

- 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
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The precipitation reaction, $\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl(s)}$, is a 1:1 reaction of $\text{Ag}^+(\text{aq})$ and $\text{Cl}^-(\text{aq})$ 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 $\text{BaCl}_2(\text{s})$ gives two moles of $\text{Cl}^-(\text{aq})$:

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

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

The molar mass of $\text{AgCl(s)} = (107.87 (\text{Ag})) + (35.45 (\text{Cl})) = 143.32$.

The mass of AgCl(s) formed is:

$$\text{mass} = \text{number of moles} \times \text{molar mass} = 0.0040 \times 143.32 = 0.57 \text{ g}$$

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 $\text{NO}_3^-(\text{aq})$ is 0.0050 mol. After mixing, the final solution has a volume of $(50 + 50) = 100 \text{ mL}$. Hence, the concentration is:

$$[\text{NO}_3^-] = \frac{\text{number of moles}}{\text{volume}} = \frac{0.0050}{100/1000} = 0.050 \text{ mol}$$

Answer: **0.050 mol**