



**CHEMISTRY ONLINE**  
— **TUITION** —

Phone: +442081445350

[www.chemistryonlinetuition.com](http://www.chemistryonlinetuition.com)

Email: [asherrana@chemistryonlinetuition.com](mailto:asherrana@chemistryonlinetuition.com)

# CHEMISTRY

## ORGANIC CHEMISTRY

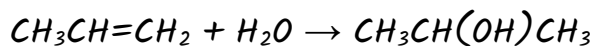
Level & Board	AQA (A-LEVEL)
TOPIC:	ORGANIC ANALYSIS
PAPER TYPE:	SOLUTION - 4
TOTAL QUESTIONS	10
TOTAL MARKS	36

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## Organic Analysis - 4

1.

**Equation:**



**IUPAC name:**

Propan-2-ol

(2)

2.

**Reagent:**

Aqueous solution of silver nitrate

**Observation with 1-chloropropane:**

No visible change.

**Observation with ethanoyl chloride:**

A white precipitate forms, and there may be a large amount of precipitate formed immediately.

(2)

3.

(a)

**Reagent:** Ammonia ( $\text{NH}_3$ ).

**Procedure:**

- Add ammonia ( $\text{NH}_3$ ) separately to each of the compounds AgBr and AgI.

**Observations:**

**AgBr +  $\text{NH}_3$  :**

- **Observation:** with excess ammonia, a creamy white precipitate of silver bromide dissolves, forming a colorless solution due to the formation of a soluble complex.
- As silver bromide (AgBr) reacts with ammonia to form a complex ion. Initially, AgBr does not dissolve in water, but in the presence of excess ammonia, a complex soluble ion is formed.

**$AgI + NH_3$  :**

- *Observation: no change is observed in the presence of ammonia. Silver iodide remains largely insoluble, so no change at all.*
- *Silver iodide ( $AgI$ ) does not readily react with ammonia to the same extent as  $AgBr$ .*

*The key distinction is based on the solubility behavior of the silver halides in ammonia.*

(3)

(b)

**Reagent:** Silver Nitrate ( $AgNO_3$ ) Solution

- *Add a few drops of silver nitrate ( $AgNO_3$ ) solution to each compound separately.*

**Observations:**

**For  $HCl$ :**

- *Formation of a white precipitate (silver chloride,  $AgCl$ ) is observed.*
- *The white precipitate formed with  $HCl$  is due to the reaction between chloride ions (from  $HCl$ ) and silver ions (from  $AgNO_3$ ), resulting in the insoluble silver chloride.*

**For  $HNO_3$ :**

- *No immediate visible reaction would occur.*
- *$HNO_3$ , being a strong oxidizing agent, does not produce a precipitate with silver nitrate.*

(3)

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4.

To confirm that a compound is pentanal using infrared spectroscopy, compare its spectrum with the known spectrum of pentanal. Focus on the carbonyl stretching region ( $1690-1750\text{cm}^{-1}$ ) for an exact match, and examine the fingerprint region for overall similarity.

An exact match in these regions, especially the carbonyl stretching band, strongly indicates the presence of pentanal's unique infrared signature

(2)

5.

#### Identification of Ethanoic Acid:

- **Method:**

Add sodium bicarbonate solution ( $\text{NaHCO}_3$ ).

- **Expected Result:**

Effervescence (bubbling) indicates the presence of an acid, confirming the presence of ethanoic acid.

#### Identification of Propan-1-ol:

- **Method:**

Oxidation with acidified potassium dichromate ( $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}_2\text{SO}_4$ ).

- **Expected Result:**

The orange color of the dichromate solution changes to green, indicating the oxidation of propan-1-ol to propanoic acid.

(4)

6.

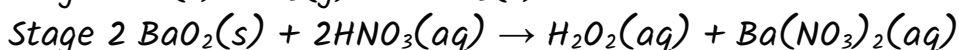
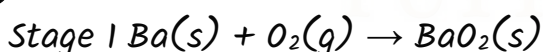
(a)

#### Method of separating hydrogen peroxide:

Fractional distillation (under reduced pressure)

(1)

(b)



One reason why nitric acid was eventually replaced by sulfuric acid in Stage 2 could be the insolubility of barium sulfate ( $\text{BaSO}_4$ ) formed during the chemical analysis.

Nitric acid is often used in analytical chemistry for precipitation reactions, but when barium sulfate forms, it is insoluble in water.

Sulfuric acid, is preferred because it reacts with the barium ions to form barium sulfate, which is also insoluble.

The advantage of using sulfuric acid is that the formed barium sulfate can be easily removed by filtration.

(1)

(c)

The OH stretching vibrations in both water and hydrogen peroxide overlap in their infrared spectra, making it difficult to differentiate and detect small amounts of water in hydrogen peroxide using infrared spectroscopy.

(1)

7.

(a)

Butan-2-ol belongs to Secondary or 2° (alcohol) class of alcohol.

(1)

(b)

The infrared spectrum is for butanone.

**Explanation:**

**Carbonyl (C=O) stretch:**

- This is a prominent peak in butanone's IR spectrum.
- It typically appears in the range of  $1700-1750\text{ cm}^{-1}$ .
- The presence of this peak confirms the presence of a ketone group (C=O bonded to two carbon atoms) in butanone.

**C-H stretches:**

- Peaks around  $2800-3000\text{ cm}^{-1}$  region are due to C-H stretching vibrations in the methyl and ethyl groups of butanone.

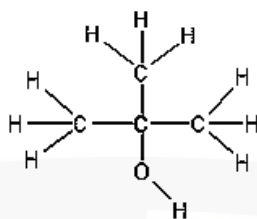
**No absorption in the range  $3230$  to  $3550\text{ cm}^{-1}$ :**

- Absence of peaks in this range suggests the absence of O-H (hydroxyl) stretching vibrations, consistent with the absence of an alcohol group.
- The lack of absorption or peak for an OH group also supports the identification of butanone.

(3)

(c)

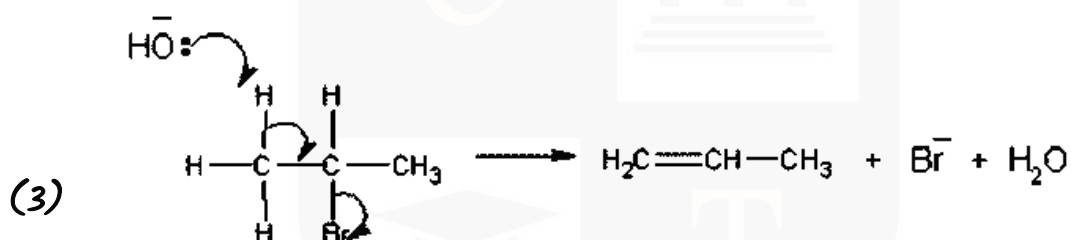
Displayed structure for 2-methylpropan-2-ol is which is resistant to oxidation by acidified potassium dichromate(VI).



(1)

8.

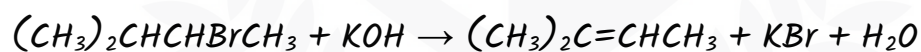
Mechanism for the elimination reaction (E1):



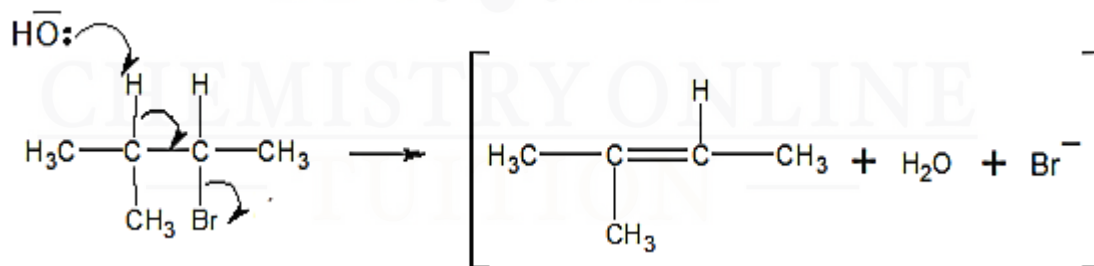
9.

(a)

Name: base Elimination



Mechanism:

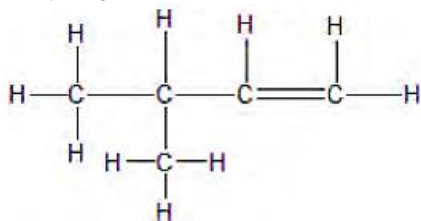


(4)

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(b)

Displayed formula for 3-methylbut-1-ene



(1)

(c)

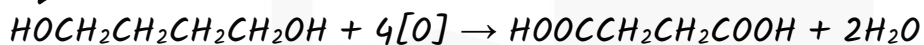
Type of structural isomerism: Positional isomerism

(1)

10.

Reagent: acidified potassium ( $\text{H}_2\text{SO}_4 / \text{K}_2\text{Cr}_2\text{O}_7$ )

Equation:



Butane-1,4-diol belongs to **primary alcohols**. In butane-1,4-diol, each carbon to which the hydroxyl groups are attached is a primary carbon, as they are each bonded to only one other carbon atom.

(3)

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**DR. ASHAR RANA**  
M.B.B.S / MS. CHEMISTRY



- Founder & CEO of Chemistry Online Tuition Ltd.
- Completed Medicine (M.B.B.S) in 2007
- Tutoring students in UK and worldwide since 2008
- CIE & EDEXCEL Examiner since 2015
- Chemistry, Physics, Math's and Biology Tutor

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## CONTACT INFORMATION FOR CHEMISTRY ONLINE TUITION

- UK Contact: 02081445350
  - International Phone/WhatsApp: 00442081445350
  - Website: [www.chemistryonlinetuition.com](http://www.chemistryonlinetuition.com)
  - Email: [asherrana@chemistryonlinetuition.com](mailto:asherrana@chemistryonlinetuition.com)
- Address: 210-Old Brompton Road, London SW5 OBS, UK