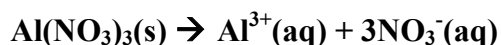


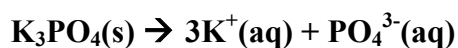
- A 0.060 M solution of aluminium nitrate and a 0.080 M solution of potassium phosphate are prepared by dissolving  $\text{Al}(\text{NO}_3)_3$  and  $\text{K}_3\text{PO}_4$  in water. Write the ionic equations for these two dissolutions reactions.

**Marks**  
**7**

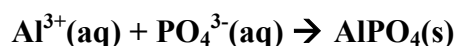
Dissolution  
of  $\text{Al}(\text{NO}_3)_3$



Dissolution  
of  $\text{K}_3\text{PO}_4$



If these solutions are combined, aluminium phosphate precipitates. Write the ionic equation for the precipitation reaction.



100.0 mL of the aluminium nitrate solution is added to 50.0 mL of the potassium phosphate solution. What amount (in mol) of aluminium phosphate precipitates?

**100.0 mL of a 0.060 M solution of  $\text{Al}(\text{NO}_3)_3$  contains:**

$$\begin{aligned} \text{number of moles of } \text{Al}^{3+} &= \text{concentration} \times \text{volume} = c \times V \\ &= 0.060 \text{ mol L}^{-1} \times 0.1000 \text{ L} = 0.0060 \text{ mol} \end{aligned}$$

**50.0 mL of a 0.080 M solution of  $\text{K}_3\text{PO}_4$  contains:**

$$\begin{aligned} \text{number of moles of } \text{PO}_4^{3-} &= \text{concentration} \times \text{volume} = c \times V \\ &= 0.080 \text{ mol L}^{-1} \times 0.0500 \text{ L} = 0.0040 \text{ mol} \end{aligned}$$

**As the ionic equation has a 1 : 1 ratio of  $\text{Al}^{3+}$  :  $\text{PO}_4^{3-}$  reacting,  $\text{PO}_4^{3-}$  is the limiting reagent. The ionic equation shows that 1 mol of  $\text{AlPO}_4$  is made from 1 mol of  $\text{PO}_4^{3-}$  so 0.0040 mol will produce 0.0040 mol.**

Answer: **0.0040 mol**

What is the final concentration of aluminium ions remaining in solution after the precipitation?

**Formation of 0.0040 mol of  $\text{AlPO}_4$  requires 0.0040 mol of  $\text{Al}^{3+}$ . Therefore, the amount remaining is:**

$$\text{number of moles of } \text{Al}^{3+} \text{ remaining} = (0.0060 - 0.0040) \text{ mol} = 0.0020 \text{ mol}$$

**After mixing the total solution volume is  $(100.0 + 50.0) \text{ mL} = 150.0 \text{ mL}$ . Hence, the concentration of  $\text{Al}^{3+}(\text{aq})$  is:**

$$\begin{aligned} \text{concentration} &= \text{number of moles} / \text{volume} = n / V \\ &= 0.0020 \text{ mol} / 0.1500 \text{ L} = 0.013 \text{ mol L}^{-1} \end{aligned}$$

Answer: **0.013 M**