Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CHEMISTRY **9701/05**

Paper 5 Practical Test

May/June 2004

1 hour 30 minutes

Candidates answer on the Question Paper.
Additional Materials: As listed in the Instructions to Supervisors.

READ THESE INSTRUCTIONS FIRST

Write your details, including practical session and laboratory where appropriate, in the boxes provided.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
You are advised to show all working in calculations.
Use of a Data Booklet is unnecessary.

SESSION
LABORATORY

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

For Examiner's Use	
1	
2	
TOTAL	

This document consists of **7** printed pages and **1** blank page.

BLANK PAGE

1 **FB 1** is zinc powder, Zn.

FB 2 is 0.8 mol dm^{-3} copper sulphate, $CuSO_4$.

You are required to determine the temperature and enthalpy changes for the following reaction.

$$Zn(s) + CuSO_4(aq) \longrightarrow Cu(s) + ZnSO_4(aq)$$

(a) Accurately weigh, to two decimal places, an empty weighing bottle. Place between 2.90 g and 3.00 g of **FB 1**, zinc powder, into the weighing bottle. Record your weighings in Table 1.1 below. If your balance has a Tare facility, do **not** use it.

Table 1.1 – Weighing of FB 1

mass of empty weighing bottle	/ g	
mass of weighing bottle + **FB 1**	/ g	
mass of weighing bottle + residual **FB 1**	/ g	
mass of **FB 1** placed in plastic cup	/ g	

[2]

(b) Place the plastic cup in the 250 cm^3 beaker provided and pipette 25.0 cm^3 of **FB 2** into the plastic cup.

Stir gently with the thermometer and take the temperature of the solution every half minute for 2½ minutes. Record the temperature readings in Table 1.2 overleaf on page 4.

At exactly 3 minutes, add the **FB 1** from the weighing bottle to the plastic cup.

Do not try to read the temperature at 3 minutes.

Stir the mixture thoroughly, and continue to stir and record the temperature every half minute from 3½ minutes to 15 minutes.

(c) Reweigh the weighing bottle and any residual zinc powder and record the mass in Table 1.1 above.

Table 1.2 – Temperature readings

time / min	*temperature / °C*	*time / min*	*temperature / °C*
0		8	
½		8½	
1		9	
1½		9½	
2		10	
2½		10½	
3		11	
3½		11½	
4		12	
4½		12½	
5		13	
5½		13½	
6		14	
6½		14½	
7		15	
7½			

[1] + [8]

(d) Plot a graph of temperature against time on the grid opposite. [3]

(e) Extrapolate the cooling section of your graph back to time = 3 minutes and read the corresponding temperature.

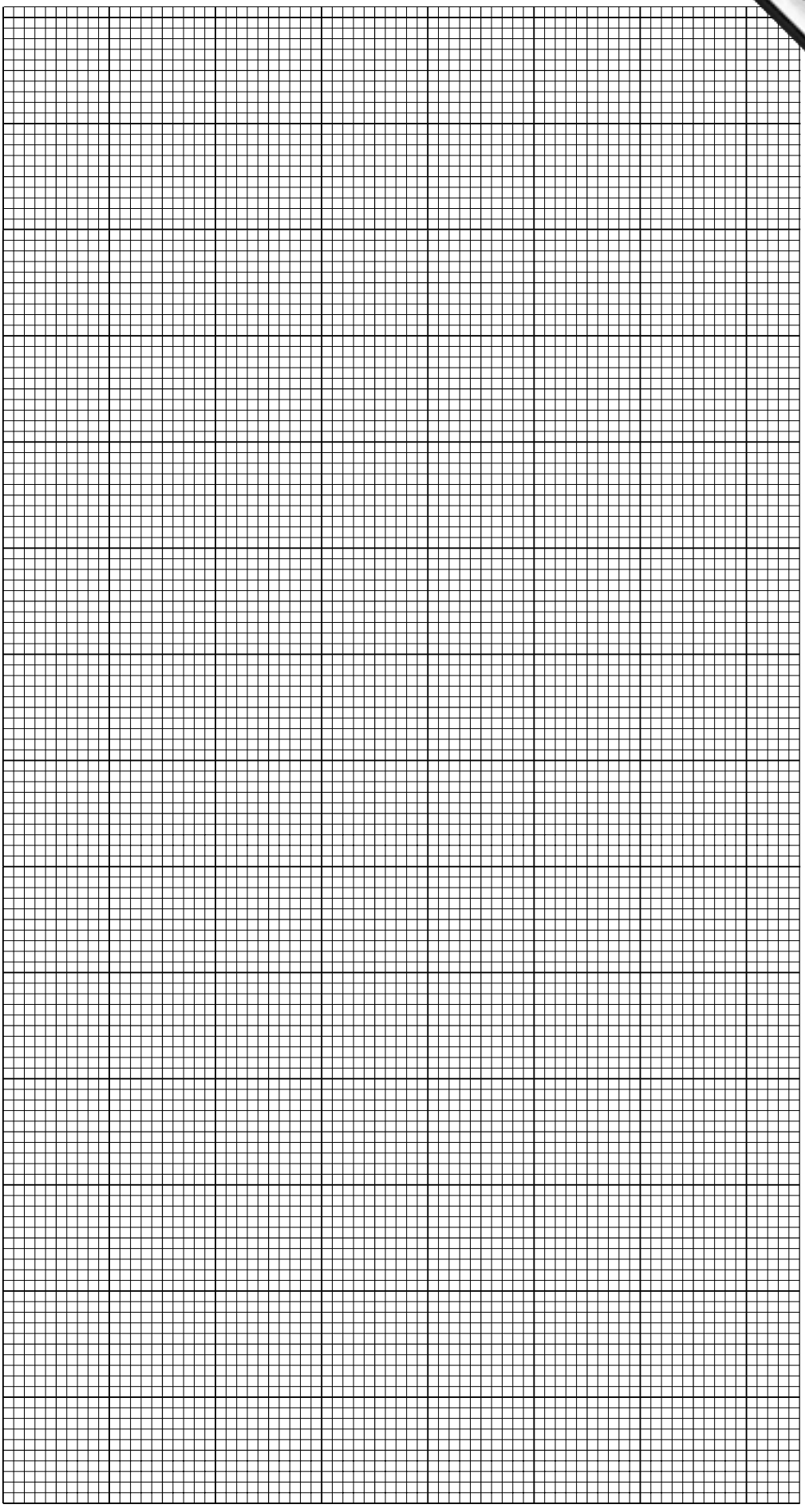
Estimated temperature = ... °C

Use this value to obtain the temperature change produced by the reaction.

Temperature change = ... °C

[1]

temperature / °C



(f) Calculate how many moles of zinc were added to the plastic cup.
[A_r: Zn, 65.4.]

[1]

(g) Calculate how many moles of copper sulphate, $CuSO_4$, were added to the plastic cup.

[1]

(h) Calculate the heat energy produced when the zinc is added to the aqueous copper sulphate in the plastic cup.
[You may assume that 4.3 J are required to raise the temperature of 1 cm^3 of any dilute solution by 1 °C.]

[1]

(i) Calculate the enthalpy change, ΔH, for the reaction. Include the sign and units in your answer.

$$Zn(s) + CuSO_4(aq) \longrightarrow Cu(s) + ZnSO_4(aq)$$

ΔH = ... [1]

[Total: 19]

2 ASSESSMENT OF PLANNING SKILLS

Lithium is an alkali metal – one of a group of very reactive metals which are stored under oil to prevent contact with air and water vapour.

The reaction of lithium with water can be represented by the equation below.

$$2Li(s) + 2H_2O(l) \longrightarrow 2LiOH(aq) + H_2(g)$$

(a) In the space below, draw a diagram that clearly shows the apparatus you could use to:

- react a weighed amount of lithium metal with water,
- collect the hydrogen gas produced,
- measure the volume of gas produced.

[2]

(b) What would you have to do before weighing lithium?

..... [1]

(c) Suggest and give a reason for one **safety** measure, related to the chemicals used or produced, that you would have to employ in conducting this experiment.

.....

..... [1]

(d) If 0.0583 g of lithium produces 100 cm^3 of hydrogen gas at room temperature and pressure show that the relative atomic mass, A_r, of lithium is approximately 7.
[V_m = 24 $dm^3 mol^{-1}$ under room conditions]

[3]

(e) Give **two** reasons why the value of A_r calculated in **(d)** is approximate.

.....

.....

..... [2]

(f) Using the aqueous lithium hydroxide remaining after the reaction, it is possible to obtain an 'accurate' value of A_r for lithium. What practical technique could be used to obtain this value?

..... [1]

(g) Explain why the method you have used in **(f)** will give you a more accurate result.

.....

.....

..... [1]

[Total: 11]