

Unit 5: Acids & Bases

Practice Set 3: 2-5, 3-1 to 3-2 Neutralization Reactions and Titration

1. What is the approximate pH of a solution that is:

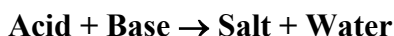
a. yellow in methyl red, yellow in phenol red, and yellow in alizarin yellow?

6.0 – 6.6

b. yellow in methyl red, red in phenol red, and red in alizarin yellow?

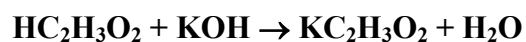
12 or higher

2. Write the general word equation for a neutralization reaction.

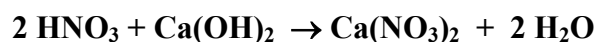


3. Write **balanced** neutralization reactions for the following:

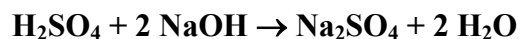
a. the reaction between acetic acid, $\text{HC}_2\text{H}_3\text{O}_2$ and potassium hydroxide, KOH



b. the reaction between nitric acid, HNO_3 and calcium hydroxide, Ca(OH)_2



c. the reaction between sulfuric acid, H_2SO_4 , and sodium hydroxide, NaOH



4. If 25.00 mL of a 0.100 M NaOH solution is required to neutralize 15.00 mL of a solution of HCl, what is the molarity of the acid?

Write the balanced equation: $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$

The acid:base ratio is 1:1, therefore the formula used to calculate the unknown concentration is:

$$M_A V_A = M_B V_B$$

Determine the values for the known variables:

M_A	M_A	M_B	0.100 M
V_A	15.00 mL	V_B	25.00 mL

Substitute values into the formula $M_A V_A = M_B V_B$ and solve for the unknown:

$$\begin{aligned} M_A V_A &= M_B V_B \\ M_A (15.00) &= (0.100)(25.00) \\ M_A (15.00) &= 2.50 \\ M_A &= \frac{2.50}{15.00} = 0.167M \end{aligned}$$

The concentration of the HCl solution is 0.167 M.

5. What is the concentration of a calcium hydroxide solution, Ca(OH)_2 , if 30.00 mL of the base is completely neutralized by 10.0 mL of 0.0200 M HCl?

Write the balanced equation: $2 \text{HCl} + \text{Ca(OH)}_2 \rightarrow \text{CaCl}_2 + 2 \text{H}_2\text{O}$

The acid:base ratio is 2:1, therefore the formula used to calculate the unknown concentration is:

$$M_A V_A = 2 M_B V_B$$

Determine the values for the known variables:

M_A	0.0200 M	M_B	M_B
V_A	10.00 mL	V_B	30.00 mL

Substitute values into the formula $M_A V_A = M_B V_B$ and solve for the unknown:

$$\begin{aligned} M_A V_A &= 2 M_B V_B \\ (0.0200)(10.00) &= 2 (M_B)(30.00) \\ 0.200 &= 60.00 (M_B) \\ \frac{0.200}{60.00} = 0.00333M &= M_B \end{aligned}$$

The concentration of the Ca(OH)_2 solution is 3.33×10^{-3} M.