CHEMISTRY 12 – UNIT II – EQUILIBRIUM

D: Dynamic Equilibrium (Introduction) ***It is expected that students will be able to…***

D1: Defining a reversible reaction

1. What does it mean for a reaction to be reversible?

   Use the reaction: $2H_2 + O_2 \rightleftharpoons 2H_2O$ in your answer's explanation.
   Make sure to use the reactants and products in your answer.

2. What is the reason that some reactions are spontaneous while other reactions are reversible?

D2 & D4: Defining Equilibrium

1. Comparing a reversible reaction and a reaction at equilibrium…
   a. What is the similarity between the 2 reactions?

   b. What is the difference between the 2 reactions?

2. An equilibrium system is said to be dynamic because at equilibrium the…

3. Define macroscopic properties and give three examples of macroscopic properties of a chemical reaction.

D3: Relate changes in rates of the forward and reverse reaction to changing concentrations of the reactants and products as equilibrium is established

4. For the following reversible reaction: $X \leftrightarrow Z + 10\ kJ$
   relate the changes in [reactant] and [product] if only particle Z was added to a reaction vessel and the reaction was allowed to proceed to equilibrium.

   a. Sketch a [concentration] vs. reaction proceeding graph to help you explain your answer!

   b. On the graph, show where equilibrium is reached.

   c. Indicate on your graph when the forward and reverse rates are equal

D7 - D9: Enthalpy and entropy changes and predicting the spontaneity of a reaction

1. Define ENTROPY and explain if chemical reactions prefer minimum or maximum entropy. In terms of ENTHALPY, do reactions prefer minimum or maximum enthalpy?

2. Consider the following reaction:

   $2\ SO_{2(g)} + O_{2(g)}\ ?\leftarrow ?\rightarrow ?\ 2\ SO_{3(g)} + 197\ kJ$

   Describe how the enthalpy and entropy change in the forward direction and state the result (will there be a reaction? If so, will it react completely or reach equilibrium?).

3. For the following reaction: $CO_{(g)} + 2\ H_{2(g)}\ ?\leftarrow ?\rightarrow ?\ CH_2OH_{(g)}$; $\Delta H = 45\ kJ$
   It was found that when carbon monoxide and hydrogen gas are mixed at room temperature the reaction did not occur. Give an explanation of why this is possible.