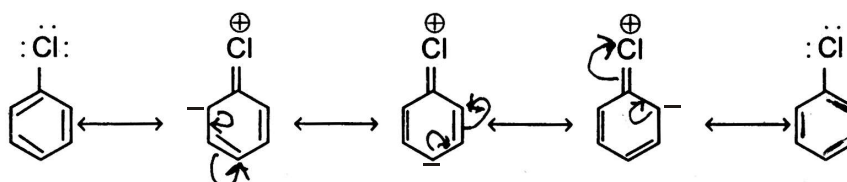


SOME IMPORTANT REASONING BASED QUESTIONS OF ORGANIC CHEMISTRY

1. Chlorobenzene is less reactive than chloromethane.

Ans. In chlorobenzene, each carbon atom of benzene ring is sp^2 hybridised and is electron withdrawing. Chlorine atom donates a lone pair of electron and acquires positive charge. The negative charge is delocalised on ortho and para position by resonance.



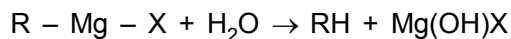
C-Cl bond acquires partial double bond character and is 169 pm as compared to 170 pm in chloromethane where C atom is sp^3 hybridised. So larger amount of energy is required to break C-Cl bond in chlorobenzene and therefore is less reactive than haloalkane towards nucleophilic substitution reaction.

2. Haloalkanes react with KCN to form alkyl cyanide as main product while AgCN form isocyanide.

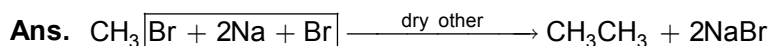
Ans. KCN is, predominantly ionic compound and provides cyanide ion $:\bar{C} \equiv \ddot{N}$ in solution. The attack mainly takes place through lone pair of electron on carbon atom due to high electron density and not through nitrogen atom since C-C bond is more stable than C-N bond. AgCN: is mainly a covalent compound therefore, nitrogen donates electron pair forming isocyanide as the main product.

3. Grignard Reagent is prepared under anhydrous conditions.

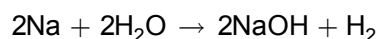
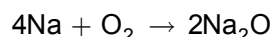
Ans. In Grignard Reagent, the carbon-magnesium covalent bond is highly polar with carbon atom of alkyl or aryl group withdrawing electrons from electropositive magnesium and magnesium halogen bond is also ionic
 $\delta^- \quad \delta^{++} \quad \delta^-$
 $R - Mg - X$. So Grignard reagent is highly reactive, and reacts with any source of proton to give hydrocarbons.



4. Wurtz Reaction is carried in dry ether.



Sodium metal is sensitive towards air and moisture forming :



So reaction is carried in dry ether to avoid air and moisture.

5. SN_1 reactions are favoured in protic solvent.

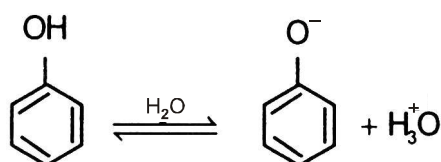
Ans. It involves C-X bond breakage for which the energy required is obtained through solvation of halide ion with the protons of protic solvent like H_2O , alcohol etc.

6. Tertiary halides do not undergo SN_2 mechanism.

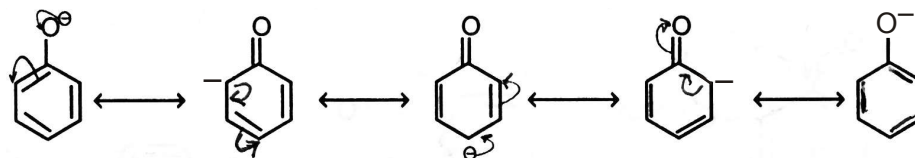
Ans. In SN_2 reaction, the nucleophile attacks to the carbon atom from the opposite side of halide atom. Three alkyl groups cause a steric hindrance to the approach of nucleophile.

7. Phenol is acidic in nature.

In phenol each atom of benzene ring is sp^2 hybridised and is electron withdrawing. Oxygen atom donates a pair of electron to the ring and acquires positive charge which facilitates the donation of proton.



The Phenoxide ion (conjugate base) is stabilised by resonance (PKa).



8. Which is more acidic, *p*-nitrophenol or phenol? Explain why?

Ans. *p*-nitrophenol is more acidic. Any electron withdrawing group like NO_2 withdraws the electron density away from oxygen atom of phenoxide ion and this results in further delocalisation of negative charge and stabilisation.

of phenoxide ion. Hence, electron withdrawing groups favour the ionisation of substituted phenol to give more and more of H^+ ions.

9. Cresol ($C_6H_5OCH_3$) is less acidic than phenol.

Ans. Cresol is less acidic than phenol. Any electron releasing group like $-CH_3$, releases the electron density over oxygen atom and destabilises it resulting in decrease in ionisation of cresol. So cresol is less acidic than phenol.

10. Ethers are insoluble in water.

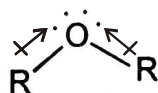
Ans. Ethers cannot form Hydrogen bonds with water because it is less polar than water and cannot break hydrogen bonds formed between H_2O molecules.

11. Boiling points of ethers are lower than isomeric alcohols.

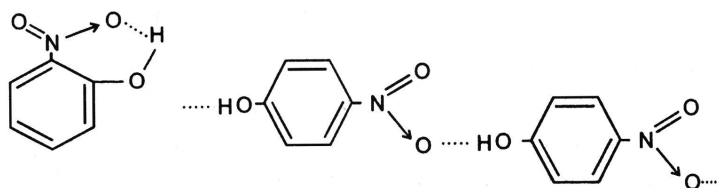
Ans. Boiling points of ethers are lower than isomeric alcohols due to lack of intermolecular hydrogen bonding in ethers whereas alcohol molecules are associated through strong hydrogen bonds.

12. Ethers are polar in nature even if both alkyl groups are identical.

Ans. Ethers have non-linear structure. Each of the two C-O bonds are polar. Net dipole moment is the vector sum of dipole moments of both the bond dipoles.

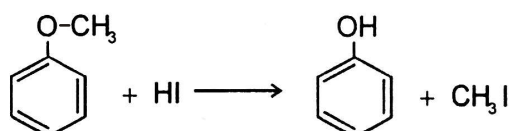


13. *o*-nitrophenol is steam volatile while *p*-nitrophenol is not.



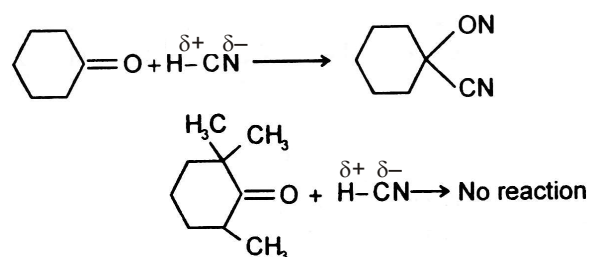
o-nitrophenol is steam volatile due to intramolecular hydrogen bonding while *p*-nitrophenol is less volatile due to intermolecular hydrogen bonding.

14. Phenyl methyl ether reacts with HI to form phenol and methyl iodide not iodobenzene and methanol.



- (a) In phenyl methyl ether, the carbon atoms of phenyl group are sp^2 hybridised and there is a partial double bond character in phenyl carbon-oxygen bond. Hence, C_6H_5-O bond is stronger than CH_3-O . Therefore, the attack of I^- on the alkyl carbon of $C_6H_5-O-CH_3$ occurs and breaks the CH_3-O -bond to form phenol and iodomethane.
- (b) Benzene ring offers a steric hinderance to I^- to attack at C_6H_5-O bond.
15. Aldehydes are more reactive towards nucleophiles than ketones.
- (a) Sterically, the presence of two large substituents in ketones hinders the approach of nucleophile to carbonyl carbon as compared with aldehydes having only one such substituent.
- (b) The two alkyl groups in ketones are electron releasing and release the electron density over carbonyl carbon, thus reduces the electrophilicity of carbonyl carbon more effectively than in aldehyde which has only one alkyl group.
16. Cyclohexanone forms cyanohydrin in good yield but 2,2,6-trimethyl cyclohexanone does not.

Ans.



- (a) The three methyl groups are electron releasing and increase the electron density over carbonyl carbon atom thus reduces its electrophilicity.
- (b) Three methyl groups causes steric hinderance to nucleophilic attack the carbonyl carbon of $>C=$ group.
17. There are two $-NH_2$ groups in semicarbazide but only one is involved in the formation of semicarbozones.

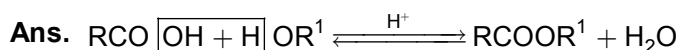


The lone pair of electrons on NH_2 nearer to $\overset{O}{\parallel}C-$ is delocalised over oxygen atom and therefore, this $-NH_2$ group is not available as nucleophile



group not involved in resonance, will act as a nucleophile.

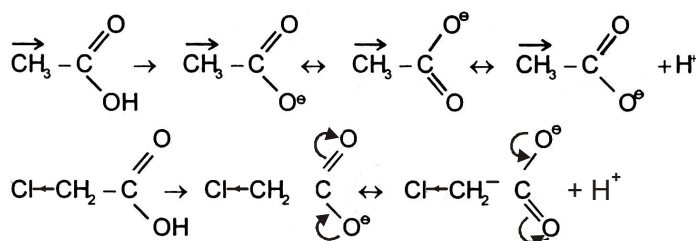
18. During the preparation of an ester from a carboxylic acid and an alcohol in the presence of an acid catalyst, ester is removed as fast as it is formed.



Both esterification and hydrolysis of ester are catalysed by acid, the reaction is reversible and an equilibrium is established, so ester or water is removed to favour the forward reaction, as per Le Chatelier's principle.

19. pKa of chloroacetic acid is less than that of acetic acid or chloroacetic acid is a stronger acid than acetic acid.

Ans.

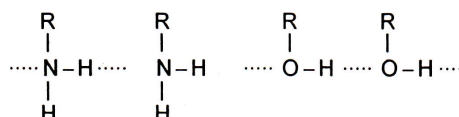


Any electron releasing group like CH_3 increases the electron density over carboxylate anion ($-\text{COO}^-$). The stability of the conjugate base is reduced and hence, H^+ cannot be donated easily. Thus, it decreases the acid strength of carboxylic acid.

Any electron withdrawing group like Cl , F , NO_2 etc. withdraws the electron density away from COO^- and spreads it and thus stabilises the carboxylate ion by delocalisation of negative charge. Thus, it increases the acid strength of carboxylic acid.

20. Amines are higher boiling compounds than hydrocarbons but lower boiling than alcohols of comparable molecular masses.

Ans. Boiling points of amines and alcohols are higher than those of hydrocarbons of comparable molecular masses due to intermolecular hydrogen bonding in amines and alcohols.

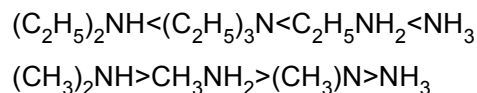


Hydrogen bonds in amines are weaker than those present in alcohols. This is because oxygen is more electronegative than nitrogen, so boiling points of amines are lower than those of alcohols of comparable molecular masses. The intermolecular forces in hydrocarbons are weak van der Waals forces due to which hydrocarbons have lower boiling points than amines or alcohols.

21. Boiling point of isomeric tertiary amines are lower than those of primary amines.

Ans. Boiling points of isomeric tertiary amines are lower than those of primary amines due to the lack of intermolecular hydrogen bonding which exists in primary amines.

22. Observed K_b order is :



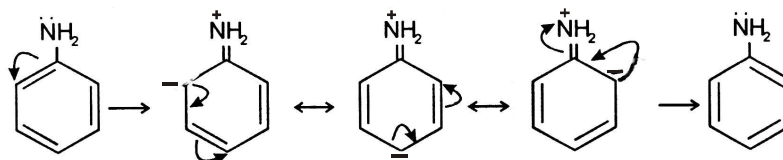
Ans. (a) In gaseous phase, where solvent factor is missing, larger the number of electron releasing groups, more basic is the amine (positive inductive effect) as they release the electron cloud over N-atom and lone pair of electrons can be donated easily. The K_b order should be: tertiary amine > secondary amine > primary amine.

- (b) In aqueous phase, the substituted ammonium cations get stabilised not only by electrons releasing effect of alkyl groups (+I) but also by solvation with water molecules via hydrogen bonding. In case the alkyl group is bigger than CH_3 group, there will be steric hinderance to H-bonding resulting in less stabilisation of substituted ammonium cation.

Combining these factors (i) Inductive effect stabilisation of substituted ammonium cations via H-bonding. (ii) steric hinderance of bigger alkyl group to H-bonding. The order of basic strength is as given above.

23. Aniline is a weaker base than CH_3NH_2 .

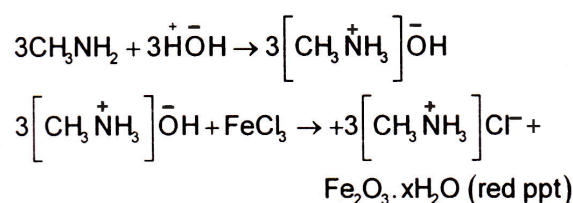
Ans. In aniline, each C-atom of benzene ring is sp^2 hybridised and is electron withdrawing. Nitrogen atom donates a lone pair of electrons to the ring and acquire (+) charge. The negative charge is delocalised on ortho and para position by resonance.



So due to delocalisation, the lone pair of electrons on benzene ring is not available for donation and therefore, aniline is weaker base than CH_3NH_2 where CH_3 is an electron releasing group and increases electron availability on N-atom which can be donated easily.

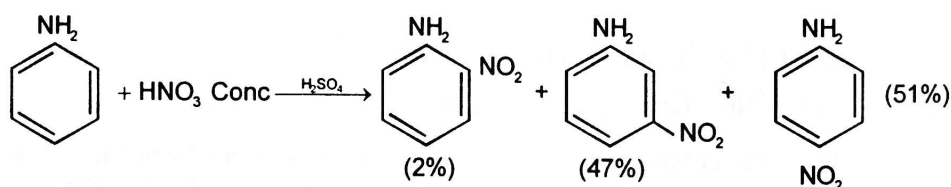
24. Methylamine in water react with ferric chloride to precipitate hydrated ferric oxide.

Ans. Methylamine in water behaves as a base to form OH^- ions which react with FeCl_3 to form hydrated ferric oxide.

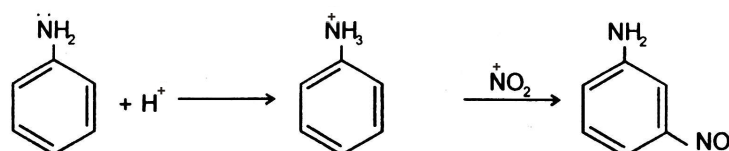
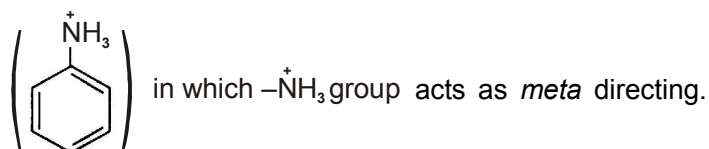


25. $-\text{NH}_2$ is ortho and para directing in aromatic electrophilic substitution reactions but aniline on nitration give a substantial amount of meta-nitro aniline.

Ans.

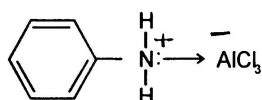


In strongly acidic medium aniline is protonated to form anilinium ion



26. Aniline does not undergo Friedel–Craft reaction.

Ans. Aniline does not undergo Friedel-Craft reaction due salt formation with aluminium chloride, the Lewis acid, which is used as catalyst. Due to this, N-atom of aniline acquires positive charge and hence, it acts as strong de-activating group for further reaction.



27. Aromatic primary amines cannot be prepared by Gabriel's phthalamide synthesis.

Ans. Aryl halides do not undergo nucleophilic substitution reaction with the anion formed by phthalamide because of partial double bond character of C—X bond of aryl halide.

28. Although chlorine atom is an electron withdrawing group yet it is ortho and para directing in electrophilic aromatic substitution reactions.

Ans. Please see Page 306, NCERT Part II.

29. Phenoxide ion has more number of resonating structure than carboxylate ion but carboxylic acid is a stronger acid than phenol.

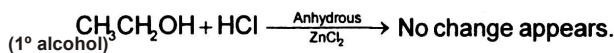
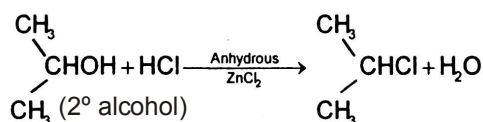
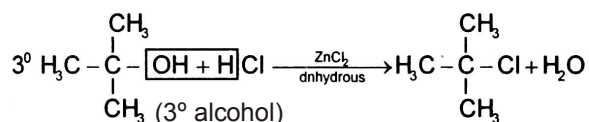
Ans. The phenoxide ion has non-equivalent resonance structures in which negative charge is at less electronegative carbon atom of phenoxide ion. The carboxylate ion has two equivalent resonance structures in which negative charge is more effectively delocalised over two electronegative oxygen atoms. In phenoxide ion, the negative charge is less effectively delocalised over one oxygen atom and less electronegative carbon atom of phenoxide ion. Thus, the carboxylate ion is more stabilised than phenoxide ion. Therefore, carboxylic acids are more acidic than phenols.

**Distinguish Between
Primary, Secondary and Tertiary alcohol**

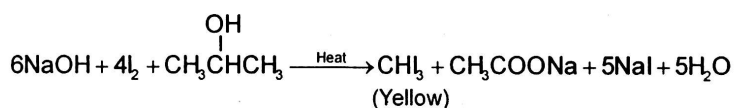
| Test | 1° Alcohol | 2° Alcohol | 3° Alcohol |
|--|------------|---------------------------------------|----------------------------------|
| (1) Add Lucas reagent Anhyd. ZnCl_2 + Conc HCl | No change | Turbidity appears within 5 minutes | Turbidity appears immediately |

Lucas Test

Lucas Test is based on Kinetics of the reaction. 3° alcohols react at the fastest rate.

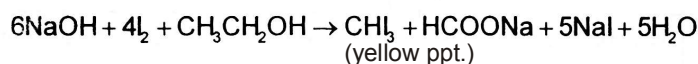


| Test | Propan-1-ol $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ | Propan-2-ol $\begin{array}{c} \text{OH} \\ \\ \text{CH}_3-\text{CH}-\text{CH}_3 \end{array}$ |
|--|---|---|
| (1) Add Lucas Reagent (Anhydrous ZnCl_2 + HCl) | No change | Turbidity appears within 5 minutes. |
| (2) Add I_2 / NaOH (Iodoform test) | No change | Yellow precipitate of CHI_3 |

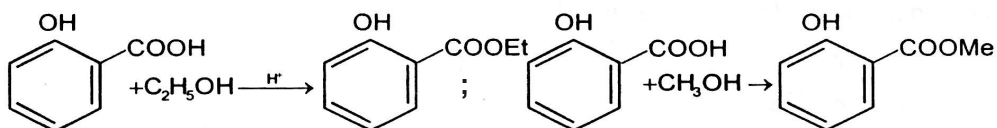



| Test | Ethanol | Propan-2-ol |
|--|-----------|-----------------------------|
| (1) Add Lucas Reagent (Anhydrous ZnCl_2 + HCl) | No change | Turbidity within 5 minutes. |

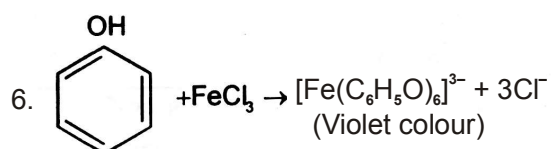
| Test | Ethanol (C ₂ H ₅ OH) | Propan-1-ol (CH ₃ CH ₂ CH ₂ OH) |
|--|--|--|
| (1) Add I ₂ / NaOH and heat | Yellow iodoform(CHI ₃) | No change |


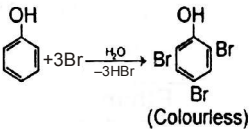



| Test | Ethanol (CH ₃ CH ₂ OH) | Methanol(CH ₃ OH) |
|--|--|------------------------------|
| (1) Add I ₂ / NaOH and heat | Yellow precipitate of CHI ₃ | No change |
| (2) Add salicylic acid | pleasant odour | odour of oil of winter green |

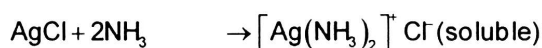
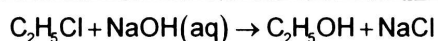


| Test | Ethanol CH ₃ CH ₂ OH | Phenol  |
|--|--|---|
| (1) Add I ₂ / NaOH and heat | Yellow precipitate of CHI ₃ | No change |
| (2) Add neutral FeCl ₃ | No Change | Violet Colouration |





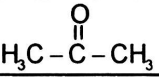
| Test | Phenol  | Propan-2-ol CH ₃ -CH(OH)CH ₃ |
|--|--|---|
| (1) Add Neutral FeCl ₃ | Violet Colour | No change |
| (2) Add Br ₂ / H ₂ O | colour of Br ₂ decolourised  | No change |

| Test | Chloroethane (C ₂ H ₅ Cl) | Chlorobenzene  |
|-------------------------------------|---|---|
| (1) Add aq NaOH + AgNO ₃ | White precipitate of AgCl soluble in Ammonia | No Change |



| Test | Chloroethane CH ₃ CH ₂ Cl | Bromoethane CH ₃ CH ₂ Br |
|---|---|--|
| (1) Add aq NaOH + AgNO ₃ | White ppt (AgCl) | Creamy yellow ppt (AgBr) |
| (2) Add NH ₃ in both test tube | White ppt get dissolved in NH ₃ | Yellow ppt dissolved partly in NH ₃ |

| Test | Benzyl Chloride  | Chlorobenzene  |
|-------------------------------------|---|---|
| (1) Add aq NaOH + AgNO ₃ | White ppt soluble in Ammonia | No change |

| Test | Acetaldehyde CH ₃ CHO | Acetone  |
|---|----------------------------------|---|
| (1) Add Fehling's reagent | Brown-red precipitate | No change |
| $\text{CH}_3\text{CHO} + 2\text{Cu}^{2+} + 5\text{OH}^- \rightarrow \text{CH}_3\text{COO}^- + \text{Cu}_2\text{O (redbrown)} + 3\text{H}_2\text{O}$ | | |
| (2) Add Tollens' reagent | Silver mirror | No change |

| Test | Acetaldehyde CH ₃ CHO | Formaldehyde HCHO |
|---|-------------------------------------|---------------------------------|
| (1) Add I ₂ / NaOH and heat | Yellow iodoform (CHI ₃) | No change |
| $4\text{NaOH} + 3\text{I}_2 + \text{CH}_3\text{CHO} \rightarrow \text{CHI}_3 + \text{HCOONa} + 3\text{NaI} + 3\text{H}_2\text{O}$ | | |
| (2) Add KMnO ₄ / H ₂ SO ₄ | | effenescence of CO ₂ |
| $\text{CH}_3\text{CHO} \xrightarrow{\text{MnO}_4^- / \text{H}^+} \text{CH}_3\text{COOH (smell of vinegar)}$ | | |
| $\text{HCHO} \xrightarrow{\text{O}} \text{HCOOH} \xrightarrow{\text{O}} \text{H}_2\text{O} + \text{CO}_2$ | | |

| Test | Ethanal (CH ₃ CHO) | Benzaldehyde (C ₆ H ₅ CHO) |
|-------------------------------|-------------------------------------|--|
| (1) Add I ₂ / NaOH | Yellow iodoform (CHI ₃) | No change |
| (2) Add Fehling's reagent | Red ppt of Cu ₂ O | No Change |

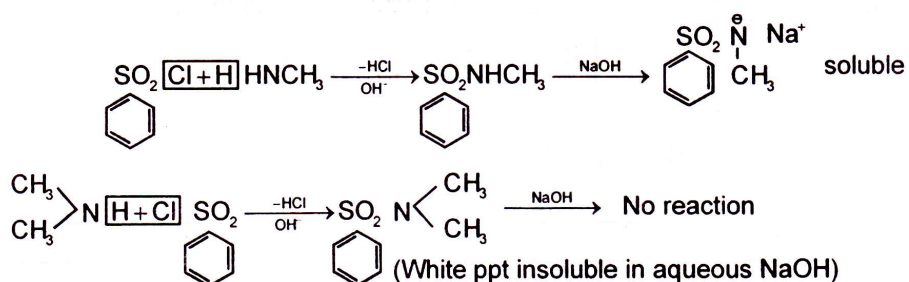
| Test | Pentan-3-one | Pentan-3-one |
|--|--|--|
| | $\text{CH}_3 - \overset{\text{O}}{\underset{\text{ }}{\text{C}}} - \text{CH}_2\text{CH}_2\text{CH}_3$ | $\text{CH}_3\text{CH}_2 - \overset{\text{O}}{\underset{\text{ }}{\text{C}}} - \text{CH}_2\text{CH}_3$ |
| (1) Add I ₂ / NaOH and heat | Yellow iodoform (CHI ₃) | No change |
| $4\text{NaOH} + 3\text{I}_2 + \text{CH}_3 - \overset{\text{O}}{\underset{\text{ }}{\text{C}}} - \text{CH}_2\text{CH}_2\text{CH}_3 \rightarrow \text{CHI}_3 + \text{CH}_3\text{CH}_2\text{CH}_2\text{COONa} + 3\text{NaI} + 3\text{H}_2\text{O}$ <p style="text-align: center;">(Yellow)</p> | | |

| Test | Acetophenone | Benzophenone |
|--|---|--|
| | $\text{C}_6\text{H}_5 - \overset{\text{O}}{\underset{\text{ }}{\text{C}}} - \text{CH}_3$ | $\text{C}_6\text{H}_5 - \overset{\text{O}}{\underset{\text{ }}{\text{C}}} - \text{C}_6\text{H}_5$ |
| (1) Add I ₂ / NaOH | Yellow iodoform (CHI ₃) | No change |
| $4\text{NaOH} + 3\text{I}_2 + \text{C}_6\text{H}_5 - \overset{\text{O}}{\underset{\text{ }}{\text{C}}} - \text{CH}_3 \rightarrow \text{CHI}_3 + \text{C}_6\text{H}_5 - \overset{\text{O}}{\underset{\text{ }}{\text{C}}} - \text{COONa} + 3\text{NaI} + 3\text{H}_2\text{O}$ | | |
| (2) Add NaHSO ₃ | White ppt | No Change |
| $\text{C}_6\text{H}_5 - \overset{\text{O}}{\underset{\text{ }}{\text{C}}} - \text{CH}_3 + \text{NaHSO}_3 \rightarrow \text{C}_6\text{H}_5 - \overset{\text{OH}}{\underset{\text{CH}_3}{\underset{\text{ }}{\text{C}}}} - \text{SO}_3^- \text{Na}^+$ | | |

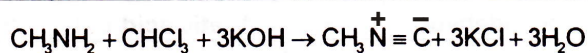
| Test | formic acid (HCOOH) | acetic acid CH ₃ COOH |
|---|---------------------|----------------------------------|
| (1) Tollens' reagent | Silver mirror (Ag) | No change |
| $\text{HCOOH} + [\text{Ag}(\text{NH}_3)_2]^+ + 2\text{OH}^- \rightarrow \text{CO}_2 + \text{Ag} + 2\text{H}_2\text{O} + 2\text{NH}_3$ | | |

| Test | Phenol (White solid) | Benzoic acid (White Solid) |
|--|------------------------------------|--------------------------------------|
| | $\text{C}_6\text{H}_5 - \text{OH}$ | $\text{C}_6\text{H}_5 - \text{COOH}$ |
| (1) Add neutral FeCl ₃ | Violet Colour | No Change |
| (2) Add NaHCO ₃ (aq) | No change | Effervescence of CO ₂ |
| $\text{C}_6\text{H}_5\text{COOH} + \text{NaHCO}_3 \rightarrow \text{C}_6\text{H}_5\text{COONa} + \text{CO}_2 + \text{H}_2\text{O}$ | | |


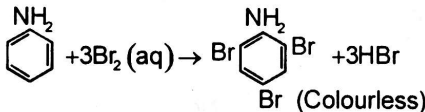
| Test | Primary Amine | Secondary Amine | Tertiary Amine |
|------------------------------------|------------------------------|--------------------------------|----------------|
| Hinsberg reagent $C_6H_5SO_2Cl$ | White ppt soluble in NaOH | White ppt insoluble in NaOH | No change |



| Test | Methanamine (CH_3NH_2) | Dimethyl amine (CH_3NHCH_3) |
|---|---|--|
| (1) Add Hinsberg reagent $C_6H_5SO_2Cl$ | White ppt (soluble in NaOH) | White ppt insoluble in NaOH (aq.) |
| (2) Add $\text{CHCl}_3 + \text{KOH}(\text{alc.})$ | Foul odour of isocyanide | No change |

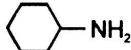
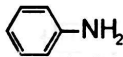


| Test | Aniline ($\text{C}_6\text{H}_5\text{NH}_2$) | N-methyle aniline ($\text{C}_6\text{H}_5\text{NHCH}_3$) |
|--|---|---|
| (1) Add Hinsberg reagent ($C_6H_5SO_2Cl$) | White ppt soluble in NaOH | White ppt insoluble in NaOH |
| $C_6H_5SO_2Cl + H_2NC_6H_5 \xrightarrow{\text{OH}^-} C_6H_5SO_2NHC_6H_5 \xrightarrow{\text{NaOH}} C_6H_5SO_2N^-(C_6H_5)Na^+$ | | |
| (2) Add $\text{CHCl}_3 + \text{KOH}(\text{alc.})$ | Foul odour of isocyanide | No change |
| $C_6H_5NH_2 + \text{CHCl}_3 + 3\text{KOH} \rightarrow C_6H_5N^+\equiv\text{C}^- + 3\text{KCl} + 3\text{H}_2\text{O}$ | | |

| Test | Aniline  | Methylamine (CH ₃ NH ₂) |
|--|---|--|
| (1) Add Br ₂ / H ₂ O | Colour of Br ₂ (aq) decolourised | No change |
|  $\text{C}_6\text{H}_5\text{NH}_2 + 3\text{Br}_2(\text{aq}) \rightarrow \text{C}_6\text{H}_2\text{Br}_3\text{NH}_2 + 3\text{HBr}$ Br (Colourless) | | |

| Test | CH ₃ COCH ₃ acetone | acetic acid CH ₃ COOH |
|--|---|----------------------------------|
| (1) Add I ₂ / NaOH + heat | Yellow iodoform (CHI ₃) | No change |
| $4\text{NaOH} + 3\text{I}_2 + \text{CH}_3\text{COCH}_3 \rightarrow \text{CHI}_3 + \text{CH}_3\text{COONa} + 3\text{NaI} + 3\text{H}_2\text{O}$ | | |
| (2) Add NaHCO ₃ | No change | Effervescence of CO ₂ |
| $\text{CH}_3\text{COOH} + \text{NaHCO}_3 \rightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2$ | | |

| Test | acetaldehyde CH ₃ CHO | Acetic acid CH ₃ COOH |
|----------------------------|----------------------------------|----------------------------------|
| (1) Add Fehling's reagent | Red ppt. of Cu ₂ O | No change |
| (2) Add Tollens' reagent | Silver mirror (Ag) | No change |
| (3) Add NaHCO ₃ | No change | Effervescence of CO ₂ |

| Test |  Cyclohexylamine |  (Aniline) |
|--|--|--|
| Add NaNO ₂ and HCl and then add phenol in presence of a base. | N ₂ gas is liberated and no colouration is observed. | Stable diazonium salt is formed which reacts with phenol to form orange dye. |

MOST FREQUENTLY ASKED REASONING BASED AND DISTINCTION BASED QUESTIONS IN ORGANIC CHEMISTRY

1. Haloarenes are less reactive than haloalkanes. Give two reasons.
2. KCN reacts with haloalkanes to form alkyl cyanide as a main product while AgCN forms isocyanamide as main product.
3. Although chlorine is an electron withdrawing group, yet is ortho and para-directing in electrophilic aromatic substitution reactions.
4. The presence of an electron withdrawing like NO_2 at ortho and para-positions increases the reactivity of haloarenes.
5. A SN_2 reaction proceeds with complete stereo-chemical inversion while SN_1 reaction proceeds with racemisation.
6. Wurtz reaction is carried out in dry ethereal medium.
7. Grignard reagent should be prepared under anhydrous conditions.
8. *tert*-Butyl chloride reacts with aqueous NaOH by SN_1 mechanism while *n*-Butyl chloride reacts with SN_2 mechanism.
9. SN_1 reactions are favoured in protic solvent.
10. Phenol is acidic in nature.
11. *p*-nitrophenol is more acidic than phenol.
12. *p*-cresol is less acidic than phenol.
13. Boiling point of ethers are lower than isomeric alcohols.
14. Ethers having two identical alkyl groups are polar in nature.
15. *o*-nitrophenol is steam volatile while *p*-nitrophenol is not.
16. Phenyl methyl ether reacts with HI to form phenol and methyl iodide and not iodobenzene and methanol.

17. Aldehydes are more reactive than ketones towards nucleophilic attack.
18. Cyclohexanone form cyanohydrin in good yield but 2,2,6-trimethylcyclohexanone does not.
19. There are two -NH_2 groups in semicarbazide ($\text{H}_2\text{N NH CONH}_2$) but only one is involved in the formation of semicarbazones.
20. Although phenoxide ion ($\text{C}_6\text{H}_5\text{O}^-$) has more number of resonating structure than carboxylate ion, carboxylic acids is a stronger acid than phenol.
21. pK_a of acetic acid is more than that of chloroacetic acid.
22. 4-Nitrobenzoic acid is stronger acid than benzoic acid but 4-methoxybenzoic acid is weaker acid than benzoic acid.
23. Formic acid is stronger acid than benzoic acid.
24. FCH_2COOH is stronger acid than ClCH_2COOH .
25. Aniline is weaker base than cyclohexylamine or an alkylamine.
26. CH_3NH_2 or RNH_2 reacts with aq. FeCl_3 to precipitate hydrated ferric oxide ($\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$).
27. NH_2 group is *ortho* - and *para* - directing in aromatic electrophilic substitution reaction but aniline on nitration gives substantial amount of *m*-nitroaniline.
28. Aniline like phenol does not undergo Friedel-Crafts reaction.
29. Aromatic amines cannot be prepared by Gabriel's phthalimide synthesis
30. CH_3NH_2 or $\text{CH}_3\text{CH}_2\text{NH}_2$ is soluble in water but aniline is not.
31. The decreasing order of basic strength in gas phase is $(\text{C}_2\text{H}_5)_3\text{N} > (\text{C}_2\text{H}_5)_2\text{NH} > \text{C}_2\text{H}_5\text{NH}_2$ but in aqueous medium the correct decreasing order is $(\text{C}_2\text{H}_5)_2\text{NH} > (\text{C}_2\text{H}_5)_3\text{N} > \text{C}_2\text{H}_5\text{NH}_2$
32. The decreasing order of basic strength in aqueous medium is $(\text{CH}_3)_2\text{NH} > \text{CH}_3\text{NH}_2 > (\text{CH}_3)_3\text{N}$
33. pK_b of aniline is more than that of methylamine.
34. CH_3NH_2 has more boiling point than $(\text{CH}_3)_3\text{N}$ but has less boiling point than CH_3OH .

Distinction - Based Questions

1. Chloroethane and Chlorobezene
2. Cyclohexyl Chloride and Chlorobenzene
3. Benzyl Chloride and Chlorobenzene
4. Allyl Chloride and Vinyl chloride.
5. Primary, secondary and tertiary alcohols.
6. Ethyl alcohol (ethanol) and isopropyl alcohol (propan-2-ol)
7. Isopropyl alcohol and *tert*-butyl alcohol.
8. Phenol and ethyl alcohol.
9. Phenol and cyclohexyl alcohol.
10. Acetaldehyble and acetone.
11. Formaldehyde and acetaldehyde
12. Ethanal and benzaldehyde
13. Acetophenone and benzophenone
14. Pentan-2-one and penton-3-one
15. Formic acid and formadehyde.
16. Formic acid and acetic acid.
17. Acetone and acetic acid.
18. Primary, secondary and tertiary amines.
19. Methylamine and dimethylamine
20. Dimethylamine and trimethylamine
21. Aniline and cyclohexylamine
22. Aniline and benzylamine
23. Phenol and aniline.
24. Acetone and acetic acid
25. Acetic acid and ethylacetate
26. Methylacetate and ethylacetate
27. Phenol and acetic acid.