All Basic Concepts of Organic Chemistry [Part-1 to 4]

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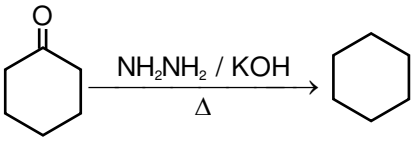
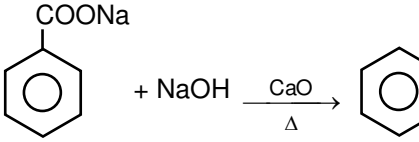
ABC-1 (Hydrocarbon)

(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) $R–CH=CH–R + H_2 \xrightarrow[Pt\ or\ Pd]{Ni\ or} R–CH_2–CH_2–R$ (b) $R–C\equiv C–R + 2H_2 \xrightarrow[Pt\ or\ Pd]{Ni\ or} R–CH_2–CH_2–R$
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)** $R-CHO \xrightarrow[\Delta]{Zn-Hg/conc.\,HCl} RCH_3 + H_2O$ **(b)** $R-\overset{\overset{O}{\|}}{C}-R' \xrightarrow[\Delta]{Zn-Hg/conc.\,HCl} RCH_2R' + H_2O$
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)** $2R - X + 2Na \xrightarrow{dry\ ether} R - R + 2NaX$ Symmetrical alkane **(b)** $2CH_3Cl \xrightarrow[dry\ ether]{Na} CH_3—CH_3$
6.	**Correy-House synthesis :** Both symmetrical and unsymmetrical alkanes can prepare by this method. $R—X \xrightarrow[(1°,\,2°,\,3°)]{2Li} \bar{R}\overset{+}{L}i \xrightarrow{CuI} R_2CuLi \xrightarrow[1°>2°]{R'-X} R–R'$ Lithium dialkyl cuprate (Gilman's reagent)	**(a)** $R—X \xrightarrow[(1°,\,2°,\,3°)]{2Li} \xrightarrow{CuI} \xrightarrow[1°>2°]{R'–X} R–R'$ **(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)

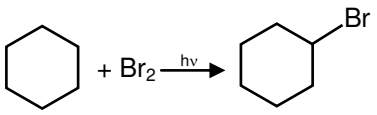
1. Photochemical halogenation:

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

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

Ex. $CH_3CH_2CH_3 + Cl_2 \xrightarrow{h\nu} CH_3\underset{\displaystyle Cl}{\underset{|}{C}}HCH_3 + CH_3CH_2CH_2Cl$

Reactivity of $X_2 = F_2 > Cl_2 > Br_2 > I_2$
Reactivity of H = 3°H > 2°H > 1°H

Ex.  (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. $CH_3CH_2CH_2CH_3 \xrightarrow[HCl]{\text{anhy. } AlCl_3} CH_3\underset{\displaystyle CH_3}{\underset{|}{C}}HCH_3$

Ex. $CH_3CH_2CH_2CH_2CH_3 \xrightarrow[HCl]{\text{anhy. } AlCl_3} CH_3\underset{\displaystyle CH_3}{\underset{|}{C}}HCH_2CH_3$

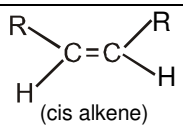
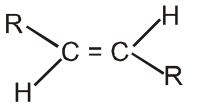
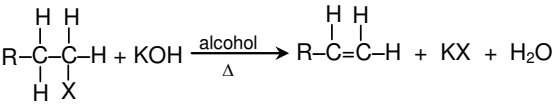
Ex. $CH_3CH_2CH_2CH_2CH_2CH_3 \xrightarrow[HCl]{\text{anhy. } AlCl_3} CH_3\underset{\displaystyle CH_3}{\underset{|}{C}}HCH_2CH_2CH_3 + CH_3CH_2\underset{\displaystyle CH_3}{\underset{|}{C}}HCH_2CH_3$

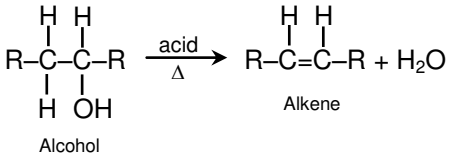
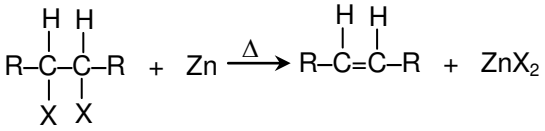
n-Hexane — 2-Methylpentane — 3-Methylpentane

(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)	$R{-}C{\equiv}C{-}R \xrightarrow[H_2, Pd, BaSO_4, S]{H_2, \text{Lindlar's catalyst or}}$  (cis alkene) $R{-}C{\equiv}C{-}R \xrightarrow{Na/NH_3(\ell)}$  (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] Rate of dehydrohalogenation of alkyl halides : 3° > 2° > 1°	 More stable alkene is the major product generally. It is also known as **Saytzeff** alkene. (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°	 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.	

Chemical reactions of alkenes [6-Reactions] :

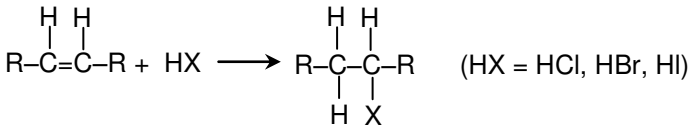
Markovnikov's rule : The rule states that the negative part of the attacking species add on the carbon atom containing less number of hydrogen atom and positive part add on the carbon atom containing more number of hydrogen atoms.

1. Addition of hydrogen halides (Hydrohalogenation)

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

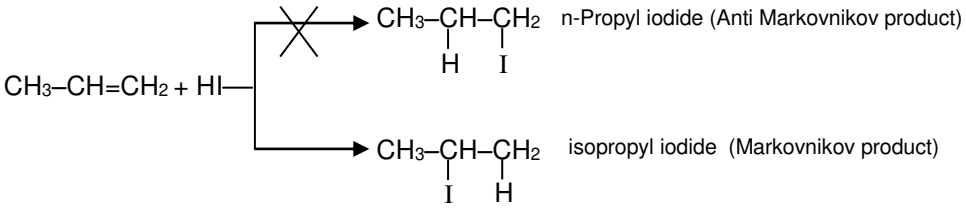
Major Product : According to Markovnikov's rule.

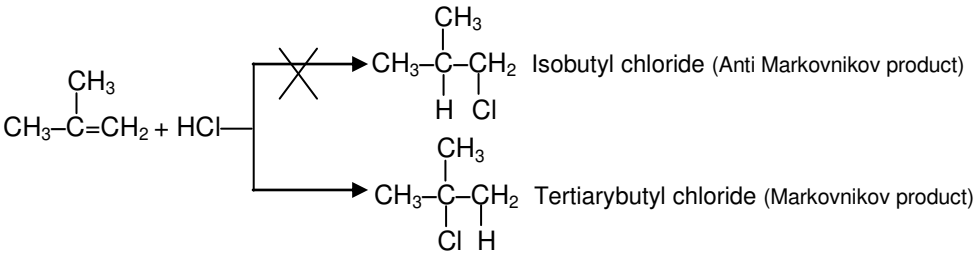
General Reaction:



(HX = HCl, HBr, HI)

Examples:

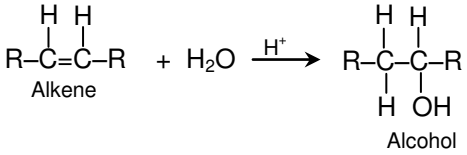




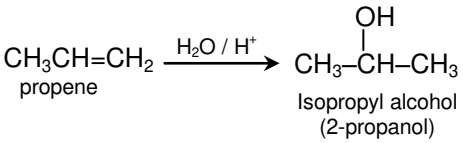
2. Addition of water (Hydration)

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

General Reaction:



Example:

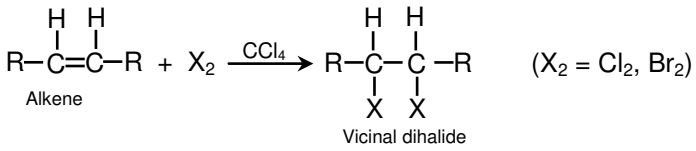


3. Addition of halogens (Halogenation)

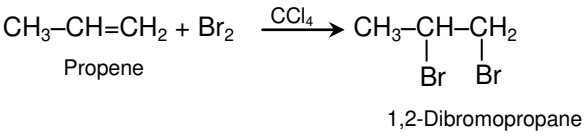
Halogen add to alkenes to form vicinal dihalides. This reaction is the best method for preparing vicinal dihalides. The reaction is carried out in an inert solvent like carbon tetrachloride.

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

General Reaction:



Example:

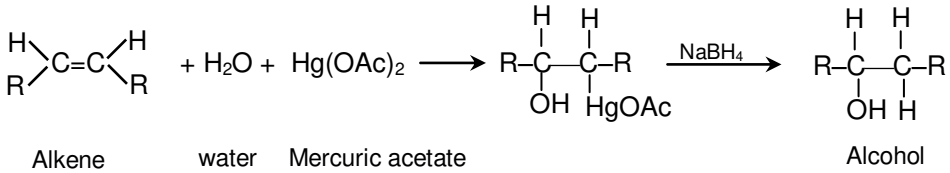


4. Hydration by $Hg(OAc)_2$, $H_2O/NaBH_4$ (Oxymercuration-demercuration)

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

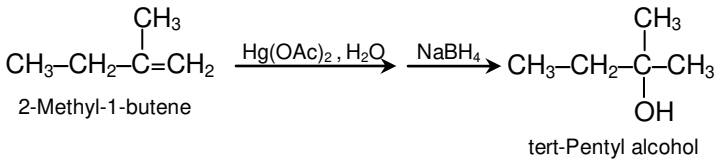
- Oxymercuration-demercuration process gives alcohols corresponding to **Markovnikov** addition of water to the carbon-carbon double bond.

General Reaction:



Acetate = (–OAc) = (CH_3COO–)

Example.

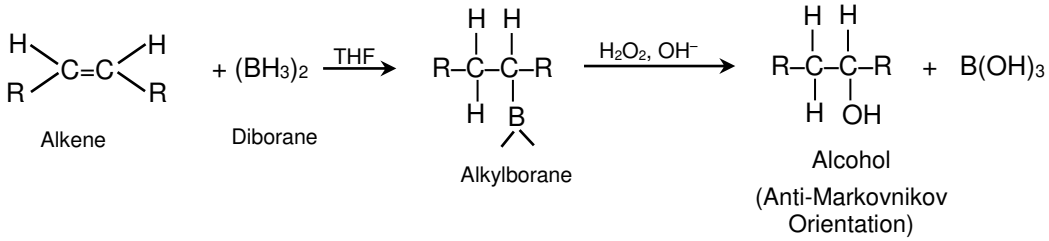


5. Hydration by B_2H_6/H_2O_2, OH^- (Hydroboration-oxidation)

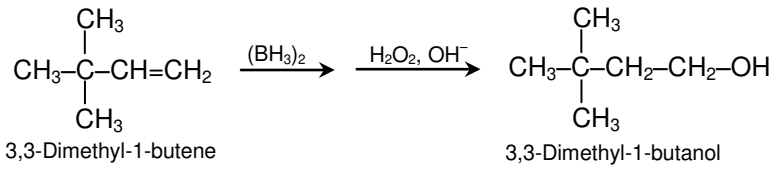
With the reagent diborane (B_2H_6), alkenes undergo hydroboration to give trialkylboranes (R_3B) which on oxidation give alcohols.

- 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:

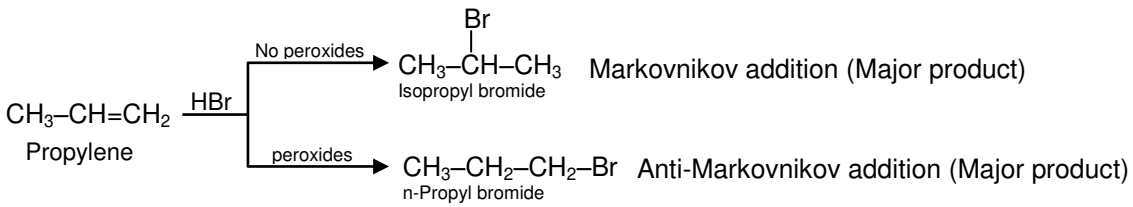


6. Peroxide effect (Addition of HBr)

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.**

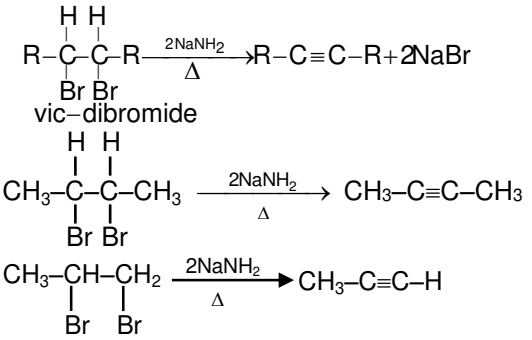
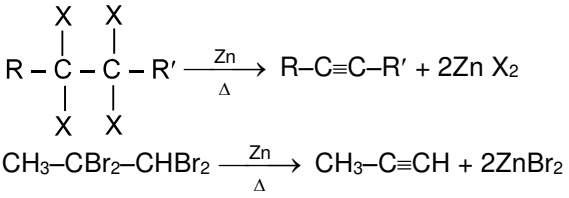
Only the addition of hydrogen bromide shows the peroxide effect. The presence or absence of peroxides has no effect on the orientation of addition of hydrogen chloride, hydrogen iodide, sulfuric acid, water, etc.

Example:



(C) ALKYNE

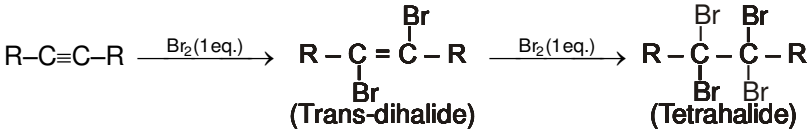
The alkynes are unsaturated hydrocarbons that contain one triple bond (C≡C). They have the general formula C_nH_{2n-2} and the triple bond is known as the 'acetylenic bond'. Many alkynes have been found in nature.

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.	 vic–dibromide
3.	**Dehalogenation of tetrahaloalkanes**	
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 :

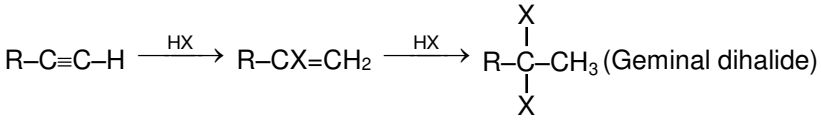
Halogens like bromine or chlorine add up to alkyne to form trans dihalides and further addition of halogen give tetrahalo alkane. It is an example of electrophilic addition reaction. This reaction is used as a test for unsaturation.

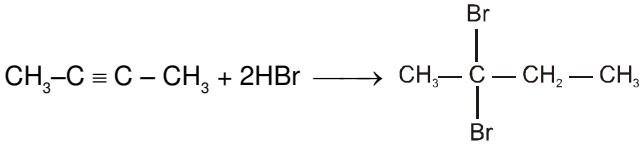


Ex. $CH_3{-}C{\equiv}CH + 2Br_2 \xrightarrow{CCl_4} CH_3{-}CBr_2{-}CHBr_2$

(2) Addition of Hydrogen halides :

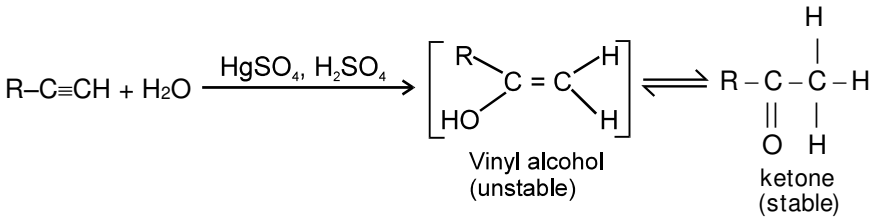
Addition of HX to unsymmetrical alkyne take place according to **Markovnikov's rule.**



Ex. 

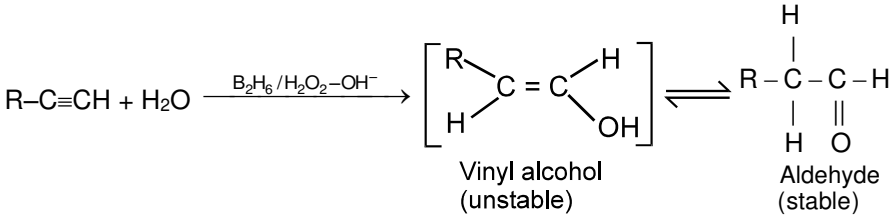
(3) Addition of water :

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



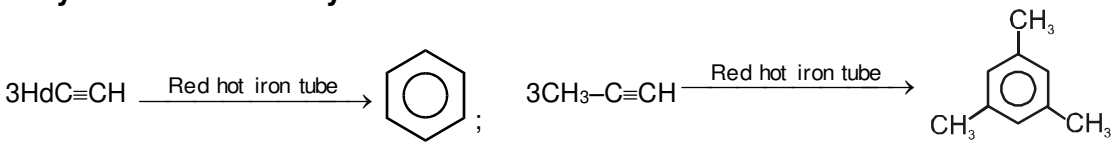
Ex. $CH_3– C \equiv CH \xrightarrow{HgSO_4,H_2SO_4} CH_3–\underset{\underset{O}{\|}}{C}–CH_3$

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



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

4. Polymerization of alkyne :



Lab Test :

1. Test for unsaturation ($>C=C<$, $—C\equiv C—$) :

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

Functional Group	Reagent	Observation
$>C=C<$, $—C\equiv C—$	Bromine water test (Br_2 + H_2O)	Red-brown colour disappears
$>C=C<$, $—C\equiv C—$	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]

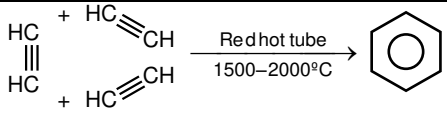
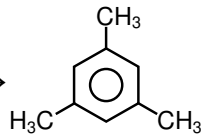
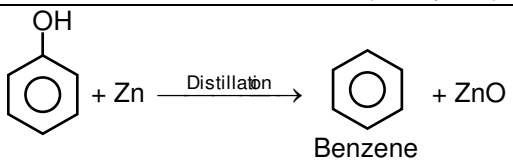
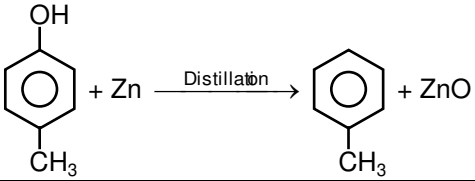
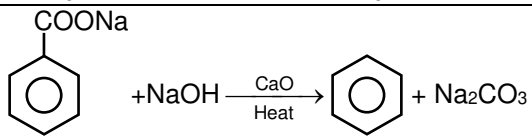
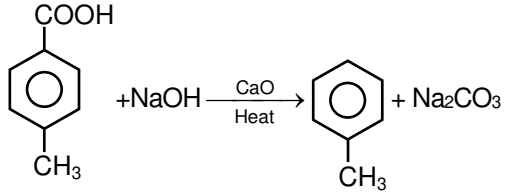
Terminal alkyne give Tollen's test and ammonical curprous chloride test

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

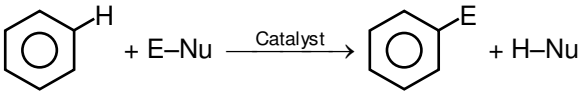
Benzene is an aromatic compound with alternate π-bonds having 6 delocalized π-electrons.
It is a colourless & highly flammable liquid.

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.** $3CH_3–C\equiv CH \xrightarrow{\text{Red hot tube}}$  (Mesitylene)
2.	**From phenol** Benzene is obtained by distillation of phenol with zinc dust.	**1.**  Benzene (–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.** 

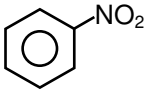
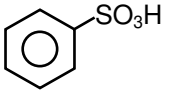
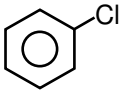
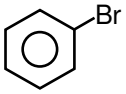
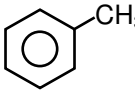
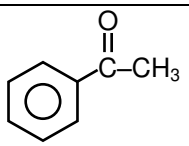
Chemical reactions of benzene [6-Reactions]

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 :



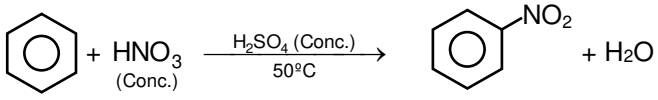
$E–Nu \longrightarrow E^+ + Nu^-$

Electrophilic substitution reactions of Benzene

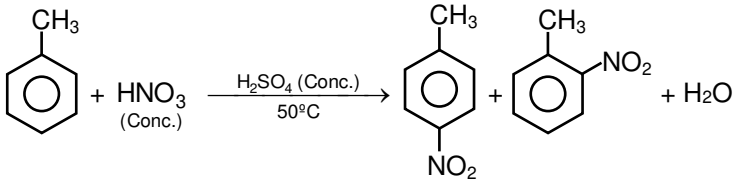
	Substrate	Reagent	Electrophile	Product	Name of reaction
1.		Conc. HNO_3 / Conc. H_2SO_4 Nitrating mixture	$NO_2^{\oplus}$		Nitration of benzene
2.		Conc. $H_2SO_4 + SO_3$	SO_3		Sulphonation of benzene
3.		Cl_2 / $AlCl_3$	$Cl^{\oplus}$		Chlorination of benzene
4.		Br_2 / $AlCl_3$	$Br^{\oplus}$		Bromination of benzene
5.		CH_3Cl / $AlCl_3$	$CH_3^{\oplus}$		Friedal Craft's alkylation of benzene
6.		$CH_3C(=O)Cl$ / $AlCl_3$	$CH_3-\overset{\oplus}{C}=O$		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.

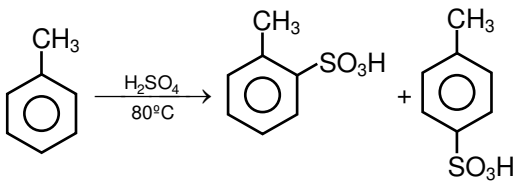
(1) Nitration

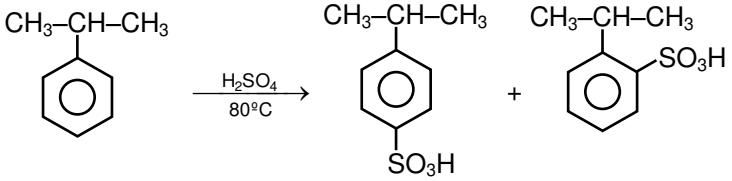
Ex. 

Nitrobenzene

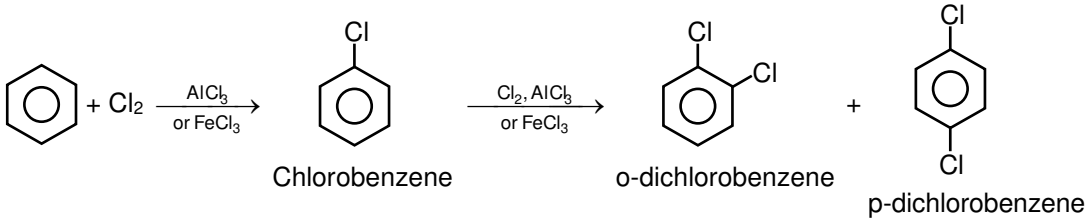
Ex. 

(2) Sulphonation

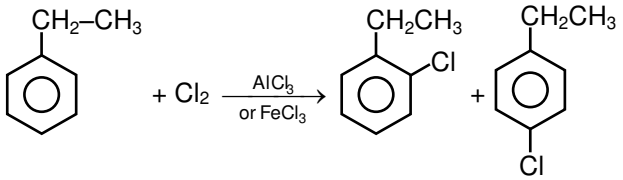
Ex. 

Ex. 

(3) Halogenation

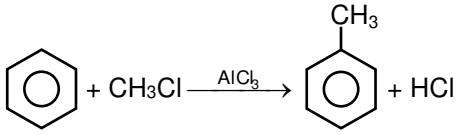
Ex. 

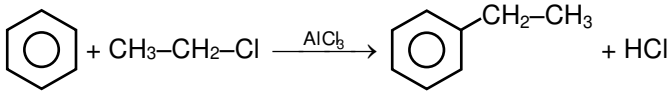
Chlorobenzene o-dichlorobenzene p-dichlorobenzene

Ex. 

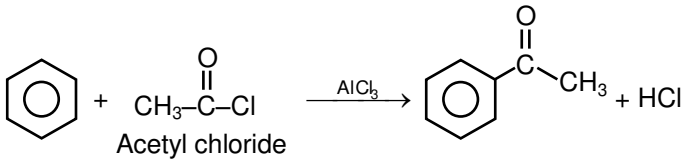
(4) Friedal-Craft's reaction

(a) Alkylation

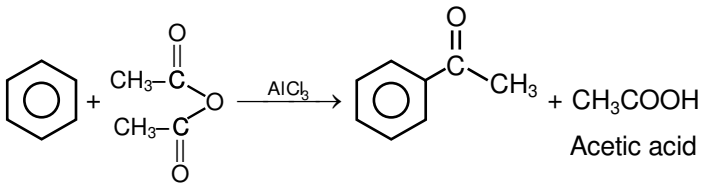
Ex. 

Ex. 

(b) Acylation

Ex. 

Acetyl chloride

Ex. 

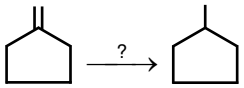
Acetic acid

Exercise

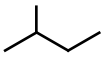
ONLY ONE OPTION CORRECT TYPE

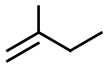
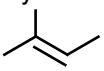
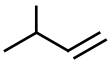
PART-A (Alkane)

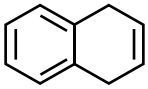
1. Which of the following catalyst can be used for the given conversion ?

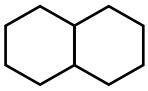
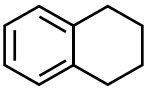
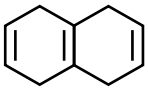
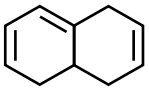


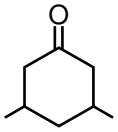
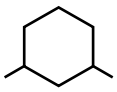
(A) H_2/Ni (B) H_2/Pd (C) H_2/Pt (D) All of these

2. X $\xrightarrow{H_2/Ni}$  ; X may be

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

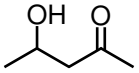
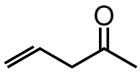
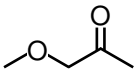
3.  $\xrightarrow[\text{room temp.}]{H_2/Ni}$ Product

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

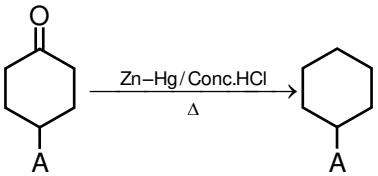
4.  $\xrightarrow{\text{Reagent}}$  , Reagent is

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

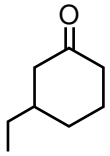
5. In which case Clemensen reduction should be avoided.

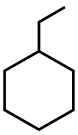
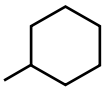
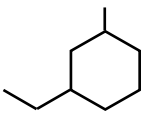
(A)  (B)  (C)  (D) All of these

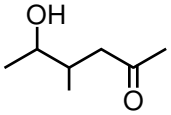
6. For the given conversion A should not be



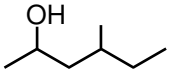
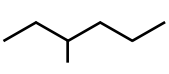
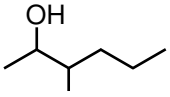
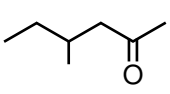
(A) Halogen (B) Alcohol (C) Carboxylic acid (D) All of these

7.  $\xrightarrow{NH_2-NH_2/KOH}$ P, Product P is

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

8.  $\xrightarrow{NH_2-NH_2/KOH}$ P

Product P is

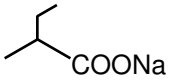
(A)  (B)  (C)  (D) 

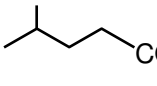
9. $CH_3COONa \xrightarrow[\Delta]{\text{reagent}} CH_4$; reagent is

(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

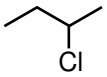
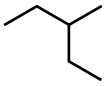
(A) Chloromethane (B) Chloroethane (C) 1-Chloropropane (D) 2-Chloropropane

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.  $\xrightarrow{2\,Li} X \xrightarrow{CuI} Y \xrightarrow{\text{Reagent}}$  , reagent is

(A) $CH_3–Cl$ (B) $CH_3–\underset{\displaystyle Cl}{\underset{|}{CH_2}}$ (C) $CH_3–\underset{\displaystyle Cl}{\underset{|}{CH}}–CH_3$ (D) $CH_3–CH_2–\underset{\displaystyle Cl}{\underset{|}{CH_2}}$

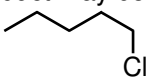
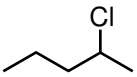
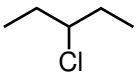
17. $CH_4 + X_2 \xrightarrow[\text{or high temp}]{h\nu} CH_3–X$

Order of reactivity of halogen is

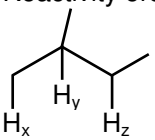
(A) $I_2 > Br_2 > Cl_2 > F_2$ (B) $F_2 > Cl_2 > Br_2 > I_2$ (C) $Br_2 > Cl_2 > I_2 > F_2$ (D) $Cl_2 > Br_2 > F_2 > I_2$

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

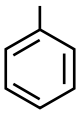
Product may be

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

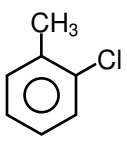
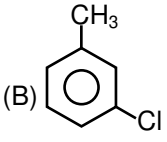
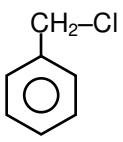
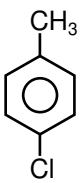
19. Reactivity order of Hydrogen for the given reaction is

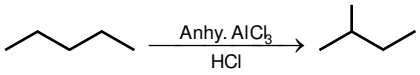
 + $Br_2 \xrightarrow{h\nu}$

(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

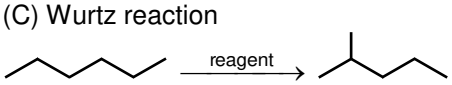
(A)  (B)  (C)  (D) 

21. 

This reaction is known as

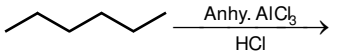
(A) Isomerisation of alkane (B) Polymerisation of alkane

(C) Wurtz reaction (D) None of these

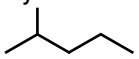
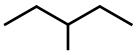
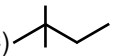
22. 

reagent may be

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

23. 

P may be

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

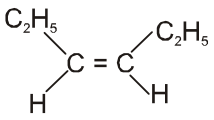
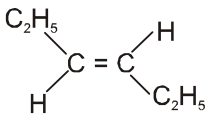
PART-B (Alkene)

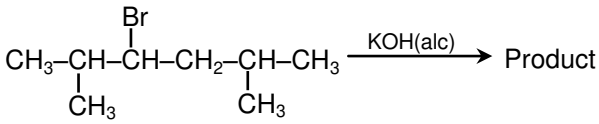
24. $CH_3–C\equiv C–CH_2–CH_2–CH_3 \xrightarrow{H_2, Pd, BaSO_4, S}$ Product

(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. $CH_3–CH_2–C\equiv C–CH_2–CH_3 \xrightarrow{Na/NH_3(\ell)}$ Product

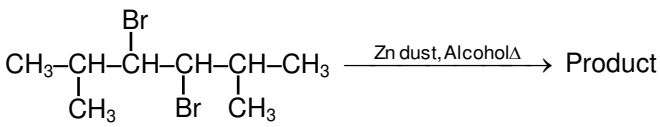
(A)  (B)  (C) Both A & B (D) None of these

26. 

Product is:

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

(C) $CH_3–C(CH_3)=CH–CH_2–CH(CH_3)–CH_3$ (D) None of these

27. 

Product is:

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

(C) $CH_3–CH(CH_3)–CH_2–CH_2–CH(CH_3)–CH_3$ (D) None of these

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

(A) $Ph–\underset{\displaystyle Br}{\underset{|}{CH_2}}–CH_2$ (B) $Ph–\underset{\displaystyle Br}{\underset{|}{CH}}=CH$ (C) $Ph–\underset{\displaystyle Br}{\underset{|}{CH}}–CH_3$ (D) $Ph–CH_2–CHBr_2$

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

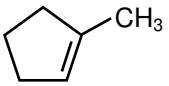
(A) $CH_3–\underset{\displaystyle OH}{\underset{|}{CH}}–CH_2–CH_3$ (B) $CH_3CH=CH–CH_2–OH$

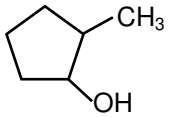
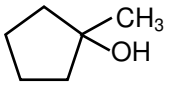
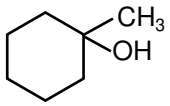
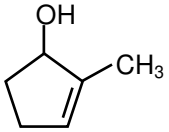
(C) $CH_3–CH_2–CH_2–CH_2–OH$ (D) None of these

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

(A) $CH_2–CH_2–\underset{\displaystyle Br}{\underset{|}{CH_2}}$ (B) $CH_3–\underset{\displaystyle Br}{\underset{|}{CH}}–CH_3$

(C) $CH_3–\underset{\displaystyle Br}{\underset{|}{CH}}–\underset{\displaystyle Br}{\underset{|}{CH_2}}$ (D) None of these

31.  $\xrightarrow[NaBH_4]{Hg(OAc)_2, H_2O}$ Product

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

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

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. $CH_3–CH_2–CH=CH_2 \xrightarrow{A} CH_3–CH_2–CH_2–\underset{\displaystyle OH}{\underset{|}{CH_2}}$

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) $Ph–\underset{\displaystyle Br}{\underset{|}{CH}}–\underset{\displaystyle Br}{\underset{|}{CH_2}}$ (B) $Ph–\underset{\displaystyle Br}{\underset{|}{CH}}=CH$ (C) $Ph–CHBr–CH_3$ (D) $Ph–CH_2–CH_2Br$

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

(A) $Ph–\underset{\displaystyle Cl}{\underset{|}{CH_2}}–CH_2$ (B) $Ph–\underset{\displaystyle Cl}{\underset{|}{CH}}=CH$ (C) $Ph–\underset{\displaystyle Cl}{\underset{|}{CH}}–CH_3$ (D) $Ph–CH_2–CHCl_2$

PART-C (Alkyne)

36. $CH_3–CH_2–\underset{\underset{Br}{|}}{\overset{\overset{H}{|}}{C}}–\underset{\underset{Br}{|}}{\overset{\overset{H}{|}}{C}}–CH_2–CH_3 \xrightarrow{2NaNH_2}$ 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≡C–Ph ; A is:

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

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

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

(A) Ph–C≡C–CH_3 (B) Ph–CH=C=CH_2 (C) Ph–CH_2–C≡CH (D) Ph–CH_2–CH_2–CH_3

40. A $\xrightarrow{Zn\ dust,\ Alcohol\Delta}$ Ph–C≡C–Ph ; A is:

(A) Ph–CH=CH–Ph (B) $Ph–\underset{\underset{Br}{|}}{\overset{\overset{Br}{|}}{C}}–\underset{\underset{Br}{|}}{\overset{\overset{Br}{|}}{C}}–Ph$ (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≡C–Ph + AgCl (D) Ph–C≡C–CH_3 + AgCl

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

Final product is:

(A) $C_2H_5–\underset{\underset{Cl}{|}}{CH}–CH_2–C_2H_5$ (B) $C_2H_5–\underset{\underset{Cl}{|}}{CH}–C_2H_5$

(C) $C_2H_5–\underset{\underset{Cl}{|}}{CH}–\underset{\underset{Cl}{|}}{CH}–C_2H_5$ (D) $C_2H_5–CCl_2–CCl_2–C_2H_5$

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

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

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

Product is:

(A) $CH_3–\underset{\underset{Br}{|}}{CH}–\underset{\underset{Br}{|}}{CH_3}$ (B) $CH_3–CH_2–CHBr_2$ (C) $CH_3–CBr_2–CHBr_2$ (D) $CH_3–\underset{\underset{Br}{|}}{\overset{\overset{Br}{|}}{C}}–CH_3$

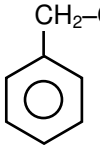
45. Alkyne react with water to form _____ compounds.
(A) carboxylic (B) ester (C) carbonyl (D) Anhydride

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

Product is:
(A) $CH_3–\underset{\underset{OH}{|}}{C}–CH_3$ (B) $CH_3CH_2–CHO$ (C) $CH_3–\underset{\underset{O}{||}}{C}–CH_3$ (D) $CH_3–CH_2–\underset{\underset{OH}{|}}{CH_2}$

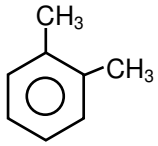
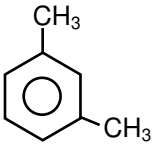
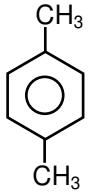
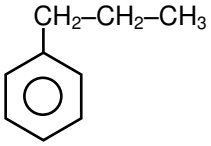
47. $CH_3CH_2C\equiv CCH_2CH_3 + H_2O \xrightarrow{HgSO_4}$ Product
Product is:
(A) $CH_3CH_2\overset{\overset{O}{||}}{C}CH_2CH_2CH_3$ (B) $CH_3CH_2CH_2CH_2CH_2CH_3$
(C) both A & B (D) None of these

PART-D (Benzene)

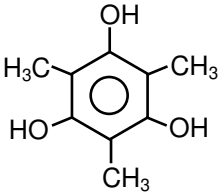
48. x $HC\equiv CH$ + y $CH_3–CH_2–C\equiv CH \longrightarrow$  ; Find the value of 'x' and 'y' ?

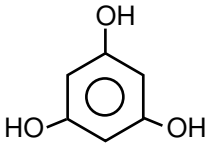
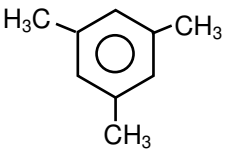
(A) x = 1, y = 2 (B) x = 2, y = 1 (C) x = 2, y = 2 (D) x = 1, y = 1

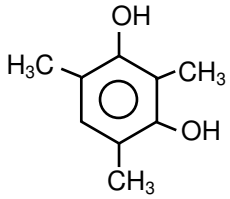
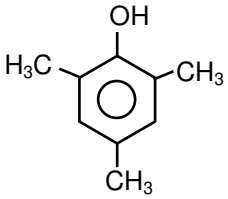
49. Which of the following will not form in the following reaction ?
$2CH_3–C\equiv C–H + HC\equiv CH \xrightarrow[\text{tube}]{\text{Red hot}}$?

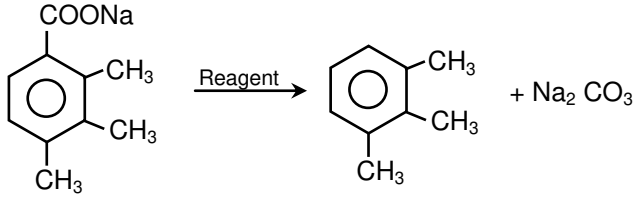
(A)  (B)  (C)  (D) 

50. Phenol upon distillation with zinc dust leads to the formation of …….
(A) Toluene (B) Benzene (C) Cyclohexane (D) n-hexane

51.  $\xrightarrow[\text{distillation}]{\text{Zn powder}}$?

(A)  (B) 

(C)  (D) 

52. 

+ Na_2CO_3

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

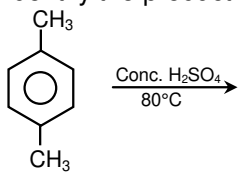
(C) both nitration and sulphonation (D) neither nitration nor sulphonation

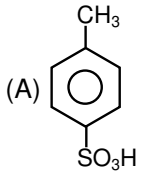
54. Benzene forms ……with hot concentrated sulphuric acid (80°C temperature)

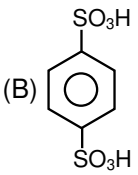
(A) Benzene sulphonic acid (B) Benzoic acid

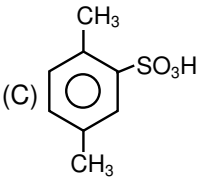
(C) Both (D) None of the above

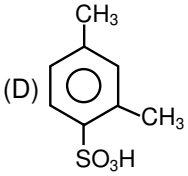
55. Identify the product :



(A) 

(B) 

(C) 

(D) 

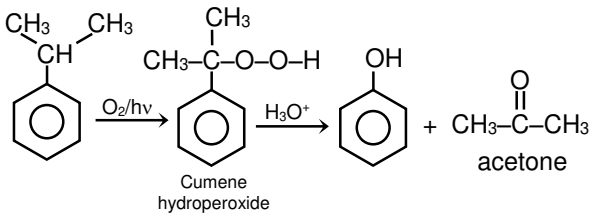
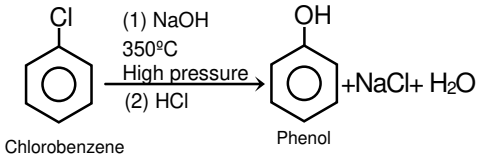
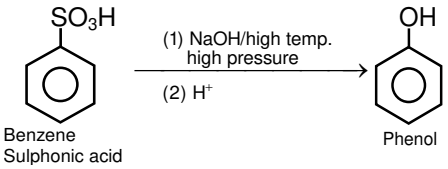
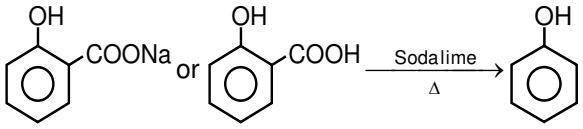
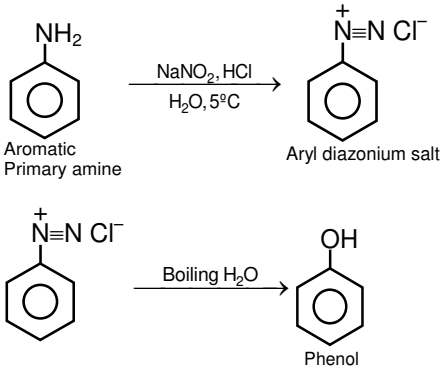
Answers

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)

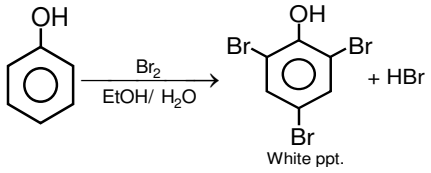
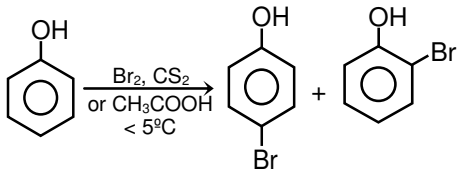
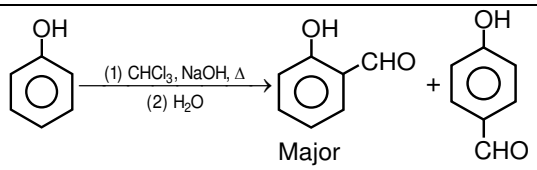
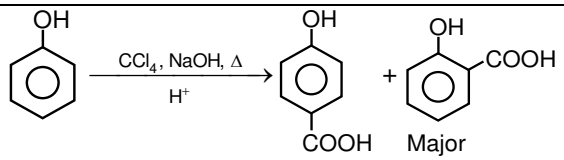
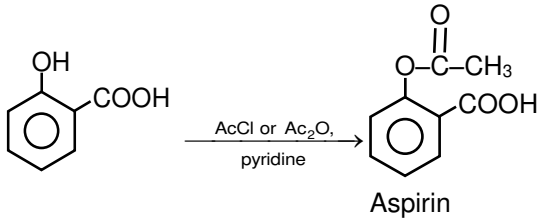
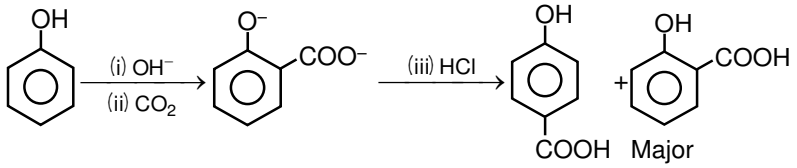
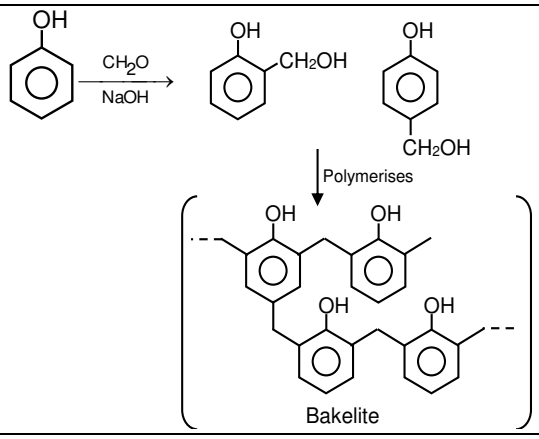
ABC-2 (Phenol & Aniline)

(A) PHENOL

Preparation of phenol (5-Methods)

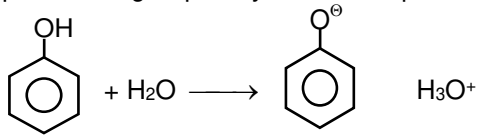
1.	**Cumene hydroperoxide method** This is an industrial process to convert cumene into phenol and acetone in the presence of oxygen from air followed by hydrolysis.	
2.	**Dow's process.** In this process chlorobenzene is heated at 350°C (under high pressure) with sodium hydroxide which yields phenol.	
3.	**Fusion of benzene sulphonic acid with concentrated NaOH** This is commercial process for synthesizing phenol. Benzene sulphonic acid is melted (fused) with sodium hydroxide at (300°C–320°C) followed by hydrolysis which yields phenol.	
4.	**Decarboxylation of salicylic acid** Distillation of salicyclic acid with soda-lime (NaOH + CaO) produces phenol.	
5.	**Hydrolysis of benzene diazonium salt** Benzene diazonium salt is prepared by reacting aromatic primary amine with $NaNO_2$, HCl at low temperature.Then this aqueous solution is heated to get phenol.	

Chemical reactions of phenol [5-Reactions]

1	**(a) Reaction with Br_2/H_2O** When bromine is added to solution of phenol in presence of ethanol or H_2O, it forms white precipitate of 2,4,6-tribromo-phenol.	
	(b) Reaction with Br_2/CS_2 In presence of non-polar solvent (like CS_2) or acids like CH_3COOH at low temperature, only monobromo product is obtained.	
2.	**Reimer Tiemann formylation** Phenol when heated with chloroform and NaOH followed by H_2O forms salicyladehyde.	
3.	**Reimer Tiemann carboxylation** Phenol when heated with CCl_4 and sodium hydroxide followed by hydrolysis forms salicylic acid.	
	Note: Salicyclic acid can be used in formation of aspirin. (Aspirin is used as painkiller)	
4.	**Kolbe's Schmidt reaction** Phenol when reacted with hydroxide ion in presence of CO_2 forms a complex which on acidification forms salicyclic acid.	
5.	**Bakelite formation** Bakelite is made by condensation reaction between phenol and formaldehyde.	

Lab test for phenol

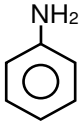
1. Litmus test : Phenol turns blue litmus red. Phenols behave as weak acid because of presence of polar O–H group, they ionise in aqueous solution to give H^+ ions.



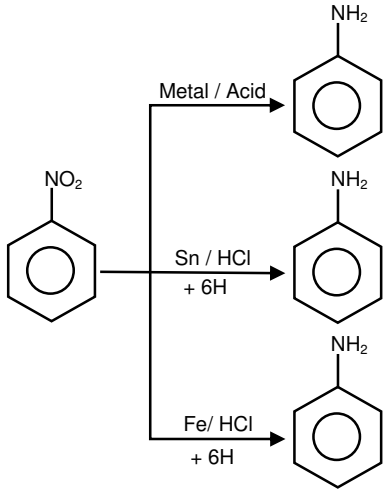
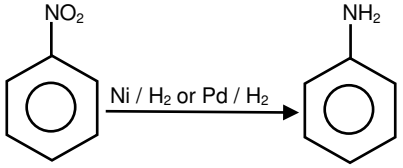
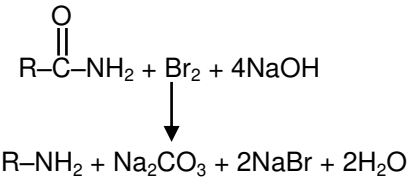
Phenol Phenoxide ion

2. Neutral $FeCl_3$: Phenols give a violet-coloured water soluble complex with neutral ferric chloride.

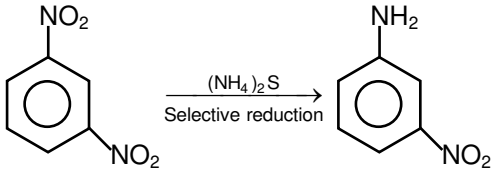
$$6Ph–OH + FeCl_3 \longrightarrow \underset{\text{Violet complex}}{Fe(OPh)_6^{3-}} + 3H^+ + 3HCl$$

(B) ANILINE 

Preparation of aniline [3-Methods]

1. Reduction by Metals	2. Reduction by H_2	3. Hofmann bromamide degradation reaction
		In this reaction an unsubstituted amides (only 1°) treated with NaOH/KOH and bromine to give a primary amine that has one carbon lesser than starting amide.  **R can be :** Alkyl or phenyl This method is used to prepar 1° aliphatic or aromatic amines.

Special :

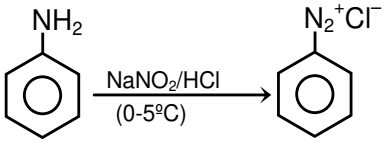


(various other sulphides can be used.)

Chemical reactions of aniline :

1. Preparation of diazonium salt:

Aniline reacts with $NaNO_2/H^+$ to form diazonium salt.



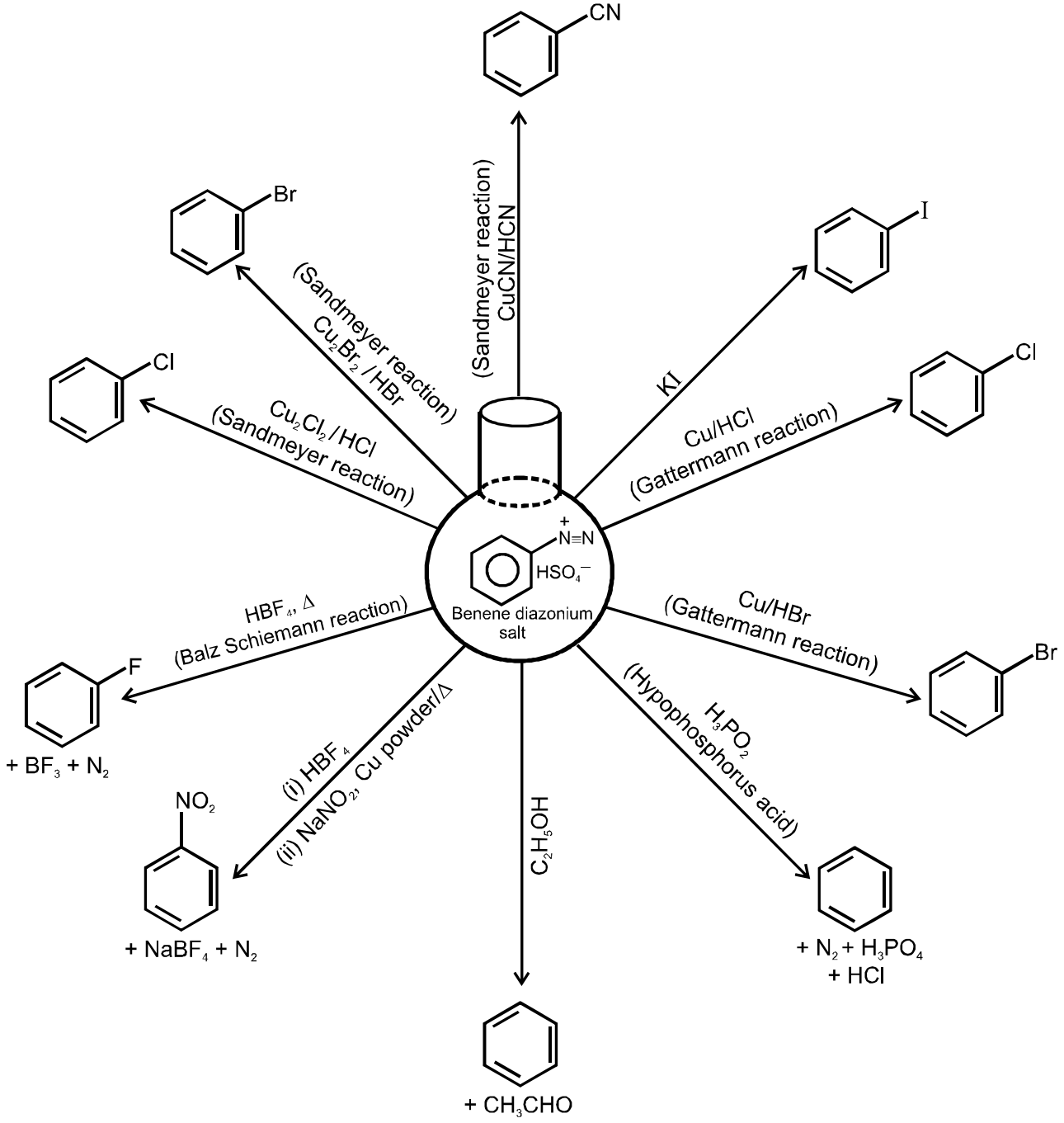
Benzene diazonium chloride

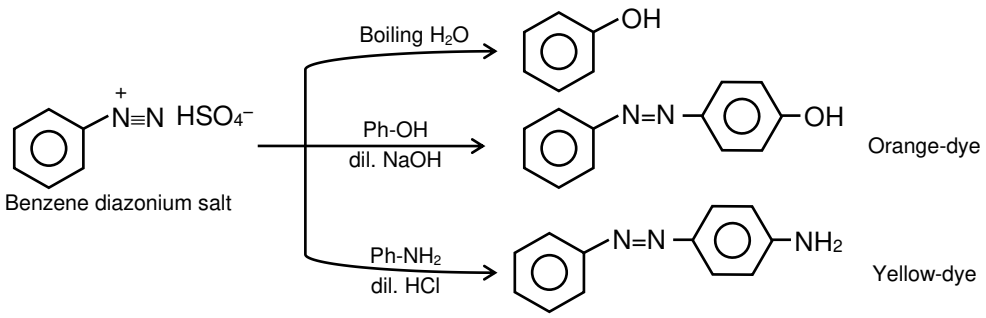
Note :

1. **Primary aliphatic amines** react with nitrous acid to form aliphatic diazonium salt which being unstable, liberate nitrogen gas.
2. Primary aromatic amines form arene diazonium salts which are stable for a short time in solution at low temperatures (273-278 K).Due to its instability, the diazonium salt is not generally stored and is used immediately after its preparation.

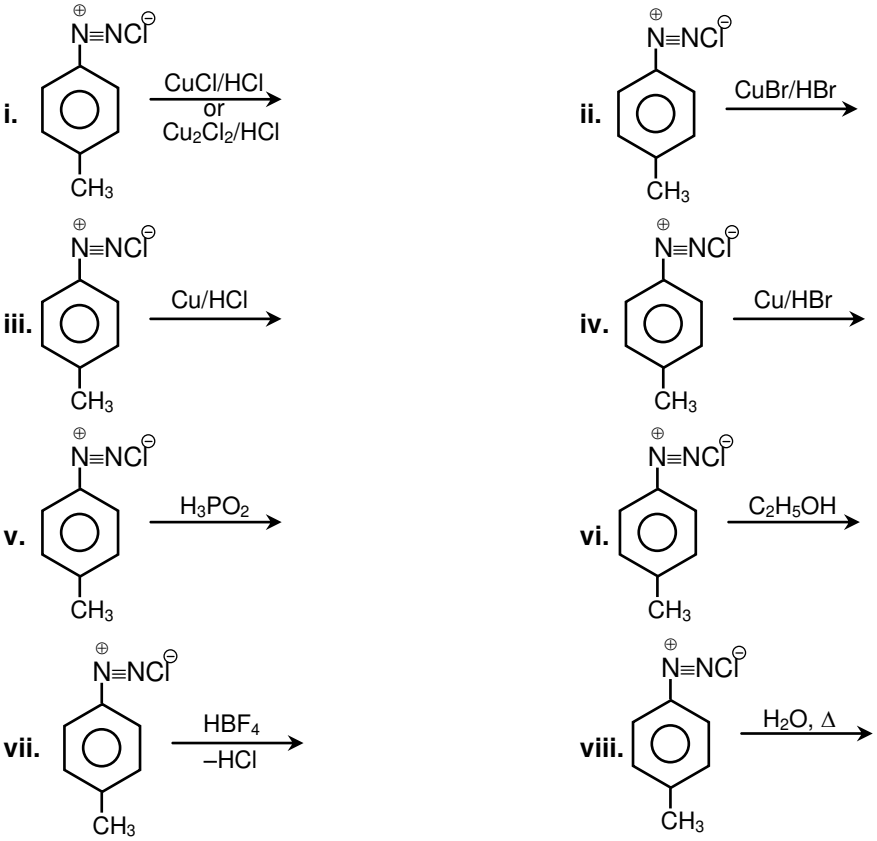
2. Chemical reactions of diazonium salt

Diazonium salt opens the way to prepare many other compounds, see following chart.

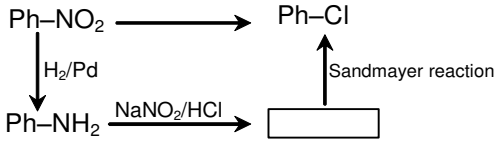




1. Complete the following reactions.



2. Conversion.



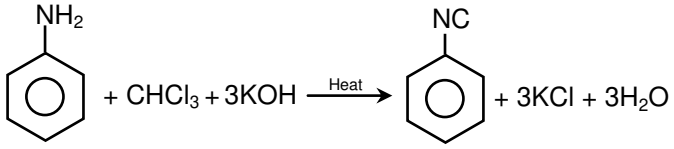
Lab test of aniline :

1. Carbylamine reaction

Primary amines (aliphatic as well as aromatic) react with chloroform ($CHCl_3$) on heating in the presence of ethanolic solution of KOH to form isocyanides (also called carbylamines) which are foul smelling substances. Secondary and tertiary amines do not undergo this reaction, therefore this reaction is used as a test for primary amines (aliphatic as well as aromatic).

$$R–NH_2 + CHCl_3 + 3KOH \xrightarrow{Heat} R–NC + 3KCl + 3H_2O$$

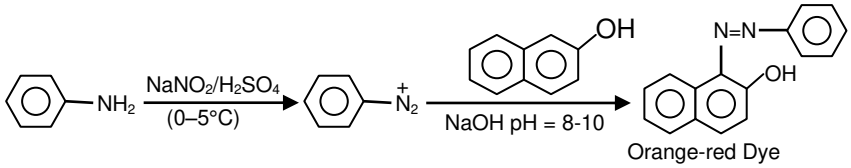
Ex. $CH_3–NH_2 + CHCl_3 + 3KOH \xrightarrow{Heat} CH_3–NC + 3KCl + 3H_2O$

Ex. 

2. Azo dye test

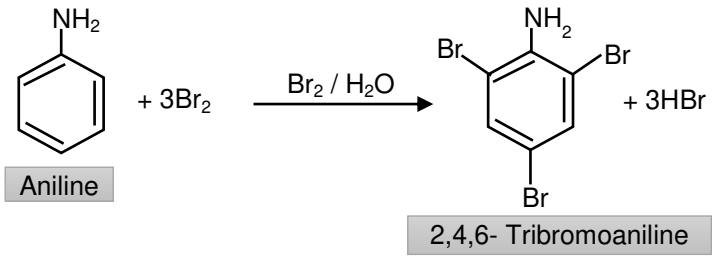
Azo compounds are usually intensely colored because of the azo linkage (–N=N–). Azo compounds, because of their intense color's and because they can be synthesized from relatively inexpensive compounds, are used extensively as dyes.

Synthesis of orange-red dye from 2-naphthol [β-naphthol] and aniline.



3. Bromine water test ($Br_2 + H_2O$):

Aniline reacts with bromine water at room temperature to give a white precipitate of 2,4,6-tribromoaniline. Aniline also gives test with $Br_2 + CS_2$



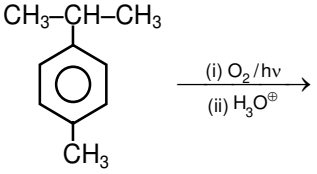
Exercise

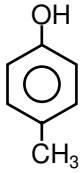
ONLY ONE OPTION CORRECT TYPE

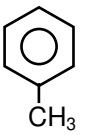
1. The process of conversion of cumene in the presence of oxygen and light followed by hydrolysis lead to the formation of _____ .

(A) Phenol (B) Aniline (C) Anisole (D) Benzene

2. Identify the product of following reaction.

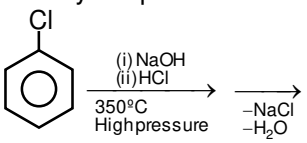


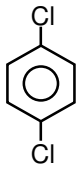
(A) 

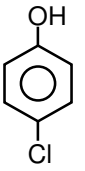
(B) 

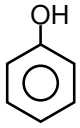
(C) 
(D) None of these

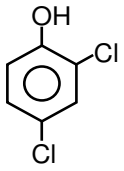
3. Identify the product of the following reaction.

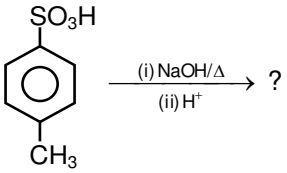


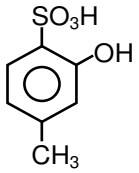
(A) 

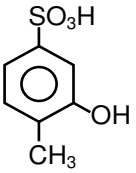
(B) 

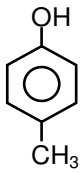
(C) 

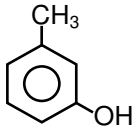
(D) 

4. 

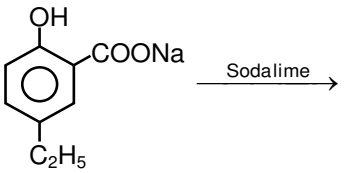
(A) 

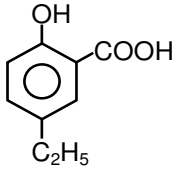
(B) 

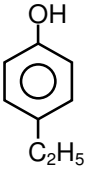
(C) 

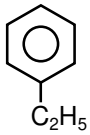
(D) 

5. Give the product for following reaction.



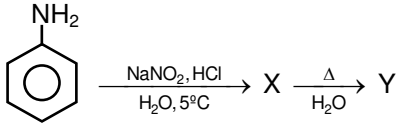
(A) 

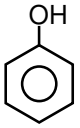
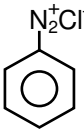
(B) 

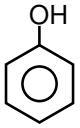
(C) 

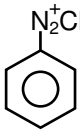
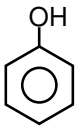
(D) None of these

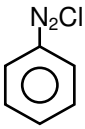
6. Identify the X and Y in the following reaction.



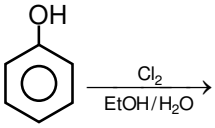
(A) X =  Y = 

(B) X =  Y = 

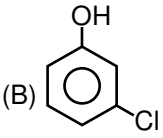
(C) X =  Y = 

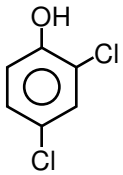
(D) X =  Y = 

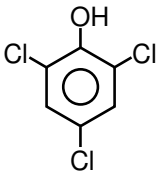
7. What will be the product of following reaction?



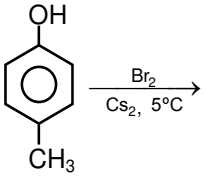
(A) 

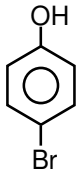
(B) 

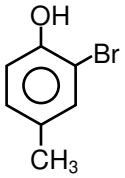
(C) 

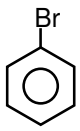
(D) 

8. Find the product for the following reaction.



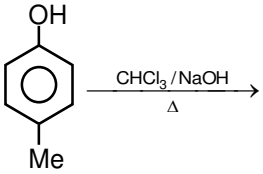
(A) 

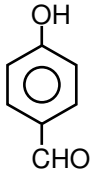
(B) 

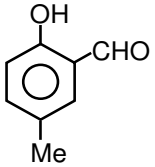
(C) 

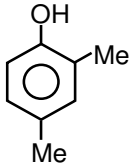
(D) None of these

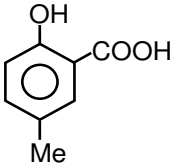
9. Give the major product for the following reaction.



(A) 

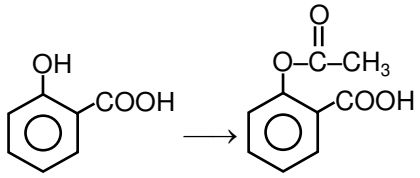
(B) 

(C) 

(D) 

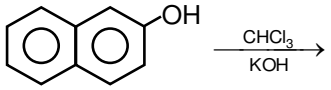
10. The reagent used for Reimer Tiemann carboxylation in order to form salicylic acid is _____ .
(A) $CHCl_3$ / NaOH / H^+ (B) CCl_4 / NaOH / H^+ (C) OH^- / CO_2 / HCl (D) None of these

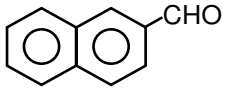
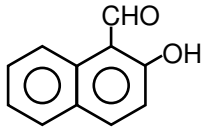
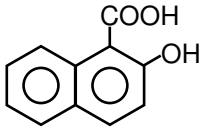
11. Aspirin can be formed from following reaction using which reagent?



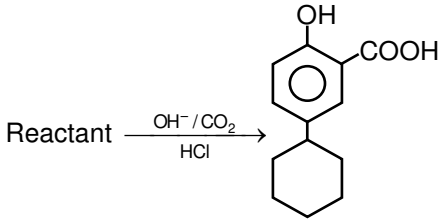
(A) $(CH_3–\overset{O}{\overset{\|}{C}}–)_2O$ / H^+ (B) $(C_2H_5–\overset{O}{\overset{\|}{C}}–)_2O$ / H^+ (C) $CHCl_3$ / NaOH (D) None of these

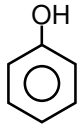
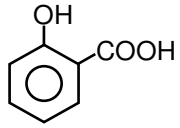
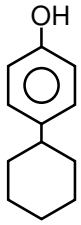
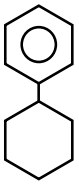
12. Give product for following reaction.

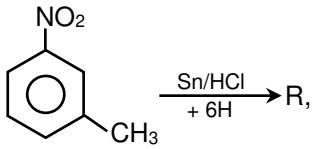


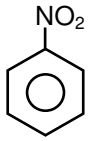
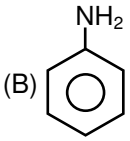
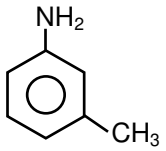
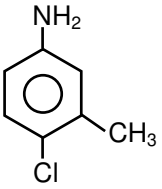
(A)  (B)  (C)  (D) None of these

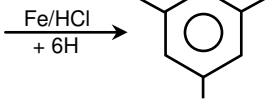
13. The reactant used in the reaction is :

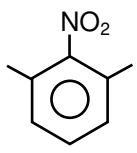
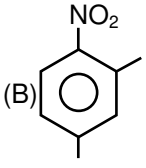
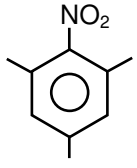
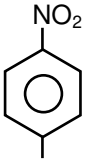


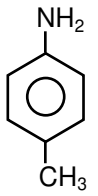
(A)  (B)  (C)  (D) 

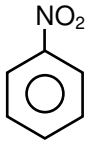
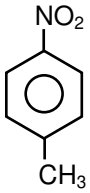
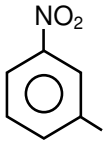
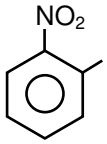
14.  R is :

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

15. R  , R is :

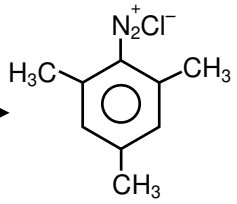
(A)  (B)  (C)  (D) 

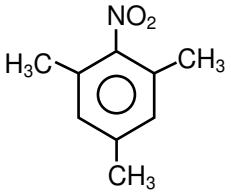
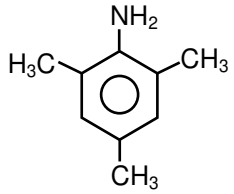
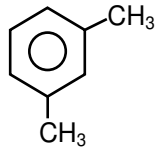
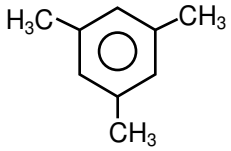
16. R $\xrightarrow{Ni/H_2}$  , R is :

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

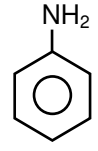
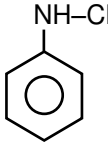
17. R $\xrightarrow{Br_2/NaOH}$ $C_2H_5–NH_2$, R is :

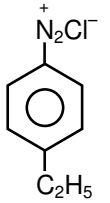
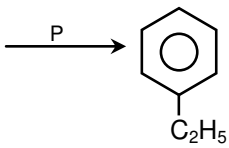
(A) $C_2H_5–CH_2–\underset{\underset{O}{\|}}{C}–NH_2$
(B) $C_2H_5–\overset{\overset{CH_3}{|}}{CH}–\underset{\underset{O}{\|}}{C}–NH_2$
(C) $C_2H_5–\underset{\underset{O}{\|}}{C}–NH_2$
(D) $C_2H_5–\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}–\underset{\underset{O}{\|}}{C}–NH_2$

18. R $\xrightarrow[(0–5°C)]{NaNO_2/HCl}$  R, is-

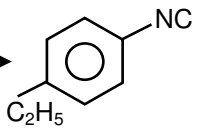
(A) 
(B) 
(C) 
(D) 

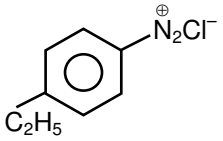
19. Which of them produces diazonium cation at 0°C ?

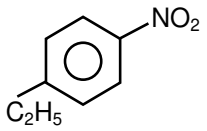
(A) 
(B) 
(C) $CH_3–CH_2–NH_2$
(D) $CH_3–\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}–NH_2$

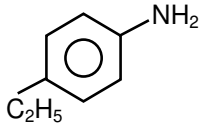
20.   , P is :

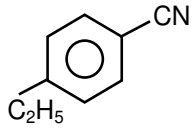
(A) Cu_2Cl_2/HCl
(B) Cu/HCl
(C) C_2H_5OH
(D) HBF_4

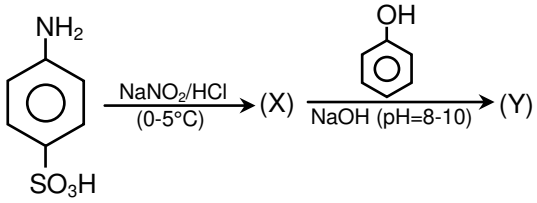
21. R $\xrightarrow{CHCl_3 + 3KOH/\Delta}$  R is -

(A) 

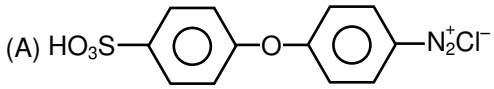
(B) 

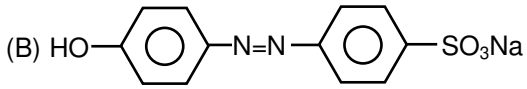
(C) 

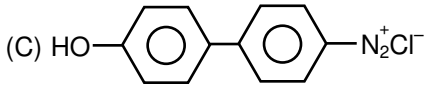
(D) 

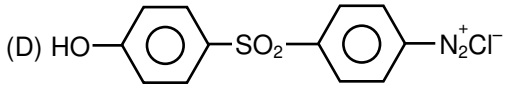
22. 

Y is :

(A) 

(B) 

(C) 

(D) 

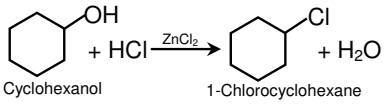
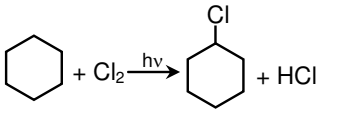
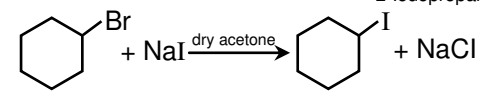
Answers

1.	(A)	**2.**	(A)	**3.**	(C)	**4.**	(C)	**5.**	(B)
6.	(C)	**7.**	(D)	**8.**	(B)	**9.**	(B)	**10.**	(B)
11.	(A)	**12.**	(B)	**13.**	(C)	**14.**	(C)	**15.**	(C)
16.	(B)	**17.**	(C)	**18.**	(B)	**19.**	(A)	**20.**	(C)
21.	(C)	**22.**	(B)						

ABC-3 (Alkyl halide, Alcohol & Ether)

(A) ALKYL HALIDE

Preparation of alkyl halides (5-Methods)

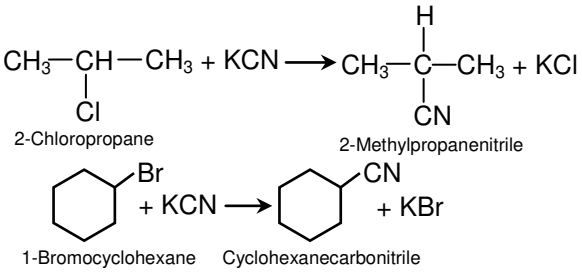
1.	**From alcohol** (i) from ($SOCl_2$) in presence of pyridine $R–OH \xrightarrow[heat,pyridine]{SOCl_2} R–Cl + SO_2 + HCl$ It is known as Darzon method.	$CH_3–CH_2–OH \xrightarrow[\Delta,\ Pyridine]{SOCl_2} CH_3–CH_2–Cl + \underbrace{SO_2 + HCl}_{\text{By products are gases}}$ Ethanol — Chloroethane
	(ii) from PCl_5 $R–OH + PCl_5 \longrightarrow R–Cl + HCl + POCl_3$	$CH_3–\underset{\underset{CH_3}{|}}{CH}–OH + PCl_5 \longrightarrow CH_3–\underset{\underset{CH_3}{|}}{CH}–Cl + HCl + POCl_3$ Propan-2-ol — 2-Chloropropane
	(iii) from PX_3 $3R–OH + PX_3 \xrightarrow{(PX_3=PCl_3,PBr_3,PI_3)} 3R–X + H_3PO_3$	$3CH_3–CH_2–OH + PCl_3 \longrightarrow 3CH_3–CH_2–Cl + H_3PO_3$ Ethanol — Chloroethane
	(iv) **Lucas test :** from HX(X= Cl, Br,I) $R–OH + HX \xrightarrow{ZnCl_2} R–X + H_2O$ (rate : 3º ROH > 2º ROH > 1º ROH)	 Cyclohexanol — 1-Chlorocyclohexane
2.	**Halogenation of alkane** Halogenation take place either at high temperature (573-773 K) or in the presence of diffuse sunlight or ultraviolet light. Rate of reaction of alkanes with halogens : $F_2 > Cl_2 > Br_2 > I_2$	$CH_4 + Cl_2 \xrightarrow{h\nu} CH_3Cl + HCl$ Methane — Chloromethane  Cyclohexane — 1-Chlorocyclohexane
3.	**Addition of hydrogen halides** Hydrogen halides add up to alkenes to form alkyl halides. The order of reactivity of hydrogen halides is HI > HBr > HCl.	$CH_2=CH_2 + HBr \longrightarrow CH_3CH_2Br$ Ethene — Bromoethane $CH_3–\underset{\underset{CH_3}{|}}{C}=CH_2 + HCl \longrightarrow CH_3–\underset{\underset{CH_3}{|}}{\overset{\overset{Cl}{|}}{C}}–CH_3$ 2-Methylprop-1-ene — 2-Chloro-2-methylpropane
4.	**Finkelstein reaction** Alkyl iodides often prepared by the reaction of alkyl chloride / bromide with NaI in dry acetone. This reaction is known as **Finkelstein** reaction.	$CH_3–\underset{\underset{Cl}{|}}{\overset{\overset{H}{|}}{C}}–CH_3 + NaI \xrightarrow{\text{Dry aceteone}} CH_3–\underset{\underset{I}{|}}{\overset{\overset{H}{|}}{C}}–CH_3 + NaCl\downarrow$ 2-Chloropropane — 2-Iodopropane  1-Bromocyclohexane — 1-Iodocyclohexane
5.	**Swart reaction** The synthesis of alkyl fluoride is best accomplised by heating an alkyl chloride/ bromide in the presence of a metallic fluoride such as AgF, Hg_2F_2, CoF_2 or SbF_3. The reaction is termed as **Swart** reaction.	$CH_3–Cl + AgF \xrightarrow{\Delta} CH_3–F + AgCl$ Chloromethane — Fluoromethane $CH_3–CH_2–\overset{\overset{Cl}{|}}{CH}–CH_3 + AgF \longrightarrow$ 2-Chlorobutane $CH_3–CH_2–\underset{\underset{F}{|}}{CH}–CH_3 + AgCl$ 2-Fluorobutane

Chemical reactions of alkyl halide (4-Reactions)

1. Reaction of alkyl halide with

(a) KCN

KCN is predominantly ionic and provides cyanide ions in solution. Although both carbon and nitrogen atoms are in a position to donate electron pairs, the attack takes place mainly through carbon atom and not through nitrogen atom since C–C bond is more stable than C–N bond.

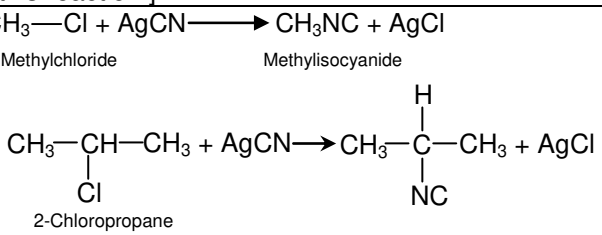


[Only for 1º and 2º alkyl halides.]

[Phenylic, vinylic and bridge head halides fail to react by this reaction.]

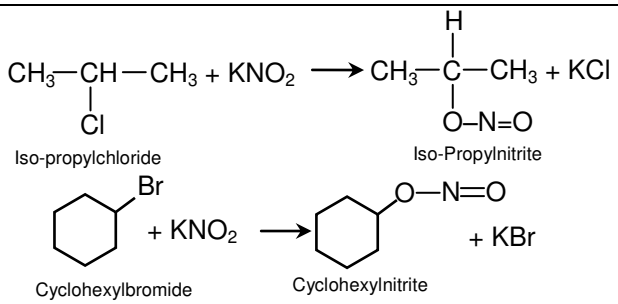
(b) AgCN

AgCN is mainly covalent in nature and nitrogen is free to donate electron pair forming isocyanide as the main product.



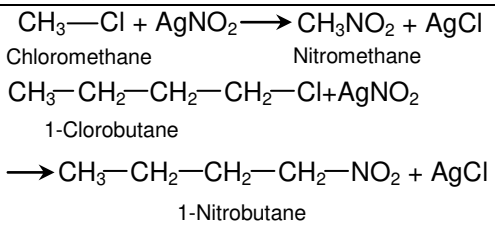
(c) KNO_2

Alkyl halides (R–X) react with KNO_2 to give R–O–N=O (Alkylnitrite).



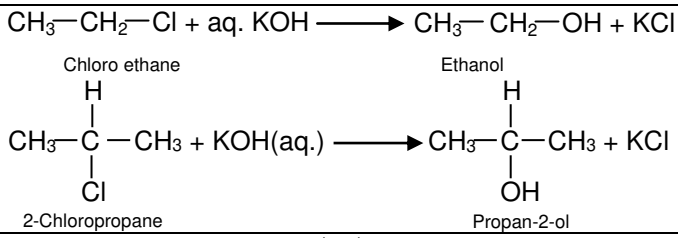
(d) $AgNO_2$

Alkyl halides (R–X) react with $AgNO_2$ to give R–NO_2 (Nitroalkane)



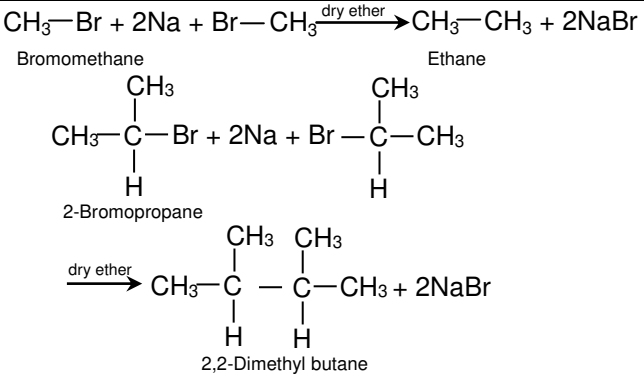
(e) Aqueous KOH

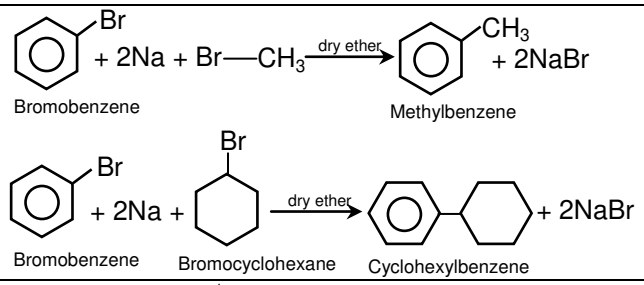
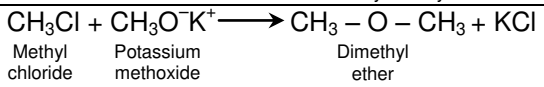
Alkyl halides (R–X) when reacts with aq. KOH gives alcohol



2. Wurtz reaction

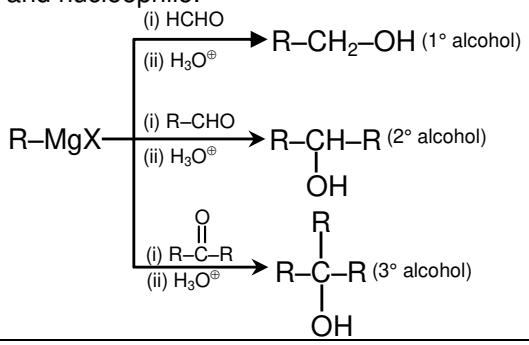
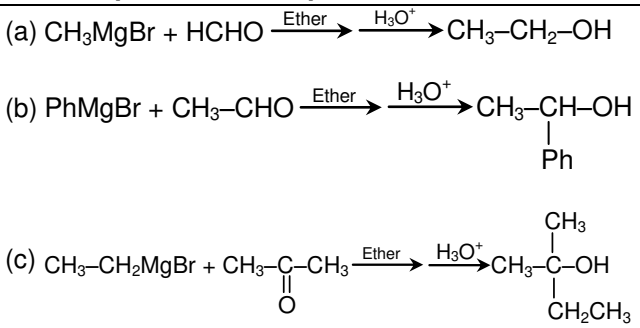
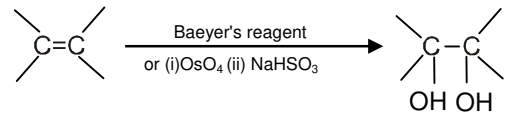
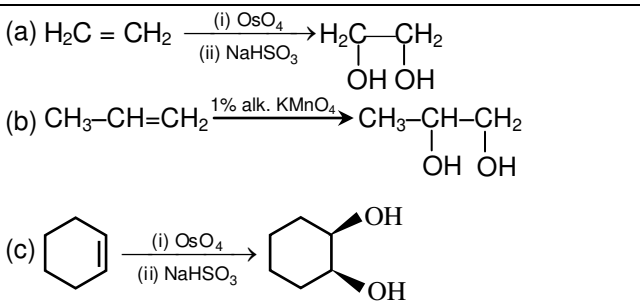
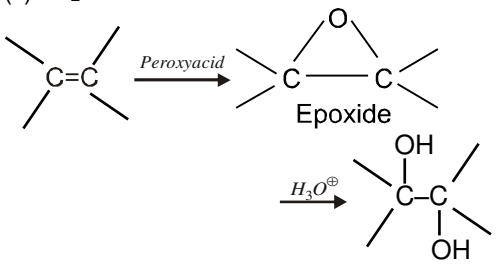
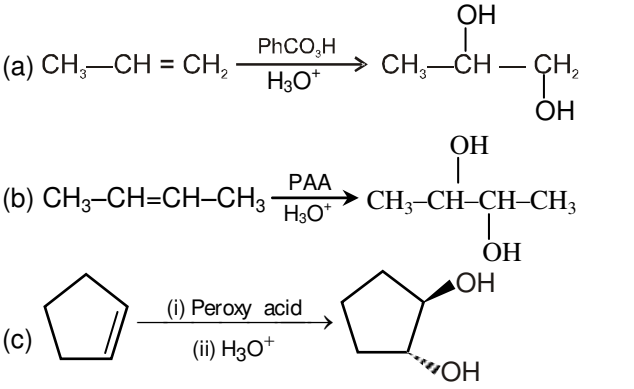
Alkyl halide on treatment with sodium metal in dry ether solution give higher alkanes. The reaction is known as **Wurtz** reaction. It is used for the preparation of higher alkanes containing even number of carbon atoms.

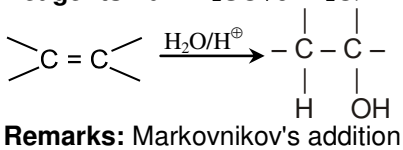


3.	**Wurtz-Fittig reaction** A mixture of an alkyl halide and aryl halide give an alkyl arene when treated with sodium in dry ether.	
4.	**Williamson ether synthesis**	

(B) ALCOHOL AND ETHERS

Preparation of alcohols (4-Methods)

1.	**From Grignard reagents [R–Mg–X]** Grignard Reagent is an organometallic compound. Grignard Reagent acts as base and nucleophile. 	
2.	**Syn hydroxylation of alkenes** **Reagents :** **a.** Baeyer's reagent: [cold dilute 1% alkaline $KMnO_4$] or **b.** (i) OsO_4 (ii) $NaHSO_3$  **Remark** It is syn addition. Both OH groups add on the same side of pi-bond.	
3.	**Anti hydroxylation of alkene** **Reagent**: (i) Peroxyacid (RCOOOH) (ii) H_2O/H^+ 	

	Remark It is anti addition. Both OH groups add on the opposite side of pi-bond. Peroxyacid may be any one of these: **a.** m-CPBA (Metachloro perbenzoic acid) **b.** PAA (Peracetic acid) **c.** PBA (Per benzoic acid) **d.** TFPAA (Trifluoro peracetic acid).	
4.	**Acid catalyzed hydration of alkene** **Reagents: dil.** H_2SO_4 or H_2O/H^+ or H_3O^+  **Remarks:** Markovnikov's addition	(a) $CH_3–CH=CH_2 + H_2O \xrightarrow{H^\oplus} CH_3–\underset{\displaystyle OH}{\underset{\vert}{CH}}–CH_3$ (b) $CH_3–CH=CH–CH_3 \xrightarrow{H_2O/H^\oplus} CH_3–\underset{\displaystyle H}{\underset{\vert}{CH}}–\underset{\displaystyle OH}{\underset{\vert}{CH}}–CH_3$

Preparation of ethers (2-Methods)

1.	**Williamson synthesis** It is an important laboratory method for the preparation of symmetrical and unsymmetrical ethers. In this method, an alkyl halide is allowed to react with sodium alkoxide. $RX + R'\overset{-}{O}–\overset{+}{Na} \longrightarrow R'–O–R + NaX$	(a) $CH_3–X + CH_3–CH_2–CH_2O–Na \longrightarrow CH_3–O–CH_2CH_2CH_3$ (b) $CH_3CH_2–X + PhO–Na \longrightarrow Ph–O–CH_2–CH_3$ (c) $Ph–CH_2–X + Ph–CH_2–O–Na \longrightarrow PhCH_2–O–CH_2–Ph$
2.	**From alcohol** Alcohols undergo dehydration in the presence of protic acids (H_2SO_4, H_3PO_4) at 413 K temperature (140ºC). $R–OH \xrightarrow[413\,K]{H_2SO_4} R–O–R$ **Remark** : Alcohols undergo dehydration by heating with conc. H_2SO_4 at 443K and give alkene.	(a) $CH_3–CH_2–OH \xrightarrow[413\,K]{H_2SO_4} C_2H_5–O–C_2H_5$ (b) $CH_3–OH + CH_3OH \xrightarrow[413\,K]{H_2SO_4} CH_3–O–CH_3$ (c) $CH_3–OH + CH_3–CH_2–OH \xrightarrow[413\,K]{H_2SO_4} CH_3–O–CH_3 + CH_3–CH_2–O–CH_2–CH_3 + CH_3–O–CH_2–CH_3$

Chemical reactions of alcohols (5-Reactions)

1.	**Reaction with HX:** $R–OH + HX \longrightarrow R–X + H_2O$ The reactions of primary and secondary alcohols with HCl require a catalyst ($ZnCl_2$). With tertiary alcohols, the reaction conduct by simply shaking with concentrated HCl at room temperature.	(a) $CH_3–CH_2–OH \xrightarrow{HBr} CH_3–CH_2–Br$ (b) $CH_3–\underset{\displaystyle CH_3}{\underset{\vert}{CH}}–OH \xrightarrow[ZnCl_2]{HCl} CH_3–\underset{\displaystyle CH_3}{\underset{\vert}{CH}}–Cl$
2.	**Reaction with phosphorus trihalides:** $3R–OH + PX_3 \longrightarrow 3R–X + H_3PO_3$ $PX_3 = PCl_3, PBr_3, PI_3$	(a) $CH_3–CH_2–CH_2–OH \xrightarrow{PBr_3} CH_3–CH_2–CH_2–Br$ (b) $CH_3–CH_2–\underset{\displaystyle CH_3}{\underset{\vert}{CH}}–CH_2–OH \xrightarrow{PCl_3}$ $CH_3–CH_2–\underset{\displaystyle CH_3}{\underset{\vert}{CH}}–CH_2–Cl$

3.	**Reaction with PCl_5** $R–OH + PCl_5 \longrightarrow R–Cl + HCl + POCl_3$	(a) $PhCH_2–OH \xrightarrow{PCl_5} PhCH_2Cl + POCl_3$ (b) $CH_3–\underset{\displaystyle CH_3}{\underset{\vert}{CH}}–OH \xrightarrow{PBr_5} CH_3–\underset{\displaystyle CH_3}{\underset{\vert}{CH}}–Br$
4.	**Reaction with thionyl chloride in presence of pyridine:** $R–OH + SOCl_2 \xrightarrow{\text{pyridine}} R–Cl + SO_2 + HCl$	(a) $CH_3–CH_2–OH \xrightarrow[\text{pyridine}]{SOCl_2} CH_3–CH_2–Cl$ (b) $Ph–CH_2–OH \xrightarrow[\text{pyridine}]{SOBr_2} Ph–CH_2–Br$
5.	**Reaction with conc. H_2SO_4 / Δ** $CH_3–\underset{\displaystyle H}{\underset{\vert}{C}}–\underset{\displaystyle H}{\underset{\vert}{C}}–CH_3 \xrightarrow[\Delta]{\text{Conc. } H_2SO_4} CH_3–CH=CH–CH_3$ (OH on the second carbon) **Remarks :** **i.** Ease of dehydration of alcohol $\Rightarrow 3^o > 2^o > 1^o$ **ii.** More stable alkene **(Saytzeff Alkene)** is formed as major product	(a) $CH_3–\underset{\displaystyle OH}{\underset{\vert}{CH}}–CH_3 \xrightarrow[\Delta]{\text{Conc. } H_2SO_4} CH_3–CH=CH_2$ (b) $CH_3–\underset{\displaystyle OH}{\underset{\vert}{\overset{\displaystyle CH_3}{\overset{\vert}{C}}}}–CH_3 \xrightarrow[\Delta]{\text{Conc. } H_2SO_4} CH_3–\overset{\displaystyle CH_3}{\overset{\vert}{C}}=CH_2$ (c) $CH_3–CH_2–\underset{\displaystyle OH}{\underset{\vert}{\overset{\displaystyle CH_3}{\overset{\vert}{C}}}}–CH_3 \xrightarrow[\Delta]{\text{Conc. } H_2SO_4} CH_3–CH=\overset{\displaystyle CH_3}{\overset{\vert}{C}}–CH_3$

$CH_3–CH_2–OH$ (1º alcohol) $\xrightarrow{\text{Conc. } H_2SO_4}$

- $\xrightarrow{80ºC}$ $CH_3–CH_2–OSO_3H$ [Alkyl hydrogen sulphate]
- $\xrightarrow{140ºC}$ $CH_3–CH_2–O–CH_2–CH_3$ [ether]
- $\xrightarrow{170ºC}$ $CH_2=CH_2$ [alkene]

* 2º and 3º alcohols generally give alkene at little less temperature than required for 1º alcohols.

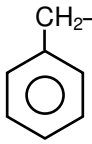
Test of alcohols (3-Test)

S.No	Test / Reagent	Observation
1	**Cerric ammonium nitrate test** **Reagent :** $[(NH_4)_2Ce(NO_3)_6]$	Red colour compound is formed
2	**Lucas reagent** **Reagent :** [Conc. HCl + anhyd. $ZnCl_2$] **Remarks :** It gives white turbidity or cloudiness with alcohols (OH groups attached with sp^3 hybridised carbon).	(a) **1° alcohol** does not give appreciable reaction. White turbidity is obtained on heating in 30 minutes. (b) **2° alcohol** gives white turbidity in 5 minutes. (c) **3° alcohol** gives white turbidity immediately.
3	**Victor Mayer test** **Reagent :** (i) $P + I_2$ (ii) $AgNO_2$ (iii) HNO_2 (iv) Base	(a) **1° alcohol –** Blood red colour. (b) **2° alcohol –** Blue colour. (c) **3° alcohol –** No colour.

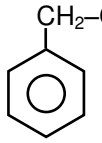
Exercise

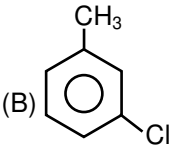
ONLY ONE OPTION CORRECT TYPE

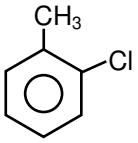
PART-A (Alkyl halides)

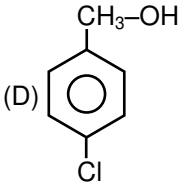
1.  $+ PCl_3 \longrightarrow [X] + H_3PO_3$

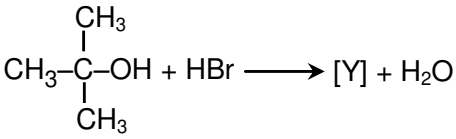
Product [X] is :

(A) 

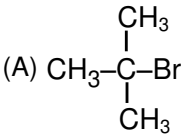
(B) 

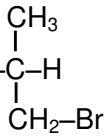
(C) 

(D) 

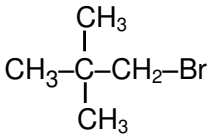
2. 

Product [Y] is :

(A) 

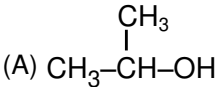
(B) 

(C) $CH_3–CH_2–CH_2–Br$

(D) 

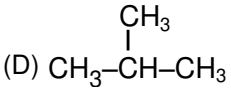
3. $[X] + PCl_5 \longrightarrow CH_3–CH_2–CH_2–Cl + HCl + POCl_3$

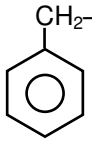
Reactant [X] is -

(A) 

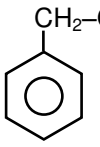
(B) $CH_3–CH_2–CH_2–OH$

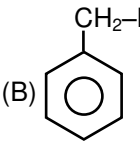
(C) $CH_3–CH_2–CH_3$

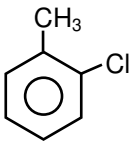
(D) 

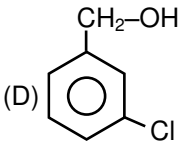
4.  $+ PCl_5 \longrightarrow [X] + HCl + POCl_3$

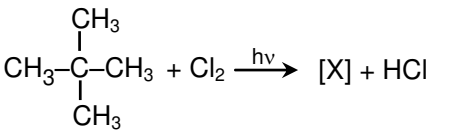
Product [X] is :

(A) 

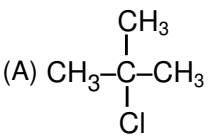
(B) 

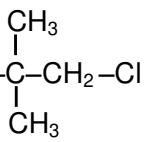
(C) 

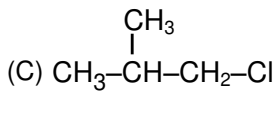
(D) 

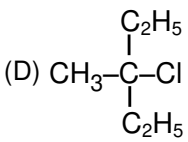
5. 

Product [X] is -

(A) 

(B) 

(C) 

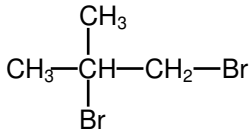
(D) 

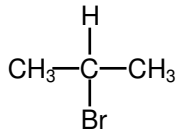
6. Iso-butane $\xrightarrow{Cl_2/h\nu}$
No. of monochloro structural isomeric product
(A) 1 (B) 2 (C) 3 (4) 4

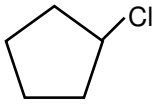
7. Iso octane $\xrightarrow{Cl_2/h\nu}$
No. of monochloro structural isomeric product
(A) 7 (B) 2 (C) 3 (D) 4

8. Cyclopentane $\xrightarrow{Cl_2/h\nu}$
No. of monochloro structural isomeric product
(A) 1 (B) 2 (C) 3 (D) 4

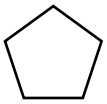
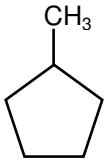
9. $CH_3–CH=CH_2 + HBr \longrightarrow [Y]$; Major product [Y] is :

(A)  (B) $CH_3—CH_2—CH_2—Br$

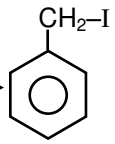
(C)  (D) $CH_3—CH_2—CH_3$

10. [Z] + HCl $\longrightarrow$ 

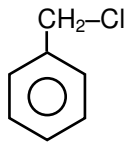
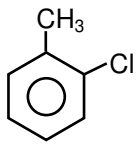
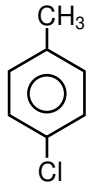
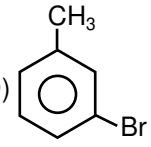
Reactant [Z] is :

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

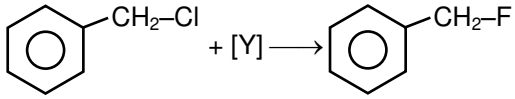
11. $CH_3–CH_2–Cl + NaI \xrightarrow{\text{Dry acetone}} [X] + NaCl$
Product [X] is -
(A) $CH_3–CH_3$ (B) $CH_3–CH_2–I$ (C) $CH_3–I$ (D) $CH_3–CH_2–CH_2–CH_3$

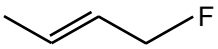
12. [Z] + NaI $\xrightarrow{\text{Dry acetone}}$ 

Reactant Z is :

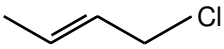
(A)  (B)  (C)  (D) 

13. $CH_3–CH_2–Cl + AgF \longrightarrow [X] + AgCl$
Product [X] is -
(A) $CH_3–CH_3$ (B) $CH_3–CH_2–F$ (C) $CH_3–CHF_2$ (D) $CH_3–F$

14. 
Reagent [Y] can be :
(A) AgF (B) Hg_2F_2 (C) SbF_3 (D) All

15. [Z] + CoF_2 ⟶ 

Reactant [Z] is :

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

16. $CH_3–CH_2–CH_2–Cl + KNO_2 \longrightarrow [X] + KCl$

Product [X] is :

(A) $CH_3–CH_2–CH_2–O–N=O$ (B) $CH_3–CH_2–CH_2–NO_2$

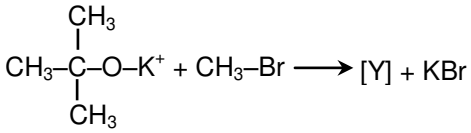
(C) $CH_3–CH_2–CH_3$ (D) $CH_3–CH=CH_2$

17. $CH_3–CH_2–CH_2–Cl + AgNO_2 \longrightarrow [X] + AgCl$

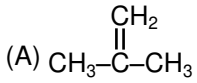
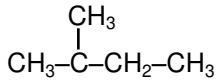
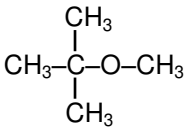
Product [X] is :

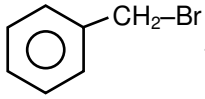
(A) $CH_3–CH_2–CH_2–O–N=O$ (B) $CH_3–CH_2–CH_2–NO_2$

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

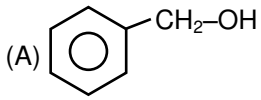
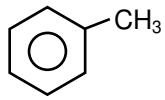
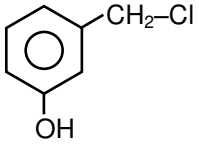
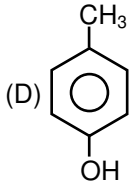
18. 

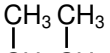
Product [Y] is :

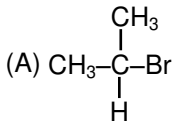
(A)  (B)  (C)  (D) $CH_3–CH_3$

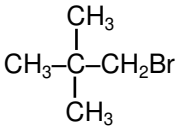
19.  + KOH (aq.) ⟶ [X] + KBr

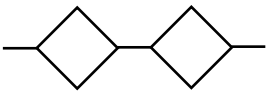
Product [X] is :

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

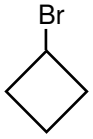
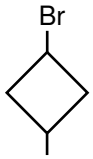
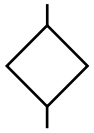
20. In wurtz reaction,  can be prepared from which of the following compound?

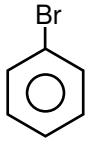
(A)  (B) $CH_3–CH_2–CH_2–Br$

(C) $CH_3–CH_2–Br$ (D) 

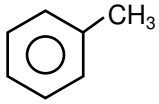
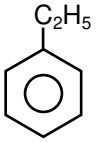
21. [X] + Na $\xrightarrow{\text{Dry ether}}$ 

Reactant [X] is -

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

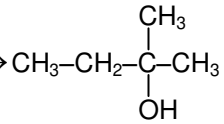
22.  + C_2H_5Br + 2Na $\xrightarrow{\text{Dry ether}}$ [X] + 2NaBr

Major product [X] is -

(A)  (B)  (C) $CH_3–CH_2–CH_2–CH_3$ (D) None of these

PART-B (Alcohols & Ethers)

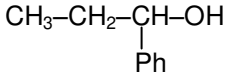
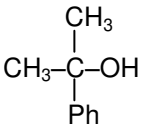
23. Which carbonyl compound is used for following interconversion:

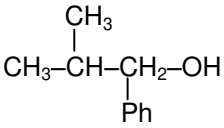
Carbonyl compound + $CH_3–CH_2–MgBr$ + X $\xrightarrow{H_3O^{\oplus}}$ 

(A) $CH_3–CHO$ (B) HCHO (C)  (D) $CH_3–CH_2–CHO$

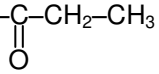
24. Which is correct product for given reaction?

$CH_3–CH_2–CHO$ + PhMgBr $\xrightarrow{H_3O^{\oplus}}$ P

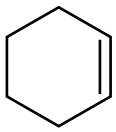
(A)  (B) 

(C)  (D) $Ph–CH_2–CH_2–CH_2–OH$

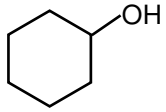
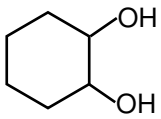
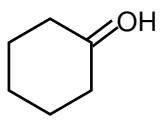
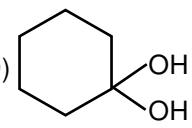
25. Which of the following carbonyl compound will give 1° alcohol after reaction with Grignard reagent followed by acidification:

(A) HCHO (B) $CH_3–CHO$ (C) $CH_3–CH_2–CHO$ (D) 

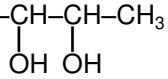
26. For the following reaction:

 $\xrightarrow{OsO_4\,/\,NaHSO_3}$ P.

Product is:

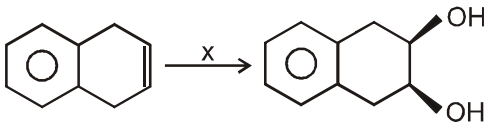
(A)  (B)  (C)  (D) 

27. For the following reaction:

$CH_3–CH=CH–CH_3$ $\longrightarrow$ 

Reagent is :

(A) HCl (B) Dil. H_2SO_4 (C) Bayer's reagent (D) H_2/Ni

28. 

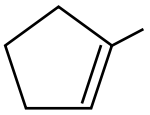
Reagent x will be :
(A) 1% alkaline $KMnO_4$ (Baeyer's reagent) (B) OsO_4 /$NaHSO_3$
(C) Peracid/H_3O^+ (D) A and B both

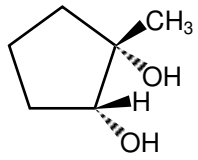
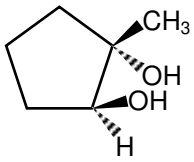
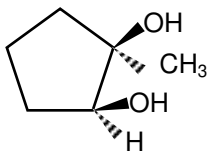
29. $CH_3–CH=CH–CH_3 \xrightarrow[(ii)\,H_3O^{\oplus}]{(i)\,\text{peroxy acid}} P$

Product is:

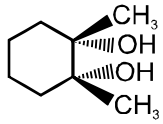
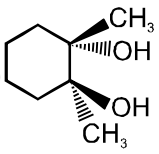
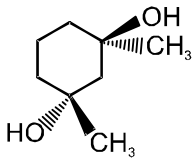
(A) $CH_3–CH_2–\underset{OH}{CH}–\underset{OH}{CH_2}$ (B) $CH_3–\underset{OH}{CH}–\overset{OH}{CH}–CH_3$

(C) $CH_3–CH_2–CH_2–CH\begin{matrix}OH\\OH\end{matrix}$ (D) $\underset{OH}{CH_2}–CH_2–CH_2–\underset{OH}{CH_2}$

30.  $\xrightarrow{CH_3COOOH/H_3O^{\oplus}}$ Product ; Product will be:

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

31.  $\xrightarrow[(2)H_3O^+]{\text{(1) Peroxyacid}}$ P ; Product is :

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

32. What is the final product of the following reaction?

$Ph–OH \xrightarrow{NaOH} \xrightarrow{CH_3–Cl}$

(A) Ph–O–CH_3 (B) Ph–CH_3 (C) Ph–O–CH_2–CH_3 (D) Ph–Cl

33. In the following reaction:

$C_2H_5ONa + C_2H_5Cl \longrightarrow$ product

Product is:

(A) C_2H_5–O–CH_3 (B) C_2H_5–O–C_2H_5 (C) CH_3–O–CH_3 (D) C_2H_5–C_2H_5

34. Predict the suitable reagent for the following conversion:

$CH_3–CH_2–OH \longrightarrow CH_3–CH_2–O–CH_2–CH_3$

(A) dil. H_2SO_4 (B) conc. H_2SO_4 / 200°C
(C) conc. H_2SO_4 / 140°C (D) Al_2O_3

35. In the following reaction:

$CH_3–OH + CH_3–CH_2–OH \xrightarrow[100–140°C]{Conc.H_2SO_4}$ product:

Which is not a possible product?

(A) $CH_3–O–CH_2–CH_3$ (B) $CH_3–O–CH_3$
(C) $CH_3–O–CH_2–CH_2–CH_3$ (D) $CH_3–CH_2–O–CH_2–CH_3$

36. Predict the reagent for the following reaction:

$$Ph–CH_2–OH \longrightarrow Ph–CH_2–O–CH_2–Ph$$

(A) dil. H_2SO_4 (B) $KMnO_4$ (C) $LiAlH_4$ (D) conc. H_2SO_4 / 140°C

37. Which alcohol gives instant turbidity with Lucas reagent?

(A) $CH_3–CH_2–OH$ (B) $CH_3–\underset{\displaystyle OH}{\underset{|}{CH}}–CH_3$ (C) $CH_3–\overset{\displaystyle CH_3}{\overset{|}{\underset{\displaystyle OH}{\underset{|}{C}}}}–CH_3$ (D) $CH_3–CH_2–CH_2–OH$

38. Which alcohol give white turbidity in 5 minutes with Lucas reagent?

(A) $CH_3–CH_2–OH$ (B) $Ph–\overset{\displaystyle Ph}{\overset{|}{\underset{\displaystyle OH}{\underset{|}{C}}}}–CH_3$

(C) $CH_3–\underset{\displaystyle OH}{\underset{|}{CH}}–CH_2–CH_3$ (D) $CH_3–\overset{\displaystyle CH_3}{\overset{|}{\underset{\displaystyle OH}{\underset{|}{C}}}}–CH_3$

39. Which test is used to distinguish 1°, 2°, and 3° alcohols?
(A) Victor Mayer test (B) Iodoform test
(C) $NaHCO_3$ test (D) Bayer's test

40. Which test is not given by alcohols?
(A) Lucas Test (B) Neutral $FeCl_3$ Test
(C) Victor major test (D) Cerric ammonium nitrate test

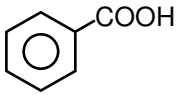
Answers

1.	(A)	**2.**	(A)	**3.**	(B)	**4.**	(A)	**5.**	(B)
6.	(B)	**7.**	(D)	**8.**	(A)	**9.**	(C)	**10.**	(C)
11.	(B)	**12.**	(A)	**13.**	(B)	**14.**	(D)	**15.**	(C)
16.	(A)	**17.**	(B)	**18.**	(C)	**19.**	(A)	**20.**	(A)
21.	(C)	**22.**	(B)	**23.**	(C)	**24.**	(A)	**25.**	(A)
26.	(B)	**27.**	(C)	**28.**	(D)	**29.**	(B)	**30.**	(B)
31.	(B)	**32.**	(A)	**33.**	(B)	**34.**	(C)	**35.**	(C)
36.	(D)	**37.**	(C)	**38.**	(C)	**39.**	(A)	**40.**	(B)

ABC-4 (Carboxylic acid & Carbonyl compounds)

(A) CARBOXYLIC ACID

➢ Compounds containing the carboxyl group (–COOH) are distinctly acidic and called carboxylic acid.

Compound	Common name	IUPAC name	Occurrence
HCOOH	Formic acid	Methanoic acid	Ants, bees & other stinging insects.
CH_3COOH	Acetic acid	Ethanoic acid	Grapes, Vinegar & pickle
$CH_3–CH_2–COOH$	Propionic acid	Propanoic acid	Animal fats, vegetables fats (coconut oil.)
$CH_3–(CH_2)_2–COOH$	Butyric acid	Butanoic acid	Rancid butter
COOH COOH	Oxalic acid	Ethanedioic acid	Kidney stone [$Ca(C_2O_4)$], Cabbage
CH_2(COOH)(COOH)	Malonic acid	Propanedioic acid	Plants (Leaves of lucerne)
$CH_2–COOH$ $CH_2–COOH$	Succinic acid	Butanedioic acid	Amber, Lignite and many plants
	Benzoic acid	Benzene carboxylic acid	Cranberries, fruit juice, soft drink, plum

Preparation of carboxylic acid (3-Methods)

1 **By Grignard reagents :**

$$\underset{\text{Grignard reagent}}{R-MgX} \xrightarrow[2.\,H_3O^+]{1.\,CO_2,\,Et_2O} \underset{\text{Carboxylic acid}}{R-\overset{\overset{O}{\|}}{C}-OH}$$

R → alkyl or aryl

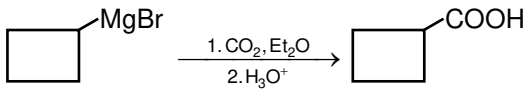
(i) Carbon dioxide is a carbonyl compound and it is an electrophile.

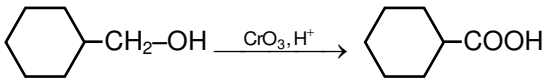
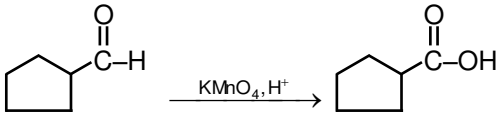
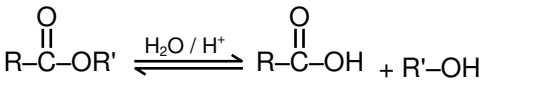
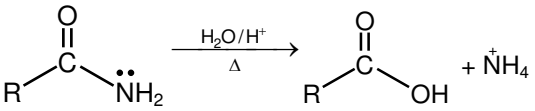
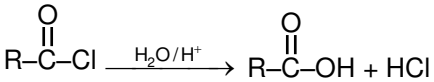
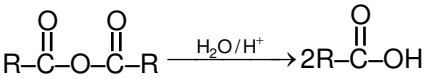
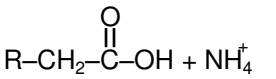
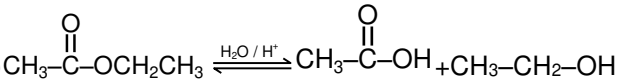
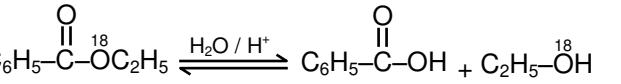
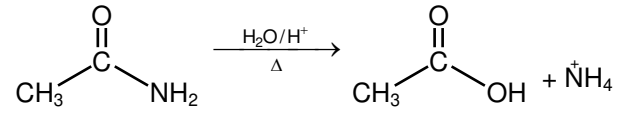
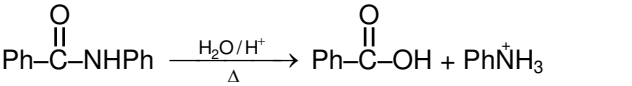
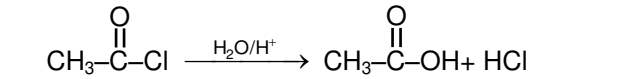
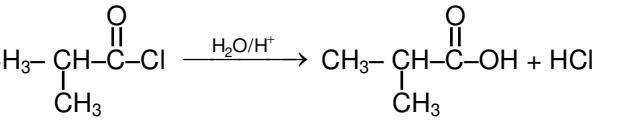
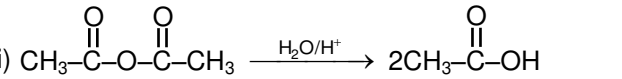
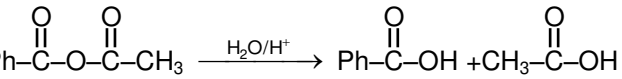
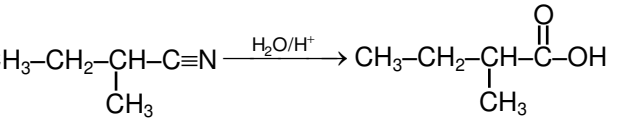
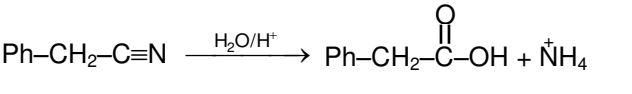
(ii) X is (Cl, Br, I)

(iii) Alkyl magnesium halide [R–MgX] is called

Grignard reagent.

(i) $CH_3–CH_2–MgCl \xrightarrow[2.\,H_3O^+]{1.\,CO_2,\,Et_2O} CH_3–CH_2–\overset{\overset{O}{\|}}{C}–OH$

(ii) 

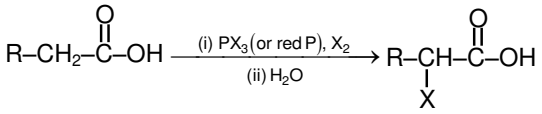
2	**By Oxidation of primary alcohol & aldehydes:** (i) Primary alcohol and aldehydes are readily oxidized to carboxylic acids with common oxidizing agents such as potassium permanganate ($KMnO_4$) in neutral, acidic or alkaline medium or potassium dichromate ($K_2Cr_2O_7$) and chromium trioxide (CrO_3) in acidic medium. (ii) Number of carbon atom in carbon chain remains same during oxidation.	$R–CH_2–OH \xrightarrow[\Delta]{(i)\,KMnO_4,\,\overset{\ominus}{O}H} R–COOH$ $R–CHO \xrightarrow[\Delta]{(i)\,KMnO_4,\,H^+} R–COOH$ (i) $CH_3–\underset{\displaystyle CH_3}{\underset{\vert}{CH}}–CH_2–OH \xrightarrow{(i)\,K_2Cr_2O_7,\,H^+} CH_3–\underset{\displaystyle CH_3}{\underset{\vert}{CH}}–COOH$ (ii)  (iii) 
3	**By Hydrolysis of acid derivatives:** **A. Hydrolysis of ester:**  **B. Hydrolysis of amides:**  Amides undergo hydrolysis when they are heated with aqueous acid. **C. Hydrolysis of acid chloride:**  Acid chloride reacts with water to form carboxylic acid. **D. Hydrolysis of acid anhydride:**  **E. Hydrolysis of nitriles:** 	**A.**(i)  (ii)  **B.**(i)  (ii)  **C.**(i)  (ii)  **D.** (i)  (ii)  **E.** (i)  (ii) 

Chemical reactions of carboxylic acid [5-Reactions]

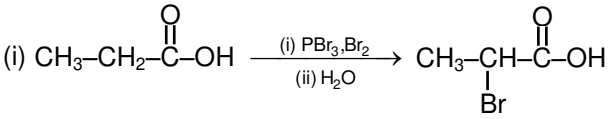
1 **Hell-Volhard-Zelinski reaction (HVZ reaction):**

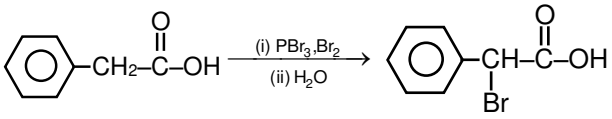
(i) In this reaction a carboxylic acid is treated with PX_3 and X_2, then halogenation at the α-carbon occurs.

(ii) X is (Cl, Br).



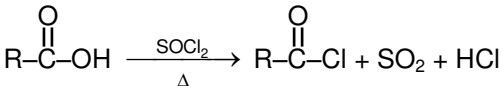
Examples

(i) 

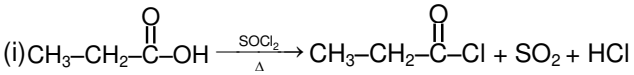
(ii) 

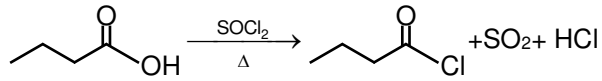
2 **Preparation of acid derivatives:**

A. Reaction with $SOCl_2$

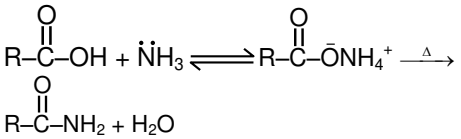


A.

(i) 

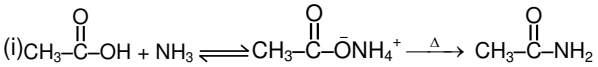
(ii) 

B. Reaction with NH_3

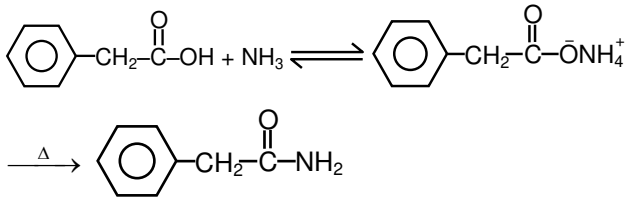


Carboxylic acid reacts with aqueous ammonia to form ammonium salts and after heating produce an amide.

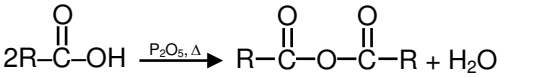
B.

(i) 

(ii)

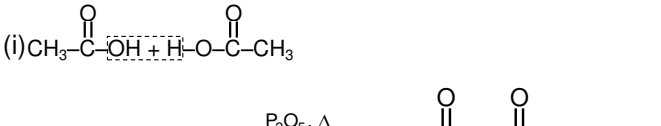


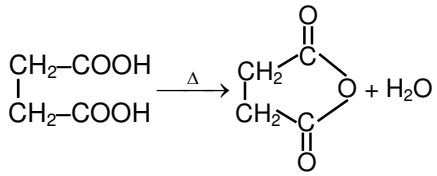
C. Reaction with RCOOH:

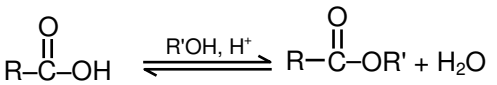
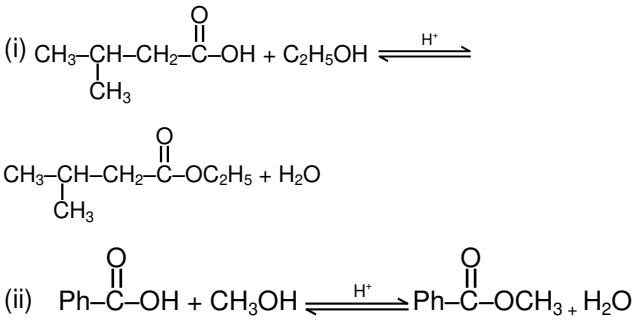
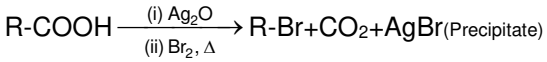
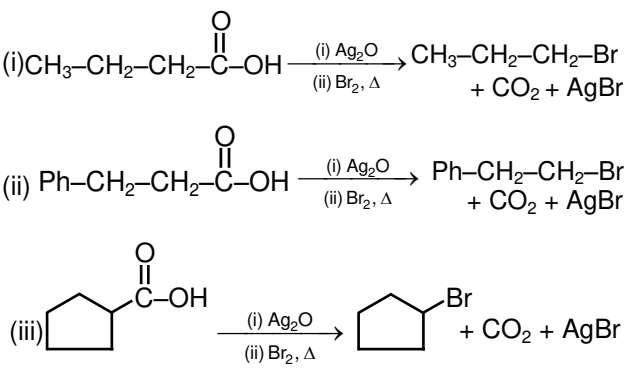
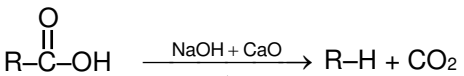
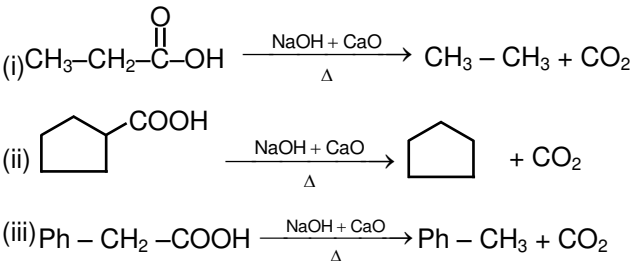
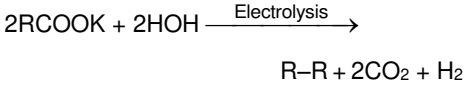
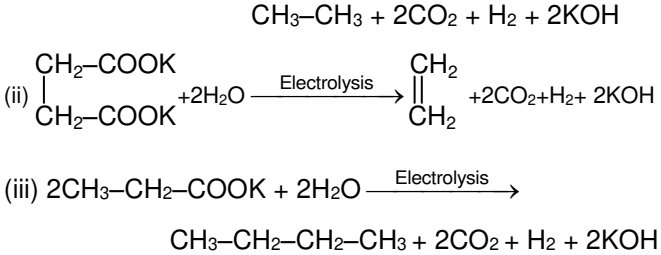


P_2O_5 is a dehydrating agent (removal of H_2O).

C.

(i) 

(ii) 

	D. Reaction with R–OH  Carboxylic acid reacts with excess alcohol in the presence of an acid catalyst produce ester. This reaction is called fisher esterification reaction.	**D.** 
3	**Hunsdiecker reaction:** (i) A carboxylic acid can be decarboxylated if a heavy metal salt of the carboxylic acid is heated with bromine. (ii) The product is an alkyl halide with one less carbon than the starting carboxylic acid. (iii) The heavy metal can be silver ion or mercuric ion. 	
4	**Sodalime decarboxylation:**  (i) **Sodalime:** NaOH + CaO (ii) Decarboxylation simply means removal of CO_2.	
5	**Kolbe's electrolysis:**  If n is the number of carbon atoms in the salt of carboxylic acid, the alkane formed has 2(n–1) carbon atoms.	

Lab test of carboxylic acid [3-Tests]

1	**Sodium bicarbonate ($NaHCO_3$) test :** All carboxylic acids & sulphonic acids give. $R–COOH + NaHCO_3 \longrightarrow R–COONa + H_2CO_3$ $\hookrightarrow H_2O + CO_2\uparrow$ $R–SO_3H + NaHCO_3 \longrightarrow R–SO_3Na + H_2CO_3$ $\hookrightarrow H_2O + CO_2\uparrow$ **Exception :** Picric acid gives $NaHCO_3$ test. Note : Phenol does not give $NaHCO_3$ test.	(i) $Ph–COOH + NaHCO_3 \rightarrow PhCOONa + H_2CO_3$ $\hookrightarrow H_2O + CO_2\uparrow$ (ii) $CH_3–SO_3H + NaHCO_3 \rightarrow CH_3SO_3Na + H_2CO_3$ $\hookrightarrow H_2O + CO_2\uparrow$
2	**Litmus test:** Acid converts blue litmus into red litmus.	
3	**Esterification of acid:** When carboxylic acid reacts with alcohol then ester forms, which are sweet (fruity) smelling liquids.	$RCOOH + R'OH \underset{}{\overset{H^+}{\rightleftharpoons}} RCOOR' + H_2O$ (sweet smelling liquid)

(B) CARBONYL COMPOUNDS

Preparation of carbonyl compounds (4-Methods)

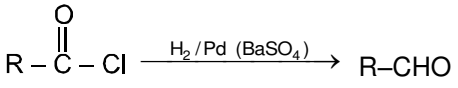
1.

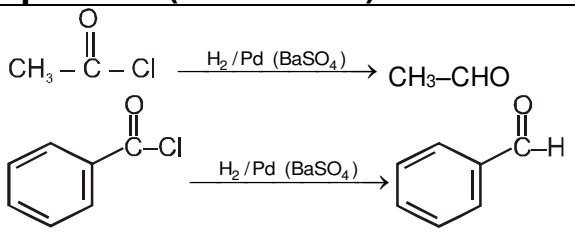
By reduction of acid halide

Reagents

Rosenmund catalyst : [H_2/Pd ($BaSO_4$, quinoline)]

General Reactions



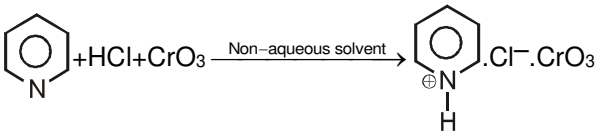


2.

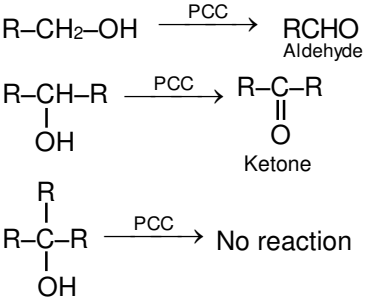
By oxidation of alcohol using PCC:

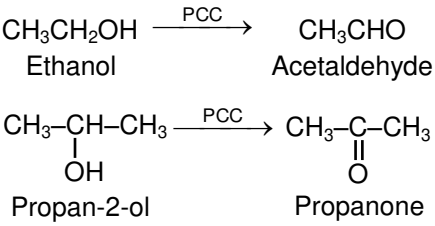
Reagents

PCC* = (Pyridinium Chloro Chromate) in CH_2Cl_2

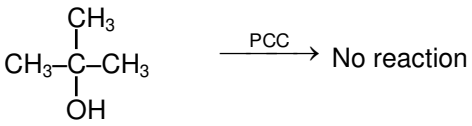


General reactions





Propan-2-ol Propanone



2-Methylpropan-2-ol

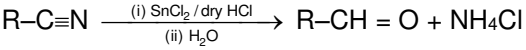
Note : 3º alcohols don't oxidize by most of the oxidizing agents

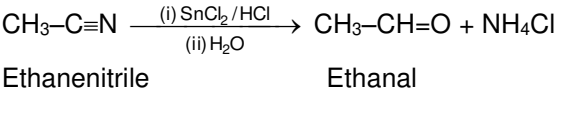
3.

By Stephen's reduction of cyanide :

Reagents : (i) $SnCl_2$/dry HCl (ii) H_2O

General reactions





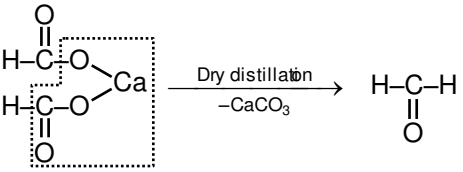
Ethanenitrile Ethanal

Benzene carbonitrile Benzaldehyde

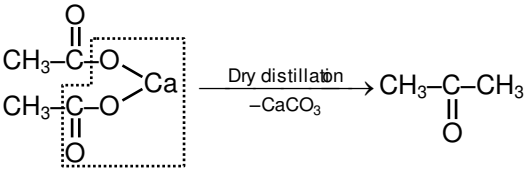
4.

Dry distillation of calcium salt of fatty acids :

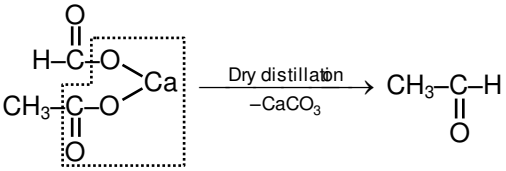
(a) By dry distillation of calcium formate :



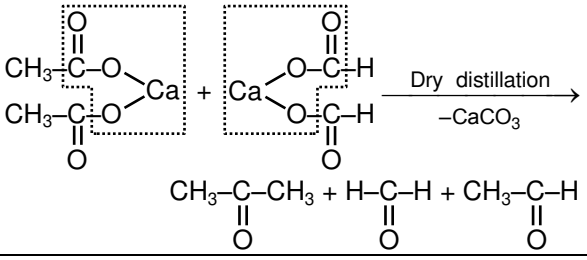
(b) By dry distillation of calcium acetate :



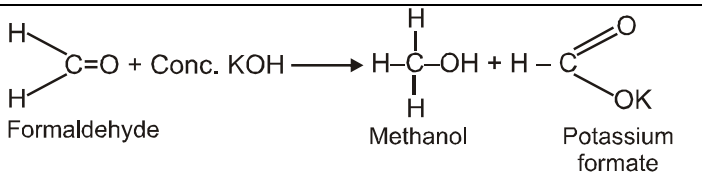
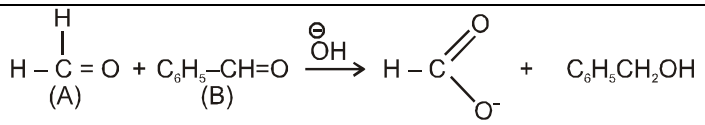
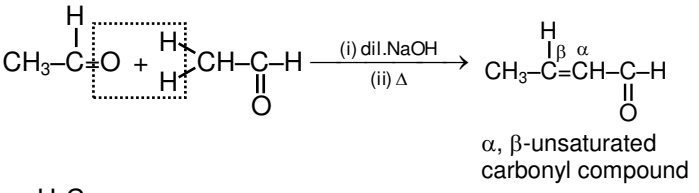
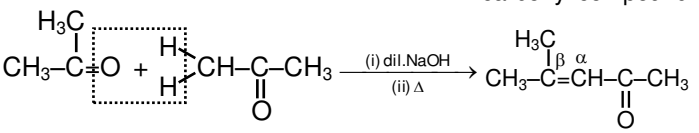
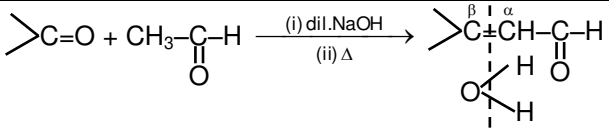
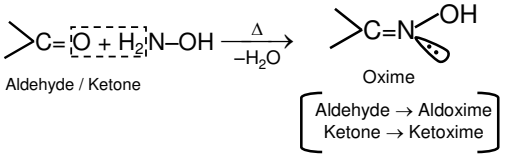
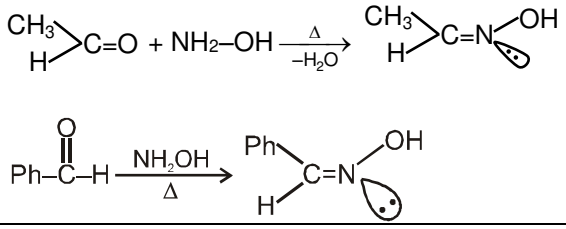
(c) By dry distillation of calcium acetate formate:



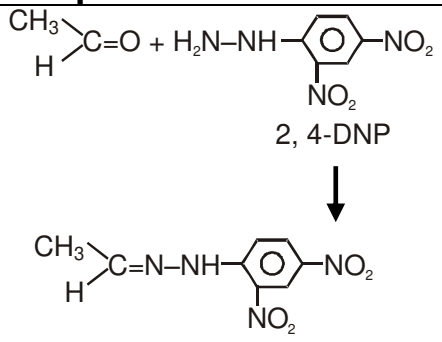
(d) By dry distillation of calcium acetate and calcium formate :

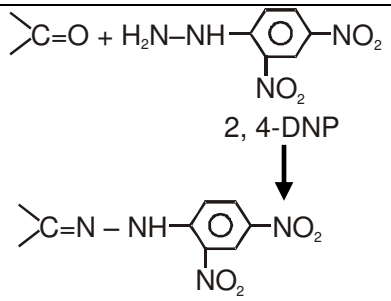


Chemical reactions of carbonyl compounds (3-Reactions)

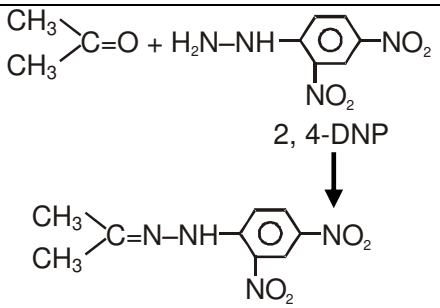
1.	**Cannizzaro reaction:**	
	Simple Cannizzaro reaction Aldehydes which do not have an α-hydrogen atom, undergo self oxidation and reduction (disproportionation) reaction on treatment with concentrated alkali.	 Formaldehyde Methanol Potassium formate
	Crossed Cannizzaro reaction On using two types of carbonyl compounds not having α-hydrogen atom, acid salt will be corresponding to that aldehyde or ketone which is less sterically crowded and another will give alcohol.	 (A) (B) less steric crowding more steric crowding
2.	**Aldol condensation (or aldol reaction):** Aldehydes and ketones with at least one α-hydrogen undergo a reaction in the presence of dilute alkali as catalyst.	 α, β-unsaturated carbonyl compound  α, β-unsaturated carbonyl compound
	Prediction of reactant	
3.	**Reaction with NH_2OH**	 Aldehyde / Ketone Oxime Aldehyde → Aldoxime Ketone → Ketoxime 

Test for carbonyl compounds

1.	**2,4-DNP(2,4-Dinitrophenyl hydrazine)Test :** Carbonyl compouds (all aldehydes and ketones) give yellow–orange precipitate with 2,4-DNP. It is also knwon as **Brady's reagent**. **General Reactions**	 2, 4-DNP (yellow–orange precipitate of Hydrazone)



(yellow–orange precipitate of Hydrazone)



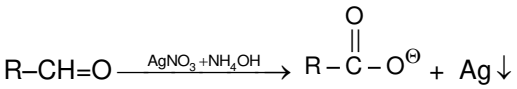
(yellow–orange precipitate of Hydrazone)

Test for Aldehydes

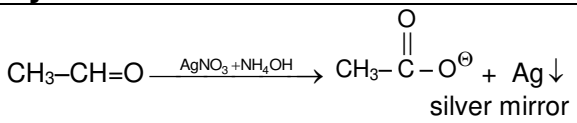
1. Tollen's reagent [$AgNO_3$ + NH_4OH or $\{Ag(NH_3)_2\}^+ OH^\ominus$] :

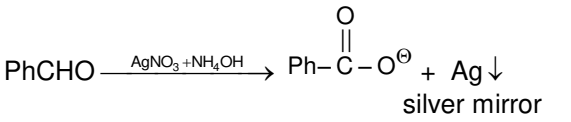
Tollen's Reagent gives silver mirror or Black precipitate with aldehydes.

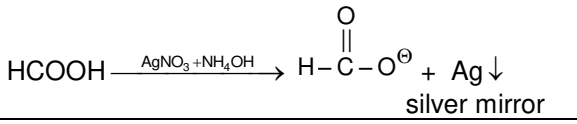
General reactions



Note : HCOOH also gives this test.



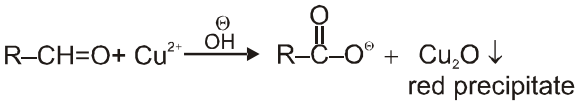




2. Fehling or Benedict test (Cu^{2+} in basic medium) :

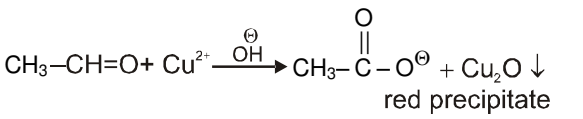
Aliphatic aldehyde gives red precipitate of Cu_2O with Fehling/Benedict solution. Cu^{2+} reduced into $Cu^{1+}$and aldehyde oxidised into acid salt.

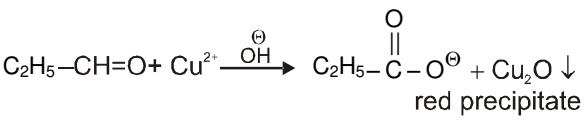
General reactions



*** Aromatic aldehydes do not give this test.**

* Schiff reagent is also use for lab test of aliphatic aldehydes only.



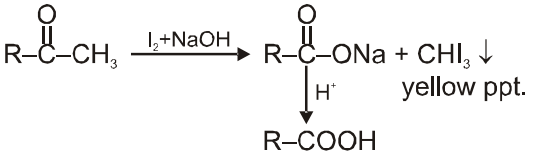


Iodoform Test

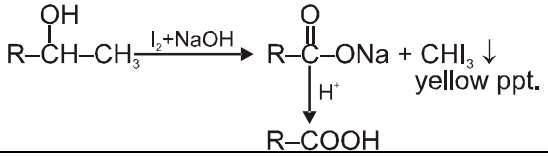
Reagents : I_2 + NaOH or NaOI (Where R = H, alkyl, aryl group)

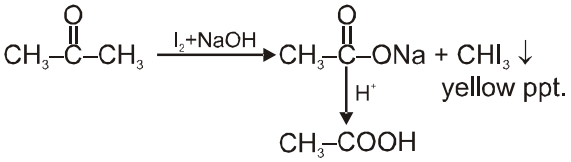
Acetaldehyde, all methyl ketones & ethyl alcohol give Iodoform test.

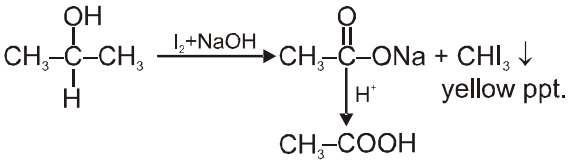
General reactions



(Acid of 1 carbon less)



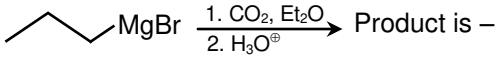


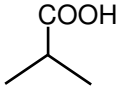


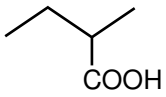
Exercise

ONLY ONE OPTION CORRECT TYPE

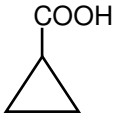
PART-A (Carboxylic acids)

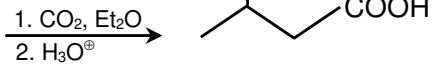
1.  Product is –

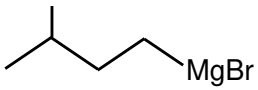
(A) 

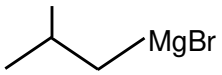
(B) 

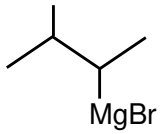
(C) 

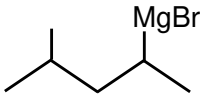
(D) 

2. A  A is :

(A) 

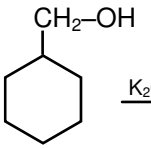
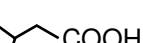
(B) 

(C) 

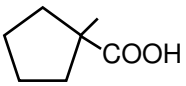
(D) 

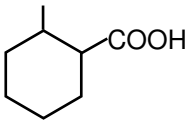
3. $Ph–CH_2–OH \xrightarrow{K_2Cr_2O_7/H^+}$ Product is -

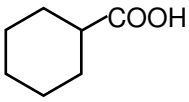
(A) $Ph–CH_2–COOH$ (B) $Ph–\underset{\displaystyle COOH}{\underset{|}{CH}}–CH_3$ (C) $Ph–COOH$ (D) $Ph–CH_2–O–\overset{\displaystyle O}{\overset{\|}{C}}–CH_3$

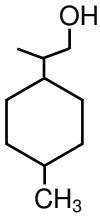
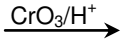
4.   Find product is –

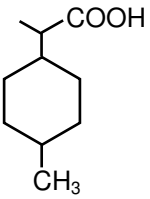
(A)

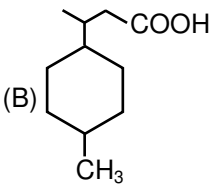
(B) 

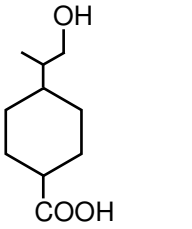
(C) 

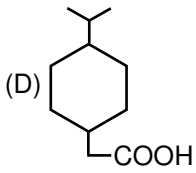
(D) 

5.   Product is –

(A) 

(B) 

(C) 

(D) 

6. $C_2H_5–\overset{O}{\overset{\|}{C}}–OCH_3 \underset{}{\overset{H_2O/H^+}{\rightleftharpoons}}$ Product is -

(A) CH_3COOH, C_2H_5OH
(B) CH_3COOH, $C_2H_5–COOH$
(C) $C_2H_5–COOH$, CH_3OH
(D) CH_3OH, $C_2H_5–OH$

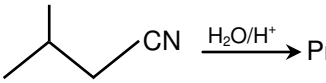
7. $CH_3–\overset{O}{\overset{\|}{C}}–NH–Ph \xrightarrow[\Delta]{H_2O/H^+} A + B$

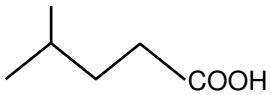
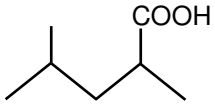
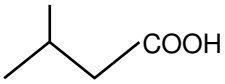
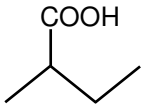
A and B are -

(A) $Ph–NH–\overset{O}{\overset{\|}{C}}–H + CH_3–COOH$
(B) $CH_3–\overset{O}{\overset{\|}{C}}–NH_2 + Ph–OH$
(C) $CH_3–\overset{O}{\overset{\|}{C}}–NH_2 + Ph–COOH$
(D) $CH_3–\overset{O}{\overset{\|}{C}}–OH + Ph–\overset{+}{N}H_3$

8. $C_2H_5–\overset{O}{\overset{\|}{C}}–O–\overset{O}{\overset{\|}{C}}–Ph \xrightarrow{H_2O/H^+} A + B$

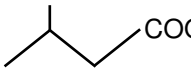
Ratio of A and B is –
(A) 1 : 2 (B) 2 : 1 (C) 1 : 1 (D) 2 : 3

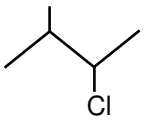
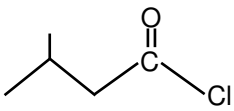
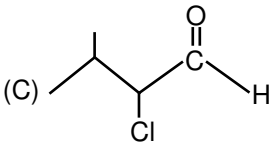
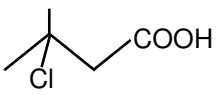
9.  $\xrightarrow{H_2O/H^+}$ Product is –

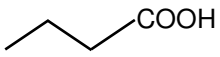
(A) 
(B) 
(C) 
(D) 

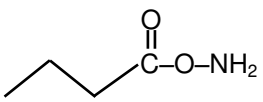
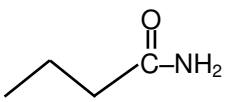
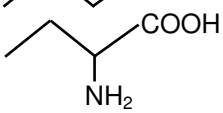
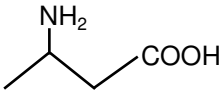
10. $CH_3CH_2CH_2COOH \xrightarrow{Red\ P + Br_2} CH_3–CH_2–\underset{\underset{Br}{|}}{CH}–COOH$

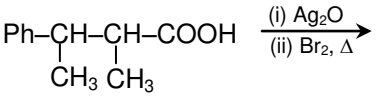
This reaction is called -
(A) cannizzaro reaction (B) Aldol reaction (C) HVZ reaction (D) Reimer Tiemann reaction

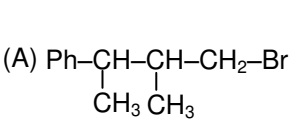
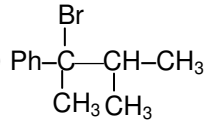
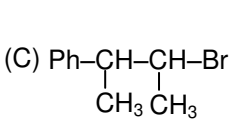
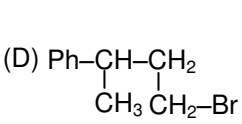
11.  $\xrightarrow[\Delta]{SOCl_2}$ Product is –

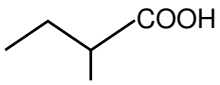
(A) 
(B) 
(C) 
(D) 

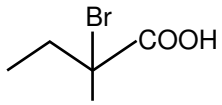
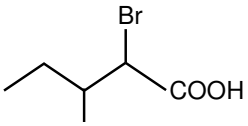
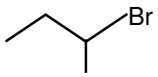
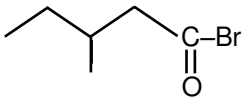
12.  $+ NH_3 \xrightarrow{\Delta}$ Product is-

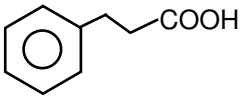
(A) 
(B) 
(C) 
(D) 

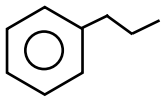
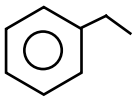
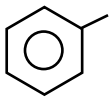
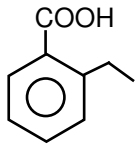
13.  Product is-

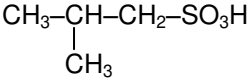
(A) 
(B) 
(C) 
(D) 

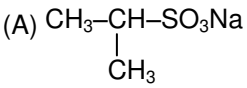
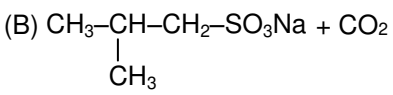
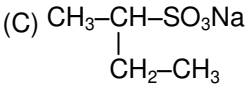
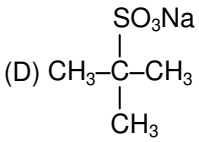
14.  Product is-

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

15.  Product is-

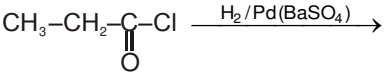
(A) 
(B) 
(C) 
(D) 

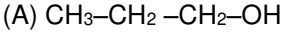
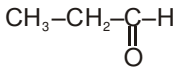
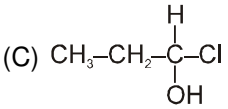
16.  Product is -

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

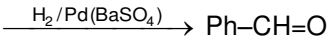
PART-B (Carbonyl compounds)

17. Product of given reaction is



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

18. Predict the reactant

Reactant 

(A) $Ph–CH_2OH$ (B) $Ph–COCl$ (C) $Ph–COOCH_3$ (D) $Ph–COCH_3$

19. $X \xrightarrow[Pd(BaSO_4)]{H_2} Y$; Y → (I_2 / HO^-) +Ve; (2,4-DNP) +Ve; (Tollen's Reagent) +Ve

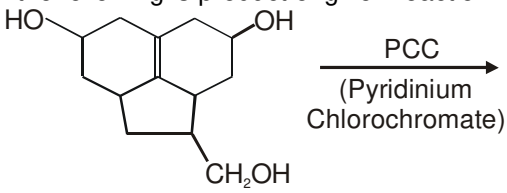
X is :

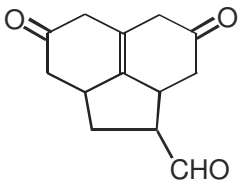
(A) $CH_3-\overset{\overset{O}{\|}}{C}-NH_2$ (B) $CH_3-\overset{\overset{O}{\|}}{C}-OH$ (C) $CH_3-\overset{\overset{O}{\|}}{C}-Cl$ (D) $CH_3-\overset{\overset{O}{\|}}{C}-OCH_3$

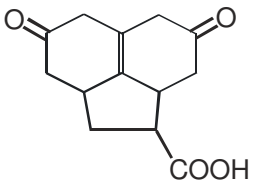
20. $CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-OH \xrightarrow{PCC} X$

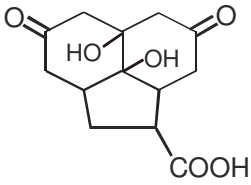
(A) $CH_3-\underset{\underset{CH_3}{|}}{CH}-COOH$ (B) $CH_3-\overset{\overset{O}{\|}}{C}-\underset{\underset{CH_2-CH_3}{|}}{}$ (C) $CH_3-\underset{\underset{CH_3}{|}}{CH}-CHO$ (D) $CH_3-\underset{\underset{CH_3}{|}}{C}=O$

21. Which of the following is product of given reaction



(A) 

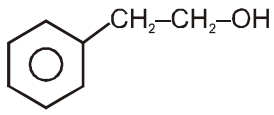
(B) 

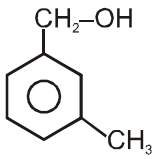
(C) 

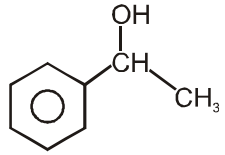
(D) None of these

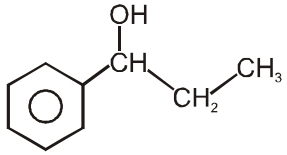
22. (X) $\xrightarrow{P.C.C}$ (Y); (Y) → (2,4-DNP) +Ve; (I_2 + NaOH) +Ve; (Tollents Reagent) –Ve

X is :

(A) 

(B) 

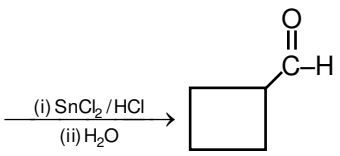
(C) 

(D) 

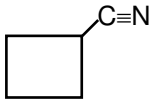
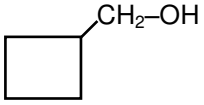
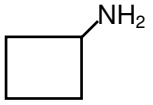
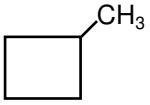
23. $CH_3–C\equiv N \xrightarrow[(ii)\ H_2O]{(i)\ SnCl_2/HCl} X + NH_4Cl$

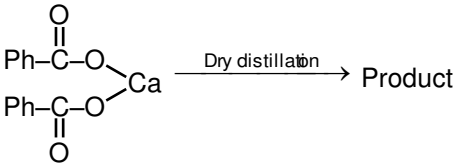
Identify 'X' :

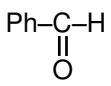
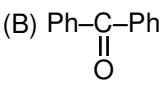
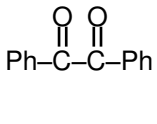
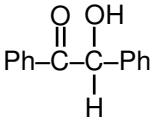
(A) $CH_3–CH=O$ (B) $CH_3–CH_2–CH=O$ (C) CH_3CH_2OH (D) $CH_3CH(OH)CH_3$

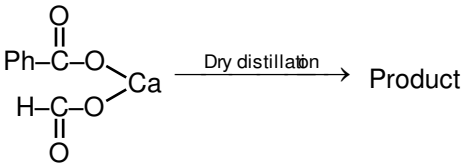
24. R 

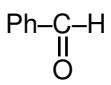
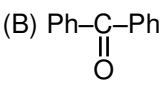
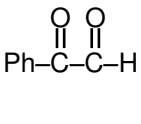
Identify 'R' :

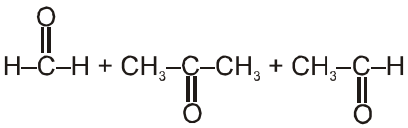
(A) 
(B) 
(C) 
(D) 

25. 

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

26. 

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

27. Ca-Salt of Carboxylic acid $\xrightarrow{\Delta}$ 

X and Y

(A) $(H–COO)_2Ca + (CH_3–COO)_2\ Ca$ (B) $(HCOO)_2Ca + (CH_3–CH_2–COO)_2Ca$

(C) $(CH_3COO)_2Ca + (CH_3CH_2–COO)_2Ca$ (D) None of these

28. Benzaldehyde, when heated with conc. KOH solution, gives

(A) $C_6H_5CH_2OH$ only

(B) C_6H_5COOH only

(C) C_6H_5COOK only

(D) a mixture of C_6H_5COOK and $C_6H_5CH_2OH$

29. The Cannizzaro's reaction is not given by :

(A) C_6H_5CHO (B) HCHO (C) CH_3CHO (D) $(CH_3)_3C–CHO$

30. In the reaction, $(CH_3)_3CCHO + HCHO \xrightarrow[heat]{NaOH} A + B$

the products (A) and (B) are respectively :

(A) $(CH_3)_3CCH_2OH$ and $HCOO^-\ Na^+$. (B) $(CH_3)_3CCOONa$ and CH_3OH.

(C) $(CH_3)_3CCH_2OH$ and CH_3OH. (D) $(CH_3)_3COONa$ and $HCOO^-\ Na^+$.

31. $(X) \xrightarrow[+\,HCl]{SnCl_2} \xrightarrow{HO^{\ominus}} C_6H_5COO^{\ominus} + C_6H_5CH_2-OH$

(A) $C_6H_5-\overset{\overset{O}{\|}}{C}-Cl$ (B) $C_6H_5-\overset{\overset{O}{\|}}{C}-NH_2$ (C) $C_6H_5-\overset{\overset{O}{\|}}{C}-OH$ (D) $C_6H_5-C\equiv N$

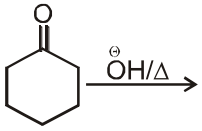
32. Which of the products is formed when acetone is reacted with dil. NaOH solution after heating?

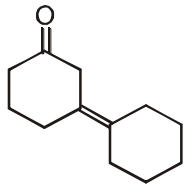
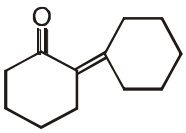
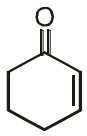
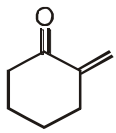
(A) $CH_3-\overset{\overset{O}{\|}}{C}-CH=\overset{\overset{CH_3}{|}}{C}-CH_3$

(B) $CH_3-\overset{\overset{O}{\|}}{C}-\underset{\underset{CH_3}{|}}{CH}-\underset{\underset{OH}{|}}{CH}-CH_3$

(C) $CH_3-\overset{\overset{O}{\|}}{C}-CH_2-\underset{\underset{CH_3}{|}}{C}=CH_2$

(D) $CH_3-\overset{\overset{OH}{|}}{\underset{\underset{CH_3}{|}}{C}}-\overset{\overset{OH}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_3$

33.  Product is :

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

34. Reactant $\xrightarrow[(ii)\,\Delta]{(i)\,dil.NaOH} CH_3-CH=CH-\overset{\overset{O}{\|}}{C}-H$

Reactant is :

(A) CH_3-CH_3 (B) $H-\overset{\overset{O}{\|}}{C}-\overset{\overset{O}{\|}}{C}-H$ (C) $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$ (D) $CH_3-\overset{\overset{O}{\|}}{C}-H$

35. $(X) \xrightarrow[+\,HCl]{SnCl_2} \xrightarrow[(ii)\,\Delta]{(i)\,HO^{\ominus}} \begin{matrix} CH_3 \\ H \end{matrix}\!\!>\!C=CH-\overset{\overset{O}{\|}}{C}-H$

(A) $H-C\equiv N$ (B) $CH_3-C\equiv N$ (C) CH_3-CH_2-CN (D) CH_3-COCl

36. The structure of the compound when acetaldehyde reacts with NH_2-OH is

(A) $CH_3CH=NCONHNH_2$ (B) $CH_3CH=NNHCONH_2$

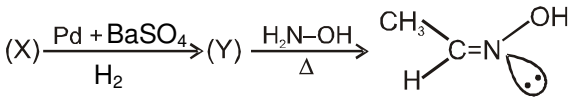
(C) $CH_3CH=NOH$ (D) $CH_3CH=NNH_2$

37. $(X) + (Y) \xrightarrow[-H_2O]{\Delta} \begin{matrix} CH_3 \\ H \end{matrix}\!\!>\!C=N-OH$

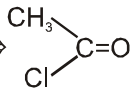
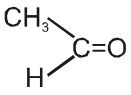
idenitfy (X) and (Y)

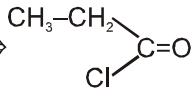
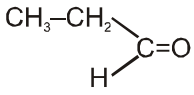
(A) X $\Rightarrow \begin{matrix} CH_3 \\ H \end{matrix}\!\!>\!C=O$; y = $NH_2CONHNH_2$ (B) X $\Rightarrow \begin{matrix} CH_3 \\ H \end{matrix}\!\!>\!C=O$; y = NH_2-NH_2

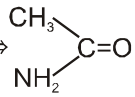
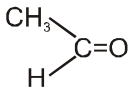
(C) X $\Rightarrow \begin{matrix} CH_3 \\ H \end{matrix}\!\!>\!C=O$; y = NH_2-OH (D) X $\Rightarrow \begin{matrix} CH_3 \\ H \end{matrix}\!\!>\!C=O$; y = $NH_2-NH-Ph$

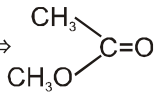
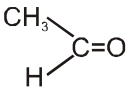
38. 

Identify (X) and (Y).

(A) (X) ⇒  (Y) ⇒ 

(B) (X) ⇒  (Y) ⇒ 

(C) (X) ⇒  (Y) ⇒ 

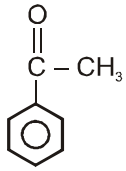
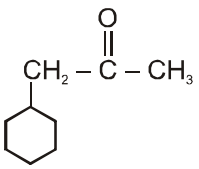
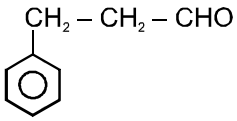
(D) (X) ⇒  (Y) ⇒ 

39. Benzaldehyde and acetone can be distinguished by
(A) Mulliken Baker test (B) Fehling solution
(C) Iodoform test (D) Ninhydrin test

40. Acetaldehyde and benzaldehyde can be distinguished by
(A) Tollen's test (B) Fehling solution
(C) $FeCl_3$ test (D) $NaHCO_3$ test

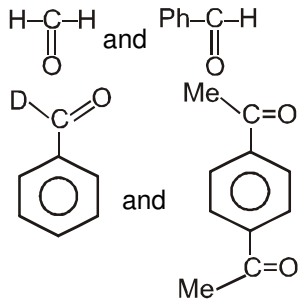
41. Propanal and propanone can not be distinguished by
(A) Iodoform test (B) Fehling solution
(C) Tollen's test (D) 2,4- DNP test

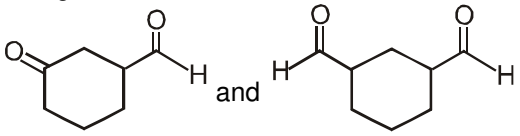
42. Which of the following compound will not react with I_2 /OH^-.

(A)  (B)  (C)  (D) $CH_3 - CHO$

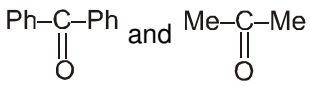
43. 2-Pentanone can be distinguished from 3- Pentanone by which reagent ?
(A) 2, 4- Dinitrophenyl hydrazine (B) Tollen's reagent
(C) I_2 and dilute NaOH (D) Fehling solution

44. Tollen's reagent ($AgNO_3$ + NH_4OH) can be used to distinguish between.

(A) 

(B) 

(C)

(D) 

Answers

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