2.4 Kinetics and Equilibria: 10-minute Pack

AQA 7405 · Calculator allowed · about 10 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 This question tests your understanding of reaction orders and how they can be identified from graphs.

(a) Define what is meant by the order of reaction with respect to a particular reactant. **(1)**

(b) State the units of the rate of a chemical reaction. **(1)**

(c) In an experiment monitoring the concentration of reactant X over time, a graph of [X] against time is a straight line with a constant negative gradient for as long as X remains present in the mixture. State the order of reaction with respect to X, and explain how the graph shows this. **(2)**

(d) In a separate experiment, a graph of initial rate against the initial concentration of reactant Y is a straight line passing through the origin. State the order of reaction with respect to Y, and explain how the graph shows this. **(2)**

(e) In a third experiment, a graph of initial rate against the initial concentration of reactant Z is a curve passing through the origin, such that doubling [Z] causes the initial rate to increase by a factor of four. State the order of reaction with respect to Z, and explain how this observation shows this. **(2)**

(Total for Question 1 is 8 marks)

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Mark scheme · 2.4 Kinetics and Equilibria: 10-minute Pack

Question 1

(a) the power to which the concentration of that reactant is raised in the (experimentally determined) rate equation oe **B1**

(a) Answer: The power to which that reactant's concentration is raised in the rate equation.

(b) mol dm^{-3} s^{-1} (or another valid concentration/time combination, e.g. mol dm^{-3} min^{-1}) oe **B1**

(b) Answer: mol dm-3 s-1

(c) zero order **B1**

(c) the gradient (rate) is constant and does not change as [X] falls, so the rate is independent of [X] oe **B1**

(c) Answer: Zero order; a constant gradient shows the rate does not depend on [X].

(d) first order **B1**

(d) rate is directly proportional to [Y] (shown by the straight line through the origin) oe **B1**

(d) Answer: First order; rate is directly proportional to [Y].

(e) second order **B1**

(e) rate is proportional to $[Z]^2$, so doubling [Z] increases the rate by a factor of $2^2 = 4$, consistent with the observation oe **B1**

(e) Answer: Second order; rate is proportional to $[Z]^2$, so doubling [Z] quadruples the rate.

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