

2) Calculate the milliliters of 0.75 M HCl required to neutralize completely 25.0 ml of 0.15 M $\text{Ba}(\text{OH})_2$.

Given:
 molarity = 0.15 M $\text{Ba}(\text{OH})_2$ and 0.75 M HCl
 volume = 25.0 ml $\rightarrow$ 0.025 L $\text{Ba}(\text{OH})_2$
 $\text{Ba}(\text{OH})_2 + 2\text{HCl} \rightarrow \text{BaCl}_2 + 2\text{H}_2\text{O}$

Sol'n: mole = (molarity) (volume)
 volume = $\frac{\text{mole}}{\text{molarity}}$

$$\text{mole of } \text{Ba}(\text{OH})_2 = (0.15 \text{ M}) (0.025 \text{ L}) = 0.00375 \text{ mole } \text{Ba}(\text{OH})_2$$

$$\text{mole of HCl} = 0.00375 \text{ mole } \text{Ba}(\text{OH})_2 \times \frac{2 \text{ mole HCl}}{1 \text{ mole } \text{Ba}(\text{OH})_2} = 0.0075 \text{ mole HCl}$$

$$\text{volume of HCl} = \frac{0.0075 \text{ mole}}{0.75 \text{ M}} = 0.01 \text{ L} \times \frac{1000 \text{ ml}}{1 \text{ L}}$$

$$\therefore \text{volume of HCl in ml} = 10 \text{ ml}$$

3) If 30.0 ml of 0.75 M HCl solution are needed to neutralize a solution of $\text{Ca}(\text{OH})_2$, how many grams of $\text{Ca}(\text{OH})_2$ must be in the solution?

Given:
 molarity = 0.75 M HCl
 volume = 30.0 ml $\rightarrow$ 0.030 L HCl



Sol'n: mole = (molarity) (volume)

$$\text{mass} = \frac{\text{mole}}{\text{MW}} \rightarrow (\text{moles}) (\text{mol. weight})$$

$$\text{mole HCl} = (0.030 \text{ L}) (0.75 \text{ M}) = 0.0225 \text{ mole} \rightarrow 0.023 \text{ mole HCl}$$

$$\text{mole } \text{Ca}(\text{OH})_2 = 0.023 \text{ mole HCl} \times \frac{1 \text{ mole } \text{Ca}(\text{OH})_2}{2 \text{ mole HCl}} = 0.0115 \text{ mole } \text{Ca}(\text{OH})_2$$

$$\text{molar weight} = \text{Ca}(\text{OH})_2$$

$$\begin{array}{l} \rightarrow 40.078 \text{ g/mol} \\ \rightarrow 15.999 \text{ g/mol} \times 2 \\ \rightarrow 1.008 \text{ g/mol} \times 2 \end{array} \left. \vphantom{\begin{array}{l} \rightarrow 40.078 \text{ g/mol} \\ \rightarrow 15.999 \text{ g/mol} \times 2 \\ \rightarrow 1.008 \text{ g/mol} \times 2 \end{array}} \right\} \text{Ca}(\text{OH})_2 = 74.092 \text{ g/mol}$$

$$\text{mass} = 0.0115 \text{ mole}$$

$$\frac{0.0115 \text{ moles}}{74.092 \text{ g/mol}} = 0.0115 \text{ moles} \times 74.092 \frac{\text{grams}}{\text{mole}}$$

$$\therefore \text{mass of } \text{Ca}(\text{OH})_2 = 0.852 \text{ grams}$$