

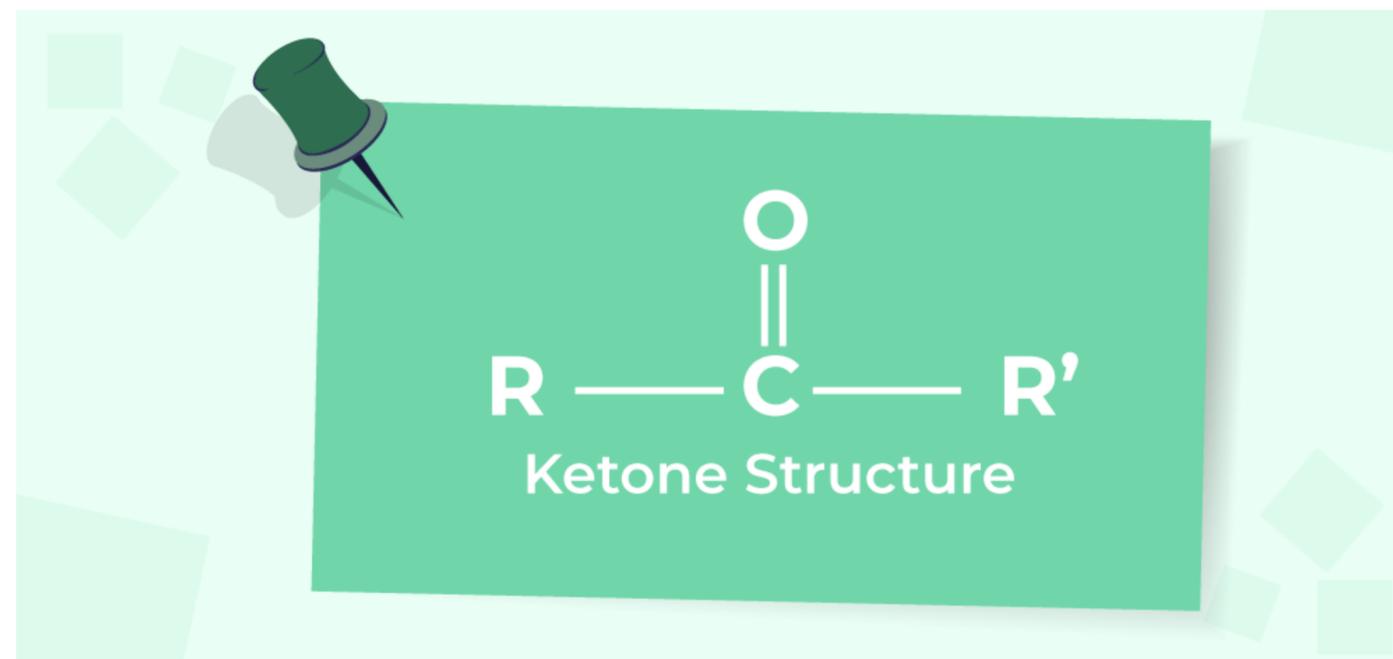
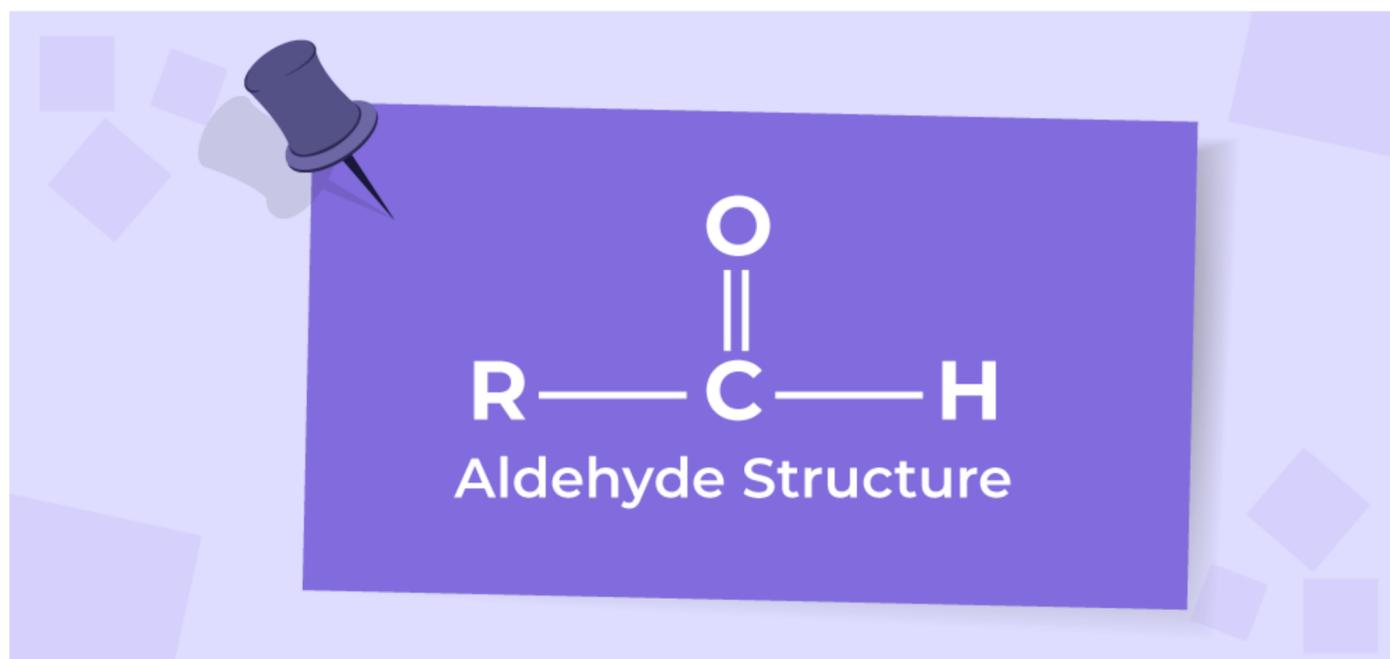
Estimation of Aldehydes and Ketones

Advance Chemistry Lab 5

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Theory

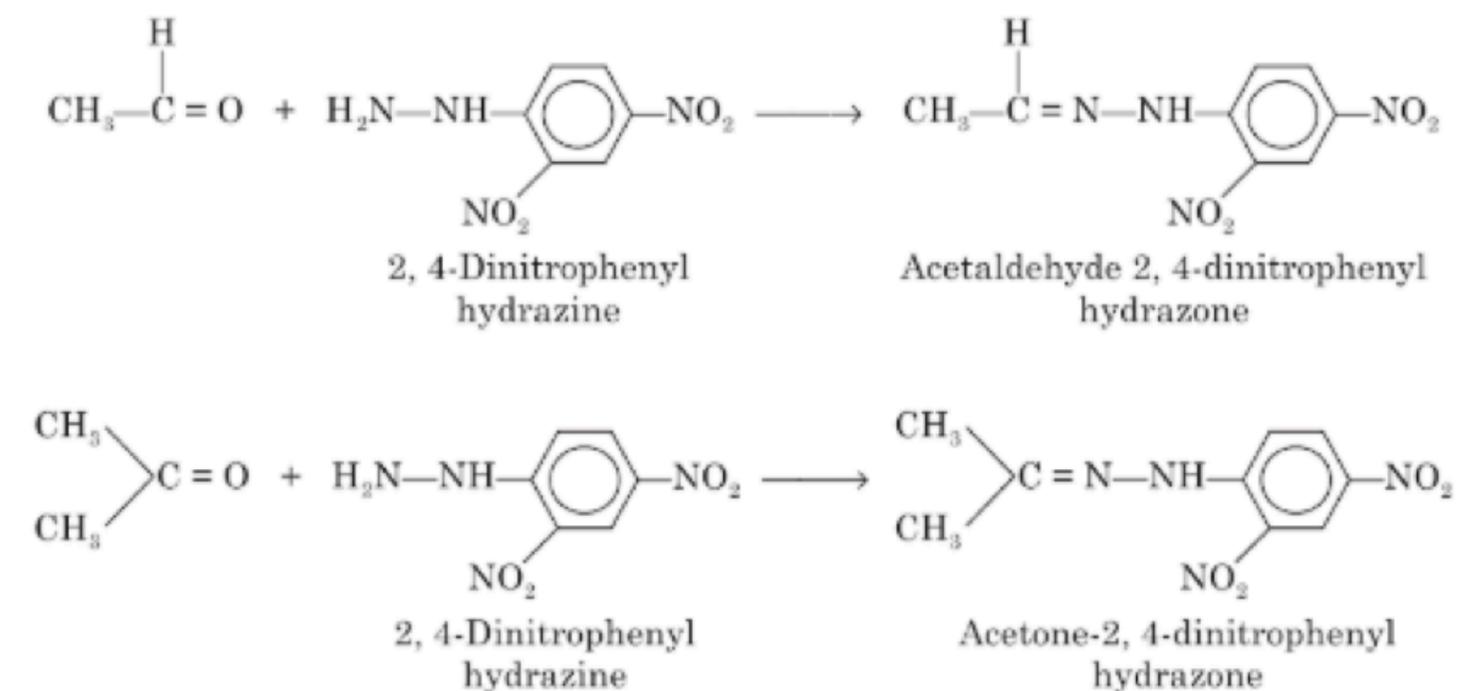
In aldehydes, the carbonyl group is attached to a hydrogen atom and an aliphatic or aromatic group (Formaldehyde is an exceptional case in which the carbonyl present in formaldehyde is attached to two hydrogen atoms). In ketones, the carbonyl group is attached to two aliphatic or aromatic groups.



The following tests are used to identify the presence of aldehydes and ketones.

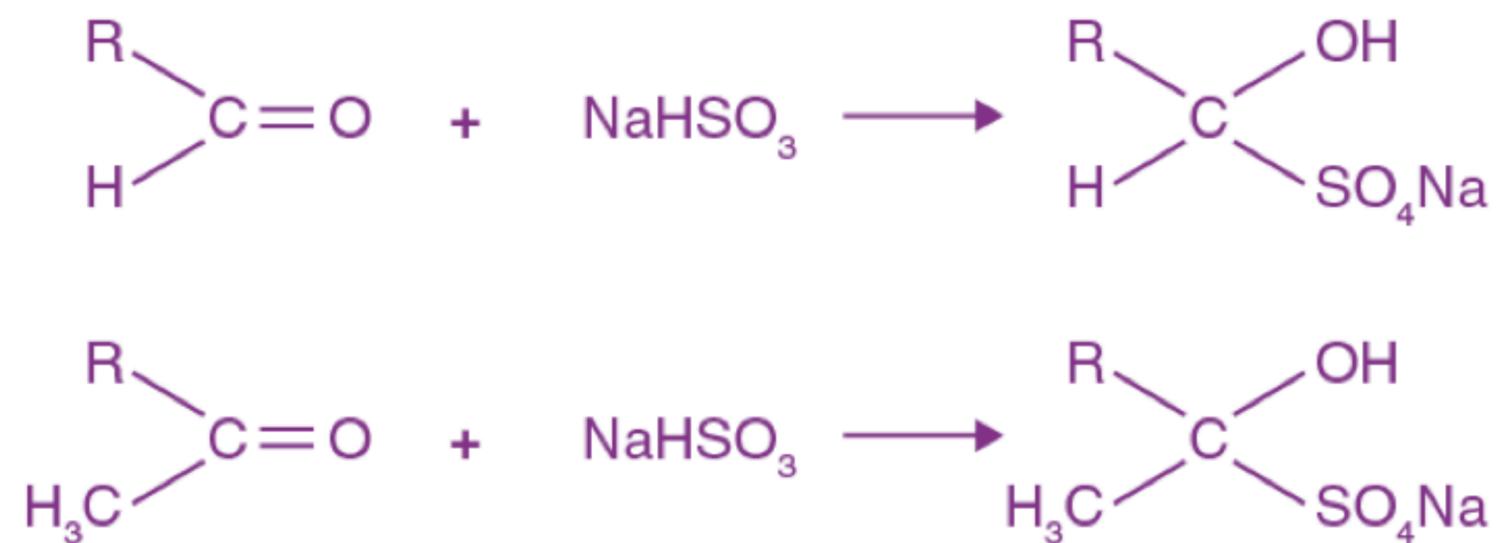
2,4-Dinitrophenylhydrazine Test

Aldehydes and ketones react with 2,4-dinitrophenylhydrazine to give an orange-yellow precipitate/crystals indicates the presence of carbonyl group.

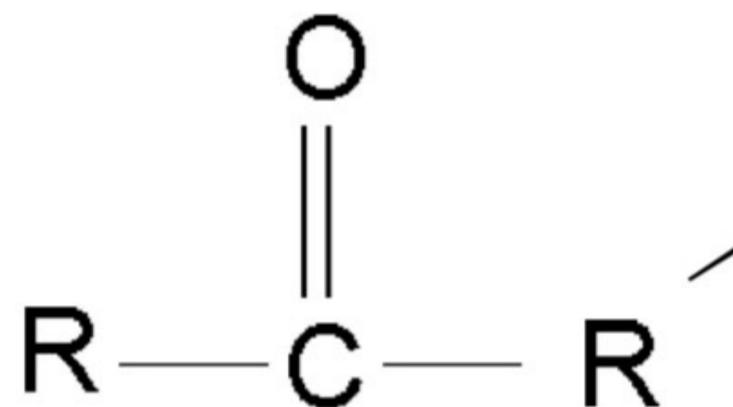
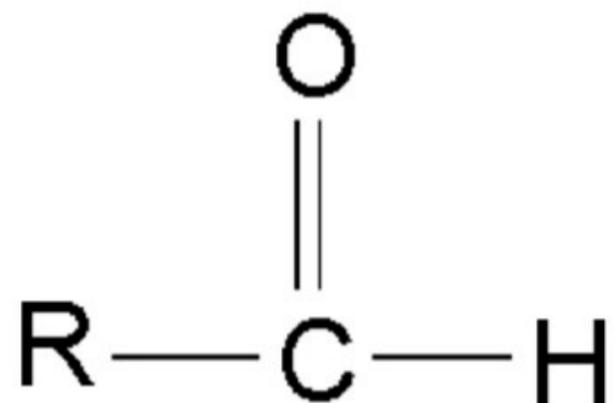


Sodium Bisulphite (NaHSO₃) Test

Aldehydes and ketones combine with sodium bisulphite to form well-crystallized water-soluble products known as “aldehyde bisulphite” and “ketone bisulphite”.



The difference between *ketone* and *aldehyde* is the carbonyl group present in aldehydes can be easily oxidised to carboxylic acids, whereas the carbonyl group in ketones is not oxidised easily. This difference in reactivity is the basis for the distinction between aldehydes and ketones.



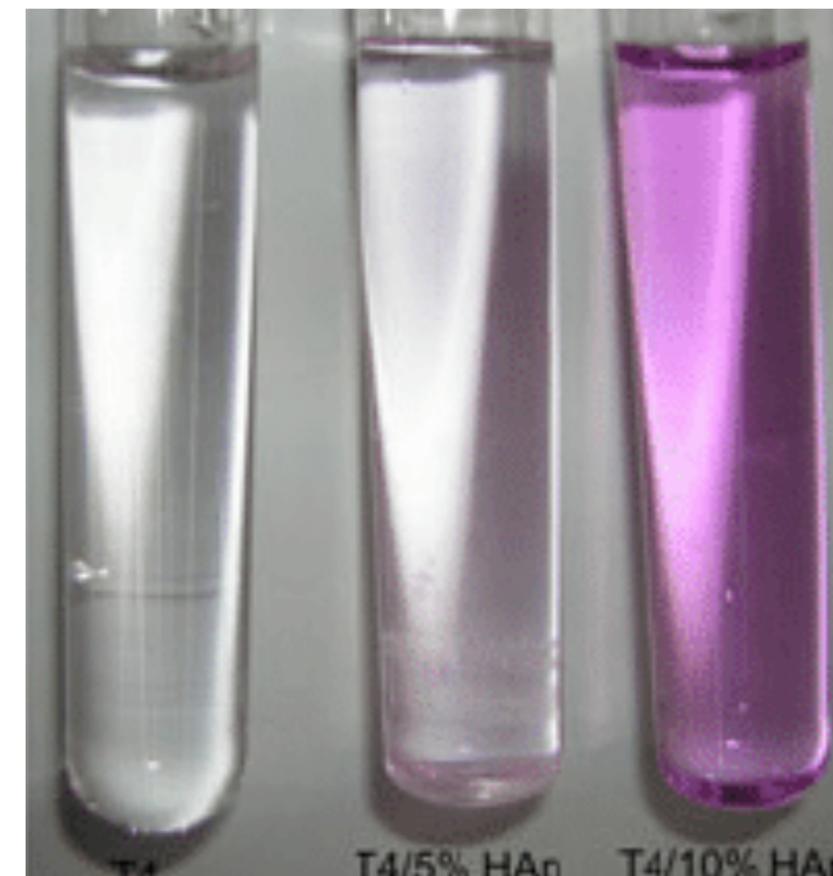
Aldehyde and Ketone are generally distinguished by the following tests:

1. Schiff's Test
2. Fehling's test
3. Tollen's test
4. Test with chromic acid
5. Sodium nitroprusside test

1- Schiff's Test:

Schiff's reagent is prepared by passing sulphur dioxide (SO_2) into a solution of the dye fuchsin. The solution becomes colourless due to the formation of an additional product. Aldehydes abstract sulphurous acid from Schiff's reagent and restore the pink colour. The colouration is due to the formation of complex compound. Ketones, in general, do not respond to this reaction.

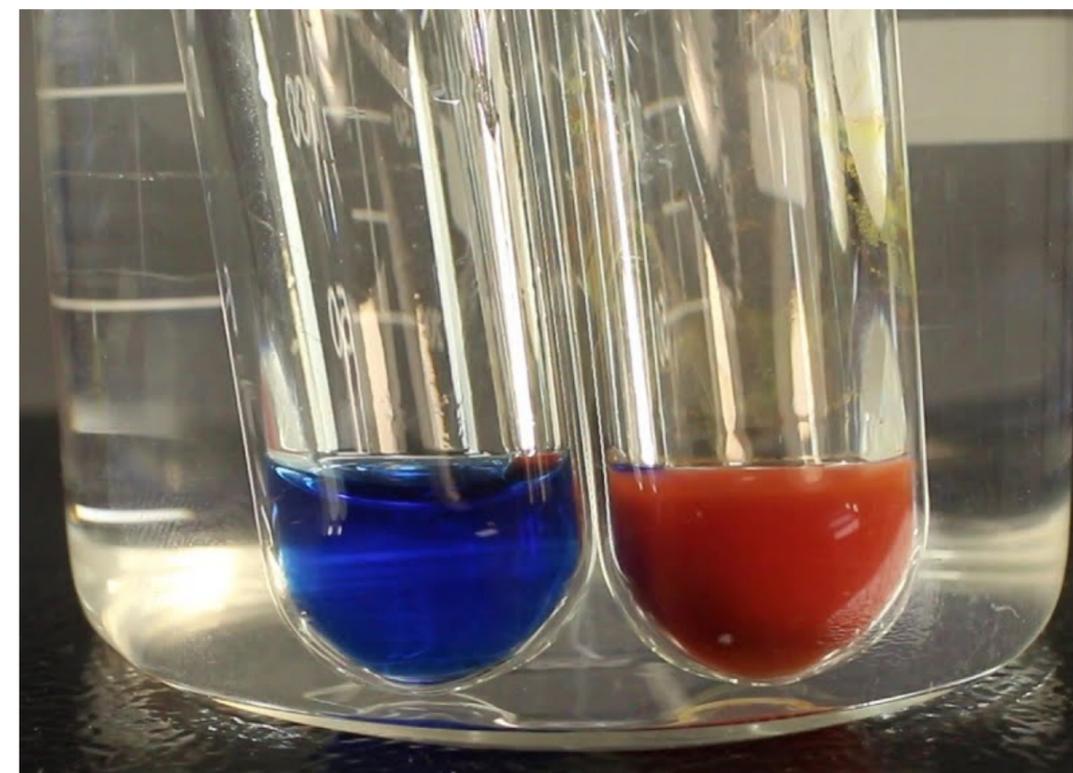
- Take the organic compound given to be tested in a clean test tube.
- Add 2-3 drops of Schiff's reagent.
- If there is immediate formation of a pink color, the presence of an aldehyde is confirmed.



2- Fehling's Test:

Fehling's solution is a complex compound of Cu^{2+} . When the aldehyde compound is treated with Fehling's solution Cu^{2+} is reduced to Cu^+ and the aldehyde is reduced to acids. During the reaction, a red precipitate is formed.

- Take the given organic compound in a clean test tube.
- Add Fehling's solution to it and heat the solution gently.
- If a brick-red precipitate appears, then the presence of aldehyde is confirmed.



Aromatic aldehydes do not respond to Fehling's test. An aqueous solution of the compound may be used instead of an alcoholic solution. Formic acid also gives this test. The appearance of red precipitate confirms the presence of an aldehydic group.

3- Tollen's Test (Silver Mirror Test):

Tollens reagent consists of silver ammonia complex in ammonia solution. Aldehydes react with Tollens reagent giving a grey-black precipitate or a silver mirror. Aldehydes are oxidised to the corresponding acids, and silver in Tollens reagent is reduced from Ag^{+1} oxidation state to its elemental form. Generally, ketones do not respond to this test.

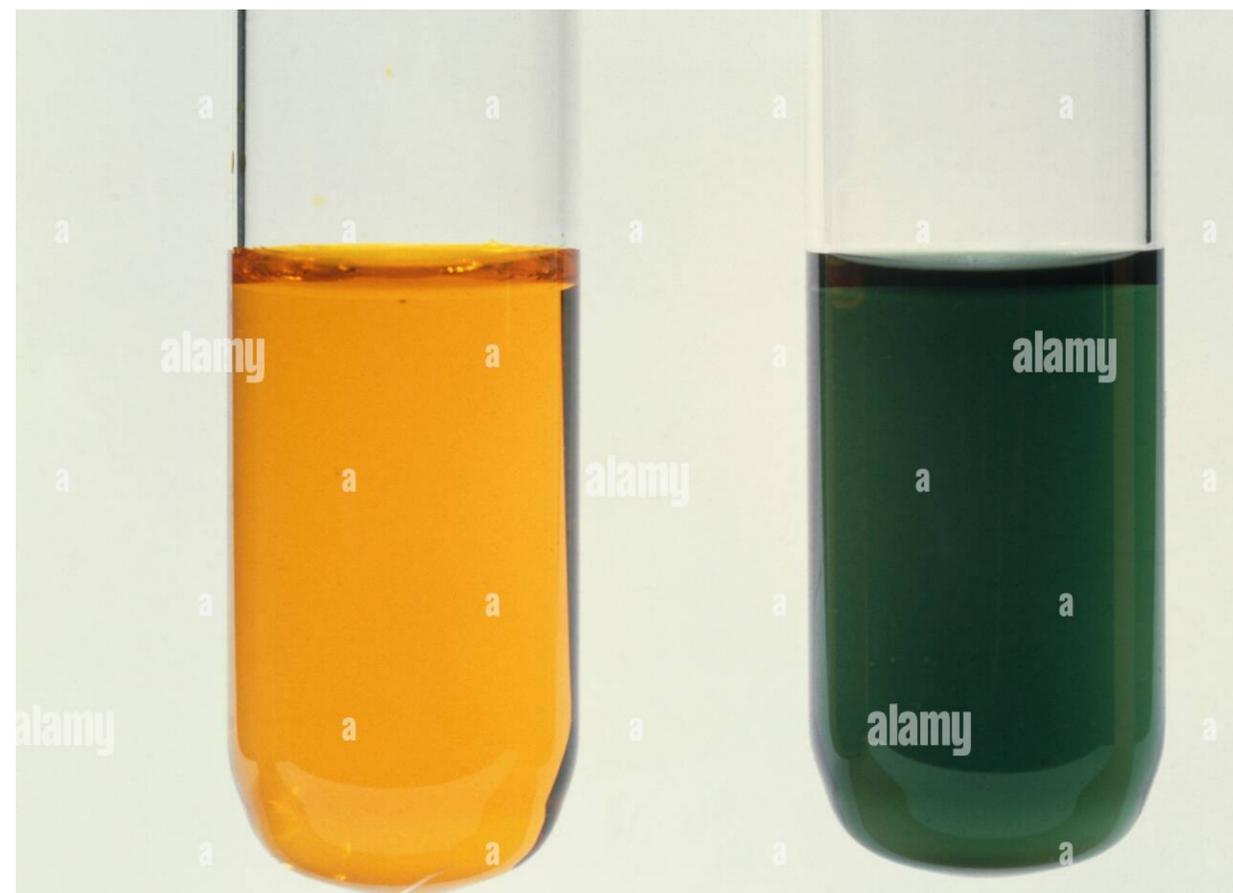
- Take 1ml of silver nitrate solution in a clean test tube.
- Add dilute sodium hydroxide solution to it, and a brown precipitate forms.
- Add dilute ammonia solution dropwise till the brown precipitate of silver oxide dissolves.
- To this freshly prepared Tollen's reagent, add the given organic compound to be tested.
- Place the test tube in a warm water bath for about 5 to 10 minutes. If there is the appearance of a silver mirror on the sides of the test tube confirms the presence of an aldehyde.



4- Chromic Acid Test:

Aldehydes react with chromic acid and gives a green precipitate. Ketones do not react with chromic acid. The appearance of green color precipitate confirms the presence of aldehydes.

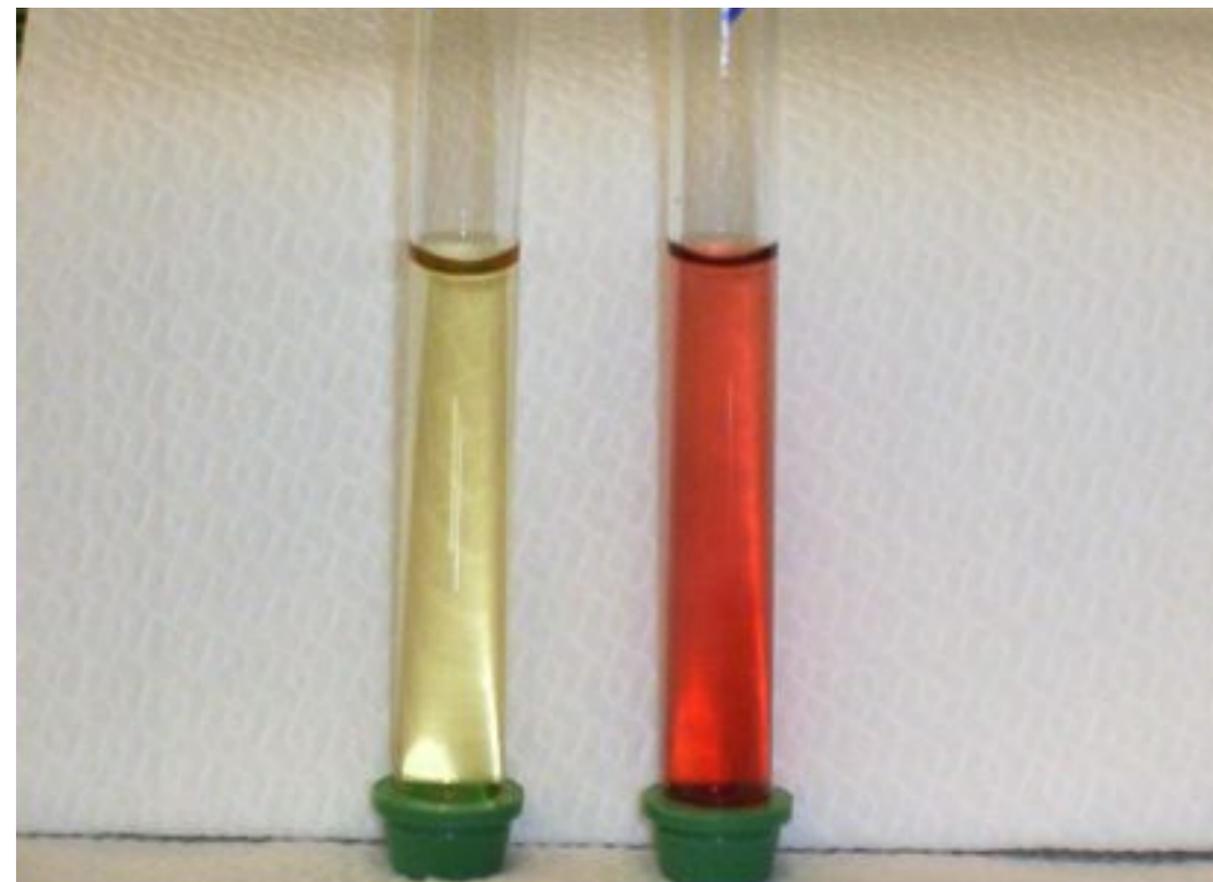
- Take the given organic compound in a clean test tube.
- Add 1ml of chromic acid reagent to the given organic compound.
- The appearance of a green color precipitate indicates the presence of aldehydes.



5- Sodium Nitroprusside Test:

Ketone responds to this test. Ketone reacts with alkali and forms an anion which further reacts with sodium nitroprusside and forms a coloured complex ion. Aldehydes do not respond to this test. The appearance of red colouration shows the presence of ketone..

- Dissolve sodium nitroprusside in distilled water in a clean test tube.
- Add 1 ml of the given organic compound to be tested.
- Shake well and add sodium hydroxide solution dropwise.
- If there is the appearance of red color then the presence of ketone is confirmed.



Precautions:

1. The reagents should be freshly prepared to perform the test.
2. Not to heat the reaction mixture directly on the flame.
3. After performing the Tollen's test, wash the test tube with nitric acid to destroy the silver mirror, because it's an explosive substance.