Weak Acid and Base Equilibria Quiz

Instructions: Choose the best answer for each question.

1. **Weak acids and bases are characterized by:**
   A) Complete ionization in water.
   B) Partial ionization in water.
   C) Formation of strong electrolytes.
   D) pH values of 7.

2. **The acid dissociation constant, Ka, is a measure of:**
   A) The strength of a strong acid.
   B) The strength of a weak acid.
   C) The concentration of acid in a solution.
   D) The rate of acid dissociation.

3. **The base dissociation constant, Kb, is a measure of:**
   A) The strength of a strong base.
   B) The strength of a weak base.
   C) The concentration of base in a solution.
   D) The rate of base dissociation.

4. **For the weak acid $HA(aq) \rightleftharpoons H^+(aq) + A^-(aq)$, the Ka expression is:**
   A) $Ka = [HA] / ([H^+][A^-])$
   B) $Ka = [H^+][A^-] / [HA]$
   C) $Ka = [H^+] + [A^-]$
   D) $Ka = [HA] / [H^+]$

5. **For the weak base $B(aq) + H_2O(l) \rightleftharpoons BH^+(aq) + OH^-(aq)$, the Kb expression is:**
   A) $Kb = [B] / ([BH^+][OH^-])$
   B) $Kb = [BH^+][OH^-] / [B]$
   C) $Kb = [BH^+] + [OH^-]$
   D) $Kb = [B] / [OH^-]$

6. **The relationship between Ka and Kb for a conjugate acid-base pair is:**
   A) Ka + Kb = 14
   B) Ka - Kb = Kw
   C) Ka x Kb = Kw
   D) Ka / Kb = Kw
   (where Kw is the ion product of water)

7. **The value of Kw at 25°C is:**
   A) 1.0×10^{-7}
   B) 1.0×10^{7}

C) 1.0×10^{-14}
D) 1.0×10^{14}

8. **Which of the following is a weak acid?**
   A) HCl
   B) H_2SO_4
   C) HNO_3
   D) CH_3COOH (acetic acid)

9. **Which of the following is a weak base?**
   A) NaOH
   B) KOH
   C) NH_3 (ammonia)
   D) $Ca(OH)_2$

10. **What is the pH of a 0.1 M solution of acetic acid ($K_a = 1.8 \times 10^{-5}$)?**
    A) 1
    B) 2.87
    C) 5
    D) 7

11. **What is the pOH of a 0.1 M solution of ammonia ($K_b = 1.8 \times 10^{-5}$)?**
    A) 1
    B) 2.87
    C) 5
    D) 11.13

12. **If the pH of a weak acid solution is 4.0, what is the approximate $[H^+]$ concentration?**
    A) 1×10^{-4} M
    B) 4 M
    C) 1×10^{-10} M
    D) 10 M13. **If the pOH of a weak base solution is 3.0, what is the approximate $[OH^-]$ concentration?**
    A) 1×10^{-3} M
    B) 3 M
    C) 1×10^{-11} M D) 11 M

13. **The percent ionization of a weak acid is defined as:**
    A) ($[H^+]$ at equilibrium / initial [HA]) x 100%
    B) (initial [HA] / $[H^+]$ at equilibrium) x 100%
    C) [HA] at equilibrium x 100%
    D) $[H^+]$ at equilibrium x 100%

14. **As the Ka value of a weak acid increases, its percent ionization:**
    A) Increases
    B) Decreases
    C) Remains constant
    D) Becomes zero

15. **As the concentration of a weak acid decreases, its percent ionization:**
    A) Increases
    B) Decreases
    C) Remains constant
    D) Becomes zero

16. **The conjugate base of a weak acid is:**
    A) A strong base.
    B) A weak base.
    C) A strong acid.
    D) A neutral species.

17. **The conjugate acid of a weak base is:**
    A) A strong acid.
    B) A weak acid.
    C) A strong base.
    D) A neutral species.

18. **Which of the following statements is true for a weak acid solution?**
    A) $[H^+] = [A^-] =$ initial [HA]
    B) $[H^+] > [A^-] >$ initial [HA]
    C) $[H^+] = [A^-] <<$ initial [HA]
    D) $[H^+] >> [A^-] >$ initial [HA]

19. **Which of the following can be used to calculate the pH of a weak acid or base?**
    A) The Henderson-Hasselbalch equation.
    B) Titration
    C) An ICE table.
    D) The Nernst Equation

Answer Key

1. B
2. B
3. B
4. B
5. B
6. C

7. C
8. D
9. C
10. B
11. B
12. A
13. A
14. A
15. A
16. A
17. B
18. B
19. C
20. C