Non Sibi High School

Andover's Chem 550/580: Advanced Chemistry

Chapter 19, Review Quiz 1

1

Sketch a completely-labeled reaction energy profile (reaction progress diagram) for an exothermic reaction. Indicate any effects a catalyst would have the sketch.

2

The following mechanism has been proposed for a reaction:

Step 1: $NO_2 + NO_2 \longrightarrow NO_3 + NO$

Step 2: $NO_3 + CO \longrightarrow NO_2 + CO_2$

Identify the intermediate and write the overall balanced equation for the reaction.

3

If the rate of formation of hydrogen gas in the reaction $4PH_3(g) \longrightarrow 6H_2(g) + P_4(g)$ is found to be 0.0066 $M \cdot s^{-1}$, what is the rate of disappearance of PH_3 gas?

4

For the reaction $\frac{1}{2}Cl_2(g) + NO(g) \longrightarrow NOCl(g)$, the following data were collected:

Experiment	$[Cl_2]$ (M)	[NO] (M)	Initial Rate ($M \cdot min^{-1}$)
1	0.12	0.12	0.0025
2	0.24	0.12	0.0050
3	0.48	0.48	0.16

Determine the overall order of the reaction, write the rate law, and calculate the value of k with units.

5

Concentration versus time data were collected for the reaction $2N_2O_5(g) \longrightarrow O_2(g) + 4NO_2(g)$. Graphs of $[N_2O_5]_t$ v. t, $\ln[N_2O_5]_t$ v. t, and $1/[N_2O_5]_t$ v. t were plotted, and the data points on the graph of $\ln[N_2O_5]_t$ v. t were found to fit a straight line most closely. Is the reaction zero-order, first-order, or second-order?

6

For the reaction $2ICl + H_2 \longrightarrow I_2 + 2HCl$, consider the following proposed mechanism:

$$ICl + H_2 \xrightarrow{k_1} HI + HCl \quad \text{(slow)}$$

$$ICl + HI \xrightarrow{k_2} I_2 + HCl \quad \text{(fast)}$$

Deduce a rate law for the overall reaction that is consistent with the proposed mechanism above.

7

For the reaction $H_2 + I_2 \longrightarrow 2HI$, consider the following proposed mechanism:

$$I_2 \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} 2\,I \quad \text{(fast)}$$

$$2I + H_2 \xrightarrow{k_2} 2HI \quad \text{(slow)}$$

Deduce a rate law for the overall reaction that is consistent with the proposed mechanism above.

8

The activation energy for a reaction is 92 kJ/mol. If $k = 3.3 \times 10^{-5}\,s^{-1}$ at 75°C for the reaction, calculate k for the reaction at 35°C.