South Pasadena • AP Chemistry

Name _____
Period ___ Date ___/___/___

18 • Reactions between Acids and Bases

STUDY QUESTIONS & PROBLEMS

1. Calculate the equilibrium constant for the neutralization of hydrocyanic acid by ammonia:

   $HCN(aq) + NH_3(aq) \rightleftharpoons NH_4^+(aq) + CN^-(aq)$

   K_a for hydrocyanic acid = 4.0×10^{-10} at 25° C

   K_b for ammonia = 1.8×10^{-5} at 25° C

2. Is the solution that results from the neutralization of hydrocyanic acid by ammonia basic or acidic?

3. If exactly 50 mL of a 0.050M solution of hydrochloric acid is added to exactly 50 mL of 0.050M ammonia, what is the pH of the resulting solution?

4. a. Calculate the pH of a 0.20M solution of formic acid HCO_2H.
   b. Now suppose sufficient sodium formate is added to make the solution 0.10M in formate ion (without changing the total volume). Would you expect the pH to increase or decrease?
   c. Calculate the pH of the new solution.
   d. What would the pH be if the concentration of formate ion was increased to 0.20M?
   e. What do you notice about the pH of this solution?

5. a. What is the pH of 100 mL of pure water at 25° C?
   b. What would the pH of this 100 mL water sample be if 0.10 mL of 12M HCl was added to it? (Assume the volume doesn't change).
   c. Calculate the pH of a buffer solution composed of 0.20M ammonia and 0.20M ammonium chloride.
   d. Calculate the pH of 100 mL of this buffer solution if 0.10mL of 12M hydrochloric acid is added to it. (Assume the volume doesn't change).

6. From the list of weak acids shown in Table 17.4 on page 799, choose an appropriate acid for the preparation of a buffer with a pH equal to 7.25. Calculate the relative quantities of the acid and its conjugate base required for the buffer solution.

7. Repeat question 6 for a buffer requiring a pH = 9.25.

8. Benzoic acid is a weak monoprotic acid ($K_a = 6.3 \times 10^{-5}$). Calculate the pH of the solution at the equivalence point when 25.0 mL of a 0.100 M solution of benzoic acid is titrated against 0.050 M sodium hydroxide.

9. A solution contains KH_2PO_4 and K_2HPO_4 and has a pH of 7.10. What is the mole ratio of K_2HPO_4 to KH_2PO_4?