Chemistry Module 14 Homework

Assignment #1

1. What is meant by the term reaction rate?
2. Name three factors that can affect the rate of a chemical reaction.
3. Two containers are filled with the same mass of both nitrogen and hydrogen gas. If the first container is significantly smaller than the second one, in which container will the reaction be faster?
4. Write the reaction rate equation for [N_2O_2] and [Br_2] if the reaction is second order with respect to both reactants and the rate constant is 0.64. What is the overall order of this reaction.
5. Write the rate equation for the experiment that is determined to be second order with respect to [PO] and first order with respect to [Br_2]. The rate constant is 2.4. What is the overall order of the reaction?
6. The order of a chemical reaction with respect to one of its reactants is given below. Explain what happens to the reaction rate if you double the concentration of the reactant.
   a. Order = zero
   b. Order = one
   c. Order = two
   d. Order = three
7. A chemist analyzes the following reaction:

$$2NO\ (g) + O_2\ (g) \rightarrow 2NO_2\ (g)$$

She collects the following data. Write the rate equation for this reaction.

Trial	Initial Concentration of NO (M)	Initial Concentration of O_2 (M)	Instantaneous Reaction Rate
1	0.125	0.253	0.281
2	0.250	0.253	1.124
3	0.250	0.506	2.248

8. A chemist does a reaction rate analysis of the following reaction:

$$BF_3\ (g) + NH_3\ (g) \rightarrow F_3BNH_3\ (g)$$

He collects the following data. Write the rate equation for this reaction.

Trial	Initial Concentration of BF_3 (M)	Initial Concentration of NH_3 (M)	Instantaneous Reaction Rate
1	0.125	0.125	0.107
2	0.250	0.125	0.107
3	0.250	0.250	0.856

9. A reaction is determined by experiment to be second order with respect to I_2 and first order with respect to Br_2. Its rate constant is 0.011 $1/M^2 \cdot s$.
    a. What is the overall order of the reaction?
    b. If the reaction were run with both reactants at concentrations of 0.5 M, what would the instantaneous reaction rate be?
    c. If you double the concentration of I_2 and didn't change the concentration of Br_2, how would the reaction rate change?
    d. If you doubled the concentration of Br_2 and didn't change the concentration of I_2, how would the reaction rate change?

10. Honors – The following results were obtained in experiments designed to study the rate of reaction of this equation: $A + 2B \rightarrow 2C$

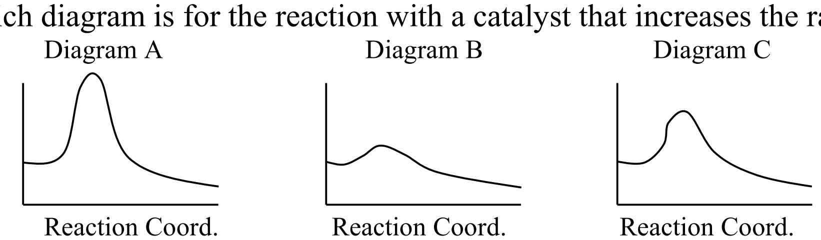
Trial	Initial Concentration of A (M)	Initial Concentration of B (M)	Instantaneous Reaction Rate (M/s)
1	0.05	0.05	3.0×10^{-3}
2	0.05	0.10	6.0×10^{-3}
3	0.10	0.10	1.2×10^{-2}
4	0.20	0.20	2.4×10^{-2}

a. Determine the order of the reaction with respect to each of the reactants and write the rate equation for the reaction.
b. Calculate the value of the rate constant for the reaction, including units.
c. If another experiment is attempted with [A] and [B], both 0.02 M, what would be the instantaneous reaction rate.
d. In experiment 2, what was the concentration of B remaining when half of the original amount of A was consumed?

Chemistry Module 14 Homework

Assignment #2

1. How long does it take most chemical reactions to be completely finished (all the reactants are used up)?
2. A chemical reaction was run at 80°C and the instantaneous reaction rate was determined to be 0.27 M/s. If the reaction is run again at 90°C, what would be the new reaction rate?
3. A chemical reaction was run at 70°C and the instantaneous reaction rate was determined to be 0.003 M/s. If the reaction is run at 100°C, what would its rate be?
4. A chemist runs a reaction at 30°C and decides that it proceeds too slowly. He wants to make the reaction 4 times faster. At what temperature should he do the experiment?
5. What do you call a chemical that speeds up the reaction rate without getting used up in the chemical reaction?
6. Reaction A has activation energy of 50 kJ and Reaction B has activation energy of 30kJ. Which reaction occurs faster?
7. What is a homogeneous catalyst?
8. What is a heterogeneous catalyst?
9. What does a catalytic converter in a car do?
10. How does a catalytic converter work?
11. Three energy diagrams for the same reaction are shown below. The same scale is used for each diagram.
    a. Which diagram is for the reaction without a catalyst?
    b. Which diagram is the one with a catalyst that increases the rate by a factor of 3?
    c. Which diagram is for the reaction with a catalyst that increases the rate by a factor of 10?



12. In the reaction below, which substance is the catalyst? Is it heterogeneous or homogeneous?

    Step 1: $2Cl\,(g) + 2O_3\,(g) \rightarrow 2\,O_2\,(g) + 2OCl\,(g)$
    Step 2: $2OCl\,(g) \rightarrow O_2\,(g) + 2Cl\,(g)$

13. Honors – The reaction below is second order with respect to A and zero order with respect to B. Reactants A and B are present in a closed container. Predict how each of the following changes to the reaction system will affect the rate and the rate constant and explain why.

$$A\,(g) + B\,(g) \rightarrow C\,(g)$$

    a. More gas A is added to the container
    b. More gas B is added to the container
    c. The temperature is increased
    d. An inert gas D is added to the container
    e. The volume of the container is decreased