Week 3 **Chem 112 Recitation Exercises**

Initial Rate Method of Determining a Rate Law

1. The reaction $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$ was studied by following the initial rate of disappearance of NO for different reactant concentrations.

Expt.	$[NO]_0$	$[O_2]_0$	Rate of consumption of NO (M/s)
1	0.0125	0.0183	0.0202
2	0.0250	0.0183	0.0803
3	0.0125	0.0370	0.0409

a. What is the order of the reaction with respect to [NO]?

b. What is the order of the reaction with respect to $[O_2]$?

c. Write the rate law.

d. Calculate the rate constant. What are the units?

e. If the reaction was carried out with $[NO] = [O_2] = 0.0200$ M, what would be the observed rate of disappearance of NO?

Chemical Equilibrium and the Equilibrium Constant

2. Suppose a chemical reaction, $A \leftrightarrows B$, is reversible as indicated by the double arrows.

a. After the reaction above has proceeded for some length of time, it is observed that the rate of the forward reaction $A \rightarrow B$ is the same as the rate of the reverse reaction $B \rightarrow A$. At this point in the reaction, would you observe a change in the concentration of A or B?

b. The point reached in a reaction when there is no further change in the concentration of reactants and products is chemical equilibrium. Since the concentrations of reactants and products are constant at chemical equilibrium, we can construct an equilibrium constant K.

$$K_c = \frac{[B]}{[A]} \qquad \text{for the reaction } A \leftrightarrows B$$

In general, for the reaction, $aA + bB \leftrightarrows cC + dD$, $$K_c = \frac{[C]^c[D]^d}{[A]^a[B]^b}$$

Write an equation for K_c for the reactions below (solids and liquids are omitted);

i) $Cr^{3+}(aq) + 4OH^-(aq) \leftrightarrows Cr(OH)_4^-(aq)$

ii) $AgCl(s) + 2NH_3(aq) \leftrightarrows Ag(NH_3)_2^+(aq) + Cl^-(aq)$

iii) $Fe(OH)_3(s) + 3H_3O^+(aq) \leftrightarrows Fe^{3+}(aq) + 6H_2O$