AQA GCSE Chemistry

The rate and extent of chemical change · Higher tier

Questions only

The newest questions on the Higher papers, about an hour. All 8 are in the exam generator.

Questions	Total marks	Time allowed
5	**57**	**1 h**

Name _____ Class or teacher _____ Date _____

Instructions

- Answer all questions in the spaces provided.
- Use black ink. Show your working for every calculation.
- You may use a scientific calculator and the periodic table insert.
- Print the separate mark scheme when you are ready to mark your answers.

For marking

Q	Source	Marks	Score
1	2023 P2H Q1 / P2F Q8	10	
2	2023 P2H Q7	10	
3	2024 P2H Q7	8	
4	2024 P2H Q9	16	
5	2025 P2H Q8	13	

Total _____ / 57 **Percentage** _____ %

Questions from AQA GCSE past papers, 2023–2025, reproduced for revision. Practise these topics online, with instant marking:
`whiteboardchemistry.com/revision/gcse-chemistry/exam-questions?topics=c6-rates-equilibrium&demand=standard,high&len=0`

Questions

The rate and extent of chemical change · Higher tier · 5 questions · 57 marks · time allowed 1 h

Q1 · June 2023 · Paper 2 Foundation · Q8 · Paper 2 Higher · Q1 · [10 marks]

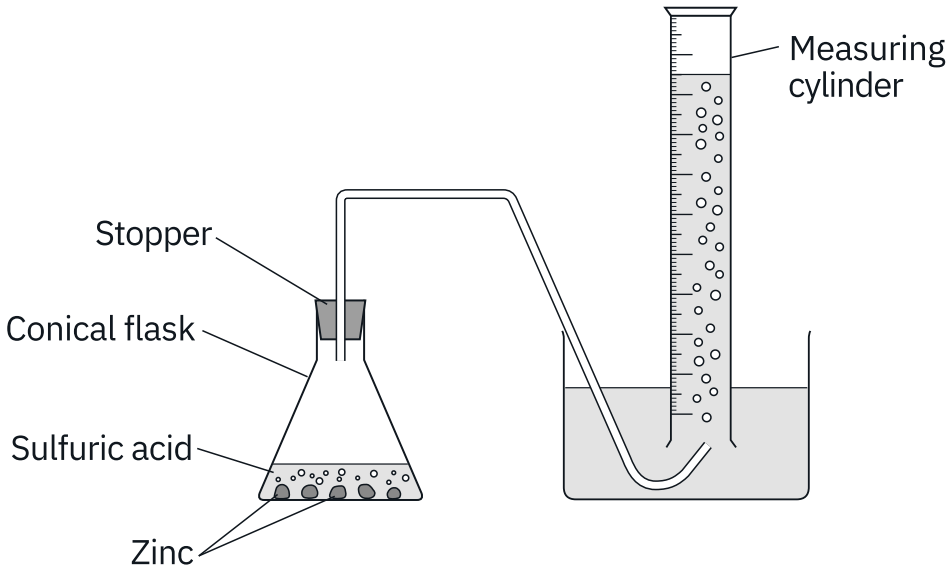
This question also needs Chemical analysis.

A student investigated the rate of the reaction between zinc and sulfuric acid.

Hydrogen gas is produced during this reaction.

Figure 7 shows the apparatus.

Figure 7



This is the method used.

1. Add 50 cm^3 of sulfuric acid to a conical flask.

2. Add 2.0 g of zinc to the conical flask.

3. Quickly put a stopper in the conical flask and start a timer.

4. Measure the time taken to collect 20 cm^3 of gas.

5. Repeat steps 1 to 4 three more times.

08.1 Suggest why the stopper must be put in the conical flask as quickly as possible in step 3.

[1 mark]

08.2 The student calculated the rate of the reaction for each trial.

Table 7 shows the results of the calculations.

Table 7

	Trial 1	**Trial 2**	**Trial 3**	**Trial 4**
Rate of reaction in cm^3/s	0.78	0.81	0.68	0.81

Determine the mean time taken to collect 20 cm^3 of gas.

Do **not** include any anomalous results.

Use the equation:

$$\text{mean rate of reaction} = \frac{\text{volume of gas collected}}{\text{mean time taken}}$$

Mean time taken = _____ s

[5 marks]

08.3 The student changed the investigation so that the mean time taken to collect 20 cm^3 of gas was greater.

Which **two** changes would increase the mean time taken to collect 20 cm^3 of gas?

Tick (✓) **two** boxes.

Use a catalyst	☐
Use a larger conical flask	☐
Use a lower temperature	☐
Use smaller pieces of zinc	☐
Use sulfuric acid of a lower concentration	☐

[2 marks]

08.4 Hydrogen gas is produced during this reaction.

Describe the test for hydrogen gas.

Give the result of the test.

[2 marks]

Test

Result

Q2 · June 2023 · Paper 2 Higher · Q7 · [10 marks]

This question also needs Quantitative chemistry.

Manganese dioxide catalyses the decomposition of hydrogen peroxide solution.

Oxygen and water are produced.

07.1 Explain how a manganese dioxide catalyst increases the rate of decomposition of hydrogen peroxide.

[2 marks]

07.2 A student investigated the rate of this reaction.

This is the method used.

1. Add 50 cm^3 of 2.0 mol/dm^3 hydrogen peroxide solution to a conical flask.

2. Add 1.0 g of manganese dioxide to the conical flask.

3. Place the conical flask on a balance and start a timer.

4. Record the total mass lost from the conical flask every 20 seconds for 180 seconds.

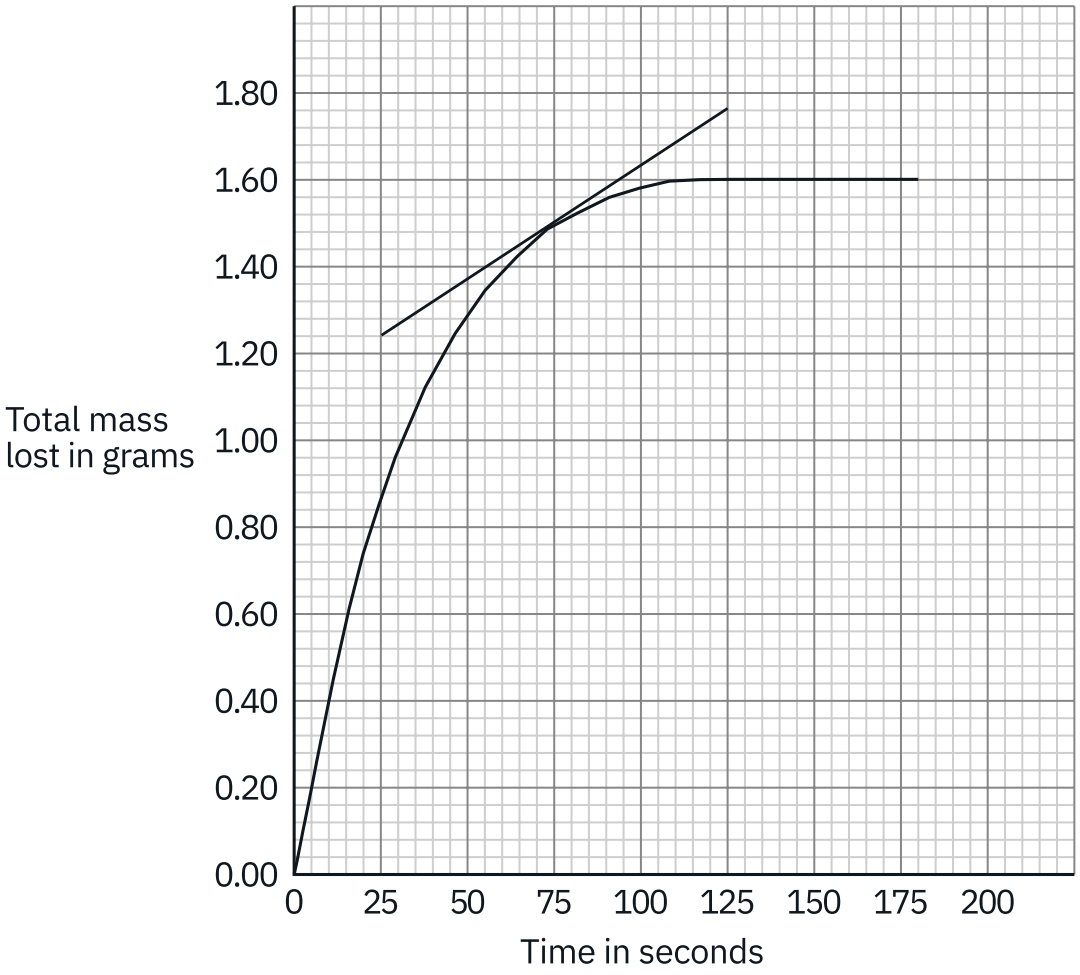
Explain why the mass of the conical flask and contents decreased.

[2 marks]

07.3 Figure 4 shows the results for 50 cm^3 of 2.0 mol/dm^3 hydrogen peroxide solution and 1.0 g of manganese dioxide.

A tangent to the line has been drawn at 75 seconds.

Figure 4



Determine the rate of reaction when the time was 75 seconds.

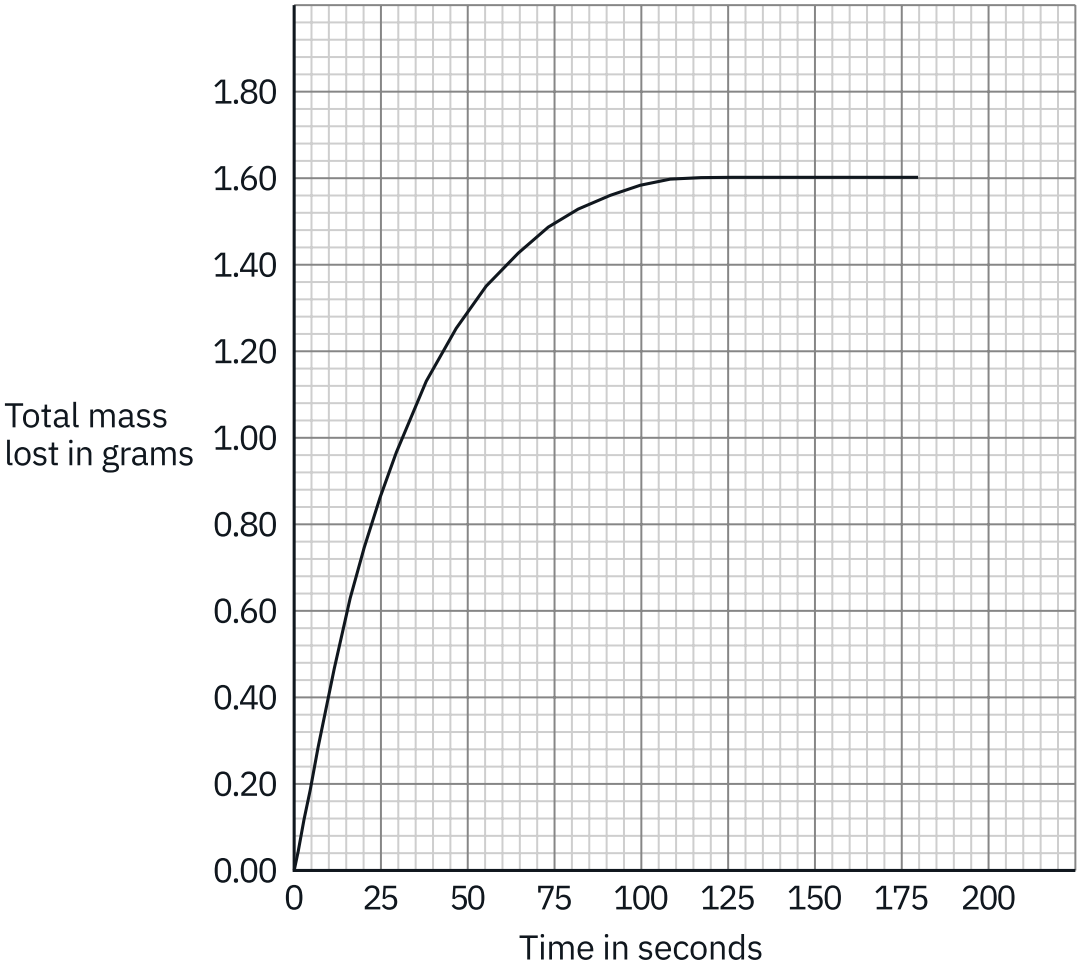
Give your answer to 2 significant figures.

Rate (2 significant figures) = _____ g/s

[4 marks]

07.4 The results for 50 cm^3 of 2.0 mol/dm^3 hydrogen peroxide solution and 1.0 g of manganese dioxide are shown again on Figure 5.

Figure 5



The student repeated the investigation using 50 cm^3 of 1.0 mol/dm^3 hydrogen peroxide solution and 1.0 g of manganese dioxide.

Sketch the expected results for 1.0 mol/dm^3 hydrogen peroxide solution on Figure 5.

[2 marks]

Q3 · June 2024 · Paper 2 Higher · Q7 · [8 marks]

This question also needs Atomic structure and the periodic table and Chemical analysis.

This question is about sulfuric acid.

07.1 Sulfuric acid contains sulfate ions.

Describe the test for the presence of sulfate ions in sulfuric acid.

Give the result of the test.

[2 marks]

Test

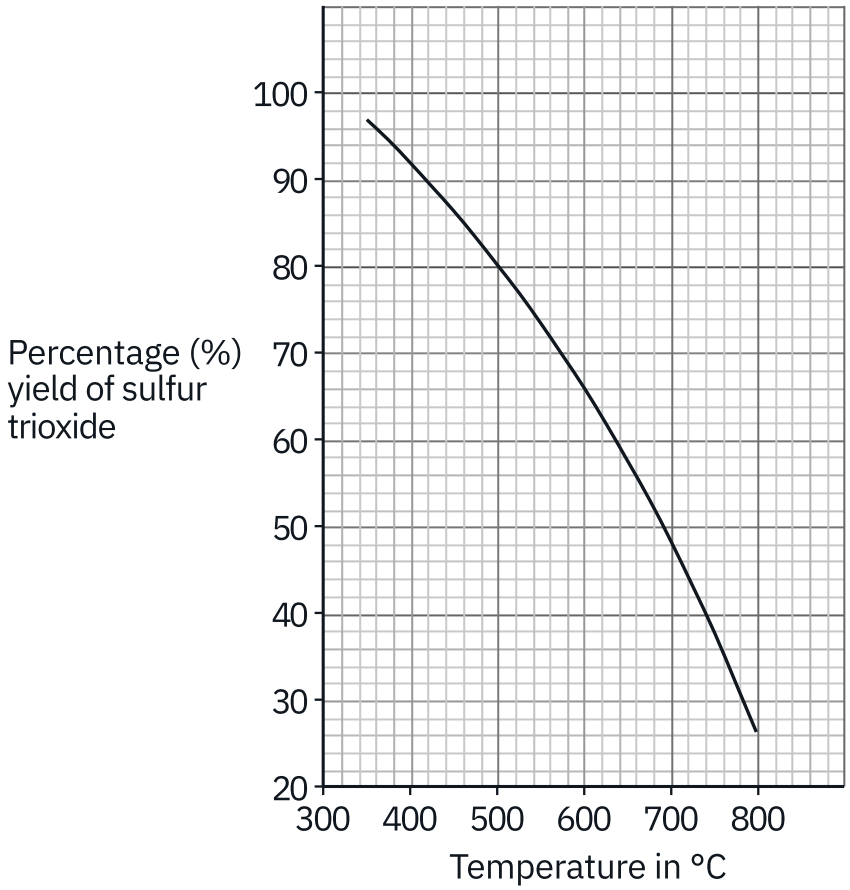
Result

07.2 One stage in the industrial production of sulfuric acid is the reaction of sulfur dioxide with oxygen to produce sulfur trioxide.

This reversible reaction reaches dynamic equilibrium.

Figure 7 shows the percentage yield of sulfur trioxide in this reaction at different temperatures.

Figure 7



Which statement about the forward reaction is correct?

Use Figure 7.

Tick (✓) **one** box.

The yield is greater at higher temperatures because the reaction is exothermic.	☐
The yield is greater at higher temperatures because the reaction is endothermic.	☐
The yield is smaller at higher temperatures because the reaction is exothermic.	☐
The yield is smaller at higher temperatures because the reaction is endothermic.	☐

[1 mark]

07.3 The equation for the reaction is:

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

Explain why the percentage yield of sulfur trioxide in this reaction is greater if the pressure is higher.

[2 marks]

07.4 In industry, the reaction is done at 450 °C and atmospheric pressure.

Under these conditions the yield of sulfur trioxide is 86%.

Suggest **two** reasons why a higher pressure is **not** used.

[2 marks]

1

2

07.5 This reaction uses a catalyst to increase the rate of the reaction.

The catalyst is a metal oxide.

Which is the most likely metal in the metal oxide catalyst?

Use the periodic table.

Tick (✓) **one** box.

Aluminium (Al)	☐
Barium (Ba)	☐
Potassium (K)	☐
Vanadium (V)	☐

[1 mark]

Q4 · June 2024 · Paper 2 Higher · Q9 · [16 marks]

This question also needs Quantitative chemistry.

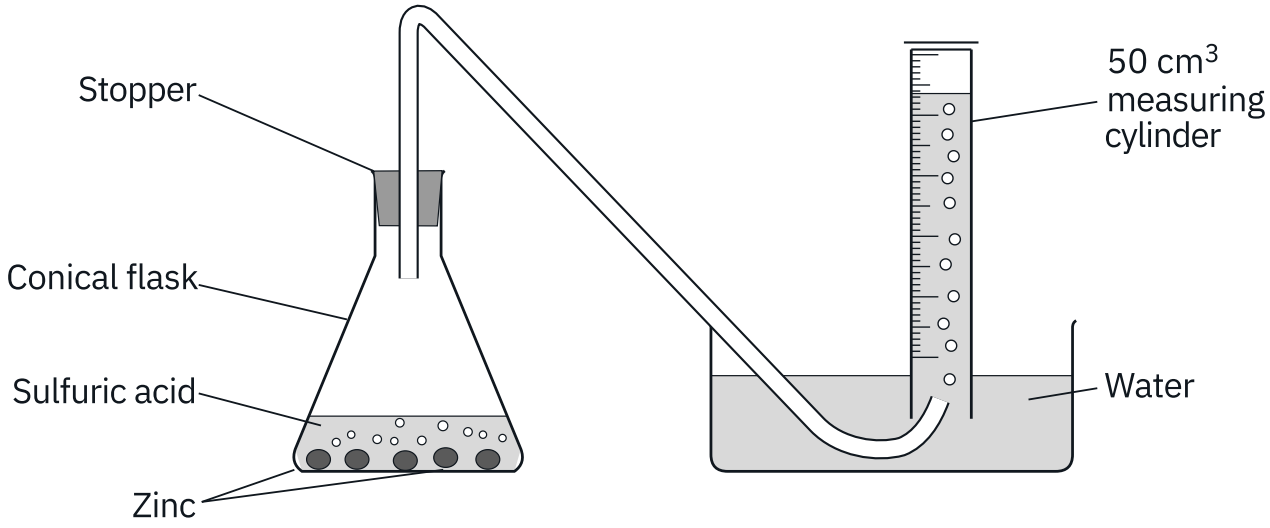
A student investigated the rate of the reaction between zinc and sulfuric acid.

The equation for the reaction is

$Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2(g)$

Figure 10 shows the apparatus.

Figure 10



This is the method used.

1. Pour 50 cm^3 of sulfuric acid into the conical flask.

2. Add excess zinc to the conical flask.

3. Insert the stopper and start a timer.

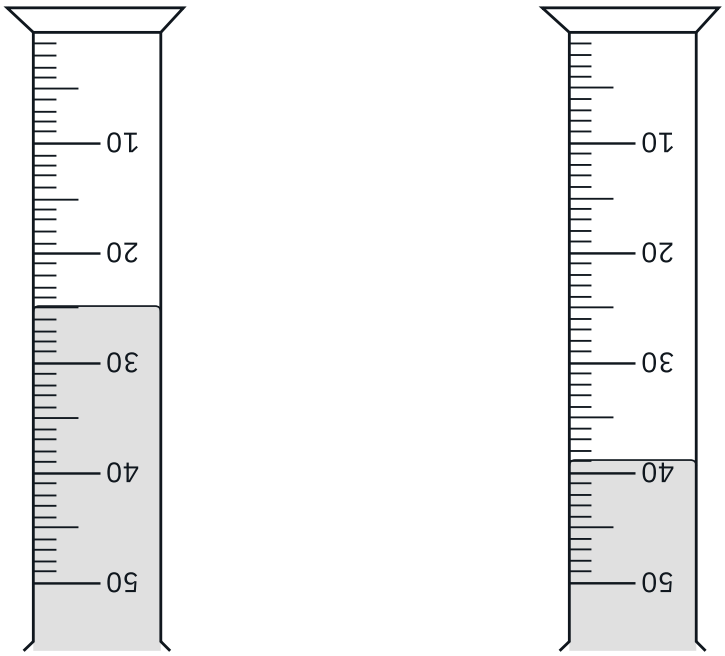
4. Measure the volume of hydrogen collected in the 50 cm^3 measuring cylinder every 20 seconds for 180 seconds.

09.1 Explain why the volume of hydrogen collected in the 50 cm^3 measuring cylinder is less than the volume of hydrogen produced.

[2 marks]

09.2 Figure 11 shows the volumes of hydrogen collected in the 50 cm^3 measuring cylinder after 40 seconds and after 100 seconds.

Figure 11



40 seconds 100 seconds

Determine the number of moles of hydrogen collected between 40 seconds and 100 seconds.

The volume of one mole of any gas at room temperature and pressure is 24 dm^3.

Moles of hydrogen = _____

[4 marks]

09.3 A different student investigated how the concentration of sulfuric acid affected the rate of the reaction.

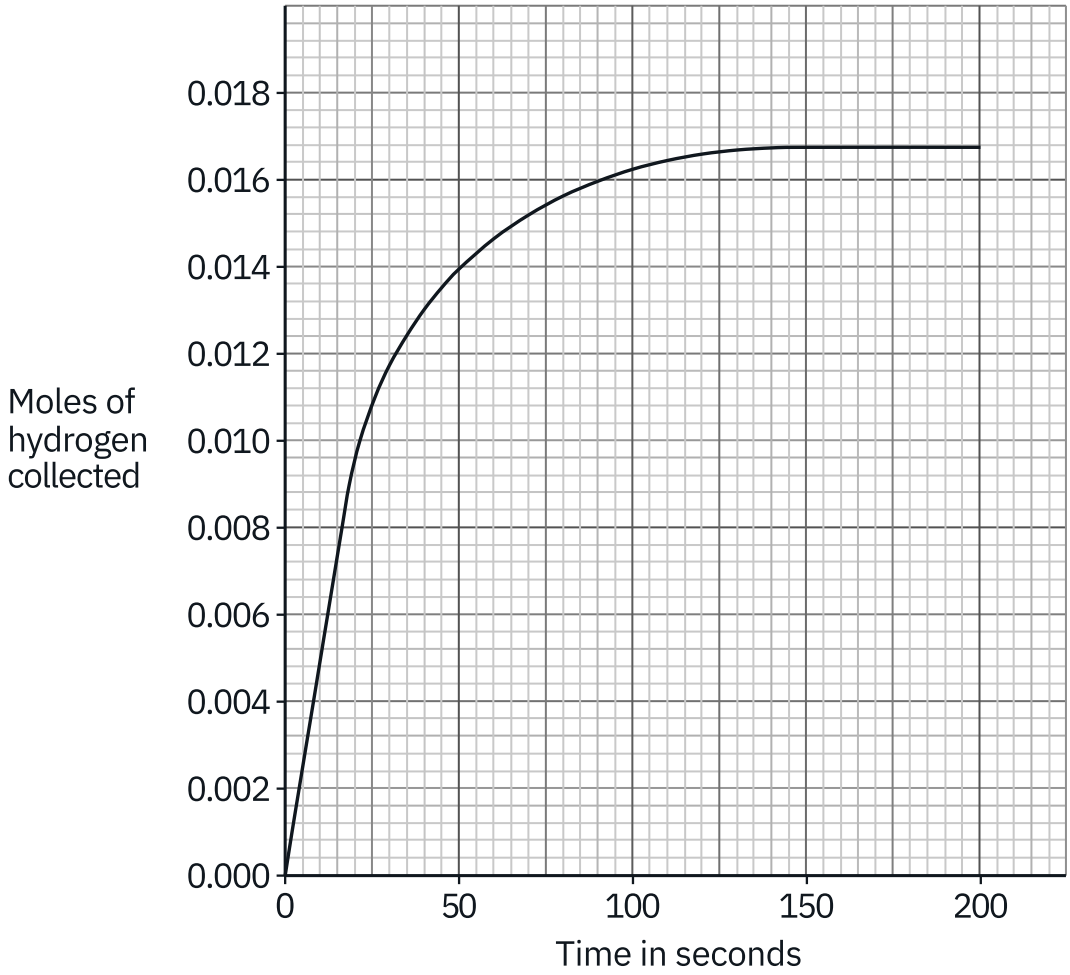
The student did a different experiment using sulfuric acid of concentration 0.40 mol/dm^3.

The student calculated the number of moles of hydrogen collected after every

20 seconds.

Figure 12 shows the results.

Figure 12



Determine the rate of reaction at 45 seconds.

You should draw a tangent on Figure 12.

Give your answer in standard form.

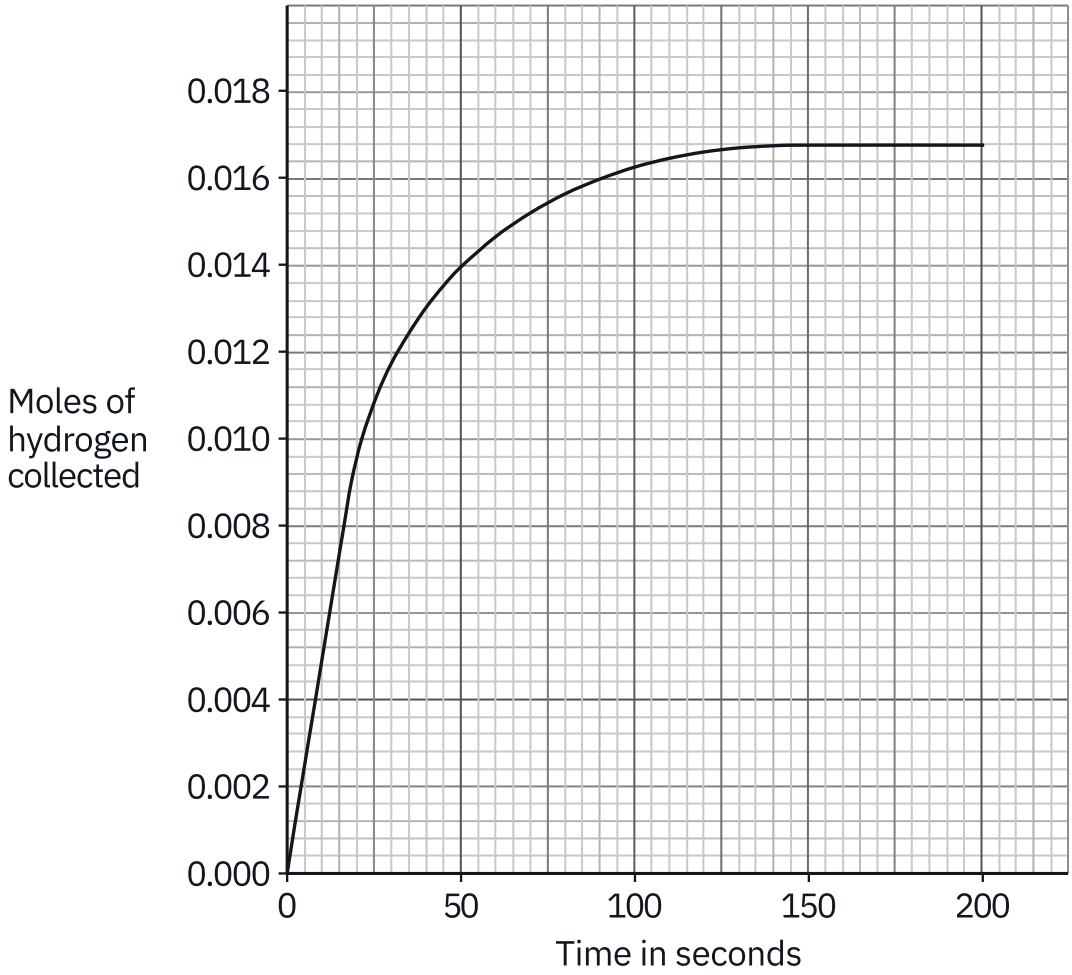
Rate of reaction (in standard form) = _____ mol/s

[5 marks]

Draw your answer on the figure above.

09.4 Figure 13 shows the results for 0.40 mol/dm^3 sulfuric acid.

Figure 13



The student repeated the experiment using 0.20 mol/dm^3 sulfuric acid instead of 0.40 mol/dm^3 sulfuric acid.

Excess zinc was used in each experiment.

Sketch a line on Figure 13 to show the results you would expect.

[2 marks]

Draw your answer on the figure above.

09.5 Explain how increasing the temperature would affect the rate of reaction between zinc and sulfuric acid.

[3 marks]

Q5 · June 2025 · Paper 2 Higher · Q8 · [13 marks]

This question also needs Quantitative chemistry.

Hydrogen peroxide decomposes into water and oxygen.

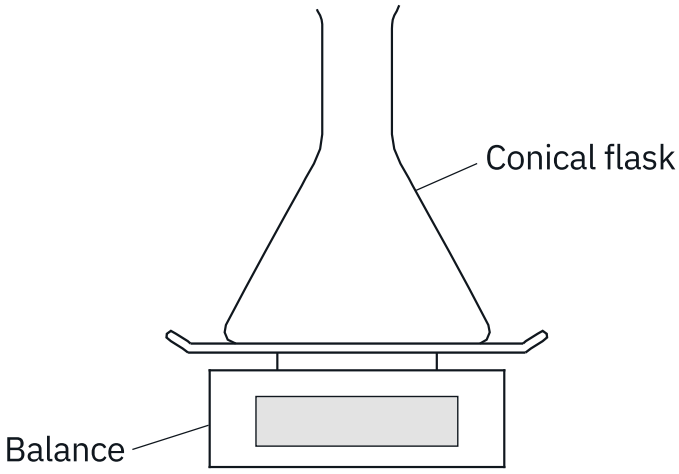
The equation for the reaction is:

$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$

A student investigated the effect of catalyst A and of catalyst B on the rate of this reaction.

Figure 6 shows the apparatus.

Figure 6



This is the method used.

1. Put the conical flask on the balance.

2. Add 50 cm^3 of 1.5 mol/dm^3 hydrogen peroxide solution to the conical flask.

3. Add 1.00 g of catalyst A to the conical flask.

4. Start a timer.

5. Record the loss in mass of the conical flask and contents every 30 seconds for 3 minutes.

6. Repeat steps 1 to 5 using catalyst B.

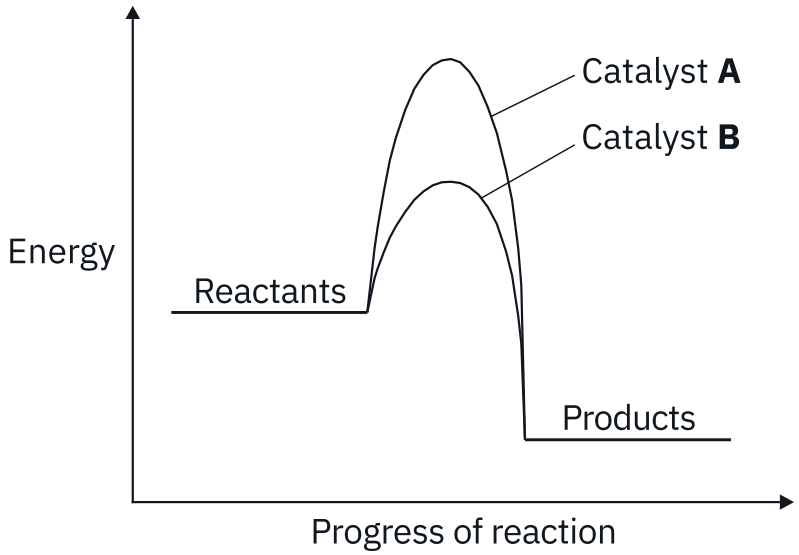
08.1 Explain why the conical flask and contents lost mass.

[2 marks]

08.2 Figure 7 shows the reaction profile for the decomposition of hydrogen peroxide using:

- catalyst A
- catalyst B.

Figure 7

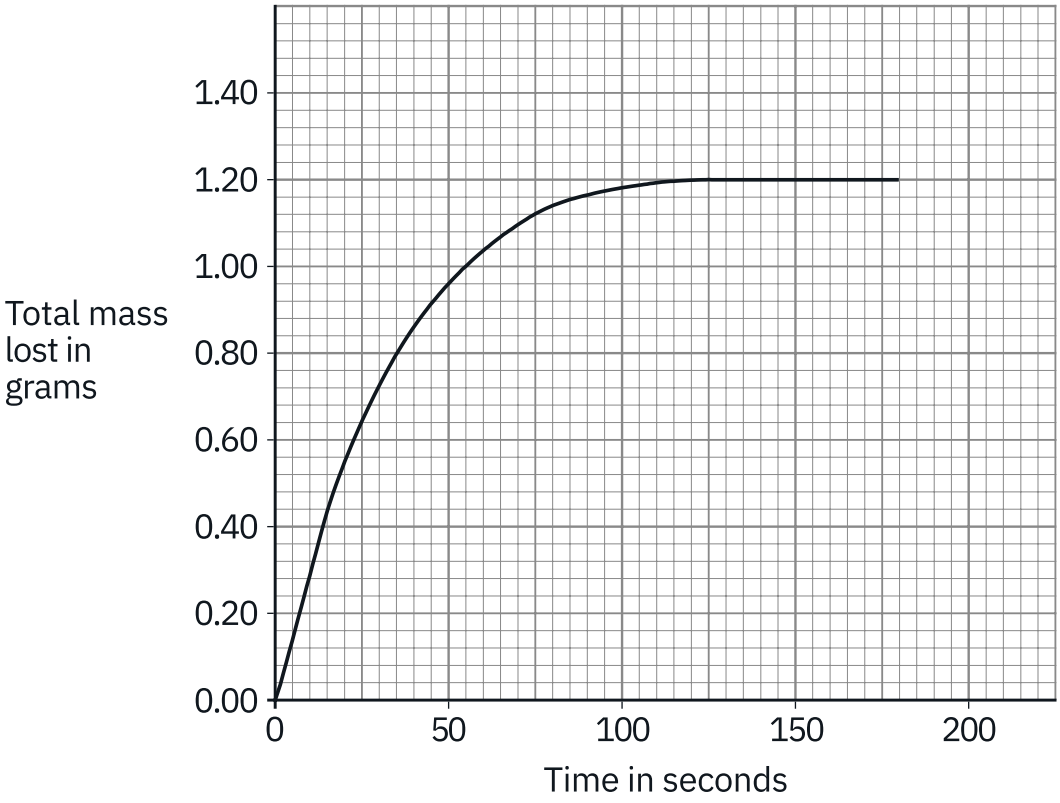


Explain why catalyst A and catalyst B give different rates of reaction for the decomposition of hydrogen peroxide.

[3 marks]

08.3 Figure 8 shows the results for catalyst A.

Figure 8



Determine the rate of the reaction when the time was 60 seconds.

Give your answer in standard form.

Rate (standard form) = _____ g/s

[5 marks]

08.4 Explain how the rate of decomposition of hydrogen peroxide depends on the temperature of the solution.

[3 marks]

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