Balancing of Reaction & Limiting Reactants

Course on Mole Concept for Class XI

akhilesh • Lesson 2 • June 5, 2021

DPP # 01 WITH ANSWER

1.

Ans. (i) 32 g (ii) 28 g (iii) 46 g (iv) 18 g
(v) 17 g (vi) 92 g (vii) 64 g (viii) 98g
(ix) 44 g (x) 180 g (xi) 60 g (xii) 342 g
(xiii) 249.5 g

2.

Ans. (i) 1 (ii) 2 (iii) 2 (iv) 4
(v) 3×10^{-3} (vi) 3×10^{-3} (vii) 0.5×10^{-3} (viii) 0.25×10^{-3}

3.

Ans. (i) 1 (ii) $1 \times N_A$ (iii) 6 (iv) 12
(v) 6 (vi) $6N_A$, $12N_A$, $6N_A$ (vii) $24N_A$

4.

Ans. (i) 0.5 (ii) 1, 0.5, 2 (iii) $0.5N_A$ (iv) N_A, $N_A/2$, $2N_A$
(v) $3.5N_A$

5.

Ans. (i) 3 (ii) $3N_A$ (iii) 6, 6, 12 (iv) $6N_A$, $6N_A$, $12N_A$
(v) $24N_A$

6.

Ans. (i) n = 2 (ii) n = 2.5 (iii) n = 2 (iv) P = 50 atm
(v) P = 74.8 Pa (vi) T = 1000 K (vii) V = 2 L (viii) P = 2500 Pa

7.

Ans. (i) 45.4 L (ii) 5.675 L (iii) 11.35 L (iv) 90.8 L

8.

Ans. (i) 1 (ii) 2
(iii) 2×10^{-3} (iv) 5×10^{-4}
(v) 0.1 (vi) 5000

(2) 28 gm N_2 — $28/28$ mol of N_2 = 1

28 gm N — $28/14$ mol of 'N' = 2.

(3) 180 gm ≡ 1 mol $C_6H_{12}O_6$ — N_A

- → 6 mol C × N_A
- → 12 mol H × N_A
- → 6 mol O × N_A

mass ⇄ Mole ⇄ No of atom.

for gases $PV = nRT$

Pressure ↑ P

Vol. ↑ V (of cont)

mol ↓ n

Temp ↓ T (const)

$$1\ \text{atm} = 1.01325 \times 10^5\ \text{Pa}$$

$$= 1.01325\ \text{bar}$$

$$= 760\ \text{mm of Hg} \equiv 76\ \text{cm of Hg}$$

$$= 760\ \text{torr}$$

$$1\ \text{bar} = 10^5\ \text{Pa}$$

$$1 \text{ litre} = 1000 \text{ ml}$$

$$= 1000 \text{ cm}^3$$

$$= 1000 \text{ cc}$$

$$= 1 \text{ dm}^3$$

$$= 10^{-3} \text{ m}^3$$

$$T(K) = 273.15 + T(^\circ C)$$

$PV = nRT$

$J = Nm$

Pa m^3

atm lit

8.314 J/mol/K

0.0821 atm. lit/mol/K.

$\frac{8.314}{4.18}$ cal/mol/K

$\simeq 2$

(1) $P = 10$ bar $\quad V = 831.4$ lit $\quad T = 300$ K

$\eta = ?$

$10^5 Pa \times 831.4 \times 10^{-3}$

$= n \times 8.314 \times 300$

(A) 0-50

(B) 50-100

(C) 100-500

(D) 500-1500

$V = 100$ lit

STP : standard temp and pressure

273 K

1 bar

Volume of 1 mol gas at STP

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

$$V = 22.4 \times 1.01325$$

$$V = 22.7 \text{ lit}$$

Vol of 1 mol at 1 atm, 273 K

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

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

SATP (std ambient temp & pressure)

298

1 bar

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

$$V = 24.789 \simeq 24.79$$

for solid & liq

mass = V x density

at STP V_m = 45.4 L mol^{-1}

moles = $\frac{45.4}{22.7}$ = 2

1 mol 'N' = 1 gm-atom Nitrogen

1 mol N_2 = 1 gm-molecule Nitrogen

Balancing of Rxn

$\Rightarrow$ $H_2 + \frac{1}{2}O_2 \longrightarrow H_2O$

$2H_2 + O_2 \longrightarrow 2H_2O$

$\Rightarrow$ $N_2 + 3H_2 \longrightarrow 2NH_3$

$$1\,C_2H_4 + 3O_2 \longrightarrow 2CO_2 + 2H_2O$$

$$\overset{1}{a}\,C_6H_6 + \overset{15/2}{b}\,O_2 \longrightarrow \overset{6}{c}\,CO_2 + \overset{3}{d}\,H_2O$$

$$\begin{cases} 6a = c \\ 6a = 2d \\ 2b = 2c + d \\ b = 15/2 \end{cases}$$

$a = 1 \quad c = 6 \quad d = 3$

Application of mole Concept :→

$2H_2 + 1O_2 \longrightarrow 2H_2O$

2 molecule	1 molecule	2 molecule
$2N_A$ molecule	N_A	$2N_A$
2 mol	1 mol	2 mol
20 mol	10 mol	20 mol

$\frac{a}{\quad}\,A + \frac{b}{\quad}\,B \longrightarrow c\,C + d\,D$

a mol $\quad b$ mol $\quad c$ mol $\quad d$ mol

x mol $\quad \frac{b}{a}x \quad \frac{c}{a}x \quad \frac{d}{a}x$

$\frac{a}{b}y \quad y \quad \frac{c}{b}y \quad \frac{d}{b}y$

$\frac{a}{d}z \quad \frac{b}{d}z \quad \frac{c}{d}z \quad z$

$a \longrightarrow c \qquad b \longrightarrow a$

$1 \longrightarrow \frac{c}{a} \qquad 1 \longrightarrow \frac{a}{b}$

$x \longrightarrow \frac{c}{a}x \qquad y \longrightarrow \frac{a}{b}y$

Type-1 problems : Rxns involving only one reactant

$$2NH_3 \longrightarrow N_2 + 3H_2$$

4 mol

$\frac{1}{2} \times 4 = 2$ $\quad$ $\frac{3}{2} \times 4 = 6$

2×28

Ans $= 6 \times 2 = 12$ gm

Q. find mass of H_2 produced by 68 gm NH_3 as per given Rxn.

moles of NH_3 $= 68/17 = 4$

Q. Calculate mass of O_2 required to produce 90 gm H_2O.

$$2H_2 + O_2 \longrightarrow 2H_2O$$

5 mol $\frac{5}{2}$ mol 5 mol

5×2

$= 10$ gm

$\frac{5}{2} \times 32$

$= 80$ gm

Type-2 problems :— Rxns involving more than one reactant

@ Amt of only one reactant is given

$$N_2 + 3H_2 \longrightarrow 2NH_3$$

2 mol — 4 mol

$\therefore$ 6 gm N_2 — mass of NH_3 = ?

S-I S-II O-I O-II J-M J-Adv

1-21

Single

Remaining DPP