Topic 8.9, 8.7 Worksheet

1. Without a calculator, determine the pH range of the buffers given below:

Buffer	K_a of acid or K_b of base	pH range
A	$K_a = 1.3 \times 10^{-4}$	
B	$K_a = 5.3 \times 10^{-8}$	
C	$K_b = 7 \times 10^{-3}$	

2. A buffer is created by mixing equal volumes of equimolar weak acid and a salt containing the conjugate base of the weak acid. A little acid or base has been added to change the concentrations of the salt or acid. Does the pH of the buffer increase, decrease, or remain the same when …
    a. the concentration of the salt is greater than the concentration of the acid. Explain your reasoning in terms of the Henderson-Hasselbalch equation.

    b. the concentration of the acid is greater than the concentration of the salt. Explain your reasoning in terms of the Henderson-Hasselbalch equation.

    c. the concentration of the acid and salt remain in the same ratio. Explain your reasoning in terms of the Henderson-Hasselbalch equation.

3. Without a calculator, determine the pH of a buffer in the following situations. The pKa of the buffer is 3.08.
    a. 20 mL of 0.1 M weak acid is mixed with 20 mL of 0.1 M salt.

    b. 20 mL of 0.1 M weak acid is mixed with 20 mL of 1.0 M salt.

    c. 20 mL of 0.1 M weak acid is mixed with 200 mL of 1.0 M salt.

    d. 200 mL of 0.1 M weak acid is mixed with 20 mL of 0.1 M salt.

4. Determine the molarity of the salt created and the resulting pH for the following situations. In each case, the acid being used is 20 mL of 0.10 M $HC_3H_5O_3$ with a K_a of 8.3×10^{-4}.
    a. The acid is mixed with 10 mL of 0.10 M NaOH.

    b. The acid is mixed with 5 mL of 0.10 M NaOH.

    c. The acid is mixed with 15 mL of 0.10 M NaOH.

5. Which species is dominant, the acid or the conjugate base of the acid, if …
    a. the pH < pKa.

    b. the pH > pKa.

    c. the pH = pKa.