

Please write clearly in block capitals.

Centre number

--	--	--	--	--

Candidate number

--	--	--	--

Surname

Forename(s)

Candidate signature

I declare this is my own work.

INTERNATIONAL AS CHEMISTRY (9620)

Unit 2: Organic 1 and Physical 1

Tuesday 5 May 2026

08:00 UK Time

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- the Periodic Table/Data Sheet, provided as an insert
- a ruler with millimetre measurements
- a scientific calculator, which you are expected to use where appropriate.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 70.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

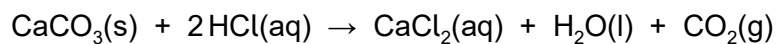


J U N 2 6 C H O 2 0 1

Answer **all** questions in the spaces provided.

0 1

CaCO_3 reacts with HCl



Experiments were done to investigate how the volume of gas produced changed when different concentrations of HCl were used.

Three experiments were done at the same temperature and pressure, each time with an excess of CaCO_3

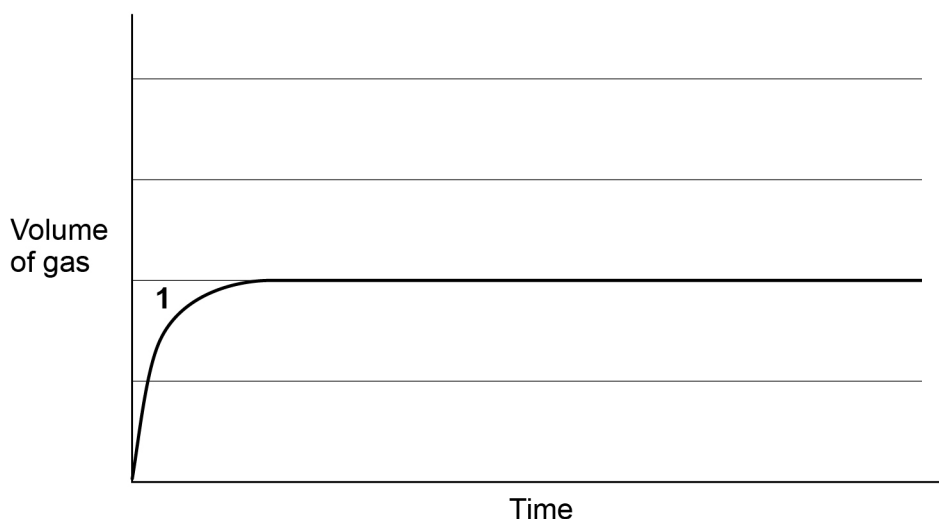
Table 1 shows the concentrations and volumes of HCl used.

Table 1

Experiment	Concentration of $\text{HCl}(\text{aq})$ / mol dm^{-3}	Volume of $\text{HCl}(\text{aq})$ / cm^3
1	0.278	30
2	0.238	70
3	0.0833	100

Figure 1 shows how the volume of gas changed over time with experiment 1.

Figure 1



0 1 . 1

Draw **two** lines on **Figure 1** to show how the volume of gas changed over time in experiments **2** and **3**.

Label each line with the correct experiment number.

[2 marks]

0 1 . 2

Draw an **X** on **Figure 1** to show the time when experiment **3** finished.

[1 mark]

0 1 . 3

Explain, in terms of collision theory, why a lower concentration of HCl gives a slower reaction with CaCO_3

[2 marks]

5

Turn over for the next question

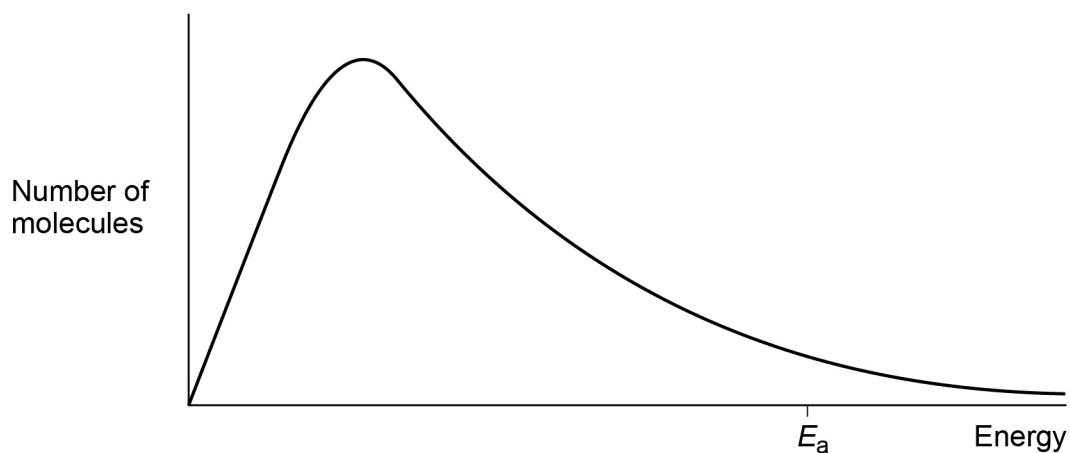
Turn over ►



0 2

Figure 2 shows the Maxwell–Boltzmann distribution curve for a mixture of gases.

Figure 2

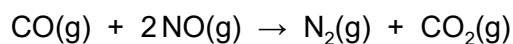


0 2 . 1

Explain why the curve never meets the x-axis even at high energy.

[1 mark]

E_a is the activation energy for the reaction between carbon monoxide and nitrogen monoxide.



0 2 . 2

The activation energy for the overall reaction changes when a catalyst is added.

Show on **Figure 2** the new activation energy for the reaction when the catalyst is added.

[1 mark]



0 2 . 3 State the effect of a catalyst on the rate of reaction.

Explain how a catalyst changes the activation energy.

[2 marks]

Effect on rate _____

Explanation _____

The reaction is repeated and the number of molecules of reactants is decreased at a constant temperature.

0 2 . 4 What is the effect, if any, on the area under the Maxwell–Boltzmann distribution curve if the number of molecules of reactants is decreased at a constant temperature?

Tick (✓) **one** box.

[1 mark]

The area increases.

☐

The area stays the same.

☐

The area decreases.

☐

0 2 . 5 What is the effect, if any, on the mean energy of the molecules if the number of molecules of reactants is decreased at a constant temperature?

Tick (✓) **one** box.

[1 mark]

The mean energy increases.

☐

The mean energy stays the same.

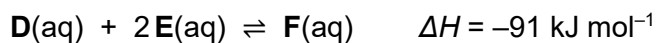
☐

The mean energy decreases.

☐


0	3
---	---

This question is about the equilibrium mixture produced when **D** and **E** react to form **F**.



0	3	.	1
---	---	---	---

1.2 mol of **D** and 1.5 mol of **E** are put in a sealed container and allowed to reach equilibrium at a given temperature.

The equilibrium mixture formed contains 0.40 mol of **F**.

Calculate the amount, in mol, of **D** in the equilibrium mixture.

Calculate the amount, in mol, of **E** in the equilibrium mixture.

[2 marks]

Amount of **D(aq)** _____ mol

Amount of **E(aq)** _____ mol



0 3 . 2 The expression for the equilibrium constant, K_c , when **D** and **E** react to form **F** is

$$K_c = \frac{[\text{F}]}{[\text{D}][\text{E}]^2}$$

Give the units.

[1 mark]

0 3 . 3 In a similar experiment, at the same temperature, the equilibrium mixture contains 0.30 mol of **D**, 0.35 mol of **E** and 0.45 mol of **F**.

The total volume of the reaction mixture is 250 cm³

Calculate the value of K_c at this temperature.

[2 marks]

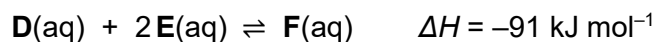
Value of K_c _____

Question 3 continues on the next page

Turn over ►



The equation for the equilibrium mixture is repeated here.



0 3 . 4

A different equilibrium mixture containing **D**, **E** and **F** is formed at the same temperature, in the presence of a catalyst.

State the effect, if any, of adding a catalyst on the value of K_c .

Explain your answer.

[2 marks]

Effect on K_c _____

Explanation _____

0 3 . 5

Another equilibrium mixture of **D**, **E** and **F** is formed at a higher temperature.

State the effect, if any, of the increase in temperature on the value of K_c .

Explain your answer.

[3 marks]

Effect on K_c _____

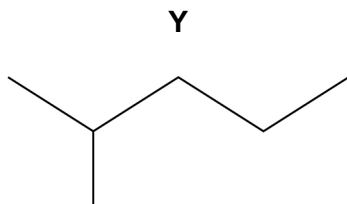
Explanation _____

10



0 4

In the presence of UV light, compound **Y** (C_6H_{14}) reacts with bromine in a free-radical substitution.



A mixture of products forms.

0 4 . 1

State the number of structural isomers with molecular formula $\text{C}_6\text{H}_{13}\text{Br}$ that can form in this reaction.

[1 mark]

0 4 . 2

$\text{C}_6\text{H}_{13}\text{Br}$ can react in a further substitution reaction to form $\text{C}_6\text{H}_{12}\text{Br}_2$

Write an equation to represent the initiation step in the mechanism.

Write the **two** propagation steps for this substitution.

[3 marks]

Initiation step

Propagation steps

1

2

 4

Turn over ►



0	5
---	---

Complete combustion of alkanes forms carbon dioxide and water.

0	5	.	1
---	---	---	---

In an experiment, 0.172 mol of an alkane burns to form 15.5 g of water.

Determine the molecular formula of the alkane.

[2 marks]

Molecular formula of alkane _____

Propanethiol ($\text{CH}_3\text{CH}_2\text{CH}_2\text{SH}$) burns completely to form carbon dioxide, water and sulfur dioxide.

0	5	.	2
---	---	---	---

Write an equation for the complete combustion of propanethiol.

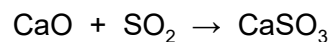
[1 mark]



0 5 . 3

Some propanethiol burns to form 2.11 kg of sulfur dioxide.

The sulfur dioxide is removed in a reaction with calcium oxide.



Calculate the mass, in g, of calcium oxide needed to remove this sulfur dioxide.
Give your answer to 3 significant figures.

[3 marks]

Mass of CaO _____ g

0 5 . 4

Give **one** environmental problem if sulfur dioxide is released into the atmosphere.

State why calcium oxide can be used to remove sulfur dioxide.

[2 marks]

Problem _____

Why calcium oxide is used _____

Turn over ►



There are no questions printed on this page

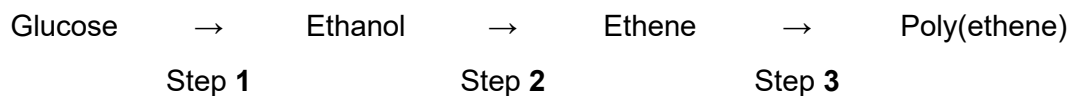
*Do not write
outside the
box*

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

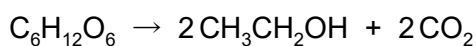


0 6

This question is about the formation of polyalkenes.

Poly(ethene) can be made from sugars such as glucose, $C_6H_{12}O_6$ **0 6 . 1**

In Step 1, glucose reacts to form ethanol.



Calculate the percentage atom economy for ethanol in this reaction.

[1 mark]

Percentage atom economy _____

0 6 . 2

Name the type of reaction occurring in Step 2.

Name the type of polymerisation in Step 3.

[2 marks]

Type of reaction in Step 2 _____

Type of polymerisation in Step 3 _____

0 6 . 3

Poly(ethene) is not biodegradable because it is unreactive.

Explain why poly(ethene) is unreactive.

[1 mark]

Question 6 continues on the next page**Turn over ►**

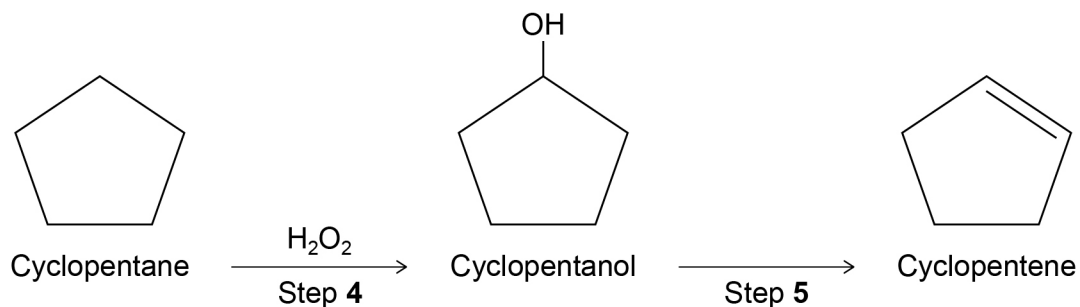
0 6 . 4 Non-renewable sources **cannot** be replaced after they are used.

Glucose is a renewable source of ethene and poly(ethene).

Name a non-renewable source of ethene and poly(ethene).

[1 mark]

Cyclopentane can be used to produce cyclopentene.



0 6 . 5 Cyclopentane can react with hydrogen peroxide (H₂O₂) to produce cyclopentanol and water in the presence of a catalyst and UV light.

Deduce an overall equation for the reaction in Step 4 using molecular formulas.

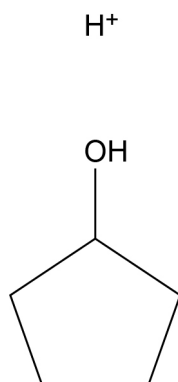
[1 mark]

0 6 . 6

In Step 5, cyclopentanol is heated with concentrated sulfuric acid to form cyclopentene.

Complete the mechanism for this reaction.

[3 marks]



0 6 . 7

Cyclopentene can form a polymer, poly(cyclopentene).

Draw the displayed formula of the repeating unit of poly(cyclopentene).

[1 mark]

Turn over for the next question

Turn over ►



0 7

This question is about isomers.

Pentanal has the molecular formula $C_5H_{10}O$

0 7 . 1

Draw the structures of two isomers of $C_5H_{10}O$ that belong to the same homologous series as pentanal.

[2 marks]**0 7 . 2**

Draw the structure of a functional group isomer of $C_5H_{10}O$ that has an absorption of $1680-1750\text{ cm}^{-1}$ on an infrared spectrum.

[1 mark]**0 7 . 3**

Name a reagent that will distinguish between pentanal and the functional group isomer you gave in Question **07.2**.

State the observation with pentanal.

[2 marks]

Reagent _____

Observation _____



But-1-ene has the molecular formula C_4H_8

0 7 . 4

Draw the skeletal formula of an isomer of but-1-ene that does **not** react with bromine.

[1 mark]

0 7 . 5

A position isomer of but-1-ene exists as a pair of stereoisomers.

Draw the Z-isomer.

Explain why this compound exists as a pair of stereoisomers.

[3 marks]

Explanation _____

9

Turn over ►



0 8

A student investigates the reactions of 1-chlorobutane, 1-bromobutane and 1-iodobutane.

Method

1. Place three test tubes containing 1 cm³ of ethanol in a warm water bath.
2. Add 3 drops of 1-chlorobutane, 1-bromobutane or 1-iodobutane to the separate test tubes containing the ethanol.
3. Add 1 cm³ of silver nitrate solution to each test tube and at the same time start a timer.
4. Record the time when each precipitate appears.

Table 2 shows the results of these experiments.

Table 2

Halogenoalkane	Time taken for precipitate to appear / s
1-chlorobutane	302
1-bromobutane	110
1-iodobutane	41

0 8 . 1

Explain the trend in time taken for the precipitates to appear.

[2 marks]

0 8 . 2

State the role of ethanol in these experiments.

[1 mark]



1-Bromobutane reacts with an excess of ammonia.

0 8 . 3

Figure 3 shows an incomplete mechanism for this reaction.

Complete **Figure 3** by adding curly arrows to Stage 1 **and** Stage 2.

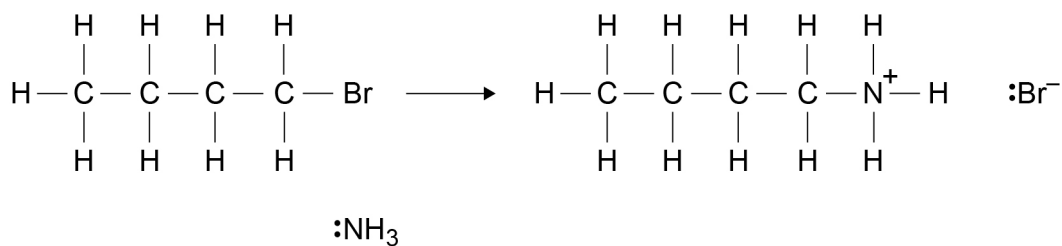
Name the organic product of Stage 2.

State the role of ammonia in Stage 1 **and** the role of ammonia in Stage 2.

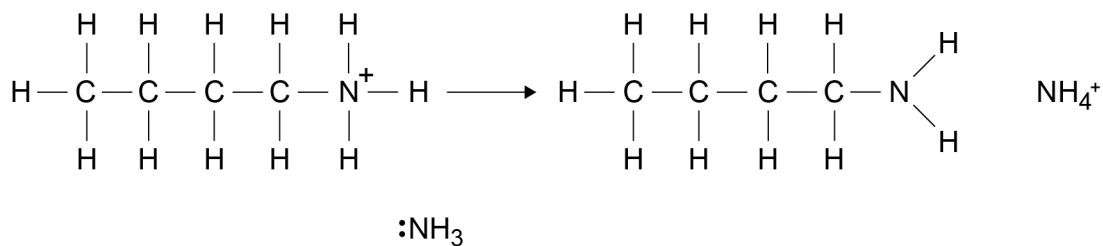
[5 marks]

Figure 3

Stage 1



Stage 2



Name of organic product _____

Role of ammonia in Stage 1 _____

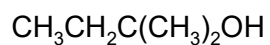
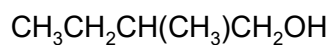
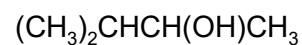
Role of ammonia in Stage 2 _____

8

Turn over ►



0 9

Alcohols **L**, **M** and **N** all have the molecular formula $C_5H_{12}O$ **L****M****N**

0 9 . 1

Give the IUPAC name for **L**.

[1 mark]

0 9 . 2

A student heats a mixture of **L**, **M** and **N** under reflux with an excess of potassium dichromate(VI) and **one** other reagent needed for the oxidation of some alcohols.

Identify the other reagent needed in the reaction.

[1 mark]

0 9 . 3

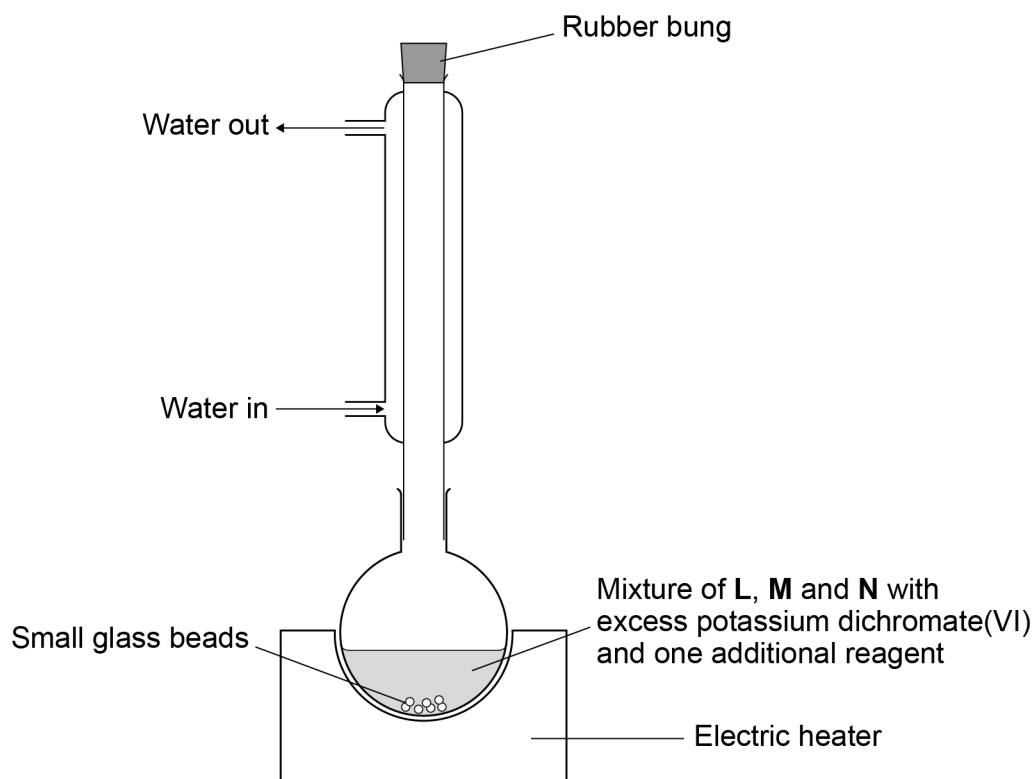
State the colour of the mixture after the potassium dichromate(VI) has reacted.

[1 mark]



The student suggests they could use the equipment in **Figure 4** to heat the mixture of alcohols **L**, **M** and **N** under reflux.

Figure 4



Suitable clamps are used to hold all the apparatus firmly in place.

0 9 . 4

Identify **one** error that the student has made with their equipment.

Explain why this error must be corrected.

[1 mark]

Error _____

Explanation _____

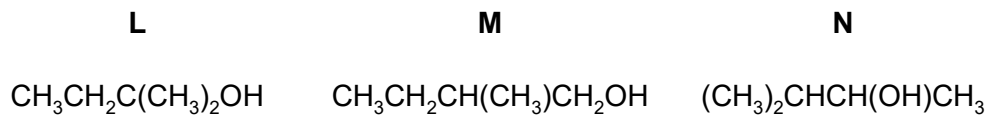
Question 9 continues on the next page

Turn over ►



After the error with the equipment has been corrected, the mixture of **L**, **M** and **N** in the flask is heated under reflux with an excess of potassium dichromate(VI) and one other reagent.

The structures of **L**, **M** and **N** are repeated here.



At the end of the reaction, **L** remains unreacted in the mixture, but **M** and **N** have reacted completely.

0 9 . 5

State why **L** remains unreacted in the mixture.

[1 mark]

0 9 . 6

The oxidation product of **M** has a higher boiling point than the oxidation product of **N**.

Explain why.

[3 marks]

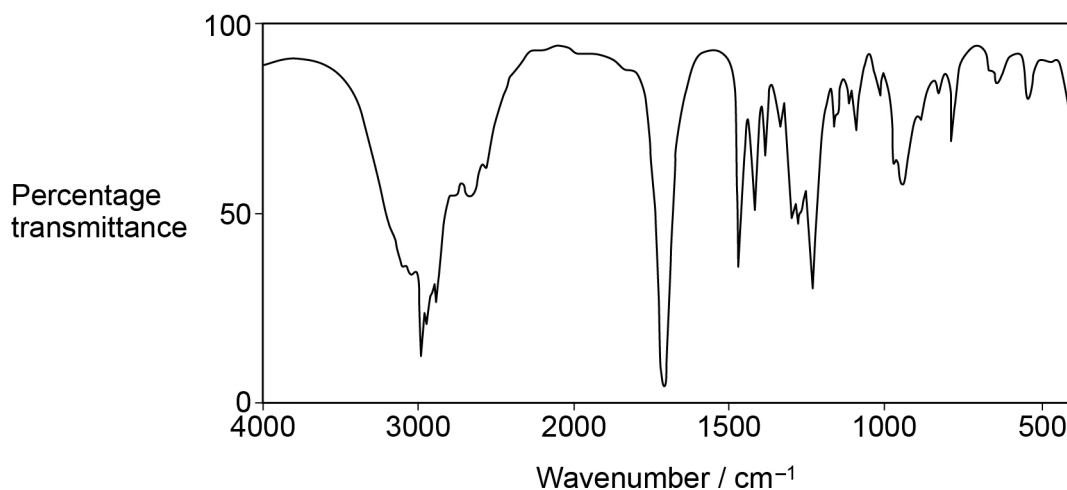


0 9 . 7

At the end of the reaction, the student uses infrared spectroscopy to investigate the three organic compounds in the mixture.

Figure 5 shows the infrared spectrum of one of these compounds.

Figure 5



The student concludes that the spectrum in **Figure 5** is for the oxidation product of **M** and is not for the unreacted **L**.

Explain why the student is correct.

Use **Figure 5** and **Table A** on the Chemistry Data Sheet.

[2 marks]

10

END OF QUESTIONS



There are no questions printed on this page

*Do not write
outside the
box*

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**



[illegible]

[illegible]

There are no questions printed on this page

*Do not write
outside the
box*

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

Copyright information

For confidentiality purposes, all acknowledgements of third-party copyright material are published in a separate booklet. This booklet is published after each live examination series and is available for free download from www.oxfordaqa.com

Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright-holders may have been unsuccessful and OxfordAQA will be happy to rectify any omissions of acknowledgements. If you have any queries please contact the Copyright Team.

Copyright © 2026 OxfordAQA International Examinations and its licensors. All rights reserved.



2 8



2 6 6 X C H 0 2

IB/G/Jun26/CH02