

PHYSICAL CHEMISTRY SYLLABUS FOR JEE

- 1. Mole concept
- 2. Concentration terms
- 3. Ideal gas
- 4. Real gas
- 5. Atomic structure
- 6. Redox Reactions
- 7. Chemical equilibrium
- 8. Ionic equilibrium
- 9. Thermodynamic
- 10. Thermochemistry
- 11. Solid state
- 12. Kinetics
- 13. Electrochemistry
- 14. Liquid solution
- 15. Surface chemistry

MOLE CONCEPT

Find the number of moles of the following :

- (i) 10 gm of H_2
- (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

MOLE CONCEPT

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

MOLE CONCEPT

Number of protons present in 14 g of $_{6}C^{14}$ is

(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}

MOLE CONCEPT

Number of neutrons present in 14 g of ${}^6\text{C}^{14}$ 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}**

O-L

②

$$\text{no. of protons} = \frac{1 \text{ gm}}{1 \text{ amu}}$$

$$= \frac{1 \text{ gm}}{1.67 \times 10^{-24}} = \underline{\underline{N_A}}$$

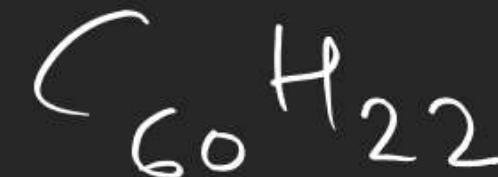
$$\text{no. of moles} = 1$$

②

$$\underline{1 \text{ gm}}$$

$$\text{Molar mass of } e^- = \frac{9.1 \times 10^{-31}}{\text{g}} \times N_A$$

(7)



$$\begin{aligned}\text{Molecular mass} &= 60 \times 12 + 22 \times 1 \\ &= 720 + 22\end{aligned}$$

$$\begin{aligned}\text{Mass of one molecule} &= 742 \\ &= 742 \text{ amu} = 742 \times 1.67 \times 10^{-24} \text{ g}_m \\ &\approx 1240 \times 10^{-24} \text{ g}_m\end{aligned}$$

(8)



$$\underline{7} + \underline{24} + \underline{1} = 32$$

no. of e^- in one ion = 32

$$\text{molar g of } \text{NO}_3^- = \frac{34.1 \times 10^{-3} \text{ gm}}{262 \times 10}$$

$$= \frac{1}{2} \times 10^{-4}$$

$$\begin{aligned} \text{no. of } e^- &= \frac{1}{2} \times 10^{-4} \times 32 \times 6 \times 10^{23} \\ &= 96 \times 10^{19} \end{aligned}$$



249.5

$$63.5 \quad \text{mass of 1 molecule} = 249.5 \text{ amu}$$

$$= 249.5 \times (1.67 \times 10^{-24}) \text{ gm}$$

$$= \frac{249.5}{N_A} \times 10^{22}$$

$$\frac{1}{N_A} = 1.67 \times 10^{-24}$$

180 gm glucose $C_6H_{12}O_6$

$$\text{moles of glucose} = \frac{180}{180} = 1 \text{ mol}$$



C - 6 mol

H - 12 "

O - 6 "

(5)

i)

$$\frac{10^{20}}{N_A}$$

iii)

 ${}_{7}^{14}N$

atomic mass of N = 14

mass of an atom of N = 14 amu

mass of 10 atom = 10×14 amu

$$= 10 \times 14 \times 1.67 \times 10^{-24}$$

$$PV = nRT$$

Pa m^3 8.314 J/mole/K
atm lit 0.0821 atm. lit/mol/K

MOLE CONCEPT

For the ideal gas, find the missing parameter in each part among P, V, T and n:

$$\rightarrow \text{(i) } P = 8.314 \text{ Pa} \quad V = 600 \text{ m}^3$$

$$T = 400 \text{ K}$$

$$1.5$$

(V)

$$P \times 821 = 10 \times 0.0821 \times 576$$

✓

$$P = 50 \text{ atm}$$

$$\rightarrow \text{(ii) } P = 380 \text{ torr} \quad V = 8.21 \text{ L}$$

$$T = 500 \text{ K}$$

$$0.1$$

$$\text{(iii) } P = 83.14 \text{ Pa} \quad V = 50 \text{ L}$$

$$T = 250 \text{ K}$$

$$0.002$$

$$\text{(iv) } V = 8.21 \text{ L} \quad T = 500 \text{ K}$$

$$n = 10$$

$$50$$

$$\text{(v) } V = 10 \text{ m}^3 \quad T = 300 \text{ K}$$

$$n = 3$$

$$\rightarrow$$

$$P \times 10 \text{ m}^3 = 3 \times 8314 \times 300$$

$$P = 90 \times 8314 \quad Pa = 748.26$$

$$= \frac{90 \times 25}{30} = 750$$

$$8314 \approx \frac{25}{3}$$

STP (standard temperature & pressure)

273K

or 0°C

1 bar
~~1 atm~~

IUPAC

Q. find volume of 1mol gas at STP?

$$PV = nRT$$

$$1 \text{ atm} = \underline{1.01325 \text{ bar}}$$

$$\frac{1}{1.01325} \text{ atm} \times V = 1 \times 0.0821 \times 273$$

$$\begin{aligned} \text{Molar volume } V_m &= 22.4 \times 1.01325 \\ \text{at STP} &= 22.7 \text{ lit} \end{aligned}$$

Q. find volume of 1mol at 1atm , 273K

$$1 \text{ atm} \times V = 1 \times 0.0821 \times 273$$

$$V = 22.4 \text{ lit}$$

~~NTP~~

SATP (std ambient temperature & pressure)

Vol of 1mole at SATP

298 K

1bar

$$\frac{1}{1.01325} \times V = 1 \times 0.0821 \times 298$$

$$V = 24.789 \text{ lit}$$

$$= \underline{\underline{821 \times 10^{-4}}}$$

$$P = 83.14 \text{ Pa}$$

$$V = 50 \text{ lit}$$

$$T = 250 \text{ K}$$

$$V = 50 \times 10^3 \text{ m}^3$$

$$\text{10 } P V = n R T$$

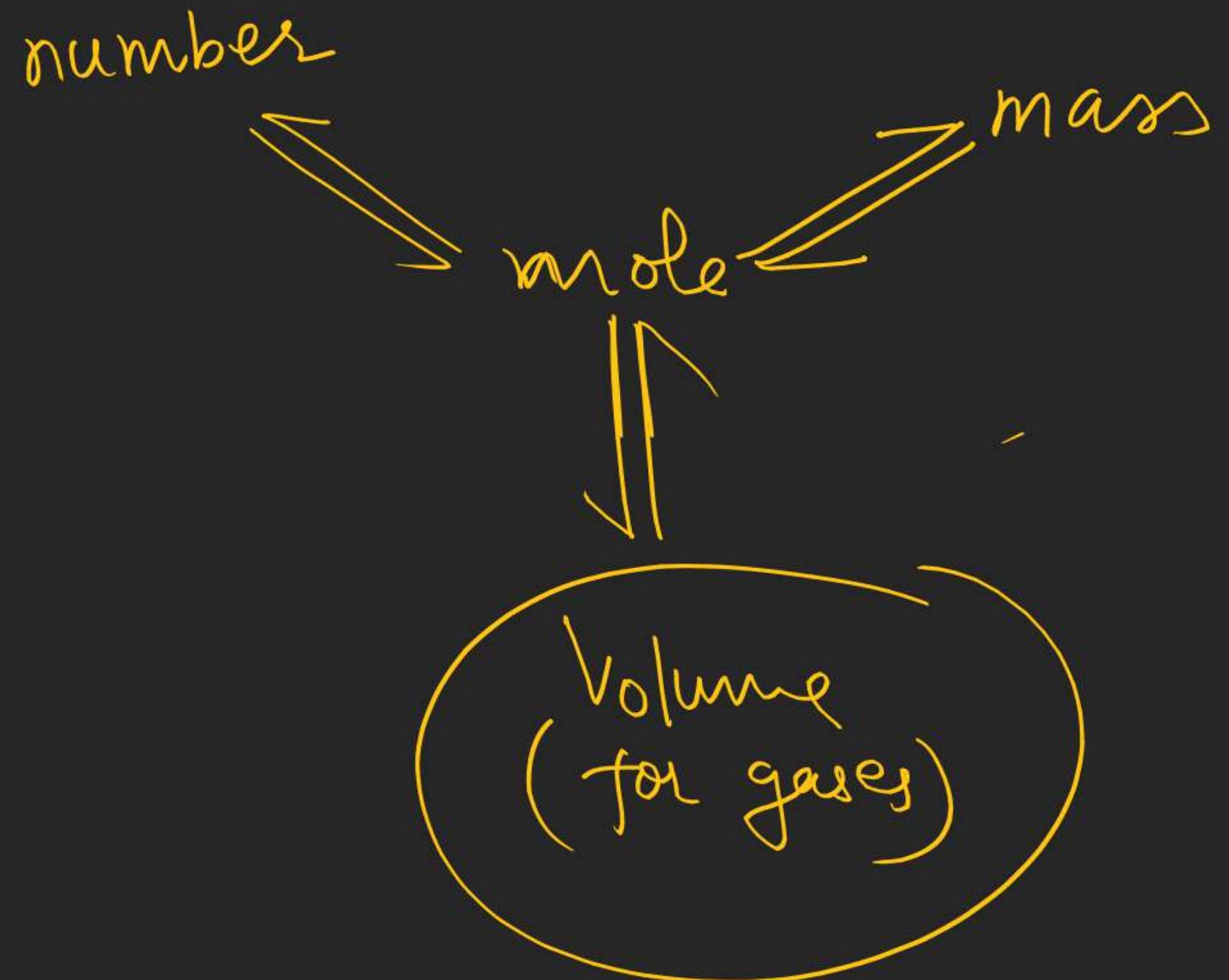
$$\cancel{83.14} \times \cancel{50} \times 10^3 = n \times \cancel{8.314} \times \cancel{250}$$

$$(Pa) \quad (m^3)$$

$$n = 2 \times 10^{-3}$$

$$= 0.002$$

✓ 0.02
 ✓ 0.002
 ✓ 0.0002
 ✓ 0.4
 ✓ 0.8
 ✓ 2.5
 ✓ 0.25
 ✓ 2



Q. find mass of O_2 present in a room of size $8.21\text{ m} \times 10\text{ m} \times 3\text{ m}$ at 300 K and 0.2 atm .

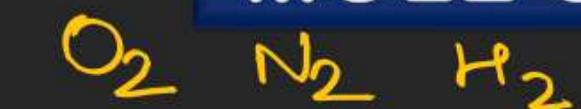
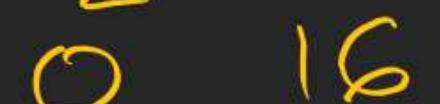
$$\begin{aligned}\text{Volume of room} &= 8.21 \times 30 \text{ m}^3 \\ &= 8.21 \times 30 \times \underline{10^3 \text{ lit}}\end{aligned}$$

$$P V = n R T$$

$$0.2 \times \cancel{8.21} \times \cancel{30} \times 10^3 = n \times \cancel{0.0821} \times 300$$

$$n = 0.2 \times 10^4 = 2 \times 10^3 = \underline{2000 \text{ mol}}$$

$$\begin{aligned}\text{mass} &= 32 \times 2000 \text{ gm} \\ &= 64000 \text{ gm} \\ &= 64 \text{ kg}\end{aligned}$$



MOLE CONCEPT

Q. The weight of 224 mL of a diatomic gas at 0°C and 2 atm pressure is 1 g .

The weight of one atom is :

weight of
one atom is $= 25$
atomic

$$PV = n RT$$

$$PV = \frac{w}{M} RT$$

$$2 \text{ atm} \times 224 \times 10^3 \text{ lit} = \frac{1}{M} \times 0.0821 \times 273$$

$$\text{no of moles} = \frac{\text{mass}(w)}{\text{Molar mass}}$$

$$n = \frac{w}{M}$$

$$M = 50 \text{ gm}$$

$$\begin{aligned} \text{Molecular mass} &= 50 \\ \text{atomic mass} &= 25 \end{aligned}$$

