CHM 112.009
Additional Problems – Chapter 16

1. Identify the species that is amphiprotic and write one equation for its reaction with OH^- (aq) and another for its reaction with H^+ (aq).

   H_2S $\qquad\qquad\qquad\qquad$ SO_2 $\qquad\qquad\qquad\qquad$ HSO_3^- $\qquad\qquad\qquad\qquad$ H_2CO_3

2. What is the $[OH^-]$ in...

   (a) paint stripper, pH = 13.7

   (b) rhubarb, pH = 3.65

   (c) blood plasma, pH = 7.42

3. Describe how you would prepare 2.00 L of an aqueous solution having a pH of 3.60 if you had a supply of 0.100 HCl available.

4. Hydrazoic acid, HN_3, ($pK_a = 4.72$) is perhaps best known through its sodium salt, sodium azide, NaN_3 which is the gas forming substance of automobile airbag systems. What molarity of HN_3 is required to produce an aqueous solution with pH=3.10?

5. Codeine, $C_{18}H_{21}NO_3$, a commonly presecribed painkiller, is a weak base. A saturated aqueous solution contains 1.00 g of codeine in 120 mL of solution and has a pH = 9.8. What is the K_b of codeine?

$$C_{18}H_{21}NO_3 + H_2O \rightleftharpoons [C_{18}H_{21}NHO_3]^+ + OH^-$$
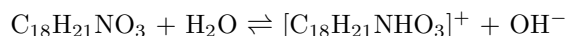
6. Predict whether each of the following solutions is acidic, basic, or neutral.

   (a) CH_3CH_2COOK (aq)

   (b) $Mg(NO_3)_2$ (aq)

   (c) NH_4CN (aq)

7. For a solution that is 0.602 M NH_4Cl, determine the pH.

8. In the titration of 20.00 mL of 0.500 M HCl by 0.500 M NaOH, calculate the volume of 0.500 M NaOH required to reach a pH of 2.0.

9. Calculate the concentration at equilibrium of H_2CO_3, HCO_3^-, CO_3^{2-}, and H_3O^+ in a solution where the initial $[H_2CO_3]$ = 0.034

10. Sodium cyanide (NaCN) is dissolved in water. If the concentration of sodium cyanide is 0.45 M, what is the pH of the solution. The K_a for hydrocyanic acid (HCN) is 6.17×10^{-10}.