Name: _____ ( ) Class: _____ Date: _____
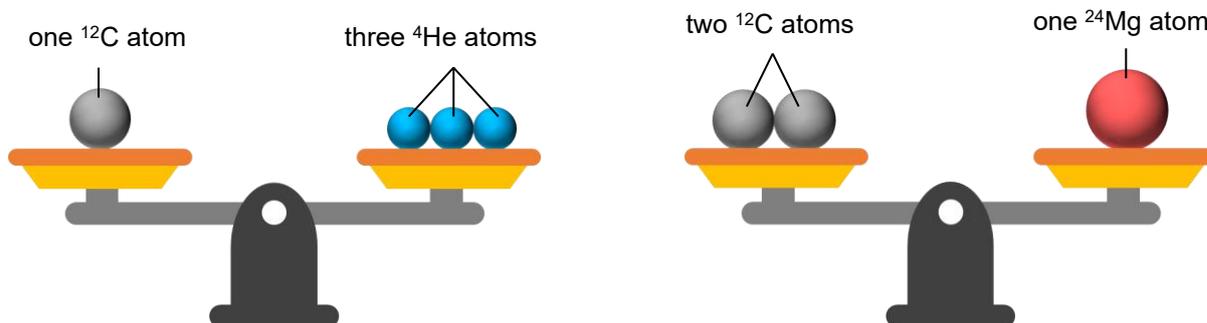
Relative isotopic mass and relative atomic mass

Enrichment of Unit 13 p. 16 *Bridge to DSE Chem – Topic II (Atomic structure)*

a Relative isotopic mass

- Atoms are very light. Ordinary units (e.g. g and kg) are unsuitable for measuring their mass.

- Scientists took the **carbon-12 (^{12}C) isotope** as the standard atom. They defined the mass of one ^{12}C atom as **exactly 12.00 units**.

- By comparing the mass of an isotope of an element with the reference standard, we can obtain the **relative isotopic mass** (相對同位素質量) of that particular isotope.

Examples:

one ^{12}C atom   three ^{4}He atoms

two ^{12}C atoms   one ^{24}Mg atom

Three ^{4}He atoms have the same mass as one ^{12}C atom.

∴ The relative isotopic mass of a ^{4}He atom
= 12 / 3 = **4**

One ^{24}Mg atom has the same mass as two ^{12}C atoms.

∴ The relative isotopic mass of a ^{24}Mg atom
= 12 × 2 = **24**

- On the **^{12}C = 12.00 scale**, the relative masses of a proton and a neutron are both **very close to 1**. The relative mass of an electron is **nearly 0**. Hence, the relative isotopic mass of an isotope is roughly equal to its mass number.

Relative isotopic mass ≈ mass number

- Relative isotopic mass carries **no unit**.

b Relative atomic mass

- The **relative atomic mass** (相對原子質量) of an element is the **weighted average** mass of all the naturally occurring isotopes of the element.

- The relative atomic mass is determined by:

  o the **relative isotopic mass**, and

  o the **relative abundance**

  of each isotope of the element in Nature.

- Relative atomic mass carries **no unit**.

Example

Chlorine has two isotopes, ^{35}Cl and ^{37}Cl, with relative abundances of 75.4% and 24.6% respectively. Calculate the relative atomic mass of chlorine.

Solution

Relative atomic mass of chlorine

= weighted average relative isotopic mass of all natural isotopes of chlorine

= 35 × 75.4% + 37 × 24.6%

= 35.49   ◄ Be reminded that it carries **no unit**.

Quick check

1 Write the relative isotopic mass of:

  a $^{31}_{15}P$ _____   **b** $^{17}_{8}O$ _____

2 Potassium has two isotopes, $^{39}_{19}K$ and $^{41}_{19}K$, with relative abundances of 93.3% and 6.7% respectively. Calculate the relative atomic mass of potassium.

_____

_____

Answers of Quick check

1 **a** 31   **b** 17

2 Relative atomic mass of potassium

   $= 39 \times 93.3\% + 41 \times 6.7\%$

   $= 39.13$