CH 223 Exam 1 Practice Key

1. A strong Bronsted-Lowry acid, HA, in water will dissociate into:
   a. $H_3O^+$ and a salt
   b. $H_3O^+$ and $A^-$
   c. $OH^-$ and HA
   d. $OH^-$ and $A^-$
   e. $H_3O^+$ and OH

2. When Fe(NO$_3$)$_3$ is dissolved in water, the pH will be
   a. Greater than 7
   b. Equal to 7
   c. Less than 7

3. The [H$^+$] of 0.56M HF ($K_a=3.5 \times 10^{-4}$) is
   a. 0.014 M
   b. 0.000196 M
   c. 0.000625 M
   d. 0.025 M
   e. 0.00035 M

4. The conjugate acid base pair for the following reaction is:
   $HCHO_2$ (aq) + H$_2$O (l) $\rightarrow$ $H_3O^+$ + $CHO_2^-$ (aq)

   Acid and Conjugate Base
   a. $H_2O$ and $CHO_2^-$
   b. $HCHO_2$ and $H_3O^+$
   c. $HCHO_2$ and $CHO_2^-$
   d. $H_2O$ and $H_3O^+$

5. What is the $K_b$ value for the conjugate base of hypochlorous acid. ($K_a = 2.9 \times 10^{-8}$)
   a. $2.9 \times 10^6$
   b. $2.9 \times 10^6$
   c. $3.4 \times 10^7$
   d. $3.4 \times 10^9$
   e. $3.4 \times 10^7$

6. Which statement about, hydrocyanic acid ($K_a= 4.9 \times 10^{-10}$) and benzoic acid ($K_a=6.5 \times 10^{-5}$) is correct?
   a. Hydrocyanic acid has a higher percent ionization in water
   b. Benzoic acid has higher percent ionization in water
   c. The concentration of CN$^-$ in a solution of hydrocyanic acid will be high.
   d. A solution of hydrocyanic acid will have a lower pH than one of benzoic acid of the same concentration
   e. Both are strong acids

7. The [OH$^-$] of a solution is $1.0 \times 10^{-6}$ M. What is the pH of the solution?
8. Identify the strongest acid.

A) $\text{HClO}_3$
B) $\text{HClO}$
C) $\text{HClO}_2$
D) $\text{HClO}_4$
E) Not enough information is given.

9. Which of the following is a Lewis acid?

A) $\text{BCl}_3$
B) $\text{CH}_4$
C) $\text{NH}_3$
D) $\text{CHCl}_3$
E) None of the above are Lewis acids.

10. Which of the following qualities makes for a good buffer?

A) small amounts of both a weak acid and its conjugate base
B) significant amounts of both a strong acid and a strong base
C) small amounts of both a strong acid and a strong base
D) significant amounts of both a weak acid and a strong acid
E) significant amounts of both a weak acid and its conjugate base

11. Calculate the pH of a buffer that is 0.058 M HF and 0.058 M LiF. The $K_a$ for HF is $3.5 \times 10^{-4}$.

A) 2.86
B) 9.31
C) 10.54
D) 3.46
E) 4.69

12. A titration curve has a single S-shape with an equivalence point at pH = 8.2. What sort of titration is this?
A) Strong acid titrated by a strong base  
B) Weak acid titrated by a strong base  
C) Weak base titrated by a strong acid  
D) Strong base titrated by a strong acid  
E) A diprotic weak acid titrated by a strong base  

13. How many mL of 0.0500 M NaOH are required to completely neutralize 25.00 mL of H₂SO₄(aq) that has a concentration of 0.0250 M?

A) 5.00 mL  
B) 12.5 mL  
C) 25.00 mL  
D) 37.5 mL  
E) 50.0 mL  

14. A student dissolves 1.22 g of a Group 1 metal hydroxide in 25.00 mL of water and titrates the resulting solution with 0.100 M HCl. The titration requires 81.2 mL of the acid solution to neutralize. What is the identity of the hydroxide?

A) LiOH  
B) NaOH  
C) KOH  
D) RbOH  
E) CsOH  

15. The molar solubility of BaSO₄ is 1.0 x 10⁻⁵ M. What is the Kₛₚ?  

(A) 1.0 x 10⁻¹⁰  
(B) 0.0032  
(C) 1.0 x 10⁻⁵  
(D) 1.0 x 10⁻²  
(E) 1.0 x 10⁻²⁵
16. The $K_{sp}$ of $\text{Ag}_2\text{CO}_3 = 8.1 \times 10^{-12}$. A student wants to prepare a saturated $\text{Ag}_2\text{CO}_3$ (aq) solution from a $3.7 \times 10^{-4}$ M $\text{AgNO}_3$ (aq) solution. What concentration of $\text{Na}_2\text{CO}_3$ (aq) is required?

(A) 2703 M  
(B) 4.6 $\times 10^{-8}$ M  
(C) 5.9 $\times 10^{-5}$ M  
(D) 2.7 $\times 10^{-5}$ M  
(E) 2.2 $\times 10^{-8}$ M

17. Which of the following is false?

(A) Many metal hydroxides are insoluble  
(B) $\text{Al(OH)}_3$ (aq) is amphoteric  
(C) $\text{HCO}_3^-$ (aq) is amphoteric  
(D) An amphoteric species cannot accept a proton, but can donate one or more protons  
(E) For $\text{Fe(NH}_3)_3^{3+}$, the formation constant ($K_f$) expression can be written:

$$K_f = \frac{[\text{Fe(NH}_3)_3^{3+}]}{[\text{Fe}^{3+}][\text{NH}_3]^3}\]$$

18. Consider $[\text{CoF}_2\text{Br}_4]^{3-}$. Which of the following is false?

(A) $\text{F}^-$ is a Lewis base  
(B) The cobalt ion ($\text{Co}^{3+}$) is the Lewis acid  
(C) cis-$[\text{CoF}_2\text{Br}_4]^{3-}$ is polar  
(D) trans-$[\text{CoF}_2\text{Br}_4]^{3-}$ is nonpolar  
(E) $[\text{CoF}_2\text{Br}_4]^{3-}$ is a square planar complex
19. How many d-electrons does Cu$^{2+}$ have?

(A) 7
(B) 8
(C) 9
(D) 10
(E) 11

20. The complex:

\[ \text{F} \quad \text{CN} \quad \text{Co}^{3+} \quad \text{F} \quad \text{CN} \]

(A) is cis-\([\text{CoF}_3(\text{CN})_3]^3-\)
(B) is trans-\([\text{CoF}_3(\text{CN})_3]^3-\)
(C) is fac-\([\text{CoF}_3(\text{CN})_3]^3-\)
(D) is mer-\([\text{CoF}_3(\text{CN})_3]^3-\)
(E) is mp3-\([\text{CoF}_3(\text{CN})_3]^3-\)

21. The coordination number for Cu in \([\text{Cu(edta)}]^2-\) is:

(A) 1
(B) 2
(C) 3
(D) 4
(E) 6