

Recitation 2 November 2009

Group Problems

1. Sketch a titration curve for a weak acid titrated with a strong base. Identify the following points on the curve.
 - a. The equivalence point
 - b. The buffering region
 - c. $\text{pH} = \text{pK}_a$
 - d. pH depends only on $[\text{HA}]$
 - e. pH depends only on $[\text{A}^-]$
 - f. pH depends only on the amount of excess strong base added.
2. Consider the titration of 50 – mL of 1.0 M benzoic acid with standardized 0.5 M NaOH.
 - (a.) Identify the halfway to the equivalence point, (b.) Identify the equivalence point, and (c.) Calculate the pH at the following points during the titration:
 - i. At the starting point in which no NaOH has been added.
 - ii. After 25 – mL of 0.5 M NaOH has been added.
 - iii. After 50 – mL of 0.5 M NaOH has been added.
 - iv. After 100 – mL of 0.5 M NaOH has been added.
 - v. After 150 – mL of 0.5 M NaOH has been added.

The K_a for Benzoic Acid is 6.4×10^{-5} .

3. Consider the titration of 40.0 mL of 0.200 M HClO_4 with 0.100 M KOH. Calculate the pH of the resulting solutions after the following volumes of KOH has been added.
(a.) 0 mL (b.) 10.0 mL (c.) 40.0 mL (d.) 80.0 mL (e.) 100.0 mL
4. Calculate the molar solubility of each of the following compounds in moles per liter and grams per liter (Ignore any acid-base properties).
 - a. Ag_3PO_4 ($K_{\text{sp}} = 1.8 \times 10^{-18}$)
 - b. CaCO_3 ($K_{\text{sp}} = 8.7 \times 10^{-9}$)
5. Calculate the solubility (in mol/L) of $\text{Fe}(\text{OH})_3$ ($K_{\text{sp}} = 4.0 \times 10^{-38}$) in each of the following instances.
 - a. Water ($\text{pH} = 7$)
 - b. A buffered solution at $\text{pH} = 5.0$
 - c. A buffered solution at $\text{pH} = 11.0$

Individual Problems

1. Calculate the pH for the titration of a 50-mL solution of 1.0 M pyridine C_5H_5N ($K_b = 1.7 \times 10^{-9}$) with 0.25 M HCl.
 - a. At the starting point with no HCl added.
 - b. After 50 – mL of HCl is added.
 - c. After 100 – mL of HCl is added.
 - d. After 200 – mL of HCl is added
 - e. After 250 – mL of HCl is added

Sketch the titration curve.

2. The K_{sp} for silver sulfate (Ag_2SO_4) is 1.2×10^{-5} . Calculate the solubility of silver sulfate in each of the following.
 - a. Water
 - b. 0.10 M $AgNO_3$
 - c. 0.20 M K_2SO_4