

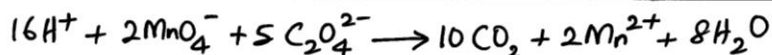
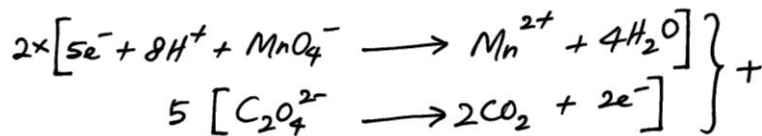
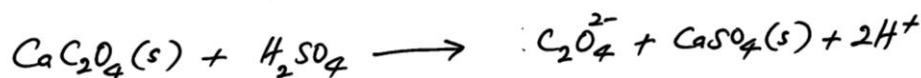
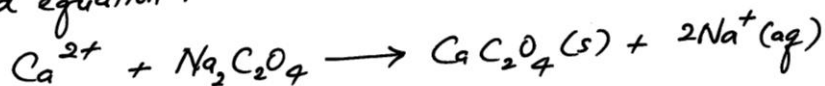
BACK-TITRATIONExample 5

To measure the concentration of  $\text{Ca}^{2+}$  ions, 1.50 mL of human blood is treated with  $\text{Na}_2\text{C}_2\text{O}_4$  solution. The precipitate,  $\text{CaC}_2\text{O}_4$  formed is filtered and dissolved in dilute  $\text{H}_2\text{SO}_4$  to release  $\text{C}_2\text{O}_4^{2-}$  ions into solution and allow it to be oxidized. This solution required 2.55 mL of 0.00044 M  $\text{KMnO}_4$  to reach the end-point.

- Calculate the mass of  $\text{Ca}^{2+}$  ions.
- Calculate the  $\text{Ca}^{2+}$  ion concentration in units of  $\text{mg Ca}^{2+}/100\text{ mL blood}$ .

Solution

Balanced equation :



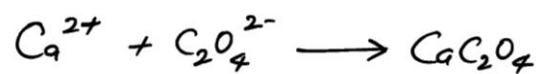
$$n_{\text{KMnO}_4} = \left( \frac{2.55 \times 0.00044}{1000} \right) \text{mols} = 1.122 \times 10^{-6} \text{ mols.}$$

$$\frac{n_{\text{C}_2\text{O}_4^{2-}}}{n_{\text{MnO}_4^-}} = \frac{5}{2} \Rightarrow n_{\text{C}_2\text{O}_4^{2-}} = \frac{5}{2} \times n_{\text{MnO}_4^-}$$

$$= \left( \frac{5 \times 1.122 \times 10^{-6}}{2} \right) \text{ mols}$$

$$= 2.805 \times 10^{-6} \text{ mols}$$

## STOICHIOMETRY : BACK TITRATION



$$M_r(\text{Ca}) = 40.08 \text{ g mol}^{-1}$$

$$n_{\text{Ca}^{2+}} = n_{\text{C}_2\text{O}_4^{2-}} = 2.805 \times 10^{-6} \text{ mol}$$

$$\begin{aligned} \therefore m_{\text{Ca}^{2+}} &= (2.805 \times 10^{-6}) (40.08 \text{ g mol}^{-1}) \\ &= \underline{\underline{1.12 \times 10^{-4} \text{ g (Ans)}}} \end{aligned}$$

$$1.50 \text{ mL blood} \equiv (1.12 \times 10^{-4}) (10^3) \text{ mg Ca}^{2+}$$

$$\begin{aligned} \therefore 100 \text{ mL blood} &\equiv \left( \frac{100 (1.12 \times 10^{-4}) (10^3)}{1.50} \right) \text{ mg Ca}^{2+} \\ &= \underline{\underline{7.47 \text{ mg Ca}^{2+} \text{ (Ans)}}} \end{aligned}$$

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