

# Chapter: 04

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## **AIM: TO PERFORM SYSTEMATIC QUALITATIVE ANALYSIS OF KETONES**

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## **Requirements**

### **Chemicals**

1. 2,4 dinitro phenyl hydrazine
2. Sodium bisulphite
3. 2,4 dinitro benzene
4. NaOH
5. Iodine

### **Glass wares**

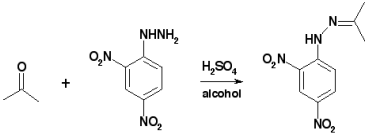
1. Test-tube
2. Stands
3. Brush
4. Holder
5. Glass rod
6. Beakers

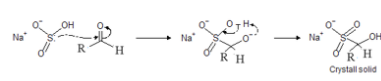
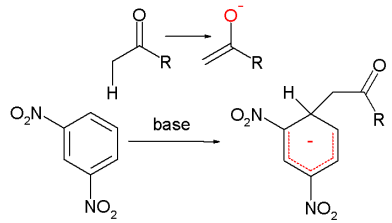
**Theory:** As a result of the presence of the carbonyl group in both aldehydes and ketones, the reactions of these two families of compounds to a large number of chemicals are quite similar. It is common practise to employ 2,4-dinitrophenylhydrazine as a testing agent for either of these classes of chemicals. Ketones, on the other hand, are much harder to oxidize than aldehydes, therefore they don't alter when exposed to mild oxidizing agents; instead, the aldehydes become carboxylic acids as a result of this reaction. However, aldehydes have a distinct behavior that sets them apart from ketones.

It is possible to easily identify carbonyl compounds, such as aldehydes and ketones, by using a variety of derivatives that are not

difficult to make. Oximes, phenylhydrazones, 2,4-dinitrophenylhydrazones, and semicarbazones are some of the compounds that fall within this category. These derivatives are good because they can be refined with relative ease, they are crystalline solids, and their melting points are relatively high. The production of these closely similar derivatives is governed by a method that begins with a conventional nucleophilic addition at the carbonyl carbon and continues with the removal of a water molecule.

### Functional Group Test for Ketones

S. No.	Identification Test	Observation	Inference
1	<p><b>2,4-DNP test:</b> Add a solution of one or two drops of the sample dissolved in two ml of CH<sub>3</sub>OH to three ml of 2,4 DNP reagent. If no precipitate appears immediately after vigorous shaking, solution is allowed to stand for 15 minutes.</p> 	Yellow/red ppt (dinitrophenyl hydrazone)	Carbonyl group may be present
2	<p><b>Sodium bisulphite addition complex:</b> In a clean &amp; dry test tube, add 0.3 ml of the sample, followed by 1 ml of the sodium bisulphite reagent. Shake the test tube vigorously with the stopper on.</p>	Precipitate is a formed	Carbonyl group may be present

	$\text{R}-\overset{\text{O}}{\parallel}{\text{C}}-\text{H} + \text{NaSO}_3\text{H} \longrightarrow \text{R}-\overset{\text{OH}}{\underset{\text{H}}{\text{C}}}-\text{SO}_3^-\text{Na}^+$ <p>Mechanism</p> 		
3	<p><b>2, 4-Dinitrobenzene test:</b> After adding a pinch of 2,4 dinitrobenzene and NaOH to the sample solution contained in the test tube, the formation of a colour that ranges from violet to pink shows the presence of ketone.</p> 	Pink/violet colour	Ketone is confirmed
4	<p><b>Sodium Nitroprusside test:</b> When sodium nitroprusside solution and sodium hydroxide solution are added to a sample solution in a test tube, the production of a colour ranging from violet to pink indicates the presence of ketone.</p> $\text{CH}_3\text{COCH}_3 + \text{NaOH} \longrightarrow \text{CH}_3\text{COCH}_2^- + [\text{Fe}(\text{CN})_5\text{NO}]^-$ $\downarrow$ $[\text{Fe}(\text{CN})_5\text{NOCH}_2\text{COCH}_3]^-$	Violet colour	Ketone is confirmed

5	<p><b>Iodoform test:</b> Dissolve five drops, which is equivalent to 50 mg, in two ml of H<sub>2</sub>O. First add 2 mL of 3M NaOH, and then gradually pour in 3 ml of iodine solution. Vigorous shaking is required. Formation of solid yellow coloured iodoform indicates presence of ketone.</p> $\text{RCOCH}_3 + 3\text{I}_2 + 4\text{NaOH} \longrightarrow \text{RCOONa} + 3\text{NaI} + 3\text{H}_2\text{O} + \text{CHI}_3$ <p style="text-align: center;">(Iodoform)</p>	Yellow colour	Ketone is confirmed
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**Result:** The results of the systemic qualitative tests performed and ketones were found and reported.