

solution of sodium thiosulfate of volume  $V=50\text{ml}$  and molar concentration  $C=0.1\text{mol/l}$  is prepared by dissolving a mass( $m$ ) of solid penta-hydrated sodium thiosulfate  $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$  in water. Calculate the mass( $m$ ).

**Solution:**

Firstly, we calculate the molar mass of  $\text{Na}_2\text{S}_2\text{O}_3$  and  $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ :

$$M(\text{Na}_2\text{S}_2\text{O}_3) = 23 \cdot 2 + 32 \cdot 2 + 16 \cdot 3 = 158 \text{ g/mol};$$

$$M(\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}) = M(\text{Na}_2\text{S}_2\text{O}_3) + 5M(\text{H}_2\text{O}) = 158 + 5 \cdot (16 + 1 \cdot 2) = 248 \text{ g/mol}.$$

So, we can determine how much  $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$  heavier than  $(\text{Na}_2\text{S}_2\text{O}_3)$ :

$$\frac{M(\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O})}{M(\text{Na}_2\text{S}_2\text{O}_3)} = \frac{248}{158} = 1.569$$

Then, we calculate the mass of  $\text{Na}_2\text{S}_2\text{O}_3$  in solution:

$$m(\text{Na}_2\text{S}_2\text{O}_3) = C[\text{mol/l}] \cdot M(\text{Na}_2\text{S}_2\text{O}_3)[\text{g/mol}] \cdot V[\text{l}] = 0.1 \cdot 158 \cdot 0.05 = 0.79 \text{ g}.$$

Finally, we calculate the mass of  $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ :

$$m(\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}) = m(\text{Na}_2\text{S}_2\text{O}_3) \cdot 1.569 = 0.79 \cdot 1.569 = 1.24 \text{ g}.$$

**Answer:  $m(\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}) = 1.24 \text{ g}$ .**