Self Quiz – Acid/Base Equilibria

1. 5.00 mL of 0.10 M HNO_3 is titrated with 0.010 M NaOH.

 a) Write the titration reaction that is occurring:

 b) Sketch the titration curve you will expect, labeling your x and y-axis with some pertinent numbers so that your curve could be used for pH estimation.

2. Suppose that your CHEM 201 instructor asked you to calculate carefully the molar solubility of mercury(II) thiocyanate ($Hg(SCN)_2$) in pure water. Hydrogen thiocyanate, HSCN, is a weak acid in water so we should expect the thiocyanate ion to be a weak base. Write the two independent <u>mass balance</u> expressions that apply to the solution of this problem. (Remember your instructor wants to see all pertinent reactions in solution).

3. Suppose that your CHEM 201 instructor asked you to calculate carefully the molar solubility of mercury(II) thiocyanate (Hg(SCN)2) in pure water. Hydrogen thiocyanate, HSCN, is a weak acid in water so we should expect the thiocyanate ion to be a weak base. Write the <u>charge balance</u> expression that applies to the solution of this problem (remember your instructor wants to see all pertinent reactions in solution).

4. A 1.0 x 10^{-3} M CuSO$_4$ solution is prepared in 1 M aqueous ammonia. As you might not know, this results in the formation of the royal blue Cu(NH$_3$)$^{+2}$ complex. Write the complete charge balance expression you'll expect if these compounds are all that is in solution (show all pertinent reactions in solution).

5. Calculate the pH of a 2.0 x 10^{-7} M solution of KOH in pure water.

6. Calculate the pH of a 7.0×10^{-8} M solution of $HClO_4$ in pure water.

7. A buffer is prepared by mixing together 100 mL each of 0.1 M ammonium chloride solution and 0.2 M ammonia (for a total volume of 200 mL). pKa = 9.24

a) Calculate the pH of the resulting solution.

b) Calculate the pH of a 10 mL portion of this buffer to which is added 1 mL of 0.2 M HCl.

c) Calculate the pH of another 10 mL portion of the original buffer to which is added 1 mL of 0.2 M KOH.

8. 25 mL of 0.2 M aqueous ammonia (NH_3, a weak base in water) is titrated with 0.1 M HNO_3.

a) Write the titration reaction.

b) Sketch the titration curve you will expect, including some pertinent values on your x and y-axis so that your curve could be used for pH estimation.

9. Write the equations of mass balance for a 0.100 M $[Cd(NH_3)_4]Cl_2$ solution.

10. Calculate the concentrations of all ions in a 0.0200 M H_2SO_4 solution.

11. Calculate the volumes of 0.500 M NH_4Cl and 0.500 M NH_3 required for the preparation of 200 mL of a buffer of pH 8.00. $K_b=1.8 \times 10^{-5}$