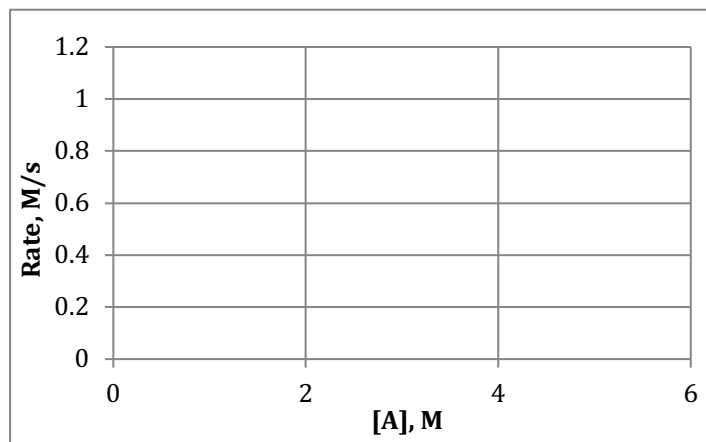


Chem 2 AP Homework #13-2: The Rate Law

Problems pg. 575 #12, 14, 15, 17, 18, 19, 20, pg. 580 #87

13.12 Consider the zero-order reaction $A \rightarrow \text{product}$ **(a) Write the rate law for the reaction.****(b) What are the units for the rate constant?****(c) Sketch a possible plot of the rate of the reaction versus $[A]$ at right.****13.14 On which of the following properties does the rate constant of a reaction depend?**

- (a) reactant concentrations
- (b) nature of reactants
- (c) temperature

13.15 The rate law for the reaction, $\text{NH}_4^+(\text{aq}) + \text{NO}_2^-(\text{aq}) \rightarrow \text{N}_2(\text{g}) + 2 \text{H}_2\text{O}(\text{l})$ is $\text{rate} = k[\text{NH}_4^+][\text{NO}_2^-]$. At 25°C , the rate constant, k , is $3.0 \times 10^{-4} / \text{M}\cdot\text{s}$. Calculate the rate of the reaction at this temperature if $[\text{NH}_4^+] = 0.26 \text{ M}$ and $[\text{NO}_2^-] = 0.080 \text{ M}$.**13.17 Consider the reaction $A + B \rightarrow \text{products}$. From the following data obtained at a certain temperature, determine the orders with respect to A and to B, write the rate law and calculate the rate constant.**

Expt.	[A] (M)	[B] (M)	Rate (M/s)
1	1.50	1.50	3.20×10^{-1}
2	1.50	2.50	3.20×10^{-1}
3	3.00	1.50	6.40×10^{-1}

13.18 Consider the reaction $X + Y \rightarrow Z$. The following data were obtained at 360 K.**(a) Determine the rate law. (Hint: First, determine the order with respect to X and to Y.)**

Expt.	Rate of disappearance of X	[X] (M)	[Y] (M)
1	0.053	0.10	0.50
2	0.127	0.20	0.30
3	1.02	0.40	0.60
4	0.254	0.20	0.60
5	0.509	0.40	0.30

(b) Determine the value of the rate constant, k , including units.

(c) Determine the initial rate of disappearance of X when the concentration of X is 0.30 M and that of Y is 0.40 M

13.19 Determine the overall orders of the reactions to which the following rate laws apply:

(Hint: To find the overall order of a reaction, just add up all exponents in the rate law.)

(a) rate = $k[\text{NO}_2]^2$ _____

(b) rate = k _____

(c) rate = $k[\text{H}_2][\text{Br}_2]^{1/2}$ _____

(d) rate = $k[\text{NO}]^2[\text{O}_2]$ _____

13.20 Consider the reaction $\text{A} \rightarrow \text{B}$. The rate of the reaction is $1.6 \times 10^{-2} \text{ M/s}$ when the concentration of A is 0.35 M. Calculate the rate constant if the reaction is:

(a) first-order in A:

(b) second-order in A:

13.87 The decomposition of N_2O_5 : $2\text{N}_2\text{O}_5 \rightarrow 4\text{NO}_2 + \text{O}_2$ in CCl_4 yields the following data. Make a plot of the initial rate vs. initial concentration of N_2O_5 to deduce the order of the reaction and write the rate law. Also, determine the rate constant, k , from the data.

$[\text{N}_2\text{O}_5]_0, \text{ M}$	Initial Rate (M/s)
0.92	0.95×10^{-5}
1.23	1.20×10^{-5}
1.79	1.93×10^{-5}
2.00	2.10×10^{-5}
2.21	2.26×10^{-5}

