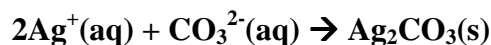


- If 50 mL of a 0.10 M solution of AgNO_3 is mixed with 50 mL of a 0.40 M solution of Na_2CO_3 , what mass of Ag_2CO_3 will precipitate from the reaction?

Marks
4

The ionic equation for the precipitation reaction is:



Thus, two moles of $\text{Ag}^+(\text{aq})$ are required for every one mole of $\text{CO}_3^{2-}(\text{aq})$.

The number of moles of $\text{Ag}^+(\text{aq})$ and $\text{CO}_3^{2-}(\text{aq})$ are given by:

$$n(\text{Ag}^+(\text{aq})) = \text{concentration} \times \text{volume} = 0.10 \times \frac{50}{1000} = 0.0050 \text{ mol}$$

$$n(\text{CO}_3^{2-}(\text{aq})) = 0.40 \times \frac{50}{1000} = 0.020 \text{ mol}$$

There is insufficient $\text{Ag}^+(\text{aq})$ to react with all of the $\text{CO}_3^{2-}(\text{aq})$ and so it is $\text{Ag}^+(\text{aq})$ is the limiting reagent. From the chemical equation, 1 mole of $\text{Ag}_2\text{CO}_3(\text{s})$ is produced from every two moles of $\text{Ag}^+(\text{aq})$ ions. The amount of $\text{Ag}_2\text{CO}_3(\text{s})$ produced is therefore:

$$n(\text{Ag}_2\text{CO}_3(\text{s})) = \frac{1}{2} \times n(\text{Ag}^+(\text{aq})) = \frac{1}{2} \times 0.0050 = 0.0025 \text{ mol}$$

The formula mass of Ag_2CO_3 is $(2 \times 107.87 (\text{Ag})) + 12.01 (\text{C}) + (3 \times 16.00 (\text{O})) = 275.75$. This number of moles thus corresponds to a mass of:

$$\text{mass of } \text{Ag}_2\text{CO}_3 = \text{number of moles} \times \text{formula mass} = 0.0025 \times 275.75 = 0.69 \text{ g}$$

Answer: **0.69 g**

What is the final concentration of CO_3^{2-} ions in the solution after the above reaction?

From the chemical equation, one mole of $\text{Ag}_2\text{CO}_3(\text{s})$ is produced from every mole of CO_3^{2-} which reacts. Therefore 0.0025 mol of CO_3^{2-} reacts. This leaves:

$$\text{number of moles of unreacted } \text{CO}_3^{2-} = 0.020 - 0.0025 = 0.018 \text{ mol}$$

The total volume of the solution after mixing is $(50 + 50) = 100$ mL. The final concentration is therefore:

$$\text{concentration} = \frac{\text{number of moles}}{\text{volume}} = \frac{0.018}{100/1000} = 0.18 \text{ M}$$

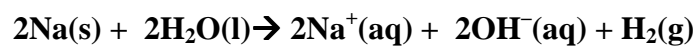
Answer: **0.18 M**

ANSWER CONTINUES ON THE NEXT PAGE

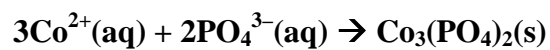
- Give balanced ionic equations for the reactions that occur in each of the following cases.

3

Sodium metal is added to excess water.



Solutions of cobalt(II) nitrate and sodium phosphate are mixed.



Solid calcium carbonate is dissolved in dilute nitric acid.

