

Chem201 Self Quiz – 4 (Acid/Base Equilibria)

1. a. Calculate the molar solubility of mercury(II) thiocyanate ($\text{Hg}(\text{SCN})_2$) 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 mass balance expressions that apply to this problem. (Remember: to give all pertinent reactions in solution).

b. Write the charge balance expression that applies to the solution of this problem (remember all pertinent reactions in solution).

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

3. A 0.3050 g sample containing a weak acid HA (FW = 60.05) is dissolved in water and diluted to 50.00 mL. This diluted solution is titrated with 0.1000 M NaOH solution. When half of the acid has been neutralized, the pH is 4.74, whereas at the equivalence point the pH is 8.72. What if I asked you to calculate the percent HA in the sample...?

Well, the answer is 98.8%, show me in detail, step by step how I got this.

4. 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). $pK_a = 9.24$

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. The pH will be around the pK_a of 9.24

5. Calculate the pH of a solution obtained by mixing equal volumes of HCl solutions having pH 2.00 and 3.00.