

Acid-Base Titration Problems

Find the requested quantities in the following problems:

- ① If it takes 54 mL of 0.1 M NaOH to neutralize 125 mL of an HCl solution, what is the concentration of the HCl?
- ② If it takes 25 mL of 0.05 M HCl to neutralize 345 mL of NaOH solution, what is the concentration of the NaOH solution?
- ③ If it takes 15.0 mL of 0.40 M NaOH to neutralize 5.0 mL of HCl, what is the molar concentration of the HCl solution?
- ④ It takes 38 mL of 0.75 M NaOH solution to completely neutralize 155 mL of a sulfuric acid solution (H_2SO_4). What is the concentration of the H_2SO_4 solution?
- ⑤ If it takes 10.0 mL of 2.0 M H_2SO_4 to neutralize 30.0 mL of KOH, what is the molar concentration of the KOH?

Acid-Base Titration Problems

Answers

- ① If it takes 54 mL of 0.1 M NaOH to neutralize 125 mL of an HCl solution, what is the concentration of the HCl?



$$\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2} \Rightarrow \frac{M_1(125 \text{ mL})}{1} = \frac{(0.1 \text{ M})(54 \text{ mL})}{1} \Rightarrow M_1 = 0.0432 \text{ M}$$

- ② If it takes 25 mL of 0.05 M HCl to neutralize 345 mL of NaOH solution, what is the concentration of the NaOH solution?



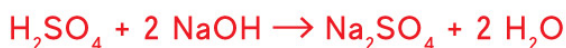
$$\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2} \Rightarrow \frac{(0.05 \text{ M})(25 \text{ mL})}{1} = \frac{M_2(345 \text{ mL})}{1} \Rightarrow M_2 = 0.0432 \text{ M}$$

- ③ If it takes 15.0 mL of 0.40 M NaOH to neutralize 5.0 mL of HCl, what is the molar concentration of the HCl solution?



$$\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2} \Rightarrow \frac{M_1(5 \text{ mL})}{1} = \frac{(0.4 \text{ M})(15 \text{ mL})}{1} \Rightarrow M_2 = 1.2 \text{ M}$$

- ④ It takes 38 mL of 0.75 M NaOH solution to completely neutralize 155 mL of a sulfuric acid solution (H_2SO_4). What is the concentration of the H_2SO_4 solution?



$$\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2} \Rightarrow \frac{M_1(155 \text{ mL})}{1} = \frac{(0.75 \text{ M})(38 \text{ mL})}{2} \Rightarrow M_1 = 0.092 \text{ M}$$

- ⑤ If it takes 10.0 mL of 2.0 M H_2SO_4 to neutralize 30.0 mL of KOH, what is the molar concentration of the KOH?



$$\frac{M_1 V_1}{n_1} = \frac{M_2 V_2}{n_2} \Rightarrow \frac{(2 \text{ M})(10 \text{ mL})}{1} = \frac{M_2(30 \text{ mL})}{2} \Rightarrow M_2 = 1.33 \text{ M}$$