CHM 112.009
Additional Problems – Chapter 17

1. Which of the following solutions and substances will increase the ionization of formic acid, HCOOH?
   (a) KI
   (b) NaOH
   (c) HNO_3
   (d) NaCOOH
   (e) CN^-
2. Calculate the $[C_6H_5C00^-]$ in a solution that is 0.015 M C_6H_5COOH and 0.051 M HCl. K_a for C_6H_5COOH is 6.3×10^{-5}.
3. What is the pH of a buffer solution that is made by
   (a) combining 0.245 M CH_3NH_2 and 0.186 M CH_3NH_3Cl. K_b for CH_3NH_2 is 4.2×10^{-4}.
   (b) adding 2.00 mL of 0.0850 M NaOH to 75.00 ml of the buffer formed in part (a.)
4. 0.500 mole formic acid (HCOOH) is combined with 50.0 g. of sodium formate (NaCOOH) in enough water to give a final volume of 1.00 L. K_a for formic acid is 1.8×10^{-4}.
   (a) compute is the pH of this solution
   (b) compute the pH of the solution after adding 400.0 ml of 1.00 M HNO_3
   (c) compute the pH after adding an additional 400.0 ml of 1.00 M HNO_3
5. 400.0 ml of 1.4 M NH_3 (ammonia) is combined with 80.0 g of NH_4Cl in enough water to give a final volume of 1.50 L. K_b for ammonia is 1.8×10^{-5}.
   (a) compute the pH of this solution
   (b) compute the pH of the solution after adding 600.0 ml of 1.00 M NaOH
   (c) compute the pH after adding an additional 600.0 ml of 1.75 M NaOH
   (d) starting with the solution in part (a), compute the pH after adding 250.0 ml of 1.00 M HCl
6. Calculate K_{sp} values for the following in which a reference book lists the indicated solubilities.
   (a) $Ce(IO_3)_4$, solubility = 1.8×10^{-4} mol/L
   (b) Hg_2SO_4, solubility = 8.9×10^{-4} mol/L
   (c) $BaCrO_4$, solubility = 0.0010 g/100 cc H_2O
7. Calculate the molar solubility of
   (a) $Mg(OH)_2$ in 0.25 M NaOH. K_{sp} for $Mg(OH)_2$ is 1.8×10^{-11}
   (b) $BaSO_4$ in 0.01 M Na_2SO_4. K_{sp} for $BaSO_4$ is 1.1×10^{-10}
8. A solution is saturated with Ag_2CrO_4. K_{sp} for Ag_2CrO_4 is 1.1×10^{-12}
   (a) Calculate the $[CrO_4^{2-}]$ in the saturated solution
   (b) What mass of $AgNO_3$ must be added to 0.635 L of this solution to reduce $[CrO_4^{2-}]$ to 1.0×10^{-8} M
9. What must be the pH of the solution that is 0.050 M Fe^{3+} to just cause $Fe(OH)_3$ to precipitate? K_{sp} for Iron (III) Hydroxide is 4.0×10^{-38}
10. Concentrated $Pb(NO_3)_2$ is slowly added to a solution that is 0.15 M Na_2CrO_4 and 0.15 M Na_2SO_4. K_{sp} for $PbCrO_4$ is 2.8×10^{-13} K_{sp} for $PbSO_4$ is 1.6×10^{-8}
    (a) What is the first ppt to form?
    (b) What $[Pb^{2+}]$ is needed to start the second precipitation
11. Calculate the solubility of $Mg(OH)_2$ in a buffer solution that is 0.75 M NH_3 and 0.50 M NH_4Cl? K_{sp} for Magnesium Hydroxide is 1.8×10^{-11}