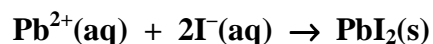


- Lead(II) iodide precipitates when 0.080 M lead(II) nitrate solution (150.0 mL) is added to 0.080 M potassium iodide solution (50.0 mL). Write a balanced ionic equation for the reaction that occurs.

Marks
6

What amount (in mol) of lead(II) iodide precipitates?

Before precipitation, the number of moles of $\text{Pb}^{2+}(\text{aq})$ and $\text{I}^{-}(\text{aq})$ present are:

$$\begin{aligned} \text{number of moles of } \text{Pb}^{2+} &= \text{concentration} \times \text{volume} \\ &= cV = (0.080 \text{ mol L}^{-1}) \times (0.1500 \text{ L}) = 0.012 \text{ mol} \\ \text{number of moles of } \text{I}^{-} &= (0.080 \text{ mol L}^{-1}) \times (0.0500 \text{ L}) = 0.0040 \text{ mol} \end{aligned}$$

The ionic equation shows that 2 moles of I^{-} are required for every one mole of Pb^{2+} . As there is less I^{-} present than Pb^{2+} , iodide is the limiting reagent and some of the lead(II) ions are left in solution after precipitation.

One mole of $\text{PbI}_2(\text{s})$ is formed for every two moles of $\text{I}^{-}(\text{aq})$ present and hence:

$$\text{number of moles of } \text{PbI}_2(\text{s}) = \frac{1}{2} \times 0.0040 \text{ mol} = 0.0020 \text{ mol}$$

Answer: **0.0020 mol**

What amount (in mol) of $\text{Pb}^{2+}(\text{aq})$ ions remain in solution after the reaction?

From above, 0.012 mol of $\text{Pb}^{2+}(\text{aq})$ is initially present. The ionic equation shows that one mole of $\text{Pb}^{2+}(\text{aq})$ is lost for every one mole of $\text{PbI}_2(\text{s})$ formed. As 0.0020 mol of $\text{PbI}_2(\text{s})$ precipitates,

$$\text{number of moles of } \text{Pb}^{2+}(\text{aq}) \text{ left} = (0.012 - 0.0020) \text{ mol} = 0.010 \text{ mol}$$

Answer: **0.010 mol**

ANSWER CONTINUES ON THE NEXT PAGE

What is the final concentration of NO_3^- (aq) ions remaining in solution after the reaction?

The nitrate is not involved in the reaction so the amount of it is unchanged.

$\text{Pb}(\text{NO}_3)_2$ contains two moles of NO_3^{2-} for every mole of Pb^{2+} . From above, 0.012 mol of Pb^{2+} is present so there must be (2×0.012) mol = 0.024 mol of NO_3^{2-} (aq).

When the solutions are mixed, the total volume becomes $(150.0 + 50.0)$ mL = 200.0 mL. Hence, the concentration of NO_3^{2-} (aq) becomes:

$$\text{concentration} = \frac{\text{number of moles}}{\text{volume}} = \frac{n}{V} = \frac{0.024 \text{ mol}}{0.2000 \text{ L}} = 0.12 \text{ mol L}^{-1}$$

Answer: **$0.12 \text{ mol L}^{-1} = 0.12 \text{ M}$**