Dougherty Valley HS Chemistry - AP
Solutions – Ksp FRQs

Worksheet #7

Name: **Period:** **Seat#:**

Directions: Show all work in a way that would earn you credit on the AP Test! This is always the rule! Grading rubrics posted in the Google Answer Key Drive. Check your work, correct in green pen after you try them yourself in an honest way! Don't peek at rubrics while you work! **USE BINDER PAPER, STAPLE TO YOUR WORKSHEET**. Clearly label work.

LONG ASSIGNMENT! DON'T WAIT UNTIL THE LAST MINUTE! BREAK IT INTO CHUNKS!
SET A TIMER FOR 1.5 MIN PER FRQ PART AND SEE IF YOU FINISH ON TIME!

2001

1. Answer the following questions relating to the solubility of the chlorides of silver and lead.

(a) At 10°C, 8.9×10^{-5} g of AgCl(s) will dissolve in 100. mL of water

(i) Write the equation for the dissociation of AgCl(s) in water.

(ii) Calculate the solubility, in mol L^{-1}, of AgCl(s) in water at 10°C.

(iii) Calculate the value of the solubility–product constant, K_{sp}, for AgCl(s) at 10°C.

(iv) How many moles of NaCl would you need to add in order to reduce the concentration of Ag^+ to 6.8×10^{-7} M?

(b) At 25°C, the value of K_{sp} for $PbCl_2$(s) is 1.6×10^{-5} and the value of K_{sp} for AgCl(s) is 1.8×10^{-10}.

(i) If 60.0 mL of 0.0400 M NaCl(aq) is added to 60.0 mL of 0.0300 M $Pb(NO_3)_2$(aq), will a precipitate form? Assume that volumes are additive. Show calculations to support your answer.

(ii) Calculate the equilibrium value of $[Pb^{2+}(aq)]$ in 1.00 L of saturated $PbCl_2$ solution to which 0.250 mole of NaCl(s) has been added. Assume that no volume change occurs.

(iii) If 0.100 M NaCl(aq) is added slowly to a beaker containing both 0.120 M $AgNO_3$(aq) and 0.150 M $Pb(NO_3)_2$(aq) at 25°C, which will precipitate first, AgCl(s) or $PbCl_2$(s)? Show calculations to support your answer.

2004

1. Answer each of the following Q's relating to the solubilities of two silver compounds, Ag_2CrO_4 and Ag_3PO_4.

Silver chromate dissociates in water according to the equation shown below.

$$Ag_2CrO_4(s) \leftrightarrow 2\ Ag^+(aq) + CrO_4^{2-}(aq) \qquad K_{sp} = 2.6 \times 10^{-12} \text{ at } 25°C.$$

(a) Write the equilibrium constant expression for the dissolving of Ag_2CrO_4(s).

(b) Calculate the concentration, in mol L^{-1}, of Ag^+(aq) in a saturated solution of Ag_2CrO_4 at 25°C.

(c) Calculate the maximum mass, in grams, of Ag_2CrO_4 that can dissolve in 100. mL of water at 25°C.

(d) A 0.100 mol sample of solid $AgNO_3$ is added to a 1.00 L saturated solution of Ag_2CrO_4. Assuming no volume change, does $[CrO_4^{2-}]$ increase, decrease, or remain the same? Justify your answer.

In a saturated solution of Ag_3PO_4 at 25°C, the concentration of Ag^+(aq) is 5.3×10^{-5} M. The equilibrium–constant expression for the dissolving of Ag_3PO_4(s) in water is shown below.

$$K_{sp} = [Ag^+][PO_4^{3-}]$$

(e) Write the balanced equation for the dissolving of Ag_3PO_4 in water.

(f) Calculate the value of K_{sp} for Ag_3PO_4 at 25°C.

(g) A 1.00 L sample of saturated Ag_3PO_4 solution is allowed to evaporate at 25°C to a final volume of 500. mL. What is $[Ag^+]$ in the solution? Justify your answer.

2006

1. Answer the following questions that relate to solubility of salts of lead and barium.

(a) A saturated solution is prepared by adding excess $PbI_2(s)$ to distilled water to form 1.0 L of solution at 25°C. The concnetration of $Pb^{2+}(aq)$ in the saturated solution is found to be 1.3×10^{-3} M. The chemical equation for the dissolution of $PbI_2(s)$ in water is shown below.

$$PbI_2(s) \leftrightarrow Pb^{2+}(aq) + 2\ I^-(aq)$$

(i) Write the equilibrium–constant expression for the equaiton

(ii) Calculate the molar concentration of $I^-(aq)$ in the solution.

(iii) Calculate the value of the equilibrium constant, K_{sp}.

(b) A saturated solution is prepared by adding $PbI_2(s)$ to distilled water to form 2.0 L of solution at 25°C. What are the molar concentrations of $Pb^{2+}(aq)$ and $I^-(aq)$ in the solution? Justify your answer.

(c) Solid NaI is added to a saturated solution of PbI_2 at 25°C. Assuming that the volume of the solution does not change, does the molar concentration of $Pb^{2+}(aq)$ in the solution increase, decrease, or remain the same? Justify your answer.

(d) The value of K_{sp} for the salt $BaCrO_4$ is 1.2×10^{-10}. When a 500. mL sample of 8.2×10^{-6} M $Ba(NO_3)_2$ is added to 500. mL of 8.2×10^{-6} M Na_2CrO_4, no precipitate is observed.

(i) Assuming that volumes are additive, calculate the molar concentrations of $Ba^{2+}(aq)$ and $CrO_4^{2-}(aq)$ in the 1.00 L of solution.

(ii) Use the molar concentrations of $Ba^{2+}(aq)$ ions and $CrO_4^{2-}(aq)$ ions as determined above to show why a precipitate does not form. You must include a calculation as part of your answer.

Reflection: Think about the types of mistakes you made, things you need to restudy, things that tricked you, etc. One of the most important skills to develop in AP Chem is self reflection and not making the same mistakes. The joke is – you should always make NEW mistakes, not the SAME mistakes ☺