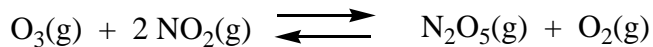


Problem of the Day 19 CHEM 1252

1. The following reaction is observed to be first order with respect to O_3 and NO_2 .



(a) Write the rate law for the reaction based on this information.

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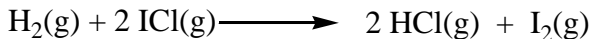
(b) The following mechanisms have been proposed for the above reaction. Determine the rate law predicted by each mechanism.

Mechanism I	Mechanism II
<p>Step 1: $NO_2 + NO_2 \xrightleftharpoons[k_{-1}]{k_1} N_2O_4$ fast</p> <p>Step 2: $N_2O_4 + O_3 \xrightarrow{k_2} N_2O_5 + O_2$ slow</p>	<p>Step 1: $NO_2 + O_3 \xrightarrow{k_1} NO_3 + O_2$ slow</p> <p>Step 2: $NO_3 + NO_2 \xrightleftharpoons[k_{-2}]{k_2} N_2O_5$ fast</p>
8	8

(c) Are any of the rate laws in part (b) consistent with the experimental observed rate law? If so which one(s)?

	2
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2. The following reaction is observed to be first order with respect to H₂ and ICl.



Experimentally Observed Rate Law

(a) Based on the above information, write the observed rate law for the reaction.

Rate =	2
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(b). Four mechanisms have been proposed to rationalize this transformation. Write the rate law for each proposed mechanism.

<p>Mechanism A</p> $\text{H}_2(\text{g}) + 2 \text{ICl}(\text{g}) \longrightarrow 2 \text{HCl}(\text{g}) + \text{I}_2(\text{g})$ <p>Rate =</p>	<p>Mechanism B</p> $\begin{aligned} \text{H}_2(\text{g}) + \text{ICl}(\text{g}) &\xrightarrow{k_1} \text{HCl}(\text{g}) + \text{HI}(\text{g}) && \text{slow} \\ \text{ICl}(\text{g}) + \text{HI}(\text{g}) &\xrightleftharpoons[k_{-2}]{k_2} \text{HCl}(\text{g}) + \text{I}_2(\text{g}) && \text{fast} \end{aligned}$ <p>Rate =</p>
<p>Mechanism C</p> $\begin{aligned} \text{H}_2(\text{g}) + \text{ICl}(\text{g}) &\xrightleftharpoons[k_{-1}]{k_1} \text{HCl}(\text{g}) + \text{HI}(\text{g}) && \text{fast} \\ \text{ICl}(\text{g}) + \text{HI}(\text{g}) &\xrightarrow{k_2} \text{HCl}(\text{g}) + \text{I}_2(\text{g}) && \text{slow} \end{aligned}$ <p>Rate =</p>	<p>Mechanism D</p> $\begin{aligned} \text{H}_2(\text{g}) + \text{ICl}(\text{g}) &\xrightarrow{k_1} \text{HClI}(\text{g}) + \text{H}(\text{g}) && \text{slow} \\ \text{H}(\text{g}) + \text{ICl}(\text{g}) &\xrightleftharpoons[k_{-2}]{k_2} \text{HCl}(\text{g}) + \text{I}(\text{g}) && \text{fast} \\ \text{HClI}(\text{g}) &\xrightleftharpoons[k_{-3}]{k_3} \text{HCl}(\text{g}) + \text{I}(\text{g}) && \text{fast} \\ \text{I}(\text{g}) + \text{I}(\text{g}) &\xrightleftharpoons[k_{-4}]{k_4} \text{I}_2(\text{g}) && \text{fast} \end{aligned}$ <p>Rate =</p>

(c) Circle the mechanism(s) which is/are consistent with the experimentally observed rate law?

Mechanism A	Mechanism B	
Mechanism C	Mechanism D	
		2