Chemistry 121, Fall 2010
Quiz 8

1. Write an expression for the $K_{eq}$ for each of the following reactions:

   a) $\text{Na}_2\text{SO}_4(s) \rightleftharpoons 2 \text{Na}^+(aq) + \text{SO}_4^{2-}(aq)$
   b) $\text{C}(s) + 2 \text{H}_2(g) \rightleftharpoons \text{CH}_4(g)$

2. For the reaction below, which of the following will increase the rate of the forward reaction? Circle your choices. (You may choose more than one.)

   $$2 \text{H}_2(g) + \text{O}_2(g) \rightarrow 2\text{H}_2\text{O}(g)$$

   a) Increase the concentration of $\text{H}_2$ in the reaction container.
   b) Increase the concentration of $\text{O}_2$ in the reaction container.
   c) Increase the concentration of $\text{H}_2\text{O}$ in the reaction container.
   d) Add a catalyst.
   e) Increase the temperature.

3. [True/False] Determine whether each of the following statements are true or false.

   ______ At equilibrium, the amount of reactants roughly equals the amount of products.
   ______ At equilibrium, the rate of the forwards and reverse reactions are about equal.
   ______ At equilibrium, the ratio of amount of products to reactants is steady.
   ______ At equilibrium, the amount of reactants and products stay constant because the forward and reverse reactions have stopped.
   ______ For the reaction, $\text{A} + \text{B} \rightarrow 2\text{C}$, if you keep the temperature constant but increase the concentration of $\text{A}$, the reaction rate will increase because the reactant molecules will collide more frequently and more forcefully.
   ______ Not all collisions between reactant molecules will produce a reaction.

4. Look at the pictures below, displaying molecular-level pictures of three different reactions at equilibrium.

   [Images of RXN 1, RXN 2, RXN 3]

   Which reaction has the largest value of $K_{eq}$?

   Which reaction has the smallest value of $K_{eq}$?
5. Predict the effect on the equilibrium system below after each of the following disturbances is applied. The reaction is endothermic:

\[ \text{C (s)} + 2 \text{H}_2 (g) \rightleftharpoons \text{CH}_4 (g) \]

a) Hydrogen is removed from the container.

b) The reaction container is compressed.

c) Carbon is removed from the container.

d) The reaction container is heated.

e) Product is removed.

6. Suppose you are a chemist conducting the following exothermic reaction in the laboratory. Which of the following, below, are things you might do to maximize the amount of product that you could collect? Circle all the choices that apply.

\[ \text{N}_2 (g) + 3 \text{H}_2 (g) \rightleftharpoons 2 \text{NH}_3 (l) \]

a) Cool the reaction.

b) Increase the volume of the container.

c) Add a substance to absorb nitrogen gas.

d) Add more NH\textsubscript{3} to the container.

7. Using collision theory, explain why increasing the concentration of a reactant in a reaction will result in an increase in the reaction rate. Be specific.