Unit 09 Problem Set 5 #1-13 KEY

1	
Write balanced equations for the dissolution (dissociation) reactions and the corresponding solubility product expressions for each of the following solids: a)$AgC_2H_3O_2$ b)$Al(OH)_3$ c)$Ca_3(PO_4)_2$	a)Ksp = $[Ag^{+1}][C_2H_3O_2^{-1}]$ b)Ksp = $[Al^{+3}][OH^{-1}]^3$ c)Ksp = $[Ca^{+2}]^3[PO_4^{-3}]^2$
2	
The molar solubility of Ag_2SO_4 is 1.44 x 10^{-2} mol/L. Calculate the K_{sp} of this compound.	Ksp = 1.19 x 10^{-5}
3	
The solubility of $CaSO_4$ (MM = 136.04 g/mol) is 0.955 g/L. Calculate the K_{sp} of $CaSO_4$.	Ksp = 4.93 x 10^{-5}
4	
Calculate the molar solubility of $Co(OH)_3$ (K_{sp} = 2.51 x 10^{-43}) in moles per liter	9.82 x 10^{-12} M
5	
Barium sulfate is a contrast agent for X-ray scans that are most often associated with the gastrointestinal tract. Calculate the mass of $BaSO_4$ that can dissolve in 100.0 mL of solution. The K_{sp} value for $BaSO_4$ is 1.5 x 10^{-9}.	9.02 x 10^{-4} g
6	
A saturated solution of AgCl (K_{sp} = 1.77 x 10^{-10}) contains a white precipitate of solid AgCl. When a solution of I^- ions is added, the white precipitate disappears and is replaced by a yellow precipitate of AgI, (K_{sp} = 8.52 x 10^{-17}). How can this observation be explained?	AgI is less soluble since Ksp is lower. Added I^- ion precipitates free Ag^+ ions causing more AgCl to dissolve until most of the AgCl has been converted to the less soluble AgI.
7	
Which is more soluble, AgCl, K_{sp} = 2x 10^{-10} or Ag_2CO_3, K_{sp} = 8 x 10^{-12}? Show calculations to support your answer.	AgCl ⇒ 1.4 x 10^{-5} M Ag_2CO_3 ⇒ 1.3 x 10^{-4} M Ag_2CO_3 is more soluble (note: comparing Ksp is not enough since number of ions in each compound is not the same)
8	
Consider the solubility equilibrium: AgI ⇔Ag^+(aq) + I^-(aq) (K_{sp} = 8.52 x 10^{-17}). Calculate the solubility of AgI in pure water. Then calculate the new solubility of AgI in a solution containing 1.00 x 10^{-3} M NaI.	in pure water: 9.23 x 10^{-9} M in 1.00 x 10^{-3} M NaI: 8.52 x 10^{-14} M (less soluble due to common ion effect with I^{-1})
9	
Determine the solubility of lead(II) fluoride, K_{sp} = 4.0 x 10^{-8} in: a) 0.10 M $Pb(NO_3)_2$ b) 0.010 M NaF	a)3.2 x 10^{-4} M b)4.0 x 10^{-4} M

10 A 200.0 mL solution of 4.00 x 10^{-3} M $BaCl_2$ is added to a 600.0 mL solution of 8.00 x 10^{-3} M K_2SO_4. Assuming that the volumes are additive, will $BaSO_4$ (K_{sp} = 1.08 x 10^{-10}) precipitate from this solution?	Q = 6 x 10^{-6} (don't forget to account for mutual dilution due to mixing to higher total volume) Q > Ksp so precipitate forms
11 Will a precipitate of $Ca(OH)_2$ (K_{sp} = 5.02 x 10^{-6}) form if 2.00 mL of 0.200 M NaOH is added to 1.00 x 10^3 mL of 0.100 M $CaCl_2$?	Q = 1.59 x 10^{-8} Q < Ksp so NO precipitate forms
12 Lead(II) chromate has a K_{sp} of 2.0 x 10^{-16}. Exactly 4.0 mL of 0.0040 M lead(II) nitrate is mixed with 2.0 mL of 0.00020 M sodium chromate. a) Write the precipitation reaction (net ionic). b) Show the K_{sp} expression for this solid precipitate dissociating. c) Will a precipitate form? Show calculations to support your answer. d) What would be the effect on the solubility equilibrium system if concentrated potassium chromate solution is added?	a)$Pb^{+2} + CrO_4^{-2} \Leftrightarrow PbCrO_4$ b)Ksp = $[Pb^{+2}][CrO_4^{-2}]$ = 2.0 x 10^{-16} c)Q = 1.78 x 10^{-7}; Q > Ksp; precipitate forms d)Adding common ion (CrO_4^{-2}) decreases solubility
13 A solution is prepared by adding 50.0 mL of 0.10 $Pb(NO_3)_2$ with 50.0 mL of 1.0 M KCl. Calculate the concentrations of Pb^{2+} and Cl^- at equilibrium (K_{sp} for $PbCl_{2\,(s)}$ = 1.6 x 10^{-5}).	$[Pb^{+2}]$ = 1 x 10^{-4} M $[Cl^{-1}]$ = 0.40 M