

GCSE Chemistry

Worksheet: Calculating rates of reactions

TIME 35 min	TOTAL 31 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Calculating rates of reactions

NAME

CLASS

DATE

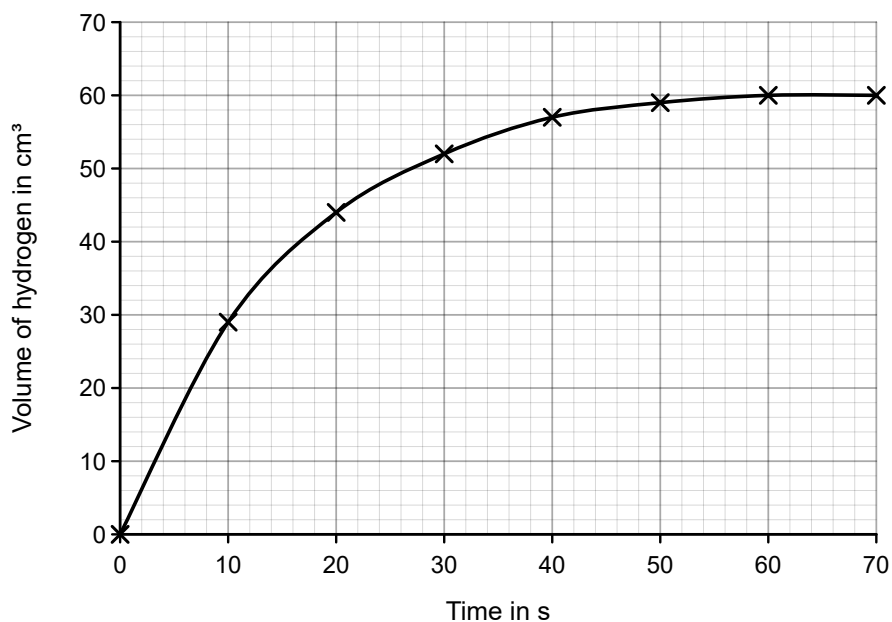
- Use black ink or black ball-point pen. Pencil should only be used for drawing.
 - Answer all questions in the spaces provided.
 - In all calculations, show clearly how you work out your answer.
 - The marks for questions are shown in brackets.
-

0 1

A student reacted magnesium ribbon with dilute hydrochloric acid and collected the hydrogen produced.

Figure 1 shows the results.

Figure 1



0 1 . 1

Use Figure 1 to find the volume of hydrogen collected in the first 20 s.

.....

.....

.....

Volume = cm³

[1 mark]

0 1 . 2

Calculate the mean rate of reaction in the first 20 s.

Use the equation:

mean rate of reaction = quantity of product formed ÷ time taken

.....

.....

.....

.....

Mean rate = cm³/s

[2 marks]

0 1 . 3

How does Figure 1 show that the reaction had stopped by 70 s?

.....

.....

[1 mark]

0 1 . 4

Which unit could be used for the rate of this reaction?

Tick (✓) **one** box.

cm³

☐

cm³/s

☐

s/cm³

☐

g/cm³

☐

[1 mark]

0 2

A student added magnesium ribbon to dilute hydrochloric acid and collected the hydrogen produced in a gas syringe.

Table 1 shows the results.

Table 1

Time in s	0	20	40	60	80	100	120
Volume of hydrogen in cm ³	0	35	50	57	60	61	62

0 2 . 1

Calculate the mean rate of reaction between 0 s and 40 s.

.....

.....

.....

.....

Mean rate = cm³/s

[2 marks]

0 2 . 2

Explain how the results show that the rate of reaction decreased during the experiment.

.....

.....

[1 mark]

0 3

A student added a small amount of manganese(IV) oxide to hydrogen peroxide solution and collected the oxygen produced in a gas syringe.

Table 2 shows the results.

Table 2

Time in s	0	20	40	60	80	100	120
Volume of oxygen in cm ³	0	23	36	42	45	47	48

0 3 . 1 Calculate the mean rate of reaction between 0 s and 20 s.

.....

.....

.....

.....

Mean rate = cm³/s

[2 marks]

0 3 . 2 Explain how the results show that the rate of reaction decreased during the experiment.

.....

.....

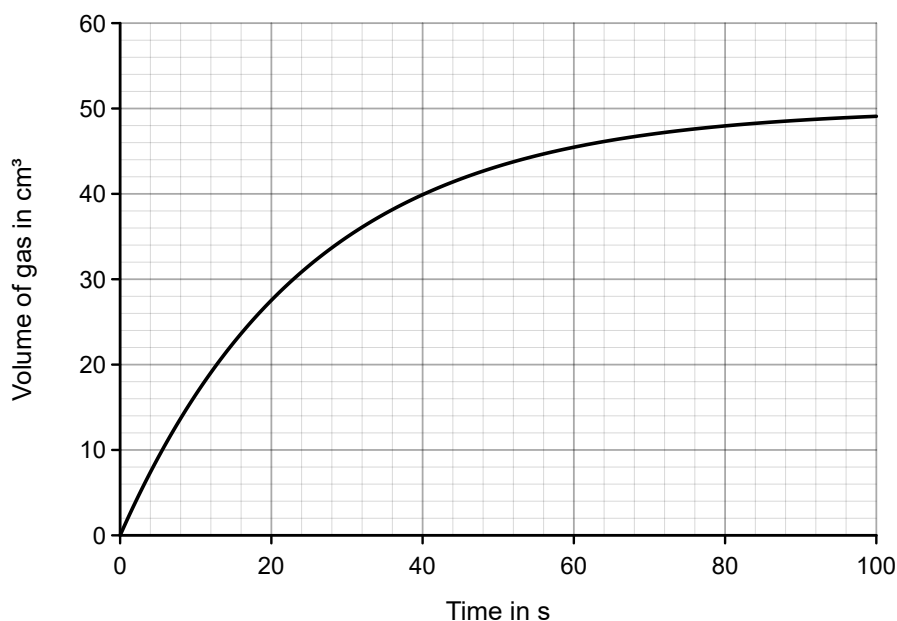
[1 mark]

.....

0 4

Figure 2 shows the volume of gas produced during a reaction.

Figure 2



0 4 . 1

During which time interval was the reaction fastest?

Tick (✓) **one** box.

0 s to 20 s

☐

20 s to 40 s

☐

60 s to 80 s

☐

80 s to 100 s

☐

[1 mark]

0 4 . 2

Explain how you can tell this from the graph.

.....

.....

[1 mark]

0 5

The mean rate of a reaction can be calculated using:

mean rate of reaction = quantity of reactant used or product formed ÷ time taken

0 5 . 1

A reaction produces 45 cm^3 of gas in 30 s.
Calculate the mean rate of reaction.

.....

.....

.....

Mean rate = cm^3/s

[1 mark]

0 5 . 2

In a different reaction, carbon dioxide is produced at a mean rate of 0.015 g/s .
Calculate the mass of carbon dioxide produced in 120 s.

.....

.....

.....

.....

Mass = g

[2 marks]

0 5 . 3

Which of these is a correct unit for the rate of a reaction?

Tick (✓) **one** box.

cm^3

cm^3/s

s/cm^3

s

☐

☐

☐

☐

[1 mark]

0 6

A student decomposed hydrogen peroxide solution using manganese(IV) oxide as a catalyst, and collected the oxygen produced in a gas syringe.

Table 3 shows the results.

Table 3

Time in s	0	15	30	45	60	75	90
Volume of oxygen in cm ³	0	22	36	44	48	49	49

0 6 . 1

Identify the time at which the reaction appears to have finished.

.....

.....

.....

Time = s

[1 mark]

0 6 . 2

Calculate the mean rate of reaction during the first 30 s.

.....

.....

.....

.....

Mean rate = cm³/s

[2 marks]

0 6 . 3

Explain why the rate of reaction was slower between 60 s and 75 s than between 0 s and 15 s.

.....

.....

.....

.....

[2 marks]

0 7

A student added magnesium ribbon to dilute hydrochloric acid and collected the hydrogen produced in a gas syringe.

Table 4 shows the results.

Table 4

Time in s	0	20	40	60	80	100	120
Volume of hydrogen in cm ³	0	38	56	65	70	72	73

0 7 . 1

Calculate the mean rate of reaction between 20 s and 40 s.

.....

.....

.....

.....

Mean rate = cm³/s

[2 marks]

0 7 . 2

Explain, in terms of particles, why the rate of reaction decreases as the reaction goes on.

.....

.....

.....

.....

[2 marks]

0 8

A student added excess calcium carbonate powder to 50 cm³ of dilute nitric acid in a flask on a balance, and recorded the total mass at intervals.

The mass of the flask and contents was 184.62 g at the start and 183.86 g after the reaction had finished.

0 8 . 1

Explain why the mass decreased during the reaction.

.....

.....

[1 mark]

0 8 . 2

The reaction took 240 s to finish.

Calculate the mean rate of reaction over this time.

Give your answer to 2 significant figures.

.....

.....

.....

.....

.....

Mean rate = g/s

[3 marks]

0 8 . 3

Suggest how the student could tell, without waiting and weighing, that carbon dioxide gas was still being produced.

.....

.....

[1 mark]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Chemistry · Worksheet: Calculating rates of reactions · 31 marks

Question 1 (5 marks)

01.1 [1 mark]

Answer: 44 cm^3

- $44 \text{ (cm}^3\text{) (1)}$

Notes: Allow 43 to 45.

01.2 [2 marks]

Answer: $2.2 \text{ cm}^3/\text{s}$

- $44 \div 20 \text{ (1)}$
- $2.2 \text{ (cm}^3/\text{s) (1)}$

Notes: Allow ECF from the previous part.

01.3 [1 mark]

Answer: The line is horizontal: no more hydrogen was produced.

- the line is horizontal / levels off (so no more hydrogen was produced) (1)
-

01.4 [1 mark]

Correct: cm^3/s

Question 2 (3 marks)

02.1 [2 marks]

Answer: $1.25 \text{ cm}^3/\text{s}$

- $50 \div 40 \text{ (1)}$
- $1.25 \text{ (cm}^3/\text{s) (1)}$

Notes: Allow 1.3.

02.2 [1 mark]

Answer: The volume of gas collected in each 20 s interval got smaller.

- the volume of gas produced in each 20 s interval gets smaller (the volume increases by less each time) (1)
-

Question 3 (3 marks)

03.1 [2 marks]

Answer: 1.15 cm³/s

- 23 ÷ 20 (1)
- 1.15 (cm³/s) (1)

Notes: Allow 1.2.

03.2 [1 mark]

Answer: The volume of gas collected in each 20 s interval got smaller.

- the volume of gas produced in each 20 s interval gets smaller (the volume increases by less each time) (1)
-

Question 4 (2 marks)

04.1 [1 mark]

Correct: 0 s to 20 s

04.2 [1 mark]

Answer: The curve is steepest (has the greatest gradient) during that interval.

- the curve is steepest / has the greatest gradient during that interval (1)
-

Question 5 (4 marks)

05.1 [1 mark]

Answer: 1.5 cm³/s

- 1.5 (cm³/s) (1)
-

05.2 [2 marks]

Answer: 1.8 g

- 0.015 × 120 (1)
 - 1.8 (g) (1)
-

05.3 [1 mark]

Correct: cm³/s

Question 6 (5 marks)

06.1 [1 mark]

Answer: 75 s

- 75 (s) (1)

Notes: Allow 'between 60 s and 75 s'.

06.2 [2 marks]

Answer: $1.2 \text{ cm}^3/\text{s}$

- $36 \div 30$ (1)
 - $1.2 \text{ (cm}^3/\text{s)}$ (1)
-

06.3 [2 marks]

Answer: The concentration of hydrogen peroxide had decreased, so there were fewer successful collisions per second.

- the concentration of hydrogen peroxide has decreased (as it is used up) (1)
 - so there are fewer successful collisions per second / a lower frequency of collisions (1)
-

Question 7 (4 marks)

07.1 [2 marks]

Answer: $0.9 \text{ cm}^3/\text{s}$

- $56 - 38 = 18 \div 20$ (1)
 - $0.9 \text{ (cm}^3/\text{s)}$ (1)
-

07.2 [2 marks]

Answer: The concentration of hydrochloric acid decreases as it is used up, so the particles collide less frequently.

- the concentration of the hydrochloric acid decreases as it is used up (1)
 - so there are fewer collisions per second (fewer successful collisions per second) (1)
-

Question 8 (5 marks)

08.1 [1 mark]

Answer: Carbon dioxide gas was produced and escaped from the open flask.

- carbon dioxide gas is produced and escapes from the (open) flask (1)
-

08.2 [3 marks]

Answer: 0.0032 g/s

- $184.62 - 183.86 = 0.76$ (g) (1)
- $0.76 \div 240$ (1)
- 0.0032 (g/s) (1)

Notes: An answer of 0.00317 (not to 2 significant figures) scores 2 marks.

08.3 [1 mark]

Answer: Bubbles (effervescence) would still be seen in the flask.

- bubbles / fizzing (effervescence) can still be seen in the flask (1)
-