

**REVIEW QUESTIONS**

**Test 2**

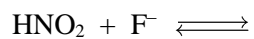
1. Calculate the pH of a 1.8 M solution of methyl amine ( $\text{CH}_3\text{NH}_2$ ).  $K_b=4.38 \times 10^{-4}$ .
2. Calculate the pH of a solution prepared by adding 40.0 mL of 0.10M  $\text{NH}_3$  to 20.0 mL of water. ( $K_b$  of  $\text{NH}_3 = 1.8 \times 10^{-5}$ )
3. Calculate the pH of a solution resulted from mixing 200. mL of HCl solution (pH=3.00) with 100. mL of HCl solution (pH=2.00).
4. How many grams of ammonia are needed to make 1.25 L solution with a pH of 11.68? ( $K_b$  of  $\text{NH}_3 = 1.8 \times 10^{-5}$ )

5. The solubility of  $\text{CO}_2(\text{g})$  in pure water is  $0.0037 \text{ mol/L}$ . Assuming that dissolved  $\text{CO}_2$  is in the form of  $\text{H}_2\text{CO}_3(\text{aq})$ , what is the pH of a  $0.0037 \text{ M}$  solution of dissolved  $\text{CO}_2$ ? ( $K_{a1}$  for  $\text{H}_2\text{CO}_3 = 4.3 \times 10^{-7}$ )
6. Calculate the pH of a  $7.5 \times 10^{-6} \text{ M}$  solution of  $\text{Mg}(\text{OH})_2$ .
7. Phenol ( $\text{C}_6\text{H}_5\text{OH}$ ) has a  $K_a$  value of  $1.6 \times 10^{-10}$ . What is the  $K_b$  value for phenoxide ion ( $\text{C}_6\text{H}_5\text{O}^-$ )?
8. A benzoic acid solution ( $\text{C}_6\text{H}_5\text{CO}_2\text{H}$ ) has a pH of 2.80. Given that  $K_a$  of benzoic acid is  $6.4 \times 10^{-5}$ , calculate the concentration and percent dissociation of this acid.

9. Determine the pH of a 0.10 M NaCN solution.
10. Write net ionic equations for the reactions that take place when aqueous solutions of the following substances are mixed:
- a) sodium cyanide and nitric acid
  
  
  - b) potassium hydrogen sulfate and lithium acetate
11. Based on molecular structure, choose the stronger acid in each pair. Explain your reasoning.
- a)  $\text{H}_2\text{S}$  or  $\text{H}_2\text{Se}$
  - b)  $\text{HClO}_2$  or  $\text{HClO}$
  - c)  $\text{H}_2\text{SO}_4$  or  $\text{H}_2\text{SeO}_4$
  - d)  $\text{CCl}_3\text{CO}_2\text{H}$  or  $\text{CH}_3\text{CO}_2\text{H}$
12. For each pair given below, determine which is more basic. (Assume the same concentration for all solutions).
- a) Solution of NaClO and solution of HF
  - b) Solution of KCl and solution of  $\text{KClO}_2$
  - c) Solution of  $\text{NH}_4\text{Cl}$  and solution of HCN

13. Calculate the pH and  $[\text{CN}^-]$  in a solution that is 0.050 M  $\text{HC}_2\text{H}_3\text{O}_2$  and 0.050 M HCN.  
( $K_a$  acetic acid =  $1.8 \times 10^{-5}$  and  $K_a$  HCN =  $4.9 \times 10^{-10}$ )  
Note: Concentration of acids given are after mixing.

14. Complete the reaction shown below and determine whether the forward reaction or the reverse reaction is favored.



15. What is the change in pH if  $[\text{H}_3\text{O}^+]$  changes by each of the following factors?
- a) 1000
  - b)  $1.0 \times 10^5$
  - c) 2.0

## ANSWERS

- 1) 12.45
- 2) 11.04
- 3) 2.40
- 4) 27.2 g
- 5) 4.40
- 6) 9.18
- 7)  $6.3 \times 10^{-5}$
- 8) 4.1%
- 9) 11.15
- 10) No answers provided
- 11) a)  $\text{H}_2\text{Se}$  (Se larger than S causing acid bond to be weaker)  
b)  $\text{HClO}_2$  (The greater number of oxygens cause more polar acidic bond)  
c)  $\text{H}_2\text{SO}_4$  (Sulfur is more electronegative than Se causing the acid bond to be more polar)  
d)  $\text{CCl}_3\text{CO}_2\text{H}$  (the 3 electronegative chlorine atoms withdraw electrons from the oxygen, in turn causing the acidic bond to become more polar)
- 12) No answers given
- 13)  $\text{pH} = 3.02$ ;  $[\text{CN}^-] = 2.6 \times 10^{-8}$
- 14) No answers provided
- 15) a) 3            b) 5            c) 0.3