CHEMISTRY

(FOR IIT, NEET, AIIMS)

Class – XI

Unit 1 : Some Basic Concept of Chemistry

Topic : Atomic Mass and Gram Atomic Mass

ATOMIC MASS

- "The number which represents how many times one atom of an element is heavier than one atom of hydrogen or $1/12^{th}$ part of one atom of C^{12} isotope is called atomic mass of the element."
- Mathematically,

$$\textbf{Atomic Mass} = \frac{\textbf{Mass of one atom of an element}}{\textbf{Mass of one atom of Hydrogen}}$$

$$= \frac{\textbf{Mass of one atom of an element}}{\frac{1}{12} \times \textbf{Mass of one atom of } C\textbf{-12 isotope}}$$

- For example, atomic mass of oxygen is 16. It implies that, one atom of oxygen is 16 times heavier than one atom of hydrogen or $1/12^{th}$ part of one atom of C^{12} isotope.
- Similarly, atomic mass of chlorine is 35.5. It implies that, one atom of chlorine is 35.5 times heavier than one atom of hydrogen or $1/12^{th}$ part of one atom of C^{12} isotope.

Atomic masses (amu) of some Most Common Elements-

Element	Symbol	Atomic mass	Element	Symbol	Atomic mass
Hydrogen	H	1.008	Calcium	Ca	40
Carbon	C	12	Chromium	Cr	52
Nitrogen	N	14	Manganese	Mn	55
Oxygen	O	16	Iron	Fe	56
Fluorine	F	19	Cobalt	Co	59
Sodium	Na	23	Nickel	Ni	58.5
Magnesium	Mg	24	Copper	Cu	63.5
Aluminium	Al	27	Zinc	Zn	65
Phosphorus	P	31	Bromine	Br	80
Sulphur	S	32	Silver	Ag	108
Chlorine	Cl	35.5	Tin	Sn	118.5
Potassium	K	39	Iodine	I	127

GRAM ATOMIC MASS (GAM)

- "The amount of an element in gram equal to its atomic mass is called Gram Atomic Mass (GAM) of the element."
- For example, atomic mass of oxygen is 16. Hence, its Gram Atomic Mass (1 GAM) will be 16 g.
- Similarly, atomic mass of chlorine is 35.5. Hence, its Gram Atomic Mass (1 GAM) will be 35.5 g.

- 1GAM of all the elements contains 6.022×10^{23} atoms of the respective element. Hence, it is also called 1 Mole of respective element.
- The number of GAM (moles) in given amount of an element is obtained using following formula-

$$\text{No. of GAM (moles), } n = \frac{\text{Mass of element } (g)}{\text{GAM of Element}}$$

- If the number of GAM or moles (n) of atoms or ions in given amount of an element is known, then total number of atoms or ions is obtained using following formula-

Total number of atoms or ions,

$$N = n \times N_0$$

$$= n \times 6.022 \times 10^{23} \text{ atoms (or ions)}$$

Where, N_0 = Avogadro's Number

Numericals

Q.1. Calculate the no. of GAM (moles) in 2.3 g of sodium.

Sol^{n}- Since,

$$\text{No. of moles, n} = \frac{Mass\ of\ element\ (g)}{GAM\ of\ Element}$$

$$= \frac{2.3\ g}{23\ g}$$

$$= 0.1\ \text{moles}$$

Q.2. Calculate the no. of GAM (moles) in 9 g of aluminium.

Sol^{n}-

$\because$ $$\text{No. of moles, n} = \frac{Mass\ of\ element\ (g)}{GAM\ of\ Element}$$

$$= \frac{9\ g}{27\ g}$$

$$= 0.33 \text{ moles}$$

Q.3. Calculate the no. of atoms in 2.3 g of sodium.

Sol^{n}-

$\because$ **No. of moles, n** $= \frac{Mass\ of\ element\ (g)}{GAM\ of\ Element}$

$= \frac{2.3\ g}{23\ g}$

$=$ **0.1 moles**

$\therefore$ Total number of atoms,

$N = n \times N_0$

$= 0.1 \times 6.022 \times 10^{23}$ atoms

$= 6.022 \times 10^{22}$ atoms

Q.4. Calculate the total no. of electrons in 2.3 g of sodium.

Sol^{n}-

$\because$ $$\text{No. of moles, n} = \frac{Mass\ of\ element\ (g)}{GAM\ of\ Element}$$

$$= \frac{2.3\ g}{23\ g}$$

$$= 0.1 \text{ moles}$$

$\therefore$ **Total number of atoms,**

$$N = n \times N_0$$

$$= 0.1 \times 6.022 \times 10^{23} \text{ atoms}$$

$$= 6.022 \times 10^{22} \text{ atoms}$$

- Total number of electrons,

  = Total no. of atoms × Atomic Number

  = $6.022 \times 10^{22} \times 11$electrons

- Here, total number of protons,

  = Total no. of atoms × Atomic Number

  = $6.022 \times 10^{22} \times 11$ protons

- Here, Total number of neutrons,

  = Total no. of atoms × No. of neutrons in one atom

  = $6.022 \times 10^{22} \times 12$ neutrons

Q.5. Calculate the total no. of electrons in 2.3 g of Na^+ ions.

Sol^n- ∵ **No. of moles, n** $= \frac{Mass\ of\ element\ (g)}{GAM\ of\ Element}$

$= \frac{2.3\ g}{23\ g}$

$=$ **0.1 moles**

∴ **Total number of** Na^+ **ions,**

$N = n \times N_0$

$= 0.1 \times 6.022 \times 10^{23}$ ions

$= 6.022 \times 10^{22}$ ions

- **Total number of electrons,**

  = Total no. of ions × No. of electrons in one ion

  = $6.022\times10^{22}\times 10$ Electrons

  = 6.022×10^{23} Electrons

- **Here, total number of protons,**

  = Total no. of ions × Atomic Number

  = $6.022\times10^{22}\times 11$ protons

- **Here, Total number of neutrons,**

  = Total no. of ions × No. of neutrons in one ion

  = $6.022\times10^{22}\times 12$ neutrons

Q.6. Calculate the total no. of electrons in 8g of O^{2-} ions.

Sol^{n}-

$\because$ No. of GAM (moles), $n = \frac{Mass\ of\ element\ \ (g)}{GAM\ of\ Element}$

$= \frac{8\ g}{16\ g}$

$= 0.5$ moles

$\therefore$ **Total number of O^{2-} ions,**

$$N = n \times N_0$$

$$= 0.5 \times 6.022 \times 10^{23} \text{ ions}$$

$$= 3.011 \times 10^{23} \text{ ions}$$

∴ Total number of electrons,

= Total no. of ions × No. of electrons in one ion

= $3.011 \times 10^{23} \times 10$ Electrons

= 3.011×10^{24} Electrons

➢ Here, total number of protons,

= Total no. of ions × Atomic Number

= $3.011 \times 10^{23} \times 8$ protons

➢ Here, Total number of neutrons,

= Total no. of ions × No. of neutrons in one ion

= $3.011 \times 10^{23} \times 8$ neutrons

THANKS

FOR

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