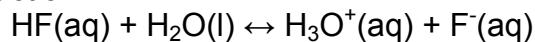
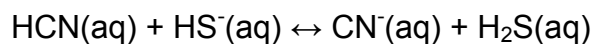


## Practice Exam 2

1. In the following reaction



- HF is an acid and  $\text{H}_3\text{O}^+$  is its conjugate base.
  - $\text{H}_2\text{O}$  is an acid and  $\text{H}_3\text{O}^+$  is its conjugate base.
  - HF is an acid and  $\text{F}^-$  is its conjugate base.
  - $\text{H}_2\text{O}$  is an acid and  $\text{H}_3\text{O}^+$  is its conjugate base.
  - HF is an acid and  $\text{H}_2\text{O}$  is its conjugate base.
2. What is the pH of a  $4.2 \times 10^{-4}$  M HBr solution at 25 °C?
- 2.80
  - 3.38
  - 3.80
  - 4.20
  - 4.62
3. Which is the strongest acid?
- Ascorbic acid,  $K_a = 8.0 \times 10^{-5}$
  - Benzoic acid,  $K_a = 6.5 \times 10^{-5}$
  - 3-chlorobenzoic acid,  $K_a = 1.5 \times 10^{-4}$
  - 2-hydroxybenzoic acid,  $K_a = 1.1 \times 10^{-3}$
  - Chloroacetic acid,  $K_a = 1.4 \times 10^{-3}$
4. Knowing that  $\text{H}_2\text{S}$  is a stronger acid than HCN, determine, if possible, in which direction the following equilibrium lies.



- equilibrium lies to the left
- equilibrium lies to the right
- equilibrium is perfectly balanced left and right
- can be determined if the relative acidity of  $\text{HS}^-$  is given
- cannot be determined

5. We have a  $4.63 \times 10^{-4}$  M solution of HCl. What is the pH of this solution at 25 °C?
- 3.33
  - 4.00
  - 4.63
  - 8.37
  - 9.25
6. What is the pH of a 3.18 M  $\text{CH}_3\text{COOH}$  solution at 25 °C?  $K_a = 1.8 \times 10^{-5}$ ?
- 2.12
  - 2.75
  - 1.40
  - 4.24
  - 4.74
7. What is the % ionization of a 3.14 M  $\text{CH}_3\text{CO}_2\text{H}$  solution at 25 °C? For  $\text{CH}_3\text{CO}_2\text{H}$ ,  $K_a = 1.8 \times 10^{-5}$ .
- 0.24%
  - 0.57%
  - 1.8%
  - 3.2%
  - 7.5%
8. Which of the following acid-base reactions will lie predominantly toward the products?
- Reaction 1:  $\text{HF}(\text{aq}) + \text{NH}_3(\text{aq}) \leftrightarrow \text{NH}_4^+(\text{aq}) + \text{F}^-(\text{aq})$   
Reaction 2:  $\text{NH}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \leftrightarrow \text{NH}_4^+(\text{aq}) + \text{OH}^-(\text{aq})$   
Reaction 3:  $\text{HF}(\text{aq}) + \text{H}_2\text{O}(\text{l}) \leftrightarrow \text{H}_3\text{O}^+(\text{aq}) + \text{F}^-(\text{aq})$
- 1 only
  - 2 only
  - 1 and 2 only
  - 2 and 3 only
  - 1, 2, and 3

9. We add 1.00 mL of 10.0 M  $\text{HNO}_3$  to 100. mL of 0.10 M  $\text{NaHCOO}$ . What is the pH of the resulting solution?  $K_a(\text{HCOOH}) = 1.8 \times 10^{-4}$
- 2.37
  - 3.45
  - 4.27
  - 4.35
  - 11.60
10. If you mix 100. mL of 0.11 M  $\text{HCl}$  with 50.0 mL of 0.22 M  $\text{NH}_3$ , what is the pH of the resulting solution? For  $\text{NH}_4^+$ ,  $K_a = 5.6 \times 10^{-10}$
- 4.63
  - 5.19
  - 6.02
  - 8.37
  - 9.37
11. If you mix 125. mL of 0.50 M  $\text{CH}_3\text{CO}_2\text{H}$  with 75.0 mL of 0.83 M  $\text{NaOH}$ , what is the pH of the resulting solution? For  $\text{CH}_3\text{COO}^-$ ,  $K_b = 5.6 \times 10^{-10}$
- 4.88
  - 5.01
  - 8.99
  - 9.12
  - 9.76
12. What effect will the addition of the reagent in each of the following have on the pH of the  $\text{CH}_3\text{CO}_2\text{H}$  solution respectively?
- Flask 1: Addition of  $\text{NaCH}_3\text{CO}_2$  to  $\text{CH}_3\text{CO}_2\text{H}(\text{aq})$   
Flask 2: Addition of  $\text{Ca}(\text{CH}_3\text{CO}_2)_2$  to  $\text{CH}_3\text{CO}_2\text{H}(\text{aq})$
- no change, increase
  - no change, decrease
  - decrease, no change
  - decrease, decrease
  - increase, increase

13. If you add 20.0 mL of 2.30 M  $\text{NH}_3$  to 100. mL of a 1.17 M  $\text{NH}_4\text{Cl}$  solution, what is the pH of the resulting solution? For  $\text{NH}_3$ ,  $K_b = 1.8 \times 10^{-5}$
- 5.15
  - 6.35
  - 7.10
  - 7.65
  - 8.85
14. We have 250. mL of a 0.56 M solution of  $\text{NaCH}_3\text{COO}$ . How many milliliters of a 0.50 M  $\text{CH}_3\text{COOH}$  solution should be added to make a buffer of pH = 4.40?  $K_a(\text{CH}_3\text{COOH}) = 1.8 \times 10^{-5}$
- 200
  - 230
  - 620
  - 710
  - 750
15. Which of the following is the solubility product constant for  $\text{Mn}(\text{OH})_2$ ?
- $K_{sp} = [\text{Mn}^{2+}][\text{OH}^-]^2$
  - $K_{sp} = [\text{Mn}^{2+}][2\text{OH}^-]^2$
  - $K_{sp} = [\text{Mn}^{2+}]^2[\text{OH}^-]^2$
  - $K_{sp} = [\text{Mn}^{2+}]^2[\text{OH}^-]$
  - $K_{sp} = [\text{Mn}^{2+}]^2[\text{OH}^-]^2$
16. Rank the compounds from lowest to highest molar solubility.  
 $\text{FeCO}_3$ ;  $K_{sp} = 3.5 \times 10^{-11}$   
 $\text{BaSO}_4$ ;  $K_{sp} = 1.1 \times 10^{-10}$   
 $\text{ZnCO}_3$ ;  $K_{sp} = 1.5 \times 10^{-11}$
- $\text{ZnCO}_3 < \text{BaSO}_4 < \text{FeCO}_3$
  - $\text{FeCO}_3 < \text{ZnCO}_3 < \text{BaSO}_4$
  - $\text{ZnCO}_3 < \text{FeCO}_3 < \text{BaSO}_4$
  - $\text{BaSO}_4 < \text{ZnCO}_3 < \text{FeCO}_3$
  - $\text{BaSO}_4 < \text{FeCO}_3 < \text{ZnCO}_3$

17. What is the concentration of  $\text{SO}_4^{2-}$  in a saturated solution of  $\text{BaSO}_4$  if  $K_{\text{Sp}} = 1.1 \times 10^{-10}$ ?
- $1.1 \times 10^{-10} \text{ M}$
  - $5.5 \times 10^{-11} \text{ M}$
  - $5.0 \times 10^{-5} \text{ M}$
  - $1.0 \times 10^{-5} \text{ M}$
  - $9.5 \times 10^{-4} \text{ M}$
18. Which of the following has the highest molar solubility?
- $\text{PbCO}_3$ ;  $K_{\text{Sp}} = 1.5 \times 10^{-13}$
  - $\text{PbS}$ ;  $K_{\text{Sp}} = 8.4 \times 10^{-28}$
  - $\text{PbI}_2$ ;  $K_{\text{Sp}} = 8.7 \times 10^{-9}$
  - $\text{PbSO}_4$ ;  $K_{\text{Sp}} = 1.8 \times 10^{-8}$
  - $\text{Pb}_3(\text{PO}_4)_2$ ;  $K_{\text{Sp}} = 3.0 \times 10^{-44}$
19. For  $\text{MgF}_2$ ,  $K_{\text{Sp}} = 6.4 \times 10^{-9}$ . If you mix 400. mL of  $1 \times 10^{-4} \text{ M}$   $\text{Mg}(\text{NO}_3)_2$  and 500. mL of  $1.00 \times 10^{-4} \text{ M}$   $\text{NaF}$ , what will be observed?
- A precipitate forms because  $Q_{\text{Sp}} > K_{\text{Sp}}$ .
  - A precipitate forms because  $Q_{\text{Sp}} < K_{\text{Sp}}$ .
  - No precipitate forms because  $Q_{\text{Sp}} = K_{\text{Sp}}$ .
  - No precipitate forms because  $Q_{\text{Sp}} < K_{\text{Sp}}$ .
  - No precipitate forms because  $Q_{\text{Sp}} > K_{\text{Sp}}$ .
20. For  $\text{AgI}$ ,  $K_{\text{Sp}} = 8.3 \times 10^{-17}$ . What is the molar solubility of  $\text{AgI}$  in a solution which is  $5.1 \times 10^{-4} \text{ M}$  in  $\text{AgNO}_3$ ?
- $5.1 \times 10^{-2} \text{ mol/L}$
  - $1.1 \times 10^{-5} \text{ mol/L}$
  - $8.3 \times 10^{-11} \text{ mol/L}$
  - $1.6 \times 10^{-13} \text{ mol/L}$
  - $4.2 \times 10^{-20} \text{ mol/L}$