

PHYSICAL CHEMISTRY SYLLABUS FOR JEE

1. Mole concept
2. Concentration terms
3. Ideal gas
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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 ${}_6\text{C}^{14}$ 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}

0-1

(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)

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

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



$$\underline{\text{Molecular mass}} = 60 \times 12 + 22 \times 1$$

$$= 720 + 22$$

$$= 742$$

$$\underline{\underline{\text{Mass of one molecule}}} = 742 \text{ amu} = 742 \times 1.67 \times 10^{-24} \text{ gm}$$

$$\approx 1240 \times 10^{-24} \text{ gm}$$

⑧



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

$$\text{no. of } e^- \text{ in an ion} = \underline{32}$$

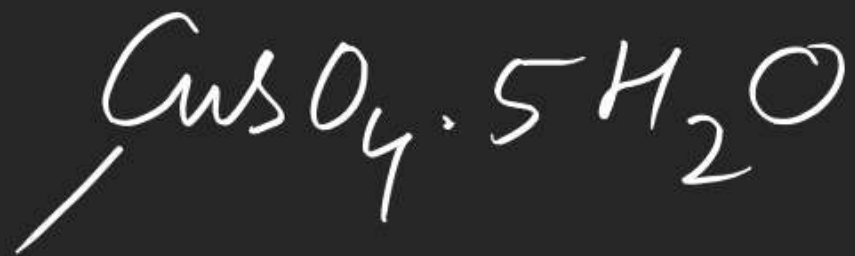
$$\text{molar of } \text{NO}_3^- = \frac{3.1 \times 10^{-3} \text{ gm}}{262 \times 10}$$

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

$$\text{no. of } e^- = \frac{1}{2} \times 10^{-4} \times 32 \times \cancel{6}^3 \times 10^{23}$$

$$= 96 \times 10^{19}$$

(10)

249.5

63.5

mass of 1 molecule = 249.5 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



atomic mass of N = 14

mass of an atom of N = 14 amu

mass of 100 atoms = $100 \times 14 \text{ amu}$

$$= 100 \times 14 \times 1.67 \times 10^{-24}$$

$$PV = nRT$$

Pa m³ 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:

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

$T = 400 \text{ K}$ 1.5

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

$T = 500 \text{ K}$ 0.1

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

$T = 250 \text{ K} \rightarrow 0.002$

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

$n = 10 \rightarrow 50$

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

$n = 3 \rightarrow$

(iv) $P \times \cancel{8.21} = 10 \times \cancel{0.0821} \times \cancel{500}$

$P = 50 \text{ atm}$

$$P \times 10 \text{ m}^3 = 3 \times 8.314 \times 300$$

$$P = \frac{90 \times 8.314}{10} \text{ Pa} = \underline{748.26}$$

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

$$8.314 \approx \frac{25}{3}$$

STP (standard temperature & pressure)

273K
or 0°C

1 bar
~~1 atm~~

IUPAC

Q. find volume of 1 mol gas at STP?

$$PV = nRT$$

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

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

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

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 1 mole at SATP 298 K 1 bar

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

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

$$\begin{aligned} &0.0821 \\ &= \underline{821 \times 10^{-4}} \end{aligned}$$

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

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

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

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

$$PV = nRT$$

$$\frac{83.14}{\text{(Pa)}} \times \frac{50}{\text{(m}^3\text{)}} \times 10^{-3} = n \times 8.314 \times \frac{250}{\text{K}}$$

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

$$= 0.002$$

$$0.02$$

$$\checkmark \quad \cancel{0.002}$$

$$0.0002$$

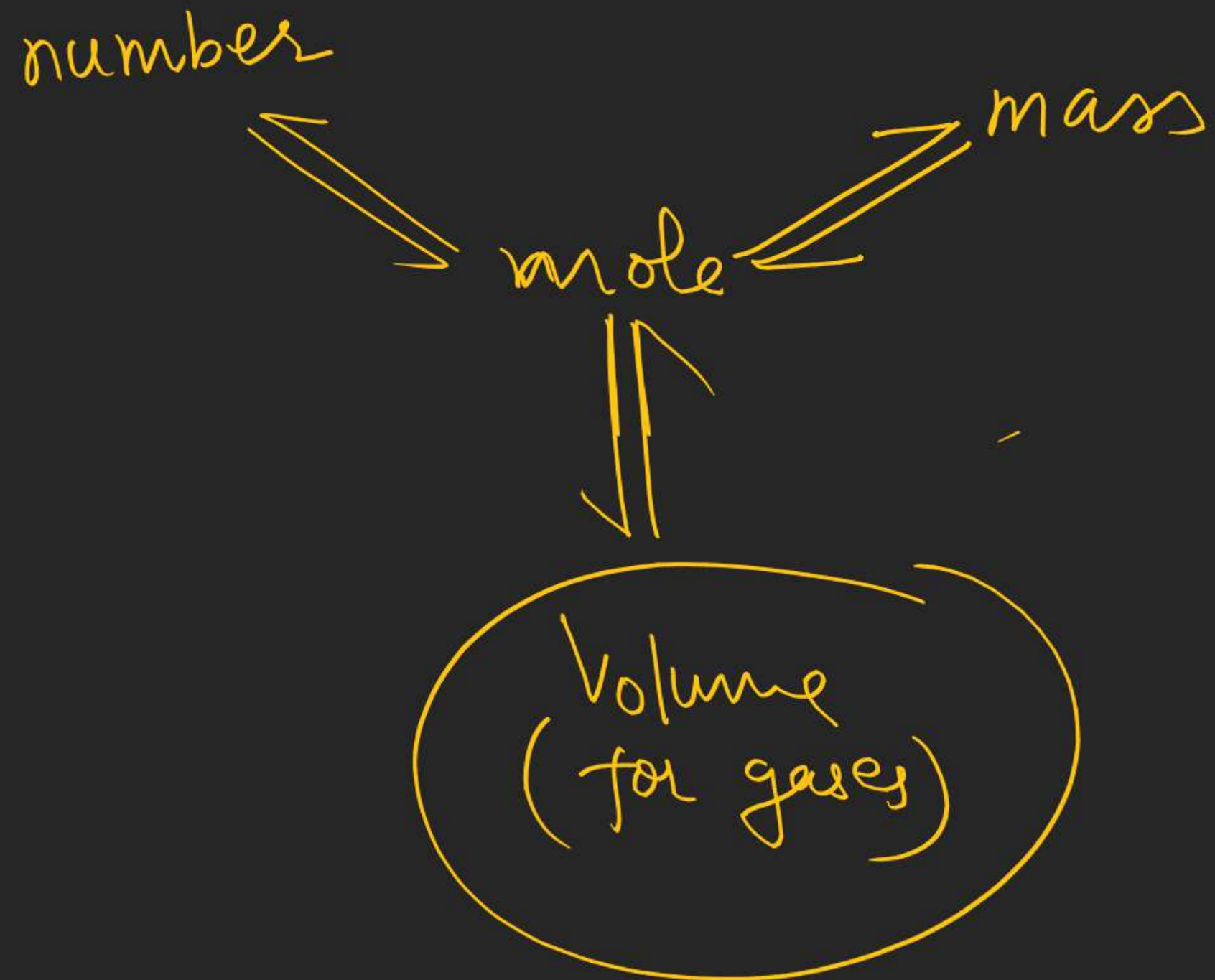
$$0.4$$

$$0.8$$

$$2.5$$

$$0.25$$

$$2$$



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 .

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

$$PV = nRT$$

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

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

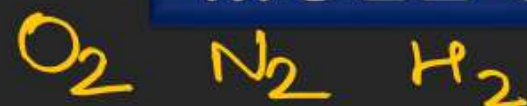
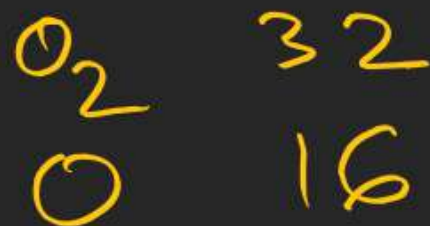
mass

$$= 32 \times 2000 \text{ gm}$$

$$= 64000 \text{ gm}$$

$$= \underline{64 \text{ kg}}$$

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 = 25 amu

$$PV = nRT$$

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

$$n \text{ of moles} = \frac{\text{mass}(w)}{\text{Molar mass}}$$

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

$$2 \text{ atm} \times 224 \times 10^{-3} \text{ lit} = \frac{1}{M} \times \frac{0.0821 \times 273}{22.4}$$

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

$$\begin{array}{l} \text{Molecular mass} = 50 \\ \text{atomic mass} = 25 \end{array}$$

