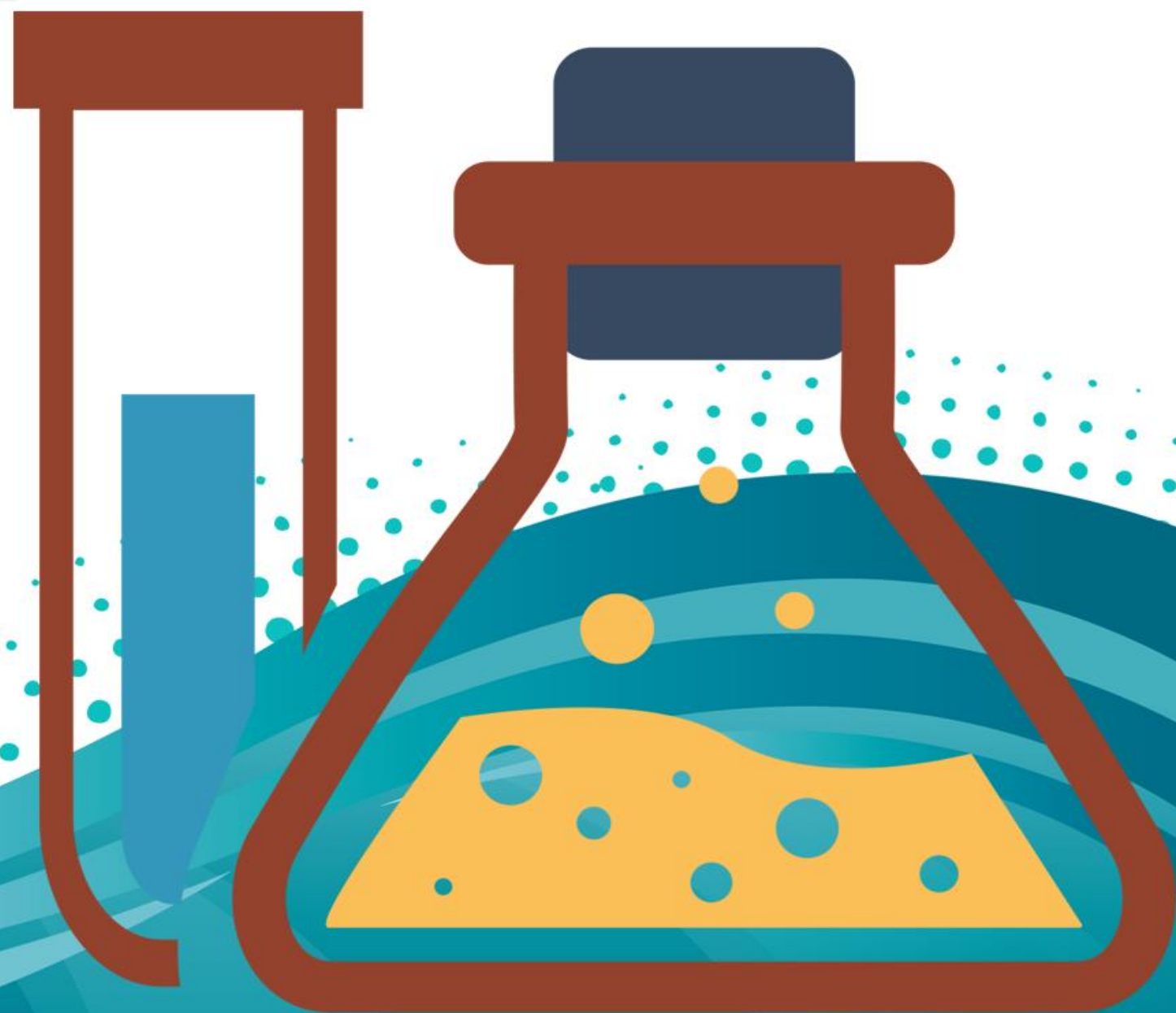
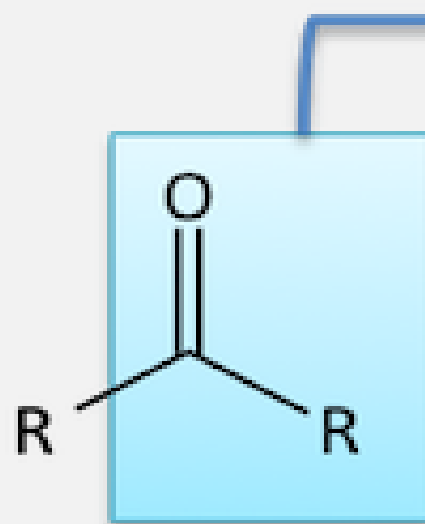


Carbonyl Compounds

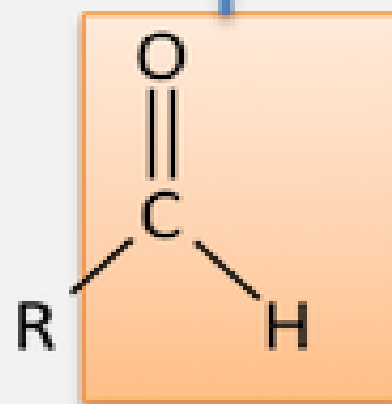
1. **Aldehydes**
2. **Ketones**



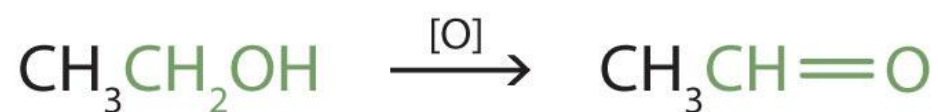
The difference



Ketone

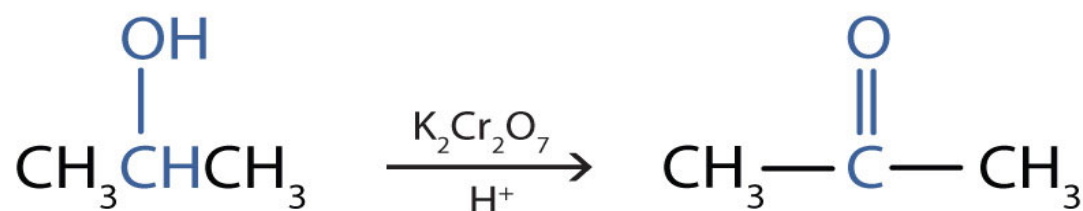


Aldehyde



Ethanol
(a primary alcohol)

Acetaldehyde
(an aldehyde)



Isopropyl alcohol
(a secondary alcohol)

Acetone
(a ketone)



Physical properties

- ✓ Colorless
- ✓ Liquid (except formaldehyde is gas)
- ✓ Have characteristic odor
- ✓ (aliphatic) M.wt (low) miscible in H_2O
(aliphatic, aromatic) M.wt (high) immiscible in H_2O



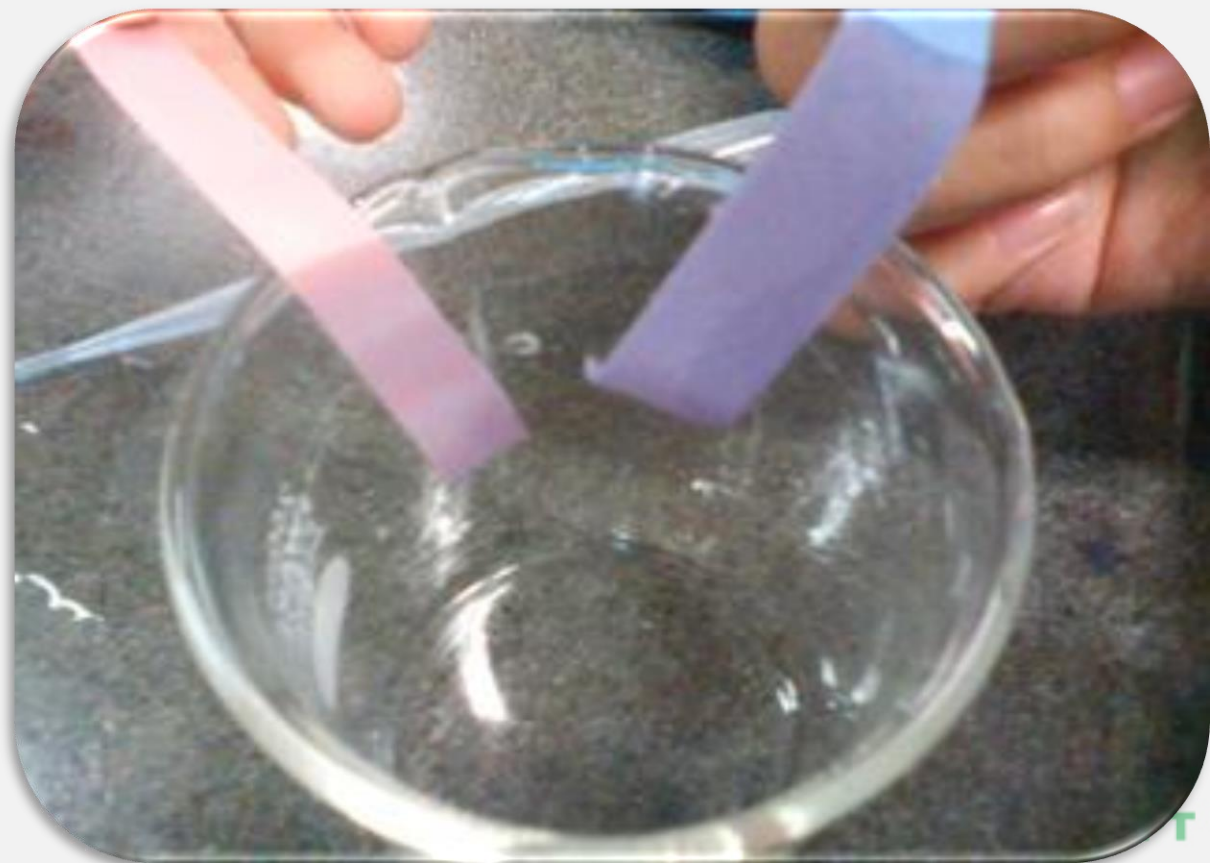
Chemical Properties

litmus paper effect

Aldehyde and ketone are neutral compounds (very weak base) no Change color of litmus

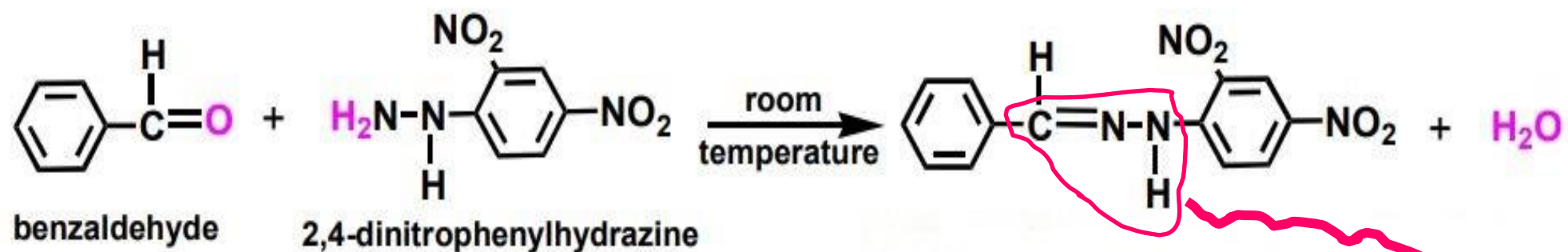


Red	→	red
Blue	→	blue

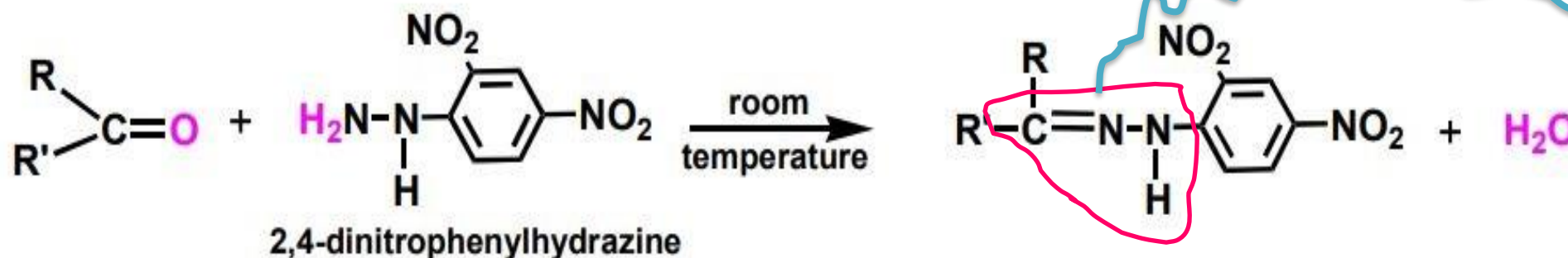


General test (for carbonyl compounds)

- Type of reaction is (nucleophilic addition reaction).
- Reagent is 2,4-dinitrophenyl hydrazine (2,4-DNP).
- Depends on **carbonyl group** react with (N) atom by nucleophilic addition, then **loss of (H₂O)** to produced (C=N-NH).
- Produced **yellow or orange ppt.**



(yellow-orange precipitate)



hydrazone
-C=N-NH-

○ **Tests used to distinguish
between aldehydes and ketones:-**

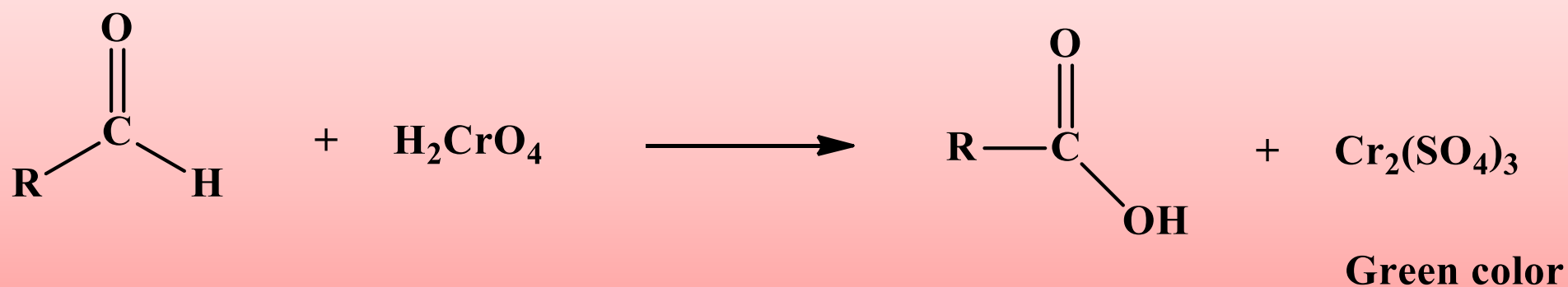
1- Chromic acid test:
(for aldehyde only)



2-Tollens' Test :
(for aldehyde only)

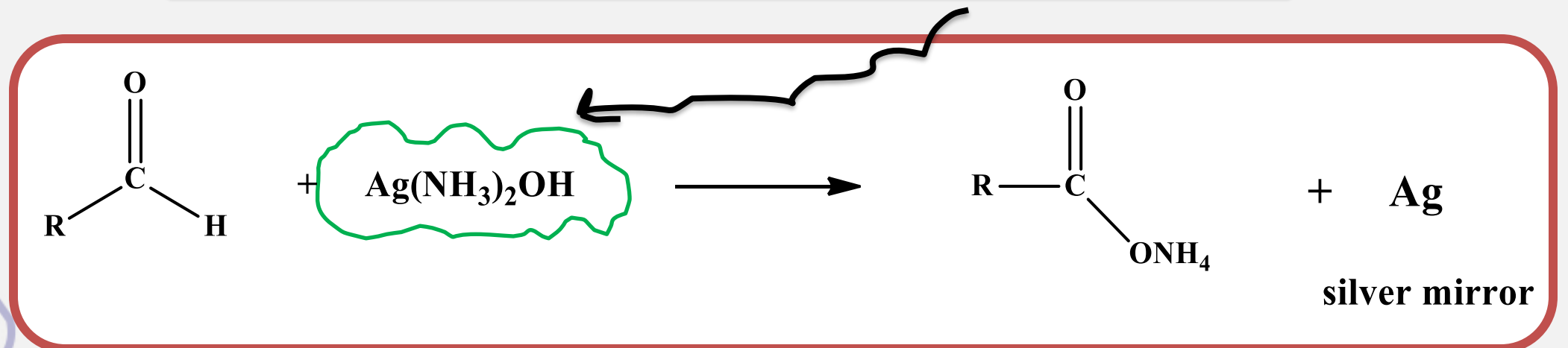
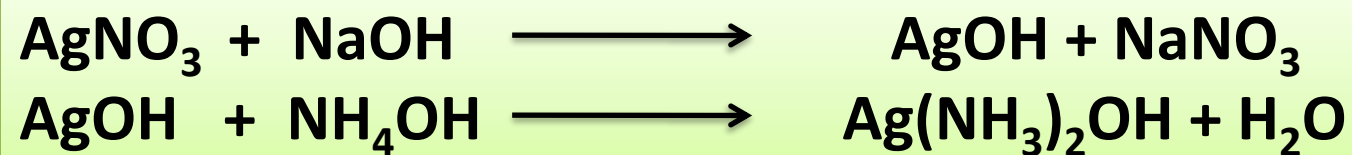
1- Chromic acid test: (for aldehyde only)

- Type of reaction is (oxidation-reduction reaction).
- Depends on Chromic acid (H_2CrO_4) (oxidizing agent) oxidized aldehyde to acid, while aldehyde (reducing agent) reduced (Cr^{+6}) to (Cr^{+3}).
- Produced green color for (Cr^{+3}).



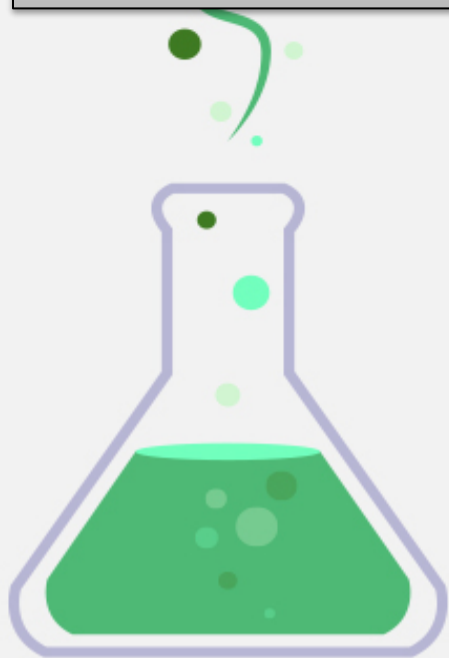
2-Tollens' Test : (for aldehyde only)

- Type of reaction is (oxidation-reduction reaction).
- Reagent is $\text{Ag}(\text{NH}_3)_2\text{OH}$.
- Depends on aldehyde (reducing agent) oxidize to salt of acid, silver ion (Ag^+) (weak oxidizing agent) reduced to silver metal (Ag) as silver mirror.
- Produced silver mirror on the inner side of test tube.



Specific tests :-

Iodoforms Test
for terminal CH_3
group

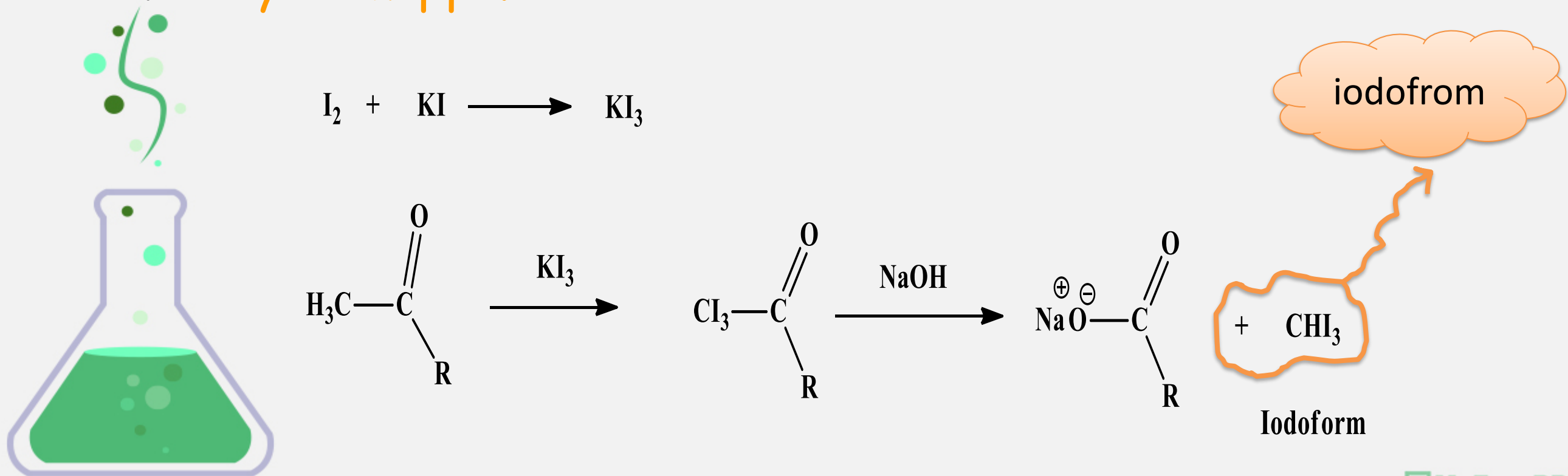


Resorcinol Test
for formaldehyde

Cannizaro reaction
for benzaldehyde

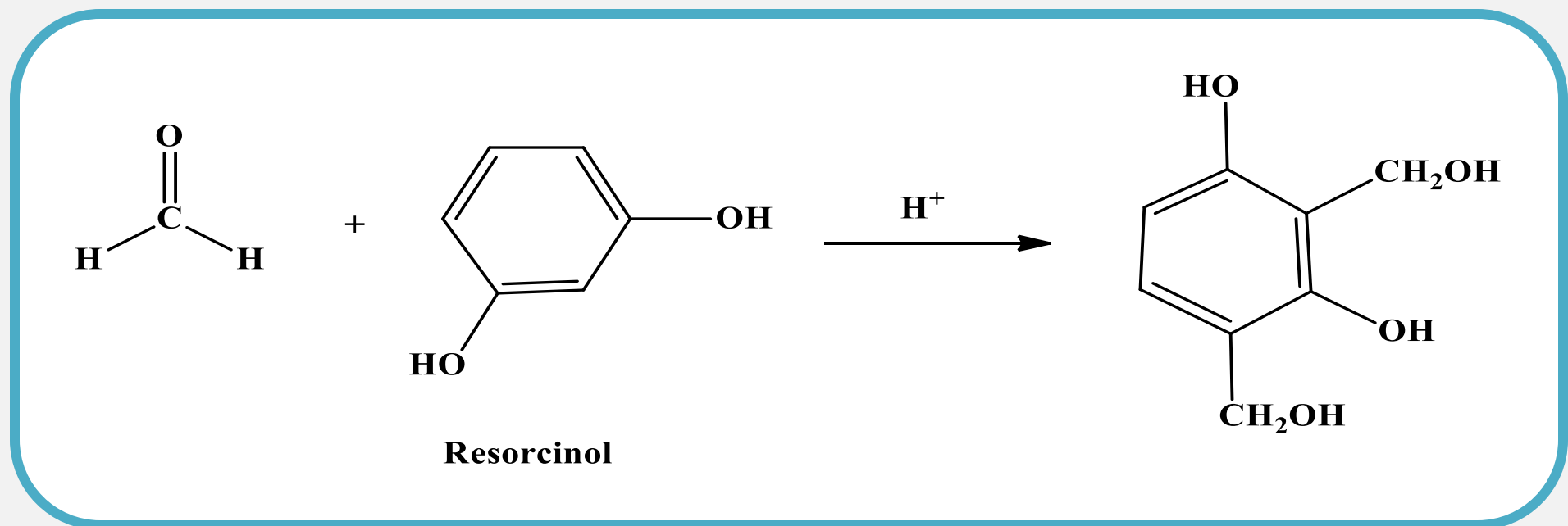
Iodoforms Test : (for terminal CH₃ group)

- Type of reaction is (halogenation-cleavage reaction).
- Reagent is I₂ \ KI in alkalin medium (NaOH).
- Depends on addition (I₂) to (CH₃) to form (triiodo derivatives) then cleavage to formation (CHI₃) and carboxylic salt.
- Produced yellow ppt.



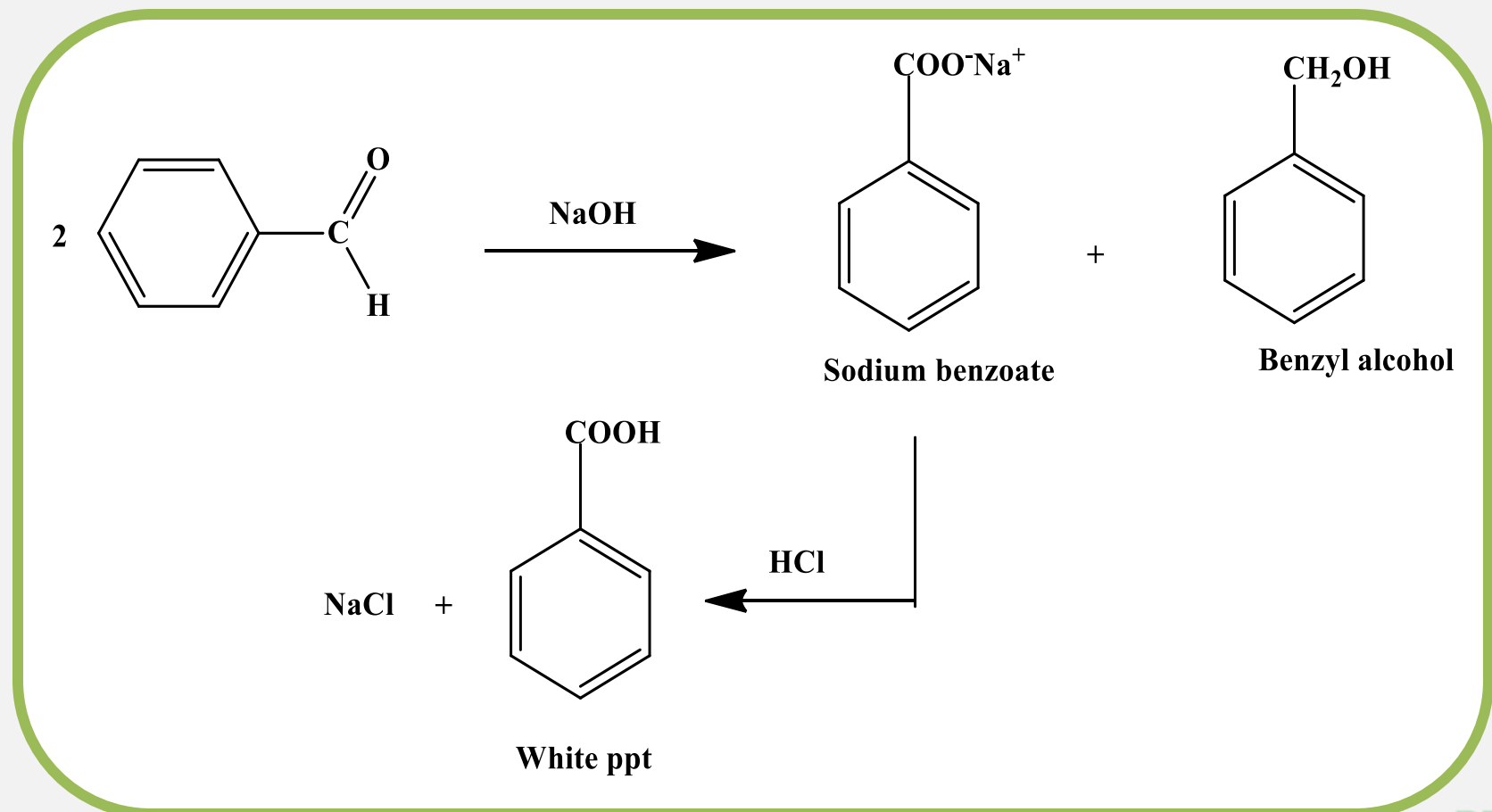
Resorcinol Test : (for formaldehyde)

- Type of reaction is (o-substitution aromatic reaction).
- Reagent is **resorcinol**.
- Depends on **substitution on aromatic ring**.
- Produced red violet ring and white ppt over ring.



Cannizaro reaction : (for benzaldehyde)

- Type of reaction is (oxidation-reduction reaction).
- Depends on 2 mole of benzaldehyde (which don't have alpha H) in the presence of a strong basic medium to yield mixture of alcohol and salt carboxylic acid.
(one molecule of the aldehyde serves as the oxidizing agent while the other mole serves as the reducing agent).
- Produced white ppt.

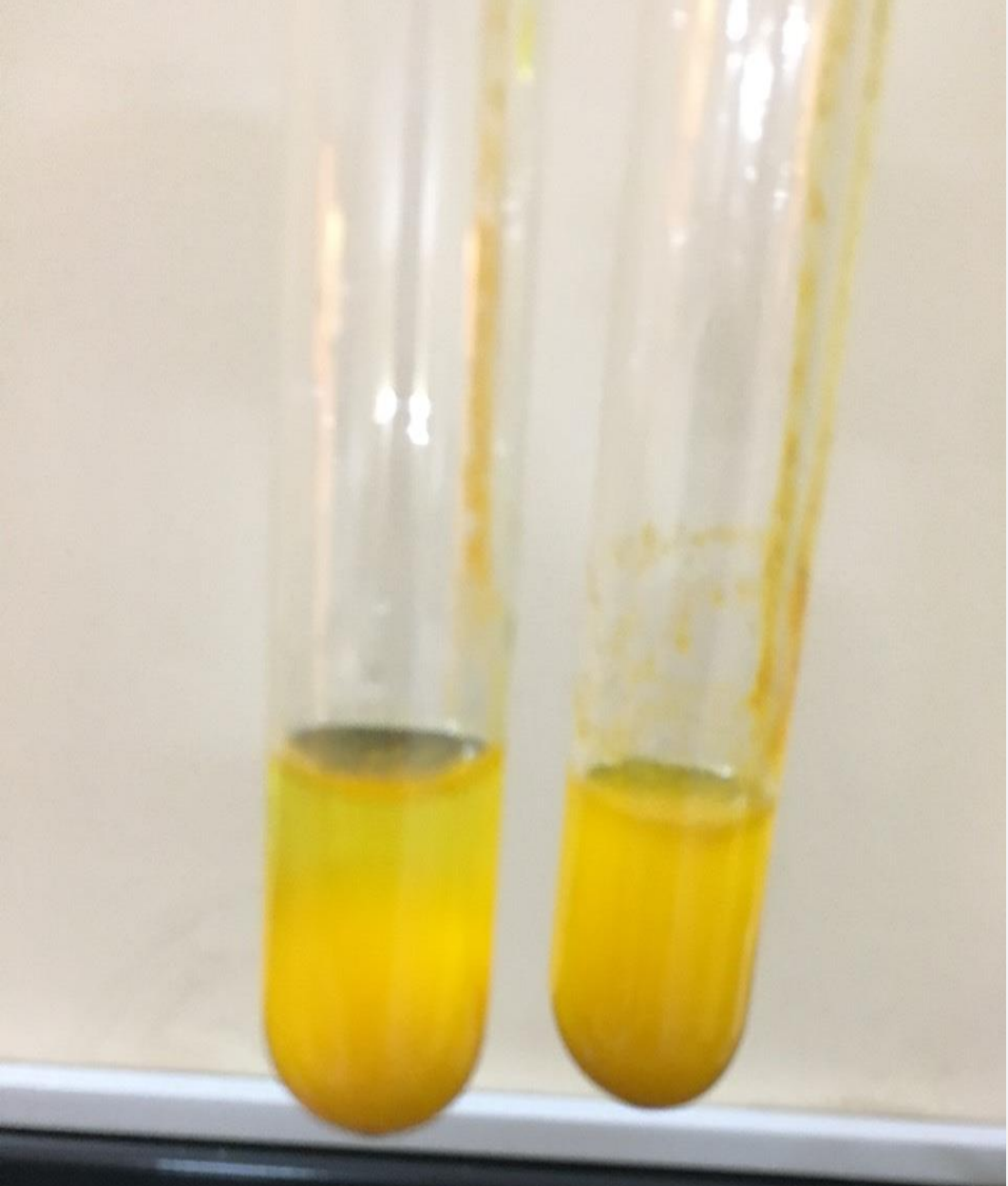


Procedure



General test


1. In different test tube add (4-5) drops of carbonyl compounds, dissolved in water if not dissolved added few drops of ethanol.
2. Add (1ml) of (2,4-DNP) shake the mixture well and observe the result.
3. Positive result is yellow or orange ppt that mean (aldehyde or ketone).



Yellow-orange
ppt

Tollen's test

1. In different test tube add (2-4) drops of carbonyl compounds.
2. Add (2-4) drops of ($\text{AgNO}_3 \setminus \text{NH}_4\text{OH}$), shake the mixture well
3. Added (2 drops) of (NaOH 10%) shake the mixture well and observe the result.
3. Positive result is Silver mirror that mean (aldehyde only).



silver mirror on
the inner side of
test tube

Iodoform test

1. In different test tube add (4-5) drops of carbonyl compounds
2. Add (1ml) of (I_2/KI) solution, shake the mixture well red color result.
3. Heat the mixture for (10-15min) on water bath then cool and dissolved in NaOH 10%..
3. Positive result is yellow ppt that mean (CHI_3).

Yellow ppt

Resorcinol test

1. In test tube add (1ml) of formaldehyde.
2. Add (1ml) of resorcinol, shake the mixture well.
3. Add drop by drop (H_2SO_4 con.) on the wall of test tube.
4. The positive result is violet ring with white ppt.

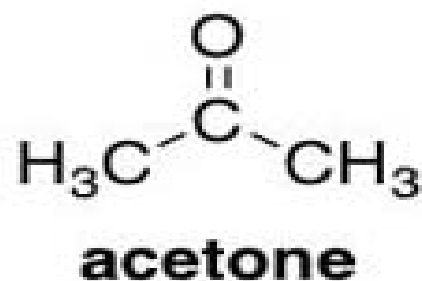


Violet ring with
white ppt

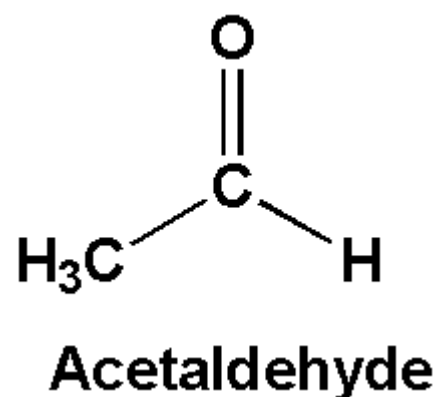
Cannizaro test

1. In test tube add (4-5) drops of benzaldehyde dissolved in (0.5ml) of (NaOH 30%).
2. Heat the solution on water bath for (3 min).
3. Add (2-5) drops of water then (2-5) drops of HCl (con.) and observed the result (white ppt).

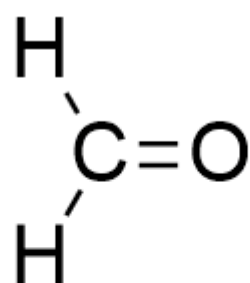




General test , iodoform

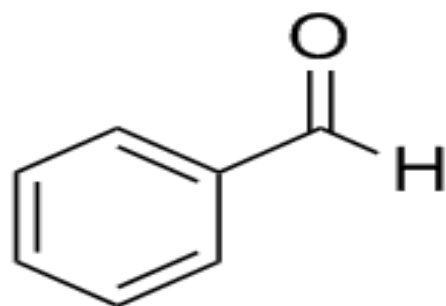


General test , iodoform,
chromic acid , tollen,



General test,
chromic acid , tollen,
resorcinol

Formaldehyde



General test ,
chromic acid , tollen,
cannizaro

benzaldehyde

summery of carbonyl compounds

General test: 2,4-DNP

(+) yellow or orange ppt

(-) not aldehyde or ketone

Tollen test: $\text{NaOH (10\%)} + \text{AgNO}_3 + \text{NH}_4\text{OH}$

(-) ketone

(+) silver mirror (aldehyde)

(-) (benzophenone)

Iodoform test:
iodine solution + 10%NaOH

(+)
Yellow ppt
(acetone)

(-) no terminal (CH_3)

Resorcinol test: resorcinol + H_2SO_4

(+) violet ring & white ppt (formaldehyde)

(-) (benzaldehyde)

Iodoform test:
iodine solution + 10%NaOH

(+)
Yellow ppt
(acetaldehyde)

Unknown contain carbonyl compounds

General test: 2drop of unknown + (1ml) of water + (1ml) of 2,4-DNP

(+) yellow or orange ppt

(-) not aldehyde or ketone

Tollen test: 5drop of unknown + (2 drops) ($\text{AgNO}_3 \backslash \text{NH}_4\text{OH}$), + 2drop of NaOH (10%) +

(-) ketone

(+) silver mirror (aldehyde)

Iodoform test: (4 drops of compound + 1ml of iodine solution + warm for 15min + cool + 3 drops 10%NaOH

(-) (benzophenone)

(+) Yellow ppt (acetone)

(-) no terminal (CH_3)

(+) Yellow ppt (acetaldehyde)

Resorcinol test: (1ml) of unknown + (1 ml) of resorcinol + drop by drop of H_2SO_4

(+) violet ring & white ppt (formaldehyde)

(-) (benzaldehyde)

Thank
you

