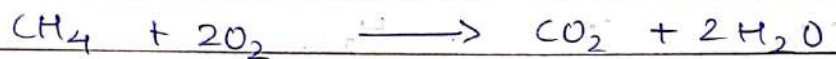


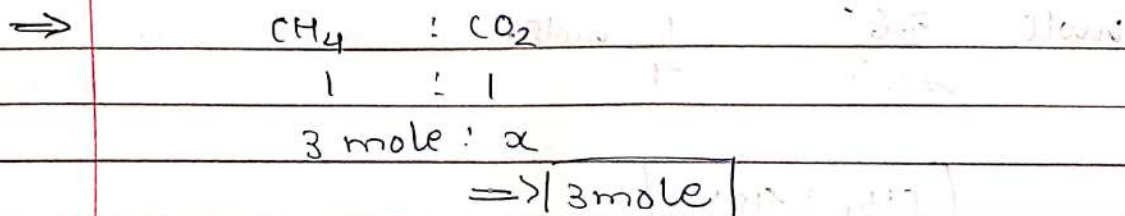
Stoichiometry and calculations:

- balanced chemical reactions are stoichiometric reactions in which different reactants ratios are constant.
- except mass ratio all different ratios in stoi. exns. ~~are~~ should be constant.

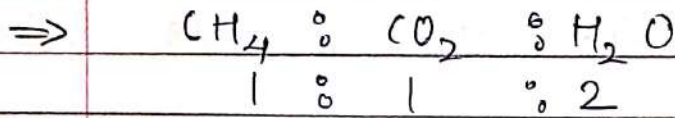


mole	1 mole	2 mole	1 mole	2 mole
vol. (at STP)	22.4 l	44.8 l	22.4 l	44.8 l
vol. (at STP)	22.4 l	44.8 l	22.4 l	44.8 l
molecules	1 molecule	2 molecule	1 molecule	2 molecule
mass	16 gm	64 gm	44 gm	36 gm

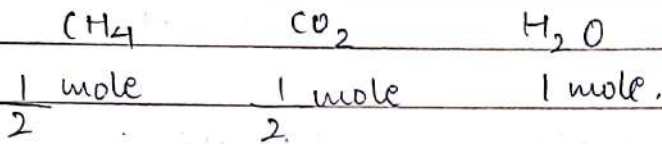
29. During complete combustion of (methane) CH_4 gas how much CO_2 formed with 3 mole CH_4 gas.



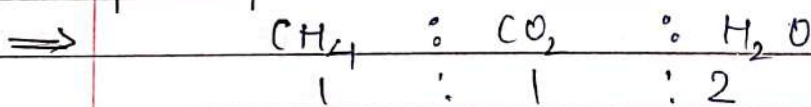
25. If 8 gm methane, completely combust. in presence of oxygen. & CO₂ & water formed



$$M = \frac{8 \text{ gm}}{16 \text{ gm}} \quad \frac{1 \text{ mole}}{2}$$



26. How much quantity methane req. at STP for prodⁿ of 11.2 l H₂O.



$$\# \frac{11.2}{2} \quad \boxed{5.6 \text{ Utr}}$$

$$\text{mole} = \frac{5.6}{22.4} \quad \frac{1 \text{ mole}}{4}$$

$$\boxed{\text{CH}_4 = 4 \text{ gm}}$$

27. For generation of 7.2 gm H_2O how much oxygen req. for complete combustion of methane gas.

$\Rightarrow O_2 : H_2O$
 $1 : 1$
 $0.2 \text{ mole} : 0.2 \text{ mole}$

$\frac{7.2}{36} = 0.2 \text{ mole.}$

$\therefore, 0.2 \times 64$
 $= 12.8 \text{ gm}$

28. Vol. of CO_2 & H_2O should at STP if 300 litres methane compl. combusted with oxygen.

$\Rightarrow CH_4 : H_2O : CO_2$
 $1 : 2 : 1$
 $300 \text{ l} : 600 \text{ l} : 300 \text{ l}$

$\therefore, H_2O = 600 \text{ l}$
 $CO_2 = 300 \text{ l.}$

29. How much H_2O formed if 5 l methane gas (at STP) comple. combust.

$\Rightarrow H_2O : CH_4$
 $2 : 1$
 $2(5 \text{ l}) : 6 \text{ l}$

$\text{mole} = \frac{10}{22.4}$

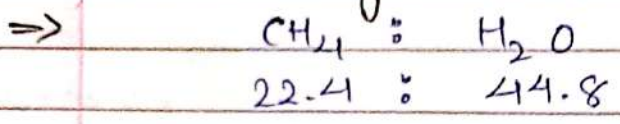
$\frac{10 \text{ l}}{22.4}$

$H_2O \text{ gm} = \frac{100}{22.4} \times 18$

$\frac{1800}{224} = 8 \frac{1}{28}$

$\frac{225}{28}$

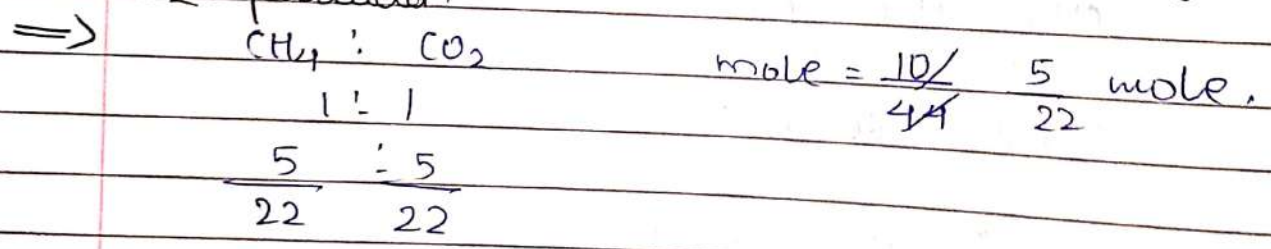
30. How much quantity H_2O formed if 22.4 L methane gas @ STP completely burn.



$\therefore \text{mole} = \frac{44.8}{22.4} \quad \boxed{2 \text{ mole}}$

$= 2 \times 18$
 $\boxed{= 36 \text{ gm}}$

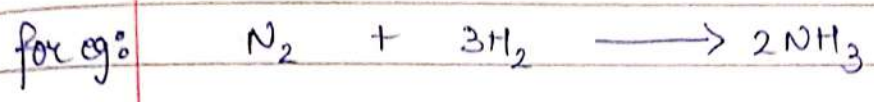
31. Quantity of methane should req. if 10 gm CO_2 produced.



$\therefore m = \frac{5}{16} \times 22$

$\rightarrow m = \frac{5 \times 168}{22 \times 11} \quad \boxed{\frac{40}{11} \text{ gm}}$

- in stoichiometric reactions, the relation between different reactant and product can also be written as



$$\Rightarrow \frac{\text{mole of } N_2}{1} = \frac{\text{mole of } H_2}{3} = \frac{\text{mole of } NH_3}{2}$$

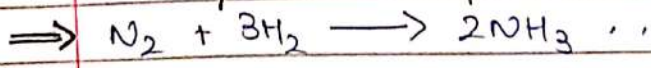
$$\Rightarrow \frac{\text{wt of } N_2}{1 \times \text{mole wt. of } N_2} = \frac{\text{wt. of } H_2}{3 \times \text{m. wt. of } H_2} = \frac{\text{wt. of } NH_3}{2 \times \text{m. wt of } NH_3}$$

32. How much quantity ^(in mole) of Nitrogen gas required in haber process to produce 20 mole of ammonia?

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

now, $2NH_3 = 20 \text{ moles}$
 $N_2 = 10 \text{ moles}$

33. In above reaction, how much quantity of Hydrogen is required to produce 13gm of ammonia?

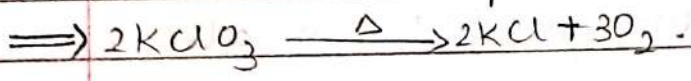


$$\text{now; } \frac{\text{mass. mole of } H_2}{3 \times 2} = \frac{\text{mass. mole of } NH_3}{2 \times 17}$$

$$H_2 = \frac{13}{2 \times 17} \times 3 \times 2$$

$$\therefore H_2 = \frac{13 \times 3}{2 \times 17} \longrightarrow \boxed{\frac{39}{17}} \text{ gm.}$$

34. How many moles of Potassium Chlorate (KClO₃) req. to be heated to produce 11.2 ltr Oxygen at STP.



$$\Rightarrow \frac{\text{mole of } KClO_3}{2} = \frac{\text{mole of } O_2}{3}$$

$$\frac{11.2}{22.4}$$

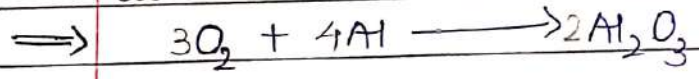
$$\Rightarrow \text{mole} = \frac{\text{given volume}}{22.4}$$

$$3 \int 22.4$$

$$= \frac{11.2}{22.4} \times \frac{1}{2}$$

$$\Rightarrow KClO_3 = \frac{1}{2} \quad \Rightarrow KClO_3 = \frac{1 \text{ mole}}{2}$$

35. If 1/2 mole of oxygen combined with aluminium to form respective metal oxide; find weight of aluminium used in reaction.



$$\Rightarrow \frac{\text{mole of Al}}{4} = \frac{\text{mole of } O_2}{3}$$

$$\frac{\text{wt. of Al}}{4 \times \text{atomic wt.}} = \frac{\text{mole } O_2}{3}$$

$$\frac{Al}{4 \times 27} = \frac{1/2}{3}$$

$$\text{wt. Al} = \frac{27 \times 2}{3}$$

$$| Al = 18 \text{ gm} |$$

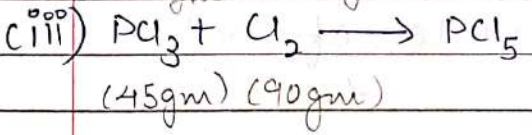
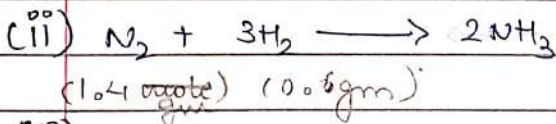
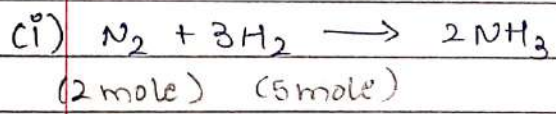
Limiting reagent & Excess reagent :-

- ★ - during chemical reactions those reagent consume first are 'limiting reagents' (LR),
- after completion of the reaction remaining reagent are 'excess reagent' (ER).
- LR and ER in stoichiometric reactions can be find as following:

Given mole Stoichiometric coefficient. Situations in which when ratio (1:1)

If LR is available in rxn's then final product quantity decides by LR.

36. Find out the LR and ER in following reactions:



\Rightarrow (a) $\frac{2}{1} : \frac{5}{3} \rightarrow 2 : 1.67$
 $\therefore N_2 = ER \quad H_2 = LR.$

(b) $\frac{1.4}{1} : \frac{0.6}{3} \rightarrow 1.4 : 0.2$
 $\therefore N_2 = ER \quad H_2 = LR$

(c) given mass = mole.
 molec. mass.

\Rightarrow $\frac{45}{26.20} : \frac{90}{10} \rightarrow 1.71 : 9$
 $\Rightarrow \frac{1}{2} : 1 \quad (0.5 : 1)$
 $\therefore H_2 = ER \quad N_2 = LR.$

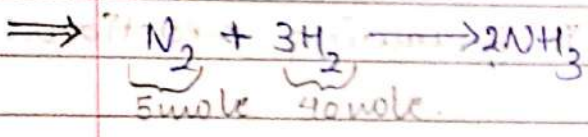
PCl_5
 $P = 31$
 $Cl_2 = 70$
 $PCl_3 = 137.5$
 $Cl_2 = 35.5 \times 2$

(c) $45 \frac{9}{10} \div 1.90$
 $\frac{137.5}{14} \quad 71$
 $\rightarrow \frac{27.5}{14} = 90$
 $\frac{18}{14} = 90$

$\therefore Cl_2 = ER$
 $PCl_3 = LR$

37. (i) In Haber process 5 mole Nitrogen and 40 mole Hydrogen reacts to form what quantity of ammonia?

(ii) If LR is present then find out remaining reagent quantity after completing rxn.



(a) 5 mole 4mole $\rightarrow ?$

$(\frac{5}{1} = \frac{40}{3} 133)$

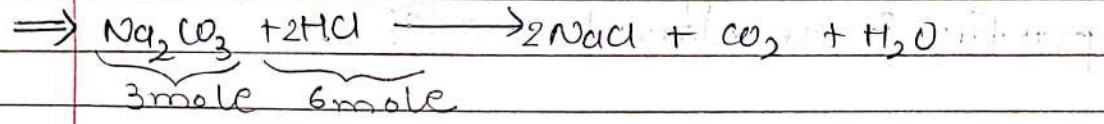
$N = LR$
 $H_2 = ER$
 $\frac{\text{mole of } N}{1} = \frac{\text{mole of } NH_3}{2}$

$\frac{5}{1} = \frac{\text{mole } NH_3}{2}$

mole of $NH_3 = 10 \text{ mole}$

(b) H_2 used = 15 mole
 \therefore remaining H_2
 = 40 mole - 15 mole
 = 25 mole

38. 3 mole of Sodium Carbonate reacted with 6 mole of HCl. Find volume of CO₂ gas produced at STP.

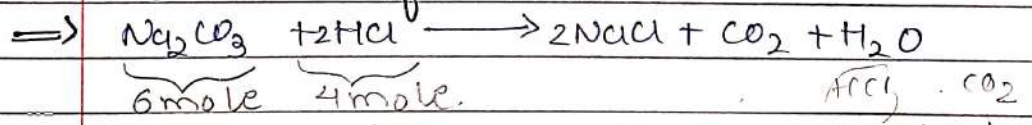


G:- $\frac{3}{1} : \frac{6}{2}$ ∴ 3:3 (no LR or ER).

∴ CO₂ = 3 mole.

$$\begin{aligned} \text{∴ volume} &= 3 \times 22.4 \\ &= \underline{67.2 \text{ l}} \end{aligned}$$

39. In above question, if 6 mole of sodium carbonate is treated with 4 mole of HCl then find out the volume of CO₂ at STP.



G:- $\frac{6}{1} : \frac{4}{2}$ ∴ 6:2 HCl is LR.

∴ 2HCl → 4 mole

as HCl : CO₂ → 2:1.

$$\begin{aligned} \text{∴ CO}_2 &\longrightarrow 2 \text{ mole} \\ &= 2 \times 22.4 \end{aligned}$$

$$= \underline{44.8 \text{ l}}$$