- If 50 mL of a 0.10 M solution of $AgNO_3$ is mixed with 50 mL of a 0.040 M solution of $BaCl_2$, what mass of AgCl(s) will precipitate from the reaction?

Marks 3

The precipitation reaction, $Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$, is a 1:1 reaction of $Ag^+(aq)$ and $Cl^-(aq)$ ions.

$$\text{Number of moles of } Ag^+ = \text{concentration} \times \text{volume} = 0.10 \times \frac{50}{1000} = 0.0050 \text{ mol}$$

As each mole of $BaCl_2(s)$ gives two moles of $Cl^-(aq)$:

$$\text{Number of moles of } Cl^- = 2 \times 0.040 \times \frac{50}{1000} = 0.0040 \text{ mol}$$

$Ag^+(aq)$ is present in excess so $Cl^-(aq)$ is the limiting reagent. Hence, 0.0040 mol of AgCl(s) will be formed.

The molar mass of AgCl(s) = (107.87 (Ag)) + (35.45 (Cl)) = 143.32.

The mass of AgCl(s) formed is:

mass = number of moles × molar mass = 0.0040 × 143.32 = 0.57 g

Answer: **0.57 g**

What is the concentration of NO_3^- ions in the final solution from the reaction above?

The number of moles of $NO_3^-(aq)$ is 0.0050 mol. After mixing, the final solution has a volume of (50 + 50) = 100 mL. Hence, the concentration is:

$$[NO_3^-] = \frac{\text{number of moles}}{\text{volume}} = \frac{0.0050}{100/1000} = 0.050 \text{ M}$$

Answer: **0.050 M**