2018-Spring semester: General Chemistry (034.020-005): Chapter 11+12 Practice

Due by 9:30 am on 2018-06-07

1. In the following reactions, identify the Lewis acid and the Lewis base.
(a) $AlCl_3$ (*g*) + Cl^- (*g*) → $AlCl_4^-$ (*g*)
(b) Co^{3+} (*aq*) + $6F^-$ (*aq*) → $[CoF_6]^{3-}$ (*aq*)
(c) CH_3COOH (*aq*) + NH_3 (*aq*) → CH_3COO^-(*aq*) + NH_4^+(*aq*)

2. Calculate the pH of a solution made by adding 0.100 mol of NH_4Cl and 0.200 mol of NH_3 to water and diluting to 1.000 L. K_a for NH_4^+ is 5.6 X 10^{-10}.

3. Aspirin is acetylsalicylic acid, $HC_9H_7O_4$, which has a K_a of 3.0 X 10^{-4}. Calculate the pH of a solution made by dissolving 0.65 g of acetylsalicylic acid in water and diluting to 50.0 mL.

4. Suppose a 0.100 M solution of each of the following substances is prepared. Rank the pH of the resulting solutions from lowest to highest: KF, NH_4I, HBr, NaCl, LiOH.

5. A solution of equal molar concentrations of glyceric acid and sodium glycerate was found to have pH = 3.52. (a) What are pK_a and *K*a for glyceric acid? (b) What would the pH be if the concentration of acid was twice that of the salt?

6. Ant venom contains formic acid (HCOOH). If you are at a pharmaceutical company working on a quick antidote and need to estimate the pH at the stoichiometric point when titrating a solution of formic acid. Estimate the pH at the stoichiometric point of the titration of 25.00 mL of 0.100 M HCOOH (*aq*) with 0.150 M NaOH (*aq*).

7. Calculate the pH in a solution prepared by dissolving 0.050 mol of acetic acid and 0.020 mol of sodium acetate in water and adjusting the volume to 500 mL. Also suppose 0.010 mol of NaOH is added to the buffer from the previous solution and calculate the pH of the solution that results.

8. Benzoic acid,. C_6H_5COOH, is used as a preservative in food and cosmetics because it is considered to be relatively safe. Suppose you are studying benzoic acid and need to predict the pH of a benzoic acid solution during a titration. Calculate the pH at the stoichiometric point of the titration of 25.00 mL of 0.120 M C_6H_5COOH (*aq*) with 0.0230 M NaOH (*aq*). The pK_a of benzoic acid is 4.19.

9. Compare the solubility of $Zn(OH)_2$ in pure water with that in a solution buffered at pH 6.00 when Ksp = 4.5 X 10^{-17}.