Practice problems from week 5:

1) How many milligrams of sodium chloride, NaCl (MW=58.5g/mol), can be added to 600. mL of 1.50 μM silver nitrate before a precipitate forms? K_{sp} of AgCl = 1.8×10^{-10}.
(4.21 mg)

2) The pH of a nitric acid solution with a density of 1.20 g/mL is 1.70 .

a) Calculate the concentration of the acid.   (0.020M)

b) If 50.0 mLs of this acid are added to 100.0 mL of 0.020 M $C_{13}H_{20}N_2O_2$ (procaine, K_b = 7.1 x 10^{-6}), what is the pH of this mixture? (8.85)

c) If 15.0 mLs of this acid are added to 34.0 mL of 0.029 M $C_{13}H_{20}N_2O_2$ (still procaine, K_b = 7.1 x 10^{-6}), what is the pH of this mixture?   (9.21)

$$C_{13}H_{20}N_2O_2 \text{ (aq)} + H_2O \text{ (l)} <===> H\,C_{13}H_{20}N_2O_2^+ \text{ (aq)} + OH^-$$
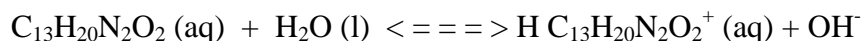
3) A biochemist needs 15.0 L of an acetic acid-sodium acetate buffer with a pH = 4.60. solid sodium acetate, $NaC_2H_3O_2$, (MW = 82.0g/mol) and glacial acetic acid, $HC_2H_3O_2$ (MW = 60.0) are available. Glacial acetic acid is 99.0% acetic acid by mass and has a density of 1.08 g/mL. If the buffer is to be 0.125 M in $HC_2H_3O_2$, how could you prepare this buffer? K_a = 1.78 x 10^{-5} for acetic acid.   (105 g+110 mL)

4) An experiment found that 0.401 mg of manganese hydroxide ($Mn(OH)_2$, 88.9g/mol) dissolved in 200. mL of a saturated aqueous solution.

A) Calculate the pH of the solution.   (9.65)

B) calculate the K_{sp} of $Mn(OH)_2$ (4.57×10^{-14})

5) What is the molar solubility of lead bromide ($PbBr_2$, K_{sp} = 6.3×10^{-6}) in a solution which already contains 0.120 M KBr.   (4.4×10^{-4})

6) What is the formation constant for the complex $[Ag(NH_3)_2]^+$ if the concentration of free silver, $[Ag^+]_{free}$ in a 0.100 M $Ag(NH_3)_2Cl$ solution is 1.2×10^{-3} M?   (1.5×10^7)

7) a) What is the molar solubility of cadmium hydroxide ($Cd(OH)_2$, K_{sp} = 1.2×10^{-14}) in a solution buffered (i.e. fixed!) at pH 8.00?   (0.012)

b) Without calculations explain if you expect the solubility of $Cd(OH)_2$ in an acidic solution, will be greater than, equal, or less than that above (i.e. pH 8.00).   (greater)