

## Chem 40S – Acid/Base Review

1. Calculate  $[H^+]$  in a 2.00 L solution of hydrogen chloride in which 3.65 g of HCl is dissolved.  $K_a$  for HCl is very large.
2. Calculate  $[H^+]$  in a solution containing 3.20 g of  $HNO_3$  in 250 mL of solution. Nitric acid is a very strong acid.
3. An acetic acid ( $HC_2H_3O_2$ ) solution is 0.25 M. Given that  $K_a$  for acetic acid is  $1.8 \times 10^{-5}$ , find  $[H^+]$ .
4. A solution of acetic acid contains 12.0 g of  $HC_2H_3O_2$  in 500 mL of solution. Calculate  $[H^+]$ .
5. Calculate  $[H^+]$  and  $[OH^-]$  at  $25^\circ C$  in:
  - a. a 0.025 M  $Ca(OH)_2$  solution.  $Ca(OH)_2$  is a strong base.
  - b. a 0.01 M  $HC_2H_3O_2$  solution.  $HC_2H_3O_2$  is a weak acid with  $K_a = 1.8 \times 10^{-5}$ .
6. A mass of 1.4 g of KOH is dissolved in water to form 500 mL of solution. What is the concentration of  $H^+$  ions in this solution if the temperature of the solution is  $25^\circ C$ ?
7. Calculate the pH of a solution of nitric acid that consists of 6.3 g of solute dissolved in 1.00 L of solution?
8. Calculate the pH of a solution that consists of 5.0 g of HCl in 250 mL of solution?
9. What is the  $[H^+]$  of a solution with a pH of 10.00 at  $25^\circ C$ ?
10. What is the pH of an aqueous solution containing 0.0020 M barium hydroxide,  $Ba(OH)_2$ ?
11. Calculate the hydronium ion concentration of:
  - a. 100.0 mL of an aqueous solution containing 0.60 g of sodium hydroxide, NaOH.
  - b. a blood sample with a pH of 7.40
12. What is the approximate pH of a solution that is:
  - a. yellow in methyl red, yellow in phenol red, and yellow in alizarin yellow?
  - b. yellow in methyl red, red in phenol red, and red in alizarin yellow?
13. Write **balanced** neutralization reactions for the following:
  - a. the reaction between acetic acid,  $HC_2H_3O_2$  and potassium hydroxide, KOH
  - b. the reaction between nitric acid,  $HNO_3$  and calcium hydroxide,  $Ca(OH)_2$
  - c. the reaction between sulfuric acid,  $H_2SO_4$ , and sodium hydroxide, NaOH
14. If 25.00 mL of a 0.100 M NaOH solution is required to neutralize 15.00 mL of solution of HCl, what is the molarity of the acid?

15. a. Write the correct symbol for the hydrogen ion: \_\_\_\_\_

b. Write the correct symbol for a hydronium ion: \_\_\_\_\_

16. Define the term **amphiprotic**.

17. Write balanced equations for the:

a. Dissociation of calcium hydroxide,  $\text{Ca}(\text{OH})_2$

b. Ionization of nitric acid,  $\text{HNO}_3$

18. Write the formulas for the conjugate base of each of the following acids.

a.  $\text{H}_2\text{SO}_3$

b.  $\text{HCO}_3^-$

c.  $\text{NH}_4^+$

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

19. Write the formulas for the conjugate acid of each of the following bases.

a.  $\text{H}_2\text{O}$

b.  $\text{CO}_3^{2-}$

c.  $\text{PH}_3$

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

20. Which of the following would you expect to act as Brønsted-Lowry bases:

a)  $\text{Br}^-$

b)  $\text{Li}^+$

c)  $\text{H}_3\text{PO}_4$

d)  $\text{NH}_4^+$

e)  $\text{H}_2\text{O}$

f)  $\text{NH}_2^-$

21. For each of the following reactions, identify the Brønsted-Lowry acid and Brønsted-Lowry base on the reactant side of the equation, and the conjugate acid and conjugate base on the product side. Also, indicate strength and favored direction.

a.  $\text{HSO}_4^-(aq) + \text{CO}_3^{2-}(aq) \rightarrow \text{SO}_4^{2-}(aq) + \text{HCO}_3^-(aq)$

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

b.  $\text{HCO}_3^-(aq) + \text{OH}^-(aq) \rightarrow \text{CO}_3^{2-}(aq) + \text{H}_2\text{O}(l)$

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_