

Pearson Edexcel International Advanced Level

Tuesday 20 January 2026

Morning (Time: 1 hour 20 minutes)

Paper
reference

WCH13/01A

Chemistry

International Advanced Subsidiary/Advanced Level

UNIT 3: Practical Skills in Chemistry I

Question Paper

You must have:

Answer Book (sent separately)

Scientific calculator, ruler

Turn over ►

P87625A

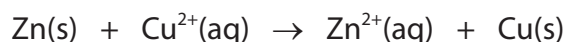
©2026 Pearson Education Ltd.
C:1/1/1/1/1/1/1/




Pearson

Answer ALL questions.

- 1** An experiment is carried out to determine the enthalpy change for the reaction between zinc and copper(II) sulfate solution.



Procedure

- weigh 4.4 g of zinc powder into a weighing bottle
- use a measuring cylinder to transfer 50.0 cm³ of 1.00 mol dm⁻³ aqueous copper(II) sulfate into a polystyrene cup, held in a 250 cm³ beaker
- stir the solution with a thermometer, record the temperature to the nearest 0.5 °C and start a timer
- continue to stir the solution, recording the temperature every minute
- at exactly 3.5 minutes, add the zinc powder to the aqueous copper(II) sulfate, stirring continuously
- record the temperature of the solution every minute, from 4.0 to 9.0 minutes.

The results are shown.

time / min	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
temperature / °C	21.5	22.5	22.0	22.0	58.0	63.0	62.5	61.0	59.5	58.0



- (a) (i) Plot a graph of temperature against time on the grid in the Answer Book. (1)
- (ii) Determine the maximum temperature change, ΔT , in this experiment using your graph.
You **must** show your working on the graph. (3)
- (b) (i) Show by calculation that zinc powder is in excess. (2)
- (ii) Calculate the energy transferred in the reaction in Joules.
Assume that the specific heat capacity of the solution is $4.2 \text{ J g}^{-1} \text{ }^{\circ}\text{C}^{-1}$. (1)
- (iii) Calculate the enthalpy change of the reaction, $\Delta_r H$, in kJ mol^{-1} , using your answers to (b)(i) and (b)(ii). (2)
- (c) Suggest **two** improvements in the experimental procedure that would improve the accuracy of the result, other than repeating the experiment or measuring the temperature more often.
Justify your answers. (2)

(Total for Question 1 = 11 marks)

2 Some tests are carried out on an inorganic compound **A**. Compound **A** is anhydrous and has one cation and one anion.

(a) Compound **A** gives a brick red colour in a flame test.
Give the formula of the **cation** present in compound **A**. (1)

(b) When a sample of compound **A** is placed in a test tube and heated, a brown gas is evolved.
(i) Identify, by name or formula, the brown gas. (1)

(ii) State why the sample of compound **A** should be heated in a fume cupboard. (1)

(iii) Identify, by name or formula, the **anion** present in compound **A**. (1)

(iv) Write an equation for the action of heat on compound **A**.
Include state symbols in your equation. (2)

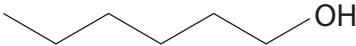
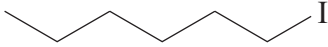
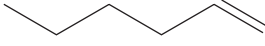
(c) Give the formula of another compound with the same anion as compound **A** that would produce the brown gas more quickly when heated at the same temperature.
You **must** justify your answer. (3)

(Total for Question 2 = 9 marks)

BLANK PAGE

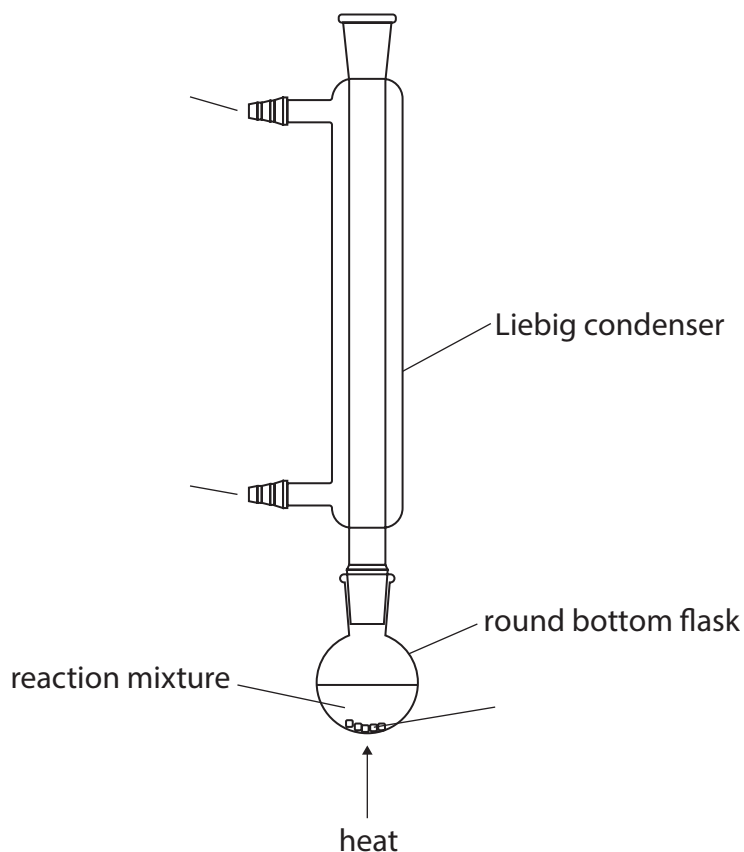


3 The skeletal formula of three organic compounds, **E**, **F** and **G**, are shown.

E	
F	
G	

- (a) Name compound **E** using IUPAC rules. (1)
- (b) Give a chemical test and its positive result to confirm the presence of the OH group in compound **E**. (2)
- (c) Give a chemical test and its positive result to confirm the presence of the iodine atom in compound **F**. (2)
- (d) A few drops of compound **G** are shaken with 2 cm³ of a dilute solution of acidified potassium manganate(VII).
- (i) State the colour change that occurs in this reaction. (1)
- (ii) Draw the **skeletal** formula of the organic product of this reaction. (1)
- (e) State the reagent and essential condition for the conversion of **F** to **G**. (2)

- (f) The apparatus used determine how far compound **E** is oxidised.
Oxidation of compound **E** is carried out using the apparatus shown.



- (i) Complete the labelling of this diagram in the Answer Book.
Assume that the apparatus is clamped appropriately. (2)
- (ii) Name the technique that is carried out using this apparatus. (1)
- (iii) Explain how the Leibig condenser works so that compound **E** is further oxidised. (3)
- (iv) Give the structural formula of the organic product of the further oxidation of compound **E**. (1)

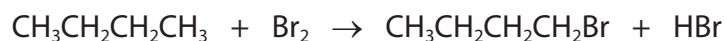
(Total for Question 3 = 16 marks)

4 There are two methods to form 1-bromobutane.

(a)

Method 1

React butane directly with bromine.



(i) Name the mechanism by which this reaction occurs. (1)

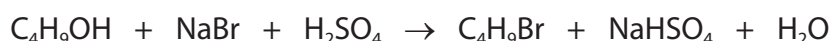
(ii) State the essential condition for **Method 1**. (1)

(iii) Give the reason why this method of making 1-bromobutane has limited use. (1)

(b)

Method 2

Butan-1-ol is heated with sodium bromide and 50% concentrated sulfuric acid.



The preparation is carried out in several stages

Stage 1 The reagents are heated under reflux for 45 minutes.

Stage 2 Impure 1-bromobutane is extracted from the reaction mixture, placed in a round bottomed flask and the mixture is distilled.

Stage 3 The distillate obtained, a mixture of 1-bromobutane and water, is transferred to a separating funnel, where it separates into two layers, an aqueous layer and a layer containing impure 1-bromobutane. The two layers are separated.

Stage 4 The impure 1-bromobutane is washed with concentrated hydrochloric acid to remove unreacted butan-1-ol and the resulting two layers are separated.

Stage 5 The 1-bromobutane layer from **Stage 4** is washed with sodium hydrogencarbonate solution and any gas formed is released.

Stage 6 The 1-bromobutane layer is collected in a conical flask and anhydrous calcium chloride is added.

Stage 7 The calcium chloride is filtered off and the filtrate is distilled again. Pure 1-bromobutane is collected.

Stage 8 The sample is weighed and the yield of the product calculated.



- (i) A diagram of the separating funnel used in Stage **3** is shown in the Answer Book.

Draw the 1-bromobutane layer and the aqueous layer on the diagram in the Answer Book. Include labels.

(1)

- (ii) State the purpose of the sodium hydrogencarbonate in Stage **5**.

(1)

- (iii) Describe the change in appearance of the 1-bromobutane layer due to the addition of anhydrous calcium chloride in Stage **6**.

(1)

- (c) In a preparation using **Method 2**, 16.20 g of butan-1-ol was used and formed 19.24 g of 1-bromobutane.
The maximum theoretical mass of 1-bromobutane was calculated to be 30.0 g.

- (i) Calculate the percentage yield of 1-bromobutane.

(1)

- (ii) Suggest **two** reasons why the actual yield of 1-bromobutane was lower than the maximum theoretical yield.

(2)

- (d) Justify which of **Method 1** or **Method 2** has the higher atom economy.
No calculation is necessary.

(1)

- (e) An experiment is conducted to compare the relative rates of hydrolysis of the halogenalkanes 1-bromobutane, 1-iodobutane and 2-bromo-2-methylbutane.

- A black cross is drawn on a test tube 2 cm from the bottom
- 1 cm³ of the halogenoalkane is added to the test tube
- 2 cm³ of ethanol is added and the test tube placed in a water bath at 50°C
- 5 drops of aqueous AgNO₃ are added and a timer started
- The black cross is observed through the mixture and the time taken for the cross to disappear is recorded.

- (i) Give the reason for the addition of ethanol to each halogenoalkane.

(1)

(ii) State the purpose of the black cross.

(1)

(iii) The results of the experiment are shown.

Halogenoalkane			
Time taken for precipitate to form / s	72	56	4

Complete the table in the Answer Book by writing the correct halogenoalkane above each time taken.

The three halogenoalkanes to choose from are:

1-bromobutane

1-iodobutane

2-bromo-2-methylpropane

(2)

(Total for Question 4 = 14 marks)

TOTAL FOR PAPER = 50 MARKS



BLANK PAGE



BLANK PAGE



Please check the examination details below before entering your candidate information

Candidate surname					Other names				
Centre Number					Candidate Number				

Pearson Edexcel International Advanced Level

Tuesday 20 January 2026

Morning (Time: 1 hour 20 minutes)

Paper reference **WCH13/01A**

Chemistry

International Advanced Subsidiary/Advanced Level

UNIT 3: Practical Skills in Chemistry I

Answer Book

You must have:

Question paper (sent separately)

Scientific calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 50.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*
- You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, including your use of grammar, punctuation and spelling.
- A Periodic Table is printed on the back cover of this paper.

Advice

- Read each question carefully before you start to answer it.
- Show all your working in calculations and include units where appropriate.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

P87632RA

©2026 Pearson Education Ltd.
C:1/1/1/1/



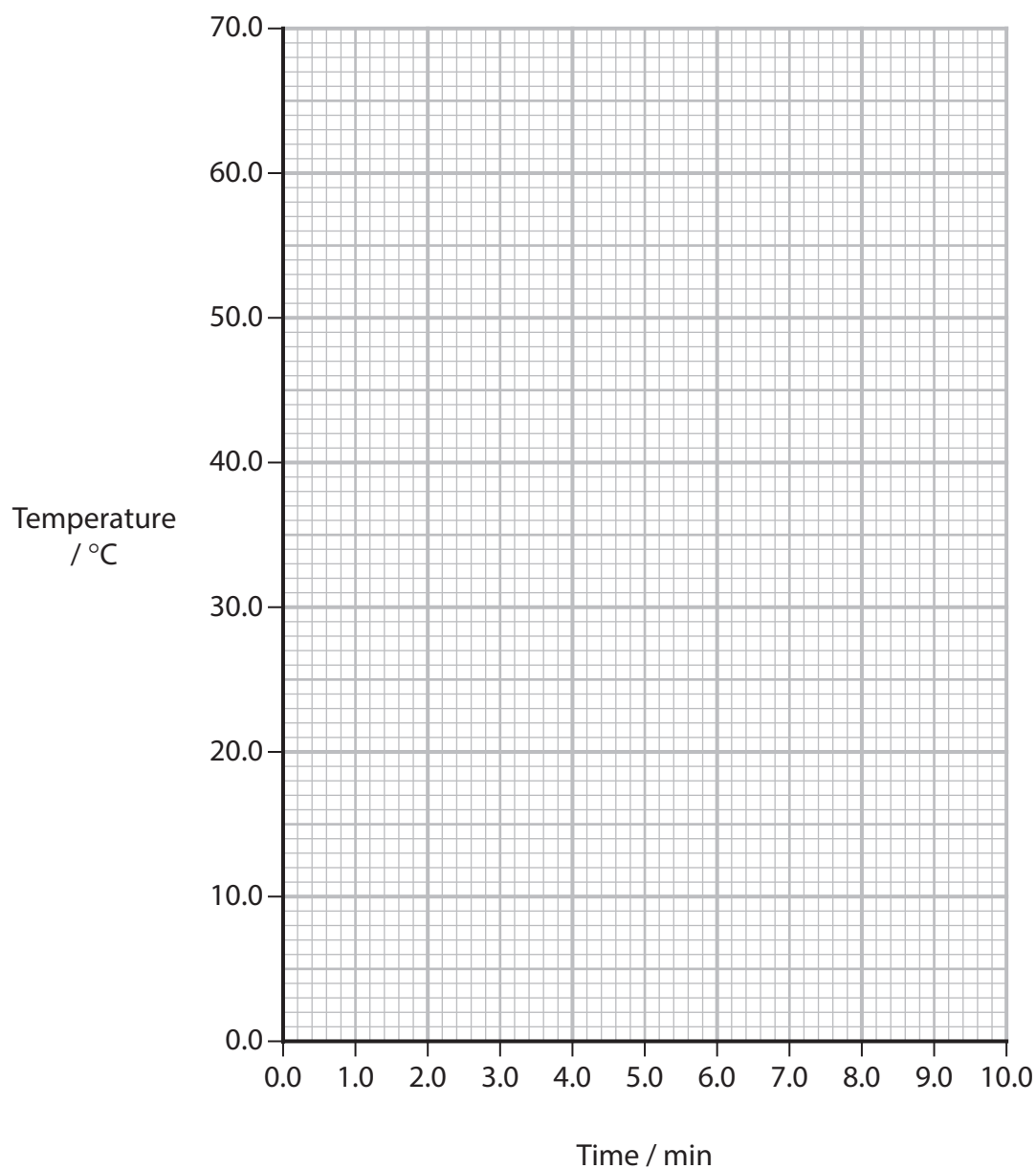

Pearson

Answer ALL questions. Write your answers in the spaces provided in the answer book.

1

(a) (i)

(1)



2



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(ii)

(3)

$\Delta T = \dots\dots\dots$ °C

(b) (i)

(2)

(ii)

(1)

(iii)

(2)

$\Delta H_r = \dots\dots\dots$ kJ mol⁻¹

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



P 8 7 6 3 2 R A 0 3 1 6

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(c)

(2)

.....

.....

.....

.....

.....

.....

(Total for Question 1 = 11 marks)



DO NOT WRITE IN THIS AREA

2

(a) (1)

(b) (i) (1)

(ii) (1)

(iii) (1)

(iv) (2)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(c)

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for Question 2 = 9 marks)



3

(a)

(1)

(b)

(2)

Test

Positive result

(c)

(2)

Test

Positive result

(d)

(i)

(1)

From to



(ii)

(1)

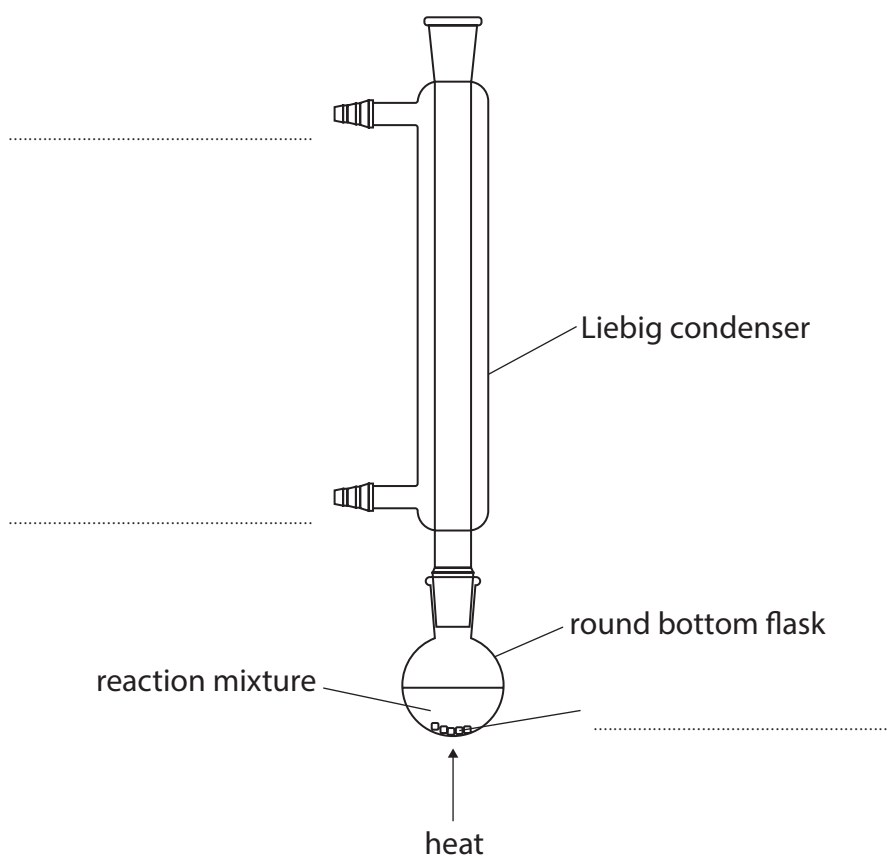
(e)

(2)

(f)

(i)

(2)



(ii)

(1)



(iii)

(3)

.....

.....

.....

.....

.....

(iv)

(1)

(Total for Question 3 = 16 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



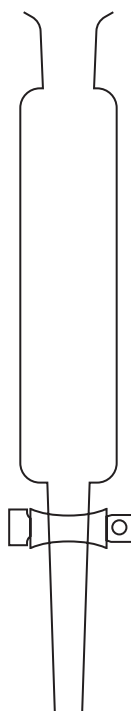
4

(a) (i) (1)

(ii) (1)

(iii) (1)

(b) (i) (1)



(ii)

(1)

(iii)

(1)

(c)

(i)

(1)

(ii)

(2)

(d)

(1)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



(e)

(i)

(1)

(ii)

(1)

(iii)

(2)

(Total for Question 4 = 14 marks)**TOTAL FOR PAPER = 50 MARKS**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE



The Periodic Table of Elements

[illegible]

* Lanthanide series

* Actinide series

