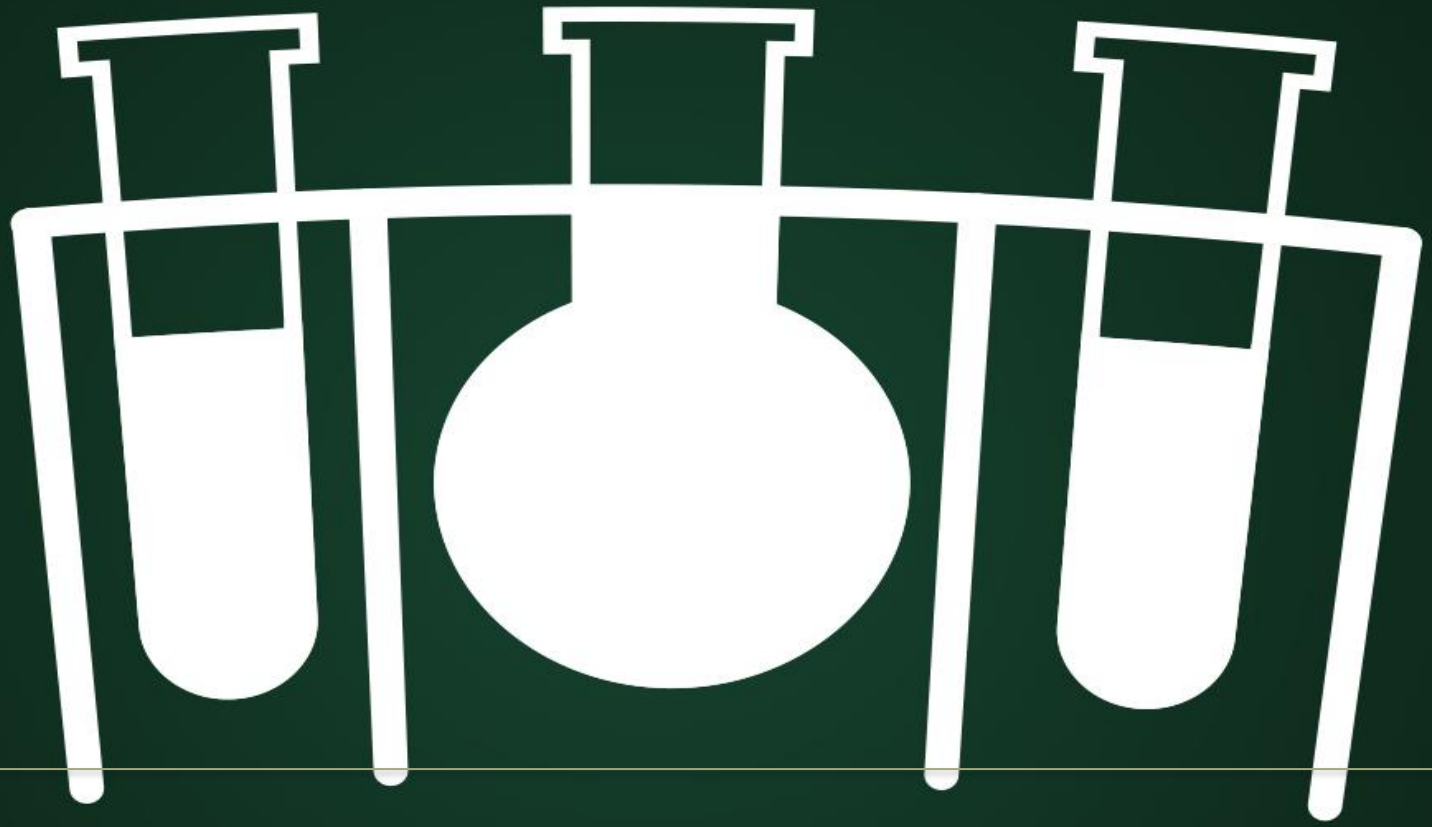
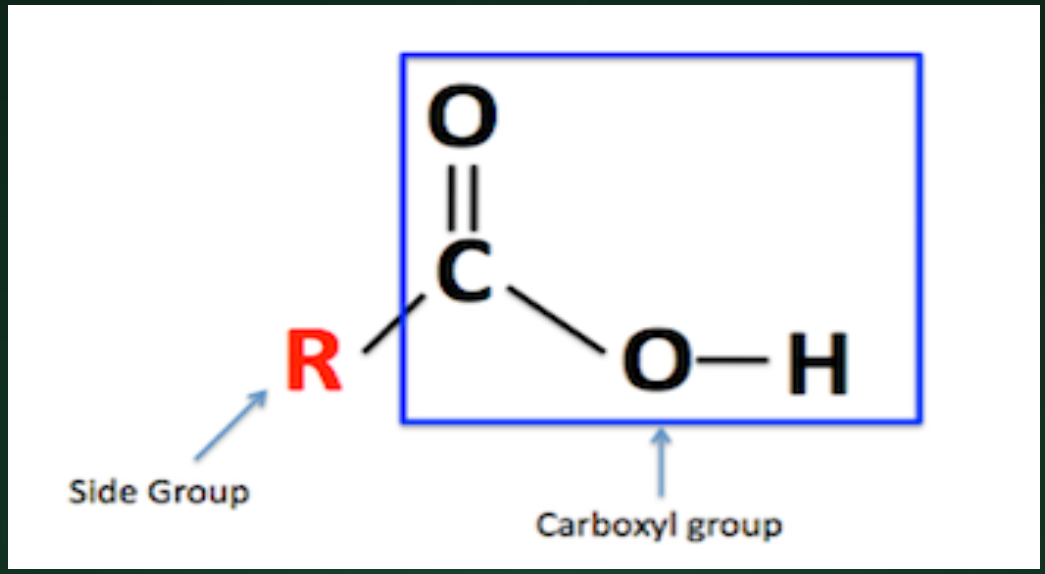


Carboxylic acid

Compiled By

Dr. Aseel S.Mansoor



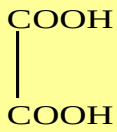
R = aliphatic group or H atom
(aliphatic acid)

R = aromatic group
(aromatic acid)

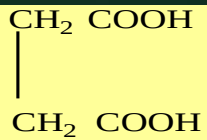
Carboxylic acid classified according to the number of (COOH)group into :-

Formic acid

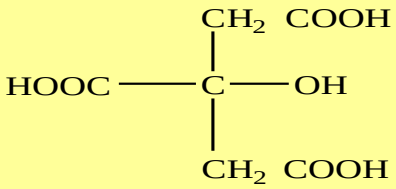
Acetic acid



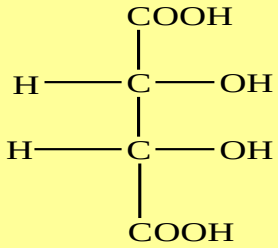
Oxalic acid



Succinic acid

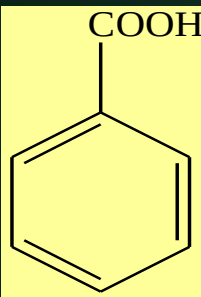


Citric acid

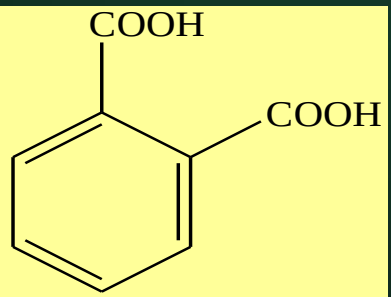


Tartaric acid

Aliphatic acid

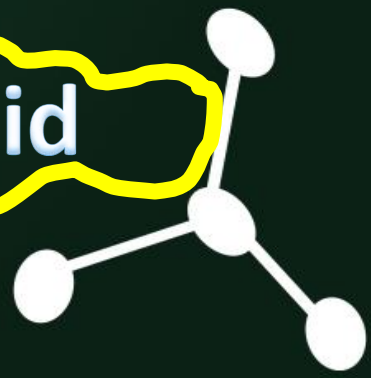


Benzoic acid



Phathalic acid

aromatic acid



Physical properties

- Colorless or white
- Solid (except formic acid, acetic acid and lactic acid is liquid)
- m.p and b.p higher than alcohol because it can make:
  - hydrogen bond.
  - van der waals forces.
  - dipole-dipole interaction.

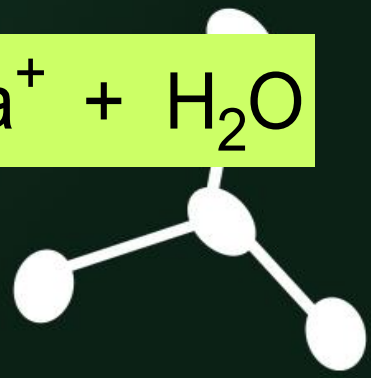
Soluble in H_2O → When acid have low M.Wt

insoluble in H_2O → When acid have high M.Wt

Soluble in NaOH, $NaHCO_3$

:

$$RCOOH + NaOH \xrightarrow{\text{deprotonation}} RCOO^- Na^+ + H_2O$$



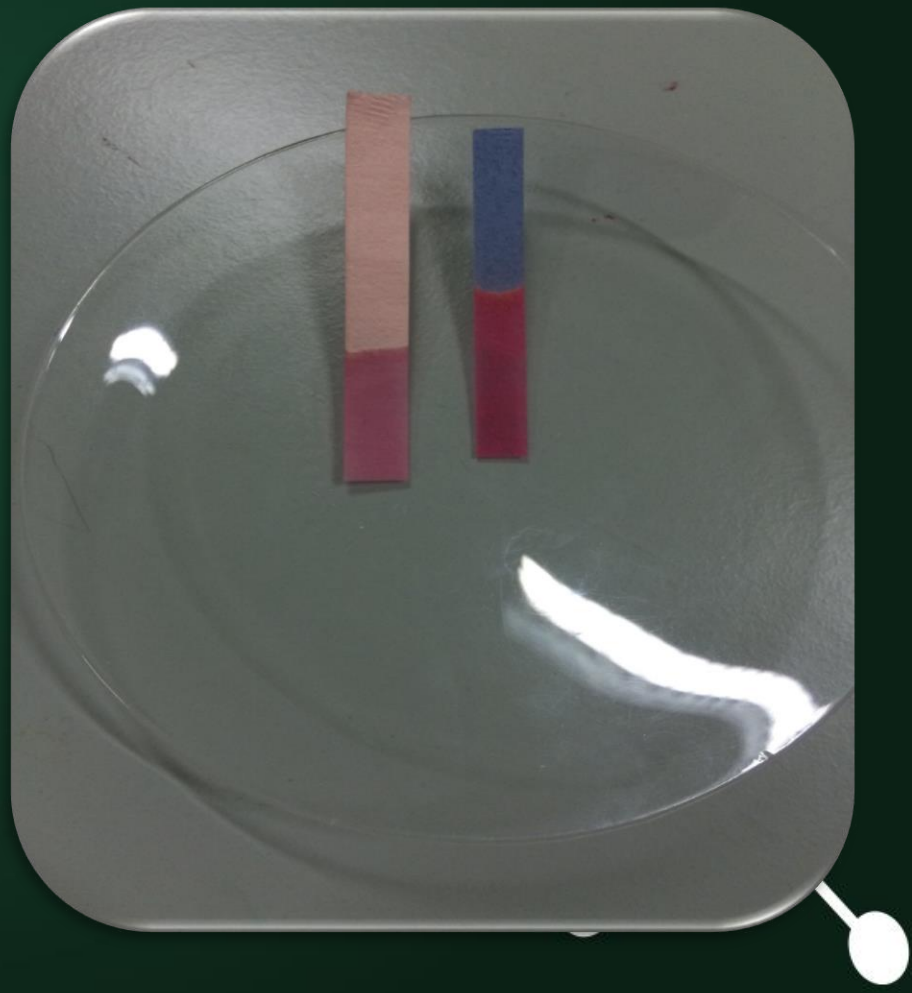
Chemical properties

litmus paper effect:-

- acidic compounds
- Change color of litmus

Red → red

Blue → red



Soluble in $NaHCO_3$
(general test for all carboxylic acid)

$$RCOOH + NaHCO_3 \xrightarrow{\text{deprotonation}} RCOO^-Na^+ + H_2O + CO_2\uparrow$$

Procedure

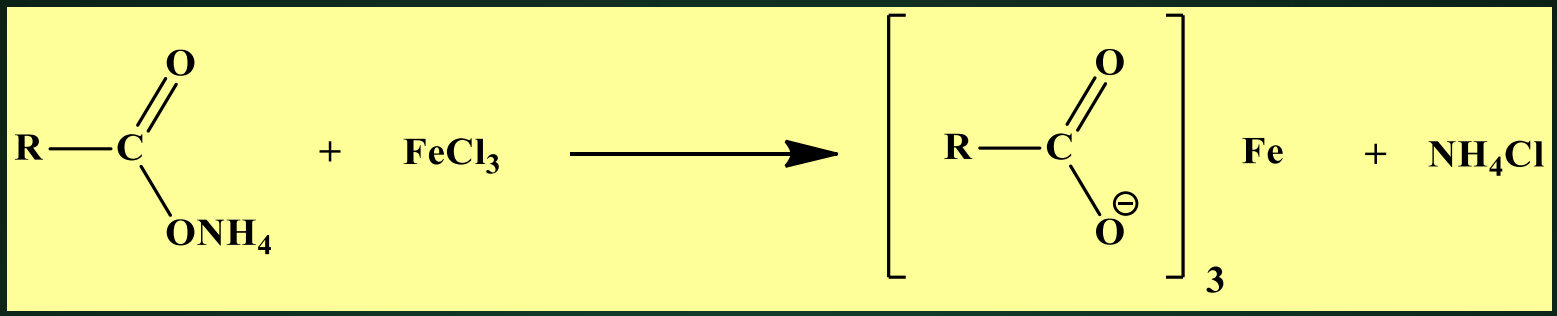
1. (1 ml) of compound
2. Few amount of sodium bicarbonate ($NaHCO_3$)
3. Observed result

1. Ferric Chloride

- Type of reaction is (complex formation).
- Reagent is $FeCl_3$
- Depends on neutral acid (salt of acid) react with reagent to produced specific color or ppt for each acids.

- Neutral Solution of acid (N.S of acid) is the ammonium salt for acid ($RCOONH_4$).

$$RCOOH + NH_3(NH_4OH) \longrightarrow RCOONH_4 + H_2O + NH_3 \uparrow$$



A- dark red ppt. ⟶ Acetic acid or formic acid

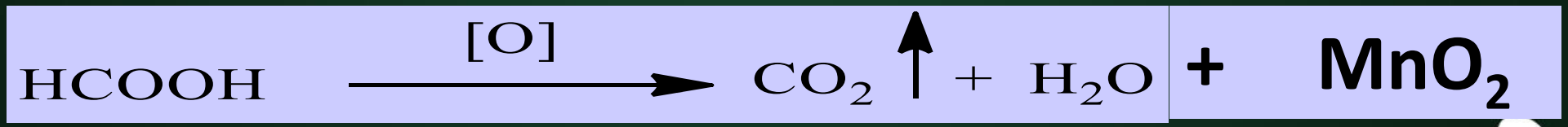
B- pale brown ppt. ⟶ Succinic acid or benzoic acid

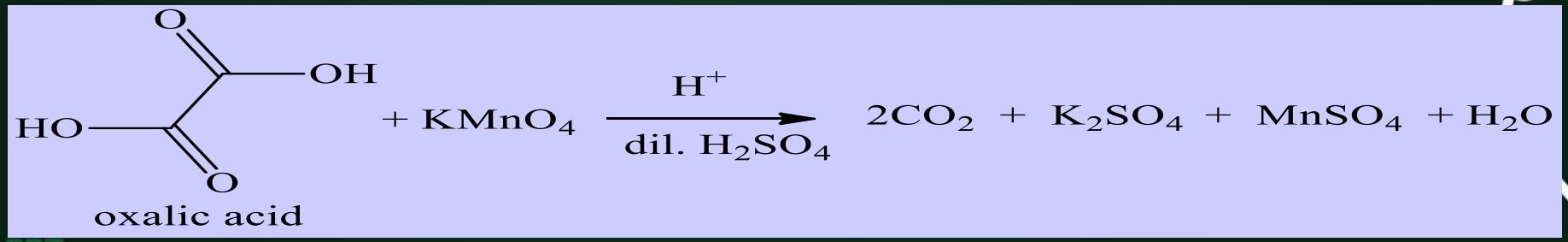
C- violet color ⟶ salicylic acid

D- no color change the acid is oxalic or citric or tartaric or lactic acid.

2. Permanganate test:

- Specific test for (formic acid & oxalic acid)
- Type of reaction is (decarboxylation reaction).
- Reagent is $KMnO_4$
- Depends on loss (CO_2) from acid by $KMNO_4$
- Produced change colors



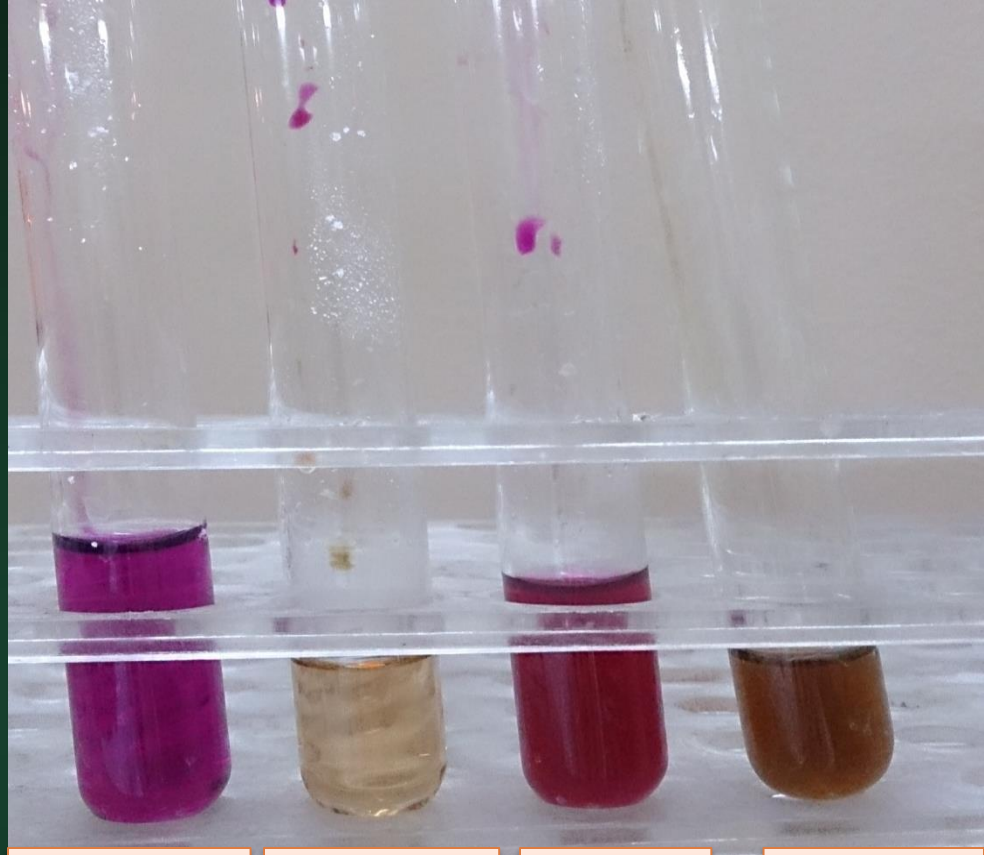


Procedure

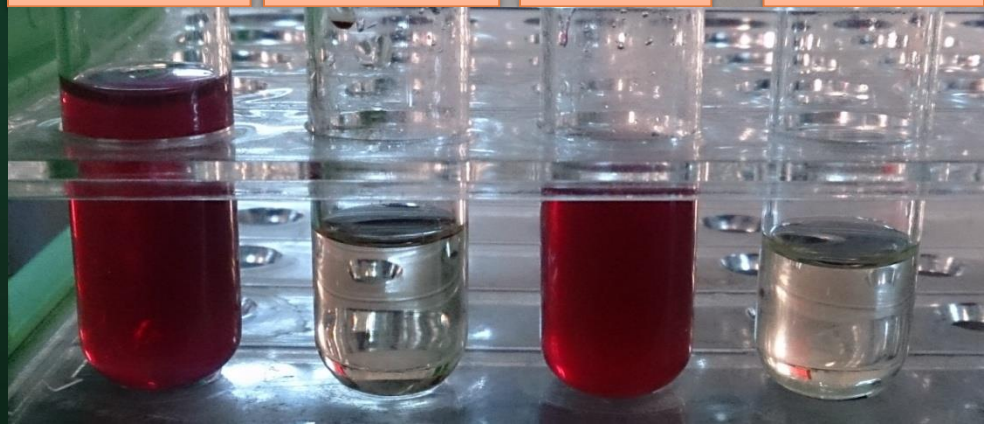
Permanganate test:

1. (1 ml) of compound
2. Heat for (1 min)
3. (3 ml) of (Na_2CO_3 dil.)
4. (1 drop) of $KMNO_4$ (1%)

Note:- when let this test stand for several time give these colors

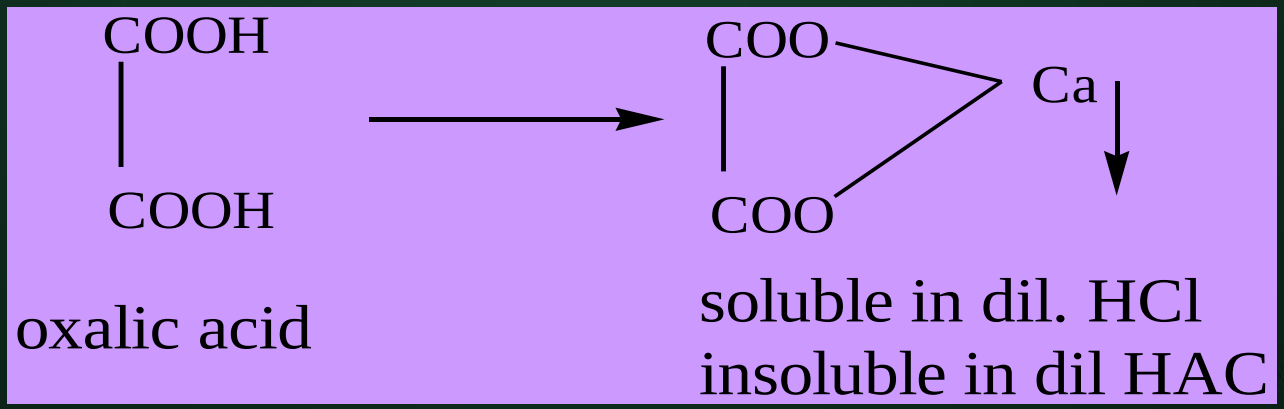


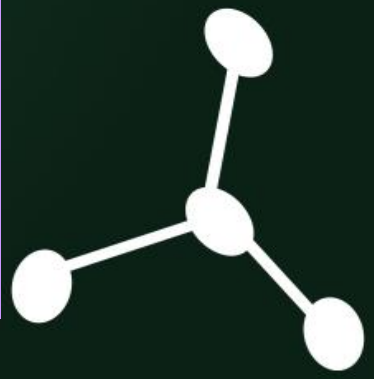
benzoic acid | tartaric acid | oxalic acid | Formic acid



Calcium chloride test:

- Specific test for (tartaric acid & oxalic acid)
- Type of reaction is (complex formation).
- Reagent is $CaCl_2$
- Depends on neutral acid (salt of acid) react with reagent to produced specific white ppt for each acids.





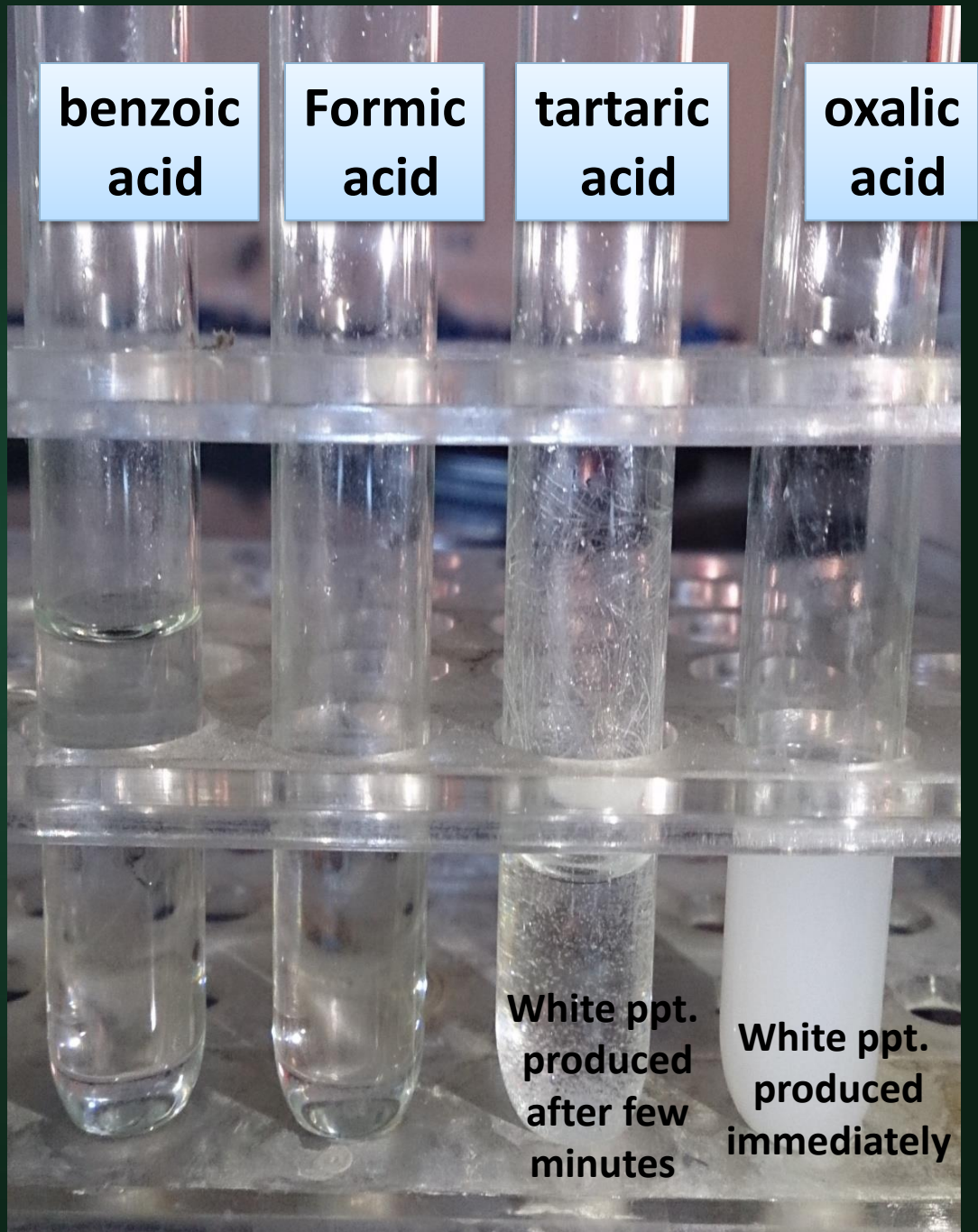
Procedure

Neutral acid (N.S)

1. (I ml) of compound
2. Drops of (NH_3) until litmus paper (red) change to (blue) (to have alkaline)

Test

Add (Iml) of ($CaCl_2$) to (N.S solution)



Unknown

(benzoic acid, formic acid, tartaric acid, oxalic acid)

General Test :

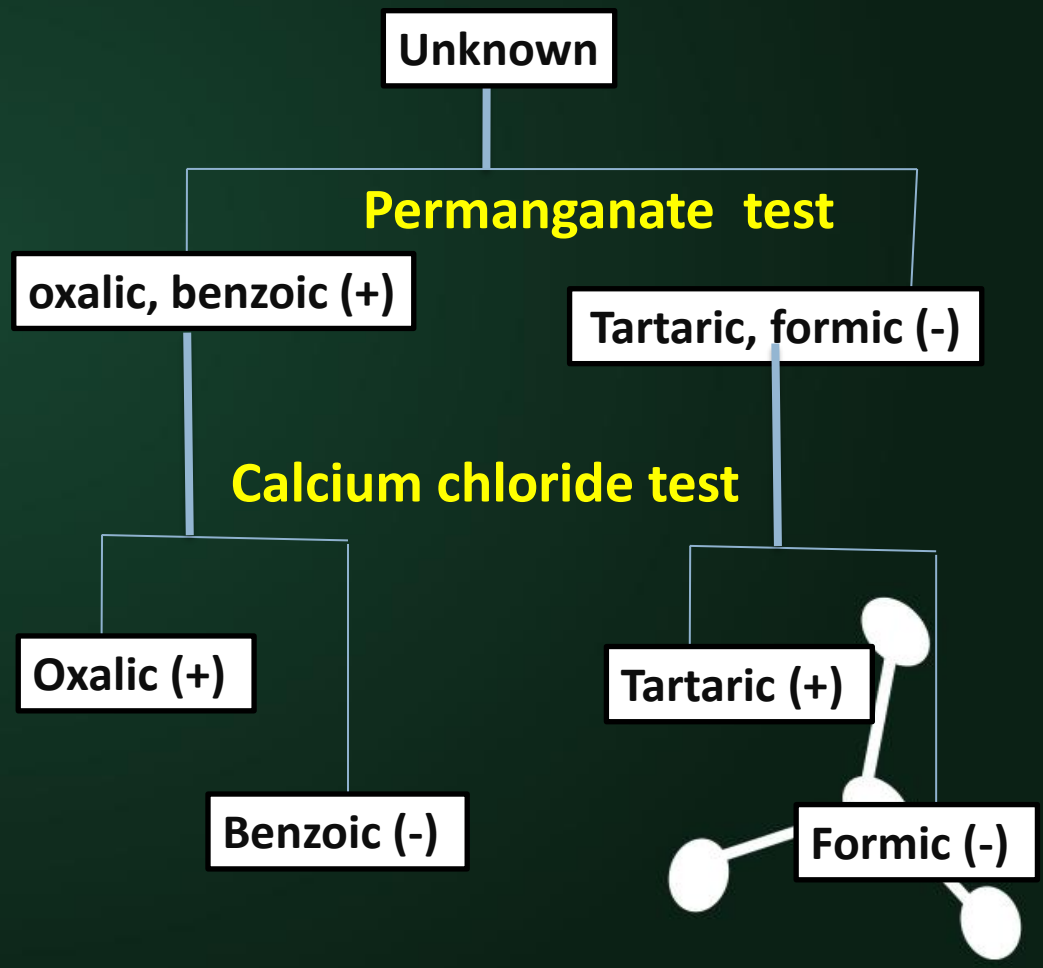
1. (1 ml) of compound
2. Few amount of sodium bicarbonate ($NaHCO_3$)

permanganate Test :

1. (few amount) of unknown (solid dissolved in water)
2. Heat for (1min)
3. (3 ml) of (Na_2CO_3 dil.)
4. (1 drop) of ($KMNO_4$)

Calicium chloride Test :

1. (few amount) of unknown
2. (drops) of NH_3 (change litmus red to blue)
3. (1 ml) of $CaCl_2$



Thank you