

Metals

Question Paper 4

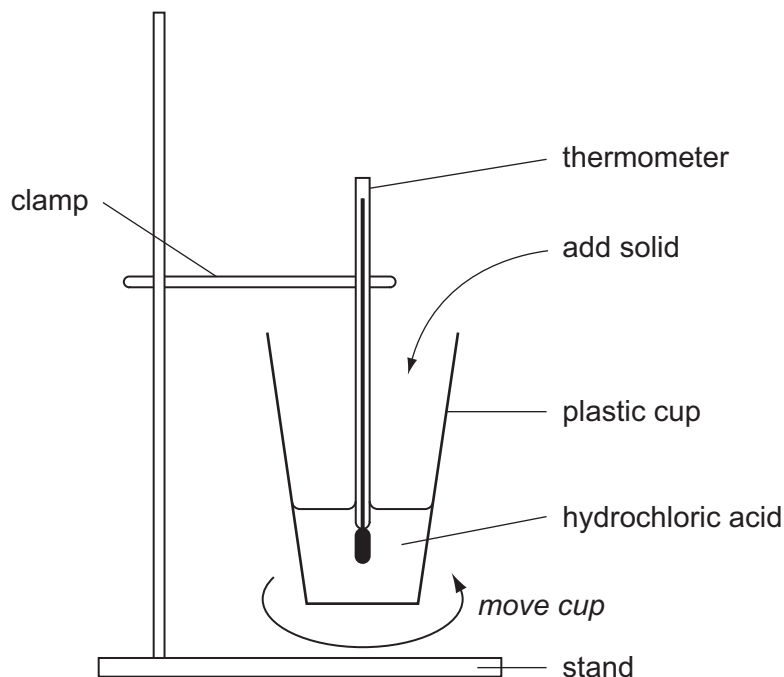
Level	IGCSE
Subject	Chemistry
Exam Board	CIE
Topic	Metals
Sub-Topic	
Paper Type	Alternative to Practical
Booklet	Question Paper 4

Time Allowed: 53 minutes

Score: /44

Percentage: /100

- 1 A student investigated the temperature changes that occur when two compounds **A** and **B**, react with hydrochloric acid. The apparatus below was used.



Experiment 1

By using a measuring cylinder, 30 cm³ of hydrochloric acid was added to the plastic cup.

Use the thermometer diagram to record the initial temperature of the acid in the table. The timer was started, and some of the solid **A** was added to the cup. Immediate effervescence occurred. The mixture was stirred by moving the cup until the fizzing stopped.

More of **A** was then added and the student continued adding **A** in this way until all of solid **A** had been added.

Use the thermometer diagrams to record the temperature of the mixture every half minute.

Experiment 2

Experiment 1 was repeated using solid **B**. Use the thermometer diagrams to record the temperatures in the table.

Table of results

Experiment 1

time/min	0.0	0.5	1.0	1.5	2.0	2.5
thermometer diagram						
temperature /°C						
	3.0	3.5	4.0	4.5	5.0	

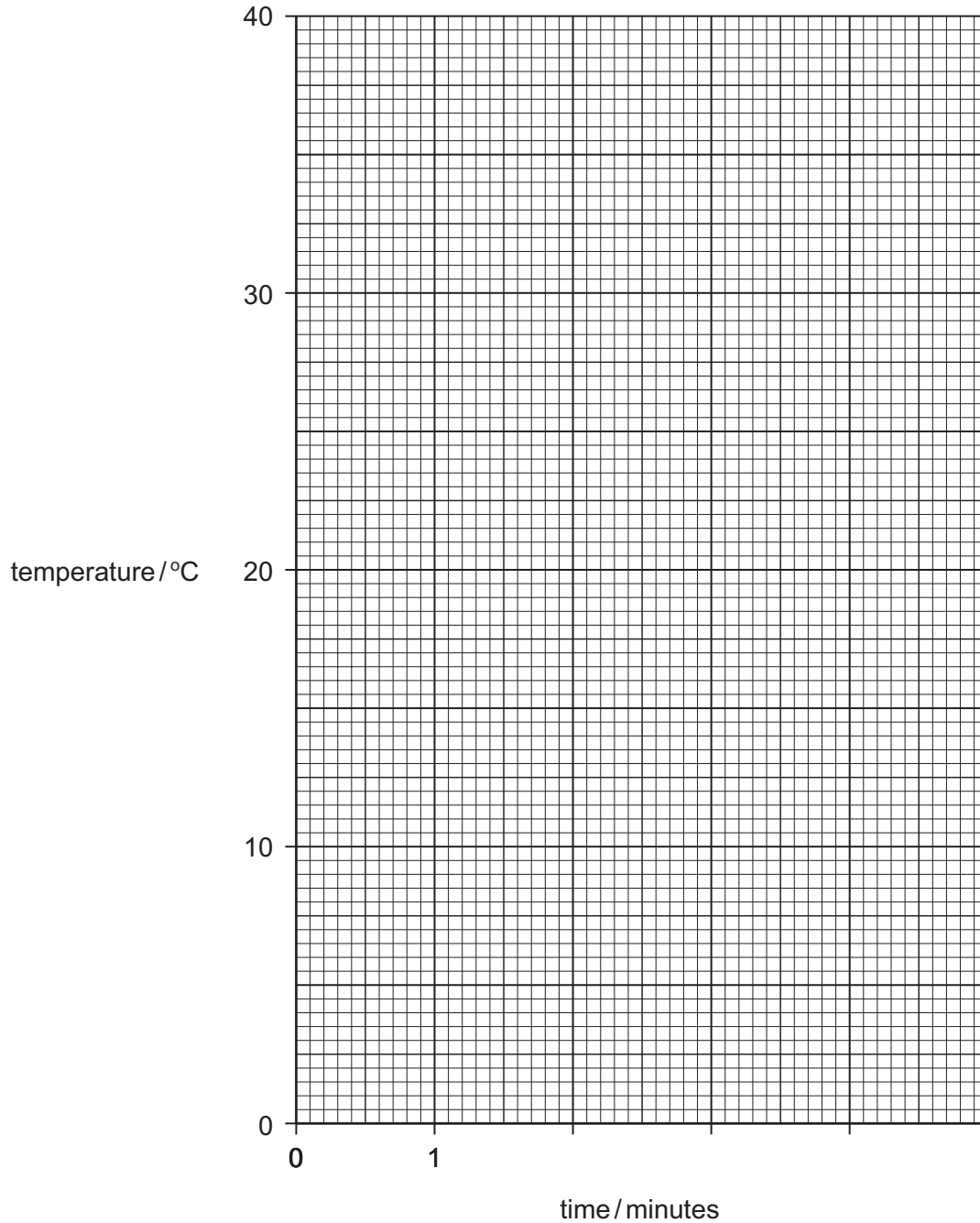
[2]

Experiment 2

time/min	0.0	0.5	1.0	1.5	2.0	2.5
thermometer diagram						
temperature /°C						
	3.0	3.5	4.0	4.5	5.0	

[2]

- (a) Plot the results from both experiments on the grid below. For each set of results draw a smooth line graph. Indicate clearly which line represents Experiment 1 and which line Experiment 2 [6]



(b) From your graphs;

- (i)** Find the temperature of the reaction mixture after the hydrochloric acid had reacted for 2 minutes 15 seconds with

solid **A**,

solid **B**. [2]

- (ii)** What type of chemical reaction occurs when

solid **A**,

solid **B**

reacts with hydrochloric acid? [2]

(c) Suggest what type of compound solids **A** and **B** are. Explain your answer

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

- (d)** If the plastic cup and final reaction mixture are left for one hour, predict the temperature at this time for

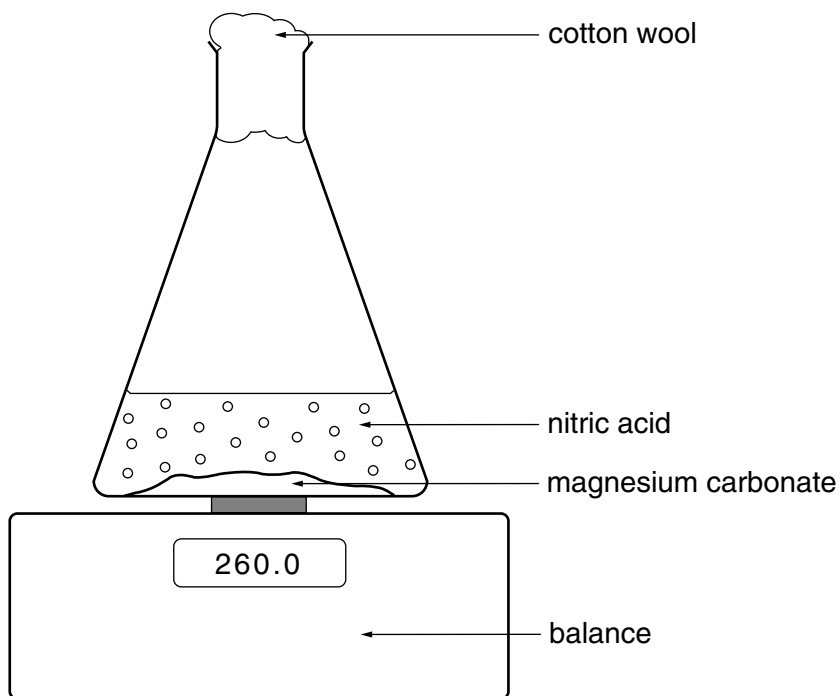
(i) solid **A** and hydrochloric acid,

(ii) solid **B** and hydrochloric acid.

Explain your answers.

.....
..... [3]

- 2 Dilute nitric acid was added to a large amount of magnesium carbonate in a conical flask as shown.

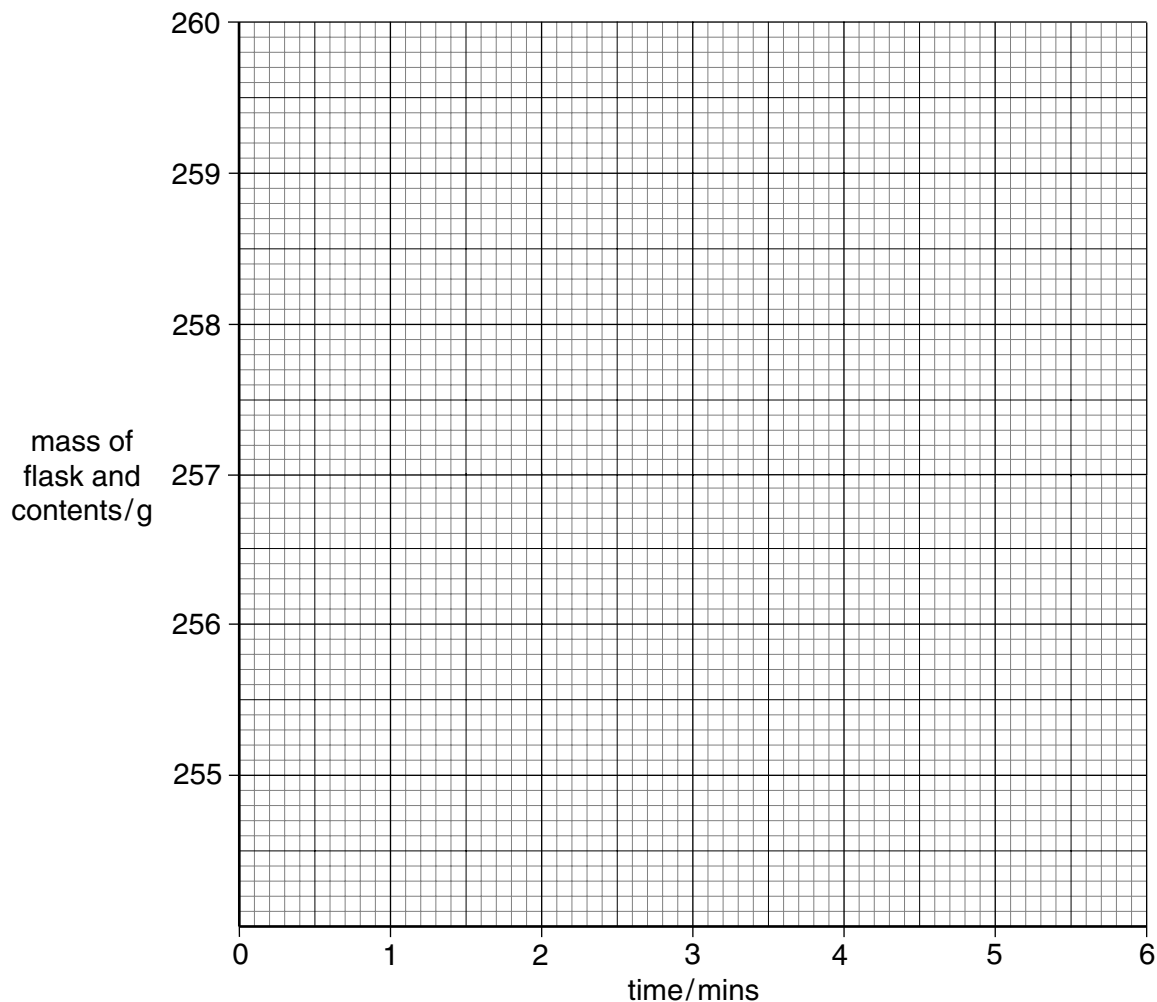


The flask was placed on a balance and the mass of the flask and contents recorded every minute. The results are shown in the table.

time / min	0	1	2	3	4	5	6
mass of flask and contents / g	260.0	257.9	256.8	256.6	255.8	255.6	255.6

- (a) Plot the results on the grid and draw a smooth line graph.

[3]



(b) Which result appears to be inaccurate? Why have you selected this result?

.....
[2]

(c) Why does the mass of the flask and contents decrease?

.....[1]

(d) Suggest the purpose of the cotton wool.

.....[1]

(e) At what time did the reaction finish?

.....[1]

(f) On the grid, sketch the graph you would expect if the experiment were repeated using nitric acid at a higher temperature. [2]

- 3 An investigation was carried out on the reactions of four different metals. Equal masses of copper, magnesium, iron and zinc were used.

Experiment 1

A 15 cm³ sample of dilute sulphuric acid was added to each of four boiling tubes. The initial temperature of the acid was measured. Zinc was added to the first tube, iron to the second tube, magnesium to the third tube and copper to the fourth tube.

The maximum temperature reached in each tube was measured and any observations were recorded in the table.

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

Table of results

metal added	temperature of acid/°C		temperature difference/°C	observations
	initial	maximum		
zinc				gas given off slowly
iron				gas given off very slowly
magnesium				gas given off rapidly: lighted splint pops
copper				no visible reaction

[6]

Use your results and observations to answer the following questions.

(i) Which metal is most reactive with sulphuric acid?

.....[1]

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

1.

2.[2]

(iii) Name the gas given off.

.....[1]

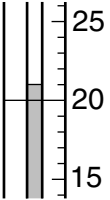
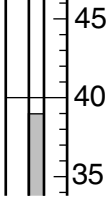
The reaction between magnesium and aqueous copper(II) sulphate was then investigated.

Experiment 2

A 5 cm³ sample of aqueous copper(II) sulphate was measured into a test-tube. The initial temperature of the solution was measured.

Magnesium powder was added to the test-tube and the maximum temperature reached was measured. Use the thermometer diagrams to complete the results table.

Table of results

initial temperature of aqueous copper(II) sulphate		
maximum temperature reached after magnesium added		

[2]

(b) How do your observations show that the reaction of magnesium with aqueous copper(II) sulphate is exothermic?

.....[1]

(c) What type of exothermic reaction occurs when magnesium is added to aqueous copper(II) sulphate?

.....[1]

(d) Use your results from Experiments 1 and 2 to put the four metals in order of reactivity.

least reactive

.....

.....

most reactive.....[1]