

Answer on the Question #63902, Chemistry / General chemistry

(a) What is the volume of 0.220 M HClO₄ solution is needed to neutralize 78.0 mL of 0.0675 M NaOH? (b) What volume of 0.25 M HCl is needed to neutralize 7.89 g of Mg(OH)₂? (c) If 87.8 mL of AgNO₃ is needed to precipitate all the chloride ions in a 429-mg sample of KCl (forming AgCl), what is the molarity of the AgNO₃ solution? (d) If 55.5 mL of 0.41 M HCl solution is needed to neutralize a solution of KOH, how many grams of KOH must be present in the solution?

Solution:

(a) Law of equivalence:

$$\begin{aligned}n(\text{HClO}_4) &= n(\text{NaOH}) \\c(\text{HClO}_4) \cdot V(\text{HClO}_4) &= c(\text{NaOH}) \cdot V(\text{NaOH})\end{aligned}$$

Volume of HClO₄ needed:

$$V(\text{HClO}_4) = \frac{c(\text{NaOH}) \cdot V(\text{NaOH})}{c(\text{HClO}_4)} = \frac{0.0675 \cdot 78.0}{0.220} = 23.9 \text{ ml}$$

(b) Law of equivalence:

$$\begin{aligned}n(\text{HCl}) &= n(\text{Mg}(\text{OH})_2) \\c(\text{HCl}) \cdot V(\text{HCl}) &= \frac{m(\text{Mg}(\text{OH})_2)}{M(\text{Mg}(\text{OH})_2)}\end{aligned}$$

Volume of HCl needed:

$$V(\text{HCl}) = \frac{m(\text{Mg}(\text{OH})_2)}{M(\text{Mg}(\text{OH})_2) \cdot c(\text{HCl})} = \frac{7.89}{57 \cdot 0.25} = 0.55 \text{ L}$$

(c) Law of equivalence:

$$\begin{aligned}n(\text{AgNO}_3) &= n(\text{KCl}) \\c(\text{AgNO}_3) \cdot V(\text{AgNO}_3) &= \frac{m(\text{KCl})}{M(\text{KCl})}\end{aligned}$$

Molality of AgNO₃:

$$c(\text{AgNO}_3) = \frac{m(\text{KCl})}{M(\text{KCl}) \cdot V(\text{AgNO}_3)} = \frac{429 \text{ mg}}{74.5 \frac{\text{mg}}{\text{mmol}} \cdot 87.8 \text{ ml}} = 0.066 \text{ M}$$

(d) Law of equivalence:

$$\begin{aligned}n(\text{HCl}) &= n(\text{KOH}) \\c(\text{HCl}) \cdot V(\text{HCl}) &= \frac{m(\text{KOH})}{M(\text{KOH})}\end{aligned}$$

Mass of KOH:

$$m(\text{KOH}) = c(\text{HCl}) \cdot V(\text{HCl}) \cdot M(\text{KOH}) = 55.5 \text{ ml} \cdot \frac{0.41 \text{ mmol}}{\text{ml}} \cdot 56 \frac{\text{mg}}{\text{mmol}} = 1206 \text{ mg}$$