

## 2nd Semester Final Review - Equilibrium

- Why does a pressure increase on a gaseous equilibrium system favor the reaction that produces fewer gas molecules? *As pressure increases, volume decreases, in an effort to maintain pressure, the mole compact side of the equilibrium is favored.*
- Why is removing a product from an equilibrium system as it forms a good way to help maximize the yield of that product? *Removing a product will shift the equilibrium in the direction that will make more product.*
- Explain what happens to the rates of the forward and reverse reactions when a reaction system reaches equilibrium. *They become equal. Equilibrium exists when there is NO net changes in concentration.*
- What does  $K_{eq}$  tell you about a system at equilibrium? *Whether the forward or reverse rxn is favored.*
- Can the same reaction have different  $K_{eq}$  values? Explain? *Yes. A rxn will have a different  $K_{eq}$  at different temperatures.*
- What does a chemical formula in brackets, such as  $[N_2O_4]$ , represent? *concentration*
- What is the  $K_{eq}$  expression for the following reaction:  $2NO(g) + O_2(g) \rightleftharpoons 2NO_2(g)$ .  

$$K_{eq} = \frac{[NO_2]^2}{[NO][O_2]}$$
- A classmate concludes that reactions with large equilibrium constants are extremely fast. Explain whether the statement is true or false. *False. Equilibrium constants tell you nothing about the speed of the reaction.*
- Predict the effect of each of the following changes on the concentration of  $N_2O_4$ .  
 $2NO_2(g) \rightleftharpoons N_2O_4(g) + kJ$ 
  - a decrease in temperature *up  $[N_2O_4]$*
  - an increase in pressure *up  $[N_2O_4]$*
  - addition of  $NO_2(g)$  *up  $[N_2O_4]$*
  - addition of a catalyst *no effect*
- How will the direction of equilibrium shift when the following changes are made?  
 $2SO_3(g) + 197 kJ \rightleftharpoons 2SO_2(g) + O_2(g)$ 
  - Oxygen is added? *To the left favors reverse rxn*
  - The pressure is decreased *to the right favors forward rxn*
  - The temperature is increased *to the right favors forward rxn*
  - Gaseous sulfur dioxide is removed *to the right favors forward rxn*
- In the presence of a catalyst, methanol,  $CH_3OH$ , can be prepared by the reaction of  $H_2$  and  $CO$  at high temperatures.  $CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$ . Write the equilibrium expression for this reaction.  $K_{eq} = \frac{[CH_3OH]}{[CO][H_2]^2}$
- What is the concentration of  $CH_3OH(g)$  if  $[H_2] = 0.08 M$  and  $[CO] = 0.025 M$  and the  $K_{eq}$  value is 290 at the reaction temperature?  $[CH_3OH] = .046 M$
- For the reaction,  $CO_2(g) + H_2(g) \rightleftharpoons CO(g) + H_2O(g)$ , equilibrium is established at a certain temperature when the following concentrations are present:  $[CO_2] = 0.012 M$ ,  $[H_2] = 0.014 M$ ,  $[CO] = 0.019 M$ , and  $[H_2O] = 0.019 M$ . Calculate the  $K_{eq}$  value for this reaction.  $K_{eq} = 2.1$