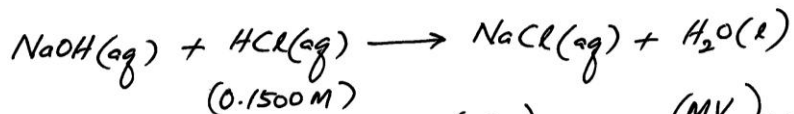


Back Titration :

Example 3 :

A 1.2907g of a pure diprotic organic acid was dissolved in 55.50 mL of a NaOH solution, and the excess base was titrated with 3.95 mL of 0.1500 M HCl. In a second titration it was established that 40.15 mL of the base were equivalent to 32.50 mL of the HCl. Calculate the molar mass of the organic acid.

Solution :



$$n(\text{NaOH}) = n(\text{HCl}) \Rightarrow \frac{(MV)_{\text{NaOH}}}{1000} = \frac{(MV)_{\text{HCl}}}{1000}$$

$$M_{\text{NaOH}} (40.15 \text{ mL}) = (32.50 \text{ mL})(0.1500 \text{ M})$$

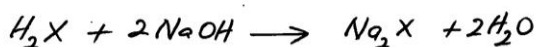
$$\therefore M_{\text{NaOH}} = \frac{(32.50)(0.1500)}{(40.15)} = 0.1214 \text{ M}$$

$$n(\text{NaOH}_{\text{total}}) = \frac{MV}{1000} = \frac{(0.1214 \text{ M})(55.50 \text{ mL})}{1000} \\ = 6.738 \times 10^{-3} \text{ mol}$$

$$n(\text{NaOH}_{\text{unreacted}}) = n_{\text{HCl}} \\ = \frac{(3.95 \text{ mL})(0.1500 \text{ M})}{1000} \\ = 5.925 \times 10^{-4} \text{ mol}$$

$$\therefore n(\text{NaOH}_{\text{reacted with organic acid}}) = (6.738 \times 10^{-3}) - (5.925 \times 10^{-4}) \\ = 6.146 \times 10^{-3} \text{ mol}$$

Assume H_2X = organic acid (diprotic)



$$n(\text{organic acid}) = \frac{1}{2} \times n_{\text{NaOH}} \\ = \left(\frac{1}{2} \times 6.146 \times 10^{-3}\right) \text{ mol} \\ = 3.073 \times 10^{-3} \text{ mol}$$

STOICHIOMETRY : BACK TITRATION

Back Titration : Example 3 : cont....

$$n \text{ (mols)} = \frac{m \text{ (mass, g)}}{M_r \text{ (molar mass, g mol}^{-1}\text{)}}$$

$$\begin{aligned} \therefore M_r \text{ (organic acid)} &= \frac{m}{n} = \frac{1.2907 \text{ g}}{3.073 \times 10^{-3} \text{ mol}} \\ &= 420 \text{ g mol}^{-1} \text{ (Ans)} \end{aligned}$$

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