

5. Calculating the concentration/number of moles and volume using the formula:

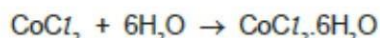
Concentration = No. of moles ÷ Volume

Unit: mole/dm³

Example:

[O/N/2010-P31-Q8b]

- (b) 6.0 g of cobalt(II) carbonate was added to 40 cm³ of hydrochloric acid, concentration 2.0 mol/dm³. Calculate the maximum yield of cobalt(II) chloride-6-water and show that the cobalt(II) carbonate was in excess.



Maximum yield

Number of moles of HCl used =

Number of moles of CoCl₂ formed =

Number of moles of CoCl₂·6H₂O formed =

Solution:

Ideal Mole ratio:[Equation 1]

CaCO₃ : HCl : CoCl₂ : CO₂ : H₂O
1 : 2 : 1 : 1 : 1 - Ideal mole ratio

0.040 : 0.080 : 0.040 : 0.040 : 0.040-Experimental mole ratio

Moles of HCl = Concentration of HCl × Volume of HCl

$$= 2 \times 0.040 = 0.080$$

Comparing with the ideal mole ratio ;

Moles of CoCl₂ formed = 0.5 × moles of HCl

$$= 0.5 \times 0.080 = 0.040$$

Also;

Ideal Mole ratio:[Equation 1]

CoCl₂ : H₂O : CoCl₂·6H₂O
1 : 6 : 1

0.040 : 0.24 : 0.040-Experimental mole ratio

Hence;

Moles of CoCl₂·6H₂O formed = Moles of CoCl₂ used = 0.040

Note: The underlined mole ratio is the data we obtain after calculations.