Name _____ AP Chemistry

Chapter 14_HW 3: Due 11/21/19
Circle and write the letter of the correct answer on the line in front of each question.

Equilibrium Constant,	K_a
HA	4.8×10^{-8}

1. _____ What is the $[H^+]$ of a 0.075 M solution of the acid HA?
   a. 6.1×10^{-4} M b. 2.2×10^{-4} M
   c. 6.0×10^{-5} M d. 4.8×10^{-8} M

2. _____ Which salt produces the most alkaline solution at a concentration of 0.1 M?
   a. KNO_3 b. $MgCl_2$ c. NH_4Cl d. $NaNO_2$

3._____ The ionization of benzoic acid is represented by this equation.
$C_6H_5COOH(aq) \rightleftharpoons H^+(aq) + C_6H_5COO^-(aq)$
If a 0.045 M solution of benzoic acid has an $[H^+] = 1.7 \times 10^{-3}$, what is the K_a of benzoic acid?
   a. 7.7×10^{-5} b. 6.4×10^{-5} c. 3.8×10^{-2} d. 8.4×10^{-1}

4. _____ $C_6H_5OH(aq) + CN^-(aq) \rightleftharpoons HCN(aq) + C_6H_5O^-(aq)$
The equilibrium constant for this reaction is less than 1. What is the strongest base in this system?
   a. $C_6H_5OH(aq)$ b. $CN^-(aq)$ c. $HCN(aq)$ d. $C_6H_5O^-(aq)$

5. _____ $HOCl(aq) \rightleftharpoons H^+(aq) + OCl–(aq)$
The ionization of hypochlorous acid represented above has $K = 3.0 \times 10^{-8}$ at 25°C. What is K for this reaction? $OCl^-(aq) + H_2O(l) \rightleftharpoons HOCl(aq) + OH^-(aq)$
   a. 3.3×10^{-7} b. 3.0×10^{-8} c. 3.0×10^{6} d. 3.3×10^{7}

6. _____ The dihydrogen phosphate ion undergoes these reactions in water.
$H_2PO_4^-(aq) + H_2O(l) \rightleftharpoons HPO_4^{2-}(aq) + H_3O^+(aq)$ $K = 6.2 \times 10^{-8}$
$H_2PO_4^-(aq) + H_2O(l) \rightleftharpoons H_3PO_4(aq) + OH^-(aq)$ $K = 1.6 \times 10^{-7}$
What is the conjugate base of $H_2PO_4^-$?
   a. $HPO_4^{2-}(aq)$ b. $H_2O(l)$ c. $OH^-(aq)$ d. $H_3PO_4(aq)$

7. _____ What is the pH of a 0.15 M solution of formic acid, HCOOH? K_a HCOOH 1.9×10^{-4}
   a. 1.49 b. 2.27 c. 3.72 d. 4.55

8. _____ Which salt gives the most acidic 0.1 M solution in water?
   a. NaCl b. $NaNO_2$ c. NH_4Cl d. NH_4NO_2

9. _____ What is the $[H^+]$ in a 0.10 M solution of ascorbic acid, $C_6H_8O_6$? $C_6H_8O_6$, $K_a = 8.0 \times 10^{-5}$
   a. 8.0×10^{-6} M b. 2.8×10^{-3} M c. 4.0×10^{-3} M d. 5.3×10^{-3} M

10. _____ A 0.10 M solution of which salt is the most acidic?
   a. $NH_4C_2H_3O_2$ b. NaCN c. KNO_3 d. $AlCl_3$

11. _____ Acetylsalicylic acid (aspirin) behaves as an acid according to the equation shown. Calculate K_b for the $C_9H_7O_4^-(aq)$ ion. ($K_a = 3.0 \times 10^{-4}$)
$HC_9H_7O_4(aq) + H_2O \rightleftharpoons H_3O^+(aq) + C_9H_7O_4^-(aq)$
   a. 3.0×10^{-17} b. 3.3×10^{-11} c. 9.0×10^{-8} d. 3.3×10^{3}

12. _____ What is the pH of a 0.0015 M solution of HNO_3?
   a. 1.41 b. 2.82 c. 5.65 d. 11.18

13. _____ In a solution of formic acid ($K_a = 1.7 \times 10^{-4}$), the $[H^+] = 2.3 \times 10^{-3}$. What is the concentration of formic acid in mol L^{-1}?
   a. 7.2×10^{-2} b. 3.1×10^{-2} c. 5.3×10^{-6} d. 3.9×10^{-7}

14. _____ What is the $[H^+]$ in a solution in which $[HA] = 4.0 \times 10^{-2}$ and $[A^-] = 2.0 \times 10^{-2}$. [$K_a = 3.0 \times 10^{-6}$]
   a. 1.5×10^{-6} b. 3.0×10^{-6} c. 6.0×10^{-6} d. 3.8×10^{-3}

15. _____ Which weak acid has the strongest conjugate base?
   a. acetic acid ($K_a = 1.8 \times 10^{-5}$) b. formic acid ($K_a = 1.8 \times 10^{-4}$)
   c. hydrofluoric acid ($K_a = 6.8 \times 10^{-4}$) d. propanoic acid ($K_a = 5.5 \times 10^{-5}$)

16. _____ What is the pH of a 0.20 M HA solution ($K_a = 1.0\times10^{-6}$) that contains 0.40 M NaA?
a. 3.15 b. 3.35 c. 5.70 d. 6.30

17. _____ A 0.1 M solution of which salt will have a pH less than 7?
a. NaCl b. NH_4Br c. KF d. NaO_2CCH_3

18. _____ Which is the weakest acid?
a. ascorbic acid ($K_a = 8.0\times10^{-5}$) b. boric acid ($K_a = 5.8\times10^{-10}$)
c. butyric acid ($K_a = 1.5\times10^{-5}$) d. hydrocyanic acid ($K_a = 4.9\times10^{-10}$)

19. _____ At 20.0 °C water has $K_w = 6.807\times10^{-15}$. What is the pH of pure water at this temperature?
a. 6.667 b. 6.920 c. 7.000 d. 7.084

20. _____ Which solution has the highest pH?
HCN, K_a 5.8×10^{-10} CH_3COOH, K_a 1.8×10^{-5}
a. 0.10 M CH_3COOH b. 0.10 M HCN c. 0.10 M CH_3COOK d. 0.10 M NaBr

21. _____ What is the pH of a 0.025 M solution of KOH?
a. 1.60 b. 3.69 c. 10.31 d. 12.40

22. _____ Which of the following acids can be oxidized to form a stronger acid?
a. H_3PO_4 b. HNO_3 c. H_2CO_3 d. H_3BO_3 e. H_2SO_3

23. _____ What is the pH of a 1.0 x 10^{-2}-molar solution of HCN? ($K_a = 4.0 \times 10^{-10}$)
a. 10 b. Between 7 and 10 c. 7 d. Between 4 and 7 e. 4

24. _____ At 25°C, aqueous solutions with a pH of 8 have a hydroxide ion concentration, $[OH^-]$, of…
a. 1×10^{-14} M b. 1×10^{-8} M c. 1×10^{-6} M
d. 1M e. 8M

25. _____ $H_2C_2O_4 + 2\ H_2O \rightleftarrows 2\ H_3O^+ + C_2O_4^{2-}$ Oxalic acid, $H_2C_2O_4$, is a diprotic acid with $K_1 = 5 \times 10^{-2}$ and $K_2 = 5 \times 10^{-5}$. Which of the following is equal to the equilibrium constant for the reaction represented above?
a. 5 x 10^{-2} b. 5 x 10^{-5} c. 2.5 x 10^{-6} d. 5 x 10^{-7} e. 2.5 x 10^{-8}

26. _____ If the acid dissociation constant, K_a, for an acid HA is 8 x 10^{-4} at 25 °C, what percent of the acid is dissociated in a 0.50-molar solution of HA at 25 °C?
a. 0.08% b. 0.2% c. 1% d. 2% e. 4%

27. _____ A 1-molar solution of which of the following salts has the highest pH?
a. $NaNO_3$ b. Na_2CO_3 c. NH_4Cl d. $NaHSO_4$ e. KBr

28. _____ Which, if any, of the following species is in the greatest concentration in a 0.100-molar solution of H_2SO_4 in water?
a. H_2SO_4 molecules b. H_3O^+ ions c. HSO_4^- ions
d. SO_4^{2-} ions e. All species have the same concentrations.

29. _____ As the number of oxygen atoms increases in any series of oxygen acids, such as HXO, HXO_2, HXO_3, ..., which of the following is generally true?
a. The acid strength varies unpredictably.
b. The acid strength decreases only if X is a nonmetal.
c. The acid strength decreases only if X is a metal.
d. The acid strength decreases whether X is a nonmetal or a metal.
e. The acid strength increases.

30. _____ A 0.20-molar solution of a weak monoprotic acid, HA, has a pH of 3.00. The ionization constant of this acid is…
a. 5.0 x 10^{-7} b. 2.0 x 10^{-7} c. 5.0 x 10^{-6} d. 5.0 x 10^{-3} e. 2.0 x 10^{-3}