Laude CH 302 Spring 2006 Worksheet 6

{To make your life easier when working the problems, convert the compounds in the problems below to H^+, OH^-, HA, A^-, B, or BH^+ when you are struggling.)

Neutralization

1. Write the balanced neutralization reactions and then calculate the final amount of each compound in solution after neutralization:

    a. 2 mol NaHCOO and 1mol HCl

    b. 1 mol HNO_3 and 1.5 mol KOH

    c. 5 mol NH_4NO_2 and 1 mol HI

    d. 0.7 mol CH_3NH_3Cl and .5 mol $Ca(OH)_2$

Simple buffers

2. Identify buffer solutions. Remember to neutralize when necessary.

    a. 1.5 M acetic acid solution (CH_3COOH) and .5M potassium acetate

    b. 2 M Na_2CO_3 solution and 1 M HCl

    c. .02 M lactic acid and 1M HCl

    d. 1.5 M $Ba(OH)_2$ and 1 M $BaCl_2$

    e. 1.0 M NaOH and 2 M hydrazine bromide (NH_3NH_3Br)

    f. 1.0 M HNO_3 and 2.0 M sodium acetate ($NaCH_3COO$)

    g. 1.0 M HNO_3 and 2.0 M sodium sulfate

    h. 1 M ammonia and 2 M ammonium nitrate

3. Write out the equation and then calculate the pH of these solutions:

    a. 1.5M $NaNO_2$ and .5 M HNO_2 $K_a = 4.3 \times 10^{-4}$

    b. 1M ammonia and 2M ammonium nitrate $K_b = 1.8 \times 10^{-5}$

    c. 3 M $NaCH_3COO$ and 1 M H_2SO_4 $K_a = 1.8 \times 10^{-5}$

    d. 2 M Na_sSO4 and 1M HF $K_a = 4.3 \times 10^{-4}$

Titration curve

4. Draw the titration curve for each of these reactions and then calculate the pH of these solutions at neutralization.

a. 100ml .5M NaOH and 150ml .5M HBr

b. Equal amounts of 2M NH_3 and 2M HNO_3, K_a of NH_4^+ = 5.55 x 10^{-10}

c. Equal amounts of 1.5M HI and 1.5 M KClO , K_b of ClO^- = 3.33 x 10^{-7}

Polyprotic acid equilibria

5. Write out the equation expressions and calculate total $[H^+]$ and pH of these solutions. In each case assume the simple (single K) eqilibria:

a. 1.2 M H_2CO_3, $K_1 = 4.3 \times 10^{-7}$ and $K_2 = 5.6 \times 10^{-11}$

b. 2 M H_2SO_4, K_1= strong, $K_2 = 1.2 \times 10^{-2}$

Approximation vs. solving quadratic equation

6. Fill in the bank:

Acid/base	K_a	[H+] using approximation (M)	[H+] by quadratic equation (M)	
.001M HF ↔ $H^+ + F^-$	4.5 x 10^{-3}			
.3M HSO_4- ↔ H^+ + SO_4^-	1.2 x 10^{-2}			
.01M NH_3+ H_2O ↔ $NH_4^+ + OH^-$	1.8 x 10^{-5}			
3 M CH_3COOH ↔ $CH_3COO^- + H^+$	1.8 x 10^{-5}			