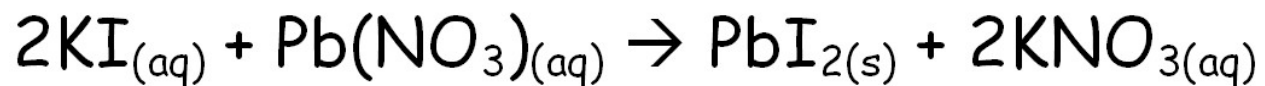


## Stoichiometry with Solutions

Consider the following equation;



If 75.5ml of a 2.00 mol/L solution of KI reacts, what mass of  $\text{PbI}_2$  will precipitate?

We can first work out the number of moles of KI which will react from the volume and molarity of the KI solution...

$$1) \begin{aligned} C &= 2.00 \text{ mol/L} \\ V &= 0.0755 \text{ L} \end{aligned} \quad C = \frac{n_{\text{KI}}}{V} \quad 2.00 \text{ mol/L} = \frac{n_{\text{KI}}}{0.0755 \text{ L}}$$

$$n_{\text{KI}} = 0.151 \text{ mol KI}$$

∴ 0.151 moles of KI will react

2) now we can determine how many moles of  $\text{PbI}_2$  will be produced by deriving a conversion factor from the balanced equation...

$$2 \text{ mol KI} = 1 \text{ mol PbI}_2 \text{ (c.f.)} \quad 0.151 \text{ mol KI} \times \frac{1 \text{ mol PbI}_2}{2 \text{ mol KI}} = 0.0755 \text{ mol PbI}_2$$

∴ 0.0755 moles of  $\text{PbI}_2$  will be produced

3) now we can determine the mass of  $\text{PbI}_2$  produced by using the molar mass of  $\text{PbI}_2$  as a conversion factor...

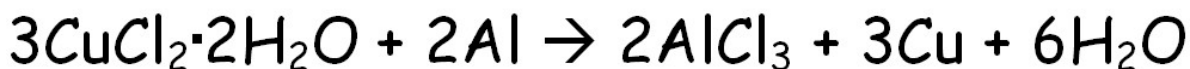
$$M_{\text{PbI}_2} = 202.7\text{g/mol} + 2(126.9)\text{g/mol} \\ \approx 461\text{g/mol}$$

$$0.0755 \text{ mol PbI}_2 \times \frac{461\text{g PbI}_2}{1 \text{ mol PbI}_2} = 34.81\text{g PbI}_2$$

∴ 34.81g of  $\text{PbI}_2$  will be produced

50ml of an unknown concentration of  $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$  reacts with excess Al to produce 0.56g of Cu. Determine the initial concentration of

$[\text{CuCl}_2 \cdot 2\text{H}_2\text{O}]$ . The balanced chemical equation is...



We need to get to how many moles of a reactant and have been given how much mass of a product. We will have to convert the mass of product to moles using the molar mass of the product then use the balanced chemical equation to derive a conversion factor from moles of product to moles of reactant and then work out the concentration using the moles of reactant divided by the volume of its solution. There is our plan so lets get started...

1)

$$M_{\text{Cu}} = 63.55\text{g/mol}$$

$$0.56\text{g Cu} \times \frac{1 \text{ mol Cu}}{63.55\text{g Cu}} = 0.0088 \text{ mol Cu}$$

2) 3 moles  $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$  = 3 moles Cu (c.f. from balanced equation)

note: we use this pair because we were given Cu and asked to find the concentration of the compound it came from...

$$0.0088 \text{ mol Cu} \times \frac{3 \text{ mol CuCl}_2 \cdot 2\text{H}_2\text{O}}{3 \text{ mol Cu}} = \text{CuCl}_2 \cdot 2\text{H}_2\text{O}$$

3)  $v = 0.050\text{L}$

$$n = 0.0088 \text{ mol}$$

$$C = ?$$

$$C = \frac{n}{V} \quad C = \frac{0.0088\text{mol}}{0.050\text{L}} = 0.176 \text{ mol/L CuCl}_2 \cdot 2\text{H}_2\text{O}$$

∴ the initial concentration of  $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$  was 0.176mol/L