WKS **Name** _____

Rate Laws From Experimental Data **Date** _____

1. The following reaction is done in lab: $\mathbf{NH_4^+\,(aq) + NO_2^-\,(aq) \longrightarrow N_2\,(g) + 2\,H_2O\,(l)}$
   Data from many experiments using varying concentrations of reactants are collected. Data is given below.

Run #	Initial $[NH_4^+]$ (M)	Initial $[NO_2^-]$ (M)	Initial Rate (M/s)
1	0.01	0.2	5.4×10^{-7}
2	0.02	0.2	10.8×10^{-7}
3	0.04	0.2	21.5×10^{-7}
4	0.2	0.02	10.8×10^{-7}
5	0.2	0.04	21.6×10^{-7}
6	0.2	0.06	32.4×10^{-7}

   a) What is the order of the reaction with respect to NH_4^+? Explain how you determined this.

   b) What is the order of the reaction with respect to NO_2^-? Explain how you determined this.

   c) Complete the Rate Law for the reaction: **Rate = *k***_____

2. The following reaction is done in lab: $\mathbf{A + B \longrightarrow C}$
   Data from many experiments using varying concentrations of reactants are collected. Data is given below.

Run #	Initial [A] (M)	Initial [B] (M)	Initial Rate (M/s)
1	0.1	0.1	4.0×10^{-5}
2	0.2	0.1	16.0×10^{-5}
3	0.1	0.2	4.0×10^{-5}

   a) What is the order of the reaction with respect to A? Explain how you determined this.

   b) What is the order of the reaction with respect to B? Explain how you determined this.

   c) Write the Rate Law for the reaction:
   d) What is the *overall* reaction order?

   e) Determine the value of the rate constant *k*.

3. A chemical reaction is expressed by the balanced equation $\mathbf{A + B \longrightarrow C}$
Use the data below to answer the following questions.

Run #	Initial [A] (M)	Initial [B] (M)	Initial Rate (M/min)
1	0.20	0.20	2.0×10^{-4}
2	0.20	0.40	8.0×10^{-4}
3	0.40	0.40	1.6×10^{-3}

a) Determine the rate law for the reaction.

b) What is the overall reaction order?

c) Calculate the value of the rate constant *k*.

d) Determine the initial rate when [A] = [B] = 0.30 M

4. The reaction, $X + Y \rightarrow Z$, is known to have the following rate law: Rate = $k[X]^2[Y]$.

a) What is the effect on the rate if the concentration of Y is reduced by one-third?

b) What is the effect on the rate if the concentration of X is doubled?

c) What is the effect on the rate if the concentration of X is cut in half and the concentration of Y is doubled?

d) What is the effect on the rate if a catalyst is added to the system?