

## Functional group detection

### 1. Test for carboxylic acid group

(a) **Litmus test**- Add blue litmus solution (1 drop) to an aqueous solution of acid, appearance of a red colour indicates the presence of a carboxylic acid (blue litmus paper may be used in place of a blue litmus solution)

(b) **Sodium bicarbonate test (*Functional group test*)**: To a saturated solution of sodium bicarbonate add small amount of given organic compound. Brisk effervescence indicates the presence of carboxylic acid group.

(c) **Fluorescein test**: Heat a small amount of organic compound, resorcinol and conc. sulphuric acid (1-2 drops) in a clean and dry test tube till a dark brown coloured liquid is formed. Then add few drops of this solution into a beaker containing dilute NaOH solution (10 mL NaOH diluted to 100 mL). Appearance of red colour solution with green fluorescence indicates the presence of dicarboxylic acid.

(d) **Test for Oxalic acid (Blue ring test)**: Heat a small amount of given organic compound, resorcinol (2-3 flakes) and water (1 mL) in a test tube. Cool the contents and add few mL of conc.  $H_2SO_4$  along the sides of the test tube. Appearance of blue ring at the junction of two layers confirms the presence of oxalic acid.

### 2. Test for phenolic functional group:

(a) **Neutral  $FeCl_3$  test (*Functional group test*)**: Dissolve the given organic compound in water or alcohol and to this a drop or two of neutral  $FeCl_3$  solution. Appearance of red/green/pink/blue-violet colours confirms the presence of phenolic functional group.

Compound	Colour with $FeCl_3$ solution
Phenol, o-cresol	Violet
p-cresol, quinol	Blue
m-cresol, naphthol (alcoholic)	Blue – violet
Resorcinol	Violet – blue
$\alpha$ -naphthol	Pink
$\beta$ -naphthol	Green

\*\*\*\*\***Preparation of neutral  $FeCl_3$  solution**: Take the solution of  $FeCl_3$  in a test tube and add NaOH solution till a small amount of precipitate is observed. Then add a drop or two of  $FeCl_3$  solution to dissolve the precipitate.

(b) **Phthalein test**- The phenols having a *free para position* respond to this test. In a dry test tube, gently heat a small amount of given organic compound with an equal amount of phthalic anhydride (or phthalic acid) and conc. sulphuric acid (2-3 drops), for 1-2 minutes. Cool and pour the mixture into a beaker containing dilute sodium hydroxide

solution. Appearance of pink, blue, green, red colouration indicates the presence of a phenol with free para position.

Compound	Colour
Phenol, o-Cresol	Red
m-Cresol	Bluish purple
Catechol	Blue
Resorcinol	Red solution with green fluorescence
1-Naphthol	Green
2-Naphthol	Very faint green with slight fluorescence

### 3. Test for alcoholic functional group:

(a) **Ceric ammonium nitrate test** (*Functional group test*): Dissolve a small amount of given organic compound in minimum amount of water or dioxane (*for water insoluble compounds*) and add freshly prepared ceric ammonium nitrate solution (few drops). Appearance of red colour shows the presence of alcoholic group.

(b) **Iodoform test:** Iodoform test is given by alcohols which contain  $\text{CH}_3\text{CHOHR}$  group and oxidize to  $\text{CH}_3\text{COR}$  group during the reaction to give a positive iodoform test (same as described for carbonyl compounds).

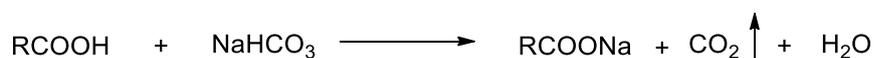
When a compound containing  $\text{CH}_3\text{CO-}$  group or the group  $\text{CH}_3\text{CH(OH)-}$  (which can be easily oxidized to  $\text{CH}_3\text{CO}$  group), is treated with a solution of iodine in basic medium, iodoform, a yellow solid separates out.

**Procedure**-Dissolve a small amount of given organic compound in minimum amount of water and add sodium hydroxide ( $\sim 1$  mL, 10%). Add to this a saturated solution of iodine-potassium iodide in water with stirring until a dark colour of iodine persists. Heat the solution in water bath and maintain the temperature at  $80^\circ\text{C}$  for few minutes. Remove the colour of excess iodine by adding a few drops of sodium hydroxide solution. A yellow precipitate of iodoform indicates the presence of  $\text{CH}_3\text{CO}$  group in the compound.

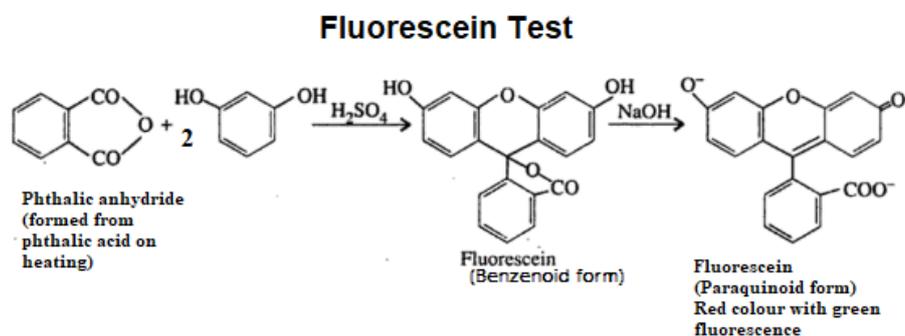
## Chemistry of tests:

### 1. Test for carboxylic acid group

#### **Sodium bicarbonate test:**

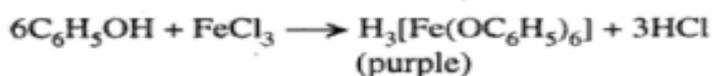


## Fluorescein Test:

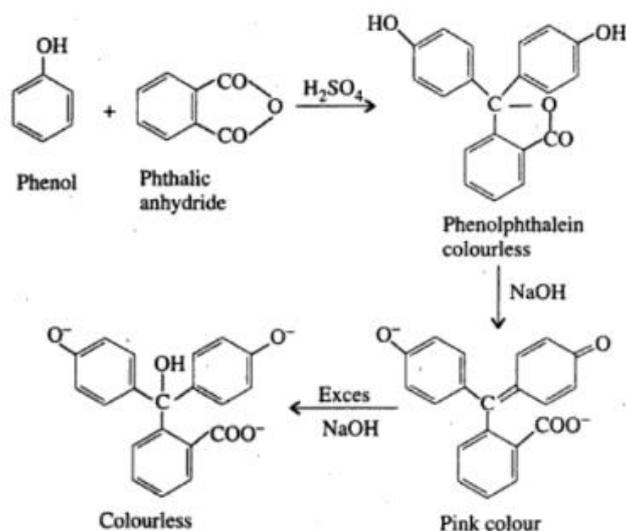


## 2. Test for Phenolic functional group

**Ferric chloride test:** (Taking phenol as an example)

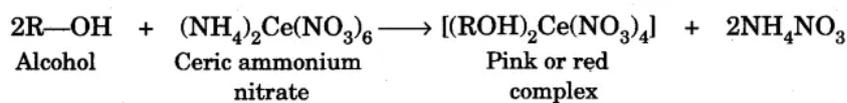


**Phthalein test:** (Taking example of phenol)



## 3. Test for alcoholic functional group

**Ceric ammonium nitrate test:**



**Iodoform test** (Taking example of isopropanol):

