Determining pH and Titrations

SECTION 2 REVIEW

17. What is meant by the transition interval of an indicator?

18. Explain how changes in pH affect the color of an indicator.

19. a. Without using an indicator, how can you determine the equivalence point of a titration experiment or the pH of a solution?
b. What can be observed about the rate of change of the pH of a solution near the end point of a titration?

20. a. What is meant by the end point of a titration?
b. What is the role of an indicator in the titration process?
c. On what basis is an indicator selected for a particular titration experiment?

21. For each of the four possible types of acid-base titration combinations (strong-strong, strong-weak, etc.), indicate the approximate pH at the end point. Also name a suitable indicator for detecting that end point.

22. Use **Figures 9(a)** and **9(b)** to sketch the pH curve of a strong acid being titrated by a weak base.

23. An unknown solution is colorless when tested with phenolphthalein but causes the indicator phenol red to turn red. Use this information to find the approximate pH of this solution.

PRACTICE PROBLEMS

24. For each of the following acid-base titration combinations, determine the number of moles of the first substance listed that would be the chemically equivalent amount of the second substance.
a. NaOH with 1.0 mol HCl
b. HNO_3 with 0.75 mol KOH
c. $Ba(OH)_2$ with 0.20 mol HF
d. H_2SO_4 with 0.90 mol $Mg(OH)_2$

25. Suppose that 15.0 mL of 2.50×10^{-2} M aqueous H_2SO_4 is required to neutralize 10.0 mL of an aqueous solution of KOH. What is the molarity of the KOH solution? (Hint: See Sample Problem F.)

26. In a titration experiment, a 12.5 mL sample of 1.75×10^{-2} M $Ba(OH)_2$ just neutralized 14.5 mL of HNO_3 solution. Calculate the molarity of the HNO_3 solution.

MIXED REVIEW

27. a. What is the $[OH^-]$ of a 4.0×10^{-4} M solution of $Ca(OH)_2$?
b. What is the $[H_3O^+]$ of the solution?

28. Given the following $[H_3O^+]$ values, determine the pH of each solution.
a. 1.0×10^{-7} M
b. 1.0×10^{-3} M
c. 1.0×10^{-12} M
d. 1.0×10^{-5} M

29. What is the $[H_3O^+]$ for a solution that has a pH of 6.0?

30. Suppose that a 5.0×10^{-5} M solution of $Ba(OH)_2$ is prepared. What is the pH of the solution?

31. a. Calculate the pH of a solution that has an $[H_3O^+]$ of 8.4×10^{-11} M.
b. Calculate the $[H_3O^+]$ of a solution that has a pH of 2.50.

32. a. What is the concentration of OH^- in a 5.4×10^{-5} M solution of magnesium hydroxide, $Mg(OH)_2$?
b. Calculate the concentration of H_3O^+ for this solution.

33. a. Calculate the molarity of H_3O^+ in a solution that has a pH of 8.90.
b. Calculate the concentration of OH^- for this solution.

34. What is the pH of a solution in which $[OH^-]$ equals 6.9×10^{-10} M?

35. In a titration, 25.9 mL of 3.4×10^{-3} M $Ba(OH)_2$ neutralized 16.6 mL of HCl solution. What is the molarity of the HCl solution?

36. Find the molarity of a $Ca(OH)_2$ solution given that 428 mL of the solution is neutralized in a titration by 115 mL of 6.7×10^{-3} M HNO_3.

37. Suppose that 10.1 mL of HNO_3 is neutralized by 71.4 mL of a 4.2×10^{-3} M solution of KOH in a titration. Calculate the concentration of the HNO_3 solution.