Chem12 Solutions : Exam Problems #1-120

1) Two solutions are mixed and a precipitate forms. The trial ion product is : a) equal to K_{sp} b) greater than K_{sp} c) less than K_{sp}

2) Determine the solubility of limestone, $CaCO_3$ in water. (K_{sp} = $4.80x10^{-9}$)

a) $2.19x10^{-5}$M   b) $4.81x10^{-9}$M   c) $6.93x10^{-5}$M   d)$2.3x10^{-18}$M

3) Given the following data :

K_{sp}	Ions in solution
AgCN = $1.6x10^{-14}$	[CN$^-$] = 0.1M
AgCl = $1.8x10^{-10}$	[Cl$^-$] = 0.1M
$AgC_2H_3O_2$ = $2.5x10^{-3}$	[$C_2H_3O_2$$^-$] = 0.1M
AgBr = $7.7x10^{-13}$	[Br$^-$] = 0.1M
AgI = $8.3x10^{-17}$	[I$^-$] = 0.1M

Which of the following precipitates would form first on dropwise addition of 0.10M $AgNO_3$ to 5 mL samples of each solution?

a) AgI   b) AgBr   c) AgCl   d) $AgC_2H_3O_2$ e) AgCN

4) What is the maximum concentration of Magnesium ions (Mg^{2+}) in a solution which has carbonate ion (CO_3^{2-}) concentration of $5.0x10^{-1}$M ?
(K_{sp} for $MgCO_3$ = $2.5x10^{-5}$)

a) $5.0x10^{-1}$M   b) $5.0x10^{-5}$M   c) $4.0x10^{-3}$M   d) $2.5x10^{-5}$M
e) $5.3x10^{-10}$M

5) The equation for silver chromate dissolving in water is : Ag_2CrO_4(s) -> $2Ag^+$(aq) + CrO_4^{2-}(aq) What is the K_{sp} expression?

a) $[Ag^+]^2[CrO_4^{2-}]$ b) $[Ag^+][CrO_4^{2-}]^2$ c) $[2Ag^+][CrO_4^{2-}]$
d) $\{[Ag^+]^2[CrO_4^{2-}]\}/[Ag_2CrO_4]$

6) What is the solubility of silver chloride, AgCl in water given :
K_{sp} = $1.8x10^{-10}$

a) $3.24x10^{-20}$M   b) $1.80x10^{-10}$M   c) $1.34x10^{-5}$M   d) $1.9x10^{-3}$M

7) What is the solubility of lead (II) iodide (PbI_2) in water given :
K_{sp} = 7.10x10^{-9} ?

a) 7.10x10^{-9}M   b) 8.44x10^{-5}M   c) 1.92x10^{-3}M   d) 1.21x10^{-3}M

8) 10.0 mL Of 1.00x10^{-5} M $AgNO_3$ and 30.0 mL of 2.00x10^{-4} M NaCl are mixed. K_{sp}(AgCl) = 1.8x10^{-10}. Which one of the following occurs ?

a) Ion product = 3.75x10^{-10} and a precipitate forms.
b) Ion product = 3.75x10^{-10} and a precipitate does not form.
c) Ion product = 2.00x10^{-9} and a precipitate forms.
d) Ion product = 2.00x10^{-9} and a precipitate does not form.

9) What is the maximum concentration of magnesium ions possible at equilibrium in a solution containing 2.0x10^{-2} M oxalate ions ($C_2O_4^{2-}$) given that K_{sp} (MgC_2O_4) = 8.6x10^{-5}

a) 4.3x10^{-3} M   b) 5.16x10^{-2} M   c) 1.04x10^{-1} M   d) 2.33x10^{-2} M

10) The solubility of thallium iodate, $TlIO_3$, is 1.5x10^{-3} M at 25°C. What is its K_{sp} at this temperature? _____

11) Which one of the following conditions will result in the formation of a precipitate of AgCl when solid NaCl is added to a solution of silver nitrate $AgNO_3$?

a) The product of the molar concentrations of aqueous Ag$^+$ and Cl$^-$ ions is less than the K_{sp} for AgCl.
b) No precipitate will occur unless the solution becomes saturated with NaCl first.
c) The product of the molar concentrations of aqueous Ag$^+$ and Cl$^-$ ions exceeds the K_{sp} for AgCl.
d) The concentration of aqueous Na$^+$ ions is greater than the concentration of aqueous Ag$^+$ ions.

12) The solubility of Cd(OH)$_2$ in water is 1.40x10^{-5} M. What is the value of the solubility product constant?

a) 2.74x10^{-15} b) 1.10x10^{-14} c) 1.71x10^{-10} d) 1.43x10^{-5}

13) Which of the following occurs when equal volumes of 0.20 M Ba(NO$_3$)$_2$ and 0.20 M K$_2$SO$_4$ are mixed?

a) No precipitate forms   b) A precipitate of KNO_3 forms.
b) A precipitate of $BaSO_4$ forms   d) Insufficient information

14) Which one of the following statements is true about what occurs when 30 mL of 8.00×10^{-8} M $Ca(NO_3)_2$ mixed with 10.0 mL of 3.00×10^{-2} M NaF ? K_{sp} for CaF_2 = 4.9×10^{-11}.

a) The trial ion product is 4.5×10^{-10} and a precipitate forms.
b) The trial ion product is 2.4×10^{-10} and a precipitate forms.
c) The trial ion product is 3.4×10^{-12} and a precipitate does not form.
d) The trial ion product is 4.5×10^{-10} and a precipitate does not form.

15) For the reaction $Ag_2CO_3(s) <-> 2Ag^+(aq) + CO_3^{2-}(aq)$ what will be the effect on the position of this equilibrium on adding solid $AgNO_3$? Give a brief explanation for your answer.

16) What is the solubility of AgI in g/L in a 0.0400 M solution of MgI_2 ? (K_{sp} for AgI = 8.30×10^{-17})

17) What is the equilibrium concentration of $Sr^{2+}(aq)$ in a saturated aqueous solution of $SrSO_4$? K_{sp} of $SrSO_4(s)$ = 2.8×10^{-7}

a) 1.4×10^{-7} M   b) 2.8×10^{-7} M   c) 5.3×10^{-4} M   d)5.3×10^{-3} M

18) $PbCl_2(s)$ is precipitated from a solution containing $Pb^{2+}(aq)$ and Cl^-(aq). Which one of the following relationships describes the concentration of the ions remaining in solution? K_{sp} = :

a) $[Pb^{2+}]^2[Cl^-]^2$ b) $[Pb^{2+}][Cl^-]$ c) $[Pb^{2+}][Cl^-]^2$ d) $[Pb^{2+}][2Cl^-]^2$

19) Which one of the following is the correct relationship between the solubility (S) and (K_{sp}) of lead (II) chloride ($PbCl_2$) ?

a) K_{sp} = S   b) K_{sp} = S/2   c) K_{sp} = 2S   d) K_{sp} = $4S^3$

20) A black precipitate of copper(II)sulfide is produced when hydrogen sulfide gas is bubbled through a solution of copper(II)sulfate. State the reason for the formation of the precipitate, and support your answer with equations for the reaction which occurs.

21) Silver acetate, $AgCH_3COO(s)$ crystals are in equilibrium with a saturated solution. Which of the following would cause more $AgCH_3COO(s)$ to dissolve ?

a) The addition of a few crystals of silver nitrate ($AgNO_3$)
b) The addition of a few drops of concentrated nitric acid (HNO_3)
c) The addition of a few crystals of sodium acetate, $NaCH_3COO$.
d) The evaporation of some water from the solution with no temperature change.

22) 1.0 L of a saturated solution of thallium bromide TlBr was evaporated to dryness to produce 0.56 g of TlBr(s). (molecular mass = 284 g/mol) What is the solubility product of thallium bromide?

a) $2.0x10^{-6}$ b) $3.9x10^{-6}$ c) $2.0x10^{-3}$ d) $4.4x10^{-2}$

23) A solution contains $Ba^{2+}(aq)$, $Pb^{2+}(aq)$, $Fe^{2+}(aq)$, and $Mg^{2+}(aq)$. Which of the following negative ions would cause a precipitate with only one of these metal ions ?

a) $I^-(aq)$ b) $SO_4^{2-}(aq)$ c) $NO_3^-(aq)$ d) $PO_4^{3-}(aq)$

24) What is the minimum mass of $Na_2SO_4(s)$ crystals that must be dissolved in 5.00 L of 0.00100 M $Ca(NO_3)_2$ solution in order to precipitate of calcium sulfate? (K_{sp} for $CaSO_4$ = $2.60x10^{-5}$)

Answers : 1) b, 2) c, 3) a, 4) b, 5) a, 6) c, 7) d, 8) a, 9) a, 10) $2.25x10^{-6}$, 11) c, 12) b, 13) b, 14) c, 15) $AgNO_3(s)$ is very soluble. When added to the solution, there is a shift to the left. This is because of the common ion effect. Le Chatelier's principle says that in an equilibrium reaction, the equilibrium shifts to the side which reduces the effect of the change., 16) $2.35x10^{-13}$, 17) c, 18) c, 19) d, 20) $H_2S(g) + CuSO_4(aq) -> CuS(s)$, 21) b, 22) b, 23) a, 24) 18.5 g.