

Self-test Questions

Topic 6 (HL)

- 1 The rate of the reaction $2A \rightarrow B$ was investigated in a series of experiments. Data from the experiments are shown in the table. What is the order of reaction with respect to A?

Expt.	[A] / mol dm ⁻³	Rate / mol dm ⁻³ s ⁻¹
1	0.10	0.50
2	0.20	2.0
3	0.40	8.0

- A 1
B 2
C 3
D 4
- 2 The rate of the reaction $2A + 2B \rightarrow C + D$ was investigated in a series of experiments. Data from the experiments are shown in the table. What are the orders of reaction with respect to A and B?

Expt.	[A] / mol dm ⁻³	[B] / mol dm ⁻³	Rate / mol dm ⁻³ s ⁻¹
1	0.20	0.20	2.0
2	0.60	0.20	6.0
3	0.60	0.80	24

- A A: 1; B: 1
B A: 1; B: 2
C A: 2; B: 1
D A: 2; B: 2
- 3 The rate of the reaction $3A + 2B \rightarrow 2C + D$ was investigated in a series of experiments. Data from the experiments are shown in the table. What are the orders of reaction with respect to A and B?

Expt.	[A] / mol dm ⁻³	[B] / mol dm ⁻³	Rate / mol dm ⁻³ s ⁻¹
1	0.400	0.400	1.400
2	0.800	0.400	2.800
3	1.200	0.800	8.400

- A A: 1; B: 1
B A: 1; B: 2
C A: 2; B: 2
D A: 3; B: 2

- 4 The rate of the reaction $3A + 2B \rightarrow 2C + D$ was investigated in a series of experiments. Data from the experiments are shown in the table. The rate expression is $\text{rate} = k[A]$

What is the rate constant for this reaction at this temperature?

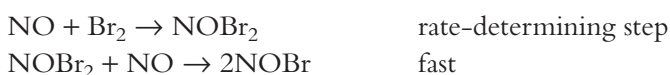
Expt.	[A] / mol dm ⁻³	[B] / mol dm ⁻³	Rate / mol dm ⁻³ s ⁻¹
1	0.400	0.400	1.400
2	1.200	0.400	4.200
3	1.200	0.800	4.200

- A 3.50 mol dm⁻³ h⁻¹
 B 3.50 h⁻¹
 C 0.286 mol dm⁻³ h⁻¹
 D 0.286 h⁻¹
- 5 The rate expression for a particular reaction is $\text{rate} = k[A][B]^2$
 If the concentration of A is doubled and the concentration of B is increased by a factor of 3, by what factor does the rate of reaction increase?
 A 5
 B 6
 C 18
 D 36
- 6 If the rate expression is $\text{rate} = k[Y]^2[Z]$
 What value is missing from the table?

Expt.	[Z] / mol dm ⁻³	[Y] / mol dm ⁻³	Rate / mol dm ⁻³ s ⁻¹
1	2.0×10^{-3}	2.0×10^{-3}	0.0500
2	1.0×10^{-2}	?	2.25

- A 3.6×10^{-3}
 B 6.0×10^{-3}
 C 0.0190
 D 1.8×10^{-2}
- 7 Three possible mechanisms for the reaction $2NO + Br_2 \rightarrow 2NOBr$ are shown below. The rate expression is $\text{rate} = k[NO]^2[Br_2]$. Which mechanism(s) is/are consistent with this rate expression?

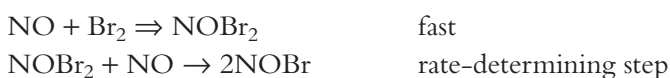
Mechanism 1



Mechanism 2



Mechanism 3

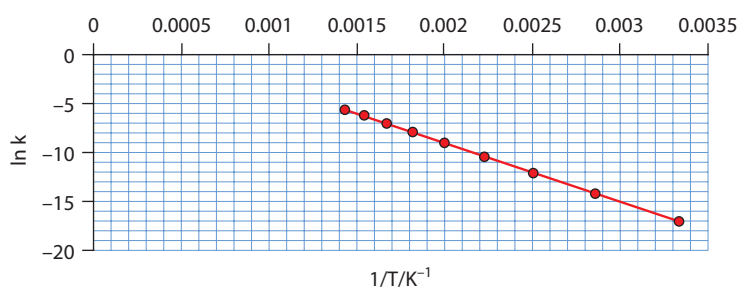


- A mechanism 1 only
 B mechanism 2 only
 C mechanism 3 only
 D mechanisms 2 and 3 only

- 8 Given the data in the table for the reaction $2A + B \rightarrow C + D$, which of the following is **unlikely** to be a rate-determining step? (X is an intermediate.)

Expt.	[A] / mol dm ⁻³	[B] / mol dm ⁻³	Rate / mol dm ⁻³ s ⁻¹
1	0.10	0.10	1.0
2	0.20	0.10	4.0
3	0.20	0.30	12.0

- A $A + B \rightarrow C$
 B $A + A \rightarrow D$
 C $B + X \rightarrow C$
 D $2A + B \rightarrow C + D$
- 9 Which of the following would **not** be a straight-line graph?
 A Concentration against time for a zero-order reaction.
 B $\ln k$ against $1/T$ for a first-order reaction, where T is the temperature in °C.
 C Rate against concentration² for a second-order reaction.
 D Rate against concentration for a zero-order reaction.
- 10 Using the graph below, what is the activation energy of the reaction?
 $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$



- A 25 kJ mol^{-1}
 B 50 kJ mol^{-1}
 C 75 kJ mol^{-1}
 D 100 kJ mol^{-1}