

# Metals

## Question Paper 3

<b>Level</b>	IGCSE
<b>Subject</b>	Chemistry
<b>Exam Board</b>	CIE
<b>Topic</b>	Metals
<b>Sub-Topic</b>	
<b>Paper Type</b>	Alternative to Practical
<b>Booklet</b>	Question Paper 3

**Time Allowed:** 48 minutes

**Score:** /40

**Percentage:** /100

- 1 A student investigated the reaction of dilute hydrochloric acid with two different solids, calcium carbonate (marble) and calcium oxide. Four experiments were carried out.

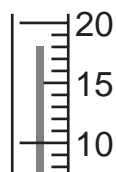
*Experiment 1*

By using a measuring cylinder, 50 cm<sup>3</sup> of dilute hydrochloric acid was poured into a polystyrene cup and the initial temperature of the acid was measured.

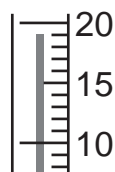
2.5 g of small marble chips were added to the cup and the mixture stirred with the thermometer.

The temperature of the mixture was measured after 2 minutes.

Use the thermometer diagrams to record the temperatures in the table of results on **page 6**.



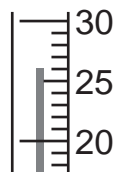
initial temperature/°C



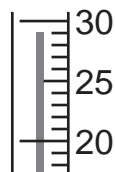
final temperature/°C

*Experiment 2*

Experiment 1 was repeated using 2.5 g of powdered calcium carbonate. Use the thermometer diagrams to record the results in the table.



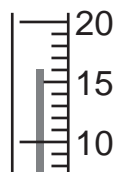
initial temperature/°C



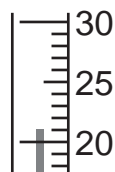
final temperature/°C

*Experiment 3*

Experiment 1 was repeated using 1.5 g of lumps of calcium oxide. Use the thermometer diagrams to record the temperatures in the table.



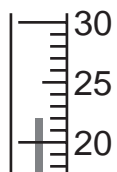
initial temperature/°C



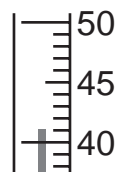
final temperature/°C

*Experiment 4*

Experiment 1 was repeated using 1.5g of powdered calcium oxide.  
Use the thermometer diagrams to record the results in the table.



initial temperature / °C



final temperature / °C

**Table of results**

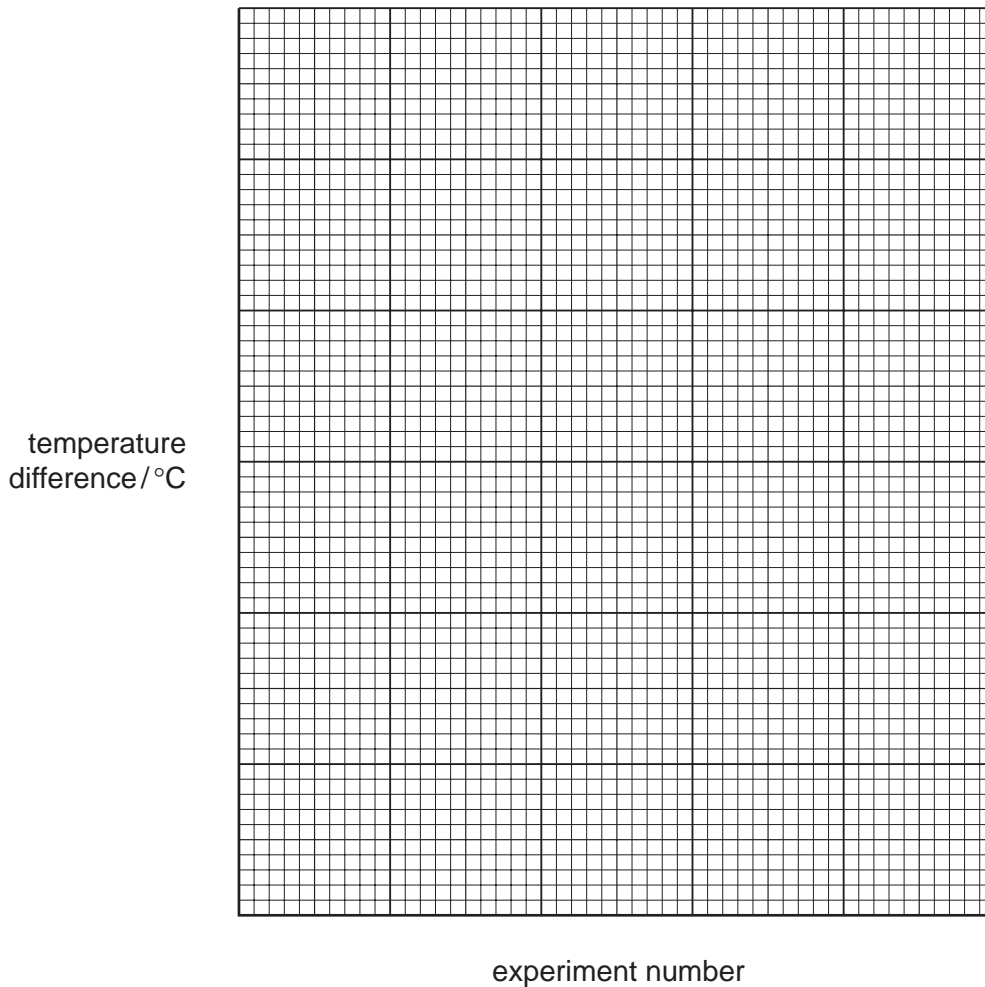
Experiment	temperature / °C		
	initial	final	difference
1			
2			
3			
4			

[4]

(a) What would be observed in Experiment 2?

..... [1]

(b) Draw a bar chart of the results of the experiments on the grid below.



[3]

(c) Which experiment produced

(i) the smallest temperature change,

..... [1]

(ii) the largest temperature change?

..... [1]

(d) Give two reasons why the temperature changes are different in (c).

1. ....  
.....

2. ....  
..... [2]

(e) In Experiment 1, how would you know which reactant is in excess? Explain your answer.

.....  
.....  
..... [2]

(f) Explain how the temperature changes would differ in the experiments if 100 cm<sup>3</sup> of hydrochloric acid were used.

.....  
.....  
..... [2]

[Total: 16]


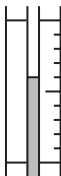
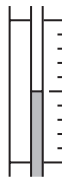



- 2 An investigation was carried out into the reactions of aqueous copper(II) sulphate with magnesium, iron and zinc.

Experiment 1

By using a measuring cylinder, 5 cm<sup>3</sup> of aqueous copper(II) sulphate was added to each of three test-tubes. The initial temperature of the solution was measured. Zinc powder was added to the first test-tube, iron powder to the second tube and magnesium powder to the third tube. The mixtures were stirred with the thermometer. All the observations were recorded and the maximum temperature reached measured.

(a) Use the thermometer diagrams to complete the results table.

Table of results

metal added	temperature of solution /°C				temperature difference /°C	observations
	initial		maximum			
zinc		.....		.....		moderate effervescence, solution paler, brown solid.
iron		.....		.....		little effervescence, brown solid.
magnesium		.....		.....		rapid effervescence, pops with lighted splint, brown solid.

[4]

(b) Use your results and observations to answer the following questions.

(i) Which metal is most reactive with aqueous copper(II) sulphate?

..... [1]

(ii) Give two reasons why you chose this metal.

1 .....

2 ..... [2]

(iii) Identify the gas given off when magnesium reacts with aqueous copper(II) sulphate.

..... [1]

- (c) The reactions of magnesium and zinc with aqueous copper(II) sulphate were investigated in more detail.

Experiment 2

By using a measuring cylinder  $10\text{ cm}^3$  of aqueous copper(II) sulphate was poured into a polystyrene cup. The initial temperature of the solution was measured.

A 1 g sample of magnesium powder was added to the cup and the temperature measured every 10 seconds for 1 minute.

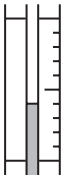
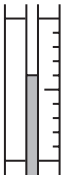

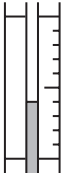
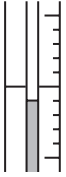
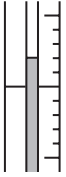
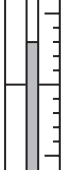
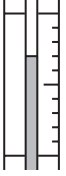
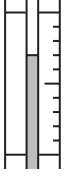
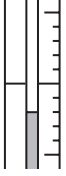
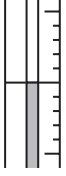
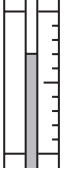


Use the thermometer diagrams on **page 8** to complete the results table.

Experiment 3

Experiment 2 was repeated using zinc powder instead of magnesium.

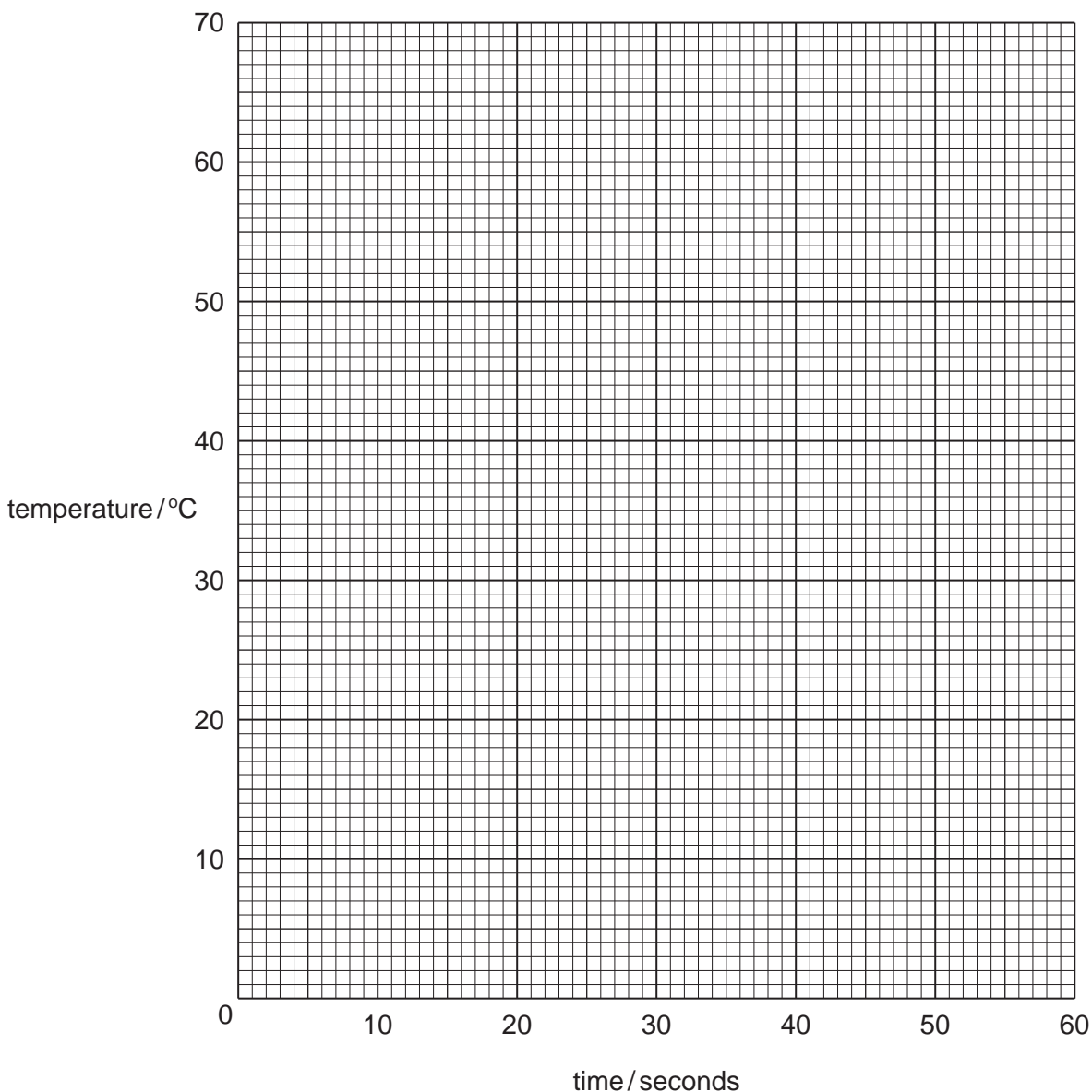
Use the thermometer diagrams on **page 8** to complete the results table.

Table of results

time / seconds	temperature / °C			
	Experiment 2		Experiment 3	
0		.....		.....
10		.....		.....
20		.....		.....
30		.....		.....
40		.....		.....
50		.....		.....
60		.....		.....



(d) Plot the results of both Experiments on the grid below. Draw two smooth line graphs. Clearly label the graphs.



[4]

(e) Use your graph to estimate the temperature of the reaction mixture in Experiment 2 after 5 seconds. Indicate clearly on the graph how you obtained your answer.

..... [2]

(f) Sketch lines on the grid to show the predicted results if Experiment 2 were repeated using:

(i) larger pieces of magnesium;

(ii) iron powder.

Clearly label the lines.

[2]

**(g)** Why is a polystyrene cup used instead of a glass container?

..... [1]

**(h)** Suggest one improvement to the method in Experiment 2.

..... [1]