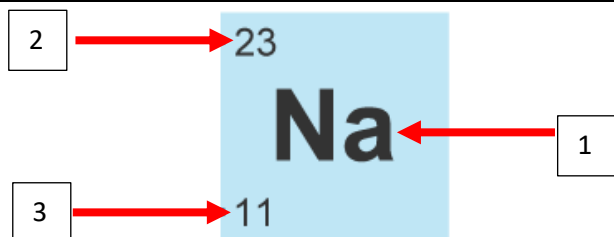


## 1. Key Words

Relative atomic mass ( $A_r$ )	This is the relative mass of an atom of an element compared to other elements.
Relative formula mass ( $M_r$ )	This is the sum total of the relative atomic mass of all the atoms in a compound

## 2. Calculating $M_r$



1	Element symbol
2	Atomic mass (total number of protons and neutrons in the nucleus)
3	Atomic number (number of protons in the nucleus)

### Example 1: Sodium Chloride ( $\text{NaCl}$ )

Atomic mass of Na = 23  
 Atomic mass of Cl = 35.5  
 $M_r = 23 + 35.5 = 58.5$

### Example 2: Aluminium Oxide ( $\text{Al}_2\text{O}_3$ )

Atomic mass of Al = 27      There are 2 atoms of Al, so  $27 \times 2 = 54$   
 Atomic mass of O = 16      There are 3 atoms of O, so  $16 \times 3 = 48$   
 $M_r = 54 + 48 = 102$

## 3. Percentage by mass

Percentage by mass =  $\frac{\text{total atomic mass of element in the compound} \times 100}{\text{Relative formula mass of the compound}}$

### Example 1: Percentage by mass of sodium in sodium chloride

Atomic mass of Na = 23  
 $M_r$  of NaCl = 58.5  
 Percentage by mass =  $\frac{23 \times 100}{58.5} = 39.3\%$

### Example 2: Percentage by mass of oxygen in aluminium oxide

Atomic mass of O = 16      There are 3 atoms of O, so  $16 \times 3 = 48$   
 $M_r$  of  $\text{Al}_2\text{O}_3 = 102$   
 Percentage by mass =  $\frac{48 \times 100}{102} = 47\%$

## 4. Calculating Moles (HT only)

Mole	Number of particles needed to make the mass equal to the relative atomic mass
Avogadro constant	$6.022 \times 10^{23}$ particles in 1 mole

$$\text{Moles (M)} = \frac{\text{mass (g)}}{\text{Relative formula mass}}$$

### Example: 27.4g of sodium chloride is made in a reaction, how many moles have been made?

$M_r$  of NaCl = 58.5  
 Moles (M) =  $\frac{27.4}{58.5} = 0.47\text{M}$

## 5. Calculating concentration

Conversions: there are 1000cm<sup>3</sup> in 1dm<sup>3</sup>

128cm <sup>3</sup> in to dm <sup>3</sup>	$128 \div 1000 = 0.128\text{dm}^3$
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1.45dm <sup>3</sup> in to cm <sup>3</sup>	$1.45 \times 1000 = 1450\text{cm}^3$
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$$\text{Concentration (g/dm}^3\text{)} = \frac{\text{mass (g)}}{\text{Volume (dm}^3\text{)}}$$

**Example: 27.4g of sodium chloride is added to 500cm<sup>3</sup> of water. What is the concentration in g/dm<sup>3</sup>?**

Conversion:  $500\text{cm}^3 \div 1000 = 0.5\text{dm}^3$

$$\text{Concentration} = \frac{27.4}{0.5} = 54.8 \text{ g/dm}^3$$

## 6. Calculating concentration in Moles (HT only)

$$\text{Concentration (M/dm}^3\text{)} = \frac{\text{Moles(M)}}{\text{Volume (dm}^3\text{)}}$$

**Example: 27.4g of sodium chloride is added to 500cm<sup>3</sup> of water. What is the concentration in g/dm<sup>3</sup>?**

Conversion:  $500\text{cm}^3 \div 1000 = 0.5\text{dm}^3$

$$\text{Concentration} = \frac{27.4}{0.5} = 54.8 \text{ g/dm}^3$$