

## Solutions II Worksheet

- 1) Which of the following salts is more soluble in water at 25°C?  
 $\text{BaF}_2$   $K_{\text{sp}} = 2.4 \times 10^{-5}$        $\text{BaCO}_3$   $K_{\text{sp}} = 1.6 \times 10^{-9}$
- 2) The solubility product constant,  $K_{\text{sp}}$ , for nickel (II) carbonate is  $1.3 \times 10^{-7}$  at 25°C.
  - a. Write the balance chemical equation for this dissolving process.
  - b. Write the equilibrium expression.
  - c. Find the maximum molar concentration of all ions in solution and the molar solubility of the solution.
- 3) The solubility product constant,  $K_{\text{sp}}$ , for calcium hydroxide is  $6.5 \times 10^{-6}$  at 25°C.
  - a. Write the balance chemical equation for this dissociation in water.
  - b. Write the equilibrium expression.
  - c. Find the molar concentration of all ions in this solution and the molar solubility of the solution.
  - d. Calculate the maximum mass of calcium hydroxide that will dissolve in 100 mL of distilled water at 25°C.
- 4) A 250 mL saturated solution of silver chloride is prepared at 25°C. The solubility product constant,  $K_{\text{sp}}$ , for silver chloride is  $1.8 \times 10^{-10}$  at 25°C.
  - a. Write the balance chemical equation for this dissolving process.
  - b. Write the equilibrium expression.
  - c. Find the molar concentrations of all ions in this solution and the molar solubility of the solution.
  - d. What are the molar concentrations of all ions in a 500 mL saturated solution of silver chloride at 25°C?
- 5) What is minimum volume of distilled water that is needed to completely dissolve a 3.0 g sample of  $\text{CuCO}_3$  at 25°C? ( $K_{\text{sp}}$  for  $\text{CuCO}_3$  is  $2.5 \times 10^{-10}$  at 25°C.)
- 6) At a certain temperature,  $9.5 \times 10^{-5}$  g of zinc carbonate will dissolve in 150 mL of water.
  - a. Write the balanced chemical equation for the dissociation of zinc carbonate in water.
  - b. Calculate the molar solubility of zinc carbonate in water at this temperature.
  - c. Calculate the value of the solubility product constant,  $K_{\text{sp}}$ , for zinc carbonate at this temperature.
- 7) A 1.0 L saturated solution of zinc hydroxide is prepared, and the concentration of  $\text{Zn}^{2+}$  is measured to be  $4.22 \times 10^{-6}$  M at 25°C.
  - a. Write the balanced chemical equation for the dissociation of zinc hydroxide in water.

- b. Calculate the molar concentration of  $\text{OH}^-$  in solution.
  - c. Calculate the value of the solubility product constant,  $K_{\text{sp}}$ .
  - d. Calculate the maximum mass of zinc hydroxide that will dissolve in 150 mL of distilled water at  $25^\circ\text{C}$ .
  - e. What is the molar concentration of  $\text{Zn}^{2+}$  if 200 mL of water evaporates from the solution?
- 8) The solubility product constant,  $K_{\text{sp}}$ , for barium sulfate is  $1.1 \times 10^{-10}$  at  $25^\circ\text{C}$ . Will a precipitate of  $\text{BaSO}_4(s)$  form when 210 mL of  $4.75 \times 10^{-2} M \text{Ba}(\text{NO}_3)_2$  is mixed with 315 mL of  $0.450 M \text{Li}_2\text{SO}_4$ .
- 9) Find the solubility product constant for lead (II) iodide if the concentration of  $\text{I}^-$  is found to be  $1.25 \times 10^{-3} M$  when the solution is saturated.
- 10) Explain why  $\Delta S$  can be less than zero for the dissolution of some salts.
- 11) Use the  $K_{\text{sp}}$  value obtained in the previous question to determine if a precipitate will form when 350 mL of  $5.5 \times 10^{-2} M$  lead (II) nitrate is mixed with 250 mL of  $4.8 \times 10^{-2} M$  sodium iodide.
- 12) Find the solubility product constant for copper (II) carbonate if the concentration of  $\text{Cu}^{2+}$  is found to be  $1.5 \times 10^{-6} M$  when the solution is saturated.
- 13) Use the  $K_{\text{sp}}$  value obtained in the previous question to determine if a precipitate will form when 325 mL of  $0.50 \times 10^{-6} M$  copper (II) nitrate is mixed with 325 mL of  $0.50 \times 10^{-6} M$  potassium carbonate.
- 14) If a  $0.50 M$  solution of  $\text{K}_2\text{SO}_4$  is slowly poured into a beaker containing  $0.25 M$  barium nitrate and  $0.30 M$  lead (II) nitrate at  $25^\circ\text{C}$ , what will be the first precipitate that forms?  $K_{\text{sp}}$  for barium sulfate is  $1.1 \times 10^{-10}$  and  $K_{\text{sp}}$  for lead (II) sulfate is  $1.6 \times 10^{-8}$ .
- 15) If a  $0.50 M$  solution of  $\text{KOH}$  is slowly poured into a beaker containing  $0.35 M$  magnesium nitrate and  $0.032 M$  calcium nitrate at  $25^\circ\text{C}$ , what will be the first precipitate that forms?  $K_{\text{sp}}$  for calcium hydroxide is  $6.5 \times 10^{-6}$  and  $K_{\text{sp}}$  for magnesium hydroxide is  $6.3 \times 10^{-10}$ .
- 16) Explain why the solubility of  $\text{AgBr}$  decreases when  $\text{NaBr}$  is added to the system.
- 17) Explain why a glass of soda at  $30^\circ\text{C}$  will go flat faster than a glass of soda at  $5^\circ\text{C}$ .
- 18) Explain why bubbles of  $\text{CO}_2(g)$  form when you open a bottle of soda.
- 19)  $\text{NO}(g)$  is more soluble in water than  $\text{O}_2(g)$ . Explain.