# NATIONAL 5 CHEMISTRY
## Calculations

1. Mass of one mole = gram formula mass (gfm)
   - Work out formula
   - Add the mass numbers of every atom in the formula together and express in grams.

2. Number of moles when given a mass

   N = actual mass / gfm
   = am/gfm

3. Number of moles when given volume and concentration

   N = cV  where c = concentration (mol $l^{-1}$)
   V = volume in **litres**

4. Mass of substance to make a solution of given concentration and volume
   - N = cV
   - Put value for N into N = am/gfm to get 'am'

5. Volume or concentration of solution from given mass of a substance
   - N = am/gfm
   - Put value for N into N = cV

6. Asked to work out the volume or concentration of an acid or alkali needed in a neutralisation reaction

   pcV(acid) = pcV(alkali)
   where p(acid) = number of H's in formula
   and p(alkali) = number of OH's in formula

7. Calculations from **balanced equations**, when asked to work out the mass of a chemical produced or needed in a reaction.
   - Take molar ratio from numbers in front of chemicals in balanced equations.

- Multiply the gfm of each chemical by the molar ratio to give the mass ratio.
- Put given value into the mass ratio and cross multiply.

Balanced equations can be used to predict masses and numbers of moles of products. The molar ratio of the balanced equation is used, eg. What mass of water would you get from 1g of $H_2$?

$$2H_2 + O_2 \longrightarrow 2H_2O$$

| | | | |
|---|---|---|---|
| Molar ratio: | 2 | : | 2 |
| Mass ratio: | 2 x gfm | : | 2 x gfm |
| | 4g | : | 36g |
| So | 1g | : | $x$g |

Cross multiply $4x = 1 \times 36$

$x = 9$g

8. **Percentage mass**, when asked to work out the percentage of an element within a compound.
- Work out the formula
- Work out the gfm
- Divide the total mass of the one element by the gfm and multiply by 100

9. **Energy released by a fuel**

$$\mathbf{E = c\ m\ \Delta T}$$

E = energy change (in kJ)
c = the specific heat capacity of water, 4.18 kJ $kg^{-1}$ $°C^{-1}$
m = the mass of **water** (in kg)
$\Delta T$ = temperature change of the water (in °C)

Energy released per gram = E/number of grams of fuel burned

Energy released per mole = E/number of moles of fuel burned