

Topic : Mole Concept
Type of Questions

Single choice Objective ('-1' negative marking) Q.1,2,3,5

(3 marks, 3 min.)

M.M., Min.

[12, 12]

Multiple choice objective ('-1' negative marking) Q.4,6

(4 marks, 4 min.)

[8, 8]

Subjective Questions ('-1' negative marking) Q.7

(4 marks, 5 min.)

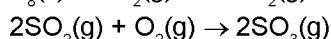
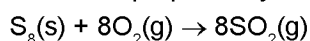
[4, 5]

Comprehension ('-1' negative marking) Q.8 to 10

(3 marks, 3 min.)

[9, 9]

1. Sulphur trioxide is prepared by the following two reactions :


 How many grams of SO_3 are produced from 1 mole of S_8 :

- (A) 1280 (B) 640 (C) 960 (D) 320

2. 3L of
- N_2
- gas are mixed with 6L of
- H_2
- gas to form
- NH_3
- gas. What volume of
- NH_3
- gas can be produced, if all volumes are measured under same temperature and pressure conditions :

- (A) 6L (B) 4L (C) 9L (D) 2L

3. Zinc and hydrochloric acid react according to the reaction :


 If 0.30 mole of Zn are added to hydrochloric acid containing 0.52 mole HCl, how many moles of H_2 are produced:

- (A) 0.26 (B) 0.52 (C) 0.14 (D) 0.30

- 4.* 3 moles of gas
- C_2H_6
- are mixed with 60 g of this gas and
- 2.4×10^{24}
- molecules of the gas are then removed. The left over gas is burnt in the presence of excess oxygen.

 Then : ($N_A = 6 \times 10^{23}$) (Density of water = 1g/mL)

- (A) 2 moles of
- C_2H_6
- are left for combustion.
-
- (B) Volume of
- CO_2
- at S.T.P. produced after combustion is 44.8 litre.
-
- (C) Volume of liquid water produced is 54 mL.
-
- (D) None of these

5. 3.68 g of a mixture of
- CaCO_3
- and
- MgCO_3
- is heated to liberate 0.04 mole of
- CO_2
- . The mole % of
- CaCO_3
- and
- MgCO_3
- in the mixture is respectively :

- (A) 50%, 50% (B) 60%, 40% (C) 40%, 60% (D) 30%, 70%

- 6.* Amongst the following, select the
- false**
- statements :

- (A) Limiting reagent must have the least moles among all the reactants available in a chemical reaction.
-
- (B) If equal masses of aluminium and oxygen are made to combine to produce
- Al_2O_3
- , then aluminium will be the limiting reagent.
-
- (C) A 2 : 3 molar ratio mixture of
- Na_2CO_3
- and
- MgCO_3
- produces 0.3 mole of
- CO_2
- per mole of the initial mixture upon strong heating.
-
- (D) All of these

7. 120 g Mg was burnt in air to give a mixture of
- MgO
- and
- Mg_3N_2
- . The mixture is now dissolved in HCl to form
- MgCl_2
- and
- NH_4Cl
- . If 107 grams
- NH_4Cl
- is produced, then determine the moles of
- MgCl_2
- formed.

Comprehension # (Q. 8 to Q. 10)

For a reaction :



Three students stated different ways of determining limiting reagent.

Student 1 : Calculate the minimum moles of 'A' needed to completely consume 'B', and if available amount of 'A' exceeds what is needed, then 'B' is limiting reagent, otherwise 'A' will be limiting reagent.

Student 2 : Calculate the mole ratio (ratio of moles of the reactants initially taken) of reactant, then compare it with theoretical mole ratio (according to stoichiometry of the reaction). If the theoretical ratio exceeds ratio of moles actually taken, then reactant in denominator will be limiting reagent.

Student 3 : Calculate the amount of product (any one of the product) that can be obtained if each reactant is completely consumed and that reactant is limiting reagent, which has produced least mass of product.

8. Which student(s) has/have defined limiting reagent correctly :
- (A) Student – 1 (B) Student – 2
(C) Student – 3 (D) All are correct
9. If student 1 in first experiment finds that, when 1 mole of 'A' reacted with excess of reagent 'B' and in second experiment when 1 mole of 'B' reacted with excess of reagent 'A', then in the later experiment, mass of the product produced was greater. Then which should be the limiting reagent :
- (A) A (B) B
(C) None of these (D) Cannot be predicted
10. If initially 'x' moles of 'A' are taken with 'y' moles of 'B', which of the following is correct :
- (i) If $\frac{a}{b} = \frac{x}{y}$, then no reactant is left over
- (ii) If $\frac{a}{b} > \frac{x}{y}$, then 'B' reactant is limiting reagent
- (iii) If $\frac{a}{b} < \frac{x}{y}$, then 'B' is limiting reagent
- (iv) If $\frac{x}{y} > \frac{a}{b}$, then 'A' is limiting reagent.
- (A) i & iv (B) i & iii (C) Only i (D) i , ii & iv

Answer Key

DPP No. # 5

- | | | | | | | | | | |
|-----|-------|----|-----|----|-----|-----|-------|-----|-----|
| 1. | (B) | 2. | (B) | 3. | (A) | 4.* | (B,C) | 5. | (A) |
| 6.* | (A,C) | 7. | 5 | 8. | (D) | 9. | (A) | 10. | (B) |

Hints & Solutions

DPP No. # 5

- For Ist reaction $\frac{\text{Mole of S}_8}{1} = \frac{\text{Mole of SO}_2}{8}$
 $\text{Mole of SO}_2 = \frac{1 \times 8}{1} = 8$
 For IInd reaction $\frac{\text{Mole of SO}_2}{2} = \frac{\text{Mole of SO}_3}{2} = 8$
 $\text{wt of SO}_3 = 8 \times 80 = 640 \text{ g.}$
- $$\begin{array}{ccc} \text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) & \longrightarrow & 2\text{NH}_3(\text{g}) \\ \text{Vol.} & \begin{array}{cc} 3 & 6 \end{array} & \\ \text{L.R.} & \frac{6 \times 2}{3} = 4 \text{ L.} & (\because V \propto n) \end{array}$$
- LR $\rightarrow$ HCl, so $\text{Mole of H}_2 = \frac{\text{Mole of HCl}}{2} = \frac{0.52}{2} = 0.26$
- *

Moles of $\text{C}_2\text{H}_6 = 3$

moles of C_2H_6 mixed = $\frac{60}{30} = 2$

total mole of $\text{C}_2\text{H}_6 = 5$

moles removed = $\frac{2.4 \times 10^{24}}{6 \times 10^{23}} = 4$

$\therefore$ moles of C_2H_6 left = 1

Now, $\text{C}_2\text{H}_6 + 7/2 \text{ O}_2 \longrightarrow 2\text{CO}_2 + 3\text{H}_2\text{O}$

clearly 3 moles of H_2O or 54 gm H_2O will be formed

volume of $\text{H}_2\text{O} = 54 \text{ ml}$ **Ans. 54**

5. Let the mass of $\text{CaCO}_3 = x$ g
then, mass of $\text{MgCO}_3 = (3.68 - x)$ g

$$\text{moles of CaCO}_3 = \frac{x}{100}$$

$$\text{moles of MgCO}_3 = \frac{3.68 - x}{84}$$

Applying POAC for C-atoms

$$\frac{x}{100} + \frac{3.68 - x}{84} = 0.04$$

$$x = 2 \text{ g}$$

$$\therefore n_{\text{CaCO}_3} = \frac{2}{100} = 0.02 \text{ and } n_{\text{MgCO}_3} = \frac{1.68}{84} = 0.02$$

$$\therefore \text{mole \% of CaCO}_3 = \frac{0.02}{0.04} \times 100 = 50\%$$

$$\therefore \text{mole \% of MgCO}_3 = \frac{0.02}{0.04} \times 100 = 50\%$$

- 6.* (A) Limiting reagent may neither have the least mass nor the least moles among all the reactants available in a chemical reaction.



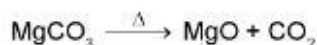
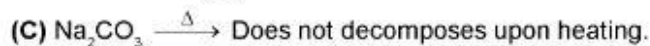
$$\text{Mass} \quad m \quad m$$

$$\text{Mole} \quad \left(\frac{m}{27}\right) \quad \left(\frac{m}{32}\right)$$

$$\frac{\text{mole}}{\text{st. coeff.}} \quad \frac{m}{27 \times 4} \quad \frac{m}{32 \times 3}$$

$$\left(= \frac{m}{108}\right) \quad \left(= \frac{m}{96}\right)$$

(LR)



$$\frac{3}{5} \times 1 \text{ mole} \quad \frac{3}{5} \times 1 \text{ mole}$$

$$\text{So, moles of CO}_2 \text{ produced} = \frac{3}{5} \times 1 = 0.6 \text{ mole.}$$



$$a \quad a \quad (5 - a) \quad \frac{(5 - a)}{3}$$



$$a \quad a \quad \frac{5 - a}{3} \quad \frac{2(5 - a)}{3} \quad (5 - a)$$

$$\therefore \text{Total moles of MgCl}_2 = a + (5 - a) = 5 \text{ moles}$$

Alternatively :

Apply POAC on Mg



$$5 \text{ moles} \quad x \text{ moles}$$

$$1 \times 5 = x \times 1 \quad \Rightarrow \quad x = 5 \text{ moles}$$