

## Chapter 14 HW 6: Due 11/22/16

Circle and write the letter of the correct answer on the line in front of each question.

1. \_\_\_\_\_ What is the  $[H^+]$  of a 0.075 M solution of the acid HA?

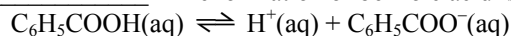
- a.  $6.1 \times 10^{-4}$  M                      b.  $2.2 \times 10^{-4}$  M  
c.  $6.0 \times 10^{-5}$  M                      d.  $4.8 \times 10^{-8}$  M

Equilibrium Constant,	$K_a$
HA	$4.8 \times 10^{-8}$

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.

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.  $7.7 \times 10^{-5}$                                   b.  $6.4 \times 10^{-5}$                                   c.  $3.8 \times 10^{-2}$                                   d.  $8.4 \times 10^{-1}$

4. \_\_\_\_\_  $C_6H_5OH(aq) + CN^-(aq) \rightleftharpoons HCN(aq) + C_6H_5O^-(aq)$ 

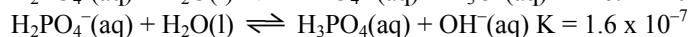
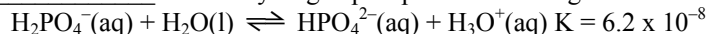
The equilibrium constant for this reaction is less than 1. What is the strongest base in this system?

- 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?                       $OCl^-(aq) +$ 

- a.  $3.3 \times 10^{-7}$                                   b.  $3.0 \times 10^{-8}$                                   c.  $3.0 \times 10^6$                                   d.  $3.3 \times 10^7$

6. \_\_\_\_\_ The dihydrogen phosphate ion undergoes these reactions in water.

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  $1.9 \times 10^{-4}$ 

- 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?

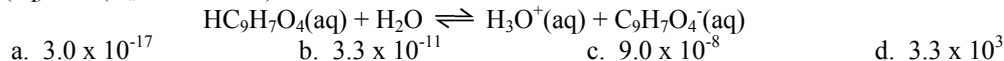
- a.  $NaCl$     b.  $NaNO_2$     c.  $NH_4Cl$     d.  $NH_4NO_2$

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.  $8.0 \times 10^{-6}$  M                                  b.  $2.8 \times 10^{-3}$  M                                  c.  $4.0 \times 10^{-3}$  M                                  d.  $5.3 \times 10^{-3}$  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. ( $K_a = 3.0 \times 10^{-4}$ )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.  $7.2 \times 10^{-2}$                                   b.  $3.1 \times 10^{-2}$                                   c.  $5.3 \times 10^{-6}$                                   d.  $3.9 \times 10^{-7}$

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.  $1.5 \times 10^{-6}$                                   b.  $3.0 \times 10^{-6}$                                   c.  $6.0 \times 10^{-6}$                                   d.  $3.8 \times 10^{-3}$

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 ( $K_a = 1.0 \times 10^{-6}$ ) 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.  $\text{NH}_4\text{Br}$                       c. KF                      d.  $\text{NaO}_2\text{CCH}_3$
18. \_\_\_\_\_ Which is the weakest acid?  
 a. ascorbic acid ( $K_a = 8.0 \times 10^{-5}$ )                      b. boric acid ( $K_a = 5.8 \times 10^{-10}$ )  
 c. butyric acid ( $K_a = 1.5 \times 10^{-5}$ )                      d. hydrocyanic acid ( $K_a = 4.9 \times 10^{-10}$ )
19. \_\_\_\_\_ At 20.0 °C water has  $K_w = 6.807 \times 10^{-15}$ . 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,  $K_a = 5.8 \times 10^{-10}$                        $\text{CH}_3\text{COOH}$ ,  $K_a = 1.8 \times 10^{-5}$   
 a. 0.10 M  $\text{CH}_3\text{COOH}$                       b. 0.10 M HCN                      c. 0.10 M  $\text{CH}_3\text{COOK}$                       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.  $\text{H}_3\text{PO}_4$                       b.  $\text{HNO}_3$                       c.  $\text{H}_2\text{CO}_3$                       d.  $\text{H}_3\text{BO}_3$                       e.  $\text{H}_2\text{SO}_3$
23. \_\_\_\_\_ What is the pH of a  $1.0 \times 10^{-2}$ -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,  $[\text{OH}^-]$ , of...  
 a.  $1 \times 10^{-14}$  M                      b.  $1 \times 10^{-8}$  M                      c.  $1 \times 10^{-6}$  M  
 d. 1M                      e. 8M
25. \_\_\_\_\_  $\text{H}_2\text{C}_2\text{O}_4 + 2 \text{H}_2\text{O} \rightleftharpoons 2 \text{H}_3\text{O}^+ + \text{C}_2\text{O}_4^{2-}$  Oxalic acid,  $\text{H}_2\text{C}_2\text{O}_4$ , 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.  $5 \times 10^{-2}$                       b.  $5 \times 10^{-5}$                       c.  $2.5 \times 10^{-6}$                       d.  $5 \times 10^{-7}$                       e.  $2.5 \times 10^{-8}$
26. \_\_\_\_\_ If the acid dissociation constant,  $K_a$ , for an acid HA is  $8 \times 10^{-4}$  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.  $\text{NaNO}_3$                       b.  $\text{Na}_2\text{CO}_3$                       c.  $\text{NH}_4\text{Cl}$                       d.  $\text{NaHSO}_4$                       e. KBr
28. \_\_\_\_\_ Which, if any, of the following species is in the greatest concentration in a 0.100-molar solution of  $\text{H}_2\text{SO}_4$  in water?  
 a.  $\text{H}_2\text{SO}_4$  molecules                      b.  $\text{H}_3\text{O}^+$  ions                      c.  $\text{HSO}_4^-$  ions  
 d.  $\text{SO}_4^{2-}$  ions                      e. All species have the same concentrations.
29. \_\_\_\_\_ As the number of oxygen atoms increases in any series of oxygen acids, such as  $\text{HXO}$ ,  $\text{HXO}_2$ ,  $\text{HXO}_3$ , ..., 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.  $5.0 \times 10^{-7}$                       b.  $2.0 \times 10^{-7}$                       c.  $5.0 \times 10^{-6}$                       d.  $5.0 \times 10^{-3}$                       e.  $2.0 \times 10^{-3}$