Chapter 16 Multiple Choice

Important Information: K_a ***(CH₃COOH)*** $= 1.8\times10^{-5}$ $K_a(HNO_2) = 4.5\times10^{-4}$ $K_{sp}(PbS) = 3.4\times10^{-28}$

1. In which one of the following solutions will acetic acid have the greatest percent ionization?
   A. 0.1 M CH_3COOH
   B. 0.1 M CH_3COOH dissolved in 1.0 M HCl
   C. 0.1 M CH_3COOH plus 0.1 M CH_3COONa
   D. 0.1 M CH_3COOH plus 0.2 M CH_3COONa

2. Which one of the following is a buffer solution?
   A. 0.40 M HCN and 0.10 KCN
   B. 0.20 M CH_3COOH
   C. 1.0 M HNO_3 and 1.0 M $NaNO_3$
   D. 0.10 M KCN
   E. 0.50 M HCl and 0.10 NaCl

3. Which of the following is the most acidic solution?
   A. 0.10 M CH_3COOH and 0.10 M CH_3COONa
   B. 0.10 M CH_3COOH
   C. 0.10 M HNO_2
   D. 0.10 M HNO_2 and 0.10 M $NaNO_2$
   E. 0.10 M CH_3COONa

4. You are asked to prepare an acetic acid/sodium acetate buffer solution with a pH of 4.00 ± 0.02. What molar ratio of CH_3COOH to CH_3COONa should be used?
   A. 0.18 B. 0.84 C. 1.19
   D. 5.50 E. 0.10

5. What is the *net ionic equation* for the reaction that occurs when small amounts of hydrochloric acid are added to a HOCl/NaOCl buffer solution?
   A. $H^+ + H_2O \rightarrow H_3O^+$
   B. $H^+ + OCl^- \rightarrow HOCl$
   C. $HOCl \rightarrow H^+ + OCl^-$
   D. $H^+ + HOCl \rightarrow H_2OCl^+$
   E. $HCl + HOCl \rightarrow H_2O + Cl_2$

6. Consider a buffer solution prepared from HOCl and NaOCl. Which is the net ionic equation for the reaction that occurs when NaOH is added to this buffer?
   A. $OH^- + HOCl \rightarrow H_2O + OCl^-$
   B. $OH^- + OCl^- \rightarrow HOCl + O^{2-}$
   C. $Na^+ + HOCl \rightarrow NaCl + OH^-$
   D. $H^+ + HOCl \rightarrow H_2 + OCl^-$
   E. $NaOH + HOCl \rightarrow H_2O + NaCl$

7. Assuming equal concentrations of conjugate base and acid, which one of the following mixtures is suitable for making a buffer solution with an optimum pH of 9.2–9.3?
   A. CH_3COONa/CH_3COOH ($K_a = 1.8 \times 10^{-5}$)
   B. NH_3/NH_4Cl ($K_a = 5.6 \times 10^{-10}$)
   C. NaOCl/HOCl ($K_a = 3.2 \times 10^{-8}$)
   D. $NaNO_2/HNO_2$ ($K_a = 4.5 \times 10^{-4}$)
   E. NaCl/HCl

8. The pH at the equivalence point of a titration may differ from 7.0 due to
   A. the initial concentration of the standard solution.
   B. the indicator used.
   C. the self–ionization of H_2O.
   D. the initial pH of the unknown.
   E. hydrolysis of the salt formed.

9. For which type of titration will the pH be basic at the equivalence point?
   A. Strong acid vs. strong base.
   B. Strong acid vs. weak base.
   C. Weak acid vs. strong base.
   D. all of the these
   E. none of these

10. Methyl red is a common acid–base indicator. It has a K_a equal to 6.3×10^{-6}. Its un–ionized form is red and its anionic form is yellow. What color would a methyl red solution have at pH = 7.8?
    A. green B. red C. blue
    D. yellow E. violet

11. For $PbCl_2$ ($K_{sp} = 2.4 \times 10^{-4}$), will a precipitate of $PbCl_2$ form when 0.10 L of 3.0×10^{-2} M $Pb(NO_3)_2$ is added to 400 mL of 9.0×10^{-2} M NaCl?
    A. Yes, $Q > K_{sp.}$ B. No, $Q < K_{sp.}$
    C. No, $Q = K_{sp.}$ D. Yes, $Q < K_{sp.}$

12. The molar solubility of magnesium carbonate is 1.8×10^{-4} mol/L. What is K_{sp} for this compound?
    A. 1.8×10^{-4} B. 3.6×10^{-4}
    C. 1.3×10^{-7} D. 3.2×10^{-8}
    E. 2.8×10^{-14}

13. The solubility product for barium sulfate is 1.1×10^{-10}. Calculate the molar solubility of barium sulfate.
    A. 5.5×10^{-11} mol/L
    B. 1.1×10^{-5} mol/L
    C. 2.1×10^{-5} mol/L
    D. 1.1×10^{-10} mol/L
    E. 2.2×10^{-10} mol/L

14. Which of the following would decrease the K_{sp} for PbI_2?
    A. Lowering the pH of the solution
    B. Adding a solution of $Pb(NO_3)_2$
    C. Adding a solution of KI
    D. None of these—the K_{sp} of a compound is constant at constant temperature.

15. Will a precipitate form (*yes* or *no*) when 50.0 mL of 1.2×10^{-3} M $Pb(NO_3)_2$ are added to 50.0 mL of 2.0×10^{-4} M Na_2S? If so, identify the precipitate.
    A. Yes, the precipitate is PbS.
    B. Yes, the precipitate is $NaNO_3$.
    C. Yes, the precipitate is Na_2S.
    D. Yes, the precipitate is $Pb(NO_3)_2$.
    E. No, a precipitate will not form.

Answers: 1. A; 2. A; 3. C; 4. D; 5. B; 6. A; 7. B; 8. E; 9. C; 10. D; 11. B; 12. D; 13. B; 14. D; 15. A.