SOME IMPORTANT DEFINITIONS

Discussion

Race - 1 : **22.** Mass of 1 oxygen molecule (O_2) = 32 amu

Mass of 1 molecule of SO_2 = 80 amu

$$20\,(\overset{10}{\cancel{80}}\ \cancel{\text{amu}}) = n\,(\overset{4}{\cancel{32}})\ \cancel{\text{amu}}$$

$$200 = 4n$$

$$n = 50$$

SOME IMPORTANT DEFINITIONS

Race-2 ③ $_{13}Al^{27}$ $p = 13$, $n = 14$, $e = 13$

(a) (c) (b)

c : b : a ⇒ 14 : 13 : 13

Race-3 ÷

SOME IMPORTANT DEFINITIONS

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25 mg

Atomic mass of an element = 50

(i) RAM = 50 amu

Mass of 1 atom in gram = $\frac{50}{6.02\times10^{23}}$ OR $= 50\times1.67\times10^{-23}$

(ii) Molar mass = $\frac{50}{6.02\times10^{23}} \times 6.02\times10^{23} = 50$ g/mol.

$$\begin{cases} 50\text{ g} \longrightarrow 6.02\times10^{23} \\ ? \longrightarrow 3.01\times10^{20}\text{ atom} \end{cases} = \frac{50\times3.01\times10^{20}}{6.02\times10^{23}}$$

10^{23}

SOME IMPORTANT DEFINITIONS

(ii) 6.022×10^{23} atom ⟶ 50 g

? ⟶ 10 g

$= \frac{10 \times 6.022 \times 10^{23}}{50} = 1.204 \times 10^{23}$ atoms.

Ex. Find the no. days required to spent 1 mol Rupees if you spent 1 millian per second. ? An

10^6 Rs ⟶ 1 Se.

6×10^{23} ⟶ ?

$\frac{6 \times 10^{23}}{10^6}$

$= 6 \times 10^{17}$ sec.

SOME IMPORTANT DEFINITIONS

$$\text{No of days} = \frac{6 \times 10^{16}}{60 \times 60 \times 24}$$

$$= \frac{10^{16}}{60 \times 24}$$

$$= 6.944 \times 10^{12} \text{ days}$$

$$= 6944000000000$$

Mole Concept

SOME IMPORTANT DEFINITIONS

Mole :- 7th basic SI unit of measurment of amount of substance.

- **Definition** :- ① The one mole is mass of substance that is exactaly equals to its molar mass.

44g CO_2 contains = 1 moles of CO_2

32g SO_2 Contains = 0.5 mole of SO_2

180g H_2O Contains = 10 mole.

$$\text{No of moles} = \frac{\text{Given mass g}}{\text{Molar mass g/mol}} = \text{mol}$$

SOME IMPORTANT DEFINITIONS

Ex. Find the number of moles in 49 g of H_2SO_4.?

$$\text{No of moles} = \frac{\text{Given mass}}{\text{Molar mass}}$$

$$= \frac{49\ g}{98\ g/mol} = 0.5\ mol.$$

Ex. Find the mass of 2 moles of Heavy water ? (D_2O)

$2 \times 2 + 16 = 20\ g/m$

$$\text{Moles} = \frac{\text{Given mass}}{\text{Molar mass}}$$

$$2 = \frac{x}{20} \qquad x = 40\ \text{gram}$$

SOME IMPORTANT DEFINITIONS

Definition (2) "for gas"

1 mole is volume of gas that contains 22.4 L volume at (NTP/STP)

- Volume of a container containing CO_2 is 11.2 L at STP find no of moles.

$\Rightarrow$ 0.5 moles.

$$\text{No of moles} = \frac{\text{Volume of gas (L) at NTP/STP (L)}}{22.4\ (\text{L/mol})}$$

SOME IMPORTANT DEFINITIONS

Definition (3) : The 1 mole is amount of substance that contains exactly 6.022×10^{23} No of particles. (atoms / molecules / ions)

$$\text{No of moles of particle} = \frac{\text{No of particles}}{6.022 \times 10^{23}}$$

Ex. Find the no of moles of O_2 if a container contains 3.01×10^{22} molecules of O_2?

$$\text{No of moles of } O_2 = \frac{1}{2} \frac{3.01 \times 10^{22}}{6.02 \times 10^{23}} = 0.05$$

SOME IMPORTANT DEFINITIONS

1.996482×10^{-23} g $\longrightarrow$ 1 atom of C-12

12 g $\longrightarrow$?

$$= \frac{12}{1.996482 \times 10^{-23}} = 6.02 \times 10^{23} = N_A.$$

$$1\,amu = \frac{1}{12} \times 1.996482 \times 10^{-23}$$

$$1\,amu = \frac{1}{N_A}$$

Mole Concept

SOME IMPORTANT DEFINITIONS

Mole Concept

MOLE

Mole : standard definition :

One mole is the amount of a substance that contains as many entities or particles as there are atoms in exactly 12 g (or 0.012 kg) of the C-12 isotopte.

$$1\ \text{mole} = \frac{12\ g}{1.994682 \times 10^{-23} g}$$

Molar Mass (Mw) :

The mass of 1 mole of a substance in gram is called its molar mass.

$$= 6.02 \times 10^{23} = N_A$$

Example :

Molar mass of NO_2 = 14 + 2 (16) = 46 g

$$1\ amu = \frac{1.996482 \times 10^{-23}}{12}$$

$$1\ amu = \frac{1}{N_A}$$

SOME IMPORTANT DEFINITIONS

No of molecules = noof moles × NA of molecule

Ex. Find the no of molecules of O_2 containing 3.2 mg of O_2.

No of moles of O_2 = $\frac{3.2 \times 10^{-3}\ g}{32\ g/mol} = 10^{-4}$ mol.

No of molecules of O_2 = $10^{-4} \times 6.02 \times 10^{23}$

= 6.02×10^{19} molecules.

SOME IMPORTANT DEFINITIONS

Ex. Find No of oxygen atom in 60 molecule of Ozone (O_3)

No of oxygen atom = $60 \times 3 = 180$ atom

Formula :

No of atoms = No of molecules × Atomicity

✔ No of atoms = No of moles of molecule × N_A × atomicity

No of atoms = No of moles of atom × N_A

SOME IMPORTANT DEFINITIONS

No of moles of molecule × atomicity = No of moles of atom

Ex:→ A sample of gas contains 3 moles of O_2.

(1) No of moles of O = $3 \times 2 = 6$ moles.

(2) No of molecules of O_2 = $3 \times N_A$

(3) No of atoms of O = $6 \times N_A$

(4) Mass of sample = (3) × 32 = 96 gram.

O_2	:	O
1	:	2
3	:	x

$\frac{1}{3} = \frac{2}{x}$

$x = 6$

SOME IMPORTANT DEFINITIONS

Ex find the no of each atoms in 2moles of $(NH_4)_2Cr_2O_7$.

$[(NH_4)_2Cr_2O_7] : N : H : Cr : O$

$1 : 2 : 8 : 2 : 7$

$2 : x : y : z : w$

$\frac{1}{2} = \frac{2}{x}$ $\quad x = 4$

No of moles of N atom = 4

No of Nitrogen atom = $4N_A$