Recitation

26 October 2009

Group Problems

1. Rank the following in order of increasing acidity (same may be relatively equal).

   NaBr, KNO_2, $HClO_4$, HNO_2, NH_4ClO_4, and NH_4NO_2.

2. Calculate the pH of the following solutions:
   a. 0.1 M NaF (HF $K_a = 7.2 \times 10^{-4}$)

   b. 0.1 M NH_4Cl (NH_3 $K_b = 1.8 \times 10^{-5}$)

   c. 0.1 M $NH_4C_2H_3O_2$ (Ammonium Acetate)

   $HC_2H_3O_2$ $K_a = 1.8 \times 10^{-5}$
   NH_3, $K_b = 1.8 \times 10^{-5}$

3. Calculate the pH of a solution of:
   a. 0.1 M HF
   b. 0.1 M HF and 0.1 M NaF

   Explain using LeChatelier's Principle why the pH is different for the two solutions above.

4. What is meant by the capacity of a buffer? How do the following buffers differ in capacity? How do they differ in pH?
    a. 0.01 M acetic acid and 0.01 M sodium acetate
    b. 0.1 M acetic acid and 0.1 M sodium acetate
    c. 1.0 M acetic acid and 1.0 M sodium acetate

5. Calculate the pH of a solution formed by mixing 100.0 mL of 0.100 M NaF (HF, $K_a = 7.2 \times 10^{-4}$) and 100.0 mL of 0.025 M HCl.

6. Using the acetate buffer, outline the steps needed to prepare a 20.0 L solution of the buffer. Identify specifically the number of moles needed to yield the desired pH of 5.1.

(acetic acid and sodium acetate, $K_a = 1.8 \times 10^{-5}$ for acetic acid)

7. How many moles of NaOH must be added to a 1.0 L solution of 2.0 M $HC_2H_3O_2$ ($K_a = 1.8 \times 10^{-5}$) to produce a solution buffered at each of the following pH values?
    a. pH = pKa
    b. pH = 4.00
    c. pH = 5.00

Individual Problems

1. Calculate the pH of a solution that is 0.60 M HF and 1.00 M HF.

2. What relative ratios of NH_4Cl and NH_3 ($K_b = 1.8 \times 10^{-5}$) are needed to achieve the following buffered pH values?
   a. 9.25
   b. 9.61
   c. 9.02

   What is the working pH range for this buffer?

3. Using 1 L of the buffered solution in problem 1, calculate the pH observed after the following additions:
   a. 100 mL of 1.0 M HCl is added
   b. 100 mL of 1.0 M NaOH is added