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AP Chemistry – Rate Laws – 55

Name ____Per ___

1. A reaction A + B → C obeys the rate law: Rate = $k[B]^2$. (a) If [A] is doubled, how will the rate of the chemical reaction change?

(b) What are the reaction orders for A and B individually and the reaction overall?

(c) What are the units of the rate constant?

2. Consider the following reaction: $2NO_{(g)} + 2H_{2(g)} \rightarrow N_{2(g)} + 2H_2O_{(g)}$. (a) The rate law for this reaction is first order in H_2 and second order in NO. Write the rate law.

(b) If the rate constant for this reaction at 1000 K is $6.0 \times 10^4/M^2s$, what is the reaction rate when [NO] = 0.050 M and $[H_2]$ = 0.010 M?

(c) What is the reaction rate at 1000 K when the concentration of NO is doubled, to 0.10 M, while the concentration of H_2 remains 0.010 M?

(d) What is the effect of doubling [NO] on the reaction rate? [Compare answers from (b) and (c).]

3. (a) For a second order reaction, what quantity, when graphed vs. time, will yield a straight line?

(b) How do the half-lives of first order and second order reactions differ?

4. The reaction $2ClO_{2(aq)} + 2OH^-_{(aq)} \rightarrow ClO_3^-{}_{(aq)} + ClO_2^-{}_{(aq)} + H_2O_{(l)}$ was studied with the following results:

Experiment	$[ClO_2]$ M	$[OH^-]$ M	Rate, M/s
1	0.060	0.030	0.0248
2	0.020	0.030	0.00276
3	0.020	0.090	0.00828

(a) Determine the rate law for the reaction. Explain your reasoning.

(b) Calculate the rate constant.

(c) Calculate the rate when $[ClO_2]$ = 0.010 M and $[OH^-]$ = 0.015 M.

5. The first order rate constant for the decomposition of $N_2O_{5(g)} \rightarrow 2NO_{2(g)} + O_{2(g)}$, at 70°C is 6.82 x 10^{-3}/s. Suppose we start with 0.0250 moles of $N_2O_{5(g)}$ in a volume of 2.0 L. (a) How many moles of $N_2O_{5(g)}$ will remain after 2.5 minutes?

(b) How many minutes will it take for the quantity of $N_2O_{5(g)}$ to drop to 0.010 moles?

(c) What is the half-life of $N_2O_{5(g)}$ at 70°C?