Chemistry Study Materials for Class 9
(NCERT Based notes of Chapter -03)

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Atoms and Molecules

PROBLEMS (BASED ON MOLE CONCEPT)

When the mass of the substance is given:

$$\text{Number of moles} = \frac{\textbf{Given mass}}{\text{Atomic mass (Molar mass)}} \qquad \text{i.e, } n = \frac{w}{M}$$

Example 1. Calculate the number of moles in 81g of aluminium

$$\text{Number of moles} = \frac{\textbf{Given mass}}{\text{Molar mass}} = \frac{81}{27} = 3\,\text{mol}$$

Example 2. Calculate the mass of 0.5 mole of iron

Solution: mass = atomic mass x number of moles

= 55.9 x 0.5 = 27.95 g

Calculation of number of particles when the mass of the substance is given:

$$\text{Number of moles} = \frac{\textbf{Given mass}}{\text{Molar mass}} \times \text{Avogadro's number} \qquad \text{i.e, } n = \frac{w}{M} \times 6.022 \times 10^{23}$$

Example 1. Calculate the number of molecules in 11g of CO_2

Solution: gram molecular mass of CO_2 = 44g

$$\text{Number of moles} = \frac{11}{44} \times 6.022 \times 10^{23} = 1.505 \times 10^{23}\,\text{molecules}$$

Calculation of mass when number of particles of a substance is given:

$$\text{Mass of substance} = \frac{\text{Number of particles}}{\text{Avogadro's number}} \times \text{Molar mass}$$

$$w = \frac{N}{N_A} \times M$$

Example 1. Calculate the mass of 18.069×10^{23} molecules of SO_2

Sol: Gram molecular mass SO_2 = 64g

$$\text{Mass of } SO_2 = \frac{18.069 \times 10^{23}}{6.022 \times 10^{23}} \times 64 = 192.03 \text{ g}$$

Example 2. Calculate the mass of glucose in 2×10^{24} molecules

Gram molecular mass of glucose = 180g

$$\text{Mass of glucose} = \frac{2 \times 10^{24}}{6.022 \times 10^{23}} \times 180 = 597.81 \text{ g}$$

Calculation of number of moles when you are given number of molecules:

$$\text{Number of mole} = \frac{\text{Number of particles}}{\text{Avogadro's number}} \quad \text{i.e, } n = \frac{N}{N_A}$$

Example 1. Calculate number of moles in 12.046×10^{22} atoms of copper

$$\text{Number of mole} = \frac{12.046 \times 10^{22}}{6.022 \times 10^{23}} = 0.2 \text{ mol}$$

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Q1. If one mole of carbon atoms weighs 12 gram,

What is the mass (in gram) of 1 atom of carbon?

Answer:

One mole of carbon atoms weighs 12 g (Given)

i.e., mass of 1 mole of carbon atoms = 12 g

Then, mass of 6.022 x10^{23} number of carbon atoms = 12 g

Therefore, mass of 1 atom of carbon = $\frac{12}{6.022 \times 10^{23}}$ = 1.9926 x 10^{23} g carbon.

Q2. Which has more number of atoms, 100 grams of sodium or 100 grams of iron (given, atomic mass of Na = 23 u, Fe = 56 u)?

Answer:

Atomic mass of Na = 23 u (Given)

Then, gram atomic mass of Na = 23 g

Now, 23 g of Na contains = 6.022 X 10^{23} number of atoms

Thus, 100 g of Na contains = $\frac{6.022 \text{ X } 10^{23}}{23}$ X 100

= 26.18 X 10^{23} atoms

Atomic mass of Fe = 56 u (Given)

Then, gram atomic mass of Fe = 56 g

Now, 56 g of Fe contains = 6.022 X 10^{23} number of atoms

Thus, 100 g of Fe contains = $\frac{6.022 \text{ X } 10^{23}}{56}$ X 100

= 10.75 X 10^{23} atoms

Therefore, 100 grams of sodium contain more number of atoms than 100 grams of iron.

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