

Name:
College ID:
Thomas Edison State University
General Chemistry II with Labs (CHE-122)
Section no.:
Semester and year:

Written Assignment 6: Reactions of Acids and Bases

Answer all assigned questions and problems, and show all work.

1. Determine the pH of (a) a 0.40 M $\text{CH}_3\text{CO}_2\text{H}$ solution, (b) a solution that is 0.40 M $\text{CH}_3\text{CO}_2\text{H}$ and 0.20 M NaCH_3CO_2 . (8 points)

(Reference: Chang 16.5)

2. Which of the following solutions can act as a buffer? (a) KCl/HCl , (b) $\text{KHSO}_4/\text{H}_2\text{SO}_4$, (c) $\text{KNO}_2/\text{HNO}_2$. (5 points)

(Reference: Chang 16.9)

3. Calculate the pH of the buffer system made up of 0.15 M NH_3 /0.35 M NH_4Cl . (5 points)

(Reference: Chang 16.11)

4. The pH of a bicarbonate-carbonic acid buffer is 8.00. Calculate the ratio of the concentration of carbonic acid (H_2CO_3) to that of the bicarbonate ion (HCO_3^-). (5 points)

(Reference: Chang 16.13)

5. The pH of a sodium acetate–acetic acid buffer is 4.50. Calculate the ratio $[\text{CH}_3\text{COO}^-]/[\text{CH}_3\text{COOH}]$. (5 points)

(Reference: Chang 16.15)

6. Calculate the pH of the 0.20 M NH_3 /0.20 M NH_4Cl buffer. What is the pH of the buffer after the addition of 10.0 mL of 0.10 M HCl to 65.0 mL of the buffer? (8 points)

(Reference: Chang 16.17)

7. A 0.2688 g sample of a monoprotic acid neutralized 16.4 mL of 0.08133 M KOH solution. Calculate the molar mass of the acid. (5 points)

(Reference: Chang 16.27)

8. In a titration experiment, 12.5 mL of 0.500 M H_2SO_4 neutralize 50.0 mL of NaOH . What is the concentration of the NaOH solution? (5 points)

(Reference: Chang 16.29)

9. A 0.1276 g sample of an unknown monoprotic acid was dissolved in 25.0 mL of water and titrated with 0.0633 M NaOH solution. The volume of base required to bring the solution to the equivalence point was 18.4 mL. (a) Calculate the molar mass of the acid. (b) After 10.0 mL of base had been added during the titration, the pH was determined to be 5.87. What is the K_a of the unknown acid? (10 points)

(Reference: Chang 16.31)

10. Calculate the pH at the equivalence point for the following titration: 0.20 M HCl versus 0.20 M methylamine (CH_3NH_3 ; $K_b = 4.4 \times 10^{-4}$) (5 points)

(Reference: Chang 16.33)

11. A 25.0 mL solution of 0.100 M CH_3COOH is titrated with a 0.200 M KOH solution. Calculate the pH after the following additions of the KOH solution: (a) 0.0 mL, (b) 5.0 mL, (c) 10.0 mL, (d) 12.5 mL, (e) 15.0 mL. (25 points)

(Reference: Chang 16.35)

12. Referring to the following table:

Indicator	Color in Acid	Color in Base	pH Range*
Thymol blue	Red	Yellow	1.2–2.8
Bromophenol blue	Yellow	Bluish purple	3.0–4.6
Methyl orange	Orange	Yellow	3.1–4.4
Methyl red	Red	Yellow	4.2–6.3
Chlorophenol blue	Yellow	Red	4.8–6.4
Bromothymol blue	Yellow	Blue	6.0–7.6
Cresol red	Yellow	Red	7.2–8.8
Phenolphthalein	Colorless	Reddish pink	8.3–10.0

*The pH range is defined as the range over which the indicator changes from the acid color to the base color.

Specify which indicator or indicators you would use for the following titrations: (9 points)

- HCOOH versus NaOH
- HCl versus KOH
- HNO_3 versus CH_3NH_2

(Reference: Chang 16.43)

13. The pK_a of butyric acid (HBut) is 4.7. Calculate K_b for the butyrate ion (But^-). (5 points)

(Reference: Chang 16.97)