CHAPTER 15 REVIEW
Acid-Base Titration and pH

MIXED REVIEW

SHORT ANSWER  Answer the following questions in the space provided.

1. Calculate the following values without using a calculator.

   a. The \([H_3O^+]\) in a solution is \(1 \times 10^{-4}\) M. Calculate the pH.

   b. The pH of a solution is 13.0. Calculate the \([H_3O^+]\).

   c. The \([OH^-]\) in a solution is \(1 \times 10^{-5}\) M. Calculate the \([H_3O^+]\).

   d. The pH of a solution is 4.72. Calculate the pOH.

   e. The \([OH^-]\) in a solution is 1.0 M. Calculate the pH.

2. Calculate the following values.

   a. The \([H_3O^+]\) in a solution is \(6.25 \times 10^{-9}\) M. Calculate the pH.

   b. The pOH of a solution is 2.34. Calculate the \([OH^-]\).

   c. The pH of milk of magnesia is approximately 10.5. Calculate the \([OH^-]\).

PROBLEMS  Write the answer on the line to the left. Show all your work in the space provided.

3. A 0.0012 M solution of \(H_2SO_4\) is 100% ionized.

   a. What is the \([H_3O^+]\) in the \(H_2SO_4\) solution?

   b. What is the \([OH^-]\) in this solution?

   c. What is the pH of this solution?
4. In a titration, a 25.0 mL sample of 0.150 M HCl is neutralized with 44.45 mL of Ba(OH)₂.
   a. Write the balanced molecular equation for this reaction.
   \[2\text{HCl}(aq) + \text{Ba(OH)}_2(aq) \rightarrow \text{BaCl}_2(aq) + 2\text{H}_2\text{O}(l)\]
   b. What is the molarity of the base solution?

5. 3.09 g of boric acid, H₃BO₃, are dissolved in 200 mL of solution.
   a. Calculate the molarity of the solution.
   b. H₃BO₃ ionizes in solution in three stages. Write the equation showing the ionization for each stage. Which stage proceeds furthest to completion?
   stage 1: H₃BO₃(s) + H₂O(l) ⇌ H₃O⁺(aq) + H₂BO₃⁻(aq)
   stage 2: H₂BO₃⁻(aq) + H₂O(l) ⇌ H₃O⁺(aq) + HBO₂²⁻(aq)
   stage 3: HBO₂²⁻(aq) + H₂O(l) ⇌ H₃O⁺(aq) + BO₃⁻(aq)
   Stage 1 proceeds furthest to completion.
   c. What is the [H₃O⁺] in this boric acid solution if the pH = 4.90?
   d. Is the percentage ionization of this H₃BO₃ solution more than or less than 1%?