

7th class.

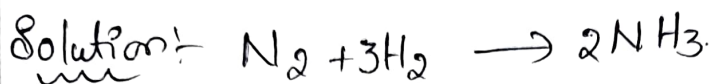
IIT Advanced.

Stoichiometric Calculations

Weight - Volume & Volume - Volume Relationship

Teaching Task

Q1) Ans:- 3.



For 1 mole N_2 , '3' moles of H_2 required.

<u>N_2</u>	mole	weight	
	1	28	
	x	2.8	$\Rightarrow 28x = 2.8$
			$x = \frac{2.8}{28} = 0.1 \text{ moles.}$

Relation b/w N_2 & H_2

N_2	H_2
1	3.
0.1	x

$$x = 3 \times 0.1 = 0.3 \text{ moles.}$$

1 mole of any gas at NTP, occupies 22.4 litres.

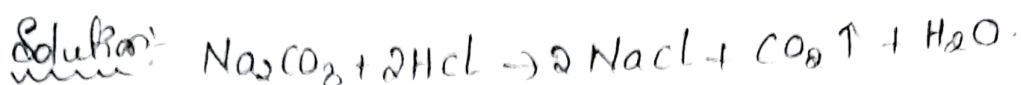
$$1 \text{ mole} \rightarrow 22.4 \text{ litres.}$$

$$0.3 \rightarrow x$$

$$x = 22.4 \times 0.3.$$

$$= 6.72 \text{ litres}$$

Q2) Ans:- 2



For 1 mole Na_2CO_3 , 1 mole ' CO_2 ' liberated.

Na_2CO_3 :-

$$\begin{array}{rcl} 1 \text{ mole} & \rightarrow & 106 \text{ gms.} \\ x & \rightarrow & 2.12 \text{ gms} \end{array}$$

$$106x = 2.12$$

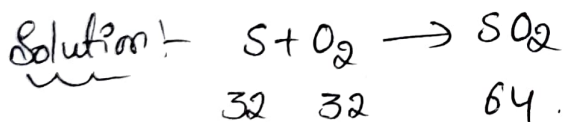
$$x = \frac{2.12}{106} = 0.02 \text{ moles.}$$

For 0.02 Na_2CO_3 , 0.02 moles of ' CO_2 ' liberated

$$\begin{array}{rcl} 1 \text{ mole} & \rightarrow & 22.4 \text{ litres} \\ 0.02 \text{ moles} & \rightarrow & x \end{array}$$

$$x = 22.4 \times 0.02 = 0.448 \text{ litres}$$

Q3) Ans:- 2



For 32 gms ' S ', 32 gms of O_2 consumed.

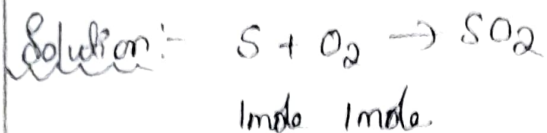
32 gms of ' S ', O_2 occupies 22.4 litres

$$\begin{array}{rcl} 32 & \rightarrow & 22.4 \text{ litres} \\ 2 & \rightarrow & x \end{array}$$

$$32x = 2 \times 22.4$$

$$x = \frac{2 \times 22.4}{32} = \frac{22.4}{16}$$

Q4) Ans:- 3.



For 1 mole 'S', 1mole 'O₂' required.

For 1.5 moles 'S', 1.5 moles of 'O₂' required.

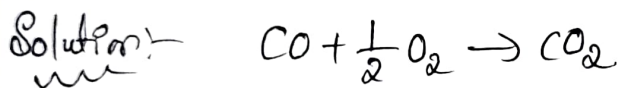
Volume:-

$$1 \text{ mole} \rightarrow 22.4.$$

$$1.5 \text{ moles} \rightarrow x$$

$$x = 1.5 \times 22.4 = 33.6$$

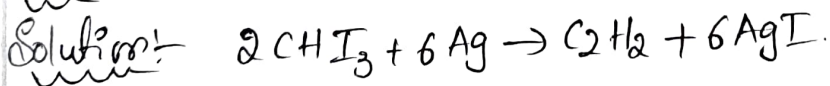
Q5) Ans:- 2.



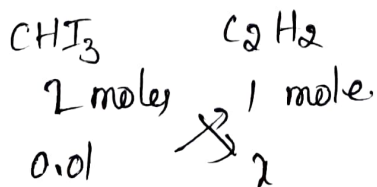
For 1 mole 'CO' $\rightarrow$ 1mole 'CO₂' formed

CO $\rightarrow$ 11.27 litres means 11.27 litres of CO₂ formed

Q6) Ans:- 2



2 moles of iodoform produces 1mole of acetylene



$$\Rightarrow x = 0.01 \\ x = 0.005 \text{ moles.}$$

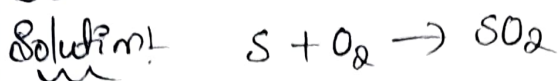
Volume:-

$$1 \text{ mole} \rightarrow 22.4 \text{ litres}$$

$$0.005 \text{ moles} \rightarrow x$$

$$\Rightarrow x = 0.112 \text{ litres} \\ = 112 \text{ mL.}$$

Q7b Ans:- 3



1 mole 'S' $\rightarrow$ 1 mole 'O₂' required.

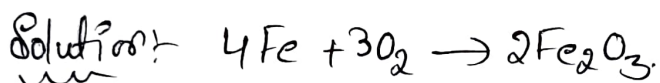
1.5 mole 'S' $\rightarrow$ 1.5 moles of 'O₂'

Volume:- 1 mole $\rightarrow$ 22.4 litres

1.5 moles $\rightarrow x$

$$x = 1.5 \times 22.4 = 33.6 \text{ litres.}$$

Q8b Ans:- 3



O₂ $\rightarrow$ 5.6 litres means 0.25 moles.

$$\begin{array}{ccc} Fe & O_2 \\ 4 & 3 \\ x & 0.25 \end{array} \Rightarrow 3x = 1 \Rightarrow x = \frac{1}{3} = 0.33 \text{ moles.}$$

F81 0.25 moles of 'O₂' $\rightarrow$ 0.33 moles of 'Fe' required

But Fe is only 5.6g. So Fe is limiting reagent

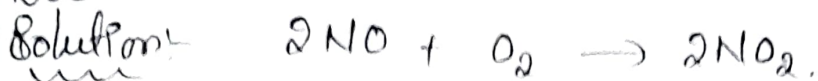
Fe:-

$$\begin{array}{ccc} 1 \text{ mole} & \rightarrow & 56 \text{ gm} \\ x & \rightarrow & 5.6 \text{ gm} \end{array} \Rightarrow 56x = 5.6 \Rightarrow x = 0.1 \text{ mole.}$$

Relation b/w Fe & Fe₂O₃.

$$\begin{array}{ccc} Fe & Fe_2O_3 \\ 4 & 2 \\ 0.1 & x \end{array} \Rightarrow 4x = 2 \times 0.1 \Rightarrow x = \frac{0.2}{4} = 0.05 \text{ moles.}$$

Q9) Ans:- 2.



For 2 moles NO $\rightarrow$ 1 mole $\text{O}_2 \rightarrow$ 2 moles NO_2

NO	O_2	NO_2
2×22.4 litres	22.4 litres	2×22.4 litres
20ml	10ml	20ml

Q10) Ans:- 3.



1 mole 1 mole 2 moles

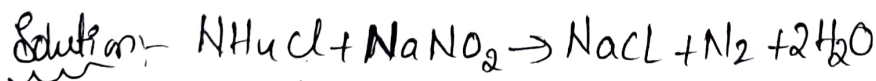
10ml of H_2 react with 10ml of Cl_2 to produce 20ml of HCl .

But Cl_2 they 12.5ml $\rightarrow$ It is excess reagent

Only 10ml of Cl_2 used, remaining 2.5ml of Cl_2

Advanced Level

Q11) Ans:- B, C, D



1 mole 1 mole

0.5 moles 0.5 moles

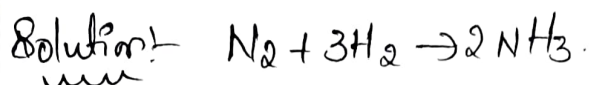
$\downarrow$
Excess reagent

For 0.5 moles of $\text{NaNO}_2 \rightarrow$ 0.5 moles of N_2

$\rightarrow$ 11.2 litres volume.

$\rightarrow$ 14gms of gas

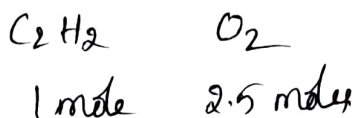
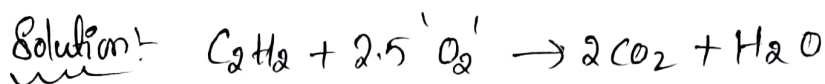
Q12) Ans:- A



1 volume of N_2 , 3 volumes of H_2 , 2 volume of NH_3 .

$N_2 : H_2$ is 1:3, which is a simple ratio.

Q13) Ans:- 2



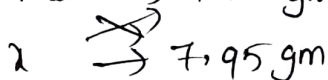
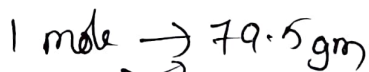
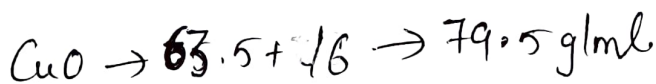
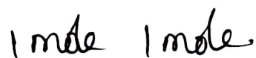
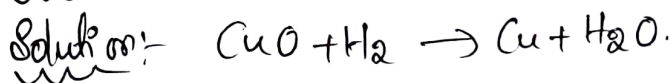
$22400 \text{ ml} \rightarrow 2.5 \times 22400 \text{ ml}$

$70 \xrightarrow{\times} x$

$22400 x = 2.5 \times 70 \times 22400$

$x = 175 \text{ ml}$

Q14) Ans:- 1



$79.5 x = 79.5 \Rightarrow x = 0.1 \text{ moles}$

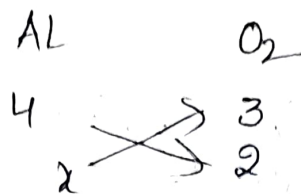
H_2 volume



$\Rightarrow x = 2.24 \text{ litres}$

Q15) Ans:- 4

Solution:-



$$8 = 3x$$

$$x = \frac{8}{3} = 2.66 \text{ mder}$$

Al:-

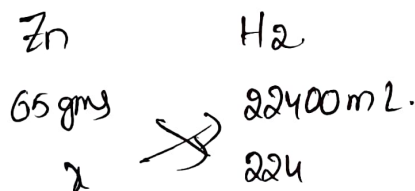
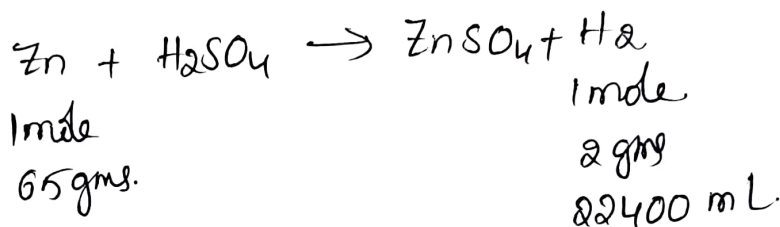
$$1 \text{ mde} \rightarrow 27 \text{ gms.}$$

$$2.66 \text{ mder} \rightarrow x$$

$$\Rightarrow x = 27 \times 2.66 = 72 \text{ gms.}$$

Q16) Ans:- 2

Solution:-

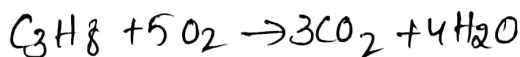


$$22400 x = 65 \times 224$$

$$x = \frac{65 \times 224}{22400} = 0.65 \text{ gms}$$

Q17) Ans:- 2

Solution:-



$$44 \text{ gms} \quad 5 \times 22.4 \text{ litres}$$

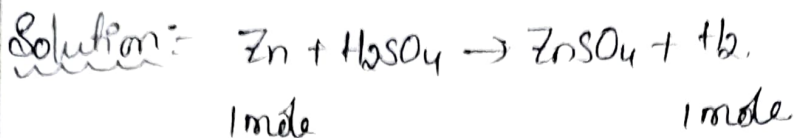
$$2.2 \text{ gms} \rightarrow x$$

$$44x = 5 \times 22.4 \times 2.2$$

$$x = \frac{5 \times 22.4 \times 2.2}{44} = 5.6 \text{ litres.}$$

Integer Type.

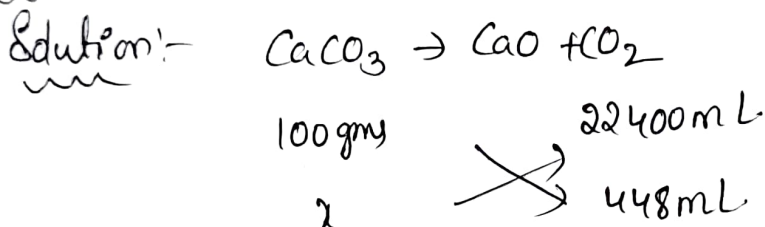
Q18) Ans:- 2



$$\begin{array}{ccc} \text{Zn} & & \text{H}_2 \\ 1 \text{ mole} & & 22.4 \text{ litres} \\ x & \nearrow & 44.8 \text{ litres} \\ 22.4x = 44.8 \end{array}$$

$$x = \frac{44.8}{22.4} \times 2 = 2 \text{ moles}$$

Q19) Ans:- 2



$$x(22400 \text{ mL}) = 44800$$

$$x = \frac{44800}{22400} \times 2 = 2 \text{ gms}$$

For 2 gms of CaCO_3 , 448 mL of CO_2 produced.

Purity:- Given sample mass = 10 gm

Pure CaCO_3 in the sample = 2 gms.

$$\text{Purity \%} = \frac{2}{10} \times 100 = 20\%$$

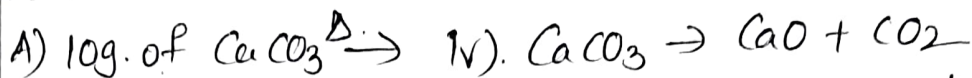
$$10x = 2 \times 10$$

$$x = 2$$

Matrix Matching

Q20) Ans:- A.

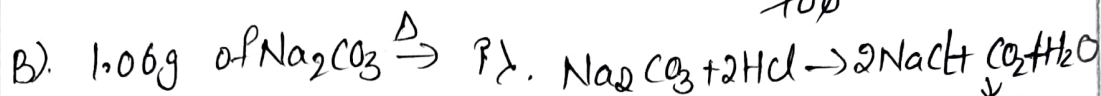
Solution:-



$$\begin{array}{ccc} 100 \text{ gms} & & 22.4 \text{ litres} \\ 10 \text{ gms} & \searrow & x \end{array}$$

$$100x = 10 \times 22.4 \text{ litres}$$

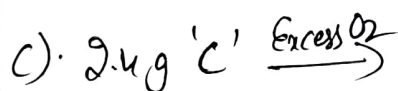
$$x = \frac{10 \times 22.4}{100} = 2.24 \text{ litres.}$$



$$\begin{array}{ccc} 106 \text{ gms} & & 22.4 \text{ litres} \\ 1.06 \text{ gms} & \searrow & x \end{array}$$

$$106x = 22.4 \text{ litres}$$

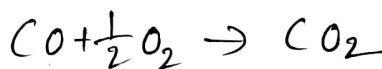
$$x = 0.224 \text{ litres}$$



$$\begin{array}{ccc} 12 \text{ gms} & & 22.4 \text{ litres.} \\ 2.4 \text{ gms} & \searrow & x \end{array}$$

$$12x = 22.4 \times 2.4$$

$$x = \frac{22.4 \times 2.4}{12} = 4.48 \text{ L}$$



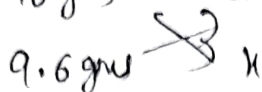
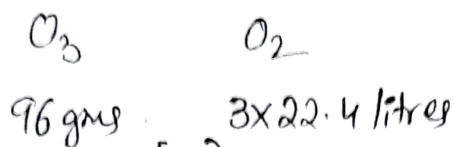
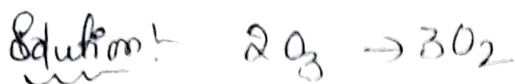
$$\begin{array}{ccc} 28 \text{ gms} & & 22.4 \text{ litres} \\ 0.56 \text{ gms} & \searrow & x \end{array}$$

$$28x = 0.56 \times 22.4$$

$$x = \frac{0.56 \times 22.4}{28} = 0.448 \text{ L}$$

learners Task

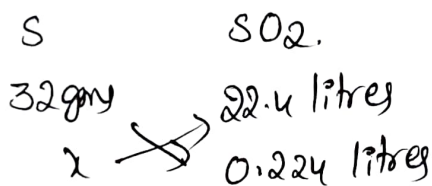
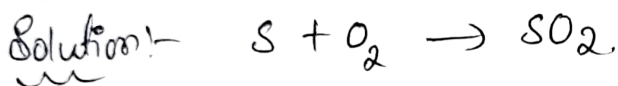
Q1) Ans:- 4.



$$96x = 3 \times 22.4 \times 9.6$$

$$x = \frac{3 \times 22.4 \times 9.6}{96} = 3 \times 2.24 = 6.72 \text{ litres}$$

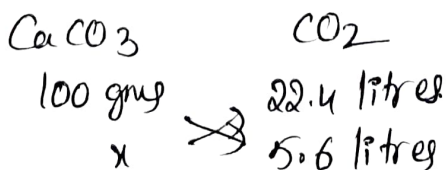
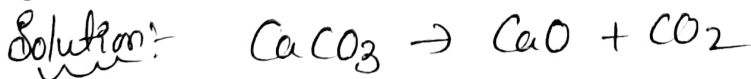
Q2) Ans:- 2.



$$22.4x = 32 \times 0.224$$

$$x = \frac{32 \times 0.224}{22.4} = 0.32 \text{ gms}$$

Q3) Ans:- 3.

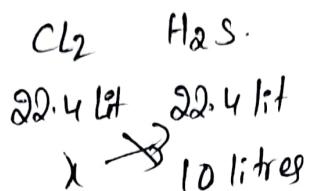
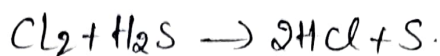


$$22.4x = 5.6 \times 100$$

$$x = \frac{5.6 \times 100}{22.4} = 25 \text{ gms}$$

Q4) Ans:- 3.

Solution:-

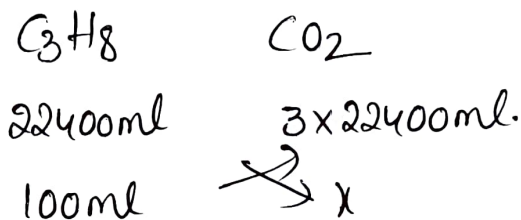
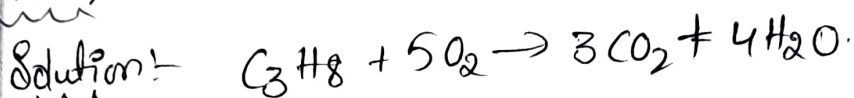


$$22.4x = 22.4 \times 10$$

$$x = 10 \text{ litres}$$

Q5) Ans:- 3.

Solution:-



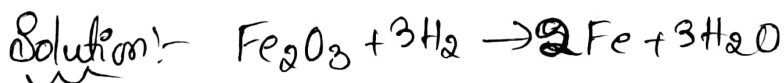
$$22400x = 3 \times 22400 \times 100$$

$$x = 300 \text{ ml}$$

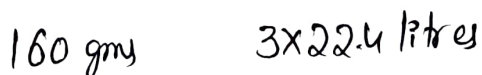
$$= 300 \text{ cm}^3$$

Q6) Ans:- 1

Solution:-

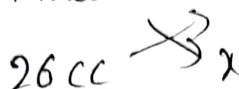
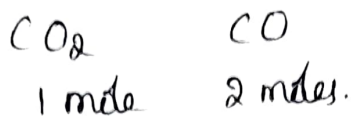


$$\text{Fe}_2\text{O}_3 = 2 \times 56 + 48 = 160 \text{ gms}$$



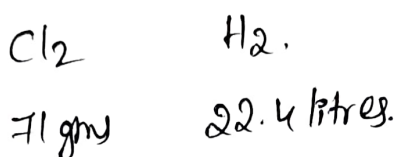
volume = $3 \times 22.4 \text{ litres}$ of H_2 gas.

Q7)

Ans:- 4Solution:-

$$x = 2 \times 26 = 52 \text{ cc}$$

Q8)

Ans:- 1Solution:-

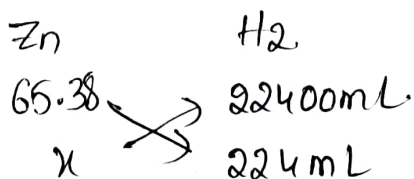
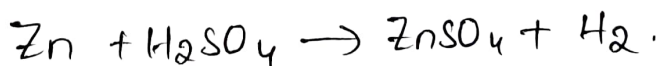
$$100 \text{ mg} = 0.1 \text{ gms}$$

$$2x = 0.1 \times 22.4 = \frac{2.24 \text{ litres of } \text{Cl}_2}{2}$$

$$= 1.12 \text{ litres of } \text{Cl}_2$$

$$= 1120 \text{ mL.}$$

Q9)

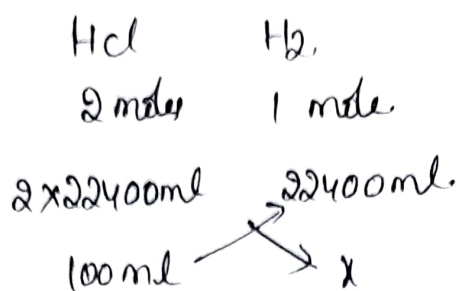
Ans:- 1Solution:-

$$22400 x = 224 \times 65.38$$

$$x = \frac{224 \times 65.38}{22400} = 0.653 \text{ gms}$$

Q10) Ans:- 4.

Solution:- $2\text{HCl} \rightarrow \text{H}_2 + \text{Cl}_2$



$$2 \times 22400 x = 22400 \times 100$$

$$x = \frac{100}{2} = 50 \text{ ml}$$

JEE Main Level Questions

Q11) Ans:- 2.

Solution:- $\text{CO} + \frac{1}{2}\text{O}_2 \rightarrow \text{CO}_2$

22.4 litres 11.2 litres 22.4 litres

CO O₂ CO₂

1 mole 0.5 mole 1 mole

2 litres 1 litre 2 litres

Q12) Ans:- 4.

Solution:- $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$

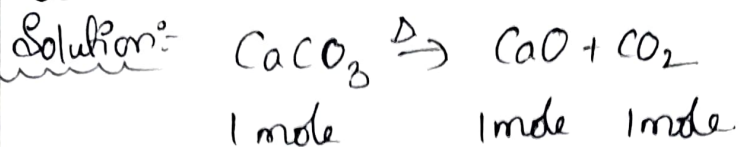
2 × 22400 ml 22400 ml

Given 26 ml of H₂ & 24 ml of O₂

For 26 ml of H₂ 13 ml of O₂ used.

Remaining O₂ = 24 - 13 = 11 ml.

Q13) Ans:- 2.



$$\text{CaCO}_3 = 40 + 12 + 48 = 100 \text{ gms}$$



100 gms 22.4 litres.
 $\frac{80 \times x}{100} \rightarrow 11.2 \text{ litres}$

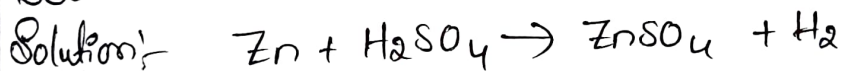
$$\frac{80}{100} \times 22.42 = 100 \times 11.2$$

$$x = \frac{100 \times 11.2}{22.42} \times \frac{100}{80} = \frac{500}{8} 62.5 \text{ gms.}$$

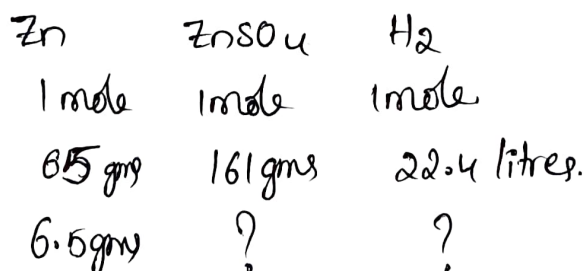
For 100% purity 50 gms

For 80% purity 62.5 gms of CaCO_3 .

Q14) Ans:- 2



Given: $\text{Z} = 6.5 \text{ gms}$



Weight of ZnSO_4 :-

$$\begin{array}{r} 65 \rightarrow 161 \\ 6.5 \rightarrow x \end{array}$$

$$65x = 161 \times 6.5$$

$$x = \frac{161 \times 6.5}{65} = 16.1 \text{ gms}$$

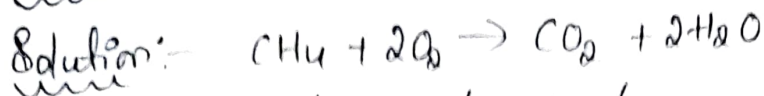
Volume of H_2

Zn H_2
 65 22.4 litres
 6.5 x

$$65x = 22.4 \times 6.5 \quad 0.1$$

$$= 2.24 \text{ litres.}$$

Q15) Ans:- 2.



1 mole 2 moles 1 mole.

22.4 L 44.8 L 22.4 L.

CH_4 O_2

1 2.

5 ml $\rightarrow$ x ml.

x = 10 ml.

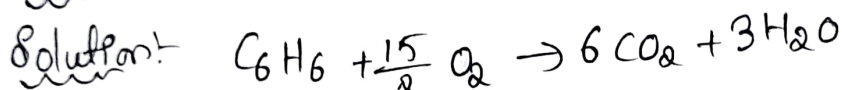
CH_4 CO_2 .

1 mole $\rightarrow$ 1 mole.

5 ml $\rightarrow$ x

x = 5 ml.

Q16) Ans:- 1



1 mole $\frac{15}{2}$ moles.

$$\text{C}_6\text{H}_6 \rightarrow (6 \times 12) + 6(1) = 72 + 6 = 78 \text{ gms.}$$

C_6H_6 O_2 .

78 $\rightarrow \frac{15}{2} \times 22.4$ litres

39 $\rightarrow$ x

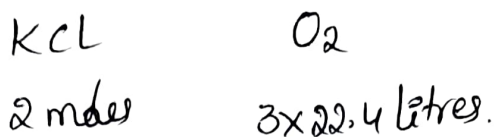
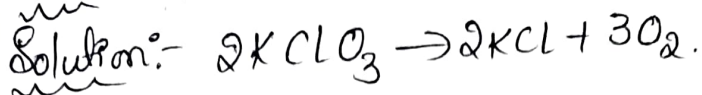
$$78x = 39 \times \frac{15}{2} \times 22.4$$

$$x = \frac{39 \times 15 \times 22.4}{2 \times 78} = \frac{7.5 \times 11.2}{1 \times 1}$$

$$= 7.5 \times 11.2$$

$$= 84 \text{ litres}$$

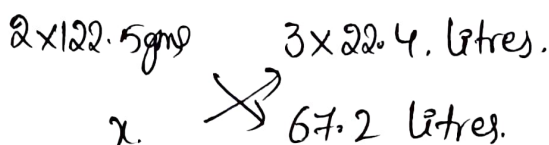
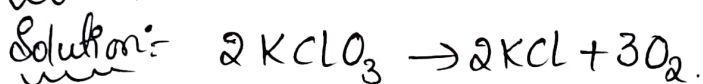
Q17) Ans:- 2



$$67.2x = 1.12 \times 74.5 \times 2$$

$$x = \frac{83.44 \times 2}{67.2} = 1.24 \times 2$$
$$= 248 \text{ gms.}$$

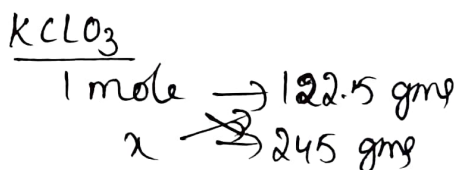
Q18) Ans:- 4



$$3 \times 22.4 x = 2 \times 122.5 \times 67.2$$

$$x = \frac{2 \times 122.5 \times 67.2}{3 \times 22.4}$$

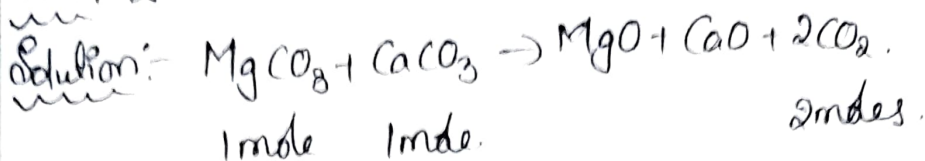
$$x = 245 \text{ gms.}$$



$$x = \frac{245}{122.5} \times 2 = 2 \text{ moles}$$

$$\begin{aligned} \text{KClO}_3 &= 39 + 35.5 + 48 \\ &= 122.5 \text{ gms.} \end{aligned}$$

Q19) Ans: 2



$$\text{MgCO}_3 \rightarrow 24 + 12 + 48 = 84 \text{ gms.}$$

$$\text{CaCO}_3 \rightarrow 40 + 12 + 48 = 100 \text{ gms.}$$

MgCO_3	CaCO_3
84 gms	$\rightarrow 100 \text{ gms}$
x	$\rightarrow 18.4 - x$

$$84(18.4 - x) = 100x$$

$$1545.6 - 84x = 100x$$

$$1545.6 = 184x$$

$$x = \frac{1545.6}{184} = 8.4 \text{ gms}$$

MgCO_3	CO_2
84 gms	88 gms

mole	MgCO_3
1 $\rightarrow$	84 gms
$x \rightarrow$	84 gms

$$84x = 8.4$$

$$x = \frac{8.4}{84} = 0.1 \text{ mole}$$

For 1 mole $\text{MgCO}_3 \rightarrow 2 \text{ moles CO}_2$ produced

0.1 mole $\rightarrow 0.2 \text{ moles of CO}_2$ produced

$$\begin{aligned}\text{CO}_2 &= 0.2 \times 22.4 \text{ litres} \\ &= 4.48 \text{ litres}\end{aligned}$$

Q20) Ans:- 3.

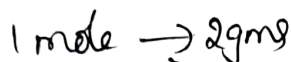
Solution:-



$$32x = 4$$

$$x = \frac{4}{32} = \frac{1}{8} = 0.125 \text{ moles}$$

At STP any gas can occupy 22.4 litres.

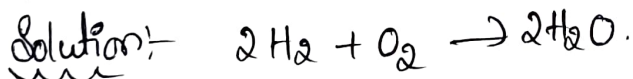


$$x = 2 \times 0.125$$

$$= 0.25 \text{ gms}$$

Advanced level Questions

Q21) Ans:- A, D.

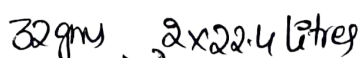
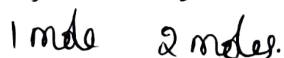


For 4 gms of H₂ $\rightarrow$ 32 gms of O₂ required.

But for 4 gms H₂ $\rightarrow$ 4 gms O₂ given.

So O₂ is limiting reagent

H₂ $\rightarrow$ Excess reagent.



$$32x = 2 \times 22.4 \times 2$$

$$x = \frac{2 \times 22.4}{8}$$

$$= 5.6 \text{ litres}$$

Q22) Ans:- 4

Solution:-



1 mole $\rightarrow$ 16gms

$x \rightarrow 8$ gms

$$16x = 8$$

$$x = \frac{8}{16} = 0.5 \text{ moles}$$



1 mole $\rightarrow$ 28gms

$x \rightarrow 14$ gms

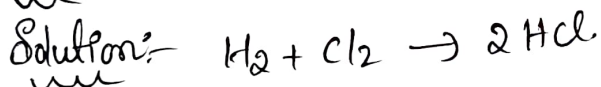
$$x = \frac{28}{14} = 0.5 \text{ moles}$$

0.5 moles of CH₄ + 0.5 moles of N₂ = 1 mole
= 22.4 litres

A $\rightarrow$ Incorrect

R $\rightarrow$ Correct

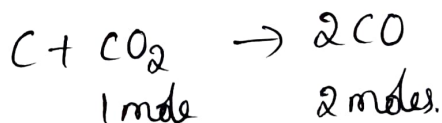
Q23) Ans:- 1



1 : 1 : 2 Ratio

Q24) Ans:- 4

Solution:-



22400ml 44800ml

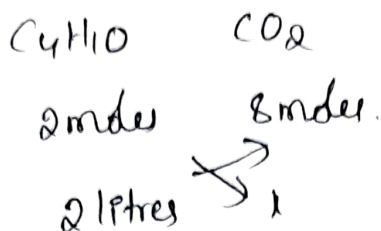
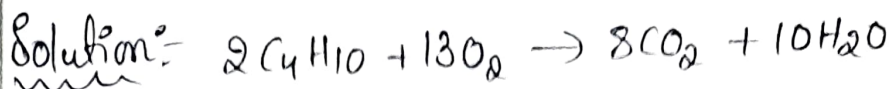
26ml $\times x$

$$22400x = 26 \times 44800$$

$$x = 52 \text{ mL}$$

$$= 52 \text{ C.C}$$

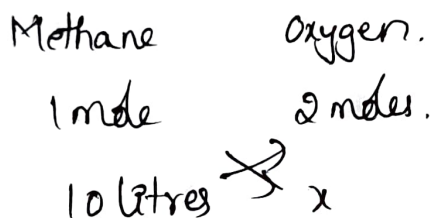
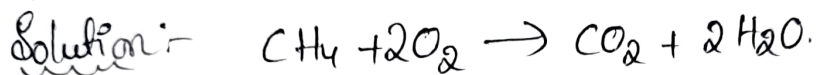
Q25) Ans:- 4



$$2x = 2 \times 8$$

$$x = 8 \text{ lit}$$

Q26) Ans:- 3.

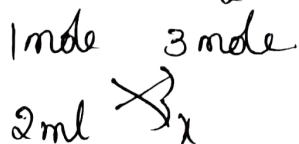
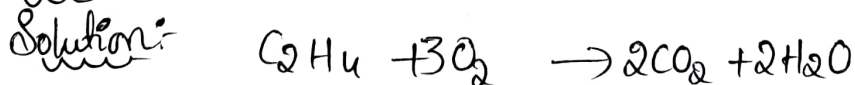


$$x = 2 \times 10 = 20 \text{ litres.}$$

For Combustion of ' CH_4 ' $\rightarrow$ 10 litres,
20 litres of O_2 required.

Integer Type

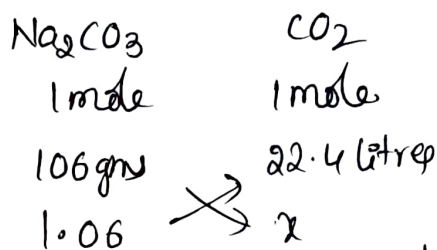
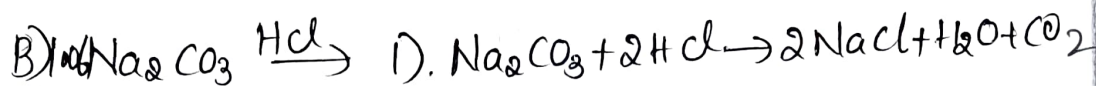
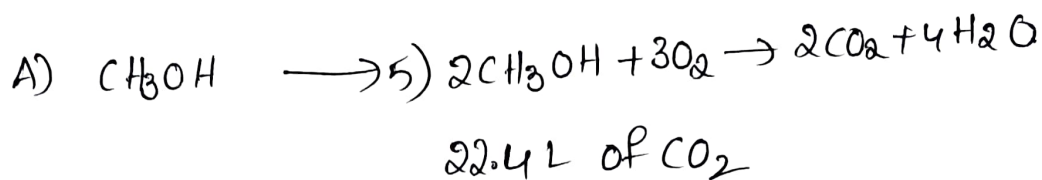
Q27) Ans:- 6.



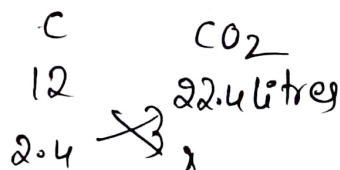
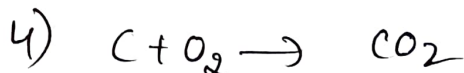
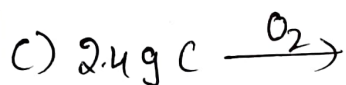
$$x = 3 \times 2 = 6 \text{ mL}$$

Q28) Ans A) Matrix 5 B) 1 C) 4 D) 3.

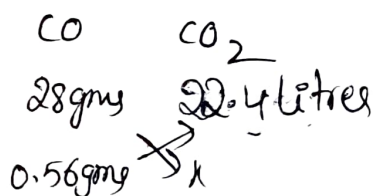
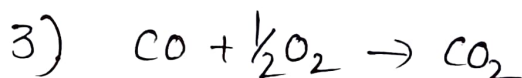
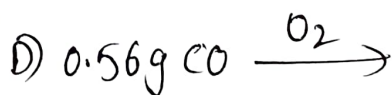
Solution:-



$106x = 22.4 \times 1.06$
 $x = 0.224 \text{ L of } \text{CO}_2$



$12x = 22.4 \times 2.4$
 $x = 2.24 \text{ Litres of } \text{CO}_2$



$28x = 22.4 \times 0.56$
 $x = 0.448 \text{ litres}$