Unit 13 – Chapter 12: Kinetics **Name _____**

Assignment #1: Differential Rate Law **Period _____**

1) Consider the general reaction: $aA + bB \rightarrow cC$
and the following average rate data over some time period Δt:

$$-\frac{\Delta A}{\Delta t} = 0.0080 \text{ mol/L} \cdot \text{s}$$

$$-\frac{\Delta B}{\Delta t} = 0.0120 \text{ mol/L} \cdot \text{s}$$

$$-\frac{\Delta C}{\Delta t} = 0.0160 \text{ mol/L} \cdot \text{s}$$

Determine a set of possible coefficients to balance this general reaction.

2) The reaction: $2\ I^-_{(aq)} + S_2O_8^{2-}{}_{(aq)} \rightarrow I_{2(aq)} + 2\ SO_4^{2-}{}_{(aq)}$ was studied at 25^0C. The following results were obtained where

$$\text{Rate} = -\frac{\Delta[S_2O_8^{2-}]}{\Delta t}$$

$[I^-]_0$ (mol/L)	$[S_2O_8^{2-}]_0$ (mol/L)	Initial Rate (mol/L · s)
0.080	0.040	12.5×10^{-6}
0.040	0.040	6.25×10^{-6}
0.080	0.020	6.25×10^{-6}
0.032	0.040	5.00×10^{-6}
0.060	0.030	7.00×10^{-6}

a. Determine the rate law.
b. Calculate a value for the rate constant for each experiment and an average value for the rate constant.

3) The following data were obtained for the gas-phase decomposition of dinitrogen pentoxide,

$$2\ N_2O_{5(g)} \rightarrow 4\ NO_{2(g)} + O_{2(g)}$$

$[N_2O_5]_0$ (mol/L)	Initial Rate (mol/L · s)
0.0750	8.90×10^{-4}
0.190	2.26×10^{-3}
0.275	3.26×10^{-3}
0.410	4.85×10^{-3}

Defining the rate as $-\frac{\Delta[N_2O_5]}{\Delta t}$, write the rate law and calculate the value of the rate constant.

4) The following data were obtained for the reaction:

$$2\ ClO_{2(aq)} + 2\ OH^-_{(aq)} \rightarrow ClO_3^-{}_{(aq)} + ClO_2^-{}_{(aq)} + H_2O_{(l)}$$

where Rate $= -\frac{\Delta[ClO_2]}{\Delta t}$

$[ClO_2]_0$ (mol/L)	$[OH^-]_0$ (mol/L)	Initial Rate (mol/L · s)
0.0500	0.100	5.75×10^{-2}
0.100	0.100	2.30×10^{-1}
0.100	0.0500	1.15×10^{-1}

a. Determine the rate law and the value of the rate constant.
b. What would be the initial rate for an experiment with $[ClO_2]_0 = 0.175$ mol/L and $[OH^-] = 0.0844$ mol/L?