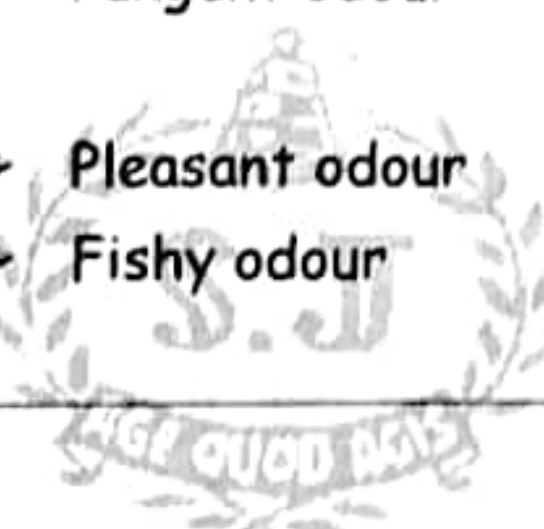


## SYSTEMATIC PROCEDURE FOR QUALITATIVE ANALYSIS OF AN ORGANIC FUNCTIONAL GROUP

EXPERIMENT	OBSERVATION	INFERENCE
<b>1. Preliminary Tests:</b>		
a) Colour	<ul style="list-style-type: none"> <li>➤ colourless liquid</li> <li>➤ white solid</li> <li>➤ brown</li> </ul>	<ul style="list-style-type: none"> <li>➤ aldehyde, ketone or alcohol may be present</li> <li>➤ carbohydrate, amide or aromatic acid may be present.</li> <li>➤ Primary aromatic amine may be present</li> </ul>
b) Nature	Liquid /solid	- - - - -
c) Odour	<ul style="list-style-type: none"> <li>➤ Spirituous odour</li> <li>➤ Carbolic odour</li> <li>➤ Pungent odour</li> <li>➤ Pleasant odour</li> <li>➤ Fishy odour</li> </ul>	<ul style="list-style-type: none"> <li>➤ Alcohol may be present ✓</li> <li>➤ Phenol may be present</li> <li>➤ Aliphatic aldehyde may be present</li> <li>➤ Ketone may be present.</li> <li>➤ Primary aromatic amine may be present.</li> </ul>
<b>II. Physical constant:</b> Melting point of the given organic solid boiling point of the given organic liquid	 _____ °C	
<b>III. Combustion test:</b> A little of the organic substance is taken in a nickel spatula and ignited	<ul style="list-style-type: none"> <li>➤ Burns with a sooty flame.</li> <li>➤ Burns with a non-sooty flame.</li> </ul>	<ul style="list-style-type: none"> <li>➤ Indicates Aromatic nature of the given organic compound</li> <li>➤ Indicates Aliphatic nature of the given organic compound</li> </ul>
<b>IV Test for Unsaturation:</b> To a little of the organic compound, Bromine in water is added.	<ul style="list-style-type: none"> <li>➤ Bromine water is decolourised.</li> <li>➤ Bromine water is not decolourised.</li> <li>➤ Bromine water is decolourised with the formation of white ppt.</li> </ul>	<ul style="list-style-type: none"> <li>➤ Unsaturated compound</li> <li>➤ Aliphatic saturated compound.</li> <li>➤ Aromatic saturated compound.</li> </ul>



<b>V Solubility:</b> 1) Cold water:	➤ Soluble in cold water	➤ Water soluble compound may be present.
2) Hot water:	➤ Soluble in hot water	➤ May be aromatic acid
3) Litmus test:	➤ Blue litmus turns to red  ➤ Red litmus turns to blue ➤ No change in litmus paper	➤ Acidic compound like carboxylic acid, phenol may be present.  ➤ Basic compound like amine may be present. ➤ Neutral compound like carbohydrate, amide, aldehyde, ketone or alcohol may be present.
4) Dil.HCl:	➤ The compound is soluble in dil.HCl and regenerated by dil.NaOH. ➤ The compound is soluble in dil.HCl and is not regenerated by dil.NaOH. ➤ Insoluble.	➤ Amine may be present.  ➤ Water soluble compound may be present.  ➤ Amine is absent.
5) Dil.NaOH:	➤ The compound is soluble in dil. NaOH and regenerated by dil. HCl. ➤ The compound is soluble in dil.NaOH and is not regenerated by dil. HCl. ➤ Insoluble.	➤ Carboxylic acid or phenol may be present.  ➤ Water soluble compound may be present.  ➤ Carboxylic acid & phenol are absent.
6) Aqueous saturated $\text{NaHCO}_3$ :	➤ Soluble with effervescence of $\text{CO}_2$ and regenerated with dil.HCl. ➤ Soluble without the effervescence of $\text{CO}_2$ ➤ Insoluble.	➤ Carboxylic acid may be present.  ➤ Water soluble compound may be present. ➤ Carboxylic acid is absent.



## VI. LASSAIGNE'S TEST FOR NITROGEN:

### Preparation of Sodium Fusion Extract:

A small piece of dry sodium metal is taken into a dry ignition tube and heated strongly until red hot. Over this red hot sodium metal, a little of the given organic compound is dropped and heated. This hot ignition tube is plunged into a mortar containing 5ml of distilled water. The contents in the mortar are crushed well with a pestle and the solution is filtered. This filtrate is called "Sodium Fusion Extract".

EXPERIMENT	OBSERVATION	INFERENCE
To one ml of the sodium fusion extract few crystals of $\text{FeSO}_4$ were added and boiled, after cooling it was acidified with dil. $\text{H}_2\text{SO}_4$ .	Prussian blue or green coloured solution was observed.	Presence of nitrogen.

## VII) IDENTIFICATION OF FUNCTIONAL GROUP:

1) Test with Borsch's reagent: To a little of the organic compound, few drops of Borsch's reagent was added and shaken well	yellow or orange precipitate was observed.	Aldehyde or ketone may be present.
2. Test with Aqueous Saturated $\text{NaHCO}_3$ : To a little of organic compound aq. Saturated $\text{NaHCO}_3$ solution was added	a colourless, odourless gas [ $\text{CO}_2$ ] with quick effervescence was evolved.	carboxylic acid may be present.
3. Test with alcoholic $\text{FeCl}_3$ : To a little of organic compound alcoholic $\text{FeCl}_3$ solution was added.	Violet coloured solution was observed.	Phenol may be present.
4. Test with $\text{NaOH}$ : To a little of organic compound $\text{NaOH}$ solution was added and heated.	colourless gas with a smell of ammonia was observed. It gives dense white fumes with a rod dipped in con. $\text{HCl}$	Amide may be present.
5. Molisch's Test: To the aqueous solution of the given organic compound, a few drops of alcoholic $\alpha$ -naphthol was added and then conc. $\text{H}_2\text{SO}_4$ was added carefully along the sides of the test tube.	Violet ring was observed at the junction of the two layers.	carbohydrate may be present.



6. <b>Carbylamine Test:</b> To a little of the organic compound alcoholic KOH and $\text{CHCl}_3$ were added and heated.	a gas with an obnoxious odour was evolved.	aromatic primary amine may be present.
7. <b>Test with Sodium Metal:</b> To a little of the organic compound taken in a dry test tube a small piece of dry Na metal was added.	brisk effervescence of hydrogen gas was observed.	alcohol may be present.

### III. CONFIRMATIVE TESTS FOR FUNCTIONAL GROUP:

EXPERIMENT	OBSERVATION	INFERENCE
<b>1. Test for Aldehyde and Ketone:</b> a) <u>Test with Tollen's Reagent:</u> To a little of the organic compound, mixture of Tollen's A and B were added and warmed on a water bath. b) <u>Test with Fehling's Solution:</u> To a little of the organic compound, mixture of Fehling's A and B were added and warmed on a water bath.	➤ Silver mirror was observed. ➤ Silver mirror was not observed. ➤ Red precipitate was observed. ➤ Red precipitate was not observed.	➤ Aldehyde is confirmed. ➤ Ketone is confirmed. ➤ Aldehyde is confirmed. ➤ Ketone is confirmed.
<b>2. Test for Carboxylic acid:</b> a) <u>Phenolphthalein Test:</u> To a little of NaOH a drop of phenolphthalein was added. To this pink solution, the given organic compound is added and shaken well. b) <u>Esterification:</u> To a little of organic compound, few ml of alcohol and a drop of conc. $\text{H}_2\text{SO}_4$ were added, warmed and the hot contents were dropped into a test tube containing sodium carbonate solution.	The solution turns pink. Pink colour is discharged. a fruity odour was observed	carboxylic acid is confirmed. carboxylic acid is confirmed.
<b>3. Test for Phenol:</b> a) <u>Bromination:</u> To a little of the organic compound, excess of bromine water	A white turbidity is observed.	Phenol is confirmed.



<p>is added.</p> <p>b) <u>Phthalein fusion test:</u></p> <p>To a little of the given organic compound, a pinch of phthalic anhydride, few drops of conc. <math>H_2SO_4</math> are added and heated.</p> <p>This mixture is poured in another test tube containing dil. NaOH solution.</p>	<p>Pink coloured solution is observed.</p>	<p>Phenol is confirmed.</p>
<p>4. <u>Test for Amide:</u></p> <p>a) <u>Biruet Test:</u></p> <p>A little of given organic compound is heated strongly to dryness. After cooling, the residue is dissolved in water. Then few drops of dil. NaOH and a drop of <math>CuSO_4</math> solution are added.</p> <p>b) <u>Test with Oxalic Acid:</u></p> <p>To a little of the given organic compound, aqueous oxalic acid solution are added.</p>	<p>Violet coloured solution is observed.</p> <p>A white crystalline precipitate is obtained.</p>	<p>Amide is confirmed.</p> <p>Amide is confirmed.</p>
<p>5. <u>Test for Carbohydrate:</u></p> <p>a) <u>Test with Tollen's Reagent:</u></p> <p>To a little of the organic compound, mixture of Tollen's A and B were added and warmed on a water bath.</p> <p>b) <u>Test with Fehling's Solution:</u></p> <p>To a little of the organic compound, mixture of Fehling's A and B were added and warmed on a water bath.</p>	<p>Silver mirror is observed.</p> <p>Orange red precipitate is observed.</p>	<p>Carbohydrate is confirmed.</p> <p>Carbohydrate is confirmed.</p>
<p>6. <u>Test for Amine:</u></p> <p>a) <u>Bromination:</u></p> <p>To a little of the organic compound, excess of bromine water is added.</p> <p>b) <u><math>K_2Cr_2O_7</math> Test:</u></p> <p>To a little of the given organic compound <math>K_2Cr_2O_7</math> and conc. <math>H_2SO_4</math> are added.</p>	<p>A white turbidity is observed.</p> <p>Black coloured precipitate is observed.</p>	<p>Amine is confirmed.</p> <p>Amine is confirmed.</p>



<b>7. Test for Alcohol:</b>		
<b>a) Esterification:</b>		
To a little of the given organic compound, few ml of acetic acid and a drop of conc. $H_2SO_4$ are added warmed and the hot contents are poured into a test tube containing $Na_2CO_3$ solution.	Fruity odour is observed.	Alcohol is confirmed.
<b>b) Ceric ammonium nitrate test:</b>		
To a little of the given organic compound, few ml of ceric ammonium nitrate solution is added.	Blood red coloured solution is observed.	Alcohol is confirmed.

### IX DERIVATIVES FOR THE FUNCTIONAL GROUP:-

1) Aldehyde and ketone:

2,4-dinitrophenylhydrazone derivative:-

To a little of the given organic substance, a few ml of 2,4-dinitrophenyl hydrazine (BORSCH'S reagent) solution is added and shaken well.

An Orange red coloured crystals are obtained.

2) Carboxylic acid:

Acid chloride derivative:

To a little of the given organic compound, two drops of  $SOCl_2$  is added.

An acid chloride derivative is obtained.

3) Phenol:

Azo dye test :

A few drops of aniline is dissolved in dil.  $HCl$  and cooled. To this ice cold aq.  $NaNO_2$  solution is added. This mixture is immediately poured into an ice cold solution of the given organic compound dissolved in  $NaOH$ .

A Scarlet red Azo dye derivative is formed.

4) Amide:

Urea nitrate derivative:

To the aqueous solution of the given organic compound, conc.  $HNO_3$  is added.

A White precipitate of Urea nitrate is obtained.

5) Carbohydrate:

Osazone derivative:

The aqueous solution of the given organic compound is added to the phenylhydrazinehydrochloride dissolved in glacial acetic acid. The above mixture is warmed on water bath for 10 minutes and then cooled.

Yellow Crystals of Osazone are obtained.

i) Amine:

Azo dye test:

A few drops of given organic compound is dissolved in dil.HCl and cooled. To this, ice cold  $\text{NaNO}_2$  solution is added. This mixture is immediately poured into ice cold solution of  $\alpha$ -naphthol dissolved in NaOH.

A Scarlet red Azo dye derivative is formed.

ii) Alcohol:

Oil of Wintergreen derivative:

To a little of the given organic compound, a few mL of salicylic acid and a drop of conc. $\text{H}_2\text{SO}_4$ , are added, warmed and the hot contents are poured into a test tube containing  $\text{Na}_2\text{CO}_3$  solution.

A white precipitate of oil of wintergreen derivative is obtained.

Report:

The given organic compound is

Aliphatic (or aromatic)

Saturated (or unsaturated)

Functional Group.