17 Rate of Reactions

Set B Exam practice

Name	Time 30 minutes	Total 15 marks	Score ____ / 15

Use a copy of the Periodic Table where you need one.

Marks by notes section For the marker: total each row. A score below the target means that section of the notes needs revising.

Notes section	Questions	Marks	Target	Score
1 Measuring the Rate	1, 3, 5(a), 5(c)	7	5	
2 What Affects the Rate	4	4	3	
3 Catalysts	2	1	1	
06 · 3 Chemical Equations *(Topic 06-07)*	5(b)(i)	1	1	
07 · 4 Stoichiometry *(Topic 06-07)*	5(b)(ii)	2	2	

A Multiple choice

3 MARKS

1 A student was given 4.0 g of magnesium carbonate powder and 100 cm^3 of 0.1 mol/dm^3 hydrochloric acid. He wants to determine the rate of reaction by measuring the change in mass of the reaction mixture. Which apparatus is **not** likely to be used in this experiment?

A conical flask **B** electronic mass balance **C** stopwatch **D** test-tube

/1

Answer ☐ [1]

Source: 2024 CHIJ Prelim P1 Q2

2 Which statement about the Haber process for the manufacture of ammonia is correct?

A At higher temperatures, the yield increases and the rate of production of ammonia is faster.

B At higher pressure, the yield increases and the rate of production of ammonia is faster.

C In the presence of a catalyst, the yield decreases but the rate of production of ammonia is faster.

D In the presence of a catalyst, the yield increases and the rate of production of ammonia is faster.

/1

Answer ☐ [1]

Source: 2025 TKGS Prelim P1 Q18

3 Excess magnesium powder is added to 25 cm^3 of 0.10 mol/dm^3 solutions of three different acids: experiment 1, methanoic acid; experiment 2, hydrochloric acid; experiment 3, sulfuric acid. Which statement is correct?

A Experiment 1 produced the smallest volume of gas.

B Experiments 1 and 2 produced the same volume of gas.

C Experiments 1 and 2 had the same speed of reaction.

D Experiments 2 and 3 had the same speed of reaction.

Answer [1]

/1

Source: 2023 SJI Prelim P1 Q19

B Structured questions

12 MARKS

4 A series of experiments was carried out to investigate the effect of concentration on the rate of reaction: $BrO_3^-(aq) + 5Br^-(aq) + 6H^+(aq) \rightarrow 3Br_2(aq) + 3H_2O(l)$. The table shows the initial rates when the concentrations of the reactants were changed.

experiment	concentration of BrO_3^- / mol/dm^3	concentration of Br^- / mol/dm^3	concentration of H^+ / mol/dm^3	initial rate / mol/dm^3/s
1	1.00	1.00	1.00	0.008
2	2.00	1.00	1.00	0.016
3	1.00	2.00	1.00	0.032
4	2.00	1.00	2.00	0.032

(a) Use the table to describe how the concentrations of Br^- and H^+ affect the initial rate of reaction.

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(b) Use ideas about collisions between particles to explain how concentration affects the initial rate of reaction.

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/4

Source: 2024 Compassvale Prelim P2 A6(a) and (b)

5 A student carried out two experiments with calcium carbonate and sulfuric acid: $CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$. The volume of carbon dioxide was measured every minute. In experiment 1, 1.20 dm^3 of gas was collected in total.

experiment	moles of calcium carbonate / mol	moles of sulfuric acid / mol	concentration of sulfuric acid / mol/dm^3
1	0.06	0.05	2.00
2	0.06	0.02	4.00

(a) Describe how the graph of volume of gas against time for experiment 2 would differ from that for experiment 1.

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[2]

(b) A third experiment used 40 cm^3 of 2 mol/dm^3 phosphoric acid, H_3PO_4, with 6 g of calcium carbonate. Phosphoric acid is a weak acid.

(i) Construct a balanced chemical equation for the reaction between calcium carbonate and phosphoric acid.

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[1]

(ii) Deduce the limiting reactant. Show your working.

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[2]

(c) Explain, in terms of collision theory, why using a weak acid affects the rate of reaction.

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[3]

/8

Source: 2026 ZHSS Prelim P2 A3 (adapted)