Multiple Choice

3. Acid is added to a buffer solution. When equilibrium is reestablished the buffering effect has resulted in $[H_3O^+]$:

   (a.) increasing slightly
   b. decreasing slightly
   c. decreasing considerably
   d. remaining constant

4. The value of K_a for HSO_4^- is 1×10^{-2}. What is the value of K_b for SO_4^{2-}?

   a. $K_b = 1 \times 10^{2}$
   b. $K_b = 1 \times 10^{-7}$
   c. $K_b = 1 \times 10^{-2}$
   (d.) $K_b = 1 \times 10^{-12}$

   $K_b = \frac{K_w}{K_a} = \frac{1E-14}{1E-2} = 1E-12$

5. Which of the following would make a good buffer when dissolved in formic acid, HCO_2H?

   a. NH_3
   b. H_2O
   c. $NaC_2H_3O_2$
   (d.) $NaCO_2H$

   CO_2H^- = CB!

$$CH_3NH_2(aq) + H_2O(l) \leftrightarrow CH_3NH_3^+(aq) + OH^-(aq)$$

6. The above equation represents the reaction between the base methylamine ($K_b = 4.38 \times 10^{-4}$) and water. Which of the following best represents the concentrations of the various species at equilibrium?

   a. $[CH_3NH_2] < [CH_3NH_3^+]$
   (b.) $[CH_3NH_2] > [CH_3NH_3^+]$
   c. $[CH_3NH_2] = [CH_3NH_3^+]$
   d. cannot be determined without more info.

7. Consider the following:

   I. H_3O^+
   II. CH_3COO^-
   III. CH_3COOH

   The purpose of a buffer system consisting of CH_3COOH and CH_3COONa is to maintain a relatively constant concentration of

   (a.) I only
   b. I and II only
   c. II and III only
   d. I, II, and III

8. A buffer solution is formed by adding which of the following to water?

   a. HCl and KOH
   (b.) HCN and ~~R~~bCN (WA + CB)
   c. NaBr and NaOH
   d. HNO_3 and $LiNO_3$

9. Which of the following would make the most effective buffer when added to 750 mL of distilled water?

   a. 2.5 moles HNO_2 + 2.5 moles $LiNO_2$ ↓ #mol
   (b.) 5.5 moles HNO_2 + 5.5 moles KNO_2 (1:1 WA:CB) ↑ #mol
   c. 5.0 moles HNO_2 + 6.0 moles $NaNO_2$] not 1:1
   d. 5.5 moles ~~H~~NO_3 + 5.5 moles $NaNO_3$ (SA)

Multiple Choice Practice

Acid	Acid Dissociation Constant, K_a
H_3PO_4	7×10^{-3}
$H_2PO_4^-$	8×10^{-8}
HPO_4^{2-}	5×10^{-13}

2. On the basis of the information above, a buffer with a pH = 9 can best be made by using

   a. $H_3PO_4 + H_2PO_4^-$
   c. $H_2PO_4^- + PO_4^{3-}$
   (b.) $H_2PO_4^- + HPO_4^{2-}$
   d. $HPO_4^{2-} + PO_4^{3-}$

	Initial pH	pH after NaOH addition
Acid 1	3.0	3.5
Acid 2	3.0	5.0

3. Two different acids with identical pH are placed in separate beakers. Identical portions of NaOH are added to each beaker, and the resulting pH is indicated in the table above. What can be determined about the strength of each acid?

   a. Acid 1 is a strong acid and acid 2 is a weak acid because acid 1 resists change in pH more effectively.
   b. Acid 1 is a strong acid and acid 2 is a weak acid because the NaOH is more effective at neutralizing acid 2.
   (c.) Acid 1 is a weak acid and acid 2 is a strong acid because the concentration of the weak acid must be significantly greater to have the same pH as the strong acid.
   d. Acid 1 is a weak acid and acid 2 is a strong acid because the concentration of the hydrogen ions will be greater in acid 2 after the NaOH addition.

4. A 1.0 L buffer is prepared by combining 0.200 M acetic acid and 0.500 $NaC_2H_3O_2$. This solution is capable of buffering the addition of which of the following without being destroyed? acid = 0.2 mol ⇒ < 0.2 mol base base = 0.5 mol ⇒ < 0.5 mol acid

   a. 0.35 moles NaOH
   c. 0.40 M LiOH
   b. 0.62 moles HI
   (d.) 0.45 M HBr

5. Which of the following techniques can be used to prepare a buffer solution?

   I. Titrate a weak acid with a strong base.
   II. Titrate a weak base with a strong acid.
   III. Combine a solution of weak acid with a salt containing its conjugate base.

   a. I only
   c. I and II
   b. III only
   (d.) I, II and III

6. Which of the following should be true when preparing a buffer solution?

   ✓ I. The acid dissociation constant will have an exponent close in value to the buffer pH.
   ✓ II. The pK_a of the weak acid will be close in value to the buffer pH.
   X III. The acid/base ratio is solution will be approximately 10:1.

   a. I only
   (c.) I and II
   b. II only
   d. I, II and III