<u>DISTINCTION BETWEEN SOME PAIRS OF ORGANIC COMPOUNDS</u> (Chemical Tests)

1. Cholorobenzene (C₆H₅Cl) and chlorocyclohexane (C₆H₁₁Cl)

Add small quantity of aqueous KOH to each compound. Acidify with dil. HNO_3 and add $AgNO_3$ solution. Chlorocylohexane gives white ppt while chlorobenezene does not give this test

Chlorocyclohexane

Chlorobenzene

2. Chlorobenzene (C₆H₅Cl) and Benzyl chloride (C₆H₅CH₂Cl)

Benzyl chloride give white ppt, when treated with aq. KOH and acidified AgNO₃ solution. While chlorobenzene does not give this test.

3. Ethyl chloride (C_2H_5Cl) and vinyl chloride ($CH_2 = CHCl$)

Ethyl chloride reacts with $AgNO_3$ solution to give white ppt. of AgCl while vinyl chloride does not give this test

$$CH_3CH_2CI + AgNO_3$$
 AgCI \downarrow (white ppt)
$$CH_2 = CHCI + AgNO_3$$
 No ppt.

4. Carbon tetrachloride (CCl₄) and chloroform (CHCl₃)

When chloroform is heated with aniline ($C_6H_5NH_2$) and alcoholic KOH solution, foul smell of isocyanide (carbylamine) is produced. Carbon tetrachloride does not give this test.

$$NH_2 + CHCl_3 + 3KOH(alc.)$$
 $N = C + 3KCl + 3H_2C$

Isocyanide

Foul smell

5. Chlorobenzene and n-Hexyl chloride (C₆H₁₃Cl)

n-Hexylchloride reacts with at alcoholic AgNO₃ solution to give white ppt. of AgCl while chlorobenzene does not give this test.

$$C_6H_{13}CI + AgNO_3$$
 AgCI \downarrow (white ppt.)

 CI
+ $AgNO_3$ No reaction

6. Chloroethane and Bromoethane

Add small amount of aq. KOH to each compound. Acidify with dil. HNO_3 and add a few drops of $AgNO_3$ solution. A white ppt is insoluble in NH_4OH , indicate chlororthane while light yellow ppt, partially soluble in NH_4OH indicates bromoethane.

$$C_2H_5CI + KOH(aq) \longrightarrow C_2H_5OH + KCI$$
 $KCI + AgNO_3 \longrightarrow AgCI \downarrow + KNO_3 \xrightarrow{NH_4OH}$ Insoluble white ppt

$$C_2H_5Br + KOH(aq)$$
 \longrightarrow $C_2H_5OH + KBr$
 $KBr + AgNO_3$ \longrightarrow $AgBr \downarrow + KNO_3$

$$\downarrow NH_4OH$$

$$\downarrow Partially soluble$$

7. 1, 1- Dichloroethane (geminal dihalide) and 1, 2-Dichloroethane (vicinal dihalide)

Add aq. KOH Solution to each compound, warm and add a few drops of 2, 4-dinitrophenyl hydrazine, 1,1-Dichloroethane forms a yellow ppt while 1,2-dichloroethane does not give the ppt. Acetaldehyde gives yellow ppt. with 2,4-dinitrophenylhydrazine

Acetaldehyde

$$O(2)$$
 $O(2)$
 $O(2)$

1,2-Dichloroethane form ethylene glycol with aquens KOH. Ethylene glycol does not give ppt with 2,4-DNP.

8. 3-Bromopropene (allyl bromide) and 1-Bromopropane (alkyl bromide)

Add a small amount of dil. Alkaline KMnO₄ solution (Bayer's Reagent) to each compound and shake. 3-Bromopropene (CH₂ = CHCH₂Br) decolorizes pink colour of KMnO₄ while 1-bromopropane (CH₃CH₂CH₂Br) does not give this test.

9. o-Bromobenzyl chloride and o-Chlorobenzyl bromide.

o-Bromobenzyl chloride on shaking with aq. NaOH and subsequent treatment with aq. AgNO $_3$ gives white ppt. of AgCl on the other hand, o-chlorobenzyl bromide on shaking with aq. NaOH and subsequent treatment with aq AgNO $_3$ produces pale yellow ppt of AgBr.

$$\begin{array}{c|c} CH_2CI & CH_2OH \\ \hline & Br & NaOH(aq) & \\ \hline & & \\ & & \\ \end{array} \begin{array}{c} Br & AgNO_3 \\ \hline & (aq) & \\ \end{array} \begin{array}{c} AgCI & (white ppt) \\ \hline \end{array}$$

O-Bromobenzyl chloride

$$\begin{array}{c|c} CH_2Br & CH_2OH \\ \hline & CI & NaOH(aq) & \\ \hline & & \\ \end{array} \begin{array}{c} CI & AgNO_3 \\ \hline & (aq) & \\ \end{array} \begin{array}{c} AgBr & (Pale yellow ppt) \\ \hline \end{array}$$

O-Chlorobenzyl bromide

10. n-propylchloride and isopropyl chloride

Isopropyl chloride on treated with aq. KOH gives isopropyl alcohol which gives yellow ppt with NaOI (Iodoform test). n-Propyl chloride on treated with aq. KOH gives n-Propyl alcohol which does not give iodoform test.

11. Methanol (CH₃OH) and Ethanol (CH₃CH₂OH)

Ethanol gives iodoform test (Yellow ppt. of CHI₃) whereas methanol does not give iodoform test

12. Ethanol (C₂H₅OH) and Benzyl alcohol (C₆H₅CH₂OH)

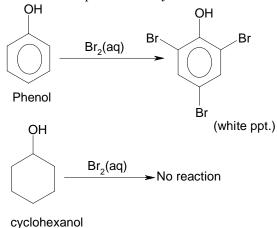
Ethanol gives iodoform test whereas benzyl alcohol does not give iodoform test.

13. Ethanol (C₂H₅OH) & Phenol (C₆H₅OH)

- (i) Ethanol gives iodoform test whereas phenol does not give yellow ppt of iodoform
- (ii) Phenol reacts with neutral FeCl₃ Solution to gives purple colour whereas ethanol does not give any colour with neutral FeCl₃ solution.
- (iii) Phenol gives coloured dye with benzene diazonium chloride. Ethanol does not give any dye.
- (iv) Phenol readily decolouries bromine water giving a white ppt. 2, 4, 6-tribromophenol but ethanol does not.

14. Phenol (C₆H₅OH) and Cyclohexanol (C₆H₁₁OH)

- (i) Phenol gives purple colouration with neutral FeCl₃ while cyclohexanol does not give.
- (ii) Phenol give coloured dye with benzene diazonium chloride whereas cyclohexanol does not.
- (iii) Phenol readily decolouries bromine water giving a white ppt. 2, 4, 6-tribromophenol. But cyclohexanol does not.



15. Propan-1-ol (CH₃CH₂CH₂OH) and Propan-2-ol [CH₃CH(OH)CH₃]

16. Butan-1-ol and Butan-2-ol

Butan-2-ol contains (CH $_3$ CHOH) group and give yellow ppt. with NaOH, I $_2$ (Iodoform test). On the other hand, Butan-1-ol does not give yellow ppt. with NaOH, I $_2$

the other hand, Butan-1-of does not give yellow
$$CH_{3} - CH - CH_{2}CH_{3} \xrightarrow{\text{NaOH, I}_{2}} CHI_{3}$$

$$OH \qquad \qquad Yellow ppt.$$

$$CH_{3}CH_{2}CH_{2}CH_{2}OH \xrightarrow{\text{NaOH, I}_{2}} \text{no yellow ppt.}$$

17. Propan-1-ol and 2-methyl propan-2-ol.

2-methyl propan-2-ol reacts with Lucas reagent (anhyd.ZnCl₂ + HCl) giving turbidity immediately. Propan-1-ol does not produce turbidity at room temp. with Lucas reagent.

$$CH_{3} \xrightarrow{CH_{3}} CH_{3} \xrightarrow{anhyd. ZnCl_{2}} CH_{3} \xrightarrow{CH_{3}} CH_{3} \xrightarrow{CH_{3}} CH_{3}$$

$$CH_{3} \xrightarrow{CH_{3}} CH_{3} \xrightarrow{CH_{3}} CH_{3}$$

$$CH_{3} \xrightarrow{CH_{3}}$$

$$\label{eq:ch3} {\rm CH_3CH_2CH_2OH} \xrightarrow{\rm anhyd.ZnCl_2} {\rm No~turbidity~at~room~temp.}$$

18. Acetone and Acetaldehyde

Acetaldehyde gives silver mirror with Tollen's reagent. Acetone does not give this

$$\mathsf{CH_3CHO} \ + \ 2[\mathsf{Ag}(\mathsf{NH_3})_2]\mathsf{OH} \ \longrightarrow \ \mathsf{CH_3COONH_4} \ + 2\mathsf{Ag} \ + \ \mathsf{H_2O} \ + \ 3\mathsf{NH_3}$$

Acetaldehyde Tollen's reagent

Silver mirror

Acetaldehyde give red ppt with Fehling solution

19. Formaldehyde and Acetaldehyde

Acetaldehyde gives yellow ppt of iodoform with an alkaline solution of iodine (iodoform) while formaldehyde does not give iodoform test.

20. Benzaldehyde and Acetaldahyde

(i) Acetaldehyde gives yellow ppt with an alkaline solution of iodine (iodoform test) while benzaldehyde does not give ppt.

Acetaldehyde give Fehling solution test but benzaldehyde does not give this test. NOTE:- Both acetaldehyde and benzaldehyde give Tollen's test positive but benzaldehyde does not give Fehling's solution test.

21. Benzaldehyde and Acerophenone

Benzaldehyde forms silver mirror with ammonical silver nitrare solution (Tollen's reagent). Acetophenone does not react.

$$C_6H_5CHO + 2[Ag(NH_3)_2]OH \longrightarrow C_6H_5COONH_4 + 2Ag + 3NH_3 + H_2O$$

Benzaldehyde Tollen's reagent

Acetophenone forms yellow ppt. of iodoform with alkaline solution iodine (iodoform). Benzaldehyde does not react.

$$CH_3COCH_3 + 4NaOH + 3I_2 \longrightarrow C_6H_5COONa + CHI_3 + 3H_2O + 3NaI$$

Acetophenone Yellow ppt

22. Pentan-3-one and Pentan-2-one

(i) Pentan-2-one forms yellow ppt with alkaline solution of iodine (iodoform test) but pentan-3-one does not give iodoform test.

$$\label{eq:coch2} \text{CH}_3\text{COCH}_2\text{CH}_2\text{CH}_3 + 3\text{I}_2 + 4\text{NaOH} \\ \longrightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{COONa} + \text{CHI}_3 + 3\text{H}_2\text{O} + 3\text{NaI} \\ \text{Yellow ppt.}$$

23. Acetophenone and Benzophenone

Acetophenone gives yellow ppt with alkaline solution of iodine (iodoform test). Benzophenone does not give this test.

$$C_6H_5COCH_3 \xrightarrow{I_2, NaOH} CHI_3 + C_6H_5COONa$$

Acetophenone Yellow ppt

24. Formic acid and Acetic acid

(i) Formic acid gives silver mirror test with Tollen's reagent, Whereas acetic acid does not give this test.

(ii) Formic acid gives white ppt with mercuric chloride solution while acetic acid does not give this test

25. Acetic acid and Acetone

(i) Acetic acid reacts with NaHCO₃ to give effervescence due to evolution of CO₂. Acetone does not give effervescence with NaHCO₃.

$$CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2$$

(ii) Acetone reacts with alkaline solution of iodine to give yellow ppt. due to iodoform (iodoform test). Acetic acid does not give this test.

(iii) Acetone also gives orange coloured ppt. with 2, 4-DNP while acetic acid does not.

26. Phenol and Benzoic acid

(i) Benzoic acid reacts with NaHCO₃ to give effervescence due to the evolution of CO₂. Phenol does not give effervescence.

$$C_6H_5COOH + NaHCO_3$$
 \longrightarrow $C_6H_5COONa + H_2O + CO_2$

(ii) Phenol gives purple colour with FeCl₃ solution but benzoic acid does not give such colour.

27. Phenol and Acetic acid

(i) Acetic acid react with NaHCO₃ to give effervescence due to the evolution CO₂. Phenol does not give effervescence.

(ii) Phenol gives purple colour with FeCl₃ solution but acetic acid does not give such colour.

28. Ethanol and Acetic acid

(i) Acetic acid gives effervescence with NaHCO₃ due to the liberation of CO₂. Ethanol does not give effervescence with NaHCO₃

(ii) Ethanol gives yellow ppt with alkaline solution of I₂ (iodoform) while acetic acid does not give this test.

29. Ethyl cyanide and ethyl isocyanide

(i) Ethyl cyanide on hydrolysis with acids gives propanoic acid

$$\mathsf{CH_3CH_2CN} \xrightarrow{\mathsf{H+} \ , \ \mathsf{H_2O}} \mathsf{CH_3CH_2COOH}$$

On the other hand, ethyl isocyanide with dil. HCl gives ethyl amine and formic acid.

$$\mathsf{CH_3CH_2NC} \xrightarrow{\mathsf{H+} \ , \ \mathsf{H_2O}} \mathsf{CH_3CH_2NH_2} \ + \ \mathsf{HCOOH}$$

(ii) Ethyl cyanide on reduction with hydrogen in the presence of Ni gives primary amine while ethyl isocyanide give secondary amine.

$$CH_3CH_2CN \xrightarrow{H_2,Ni} CH_3CH_2CH_2NH_2$$

$$CH_3CH_2NC \xrightarrow{H_2,Ni} CH_3CH_2 -NH -CH_3$$

$$2^0 \text{ Amine}$$

30. Nitroethane and ethyl nitrite

(i) Nitrothane on reduction with H₂/Ni primary amines while nitite gives primary alcohol.

$$CH_3CH_2NO_2 + 6[H] \xrightarrow{Sn,HCl} CH_3CH_2NH_2 + 2H_2O$$

Nitro ethane

$$CH_3CH_2 \longrightarrow O \longrightarrow N = O + 6[H] \longrightarrow CH_3CH_2OH + NH_3 + H_2O$$

Ethylnitrite

(ii) Ethyl nitrite on hydrolysis form alcohol while nitroethane does not get hydrolysed.

$$C_2H_5$$
—O—N = O + NaOH — Hydrolysis \rightarrow C_2H_5 OH + NaNO₂
 C_2H_5 NO₂ + NaOH — Not hydrolysed

31. Ethylamine and Aniline

Azodye test:- Dissolve the compound in conc. HCl and add ice-cold solution of HNO₂ (NaNO₂ + dil. HCl) and then react, it with an alkaline solution of phenol. Appearance of brilliant orange dye indicates aniline. Ethylamine does not form dye. It will give brisk effervescences due to the evolution of N₂ but solution remains clear

$$N_2^{\dagger}Cl^{-}$$
 + OH $\frac{\text{dil.NaOH}}{\text{AZO dye}}$ (Orangecolour)

32. Ethylamine and diethylamine

(i) **Carbylamine test:-** When heated with an alcoholic solution of KOH and CHCl₃, ethylamine gives foul smell of ethyl isocyanide. Diethylamine does not give the test.

(ii) **Hinsberg's test:-** When treated with **Hinsberg's reagent** [benzene sulphonyl chloride (C₆H₅SO₂Cl)], ethylamine gives N-ethylbenzene sulphonamide which is soluble in aq. KOH solution.

$$C_6H_5SO_2CI + CH_3CH_2NH_2 \xrightarrow{HCI} C_6H_5SO_2NHCH_2CH_3 \xrightarrow{KOH} Soluble$$

Diethylmine gives N,N-diethyl benzene sulphonamide which is insoluble in aq. KOH

$$C_6H_5SO_2CI + (CH_3CH_2)_2NH \longrightarrow C_6H_5SO_2 - N(CH_2CH_3)_2 + HCI$$

KOH(aq)

Insoluble