

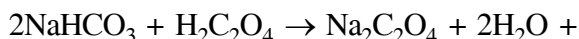
MOLE CONCEPT

1. A 10 mg effervescent tablet containing sodium bicarbonate and oxalic acid releases 0.25 ml of CO_2 at $T = 298.15 \text{ K}$ and $p = 1 \text{ bar}$. If molar volume of CO_2 is 25.0 L under such condition, what is the percentage of sodium bicarbonate in each tablet? [Molar mass of $\text{NaHCO}_3 = 84 \text{ g mol}^{-1}$]
- (1) 16.8 (2) 8.4
(3) 0.84 (4) 33.6
2. For the following reaction, the mass of water produced from 445 g of $\text{C}_{57}\text{H}_{110}\text{O}_6$ is :

$$2\text{C}_{57}\text{H}_{110}\text{O}_6(\text{s}) + 163\text{O}_2(\text{g}) \rightarrow 114\text{CO}_2(\text{g}) + 110 \text{H}_2\text{O}(\text{l})$$
- (1) 495 g (2) 490 g (3) 890 g (4) 445 g
3. An organic compound is estimated through Dumas method and was found to evolve 6 moles of CO_2 , 4 moles of H_2O and 1 mole of nitrogen gas. The formula of the compound is
- (1) $\text{C}_{12}\text{H}_8\text{N}$ (2) $\text{C}_{12}\text{H}_8\text{N}_2$
(3) $\text{C}_6\text{H}_8\text{N}$ (4) $\text{C}_6\text{H}_8\text{N}_2$
4. The percentage composition of carbon by mole in methane is :
- (1) 80% (2) 25%
(3) 75% (4) 20%
5. For a reaction,

$$\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g}) ;$$
 identify dihydrogen (H_2) as a limiting reagent in the following reaction mixtures.
- (1) 14g of N_2 + 4g of H_2
(2) 28g of N_2 + 6g of H_2
(3) 56g of N_2 + 10g of H_2
(4) 35g of N_2 + 8g of H_2
6. What would be the molality of 20% (mass/mass) aqueous solution of KI?
(molar mass of KI = 166 g mol^{-1})
- (1) 1.08 (2) 1.48
(3) 1.51 (4) 1.35
7. At 300 K and 1 atmospheric pressure, 10 mL of a hydrocarbon required 55 mL of O_2 for complete combustion and 40 mL of CO_2 is formed. The formula of the hydrocarbon is :
- (1) C_4H_8 (2) $\text{C}_4\text{H}_7\text{Cl}$
(3) C_4H_{10} (4) C_4H_6
8. The minimum amount of $\text{O}_2(\text{g})$ consumed per gram of reactant is for the reaction :
- (Given atomic mass : Fe = 56, O = 16, Mg = 24, P = 31, C = 12, H = 1)
- (1) $\text{C}_3\text{H}_8(\text{g}) + 5 \text{O}_2(\text{g}) \rightarrow 3 \text{CO}_2(\text{g}) + 4 \text{H}_2\text{O}(\text{l})$
(2) $\text{P}_4(\text{s}) + 5 \text{O}_2(\text{g}) \rightarrow \text{P}_4\text{O}_{10}(\text{s})$
(3) $4 \text{Fe}(\text{s}) + 3 \text{O}_2(\text{g}) \rightarrow 2 \text{Fe}_2\text{O}_3(\text{s})$
(4) $2 \text{Mg}(\text{s}) + \text{O}_2(\text{g}) \rightarrow 2 \text{MgO}(\text{s})$
9. 5 moles of AB_2 weigh $125 \times 10^{-3} \text{ kg}$ and 10 moles of A_2B_2 weigh $300 \times 10^{-3} \text{ kg}$. The molar mass of A (M_A) and molar mass of B (M_B) in g mol^{-1} are :
- (1) $M_A = 50 \times 10^{-3}$ and $M_B = 25 \times 10^{-3}$
(2) $M_A = 25 \times 10^{-3}$ and $M_B = 50 \times 10^{-3}$
(3) $M_A = 5 \times 10^{-3}$ and $M_B = 10 \times 10^{-3}$
(4) $M_A = 10 \times 10^{-3}$ and $M_B = 5 \times 10^{-3}$
10. 25 g of an unknown hydrocarbon upon burning produces 88 g of CO_2 and 9 g of H_2O . This unknown hydrocarbon contains.
- (1) 20g of carbon and 5 g of hydrogen
(2) 24g of carbon and 1 g of hydrogen
(3) 18g of carbon and 7 g of hydrogen
(4) 22g of carbon and 3 g of hydrogen

SOLUTION

1. **Ans. (2)**

$$2\text{CO}_2 \quad \text{moles of CO}_2 = \frac{0.25 \times 10^{-3}}{25} = 10^{-5}$$

$$\text{moles of NaHCO}_3 = 10^{-5} \text{ mol}$$

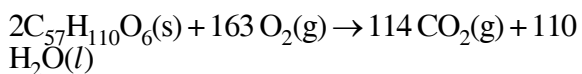
$$\text{mass of NaHCO}_3 = 10^{-5} \times 84 \text{ gm}$$

$$\% \text{ of NaHCO}_3 = \frac{84 \times 10^{-5}}{10 \times 10^{-3}} = 100$$

$$= 8.4\%$$

2. **Ans. (1)**

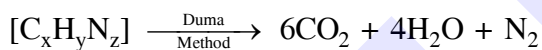
$$\text{moles of C}_{57}\text{H}_{110}\text{O}_6(\text{s}) = \frac{445}{890} = 0.5 \text{ moles}$$



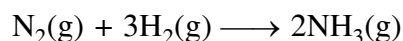
$$n_{\text{H}_2\text{O}} = \frac{110}{4} = \frac{55}{2}$$

$$m_{\text{H}_2\text{O}} = \frac{55}{2} \times 18$$

$$= 495 \text{ gm}$$

3. **Ans. (4)**Hence, $\text{C}_6\text{H}_8\text{N}_2$ 4. **Ans. (4)**

$$\begin{aligned} \% \text{ by mole of carbon} &= \frac{1 \text{ mol atom}}{5 \text{ mol atom}} \times 100 \\ &= 20\% \end{aligned}$$

5. **Ans. (3)**

$$(1) \begin{array}{cc} 0.5 \text{ mol} & 2 \text{ mol} \\ \text{(LR)} & \end{array}$$

$$(2) \begin{array}{cc} 1 \text{ mol} & 3 \text{ mol} \\ & \text{(completion)} \end{array}$$

$$(3) \begin{array}{cc} 2 \text{ mol} & 5 \text{ mol} \\ \text{(LR)} & \end{array}$$

$$(4) \begin{array}{cc} 1.25 \text{ mol} & 4 \text{ mol} \\ \text{(LR)} & \end{array}$$

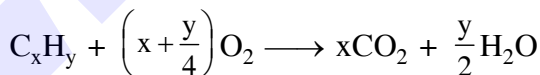
 \therefore Ans.(3)6. **Ans. (3)**

$$\frac{w}{w} \% = 20$$

100 gm solution has 20 gm KI

80 gm solvent has 20 gm KI

$$m = \frac{\frac{20}{166}}{\frac{80}{1000}} = \frac{20 \times 1000}{166 \times 80} = 1.506 \approx 1.51 \text{ mol/kg}$$

7. **Ans. (4)**

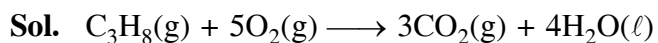
$$\begin{array}{ccc} 10 & 10\left(x + \frac{y}{4}\right) & 10x \end{array}$$

$$\text{By given data, } 10\left(x + \frac{y}{4}\right) = 55 \quad \dots (1)$$

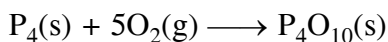
$$10x = 40 \quad \dots (2)$$

$$\therefore x = 4, y = 6 \Rightarrow \text{C}_4\text{H}_6$$

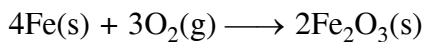
8. Ans. (3)



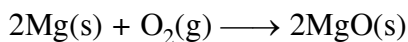
Each 1g of C_3H_8 requires 3.63 g of O_2



Each 1g of P_4 requires 1.29 g of O_2



Each 1g of Fe requires 0.428 g of O_2



Each 1g of Mg requires 0.66 g of O_2

therefore least amount of O_2 is required in option (3).

9. Ans. (3)

$$5[M_A + 2M_B] = 125$$

$$M_A + 2M_B = 25 \quad \dots(1)$$

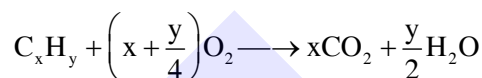
$$2M_A + 2M_B = 30 \quad \dots(2)$$

from eq. (1) & (2)

$$M_A = 5$$

$$M_B = 10$$

10. Ans. (2)



$$\left(\frac{25}{M}\right) \qquad \qquad \qquad x \times \frac{25}{M} \qquad \frac{y}{2} \times \frac{25}{M}$$

$$\qquad \qquad \qquad \qquad \qquad \qquad = 2 \qquad \qquad = 0.5$$

C $x \times \frac{25}{M} = 2$

H $y \times \frac{25}{M} = 1$

$$C_{2y}H_y \equiv 24y \text{ gm C} + y \text{ gm H}$$

or

24 : 1 ratio by mass