CHM 152/54 Quiz #2 25 Pts Spring 05 Name: Key

Work must be shown to receive credit.

1. (4 Pts) The reaction A + 2B + C → products was found to have the rate law, rate = k[A]^2 [B]. While holding the concentration of A constant, the concentration of B was increased from x to 3x and the concentration of C was increased from x to 2x. Predict by what factor the rate of reaction will increase. (i.e. 2 times as fast, 3 times as fast, etc)

rate = k [3] 3-fold increase

2. For the hypothetical reaction A + 3B → 2C.

a.(2 Pts) Write a general rate equation.

rate = k [A]^x [B]^y [C]^z quite often not used as it often = 0 order

b. (3 Pts) Write rate expressions in terms of [A], [B], and [C] and then show how they can be set equal to one another.

$$\text{rate} = \frac{-\Delta[A]}{\Delta t} = \frac{-\Delta[B]}{3\Delta t} = \frac{\Delta[C]}{2\Delta t}$$

3. a. (2 Pts) What are the units for a first order rate constant? rate = k[A] k units = $\frac{1}{\text{time}}$

b. (2 Pts) What are the units for a second order rate constant? rate = k[A]^2 k units = $\frac{1}{M \cdot \text{time}}$

4. (8 Pts) Nitric oxide reacts with chlorine to form nitrosyl chloride, NOCl. Use the following data to determine the rate equation and the rate constant (with proper units) for the reaction.

NO + 1/2Cl$_2$ → NOCl

rate = k [NO]^x [Cl$_2$]^y

Expt. #	[NO]	[Cl$_2$]	Initial Rate
1	0.22	0.065	0.96 M/min
2	0.66	0.065	8.6 M/min
3	0.22	0.032	0.48 M/min

for NO use Exp 1 + 2 $\frac{\text{rate}_2}{\text{rate}_1} = \frac{k[0.66]^x (0.065)^y}{k[0.22]^x (0.065)^y} = \frac{8.6}{0.96}$

$(3)^x = 8.96$ so $x = 2$

for Cl$_2$ use Exp 1 + 3 $\frac{\text{rate}_1}{\text{rate}_3} = \frac{k[0.22]^x [0.065]^y}{k[0.22]^x [0.032]^y} = \frac{0.96}{0.48}$

$(2)^y = 2$ $y = 1$

So rate law is: rate = k[NO]^2[Cl$_2$] and k = 30.5 M^{-2} min^{-1}

5. (4 Pts) The solubility of Ba(NO$_3$)$_2$ is 130.5 grams per liter at 0°C. How many moles of dissolved salt are present in 3.00 liters of a saturated solution of Ba(NO$_3$)$_2$ at 0°C? (molar masses: Ba 137.33, N 14.007, O 16.00)

$$3.00\ \text{L} \left| \frac{130.5\ \text{g}}{\text{L}} \right| \frac{\text{mol}}{261.344\ \text{g}} = 1.498\ \text{mol}$$