Calculating Quantities from Balanced Equations

Interpreting Chemical Equations

A balanced chemical equation contains the number of particles, the number of moles and the masses of the components of the reaction:

A. The coefficients tell us how many moles of each substance are present.
B. Maps can be calculated by multiplying the number of moles (coefficients) by the molar mass of each element.
C. Mole calculations: use the mole ratio to find the unknown quantity of reactants or products.

Eg. Determine how many moles of oxygen are produced when 3.5 mol of water decompose.

G: $2\ H_2O_{(l)} \rightarrow 2\ H_{2(g)} + O_{2\ (g)}$
2 mol   2 mol   1 mol
$n_{H2O} = 3.5$ mol

R: $n_{O2} = ?$ mol

A: mole ratio is 2:1

S: $n_{O2} = 3.5\ \text{mol} / 2 = 1.75$ mol

P: The reaction produces 1.75 mol of oxygen.

D. Mass Calculations: when you have the mass of one substance and need to find the mass of another, you use the mole ratio.

Eg. Calculate the mass of hydrogen needed to produce 15.5g of ammonia in the presence of an abundant amount of nitrogen.

G: $N_{2(g)} + 3\ H_{2(g)} \rightarrow 2\ NH_{3(g)}$
3 mol   2 mol

$m_{NH3} = 15.5$ g

R: $m_{H2} = ?$ g

A: mole ratio is 3:2
$M_{NH3} = 17.04$ g/mol
$M_{H2} = 2.02$ g/mol

S: $m_{H2} = 15.5\ \text{g} / 17.04\ \text{g/mol} \times 3/2 \times 2.02\ \text{g/mol} = 2.76$ g

P: The reaction requires 2.76 g of hydrogen.