}}-R \qquad (X_2 = Cl_2, Br_2)$$

Example:

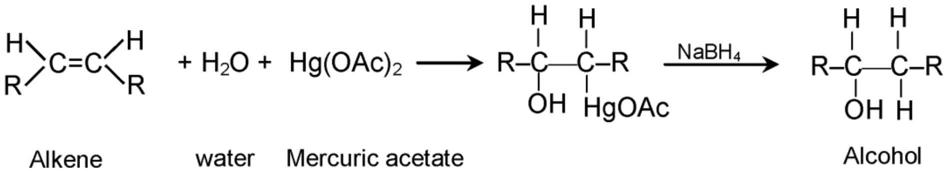

$$CH_3-CH=CH_2 + Br_2 \xrightarrow{CCl_4} CH_3-\underset{Br}{CH}-\underset{Br}{CH_2}$$

4. Hydration by $Hg(OAc)_2$, $H_2O/NaBH_4$ (Oxymercuration-demercuration)

Alkenes react with mercuric acetate in the presence of water to give hydroxyl-mercurial compounds which on reduction yield alcohols.

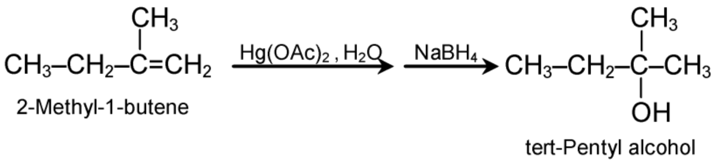
- Oxymercuration-demercuration process gives alcohols corresponding to **Markovnikov** addition of water to the carbon-carbon double bond.

General Reaction:


$$\begin{smallmatrix}H\\R\end{smallmatrix}\!>\!C=C\!<\!\begin{smallmatrix}H\\R\end{smallmatrix} + H_2O + Hg(OAc)_2 \longrightarrow R-\underset{OH}{\overset{H}{C}}-\underset{HgOAc}{\overset{H}{C}}-R \xrightarrow{NaBH_4} R-\underset{OH}{\overset{H}{C}}-\underset{H}{\overset{H}{C}}-R$$

Acetate = (–OAc) = (CH_3COO–)

Example.

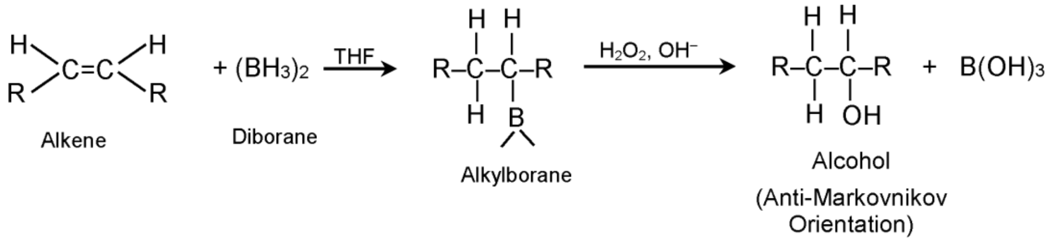


5. Hydration by $B_2H_6/H_2O_2, OH^-$ (Hydroboration-oxidation)

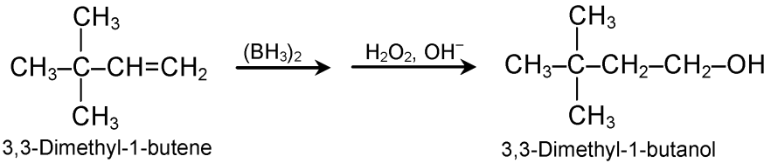
With the reagent diborane (B_2H_6), alkenes undergo hydroboration to give trialkylboranes (R_3B) which on oxidation give alcohols.

- The hydroboration–oxidation process gives alcohols corresponding to **anti-Markovnikov** addition of water to the carbon-carbon double bond.
- It is syn addition of H and OH.
- Ethers like tetrahydrofurane (THF) acts as inert solvent with diborane.

General Reaction:



Example:

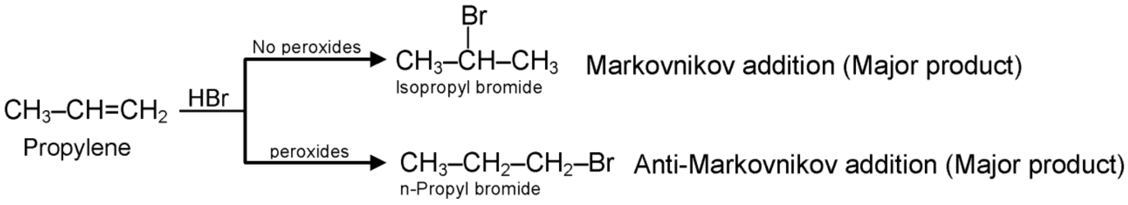


6. Peroxide effect (Addition of HBr)

In the absence of peroxides, hydrogen bromide adds to alkenes according to Markovnikov's rule but in the presence of peroxides, the position of addition is exactly reversed. This reversal of the orientation of addition caused by the presence of peroxides is known as the **peroxide effect/Khrasch effect.**

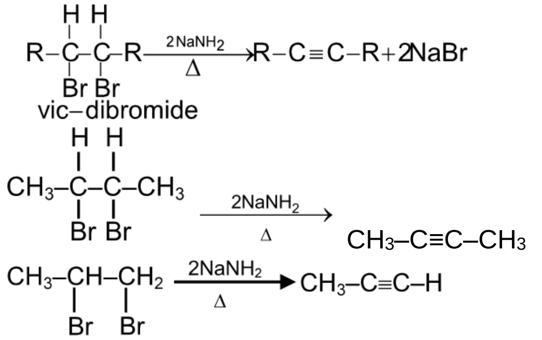
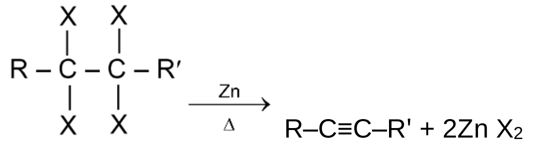
Only the addition of hydrogen bromide shows the peroxide effect. The presence or absence of peroxides has no effect on the orientation of addition of hydrogen chloride, hydrogen iodide, sulfuric acid, water, etc.

Example:



(C) ALKYNE

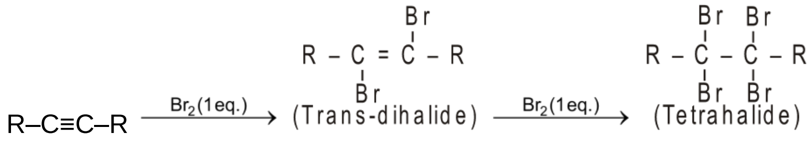
The alkynes are unsaturated hydrocarbons that contain one triple bond (C≡C). They have the general formula C_nH_{2n-2} and the triple bond is known as the 'acetylenic bond'. Many alkynes have been found in nature.

Preparation of alkynes (4-Methods)		
1.	**Hydrolysis of carbides**	1. $CaC_2 + 2HOH \rightarrow CH\equiv CH + Ca(OH)_2$; 2. $Mg_2C_3 + 4HOH \rightarrow CH_3-C\equiv CH + 2Mg(OH)_2$
2.	**Dehydrohalogenation of gem and vicinal dihalides.** Dihalides in which two halogen atoms are attached to two adjacent carbon atoms are known as vicinal dihalides. Dihalides in which two halogen atoms are attached to same carbon atom are known as geminal dihalides.	 $R-\underset{Br}{\overset{H}{C}}-\underset{Br}{\overset{H}{C}}-R \xrightarrow[\Delta]{2NaNH_2} R-C\equiv C-R+2NaBr$ vic–dibromide $CH_3-\underset{Br}{\overset{H}{C}}-\underset{Br}{\overset{H}{C}}-CH_3 \xrightarrow[\Delta]{2NaNH_2} CH_3-C\equiv C-CH_3$ $CH_3-\underset{Br}{CH}-\underset{Br}{CH_2} \xrightarrow[\Delta]{2NaNH_2} CH_3-C\equiv C-H$
3.	**Dehalogenation of tetrahaloalkanes**	 $R-\underset{X}{\overset{X}{C}}-\underset{X}{\overset{X}{C}}-R' \xrightarrow[\Delta]{Zn} R-C\equiv C-R' + 2Zn\,X_2$ $CH_3-CBr_2-CHBr_2 \xrightarrow[\Delta]{Zn} CH_3-C\equiv CH + 2ZnBr_2$
4.	**1,1,1-trihaloalkane with Ag (Silver) powder**	$2R-CX_3 + 6Ag \longrightarrow R-C\equiv C-R + 6AgX$ $2CHI_3 + 6Ag \longrightarrow H-C\equiv C-H + 6AgI$ $2CH_3-CCl_3 + 6Ag \longrightarrow CH_3-C\equiv C-CH_3$

Chemical reactions of alkynes (4-Reactions)

(1) Addition of Halogens :

Halogens like bromine or chlorine add up to alkyne to form trans dihalides and further addition of halogen give tetrahalo alkane. It is an example of electrophilic addition reaction. This reaction is used as a test for unsaturation.

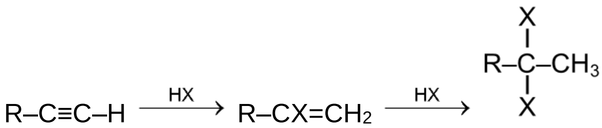


$$R-C\equiv C-R \xrightarrow{Br_2(1eq.)} \underset{(Trans\text{-}dihalide)}{R-\underset{Br}{C}=\overset{Br}{C}-R} \xrightarrow{Br_2(1eq.)} \underset{(Tetrahalide)}{R-\underset{Br}{\overset{Br}{C}}-\underset{Br}{\overset{Br}{C}}-R}$$

Ex. $CH_3-C\equiv CH + 2Br_2 \xrightarrow{CCl_4} CH_3-CBr_2-CHBr_2$

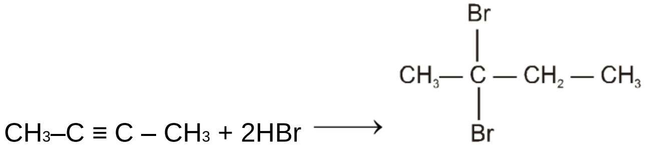
(2) Addition of Hydrogen halides :

Addition of HX to unsymmetrical alkyne take place according to **Markovnikov's rule.**



$$R\text{–}C\equiv C\text{–}H \xrightarrow{HX} R\text{–}CX{=}CH_2 \xrightarrow{HX} R\text{–}CX_2\text{–}CH_3$$

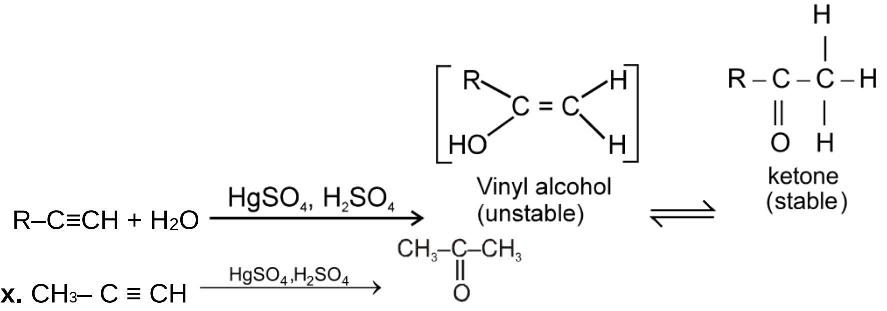
(Geminal dihalide)



Ex. $CH_3\text{–}C\equiv C\text{–}CH_3 + 2HBr \longrightarrow CH_3\text{–}CBr_2\text{–}CH_2\text{–}CH_3$

(3) Addition of water :

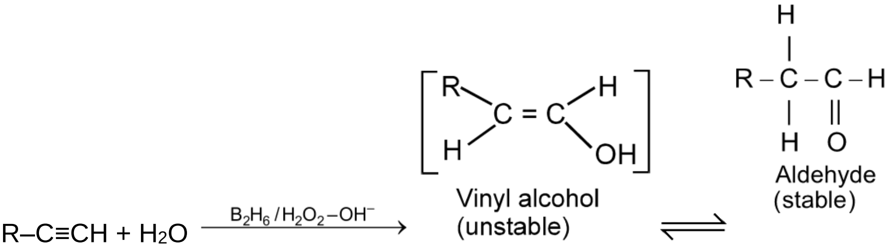
(A) Alkyne react with water to form carbonyl compounds, in accordance with the **Markovnikov rule.** Catalyst-Hg^{2+}



$$R\text{–}C\equiv CH + H_2O \xrightarrow{HgSO_4,\ H_2SO_4} \underset{\text{(unstable)}}{\underset{\text{Vinyl alcohol}}{\left[R(HO)C{=}CH_2\right]}} \rightleftharpoons \underset{\text{(stable)}}{\underset{\text{ketone}}{R\text{–}CO\text{–}CH_3}}$$

Ex. $CH_3\text{–}C\equiv CH \xrightarrow{HgSO_4,H_2SO_4} CH_3\text{–}CO\text{–}CH_3$

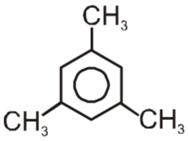
(B) Alkynes react with $B_2H_6/H_2O_2,\ OH^-$ to form carbonyl compounds, in accordance with the **anti-Markovnikov rule**.



$$R\text{–}C\equiv CH + H_2O \xrightarrow{B_2H_6/H_2O_2\text{–}OH^-} \underset{\text{(unstable)}}{\underset{\text{Vinyl alcohol}}{\left[RHC{=}CH(OH)\right]}} \rightleftharpoons \underset{\text{(stable)}}{\underset{\text{Aldehyde}}{R\text{–}CH_2\text{–}CHO}}$$

Ex. $CH_3\text{–}C\equiv CH \xrightarrow{B_2H_6/H_2O_2\text{–}OH^-} CH_3\text{–}CH_2\text{–}CHO$

4. Polymerization of alkyne :

$3HC\equiv CH \xrightarrow{\text{Red hot iron tube}}$  ; $3CH_3\text{–}C\equiv CH \xrightarrow{\text{Red hot iron tube}}$ 

Lab Test :

1. Test for unsaturation ($>C{=}C<$, —C≡C—) :

Unsaturated compound give bromine water test ($Br_2 + H_2O$) and Baeyer's test (Cold dil. alkaline $KMnO_4$).

Functional Group	Reagent	Observation
$>C{=}C<$, —C≡C—	Bromine water test ($Br_2 + H_2O$)	Red-brown colour disappears
$>C{=}C<$, —C≡C—	Baeyer's reagent (Cold, dil. alk. $KMnO_4$)	Purple colour disappear

Note : (i) Benzene does not give bromine water test and Baeyer's test.
(ii) phenol and aniline both give bromine water test but not Baeyer's test.

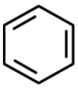
2. Test for terminal alkyne [R—C≡C—H]

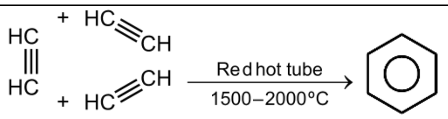
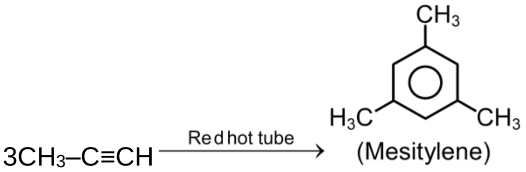
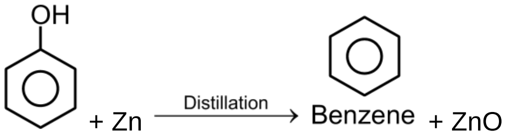
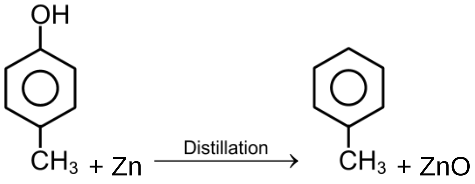
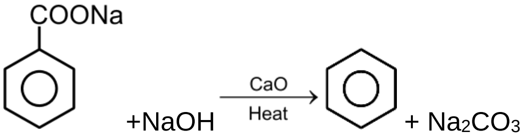
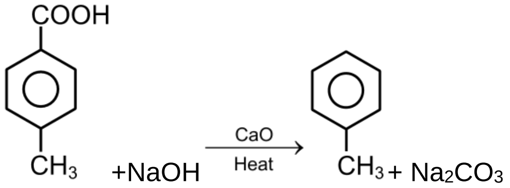
Terminal alkyne give Tollen's test and ammonical curprous chloride test

Functional Group	Reagent	Observation
[R—C≡C—H]	Tollen's reagent [$AgNO_3$ + NH_4OH]	white precipitate
[R—C≡C—H]	Ammonical cuprous chloride (Cu_2Cl_2 + NH_4OH)	Red precipitate

(D) BENZENE

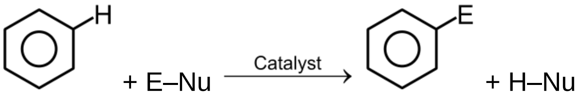
Benzene is an aromatic compound with alternate π-bonds having 6 delocalized π-electrons.
It is a colourless & highly flammable liquid.

It is represented as  or  or 

Preparation of benzene (3-Methods)		
1.	**From alkyne** When acetylene is passed through a red hot metallic tube, cyclic polymerization takes place and benzene is formed	**1.**  **2.** 
2.	**From phenol** Benzene is obtained by distillation of phenol with zinc dust.	**1.**  (–OH group of the benzene nucleus is replaced by –H in this reaction) **2.** 
3.	**From decarboxylation of benzoic acid** Benzene is conveniently prepared in the laboratory by heating the mixture of benzoic acid/sodium benzoate with soda lime (NaOH + CaO). This reaction is called sodalime decarboxylation.	**1.**  **2.** 

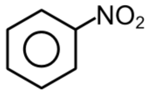
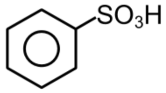
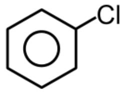
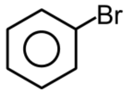
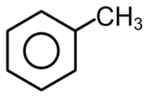
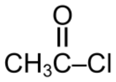
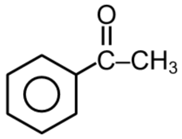
Chemical reactions of benzene [6-Reactions]

The reactions in which hydrogen atom of the benzene ring is replaced by an electrophile (electron deficient specie) are called electrophilic aromatic substitution reactions. Benzene undergoes electrophilic substitution reaction because it is an electron rich system due to delocalized π-electrons. The reactions can be represented as :



E–Nu $\longrightarrow$ $E^+ + Nu^-$

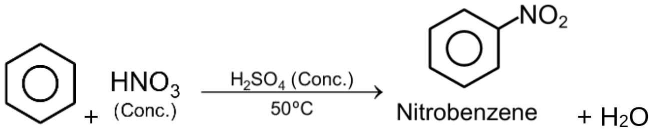
Electrophilic substitution reactions of Benzene

	Substrate	Reagent	Electrophile	Product	Name of reaction
1.		Conc. HNO_3 / Conc. H_2SO_4 Nitrating mixture	$NO_2^{\oplus}$		Nitration of benzene
2.		Conc. $H_2SO_4 + SO_3$	SO_3		Sulphonation of benzene
3.		$Cl_2 / AlCl_3$	$Cl^{\oplus}$		Chlorination of benzene
4.		$Br_2 / AlCl_3$	$Br^{\oplus}$		Bromination of benzene
5.		$CH_3Cl / AlCl_3$	$CH_3^{\oplus}$		Friedal Craft's alkylation of benzene
6.		 $CH_3\overset{O}{\overset{\Vert}{C}}–Cl$ / $AlCl_3$	$CH_3-\overset{\oplus}{C}=O$		Friedal Craft's acylation of benzene

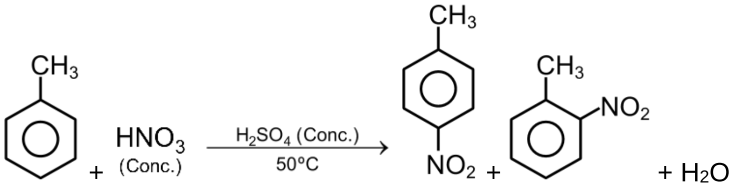
Note- In the halogenation and Friedal Craft's reactions, the catalyst involved can be either of $AlCl_3$, $FeCl_3$, $SnCl_4$, BF_3, BCl_3 or $ZnCl_2$(Lewis acid). However, $AlCl_3$ provides satisfactory results.

(1) Nitration

Ex.

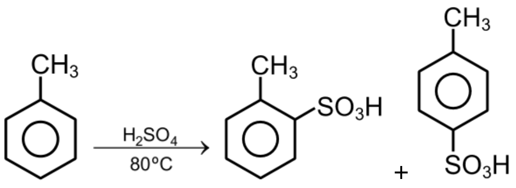


Ex.

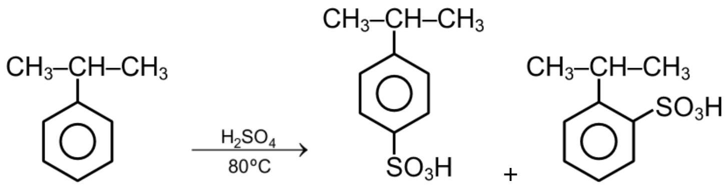


(2) Sulphonation

Ex.

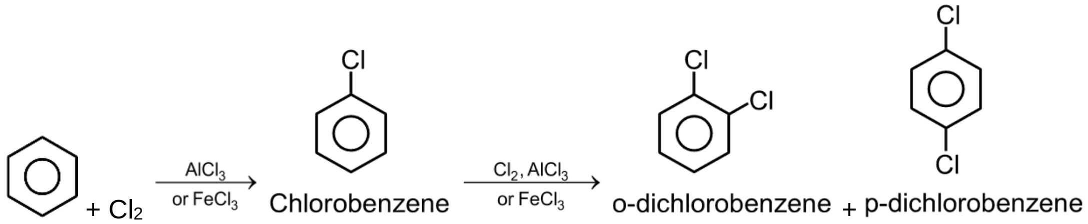


Ex.

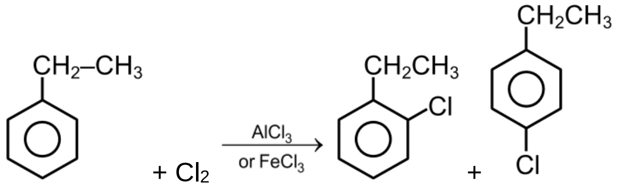


(3) Halogenation

Ex.



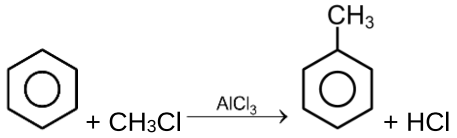
Ex.



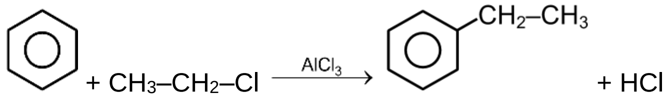
(4) Friedal-Craft's reaction

(a) Alkylation

Ex.

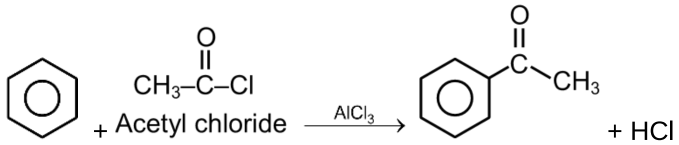


Ex.

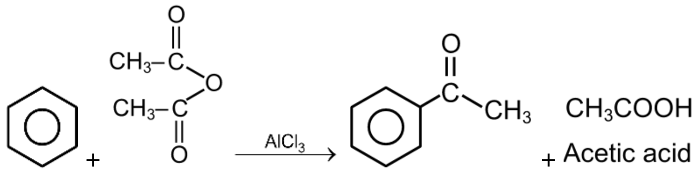


(b) Acylation

Ex.



Ex.

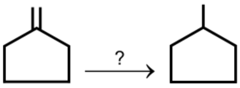


Exercise

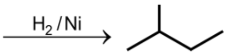
ONLY ONE OPTION CORRECT TYPE

PART-A (Alkane)

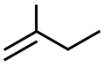
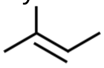
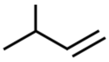
1. Which of the following catalyst can be used for the given conversion ?

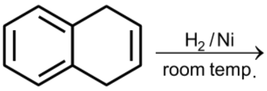


(A) H_2/Ni (B) H_2/Pd (C) H_2/Pt (D) All of these

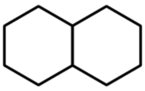
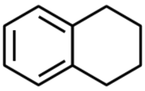
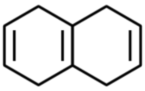
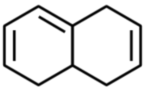
2. X 

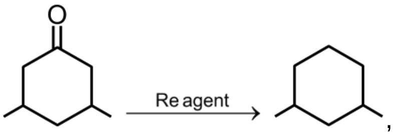
; X may be

(A)  (B)  (C)  (D) All of these

3. 

Product

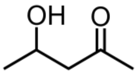
(A)  (B)  (C)  (D) 

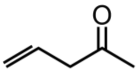
4. 

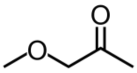
, Reagent is

(A) H_2/Pd (B) $LiAlH_4$ (C) Zn–Hg/conc. HCl (D) All of these

5. In which case Clemensen reduction should be avoided.

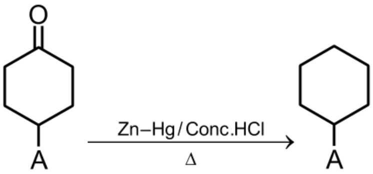
(A) 

(B) 

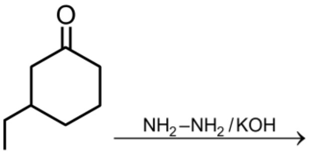
(C) 

(D) All of these

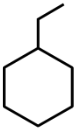
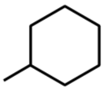
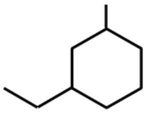
6. For the given conversion A should not be

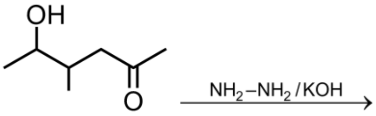


(A) Alkene (B) Alcohol (C) Carboxylic acid (D) All of these

7. 

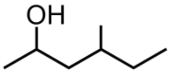
P, Product P is

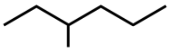
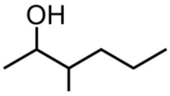
(A)  (B)  (C)  (D) 

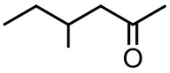
8. 

P

Product P is

(A) 

(B)  (C) 

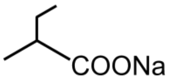
(D) 

9. $CH_3COONa \xrightarrow[\Delta]{\text{reagent}} CH_4$; reagent is

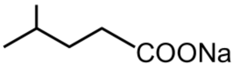
(A) $NH_2{-}NH_2$ / KOH (B) Zn–Hg / HCl (C) NaOH + CaO (D) All of these

10. $A \xrightarrow[\Delta]{NaOH + CaO} CH_3{-}CH_2{-}CH_3$; A can be

(A) CH_3CH_2COONa (B) $CH_3CH_2CH_2COONa$

(C) 

(D) $CH_3CH_2CH_2ONa$

11. 

$\xrightarrow[\Delta]{NaOH + CaO}$ P ; Product P is

(A) Butane (B) 2-Methylbutane (C) 3-Methylbutane (D) Pentane

12. $CH_3{-}CH_2{-}Cl \xrightarrow{Na / \text{Dry ether}}$ P ; Product P is

(A) Ethane (B) Propane (C) Butane (D) Pentane

13. $A \xrightarrow{Na / \text{Dry ether}}$  ; A may be

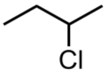
(A) Chloromethane (B) Chloroethane (C) 1-Chloropropane (D) 2-Chloropropane

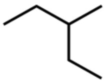
14. Preparation of alkane by Wurtz reaction the reactant used is

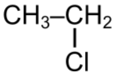
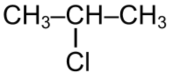
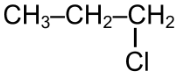
(A) Alkyl halide (B) Acid halide (C) Both A & B (D) None of these

15. $CH_3{-}CH_2{-}Cl \xrightarrow{2Li} X \xrightarrow{CuI} Y \xrightarrow{CH_3-Cl} Z$; Final product Z is

(A) Ethane (B) Propane (C) Butane (D) Pentane

16. 

$\xrightarrow{2\,Li} X \xrightarrow{CuI} Y \xrightarrow{\text{Re agent}}$  , reagent is

(A) $CH_3{-}Cl$ (B) 
$\underset{Cl}{CH_3{-}CH_2}$
(C) 
$CH_3{-}\underset{Cl}{CH}{-}CH_3$
(D) 
$CH_3{-}CH_2{-}\underset{Cl}{CH_2}$

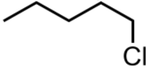
17. $CH_4 + X_2 \xrightarrow[\text{or high temp}]{h\nu} CH_3{-}X$

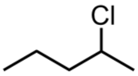
Order of reactivity of halogen is

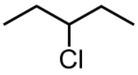
(A) $I_2 > Br_2 > Cl_2 > F_2$ (B) $F_2 > Cl_2 > Br_2 > I_2$ (C) $Br_2 > Cl_2 > I_2 > F_2$ (D) $Cl_2 > Br_2 > F_2 > I_2$

18.  $\xrightarrow{Cl_2 / h\nu}$ P

Product may be

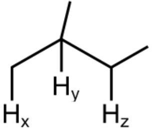
(A) 

(B) 

(C) 

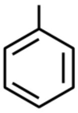
(D) All of these

19. Reactivity order of Hydrogen for the given reaction is

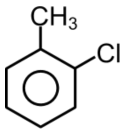
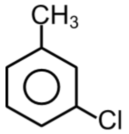
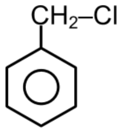
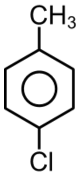


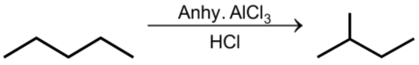
$+ Br_2 \xrightarrow{h\nu}$

(A) X > Y > Z (B) Z > X > Y (C) Y > Z > X (D) Z > Y > X

20.  $\xrightarrow{Cl_2 / h\nu}$ P

P may be

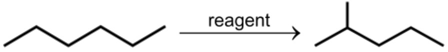
(A) 
(B) 
(C) 
(D) 

21. 

This reaction is known as

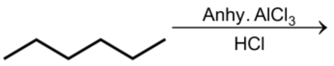
(A) Isomerisation of alkane (B) Polymerisation of alkane

(C) Wurtz reaction (D) None of these

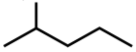
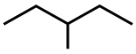
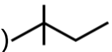
22. 

reagent may be

(A) $NH_2–NH_2$ / KOH (B) Zn–Hg / HCl (C) Anhy. $AlCl_3$ / HCl (D) Na / Dry ether

23.  P

P may be

(A) 
(B) 
(C) 
(D) A & B both

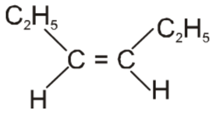
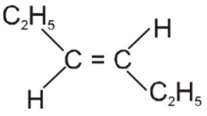
PART-B (Alkene)

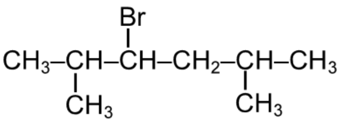
24. $CH_3–C≡C–CH_2–CH_2–CH_3 \xrightarrow{H_2,\ Pd,\ BaSO_4,\ S}$ Product

(A) $CH_3–CH=CH–CH_3$ (B) $CH_3–CH_2–CH_2–CH_2–CH_2–CH_3$

(C) $CH_3–CH=CH–CH_2–CH_2–CH_3$ (cis) (D) $CH_3–CH=CH–CH_2–CH_2–CH_3$ (trans)

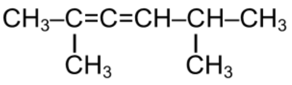
25. $CH_3–CH_2–C≡C–CH_2–CH_3 \xrightarrow{Na/NH_3(\boxtimes)}$ Product

(A) 
(B) 
(C) Both A & B (D) None of these

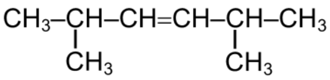
26. 

$$\underset{\textstyle CH_3}{CH_3–\underset{|}{CH}}–\overset{\textstyle Br}{\overset{|}{CH}}–CH_2–\underset{\textstyle CH_3}{\underset{|}{CH}}–CH_3 \xrightarrow{KOH(alc)} \text{Product}$$

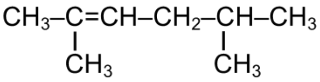
Product is:

(A) 

$$CH_3–\underset{\textstyle CH_3}{\underset{|}{C}}=C=CH–\underset{\textstyle CH_3}{\underset{|}{CH}}–CH_3$$

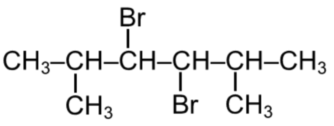
(B) 

$$CH_3–\underset{\textstyle CH_3}{\underset{|}{CH}}–CH=CH–\underset{\textstyle CH_3}{\underset{|}{CH}}–CH_3$$

(C) 

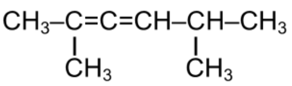
$$CH_3–\underset{\textstyle CH_3}{\underset{|}{C}}=CH–CH_2–\underset{\textstyle CH_3}{\underset{|}{CH}}–CH_3$$

(D) None of these

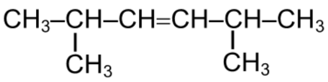
27. 

$$CH_3–\underset{\textstyle CH_3}{\underset{|}{CH}}–\overset{\textstyle Br}{\overset{|}{CH}}–\underset{\textstyle Br}{\underset{|}{CH}}–\underset{\textstyle CH_3}{\underset{|}{CH}}–CH_3 \xrightarrow{\text{Zn dust, Alcohol }\Delta} \text{Product}$$

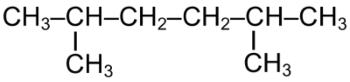
Product is:

(A) 

$$CH_3–\underset{\textstyle CH_3}{\underset{|}{C}}=C=CH–\underset{\textstyle CH_3}{\underset{|}{CH}}–CH_3$$

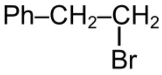
(B) 

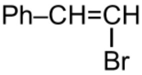
$$CH_3–\underset{\textstyle CH_3}{\underset{|}{CH}}–CH=CH–\underset{\textstyle CH_3}{\underset{|}{CH}}–CH_3$$

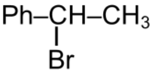
(C) 
$CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_2-\underset{\underset{CH_3}{|}}{CH}-CH_3$

(D) None of these

28. $Ph-CH=CH_2 + HBr \longrightarrow$ Product

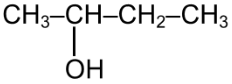
(A) 
$Ph-CH_2-\underset{\underset{Br}{|}}{CH_2}$

(B) 
$Ph-CH=\underset{\underset{Br}{|}}{CH}$

(C) 
$Ph-\underset{\underset{Br}{|}}{CH}-CH_3$

(D) $Ph-CH_2-CHBr_2$

29. $CH_3-CH=CH-CH_3 \xrightarrow{H_2O/H^+}$ Product

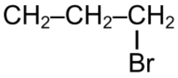
(A) 
$CH_3-\underset{\underset{OH}{|}}{CH}-CH_2-CH_3$

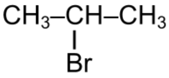
(B) $CH_3CH=CH-CH_2-OH$

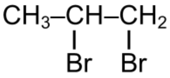
(C) $CH_3-CH_2-CH_2-CH_2-OH$

(D) None of these

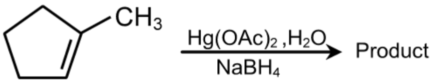
30. $CH_3-CH=CH_2 + Br_2 \xrightarrow{CCl_4}$ Product

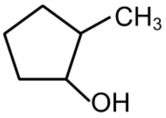
(A) 
$CH_2-CH_2-\underset{\underset{Br}{|}}{CH_2}$

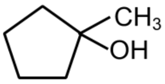
(B) 
$CH_3-\underset{\underset{Br}{|}}{CH}-CH_3$

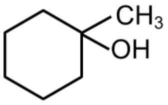
(C) 
$CH_3-\underset{\underset{Br}{|}}{CH}-\underset{\underset{Br}{|}}{CH_2}$

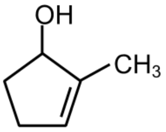
(D) None of these

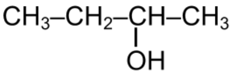
31. 

(A) 

(B) 

(C) 

(D) 

32. $CH_3-CH_2-CH=CH_2 \xrightarrow{A}$ 
$CH_3-CH_2-\underset{\underset{OH}{|}}{CH}-CH_3$

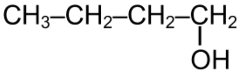
Reagent A will be ?

(A) $Hg(OA)_2$, H_2O / $NaBH_4$

(B) B_2H_6, $H_2O_2 + OH^-$

(C) Both (A) and (B)

(D) None of these

33. $CH_3-CH_2-CH=CH_2 \xrightarrow{A}$ 
$CH_3-CH_2-CH_2-\underset{\underset{OH}{|}}{CH_2}$

Reagent A will be ?

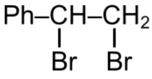
(A) $Hg(OA)_2$, H_2O / $NaBH_4$

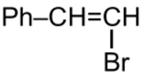
(B) B_2H_6, $H_2O_2 + OH^-$

(C) Both (A) and (B)

(D) None of these

34. $Ph-CH=CH_2 + HBr \xrightarrow{peroxide}$ Product

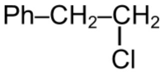
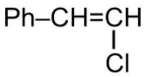
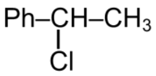
(A) 
$Ph-\underset{\underset{Br}{|}}{CH}-\underset{\underset{Br}{|}}{CH_2}$

(B) 
$Ph-CH=\underset{\underset{Br}{|}}{CH}$

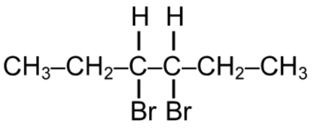
(C) $Ph-CHBr-CH_3$

(D) $Ph-CH_2-CHBr$

35. $Ph-CH=CH_2 + HCl \xrightarrow{peroxide}$ Product

(A)  $Ph-CH_2-\underset{\underset{Cl}{|}}{C}H_2$ (B)  $Ph-CH=\underset{\underset{Cl}{|}}{C}H$ (C)  $Ph-\underset{\underset{Cl}{|}}{C}H-CH_3$ (D) $Ph-CH_2-CHCl_2$

PART-C (Alkyne)

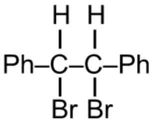
36.  $CH_3-CH_2-\overset{\overset{H}{|}}{\underset{\underset{Br}{|}}{C}}-\overset{\overset{H}{|}}{\underset{\underset{Br}{|}}{C}}-CH_2-CH_3$ $\xrightarrow{2NaNH_2}$ Product

Product is:

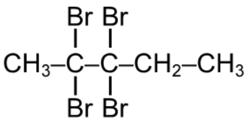
(A) $CH_3-C\equiv C-CH_2-CH_2-CH_3$ (B) $CH_3-CH_2-C\equiv C-CH_2-CH_3$

(C) $CH\equiv C-CH_2-CH_2-CH_2-CH_3$ (D) $CH_3-CH=CH-CH_2-CH_2-CH_3$

37. A $\xrightarrow{2NaNH_2}$ $Ph-C\equiv C-Ph$; A is:

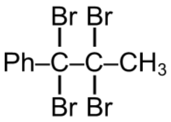
(A) $CH_3-CH=CH-Ph$ (B)  $Ph-\overset{\overset{H}{|}}{\underset{\underset{Br}{|}}{C}}-\overset{\overset{H}{|}}{\underset{\underset{Br}{|}}{C}}-Ph$

(C) $CH_3-CH_2-CH_2-CH_3$ (D) None of these

38.  $CH_3-\overset{\overset{Br}{|}}{\underset{\underset{Br}{|}}{C}}-\overset{\overset{Br}{|}}{\underset{\underset{Br}{|}}{C}}-CH_2-CH_3$ $\xrightarrow{\text{Zn dust, Alcohol } \Delta}$ Product is :

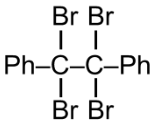
(A) $CH_2=C=CH-CH_2-CH_3$ (B) $CH_3-C\equiv C-CH_2-CH_3$

(C) $CH_3-CH_2-CH_2-CH_2-CH_3$ (D) $CH\equiv C-CH_2-CH_2-CH_3$

39.  $Ph-\overset{\overset{Br}{|}}{\underset{\underset{Br}{|}}{C}}-\overset{\overset{Br}{|}}{\underset{\underset{Br}{|}}{C}}-CH_3$ $\xrightarrow{\text{Zn dust, Alcohol } \Delta}$ Product is :

(A) $Ph-C\equiv C-CH_3$ (B) $Ph-CH=C=CH_2$ (C) $Ph-CH_2-C\equiv CH$ (D) $Ph-CH_2-CH_2-CH_3$

40. A $\xrightarrow{\text{Zn dust, Alcohol } \Delta}$ $Ph-C\equiv C-Ph$; A is:

(A) $Ph-CH=CH-Ph$ (B)  $Ph-\overset{\overset{Br}{|}}{\underset{\underset{Br}{|}}{C}}-\overset{\overset{Br}{|}}{\underset{\underset{Br}{|}}{C}}-Ph$ (C) $Ph-CH_2-CH_2-Ph$ (D) None of these

41. $2Ph-CCl_3 + Ag \longrightarrow$ Product

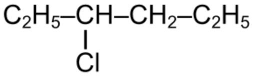
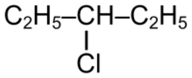
Product is:

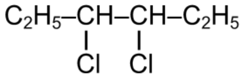
(A) $Ph-CH=CH-Ph + AgCl$ (B) $Ph-CH_2-CH_2-Ph + AgCl$

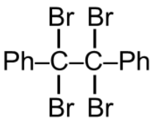
(C) $Ph-C\equiv C-Ph + AgCl$ (D) $Ph-C\equiv C-CH_3 + AgCl$

42. $C_2H_5-C\equiv C-C_2H_5 + Cl_2 \xrightarrow{CCl_4}$ Product

Final product is:

(A)  $C_2H_5-\underset{\underset{Cl}{|}}{C}H-CH_2-C_2H_5$ (B)  $C_2H_5-\underset{\underset{Cl}{|}}{C}H-C_2H_5$

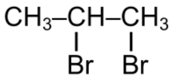
(C)  $C_2H_5-\underset{\underset{Cl}{|}}{C}H-\underset{\underset{Cl}{|}}{C}H-C_2H_5$ (D) $C_2H_5-CCl_2-CCl_2-C_2H_5$

43. A + $2Br_2 \xrightarrow{CCl_4}$  $Ph-\overset{\overset{Br}{|}}{\underset{\underset{Br}{|}}{C}}-\overset{\overset{Br}{|}}{\underset{\underset{Br}{|}}{C}}-Ph$; A is:

(A) PhCH=CHPh (B) $PhCH_2CH_2Ph$ (C) Ph–C≡C–Ph (D) None of these

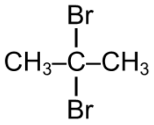
44. $CH_3–C≡CH + HBr \longrightarrow$ Product

Product is:

(A) 
$\underset{Br}{CH_3–CH}–\underset{Br}{CH_3}$

(B) $CH_3–CH_2–CHBr_2$

(C) $CH_3–CBr_2–CHBr_2$

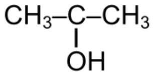
(D) 
$CH_3–\overset{Br}{\underset{Br}{C}}–CH_3$

45. Alkyne react with water to form _____ compounds.

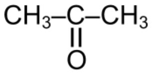
(A) carboxylic (B) ester (C) carbonyl (D) Anhydride

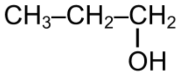
46. $CH_3–C≡CH \xrightarrow[H_2O_2/OH^-]{B_2H_6}$ Product

Product is:

(A) 
$CH_3–\underset{OH}{C}–CH_3$

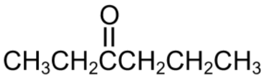
(B) $CH_3CH_2–CHO$

(C) 
$CH_3–\underset{O}{\underset{\|}{C}}–CH_3$

(D) 
$CH_3–CH_2–\underset{OH}{CH_2}$

47. $CH_3CH_2C≡CCH_2CH_3 + H_2O \xrightarrow{HgSO_4}$ Product

Product is:

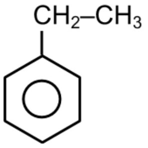
(A) 
$CH_3CH_2\overset{O}{\overset{\|}{C}}CH_2CH_2CH_3$

(B) $CH_3CH_2CH_2CH_2CH_2CH_3$

(C) both A & B

(D) None of these

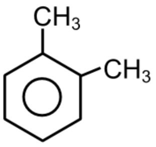
PART-D (Benzene)

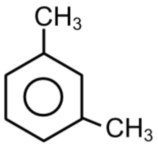
48. $x\ HC≡CH + y\ CH_3–CH_2–C≡CH \longrightarrow$  ; Find the value of 'x' and 'y' ?

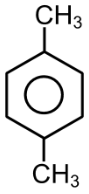
(A) x = 1, y = 2 (B) x = 2, y = 1 (C) x = 2, y = 2 (D) x = 1, y = 1

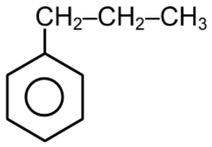
49. Which of the following will not form in the following reaction ?

$2CH_3–C≡C–H + HC≡CH \xrightarrow[\text{tube}]{\text{Red hot}}$?

(A) 

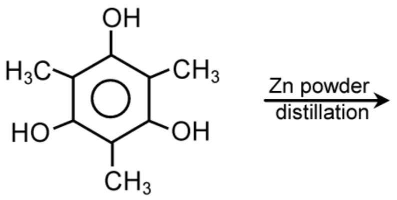
(B) 

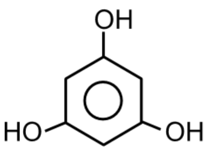
(C) 

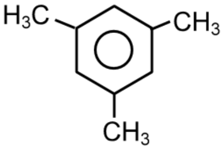
(D) 

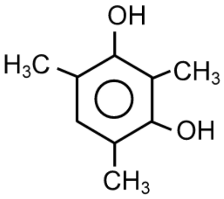
50. Phenol upon distillation with zinc dust leads to the formation of ……………….

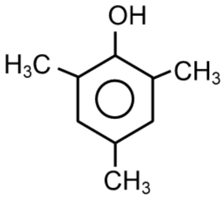
(A) Toluene (B) Benzene (C) Cyclohexane (D) n-hexane

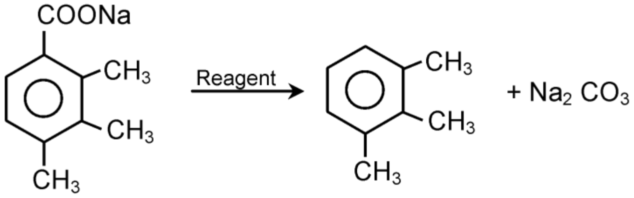
51.  ?

(A) 

(B) 

(C) 

(D) 

52. 

Reagent may be -

(A) Soda lime (B) Zinc dust (C) Red hot tube (D) none of these

53. Benzene upon addition with the mixture of conc. HNO_3 and conc. H_2SO_4 undergoes ………….

(A) nitration (B) sulphonation

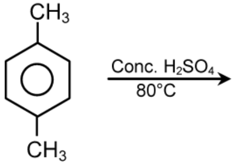
(C) both nitration and sulphonation (D) neither nitration nor sulphonation

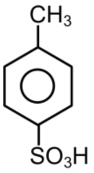
54. Benzene forms ………………with hot concentrated sulphuric acid (80°C temperature)

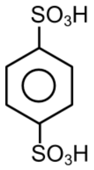
(A) Benzene sulphonic acid (B) Benzoic acid

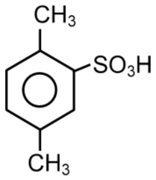
(C) Both (D) None of the above

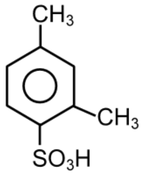
55. Identify the product :



(A) 

(B) 

(C) 

(D) 

Answers

1.	(D)	**2.**	(D)	**3.**	(B)	**4.**	(C)	**5.**	(D)
6.	(B)	**7.**	(B)	**8.**	(C)	**9.**	(C)	**10.**	(B)
11.	(B)	**12.**	(C)	**13.**	(C)	**14.**	(A)	**15.**	(B)
16.	(B)	**17.**	(B)	**18.**	(D)	**19.**	(C)	**20.**	(C)
21.	(A)	**22.**	(C)	**23.**	(D)	**24.**	(C)	**25.**	(B)
26.	(C)	**27.**	(B)	**28.**	(C)	**29.**	(A)	**30.**	(C)
31.	(B)	**32.**	(A)	**33.**	(B)	**34.**	(D)	**35.**	(C)
36.	(B)	**37.**	(B)	**38.**	(B)	**39.**	(A)	**40.**	(B)
41.	(C)	**42.**	(D)	**43.**	(C)	**44.**	(D)	**45.**	(C)
46.	(B)	**47.**	(A)	**48.**	(B)	**49.**	(D)	**50.**	(B)
51.	(B)	**52.**	(A)	**53.**	(A)	**54.**	(A)	**55.**	(C)