Worksheet 5

1. Write the K_a expression and then rearrange it to show that $K_a = [H_3O^+]$ when the concentrations of acid and base are the same.

2. Given the K_a for HOBr is 1.8×10^{-8}, calculate the pH of a solution that is 0.50 M with respect to HOBr and 0.30 M with respect to KOBr.

3. Using your answer to question 1, derive the Henderson-Hasselbalch equation.

4. Given the K_a for acetic acid is 1.8×10^{-5}, what will be the pH of a 1:1 solution of acetic acid:acetate?

5. How many grams of dry NH_4Cl need to be added to 2.00 L of a 0.750 M solution of ammonia, NH_3, to prepare a buffer at pH 8.78 if the K_b is 1.8×10^{-5}?

6. You need to produce a buffer solution that has a pH of 4.28. Your solution already contains 10 mmol of acetic acid. How many millimoles of acetate do you need to add? The pK_a of acetic acid is 4.74.

7. Without doing any calculations, determine whether 0.10 mol of the weak acid HA and 0.075 mol of OH^- in 1.0 L of solution will have:

   (a) $pH = pK_a$

   (b) $pH > pK_a$

   (c) $pH < pK_a$

8. Determine the pH of the buffer created with 3.30 g of NH_3 and 4.88 g of HCl, diluted to a final volume of 384.0 mL.

9. Which of the following buffer systems would be the best choice to create a buffer with pH 9.05?

   (a) HF/KF

   (b) HNO_2/KNO_2

   (c) NH_3/NH_4Cl

   (d) HClO/KClO

10. For the best system above, calculate the ratio of the masses of the components required to make the buffer.

11. A buffer is prepared by adding 0.605 mol of the weak acid HA to 0.507 mol of NaA in 2.00 L solution. The K_a of HA is 5.66×10^{-7}.

    (a) What is the pH of the resulting buffer solution?

    (b) What is the pH after 0.150 mol HCl is added to the buffer from Part A? Assume no volume change.

(c) What is the pH after 0.195 mol NaOH is added to the buffer from Part A? Assume no volume change.