

## Using mole calculations to solve problems

This resource accompanies the infographic **Moles and Avogadro's number** in *Education in Chemistry* which can be viewed at: <https://rsc.li/3Ksvr07>

### Learning objectives

- 1 Recall how to use simple mole calculations to calculate masses, moles, or relative formula masses.
- 2 Practice rearranging equations.
- 3 Develop confidence in decoding complex word problems.

The accompanying student worksheet is designed to support students in using simple mole calculations learned in pre-16 chemistry, embedded within more complex problems and multi-step calculations of the form encountered at a more advanced level.

### Answers: moles, mass, and relative formula mass

#### Part 1: Working out the moles from the mass of a known substance

##### Practice questions

1.  $600 \text{ mg} = 0.60 \text{ g}$   
 $\text{mol}(\text{C}_{34}\text{H}_{24}\text{N}_6\text{Na}_4\text{O}_{14}\text{S}_4) = 0.00063 \text{ mol or } 6.3 \times 10^{-4} \text{ mol (to 2 sf)}$
2.  $M_r(\text{C}_8\text{H}_9\text{NO}_2) = 151$   
 $\text{mass}(\text{C}_8\text{H}_9\text{NO}_2) = 0.50 \text{ g}$   
 $\text{mol}(\text{C}_8\text{H}_9\text{NO}_2) = 0.0033 \text{ mol or } 3.3 \times 10^{-3} \text{ (to 2 sf)}$

#### Part 2: Working out the mass given the number of moles of a known substance

##### Practice questions

1.
  - (a)  $2\text{Mg}(s) + \text{O}_2(g) \rightarrow 2\text{MgO}(s)$
  - (b)  $\text{mol}(\text{Mg}) = 0.40 \text{ mol}$   
 $\text{mass}(\text{Mg}) = 0.96 \text{ g (to 2 sf)}$
  - (c) Possible answers include:  
Incomplete reaction  
Impurities on the surface of the magnesium metal will not burn  
Magnesium held by the tongs will not burn

2.

$$\begin{aligned} \text{(a) } Mr(\text{C}_7\text{H}_6\text{O}_3) &= 138 \\ mol(\text{C}_7\text{H}_6\text{O}_3) &= 0.014 \text{ mol (to 2 sf)} \end{aligned}$$

$$\begin{aligned} \text{(b) } mol(\text{C}_9\text{H}_8\text{O}_4) &= 0.0072 \text{ mol (to 2 sf)} \\ Mr(\text{C}_9\text{H}_8\text{O}_4) &= 180 \\ mass(\text{C}_9\text{H}_8\text{O}_4) &= 1.3 \text{ g (to 2 sf)} \end{aligned}$$

$$\text{(c) Percentage of aspirin in the product} = 76\% \text{ (to 2 sf)}$$

### Part 3: Working out the identity of a substance from a known mass and known number of moles

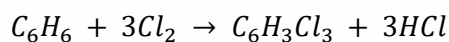
#### Practice questions

1.

$$\begin{aligned} \text{(a) } Mr(\text{C}_6\text{H}_6) &= 78 \\ mol(\text{C}_6\text{H}_6) &= 0.0513 \text{ mol (to 3 sf)} \end{aligned}$$

$$\begin{aligned} \text{(b) } mol(\text{chlorobenzene}) &= 0.0513 \text{ mol} \\ Mr(\text{chlorobenzene}) &= 181.5 \end{aligned}$$

$$\text{(c) Formula of chlorobenzene with } Mr = 181.5 \text{ is } \text{C}_6\text{H}_3\text{Cl}_3$$



$$\begin{aligned} \text{2. } mol(\text{A}_x\text{O}) &= 0.1 \text{ mol} \\ Mr(\text{A}_x\text{O}) &= 56 \end{aligned}$$

If  $x = 1$ :  $Ar(\text{A}) = 40$ , so  $\text{A}$  would be  $\text{Ca}$  which is a metal.

If  $x = 2$ :  $Ar(\text{A}) = 20$ , so  $\text{A}$  would be  $\text{Ne}$  which is a gaseous non-metal.

So  $\text{A}$  is  $\text{Ca}$ , and the product of the reaction is  $\text{CaO}$ .