Rate(speed) of Reaction

Question Paper 1

Level	IGCSE
Subject	Chemistry
Exam Board	CIE
Topic	Chemical Reactions
Sub-Topic	Rate (speed) of Reactions
Paper Type	Alternative to Practical
Booklet	Question Paper 1

Time Allowed: **53 minutes**

Score: **/44**

Percentage: **/100**

1 A student investigated the rate of reaction between magnesium ribbon and four different solutions of dilute sulfuric acid, **A**, **B**, **C** and **D**. The sulfuric acid was in excess in all experiments.

Four experiments were carried out.

(a) *Experiment 1*

Using a measuring cylinder, 30 cm^3 of aqueous sulfuric acid **A** was poured into a beaker. The stop clock was started and a 4 cm length of magnesium was added to the sulfuric acid in the beaker. The mixture was stirred constantly. The time taken for all of the magnesium to react and disappear was measured.
The beaker was rinsed out with distilled water.

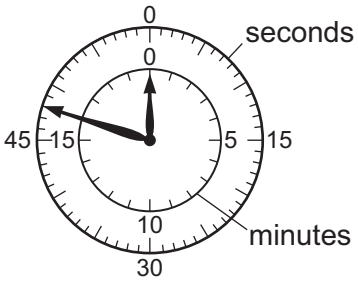
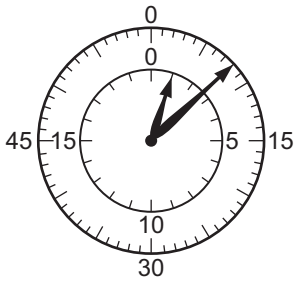
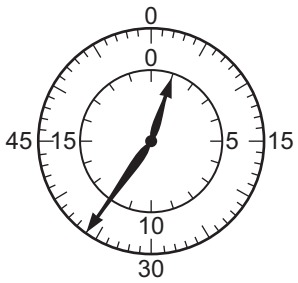
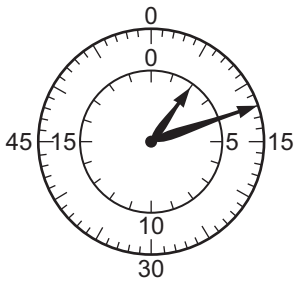
(b) *Experiment 2*

Experiment 1 was repeated using the solution **B** of sulfuric acid.

(c) *Experiments 3 and 4*

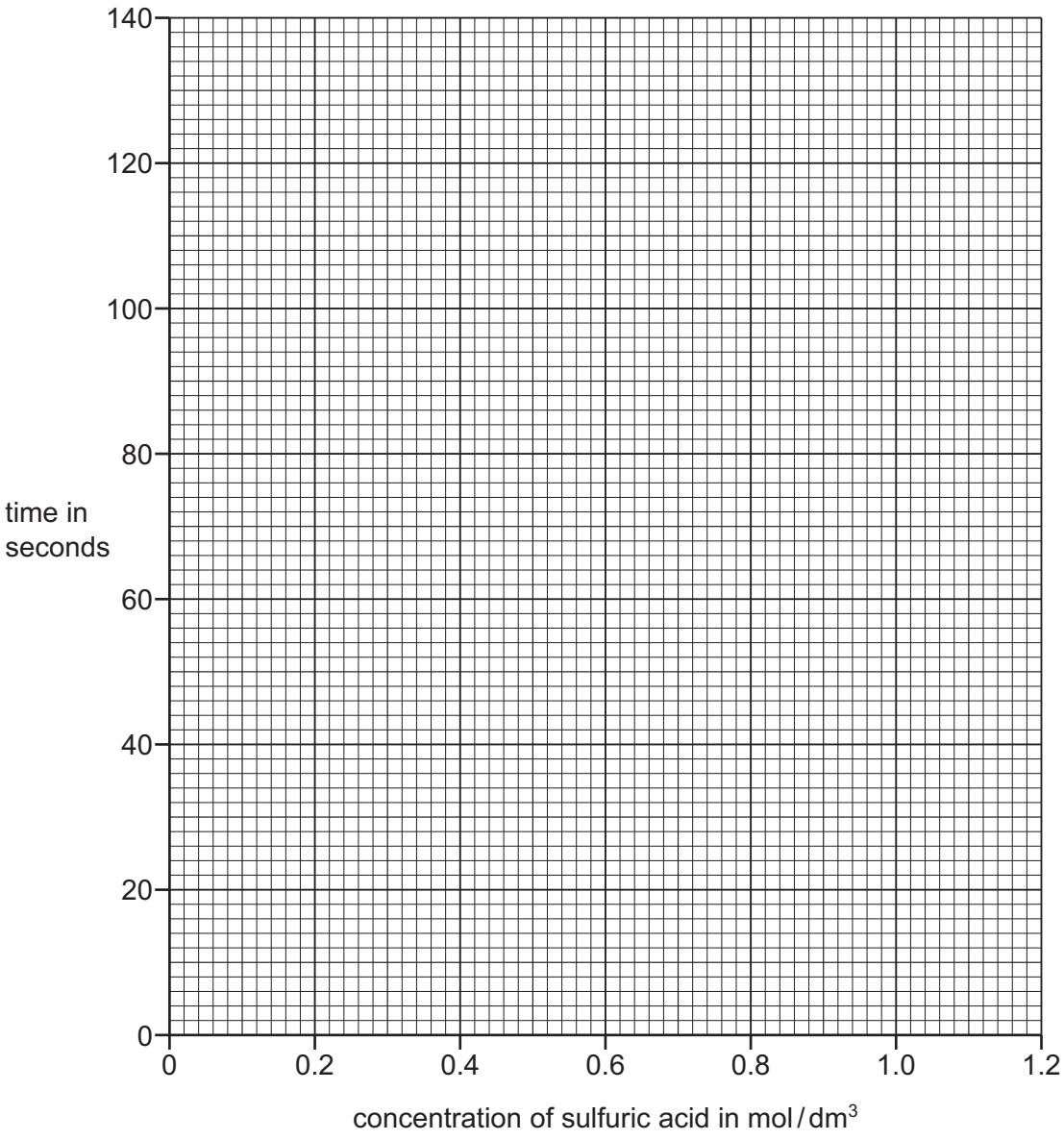
Experiment 1 was repeated, using the solutions **C** and **D** of sulfuric acid.

(d) Use the stop clock diagrams to record the times in the table.

Experiment number	concentration of sulfuric acid in mol / dm^3	stop clock diagram	time for magnesium to completely disappear in seconds
1	1.0		
2	0.8		
3	0.6		
4	0.5		

[4]

(e) Plot the results for Experiments 1, 2, 3 and 4 on the grid and draw a smooth line graph.



[3]

(f) (i) **From your graph**, deduce the concentration of the sulfuric acid if the time for the reaction was 80 s.
Show clearly **on the graph** how you worked out your answer.

..... mol / dm^3 [2]

(ii) **From your graph**, deduce how long the reaction would take if a solution of sulfuric acid of concentration 1.2 mol / dm^3 was used.
Show clearly **on the graph** how you worked out your answer.

..... s [2]

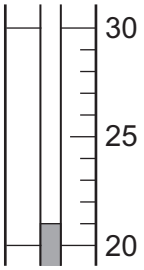
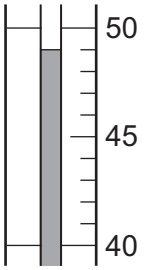
(g) Why was the same amount of magnesium used in Experiments 1, 2, 3 and 4?

..... [1]

(h) Another experiment was carried out.
A 4 cm length of magnesium ribbon was added to dilute sulfuric acid. The temperature of the solution was measured before and after the reaction. The observations were recorded and the gas given off tested.

Observations: Rapid effervescence and the tube felt hot. A lighted splint popped.

Use the thermometer diagrams to record the temperatures.

before addition of magnesium	temperature / °C	after addition of magnesium	temperature / °C
			

[2]

(i) **(i)** What type of chemical reaction occurred when magnesium reacted with sulfuric acid?

..... [1]

(ii) Identify the gas given off.

..... [1]

(iii) Suggest the effect on the temperature change if this experiment was repeated using 2 cm of magnesium ribbon.

.....

..... [2]

(j) Suggest a different method which could be used to investigate the rate of the reaction between magnesium and sulfuric acid. State the difference in the apparatus used and measurements to be taken.

apparatus .....

measurements .....

.....

..... [3]

[Total: 21]

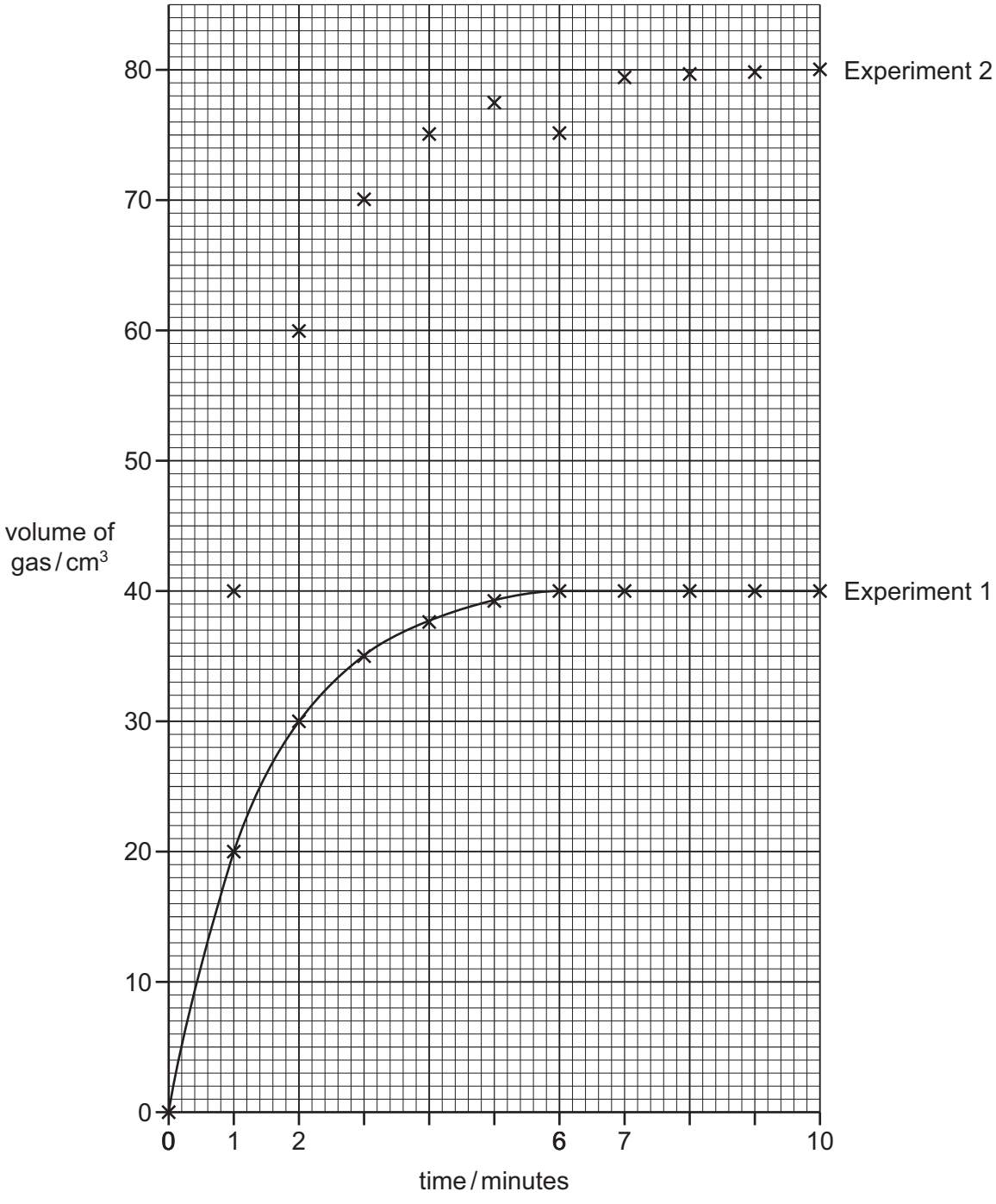
2 Two experiments were carried out to show what factors affect the rate of decomposition of hydrogen peroxide, H_2O_2.
In each experiment the volume of gas produced was measured every minute for ten minutes.

Experiment 1

The student used a mixture of 50 cm^3 of hydrogen peroxide, 50 cm^3 of water and 1 g of manganese(IV) oxide at a room temperature of 20 °C.
The results were plotted to obtain the graph shown.

Experiment 2

The student repeated Experiment 1 but did not record how much of each substance was used. The points were plotted on the grid.



(a) Complete the graph for Experiment 2. [1]

(b) Suggest the composition of the mixture used in Experiment 2. Explain your suggestion.

composition .....

.....

explanation .....

..... [4]

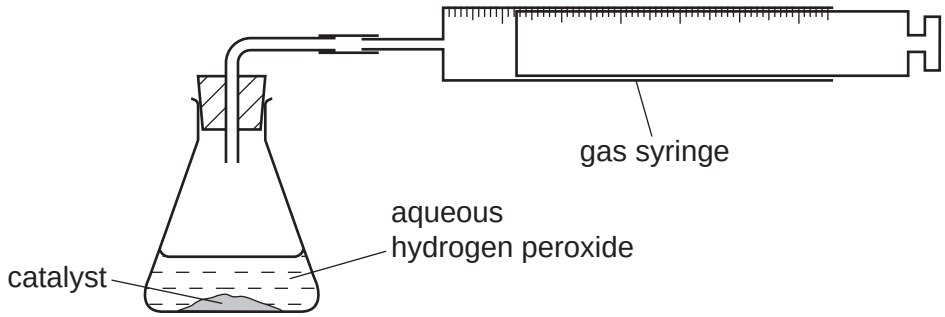
(c) What is the function of the manganese(IV) oxide?

..... [1]

(d) Sketch on the grid the curve that you would expect if Experiment 1 was repeated at 10 °C. [2]

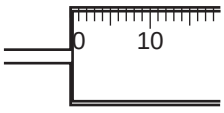
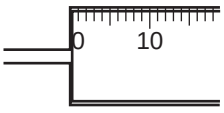
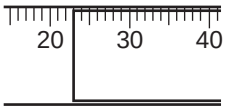
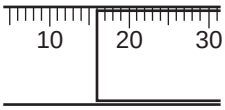
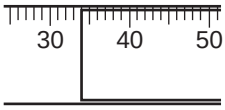
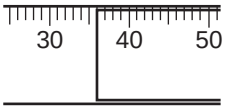
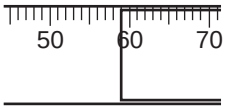
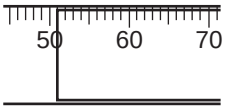
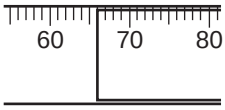
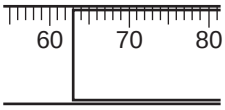
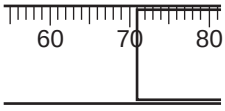
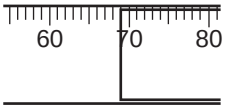
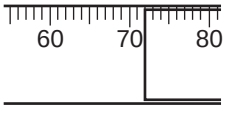
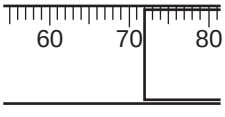
[Total: 8]

3 Two experiments using catalysts were carried out. Catalysts **R** and **S** were used to break down 50 cm^3 of aqueous hydrogen peroxide at a temperature of 20 °C. The volume of oxygen given off was measured using the apparatus shown.



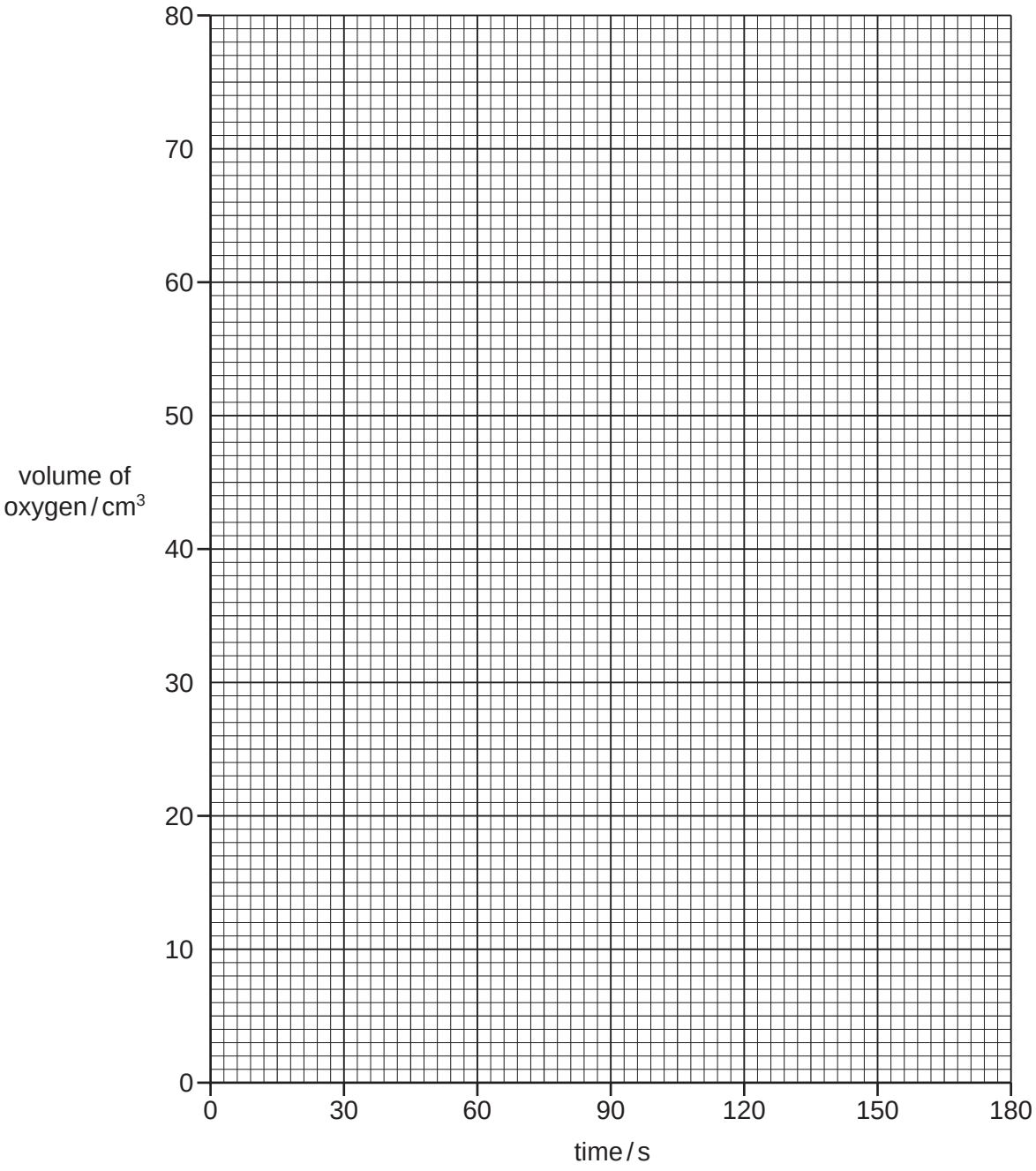
The gas syringe diagrams show the volume of oxygen formed every 30 seconds in each experiment.

(a) Use the syringe diagrams to complete the volumes in the table.

time / s	using catalyst **R**		using catalyst **S**	
	syringe diagram	volume / cm^3	syringe diagram	volume / cm^3
0				
30				
60				
90				
120				
150				
180				

[4]

(b) Plot a graph to show each set of results. Clearly label the graphs **R** and **S**.



[6]

(c) Which result using catalyst **R** was inaccurate?

..... [1]

(d) Which is the better catalyst in this reaction? Explain your answer.

.....

..... [2]

(e) Sketch a line on the grid to show the graph you would expect if the reaction with catalyst **R** was repeated at 50 °C. [2]

[Total: 15]