InkChemistry

QUESTION WORKBOOK

Collision theory, activation energy and the rate of reaction

Kinetics · Unit C05

AQA 3.1.5.1, 3.1.5.3, 3.1.5.4 · OCR A 3.2.2

13 questions · 44 marks

NAVY SCREEN EDITION

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SECTION A · Short, 1 to 2 marks

A1 CTA-Q14

Suggest why a reaction between two large molecules, each with a single reactive group at one end, is slower than a reaction between two small molecules with the same activation energy, at the same concentrations and temperature. [2]

SECTION B · Standard, 3 to 5 marks

B1 CTA-Q2

State the two conditions that a collision between two reactant particles must meet for it to lead to a reaction, and explain why most collisions between gas molecules at room temperature do not lead to a reaction. [4]

B2 CTA-Q10

Calculate the initial rate at which the concentration of the acid falls when marble chips react with 25.0 cm^3 of hydrochloric acid, given that carbon dioxide is produced at an initial rate of 1.8 $cm^3\ s^{-1}$ at room temperature and pressure. $CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$. The molar volume is 24.0 $dm^3\ mol^{-1}$. [4]

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B3 CTA-Q19 Explain why halving the volume of a mixture of two reacting gases, at constant temperature, increases the rate of the reaction, but pumping argon into the same mixture in a sealed vessel of fixed volume raises the total pressure without changing the rate. [4]

B4 CTA-Q3 Give the meaning of the term activation energy and of the term rate of reaction, and give the units of a rate of reaction. [3]

B5 CTA-Q5 Explain why increasing the concentration of hydrochloric acid increases the rate of its reaction with magnesium ribbon at the same temperature. [3]

B6 CTA-Q6 Explain why powdered marble reacts faster with dilute hydrochloric acid than the same mass of marble in large chips. [3]

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B7 CTA-Q7 Explain why the rate of reaction between excess marble chips and dilute hydrochloric acid decreases as the reaction proceeds. [3]

B8 CTA-Q12 Describe how a graph of the volume of gas produced against time is used to find the initial rate of a reaction. [3]

B9 CTA-Q13 Suggest why a sack of flour burns only slowly in a fire, but flour dust spread through the air of a mill can explode when a spark reaches it. [3]

B10 CTA-Q15 Compare the initial rate with the mean rate over the whole reaction for a reaction in which the tangent at t = 0 has a gradient of 2.0 $cm^3\ s^{-1}$ and the reaction finishes after 120 s, having produced 90 cm^3 of gas. [3]

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B11 CTA-Q16 Evaluate the claim that a reaction with $\Delta H = -300$ kJ mol^{-1} must be faster than a reaction with $\Delta H = -50$ kJ mol^{-1} under the same conditions. [3]

SECTION C · Long, 6 marks or more

C1 CTA-Q17 Explain, using collision theory, the results of three experiments in which 1.0 g of calcium carbonate reacts with 50 cm^3 of hydrochloric acid, an excess, at 20 °C. A: chips in 1.0 mol dm^{-3} acid. B: powder in 1.0 mol dm^{-3} acid. C: chips in 2.0 mol dm^{-3} acid. B and C both have a greater initial rate than A, and all three give the same final volume of carbon dioxide. [6]

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