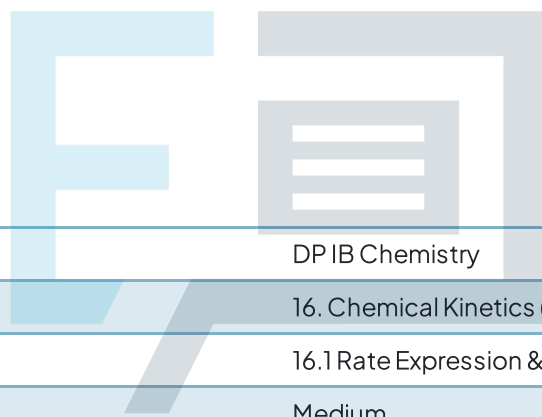




16.1 Rate Expression & Reaction Mechanism

Mark Schemes



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

Exam Papers Practice

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

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The correct answer is **A** because:

- Statement I is correct
 - The size of k can indicate the speed of a reaction, e.g. high values of k are associated with fast reactions and low values of k are associated with slow reactions
- Statement II is correct
 - The rate constant is affected by temperature
- Statement III is incorrect
 - The units of k depend on the rate expression and therefore the orders / reactions of differing orders
 - The units of k are:
 - $\text{mol dm}^{-3} \text{s}^{-1}$ for a zero order reaction
 - s^{-1} for a first order reaction
 - $\text{mol}^{-1} \text{dm}^3 \text{s}^{-1}$ for a second order reaction
 - $\text{mol}^{-2} \text{dm}^6 \text{s}^{-1}$ for a third order reaction

B, C & D are incorrect as **statement III is incorrect**

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The correct answer is **C** because:

- **Careful:** The graph is for the concentration of propanone only
 - You do not need to consider $[\text{H}^+]$
- As propanone features in the rate expression but is not raised to a power, we can deduce that the reaction with respect to propanone is first order
- In a first-order reaction, the rate is directly proportional to the concentration of a reactant
- On a rate-concentration graph, a first order reaction is a straight line starting at the origin



A is incorrect as	this is the shape of a first order concentration-time graph
B is incorrect as	this is the shape of a zero order concentration-time graph
D is incorrect as	this is the shape of a second order rate-concentration graph



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The correct answer is **A** because:

- When $[C_2H_5Br]$ doubles but $[OH^-]$ remains constant, then the rate doubles
 - Therefore, the reaction is first order with respect to $[C_2H_5Br]$
- When $[OH^-]$ doubles but $[C_2H_5Br]$ remains constant, then the rate doubles
 - Therefore, the reaction is first order with respect to $[OH^-]$

B, C & D are incorrect as	neither chemical is second order
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The correct answer is **C** because:

- From the overall equation
 - The only reactant listed in the table is CH_3COCH_3
 - None of the chemicals listed in the table are products
- Since $\text{CH}_3\text{COHCH}_2$ and H^+ are not reactants or products, they can only be intermediates or catalysts
 - Since $\text{CH}_3\text{COHCH}_2$ is not reformed at the end, it must be an intermediate
 - Since H^+ is reformed at the end, it must be a catalyst

A is incorrect as	none of the classifications are correct
B is incorrect as	the classifications for H^+ and $\text{CH}_3\text{COHCH}_2$ are incorrect
D is incorrect as	H^+ is not a product

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The correct answer is **A** because:

- The correct rate expression is $\text{rate} = k[\text{CH}_3\text{CHO}][\text{OH}^-]$
- It is very easy to miss the rate constant, k , out of rate expressions and this can cost you a mark in exams



B is incorrect as	this is a correct statement Step 1 is identified as the slow step which means that it is the rate-determining step
C is incorrect as	this is a correct statement OH^- features in the rate expression but not in the overall reaction equation, therefore, it is a catalyst
D is incorrect as	this is a correct statement The slowest step in a reaction mechanism has the highest activation energy, therefore, steps 2 and 3 must be lower in activation energy than step 1

Exam Papers Practice