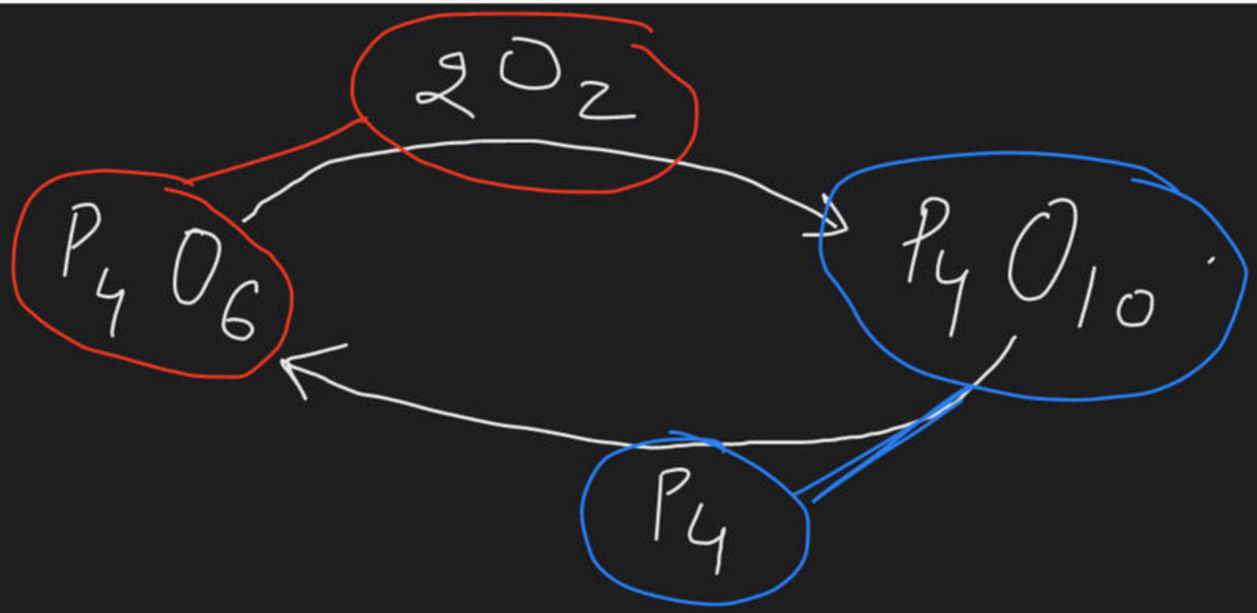
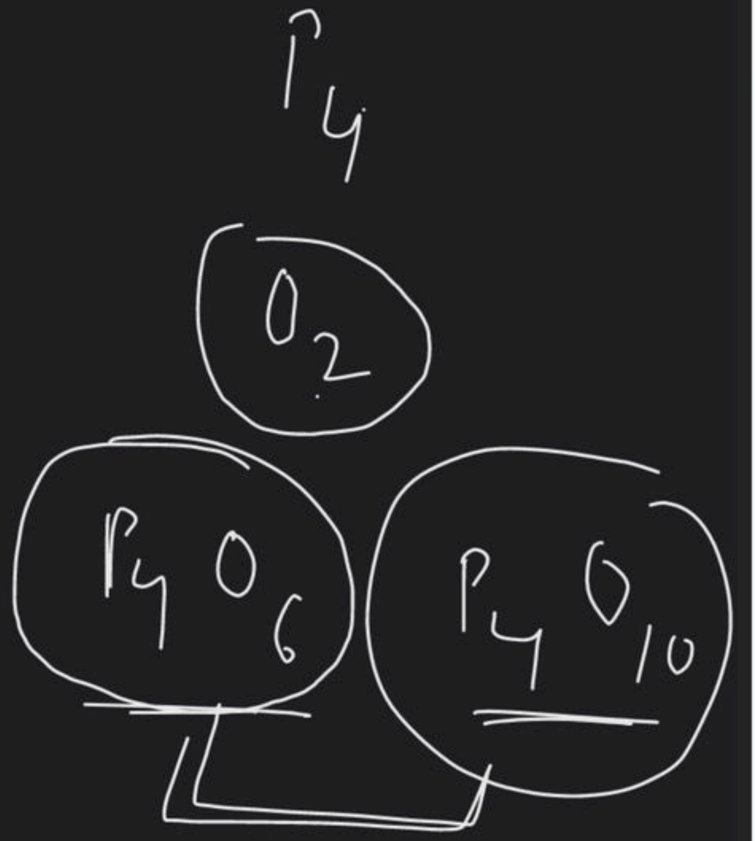
# Degree of Dissociation, Empirical & Molecular Formula

Course on Mole Concept for Class XI

akhilesh • Lesson 6 • June 15, 2021

(2)




(1)

$$P_4 + 3O_2 \longrightarrow P_4O_6$$

3 mol | 11 mol | x

3 mol | 2 mol | 3 mol

0

$$P_4O_6 + 2O_2 \longrightarrow P_4O_{10}$$

$2 = 3 - 1$

2

1

$$C + O_2 \longrightarrow CO_2 \qquad \eta_{O_2} \geq 1$$

1 mol

$$C + \tfrac{1}{2} O_2 \longrightarrow CO \qquad \eta_{O_2} \leq 1/2$$

1 mol

$$\frac{1}{2} < \eta_{O_2} < 1$$

$P_4 + 3O_2 \longrightarrow P_4O_6$ $\quad n_{O_2} \leq 3$

1 mol

$P_4 + 5O_2 \longrightarrow P_4O_{10}$ $\quad n_{O_2} \geq 5$

1 mol

$$3 < n_{O_2} < 5$$

(1)

(4)

| % N | $P_2O_5$ | $K_2O$ |
|---|---|---|
| 30% | 10% | 10% (by mass) |
| 30 gm | 10 gm | 10 gm |


moles

$\frac{30}{14}$ : $\frac{10}{142}$ : $\frac{10}{94}$

$\frac{30}{14}$ : $\frac{10}{142} \times 2$ : $\frac{10}{94} \times 2$

35 40 gm [$BeCO_3$ + Imp.]

39 gm 1 gm 1/2

$BeCO_3 + 2HCl \longrightarrow BeCl_2 + H_2O + CO_2$

39/69 ×

$3CaCO_3 + 2H_3PO_4 \longrightarrow$

0.5 0.7

6

$$\left(0.7 - \frac{2}{3} \times 0.5\right) \times 98$$

$$\frac{1.1}{3} \times 98$$

# Avg atomic / Molecular Mass :→

$Cl^{35}$ $Cl^{37}$

75 % 25 % by mole

75 mol 25 mol

3 mol 1 mol

$$\text{Avg atomic mass} = \frac{n_1 M_1 + n_2 M_2}{n_1 + n_2}$$

$$= \frac{3 \times 35 + 1 \times 37}{4} = 35.5$$

$$M_{avg} = \frac{\text{Total mass}}{\text{Total no of moles}} = \frac{n_1 M_1 + n_2 M_2}{n_1 + n_2}$$

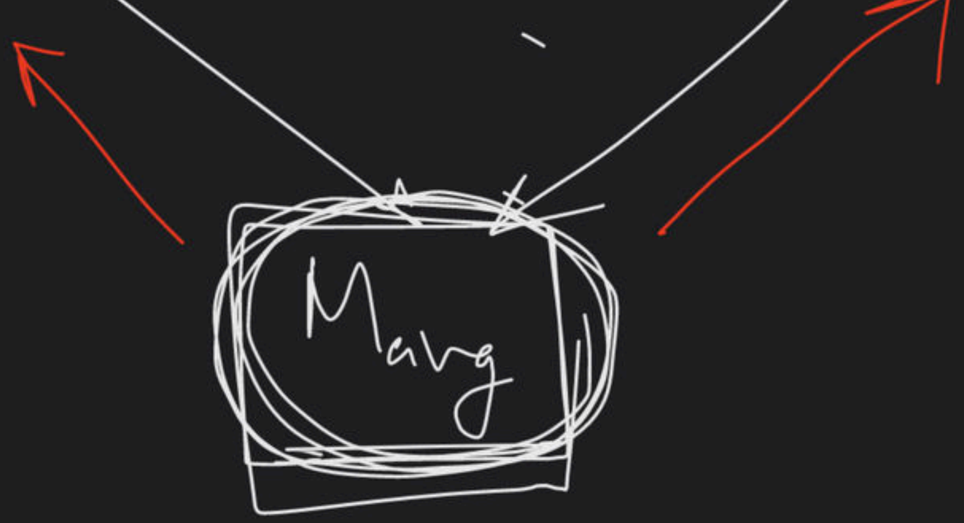
$M_{avg} = \dfrac{1 \times 16 + 4 \times 4}{5}$

| $CH_4$ | $He$ | |
|---|---|---|
| 50% | 50% | by mass |
| $\frac{16\ gm}{16}$ | $\frac{16\ gm}{4}$ | |
| 1 mol | 4 mol | |

$$M_{avg} = \frac{W_1 + W_2}{\frac{W_1}{M_1} + \frac{W_2}{M_2}} = \frac{16+16}{\frac{16}{16} + \frac{16}{4}}$$

$$= \frac{32}{5} = 6.4$$

% by mole $\Longleftrightarrow$ % by mass



$N_2$ $O_2$

80% 20% by moles

4 1

$$M_{avg} = \frac{4 \times 28 + 1 \times 32}{5} = 28.8$$

(A) 28.8 (D) 27.6

(B) 29

(C) 30.6

Let the total moles = 100

| He | $CH_4$ |
|---|---|
| $x$ | $(100-x)$ moles |

(A) % by mol He

(B) % by mass He

$$M_{avg} = 10$$

$$10 = \frac{4 \times x + (100-x) \times 16}{100}$$

$$12x = 600$$

$$x = 50$$

| He | $CH_4$ |
|---|---|
| 1 | 1 |
| 4 gm | 16 gm |

20%

80% by mass

Let the total mass = 100 gms

" mass of He = $x$ gms

$CH_4$ = $(100 - x)$ gms

$$10 = \frac{W_1 + W_2}{\frac{W_1}{M_1} + \frac{W_2}{M_2}} = \frac{100}{\frac{x}{4} + \frac{100 - x}{16}}$$

#

He $\longleftrightarrow$ $CH_4$

4 $\longleftrightarrow$ 16

$M_{avg} = 10$

$N_2$ $O_2$

28 32

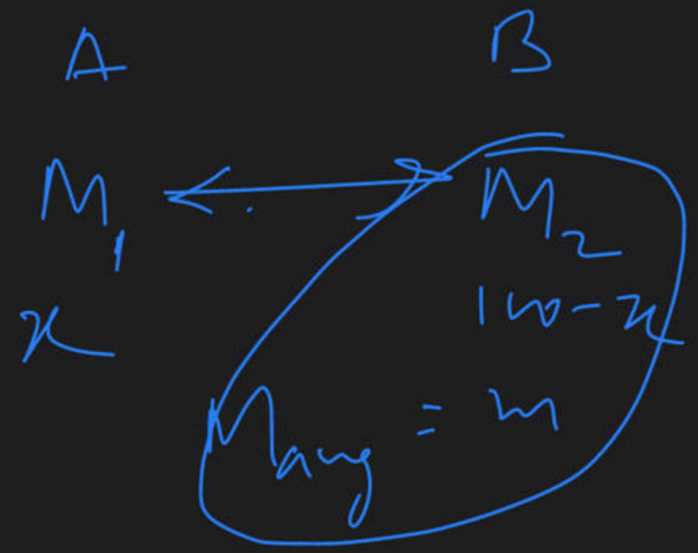
$M_{avg} = 29$

% by mol of He $= \frac{6}{12} \times 100 = 50\%$

% by mol of $CH_4$ $= \frac{6}{12} \times 100 = \underline{50\%}$

% by mol of $N_2 = \frac{3}{4} \times 100$

% by mol of $O_2 = \frac{1}{4} \times 100$




$$\% \text{ by mass of } M_1 = \% \text{ by moles of } M_1 \times \frac{M_1}{M_{avg}}$$

$$m = \frac{x M_1 + (100 - x) M_2}{100}$$

$$100m - 100 m_2 = x (M_1 - M_2)$$

$$\frac{100 (m - m_2)}{m_1 - m_2} = x$$

$N_2$ $O_2$

$M_{avg} = 29$

% by mol of $N_2$ = 75%

% by mol of $O_2$ = 25%

% by mass = $75 \times 28/29$

% by ~~water~~ mass = $25 \times 32/29$

3 B

60%

3 balls

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20 gm

60 gm

50%

×

2 G

40%

2 balls

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30 gm

60 gm

50%

% by number

= % by mole

by mass

# Degree of dissociation :→

100

70%

$$A \longrightarrow 2B + C$$

| | | | |
|---|---|---|---|
| | $a$ | | |
| | $0$ | $2a$ | $a$ |
| | | × | |
| | $a-x$ | $2x$ | $x$ |
| | $a-a\alpha$ | $2a\alpha$ | $a\alpha$ |
| | $a(1-\alpha)$ | $2a\alpha$ | $a\alpha$ |

Amt reacted per mole of reactant.

$\alpha = x/a$

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

| | | |
|---|---|---|
| $a-x$ | $x/2$ | $3x/2$ |

$\alpha = x/a$

$x = a\alpha$

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| | | |
|---|---|---|
| $a(1-\alpha)$ | $\frac{a\alpha}{2}$ | $\frac{3a\alpha}{2}$ |

$$3A \longrightarrow 4C + 5D$$

| | | |
|---|---|---|
| $a-x$ | $4/3\,x$ | $5/3\,x$ |
| $a(1-\alpha)$ | $4/3\,a\alpha$ | $5/3\,a\alpha$. |

S-1 47, 48

S-2 7-13

0-1 36, 37, 43

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

5

$5 - 1$ $\quad 0.5 \quad 1.5$

$\alpha = 1/5 = 0.2$