

A- Elemental Moles

Help

To work out the moles of an element you have to divide the mass by the 'atomic mass'. The atomic mass is found on the periodic table, it is the larger of the two numbers. This can be summarised in the following equation:

$$\text{moles} = \frac{\text{mass}(g)}{\text{atomic mass}}$$

Worked answers.

1(a) Carbon has an atomic mass of 12.

$$\frac{6g}{12} = 0.5 \text{ moles}$$

1(b) Sulphur has an atomic mass of 32.1

$$\frac{4g}{32.1} = 0.125 \text{ moles to 3 d.p.}$$

2(a) For question 2 the equation above needs rearranging to:

$$\text{mass}(g) = \text{moles} \times \text{atomic mass}$$

Argon has an atomic mass of 39.9

$$2 \times 39.9 = 79.8g$$

2(b) Sodium has an atomic mass of 23

$$0.5 \times 23 = 11.5g$$

Further practice

- How many moles of atoms are present in:
(a) 7g of nitrogen (b) 62g of phosphorus (c) 3g of Beryllium
- How many grams do the following weigh?
(a) 2 moles of helium atoms (b) 0.5 moles of chromium (c) 0.25 moles of Boron

B- Formula mass

Help

Formula mass is just the sum of the relative atomic masses of all the atoms present in the compound. The atomic masses for individual atoms are on the periodic table. It is essential that you understand what the numbers like this and brackets mean. Small numbers show how many of the atom or group of atoms directly before it there are. Brackets are used to group atoms together.

Worked answers to questions on self assessment sheet

3(a) There is one carbon atom and 4 hydrogen atoms:

$$12 + (4 \times 1) = 16$$

3(b) There are 2 hydrogen atoms, one sulphur atom and four oxygen atoms:

$$(2 \times 1) + 32.1 + (4 \times 16) = 98.1$$

3(c) There is one calcium atom and there are two lots of hydroxide (OH):

$$40.1 + (16 + 1) + (16 + 1) = 74.1$$

Further practice

1. What is the formula mass of:

- | | | | |
|---|---|--------------------------|---|
| (a) NH ₃ | (b) HNO ₃ | (c) Mg (OH) ₂ | (d) ethanol, C ₂ H ₅ OH |
| (e) propene C ₃ H ₆ | (f) K ₂ O | (g) MgS ₂ | |
| (h) Al ₂ O ₃ | (i) Al ₂ (SO ₄) ₃ | | |

C- Moles of compounds

Help

These questions require you to calculate the formula mass (see sheet B if you do not know what this is) of a compound and use it in the following equation

$$\text{moles} = \frac{\text{mass}(g)}{\text{formula mass}}$$

Worked answers to questions on self assessment sheet

4(a) There is one magnesium atom and one oxygen atom, the formula mass is:

$$24.3 + 16 = 40.3$$

using this value in the equation:

$$\text{moles} = \frac{20g}{40.3} = 0.5$$

4(b) There is one calcium atom and two nitrate groups:

$$40.1 + (14 + 16 \times 3) + (14 + 16 \times 3) = 164.1$$

using this value in the equation:

$$\text{moles} = \frac{250g}{164.1} = 1.5$$

5(a) There is one hydrogen atom and one chlorine atom

$$1 + 35.5 = 36.5$$

To answer this question we need to rearrange the equation at the top of the page to:

$$\text{mass} = \text{moles} \times \text{molar mass} = 2 \times 36.5 = 73g$$

5(b) There are two potassium atoms, one sulphur and four oxygen atoms

$$(2 \times 39.1) + 32.1 + (4 \times 16) = 174.3$$

To answer this question we need to rearrange the equation at the top of the page to:

$$\text{mass} = \text{moles} \times \text{molar mass} = 0.5 \times 174.3 = 87.15g$$

Further practice

- How many moles are there in:
(a) 10g of MgO (b) 500g of $\text{Ca}(\text{NO}_3)_2$
- How many grams do the following weigh?
(a) 3 moles of HCl (b) 1.5 moles of K_2SO_4
- How many moles are there in:
(a) 10g of CaO (b) 500g of MgCO_3
- How many grams do the following weigh?
(a) 3 moles of HNO_3 (b) 1.5 moles of Na_2SO_4