Three step conversions
Sample Problems

(A) $2CO_{(g)} + O_{2(g)} \rightarrow 2CO_{2(g)}$ (at STP)

How many litres of O_2 are required to react with 3.86 L of $CO_{(g)}$?

$L\ CO_{(g)} \xrightarrow{①} mol\ CO_{(g)} \xrightarrow{②} mol\ O_{2(g)} \xrightarrow{③} L\ O_{2(g)}$

① $3.86\ \cancel{L\ CO_{(g)}} \times \frac{1\ mol}{22.4\ \cancel{L}} = 0.172\ mol\ CO_{(g)}$

② $0.172\ \cancel{mol\ CO_{(g)}} \times \frac{1\ mol\ O_{2(g)}}{2\ \cancel{mol\ CO_{(g)}}} = 0.086\ mol\ O_{2(g)}$

③ $0.086\ \cancel{mol\ O_{2(g)}} \times \frac{22.4\ L}{1\ \cancel{mol}} = 1.93\ L\ O_{2(g)}$

(B) $2H_2O_{(l)} \rightarrow 2H_{2(g)} + O_{2(g)}$

How many molecules of $O_{2(g)}$ are produced when 29.2 g of $H_2O_{(l)}$ reacts?

$g\ H_2O_{(l)} \xrightarrow{①} mol\ H_2O_{(l)} \xrightarrow{②} mol\ O_{2(g)} \xrightarrow{③} molecules\ O_{2(g)}$

① $29.2\ \cancel{g\ H_2O_{(l)}} \times \frac{1\ mol\ H_2O}{18.02\ \cancel{g\ H_2O}} = 1.62\ mol\ H_2O_{(l)}$

② $1.62\ \cancel{mol\ H_2O_{(l)}} \times \frac{1\ mol\ O_{2(g)}}{2\ \cancel{mol\ H_2O_{(l)}}} = 0.81\ mol\ O_{2(g)}$

③ $0.81\ \cancel{mol\ O_{2(g)}} \times \frac{6.02 \times 10^{23}\ molecules}{1\ \cancel{mol}} = 4.88 \times 10^{23}\ molecules\ O_{2(g)}$

H_2O

$2 \times H = 2 \times 1.01\ g/mol = 2.02\ g/mol$

$1 \times O = 1 \times 16.00\ g/mol = 16.00\ g/mol$

$18.02\ g/mol$