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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

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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 $_6C^{14}$ 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 ${}_{6}C^{14}$ 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}

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O-I

2

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

$$= \frac{1\,\text{gm}}{1.67\times10^{-24}} = N_A$$

no. of moles = 1

2

$$\frac{1\,\text{gm}}{}$$

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

(7) $C_{60}H_{22}$

Molecular mass $= 60 \times 12 + 22 \times 1$

$= 720 + 22$

$= 742$

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

$\simeq 1240 \times 10^{-24}$ gm

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$\underline{N}O_3^{\ominus}$ $\quad \underline{7} + \underline{24} + \underline{1} = 32$

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

moles of $NO_3^- = \dfrac{\cancel{31}^{16} \times 10^{-3}\ gm}{2\ \cancel{62} \times 10}$

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

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

$= 96 \times 10^{19}$

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10 $CuSO_4 \cdot 5H_2O$ 249.5

63.5

mass of 1 molecule $= 249.5$ amu

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

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

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

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180 gm glucose $C_6H_{12}O_6$

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

$C_6H_{12}O_6$

C — 6 mol

H — 12 "

O — 6 "

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5

i

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

iii

${}_7N^{14}$

atomic mass of N = 14

mass of an atom of N = 14 amu

mass of 100 atom = 100 × 14 amu

= 100 × 14 × 1.67×10^{-24}

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$$PV = nRT$$

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

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MOLE CONCEPT

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

(i) P = 8.314 Pa V = 600 m^3 T = 400 K 1.5

(ii) P = 380 torr V = 8.21 L T = 500 K 0.1

(iii) P = 83.14 Pa V = 50 L T = 250 K → 0.002

(iv) V = 8.21 L T = 500 K n = 10 → 50

(v) V = 10 m^3 T = 300 K n = 3 →

(iv) $P \times \cancel{8}21 = 10 \times \cancel{0.08}21 \times 5\cancel{00}$ 100

$P = 50$ atm

$P \times 10\,m^3 = 3 \times 8.314 \times 300$

$P = 90 \times 8.314$ Pa $= 748.26$

$= \frac{\cancel{90} \times 25}{\cancel{3}} = 750$ 30

$8.314 \simeq 25/3$

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STP (standard temperature & pressure)

273K or 0°C

1 bar

~~1 atm~~

IUPAC

Q. find volume of 1 mol gas at STP?

$$PV = nRT$$

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

1 atm = 1.01325 bar

molar volume at STP $= V_m = 22.4 \times 1.01325$

$= 22.7$ lit

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

$$1\,atm \times V = 1 \times 0.0821 \times 273$$

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

~~NTP~~

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SATP (std ambient temperature & pressure)

temperature → 298 K

pressure → 1 bar

Vol of 1 mole at SATP

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

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

0.0821

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

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$P = 83.14\ Pa \qquad V = 50\ lit \qquad T = 250K$

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

$PV = nRT$

$\overset{10}{\cancel{83.14}} \times \cancel{50} \times 10^{-3} = n \times \cancel{8.314} \times \overset{5}{\cancel{250}}$

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

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

$= 0.002$

0.02

0.002

0.0002

0.4

0.8

2.5

0.25

2

number $\rightleftharpoons$ mole $\rightleftharpoons$ mass

mole $\rightleftharpoons$ Volume (for gases)

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

Volume of room $= 8.21 \times 30\,m^3$

$= 8.21 \times 30 \times 10^3$ lit

$PV = nRT$

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

$n = 0.2 \times 10^4 = 2 \times 10^3 = 2000$ mol

mass

$= 32 \times 2000$ gm

$= 64000$ gm

$= 64$ kg

MOLE CONCEPT

O_2 32

O 16

O_2 N_2 H_2

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 $= 25$ amu

$$PV = nRT$$

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

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

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

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

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

Molecular mass $= 50$

atomic mass $= 25$

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S - I	6 — 18
0 - I	11 — 15