

# Chapter 18 WS

**K<sub>sp</sub>, Gibbs, Order of Reactions**

Name: \_\_\_\_\_

Period: \_\_\_\_\_ Date: \_\_\_\_\_

Answer each of the following questions. Be specific and thorough.

- 1) Write the equilibrium dissociation equation as well as the solubility product equation for each of the following:
  - a. Calcium Sulfide
  - b. Lead (II) Sulfate
  - c. Silver Phosphate
  - d. Mercury (I) Iodide
  - e. Iron (III) Hydroxide
  
- 2) Use your understanding of solubility products and solubility to answer each of the following questions:
  - a. If the K<sub>sp</sub> of nickel (II) sulfide is  $4.0 \times 10^{-20}$ , what is the concentration of each at equilibrium?
  
  - b. If the K<sub>sp</sub> of silver sulfide is  $8.0 \times 10^{-51}$ , what is the concentration of each ion at equilibrium?
  
  - c. Based on the solubility products, which substance is more soluble in water? Why?
  
  - d. Does your answers for a and b verify your answer for c? Why or why not?
  
- 3) The K<sub>sp</sub> of silver bromide is  $5.00 \times 10^{-13}$ , what would be the bromide-ion concentration of a 1.00 L saturated solution of silver bromide if 0.0400 mol of silver nitrate is added to the solution?
  
  
  
  
  
  
  
  
  
  
- 4) What symbol do we use for entropy and what does it measure?
  - a. What does a negative entropy mean?
  - b. What does a positive entropy mean?
  
  
  
  
  
  
  
  
  
  
- 5) Will the entropy for each of the following be positive or negative? Why?
  - a. Sugar dissolving in tea
  - b. Frost forming on a window pane
  - c. Air pumped into a tire
  - d.  $CaCO_3(aq) \rightarrow CaO(aq) + CO_2(g)$
  - e.  $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

- 6) What symbol do we use for enthalpy and what does it measure?
- a. What does a negative enthalpy mean?
- b. What does a positive enthalpy mean?
- 7) What symbol do we use for free energy and what does it measure?
- a. What does a negative free energy mean?
- b. What does a positive free energy mean?
- 8) Calculate the free energy for each of the following reactions using the information given. Will the reaction occur at the temperature given?
- a.  $CH_3OH_{(l)} + \frac{3}{2}O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(g)}$      $\Delta H = -638.4 \text{ kJ}$      $\Delta S = 1.56 \frac{\text{kJ}}{\text{K}}$      $0^\circ\text{C}$
- b.  $C_2H_{4(g)} + H_{2(g)} \rightarrow C_2H_{6(g)}$      $\Delta H = -136.9 \text{ kJ}$      $\Delta S = -1.207 \frac{\text{kJ}}{\text{K}}$      $25^\circ\text{C}$

Reaction #1			Reaction #2		
Initial [A]	Initial [B]	Initial Rate	Initial [A]	Initial [B]	Initial Rate
0.100	.200	$5.4 \times 10^{-7}$	0.250	0.250	$1.0 \times 10^{-3}$
0.200	.200	$10.8 \times 10^{-7}$	0.250	0.500	$4.0 \times 10^{-3}$
0.200	.400	$21.6 \times 10^{-7}$	0.500	0.250	$9.0 \times 10^{-3}$

- 9) Use the information from the table for Reaction #1 to answer each of the following:
- a. What is the order of the reaction for A? Explain.
- b. What is the order of the reaction for B? Explain.
- c. What is the overall order of the reaction? Explain.
- d. What is the rate equation for Reaction #1?
- 10) Use the information from the table for Reaction #2 to answer each of the following:
- a. What is the order of the reaction for A? Explain.
- b. What is the order of the reaction for B? Explain.
- c. What is the overall order of the reaction? Explain.
- d. What is the rate equation for Reaction #2?