Name: _____   **Period:** _____   **Date:**
_____

Acids and Bases Study Guide

Multiple Choice
Identify the choice that best completes the statement or answers the question.

_____ 1) Consider the reaction
$HC_2H_3O_2(aq) + H_2O(l) \rightarrow H_3O^+(aq) + C_2H_3O_2^-(aq)$. Which species is the conjugate acid?
  Ⓐ $HC_2H_3O_2(aq)$ Ⓒ $C_2H_3O_2^-(aq)$
  Ⓑ $H_2O(l)$ Ⓓ $H_3O^+(aq)$

_____ 2) Identify the Bronsted acids and bases in the following equation (A = Bronsted acid, B = Bronsted base):
$HSO_3^- + CN^- \rightarrow HCN + SO_3^{2-}$
  Ⓐ B   A   B   A   Ⓒ A   B   A   B
  Ⓑ B   A   A   B   Ⓓ A   B   B   A

_____ 3) Which of the following is not a conjugate acid-base pair?
  Ⓐ H_2SO_4, SO_4^{2-} Ⓒ HBr, Br^-
  Ⓑ HNO_3, NO_3^- Ⓓ $H_2PO_4^-$, HPO_4^{2-}

_____ 4) Which of the following is a conjugate acid-base pair?
  Ⓐ HPO_4^{2-}, PO_4^{3-} Ⓒ HNH_4, NH_4^+
  Ⓑ HNO_3^-, H_2NO_3 Ⓓ H_2CN, CN^-

_____ 5) Choose the case that is not a Bronsted conjugate acid-base pair.
  Ⓐ HCN, CN^- Ⓒ H_3BO_3, $H_2BO_3^-$
  Ⓑ HCO_2H, $HCOH$ Ⓓ $HClO_2$, ClO_2^-

_____ 6) In deciding which of two acids is the stronger, one must know
  Ⓐ the pH of each acid solution
  Ⓑ both the concentration of each acid solution and the equilibrium constant of each acid
  Ⓒ the concentration of each acid solution
  Ⓓ the equilibrium constant of each acid

_____ 7) The fact that $HCl(aq)$ is a strong acid also means that Cl^- is a(n) _____.
  Ⓐ strong conjugate base   Ⓒ weak conjugate base
  Ⓑ proton donor   Ⓓ amphoteric substance

_____ 8) Which of the following is the strongest conjugate base?
  Ⓐ NO_3^- Ⓒ Cl^-
  Ⓑ $C_2H_3O_2^-$ or CH_3COO^- Ⓓ all the same

_____ 9) Which of the following is *not* a strong acid?
  Ⓐ HCl Ⓒ HNO_3
  Ⓑ H_2SO_4 Ⓓ $HC_2H_3O_2$ or CH_3COOH

____ 10) Which of the following must be *true* if a solution is to be considered acidic?
    Ⓐ $K_w = [H^+]/[OH^-]$ Ⓒ $[H^+] < [OH^-]$
    Ⓑ $[H^+] = [OH^-]$ Ⓓ $[H^+] > [OH^-]$

____ 11) As water is heated, its $[H^+]$ increases. This means that
    Ⓐ $[OH^-] > [H^+]$
    Ⓑ the water is no longer neutral
    Ⓒ the water is no longer neutral and $[H^+] > [OH^-]$ are correct
    Ⓓ $[H^+] > [OH^-]$
    Ⓔ None of the other choices

____ 12) Choose the pair of concentrations that cannot be in a given aqueous solution at 25°C.
    Ⓐ $[H^+] = 10^{-3} M$, $[OH^-] = 10^{-11} M$ Ⓓ $[H^+] = 10^{-7} M$, $[OH^-] = 10^{-7} M$
    Ⓑ $[H^+] = 10^{-13} M$, $[OH^-] = 1 M$ Ⓔ None of the other choices
    Ⓒ $[H^+] = 10 M$, $[OH^-] = 10^{-15} M$

____ 13) A solution has $[H^+] = 4.2 \times 10^{-3} M$. The $[OH^-]$ in this solution is
    Ⓐ $4.2 \times 10^{-3} M$ Ⓒ $1.0 \times 10^{-14} M$
    Ⓑ $2.4 \times 10^{-12} M$ Ⓓ $4.2 \times 10^{-11} M$

____ 14) A solution has $[OH^-] = 2.8 \times 10^{-7} M$. The $[H^+]$ in this solution is
    Ⓐ $2.8 \times 10^{-7} M$ Ⓒ $3.6 \times 10^{-8} M$
    Ⓑ $1.0 \times 10^{-7} M$ Ⓓ $1.0 M$

____ 15) Calculate the $[H^+]$ in a solution that has a pH of 8.95.
    Ⓐ $8.9 \times 10^{-6} M$ Ⓒ $1.1 \times 10^{-9} M$
    Ⓑ $1.1 \times 10^{-2} M$ Ⓓ $1.0 \times 10^{-7} M$

____ 16) Calculate the $[OH^-]$ in a solution that has a pH of 3.70.
    Ⓐ $5.0 \times 10^{-1} M$ Ⓒ $5.0 \times 10^{-11} M$
    Ⓑ $1.0 \times 10^{-7} M$ Ⓓ $5.0 \times 10^{-4} M$

____ 17) A solution with a pH of 2 is how many times more acidic as a solution with a pH of 4?
    Ⓐ 2   Ⓒ 10
    Ⓑ 0.5   Ⓓ 100

____ 18) A solution with a pH of 3 is how many times as acidic as a solution with a pH of 4?
    Ⓐ 15 times as acidic   Ⓒ 80 times as acidic
    Ⓑ 12 times as acidic   Ⓓ 10 times as acidic

____ 19) Calculate the $[H^+]$ in a solution that shows a pH of 11.70.
    Ⓐ $2.0 \times 10^{-12} M$ Ⓒ $11.7 M$
    Ⓑ $5.0 \times 10^{-3} M$ Ⓓ $2.3 M$

____ 20) Calculate the $[H^+]$ in a solution that shows a pH of 2.30.
    Ⓐ $5.0 \times 10^{-3} M$ Ⓒ $2.0 \times 10^{-12} M$
    Ⓑ $2.3 M$ Ⓓ $11.7 M$

_____ 21) The pH of a solution at 25°C in which $[OH^-] = 3.4 \times 10^{-5} M$ is
    Ⓐ 6.34   Ⓒ 4.47
    Ⓑ 10.47   Ⓓ 9.53

_____ 22) Solid calcium hydroxide is dissolved in water until the pH of the solution is 10.94. The hydroxide ion concentration $[OH^-]$ of the solution is
    Ⓐ $1.1 \times 10^{-11} M$ Ⓒ $3.06 M$
    Ⓑ $1.0 \times 10^{-13} M$ Ⓓ $8.7 \times 10^{-4} M$

_____ 23) A solution has $[H^+] = 4.0 \times 10^{-8} M$. The pH of this solution is
    Ⓐ 7.40   Ⓒ 6.60
    Ⓑ 10.80   Ⓓ 3.20

_____ 24) A solution has $[H^+] = 4.0 \times 10^{-8} M$. The pOH of this solution is
    Ⓐ 6.60   Ⓒ 7.40
    Ⓑ 3.20   Ⓓ 10.80

_____ 25) Calculate the $[H^+]$ in a solution that has a pH of 5.21.
    Ⓐ $1.6 \times 10^{-2} M$ Ⓒ $1.6 \times 10^{-9} M$
    Ⓑ $4.0 \times 10^{-3} M$ Ⓓ $6.2 \times 10^{-6} M$

_____ 26) A solution has a pH of 6.49. The pOH of this solution is
    Ⓐ 6.49   Ⓒ 6.51
    Ⓑ 7.51   Ⓓ 3.2×10^{-6}

_____ 27) A solution has $[OH^-] = 5.0 \times 10^{-4} M$. The pH of this solution is
    Ⓐ 4.50   Ⓒ 3.30
    Ⓑ 10.70   Ⓓ 2.0×10^{-11}

_____ 28) A solution has a pH of 4.35. The $[H^+]$ in this solution is
    Ⓐ $4.35 M$ Ⓒ $4.35 \times 10^{-5} M$
    Ⓑ $3.50 \times 10^{-4} M$ Ⓓ $4.50 \times 10^{-5} M$

_____ 29) What is the pH of a solution that has $[OH^-] = 4.0 \times 10^{-9} M$?
    Ⓐ 9.40   Ⓒ 4.60
    Ⓑ 8.40   Ⓓ 5.60

_____ 30) What is the pH of a solution prepared by dissolving 80.0 g NaOH in enough water to make 0.50 L of solution?
    Ⓐ 14.60   Ⓒ 0.60
    Ⓑ 4.00   Ⓓ -0.60

_____ 31) How many moles of pure NaOH must be used to prepare 1.0 L of a solution that has pH = 13.00?
    Ⓐ 10.0 mol   Ⓒ 1.0 mol
    Ⓑ 13.0 mol   Ⓓ 0.10 mol

____ 32) Calculate the pH of a 0.53 M HCl solution.
     Ⓐ 13.70   Ⓒ -0.53
     Ⓑ 0.53   Ⓓ 0.28

____ 33) Which statement is true for a strong acid solution with a concentration greater than 1.0 M?
     Ⓐ pH < 0   Ⓒ pH > pOH
     Ⓑ pOH > pH   Ⓓ two of these

____ 34) A solution is prepared by dissolving 36.5 g HCl(g) in enough water to make 1.0 L of solution. The pH of this solution is
     Ⓐ 1.00   Ⓒ 0
     Ⓑ -1.00   Ⓓ 14.00

____ 35) Calculate the pH of an acid solution containing 0.10 M HNO_3.
     Ⓐ 7.00   Ⓒ -1.00
     Ⓑ 0.10   Ⓓ 1.00

____ 36) Calculate the pH of 1.0×10^{-3} M HCl.
     Ⓐ 2.90   Ⓒ 11.00
     Ⓑ 1.00   Ⓓ 3.00

____ 37) Calculate the pH of 0.010 M $HClO_4$.
     Ⓐ 2.00   Ⓒ 0.010
     Ⓑ 1.00   Ⓓ -2.00

____ 38) What is the pH of a 10 M solution of HNO_3?
     Ⓐ 10   Ⓒ 0
     Ⓑ -1.0   Ⓓ 1.0

____ 39) What is the pH of a 2.0 M solution of $HClO_4$?
     Ⓐ -0.30   Ⓒ 14.30
     Ⓑ 13.70   Ⓓ 0.30

____ 40) A weak acid, HF, is in solution with dissolved sodium fluoride, NaF. If HCl is added, which ion will react with the extra hydrogen ions from the HCl to keep the pH from changing?
     Ⓐ OH^- Ⓒ Na^+
     Ⓑ Na^+ Ⓓ F^-