$$\text{Atomic mass} = \frac{\text{mass of an atom}}{\text{mass of reference}}$$

$$\text{Atomic mass} = \frac{\text{mass of an atom}}{\left(\frac{1}{12}\text{th of mass of single atom of } C\text{-}12\right)}$$

$$\text{Atomic mass} = \frac{\text{mass of an atom}}{1\ \text{amu}}$$

$$\text{mass of an atom} = \text{Atomic mass} \times 1\ \text{amu}$$

Atomic mass of Al = 27

" " Fe = 56

Unit less

Mass of an atom of Al = 27 amu = $27 \times 1.67 \times 10^{-24}$ gm

" Fe = 56 amu = $56 \times 1.67 \times 10^{-24}$ gm

$$1 \text{ amu} = 1.67 \times 10^{-24} \text{ gm}$$

Q. find no. of atoms of Fe in it gm atomic mass

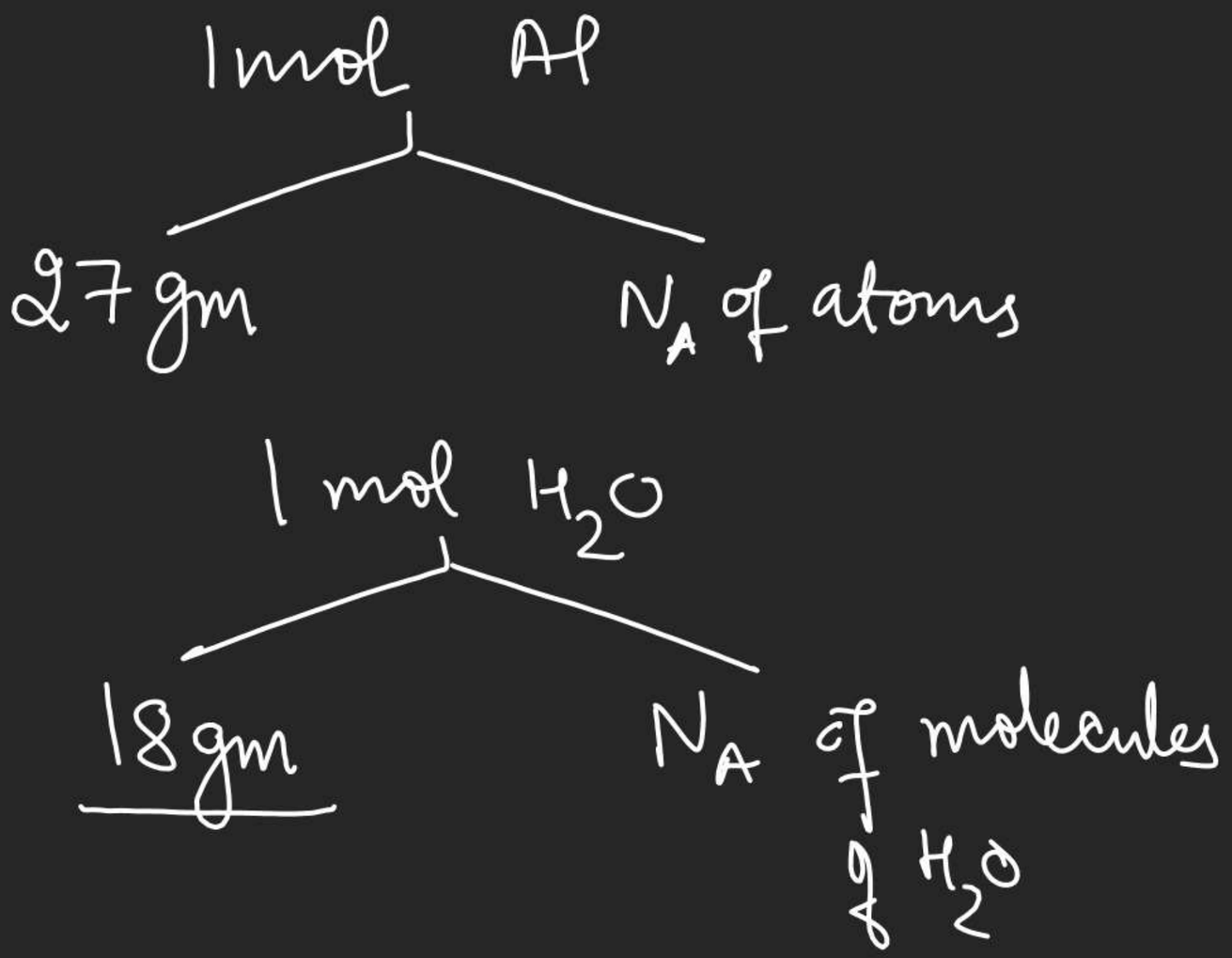
Soln no of atom of Fe = $\frac{56 \text{ gm}}{56 \text{ amu}}$

$= \frac{56 \text{ gm}}{56 \times 1.67 \times 10^{-24}}$

gm atomic mass
= mass of 1 mol
= Molar mass

$= 6.022 \times 10^{23}$ = Avogadro's number (N_A)

= 1 mole



① no of moles $= \dfrac{\text{mass of substance}}{\text{gm atomic / molecular mass}}$ I — VII

② no. of moles $= \dfrac{\text{no of atoms / Molecule}}{N_A}$ VIII IX

Atomic mass of Al = 27

mass of an atom of Al = 27 amu

molar mass of Al = 27 gm = gm atomic mass

Molecular mass of H_2O = 2 + 16 = 18

mass of 1 molecule of H_2O = 18 amu

$= 18 \times 1.67 \times 10^{-24}$ gm

$= 18 \times 1.67 \times 10^{-27}$ kg

Molecular mass of H_2SO_4 = 2 + 32 + 4 × 16

= 2 + 32 + 64 = 98

mass of 1 molecule of H_2SO_4 = 98 amu

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MOLE CONCEPT

Find the number of moles of the following :

(i) 10 gm of H_2 — 5

(ii) 10 gm of H

(iii) 54 gm of Al

(iv) 69 gm of Na

(v) 44 mg of N_2O

(vi) 308 gm of CCl_4

(vii) 23 kg of NO_2

(viii) 1.2×10^{25} atom of Ar

(ix) 3 N_A molecule of water

$= \frac{10 \text{ gm}}{2 \text{ gm}} = 5 \text{ mol of } H_2$

$= 10$

$= \frac{10}{1} = 10 \text{ mol of H}$

$\frac{54}{27} = 2 \text{ mol Al}$

$\frac{69}{23} = 3 \text{ mol Na}$

$= \frac{120 \times 10^{23}}{6 \times 10^{23}} = 20$

$= \frac{3N_A}{N_A} = 3$

(v) $= \frac{44 \times 10^{-3} \text{ gm}}{44}$

$= 10^{-3} \text{ mol } N_2O$

(vi) $= \frac{308}{154} = 2$

(vii) $= \frac{23 \times 10^3}{46}$

$= 500 \text{ mol}$

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MOLE CONCEPT

find the

Number of protons present in 14 g of $_6C^{14}$ is — atomic mass = 14

(Take $N_A = 6 \times 10^{23}$)

(A) 1.2×10^{22} **(B) 1.2×10^{25}** **(C) 3.6×10^{23}** ✓ **(D) 3.6×10^{24}**

no. of moles of $C^{14} = \frac{14\ gm}{14\ gm} = 1\ mol$

$1\ mol\ {}_6C^{14}$

no of moles of proton $= 6\ mol = 6 \times 6 \times 10^{23}$

$= 3.6 \times 10^{24}$

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$^{14}_{6}C$ ← mass number = no. of proton + no. of Neutron

atomic number = no. of proton

In 1 atom no. of proton = 6 = no of electron

no of Neutron = 8

$^{35}_{17}Cl^-$

no. of 'p' = 17

no. of 'n' = 18

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MOLE CONCEPT

Number of neutrons present in 14 g of $_6C^{14}$ is

(Take $N_A = 6 \times 10^{23}$)

(A) 4.8×10^{24} (B) 1.2×10^{25} (C) 7.2×10^{21} (D) 1.08×10^{22}

1 mol $_6C^{14}$

moles of neutron $= 1 \times 8$ moles

no. of neutron $= 8 \times N_A = 8 \times 6 \times 10^{23}$

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MOLE CONCEPT

$24 + 4 + 32$

$C_2H_4O_2$

Q. For 180 gm of Acetic acid (CH_3COOH), calculate the following :

(i) Number of moles of acetic acid

(ii) Number of molecules of acetic acid

(iii) Number of moles of carbon, oxygen and hydrogen atom

(iv) Number of atoms of carbon, oxygen, and hydrogen

(v) Total number of atoms

Molar mass of acetic acid = 60 gm

$24\ N_A$

Ans (i) $= \frac{180}{60} =$ 3 mol $C_2H_4O_2$

(ii) $= 3N_A =$ $3 \times 6.022 \times 10^{23}$

(iii) 3 mol $C_2H_4O_2$

	(iv)	(v)
C →	6 mol	$6N_A$
H →	12 mol	$12N_A$
O →	6 mol	$6N_A$

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MOLE CONCEPT

H_2O

		H	O
1 molecule H_2O	⇒	2 atom	1 atom
10 molecule H_2O	⇒	20	10 atom
1 Dozen H_2O	⇒	2 Dozen	1 Dozen
1 mol H_2O	⇒	2 mol	1 mol
5 mol H_2O	⇒	10 mol	5 mol

5 mol H_2SO_4

H → 10 mol

S → 5 mol

O → 20 mol

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MOLE CONCEPT

Flat

B_3HK

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MOLE CONCEPT

$PV = nRT$ ← can be used only for gases

ideal gas equation

T = Temperature

V = Volume of gas = volume of container

P = Pressure

n = no. of moles

R = Constant

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MOLE CONCEPT

Temperature

273.15

$$T(K) = 273 + T(^\circ C)$$

Kelvin

Volume

1 litre = 1000 ml

= 1000 cm^3

= 1000 CC → Cubic centimeter

= 10^{-3} m^3

= 1 dm^3

deci = 10^{-1}

$1\ m^3 = 1000$ litre

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MOLE CONCEPT

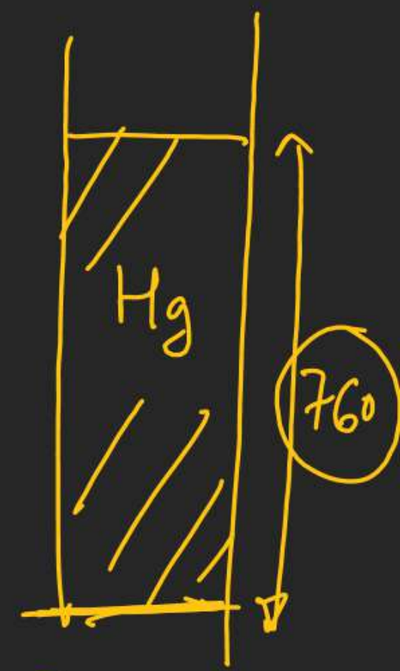
Pressure

$1\ atm = 760\ mm\ of\ Hg$

$= 760\ torr$

$= 1.01325 \times 10^5\ Pa$

$= 1.01325\ bar$



SI unit

$1\ bar = 10^5\ Pa$

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MOLE CONCEPT

$$PV = nRT$$

P → atm, Pa

V → lit, m^3

n → moles

T → Kelvin

R → 0.0821 atm. lit/mol/k

8.314 J/mol/k

Joule = N x m

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MOLE CONCEPT

① $P = 0.821$ atm

$n = 2$ mol

$T = 300$ K

$V = ?$

$PV = nRT$

$10 \times 0.821 \times V = 2 \times 0.0821 \times 300$

(atm) (lit) (K)

$\longrightarrow V = 60$ lit

$V = 60 \times 10^{-3}\ m^3$

$= 60 \times 10^{3}$ ml

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MOLE CONCEPT

$$\begin{bmatrix} O-I & 1-10 \\ S-I & 1-5 \end{bmatrix}$$

Homework