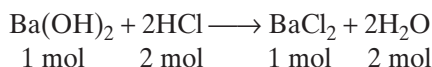


2 PLAN

1. balanced neutralization equation \longrightarrow chemically equivalent amounts



2. volume of known basic solution used (mL) \longrightarrow amount of base used (mol)

$$\frac{\text{mol Ba(OH)}_2}{1 \text{ L}} \times \text{mL of Ba(OH)}_2 \text{ solution} \times \frac{1 \text{ L}}{1000 \text{ mL}} = \text{mol Ba(OH)}_2$$

3. mole ratio, moles of base used \longrightarrow moles of acid used from unknown solution

$$\frac{2 \text{ mol HCl}}{1 \text{ mol Ba(OH)}_2} \times \text{mol Ba(OH)}_2 \text{ in known solution} = \text{mol HCl in unknown solution}$$

4. volume of unknown, moles of solute in unknown \longrightarrow molarity of unknown

$$\frac{\text{amount of solute in unknown solution (mol)}}{\text{volume of unknown solution (mL)}} \times \frac{1000 \text{ mL}}{1 \text{ L}} = \text{molarity of unknown solution}$$

3 COMPUTE

1. The mole ratio from the equation is 1 mol Ba(OH)₂ for every 2 mol HCl.

$$2. \frac{0.0154 \text{ mol Ba(OH)}_2}{1 \cancel{\text{L}}} \times \frac{1 \cancel{\text{L}}}{1000 \cancel{\text{mL}}} \times 27.4 \cancel{\text{mL}} = 4.22 \times 10^{-4} \text{ mol Ba(OH)}_2$$

$$3. \frac{2 \text{ mol HCl}}{1 \cancel{\text{mol Ba(OH)}_2}} \times 4.22 \times 10^{-4} \cancel{\text{mol Ba(OH)}_2} = 8.44 \times 10^{-4} \text{ mol HCl}$$

$$4. \frac{8.44 \times 10^{-4} \text{ mol HCl}}{20.0 \cancel{\text{mL}}} \times \frac{1000 \cancel{\text{mL}}}{1 \text{ L}} = \frac{4.22 \times 10^{-2} \text{ mol HCl}}{1 \text{ L}} = 4.22 \times 10^{-2} \text{ M HCl}$$

PRACTICE

Answers in Appendix E

1. A 15.5 mL sample of 0.215 M KOH solution required 21.2 mL of aqueous acetic acid solution in a titration experiment. Calculate the molarity of the acetic acid solution.
2. By titration, 17.6 mL of aqueous H₂SO₄ neutralized 27.4 mL of 0.0165 M LiOH solution. What was the molarity of the aqueous acid solution?

extension

Go to go.hrw.com for more practice problems that ask you to calculate molarities of acidic or basic solutions.



Keyword: HC6ABTX

SECTION REVIEW

1. Name an appropriate indicator for titrating the following:

- a. a strong acid and a weak base
- b. a strong base and a weak acid

2. If 20.0 mL of 0.0100 M aqueous HCl is required to neutralize 30.0 mL of an aqueous solution of NaOH, determine the molarity of the NaOH solution.

3. Suppose that 20.0 mL of 0.010 M Ca(OH)₂ is required to neutralize 12.0 mL of aqueous HCl solution. What is the molarity of the HCl solution?

Critical Thinking

4. **PREDICTING OUTCOMES** Sketch the titration curve for 50.0 mL of 0.10 M NH₃ that is titrated with 0.10 M HCl.