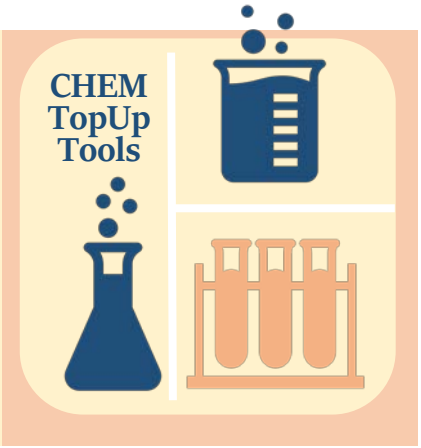
Stoichiometry



VCE U3&4 Chem exam facts

- approx. 20% marks allocated to calculations
- approx. 50% calculations require stoichiometry skills

1. **Write balanced chemical equation.**
2. **Convert units of known substance to moles.**
3. **Use the mole ratio to calculate moles of unknown.**
4. **Convert moles of unknown substance to required units.**

Example 1

Find the mass of carbon dioxide, CO_2, produced when 2.34 L of propane is completely combusted.

$C_3H_8 + O_2 \rightarrow 3CO_2 + 4H_2O$
known unknown

1. Write balanced chemical equation.

- Combustion requires O_2
- Products of complete combustion; CO_2, H_2O
- Balance carbon first, then hydrogen and then oxygen

$$C_3H_{8(g)} + 5O_{2(g)} \rightarrow 3CO_{2(g)} + 4H_2O_{(g)}$$

Balancing equations

Redox

Balance:
Key elements
Oxygen (+H_2O)
Hydrogen (+H^+)
Electrons
States

Combustion

Balance:
Carbon
Hydrogen
Oxygen

2. Convert units of known substance to moles.

known: $V(C_3H_8)$ = 2.34 L, unknown: $m(CO_2)$ = ?

$n = \frac{V}{Vm}$, $n(C_3H_8) = \frac{2.34}{24.8}$, $n(C_3H_8)$ = 0.0944 mol

Formulae

$$n = CV \quad n = \frac{m}{M} \quad n = \frac{V}{Vm}$$

$$n = \frac{PV}{RT} \quad Q = It \quad n(e^-) = \frac{Q}{F}$$

3. Use the mole ratio to calculate moles of unknown.

$n(CO_2) : n(C_3H_8)$ = 3: 1 , $n(CO_2) = \frac{3}{1} n(C_3H_8)$

$n(CO_2)$ = 0.283 mol

Calculating mole ratio

$$n(\text{unknown}) = \frac{\text{unknown coefficient}}{\text{known coefficient}} \times n(\text{known})$$

4. Convert moles of unknown substance to required units.

$n(CO_2)$ = 0.283 mol, $M(CO_2)$ = 44 $g.mol^{-1}$

$m = n \times M$, $m(CO_2)$ = 0.283 x 44, $m(CO_2)$ = 12.5 g

Formulae

$$C = \frac{n}{V} \quad m = nM \quad V = nV_m$$

$$PV = nRT$$

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