16.1 Rate Expression & Reaction Mechanism

Question Paper

Course	DP IB Chemistry
Section	16. Chemical Kinetics (HL only)
Topic	16.1 Rate Expression & Reaction Mechanism
Difficulty	Medium

To be used by all students preparing for DP IB Chemistry HL
Students of other boards may also find this useful

Question 1

Which of the following statements about the rate constant, *k*, are correct?

I. High values of *k* are associated with fast reactions
II. The rate constant is affected by temperature
III. The units of *k* are independent of the orders of reaction

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

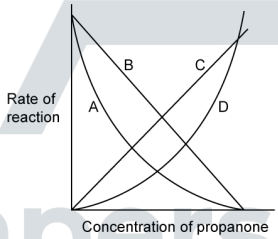
[1 mark]

Question 2

A student experimentally determined the rate expression for the reaction between iodine and propanone to be:

$$\text{Rate} = k[H^+][C_3H_6O]$$

Which graph is consistent with this information?



[1 mark]

Question 3

The rate information below was obtained for the following reaction at a constant temperature:

$$C_2H_5Br\,(aq) + OH^-\,(aq) \rightarrow C_2H_5OH\,(aq) + Br^-\,(aq)$$

$[C_2H_5Br]$ / mol dm^{-3}	$[OH^-]$ / mol dm^{-3}	Rate / mol dm^{-3} s^{-1}
3.0×10^{-3}	2.0×10^{-2}	4.0×10^{-4}
6.0×10^{-3}	2.0×10^{-2}	8.0×10^{-4}
6.0×10^{-3}	4.0×10^{-2}	1.6×10^{-3}

What are the orders of reaction with respect to C_2H_5Br and OH^-?

A. C_2H_5Br is first order and OH^- is first order

B. C_2H_5Br is first order and OH^- is second order

C. C_2H_5Br is second order and OH^- is first order

D. C_2H_5Br is second order and OH^- is second order

[1 mark]

Question 4

The mechanism for the following reaction between iodine and propanone is shown.

$$CH_3COCH_3\,(aq) + I_2\,(aq) \rightarrow CH_3COCH_2I\,(aq) + HI\,(aq)$$

Step 1: $CH_3COCH_3 + H^+ \rightarrow CH_3COH^+CH_3$

Step 2: $CH_3COH^+CH_3 \rightarrow CH_3COHCH_2 + H^+$

Step 3: $CH_3COHCH_2 + I_2 \rightarrow CH_3COHCH_2I + I^-$

Step 4: $CH_3COHCH_2I \rightarrow CH_3COCH_2I + H^+$

Which classifications of CH_3COCH_3, H^+ and CH_3COHCH_2 are correct?

	CH_3COCH_3	H^+	CH_3COHCH_2
A	Intermediate	Intermediate	Catalyst
B	Reactant	Intermediate	Product
C	Reactant	Catalyst	Intermediate
D	Reactant	Product	Intermediate

[1 mark]

Question 5

The proposed mechanism for the following reaction where ethanal dimerises in dilute alkaline solution to form 3–hydroxybutanal is shown.

$$2CH_3CHO \rightarrow CH_3CH(OH)CH_2CHO$$

Step 1: $CH_3CHO + :OH^- \rightarrow :CH_2CHO + H_2O$ slow step

Step 2: $CH_3CHO + :CH_2CHO \rightarrow CH_3CH(O:^-)CH_2CHO$ fast step

Step 3: $CH_3CH(O:^-)CH_2CHO + H_2O \rightarrow CH_3CH(OH)CH_2CHO + :OH^-$ fast step

Which of the following statements is **not** correct?

A. The rate expression is rate = $[CH_3CHO]\,[OH^-]$

B. Step 1 is the rate-determining step

C. OH^- is a catalyst

D. Steps 2 and 3 have a lower activation energy than step 1

[1 mark]