

# MOLE CONCEPT

1) A) moles of  $C_2H_6 = \frac{15}{30}$ , moles of (-atom)  $= \frac{15}{30} \times 2 = 1$

B)  $n_{N_2C_2O_4} = \frac{40.2}{134} = 0.3$ ,  $n_c = 0.3 \times 2 = 0.6$

C)  $n_{C_6H_{12}O_6} = \frac{72}{180} = 0.4$ ,  $n_c = 2.4$

D)  $n_{CSH_{10}} = \frac{35}{70} = 0.5$ ,  $n_c = 0.5 \times 5 = 2.5$

2)  $w_{NaI} = \frac{0.5}{100} \times 3 = \frac{1.5}{100} \text{ gm}$

$m_{NaI} = \frac{\frac{1.5}{100}}{\frac{150}{150}} = 10^{-4}$

No. of  $I^-$  ions  $= 6.02 \times 10^{19}$

3)

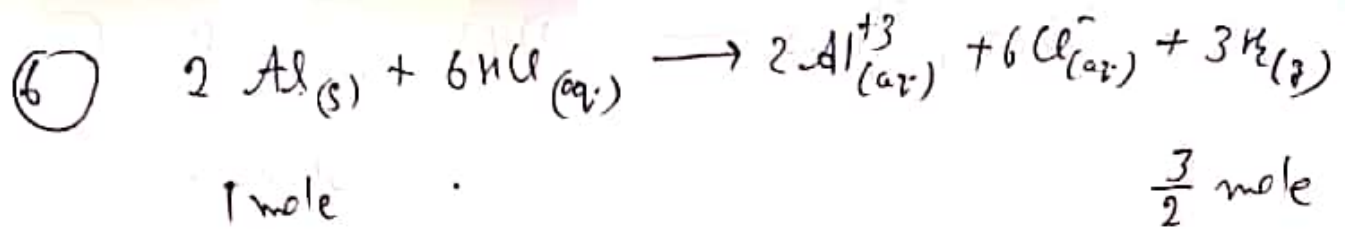
	$NO_2$	$NO$
det. % by mole	$x\%$	$(100-x)\%$

$$34 = \frac{x \times 46 + (100-x) \times 30}{x + (100-x)} = 25$$

4)  $w_{Co} = \frac{2.01 \times 10^{23}}{6.02 \times 10^{23}} \times 28 = 9.3 \text{ gm}$

5) 8 moles of O atom will be contained by = 1 mole

$\therefore 0.25 \text{ mole } \text{Mg}_3(\text{PO}_4)_2 = \frac{1}{8} \times 0.25 \text{ moles of } \text{Mg}_3(\text{PO}_4)_2$   
 $= 3.125 \times 10^{-2}$



$$= \frac{3}{2} \times 22.4$$

At STP  $\uparrow$

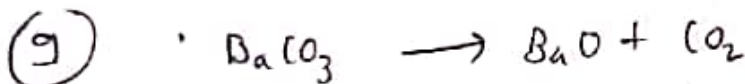
$$(7) \quad n_c = \frac{1.2 \times 10^{-3}}{12} = 10^{-4}$$

$$\text{No. of } (-) \text{ atoms} = 6.02 \times 10^{19}$$

$$(8) \quad \begin{array}{ccc} M_y^{24} & M_y^{25} & M_y^{26} \\ \text{mole \%} = & 79 & (21-x) \quad x (\text{let}) \end{array}$$

$$24.31 = \frac{79 \times 24 + (21-x) 25 + x(26)}{79 + (21-x) + x}$$

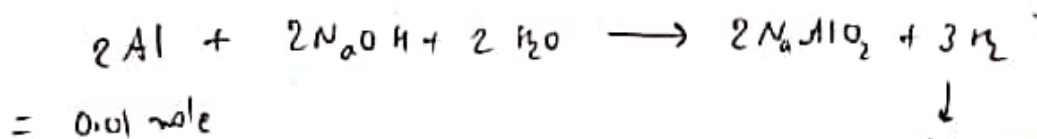
$$x = 10$$



$$n = \frac{9.85}{197} = 0.05 \text{ moles}$$

$$\begin{array}{c} \downarrow \\ 0.05 \text{ mole} \quad \text{At STP} \\ V_{\text{CO}_2} = (0.05 \times 22.7) \text{ l} \\ = 1.135 \text{ l.} \end{array}$$

$$(10) \quad \text{Note that: } 1.013 \text{ bar} = 1 \text{ atm}$$

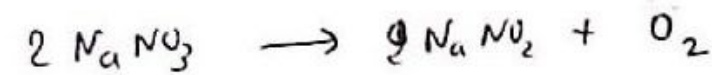


$$PV = nRT$$

$$V = \frac{3}{2} \times 0.01 \times 0.0821 \times 300$$

$$= 369 \text{ ml.}$$

(11)



$$= \frac{8.5}{85}$$

$$= 0.1 \text{ mole}$$

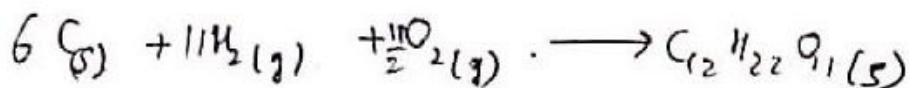
$$\downarrow$$

$$= \frac{0.1}{2} \text{ mole}$$

$$V = nRT/p$$

$$= 1.12 \text{ L.}$$

(12)



$$= \frac{84}{12} = \frac{11}{2} = \frac{56}{22.4}$$

$$= 7 \text{ mole} = 6 \text{ mole} = 2.5 \text{ mole}$$

$$\omega = \frac{3}{11} \times 2.5 \times 342$$

$$= 155.5 \text{ gm}$$

(13)

If we are required to produce maximum products from a given mass of reactant mixture, then always the reactant should be in stoichiometric ratio

let:  $n$  moles $2n$  mole

60 gm

64 gm

$$60n + 64n = 20$$

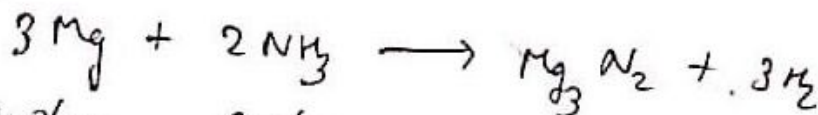
$$n = 5$$

$$\downarrow$$

$$10 \text{ mole}$$

$$= 440 \text{ gm.}$$

(14)



$$n = 48/24$$

$$34/17$$

$$= 2 \text{ mole}$$

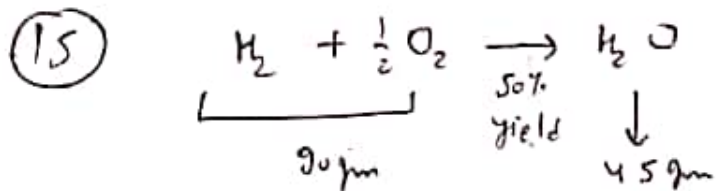
$$= 2 \text{ mole}$$

Mg is L.R.

$$\downarrow$$

$$2/3 \text{ mole}$$

$$= \frac{2}{3} \times 100 \text{ gm.}$$

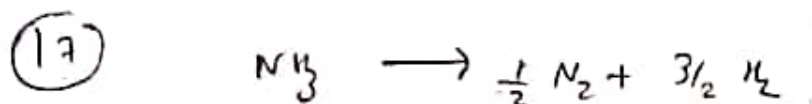


(16) Let us assume, impure sample of  $CaCO_3 = 100 \text{ gm.}$

$$W_{Ca} = 38 \text{ gm.}$$

$$m_{Ca} = 38/40 = 0.95$$

$$m_{CaCO_3} = 0.95 \quad W_t \text{ of } CaCO_3 = 95 \text{ gm. } [0.95 \times 100]$$



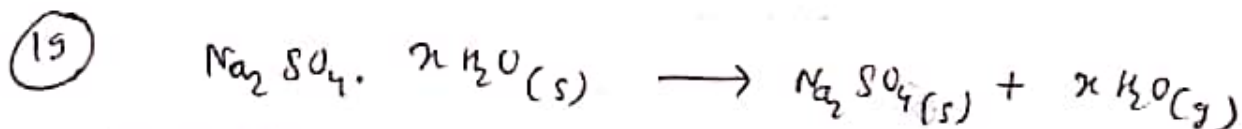
$\epsilon = 0.1 \text{ mole}$

$$\begin{aligned} \epsilon = + (1 - 0.2) \text{ mole} &= 0.8/2 = 3/2 \times 0.2 \\ &= 0.8 \text{ mole} \quad = 0.1 \text{ mole} \quad = 0.3 \text{ mole} \end{aligned}$$

$$W_{N_2}/W_{NH_3} = \frac{0.1 \times 28}{0.8 \times 17} = 7/34$$

(18) for  $10^{-2} \cdot P$  atom  $= 100 \text{ molecule}$

$$\therefore 31 \text{ wt of } P = 31 \times 10.5$$



$$n = \frac{13.4}{142 + 18x}$$

$$\downarrow$$
  

$$6.3 \text{ gm}$$

$$m_{H_2O} = \frac{(13.4)x}{142 + 18x} = \frac{6.3}{18}$$

$$x = 7$$

(20) for min. molecular wt.; we consider that at least one sulphur atom should be there in one molecule

$$4 \text{ wt. of } S \longrightarrow 100 \text{ wt of molecule}$$

$$32 \text{ wt of } S \longrightarrow \frac{100}{4} \times 32 = 800 \text{ wt of molecule.}$$



(21)

	C	H	N
wt	9g	1g	3.5g
n	$\frac{9g}{12}$	$\frac{1g}{1}$	$\frac{3.5g}{14} = \frac{0.25g}{1}$
	$= 0.75x$		

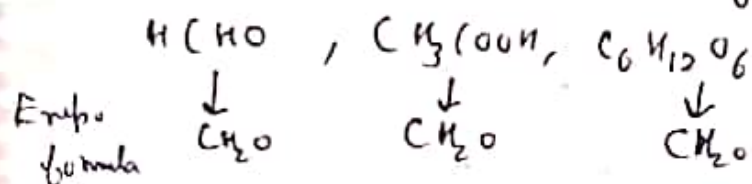
Simplest ratio  $\Rightarrow 3 \quad 4 \quad 1$

Empirical formula =  $C_3H_4N$

$$n = \frac{108}{54} = 2$$

M.F. =  $C_6H_8N_2$

(22) The molecules having same Empirical formula will have same percent of constituent atom



$$\% C = \frac{12}{2n} \times 100 = 40\%$$

(23)

mole ratio

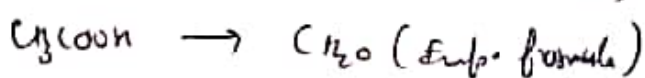
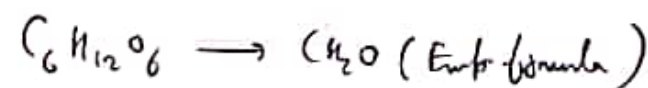
	N	O
	$\frac{30.5}{14}$	$\frac{69.5}{16}$
	2.18	4.34
	1	2

Empirical formula =  $NO_2$

$$n = \frac{MW}{Emp. wt} = \frac{92}{46} = 2$$

Mol. formula =  $(NO_2)_2 = N_2O_4$

(24)

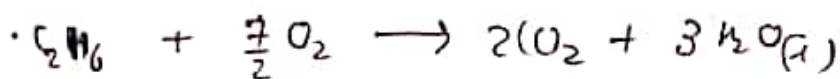
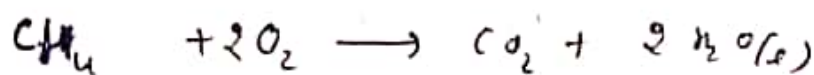
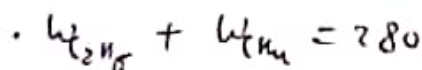


(25)

	X	Y
mole ratio	$\frac{m}{30}$	$\frac{m}{20}$
	2	3

$\boxed{M_2Y_3}$

(26)

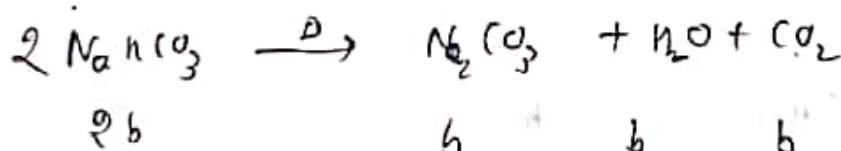
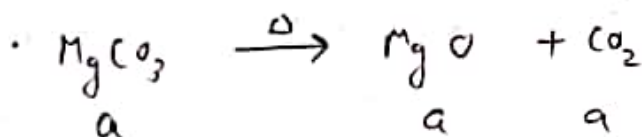

 $2x$ 
 $7x$ 

 $5x$ 
 $5x$ 


$$\Rightarrow 2x(80) + 5x(16) = 280$$

$$x = 2$$

$$n_{\text{CO}_2} = 4x + 5x = 9x = 18 \text{ mol}$$

(27)



$$\frac{a+b}{b} = \frac{3}{1}$$

$$a = 2 \quad b = 1$$

$$\text{mass \% of NaHCO}_3 = \frac{(2b) \times 84}{(2b) \times 84 + a(84)} \times 100 = 50\%$$

(28)


 $\text{to 1 mole}$ 

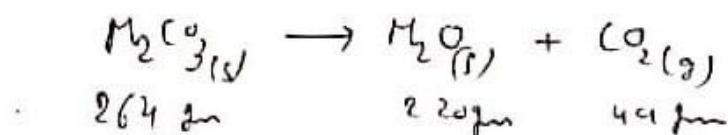
$$\begin{array}{ccc} 1-x & x & x \\ 0.5 & 0.5 & 0.5 \end{array}$$

$$\alpha = 0.5$$

$$M_{\text{avg}} = \frac{\text{total mass}}{\text{total mole}} = \frac{208.5}{1.5}$$

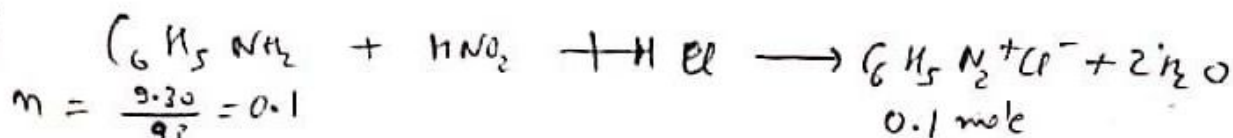
$$\% \text{ change} = \frac{1}{3} \times \frac{208.5}{208.5} \times 100 = 33.33\%$$

(29)

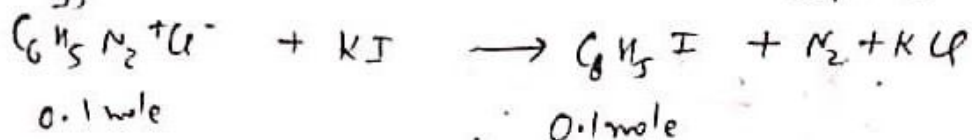
loss in mass due to gaseous product  $\text{CO}_2(\text{g})$ 

$$\% \text{ loss in mass} = \frac{44}{264} \times 100 = \frac{50}{3} \%$$

(30)



$$n = \frac{9.30}{93} = 0.1$$



$$W = 20.4 \text{ gm}$$

$$\% \text{ yield} = \frac{20.1632}{20.4} \times 100 = 80\%$$

### CONCENTRATION TERMS

31)



$$n_1 = \frac{8}{40} \times \frac{125}{100} = \frac{10}{100} \times \frac{125}{36.5}$$

(LR)

Solution will be acidic

32)

$$M = \frac{8}{40} = 0.2 \text{ M}$$

33)

$$M_{\text{H}_2\text{O}} = \frac{1000}{18} = 55.6 \text{ M}$$

34)

$$X_{\text{gly}} = \frac{46}{\frac{46}{92} + \frac{36}{18}} = 0.2$$

35)

$$X_{\text{O}_2} = \frac{\frac{8}{32}}{\frac{8}{32} + \frac{7}{28}} = \frac{\frac{1}{4}}{\frac{1}{4} + \frac{1}{4}} = \frac{1}{2}$$

$$36) M = \frac{5.85}{58.5} \times \frac{1000}{500} = 0.2$$

$$37) M_{H_2SO_4} = \frac{10 \times 98 \times 1.8}{98} = 18$$

38) Molality does not depend on temperature

$$39) \frac{W_{H_2SO_4}}{98} \times \frac{1}{1} = 0.1 \Rightarrow W = 9.8 \text{ gm.}$$

$$40) m = \frac{X_A \times 1000}{(1 - X_A) \times 18} = \frac{55.5(X_A)}{(1 - X_A)}$$

$$41) \pi = 3 \text{ molal} = 3 \text{ mole/kg.}$$

$$1000 \text{ gm} = W_{\text{solvent}} \quad \cdot \quad W_{\text{soln}} = 1000 + 120$$

$$n_{\text{solute}} = 3 \text{ mole}$$

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

$$W_{\text{solute}} = 3 \times 40 = 120 \text{ gm}$$

$$V_{\text{soln}} = \frac{1120}{1.12} = 1000 \text{ ml}$$

$$= 1 \text{ L}$$

$$M = \frac{3}{1} = 3$$

$$42) M = \frac{5}{34} \times \frac{1000}{100} = 1.5 \text{ M}$$

$$43) \pi = 20\% \text{ w/w} \Rightarrow 100 \text{ gm soln has} = 20 \text{ gm glucose}$$

$$W_{\text{solvent}} = 80 \text{ gm}$$

$$m = \frac{20}{80} \times \frac{1000}{180} = \frac{25}{18} \text{ m}$$

$$44) \pi_{H_2O} = \frac{1000 \times 1.17}{36.5} = 32.05 \text{ M}$$

$$45) M = \frac{50 \times 18}{100} = 9 \text{ M}$$

$$46) m = \frac{1000 \times dM}{1000d - M(W)_{\text{solute}}} \Rightarrow d = .$$



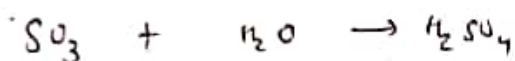
$$47) \quad M_{H_2O} = \frac{34 \times 1000}{34 \times 1135} = \frac{1000}{1135}$$

$$\text{Vol. strength} = 11.35 \times \frac{1000}{1135} = 10V$$

$$48) \quad X_{SO_3} = 0.6$$

$$W_{SO_3} = 60 \text{ gm}, \quad W_{H_2SO_4} = 40 \text{ gm.}$$

$$W_T = 100 \text{ gm}$$



$$n = \frac{60}{80} \quad W = \frac{60}{80} \times 18 = 13.5 \text{ gm}$$

$$\% \text{ labelling} = (100 + 13.5)\% = 113.5\%$$

$$49) \quad 118\%$$

18 gm water required for complete hydrolysis for 100 gm sample of oleum

for 50 gm oleum,  $(W_{H_2O})_{\text{req.}} = 9 \text{ gm.}$

So, final sol<sup>n</sup> contain 50 gm  $H_2SO_4$  & 9 gm water

50) for 100 gm oleum,  $W_{H_2SO_4} \text{ total} = 112 \text{ gm.}$

$$\text{for } 12.5 \text{ gm} \quad \frac{112}{100} \times 12.5 = 14 \text{ gm.}$$

~~112 gm~~  $W_{H_2SO_4} = 14 \text{ gm after hydrolysis}$

$$[n+] = \frac{14 \times 2}{98 \times \frac{1}{100}} = \frac{2}{700}$$

10 ml  $\text{CH}_4$  gas is burnt completely in air ( $\text{O}_2 = 20\%$ , by volume). The minimum volume of air needed is -

(A) 20 ml

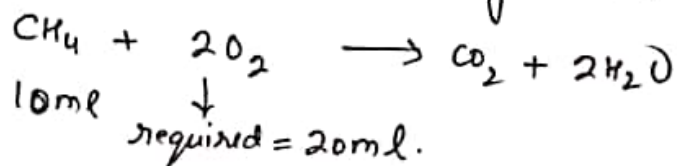
(B) 50 ml

(C) 80 ml

(D) 100 ml

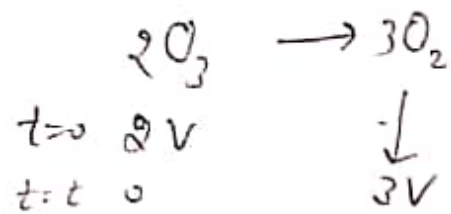
12

air has 20%  $\text{O}_2$  by volume.



$$\text{volume of air} = V; \quad 20 = \frac{20}{V} \times 100 \Rightarrow V = 100 \text{ ml.}$$
$$\left\{ \% \text{O}_2 = \frac{V_{\text{O}_2}}{V_{\text{air}}} \times 100 \right\}$$

Q2.



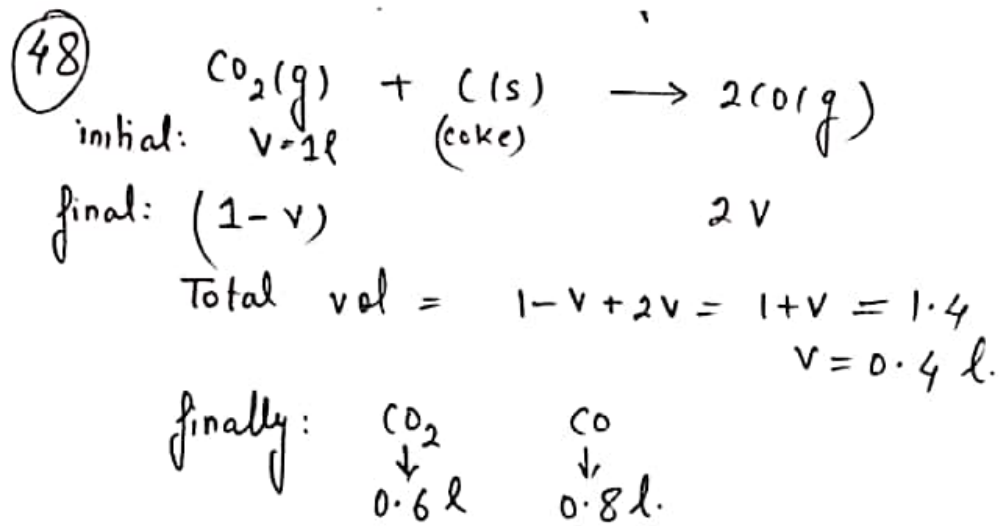
$$\therefore \text{So, } 3V + (20-2V) = 29$$

$$\underline{V = 9 \text{ ml}}$$

$$\% \text{ of } O_2 = \frac{20-2V}{20} \times 100 = 10\%$$

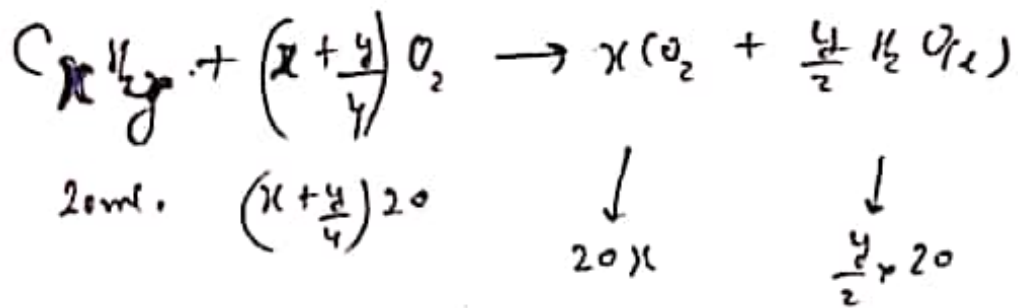
48. When one litre of  $\text{CO}_2$  is passed over hot coke, the volume becomes 1.4 litres. The composition of final products will not be.

- (A)  $V_{\text{CO}_2} : V_{\text{CO}} = 3:4$  (B)  $V_{\text{CO}} = 1.6 \text{ ltr.}$  (C)  $n_{\text{CO}_2} : n_{\text{CO}} = 3:4$  (D)  $\% \text{ V of CO} = \frac{400}{7}$





(54)

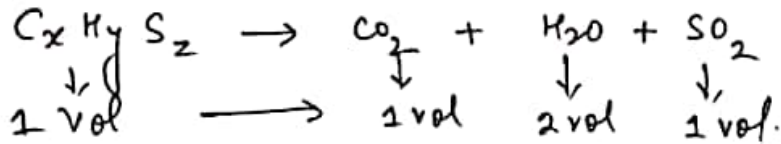


$$\begin{aligned} V_{O_2} &= 60 \text{ ml.} \\ 20x &= 60 \text{ ml.} \end{aligned}$$

$$\underline{n=3}$$

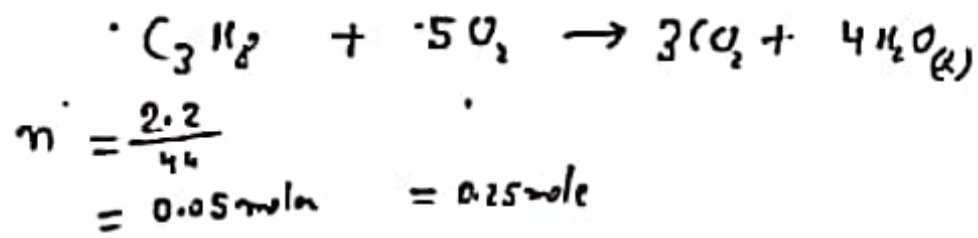
Each volume of a gaseous organic compound containing C, H and S only produce 1 volume  $\text{CO}_2$ , 2 volume  $\text{H}_2\text{O}$  vapours and 1 volume  $\text{SO}_2$  gases on complete combustion. The molecular formula of compound is -

- (A)  $\text{CH}_2\text{S}$                       (B)  $\text{CH}_4\text{S}$                       (C)  $\text{C}_2\text{H}_4\text{S}$                       (D)  $\text{C}_2\text{H}_6\text{S}$



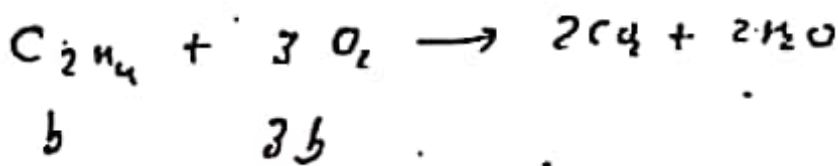
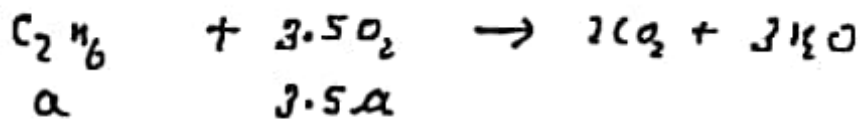
$$\left. \begin{array}{l} \text{POAC for C: } x \times 1 = 1 \times 1 \Rightarrow x = 1 \\ \text{POAC for H: } y \times 1 = 2 \times 2 \Rightarrow y = 4 \\ \text{POAC for S: } z \times 1 = 1 \times 1 \Rightarrow z = 1 \end{array} \right\} \text{CH}_4\text{S}$$

(56)



$$V_{\text{O}_2} = 22.4 \times 0.25 = 5.6 \text{ L}$$

(57)



$$a + b = \frac{28}{22.4}$$

$$3.5a + 3b = 4$$

$$a = 0.5$$

$$b = 1.05$$

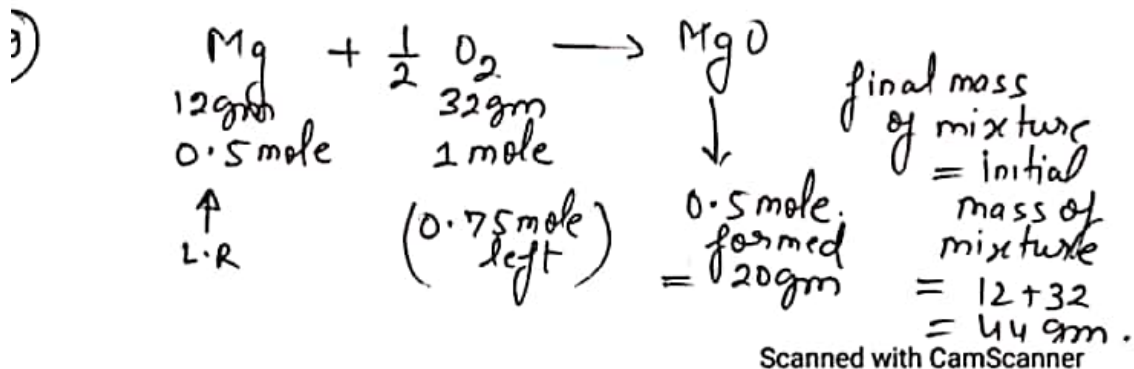
$$\begin{aligned} X_{\text{C}_2\text{H}_6} &= \frac{a}{a+b} \\ &= \frac{0.5}{1.25} \\ &= 0.4 \end{aligned}$$

0 2 SOLUTIONS \_\_\_\_\_

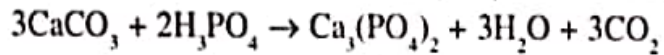


12 g of Mg was burnt in a closed vessel containing 32 g oxygen. Which of the following is /are correct.

- (A) 2 gm of Mg will be left unburnt.
- (B) 0.75 gm-molecule of  $O_2$  will be left unreacted.
- (C) 20 gm of MgO will be formed.
- (D) The mixture at the end will weight 44 g.



1. 50 gm of  $\text{CaCO}_3$  is allowed to react with 68.6 gm of  $\text{H}_3\text{PO}_4$  then select the correct option(s)-

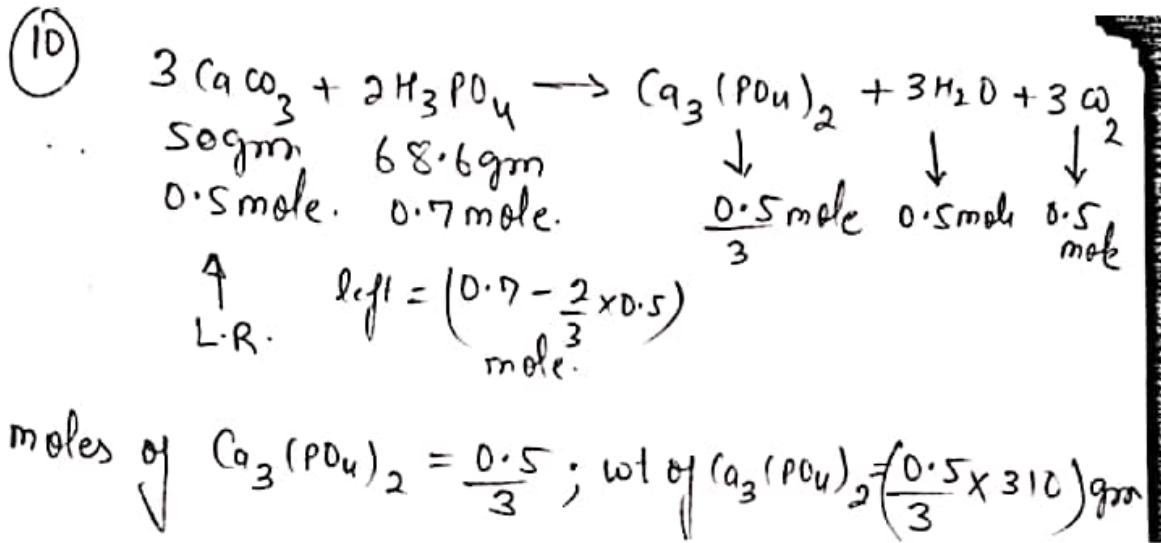


(A) 51.67 gm salt is formed

(B) Amount of unreacted reagent = 35.93 gm

(C)  $n_{\text{CO}_2}$  formed = 0.5 moles

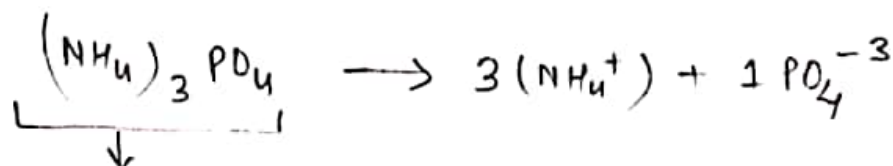
(D)  $n_{\text{H}_2\text{O}}$  formed = 0.7 mole



Select the correct statement(s) for  $(\text{NH}_4)_3\text{PO}_4$ .

- (A) Ratio of number of oxygen atoms to number of hydrogen atoms is 1 : 3
- (B) Ratio of number of cations to number of anions is 3 : 1
- (C) Ratio of number of gm-atoms of nitrogen to gm-atoms of oxygen is 3 : 2
- (D) Total number of atoms in one mole of  $(\text{NH}_4)_3\text{PO}_4$  is 20.

11)



No. of O-atoms = 4

No. of H-atoms = 12

Total moles of atoms in 1 mole  $(\text{NH}_4)_3\text{PO}_4 = 20 \text{ mole}$   
No. of atoms =  $(20 \times N_A)$

The recommended daily dose is 17.6 milligrams of vitamin C (ascorbic acid) having formula  $C_6H_8O_6$ . Match the following. Given :  $N_A = 6 \times 10^{23}$

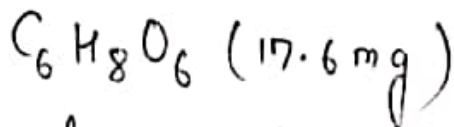
**Column I**

- (A) O-atoms present in daily dose  
 (B) Moles of vitamin C in 1 gm of vitamin C  
 (C) Moles of vitamin C that should be consumed daily

**Column II**

- (P)  $10^{-4}$  mole  
 (Q)  $5.68 \times 10^{-3}$   
 (R)  $3.6 \times 10^{20}$

30



$$\text{mole of vitamin C (daily)} = \frac{17.6 \times 10^{-3}}{176} = 10^{-4}$$

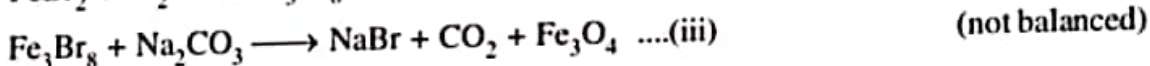
$$\text{in 1 gm vitamin C moles} = \frac{1}{176} = 5.68 \times 10^{-3}$$

$$\begin{aligned} \text{O-atoms} &= 10^{-4} \times 6 \times 6 \times 10^{23} = 36 \times 10^{19} \\ &= 3.6 \times 10^{20} \end{aligned}$$



**Paragraph for Q.16 to Q.18**

NaBr, used to produce AgBr for use in photography can be self prepared as follows :



(At. mass : Fe = 56, Br = 80)

Mass of iron required to produce  $2.06 \times 10^3 \text{ kg NaBr}$

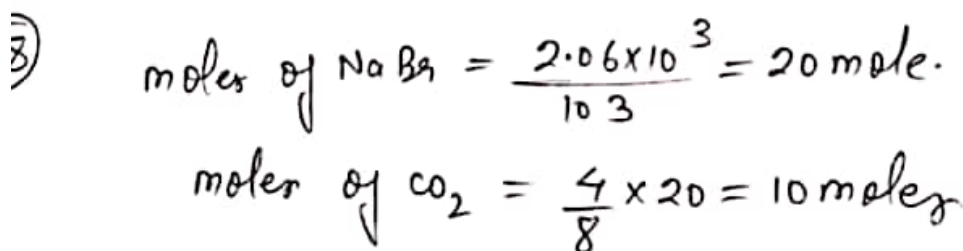
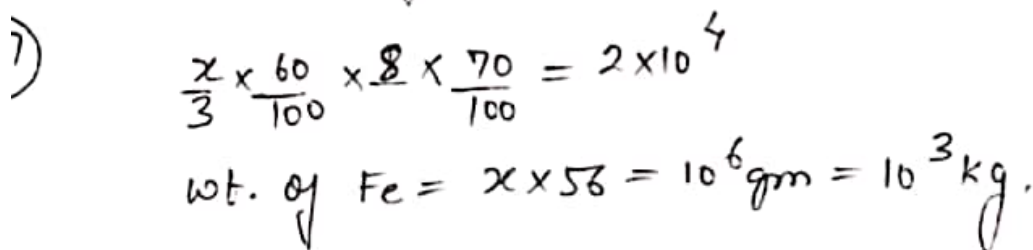
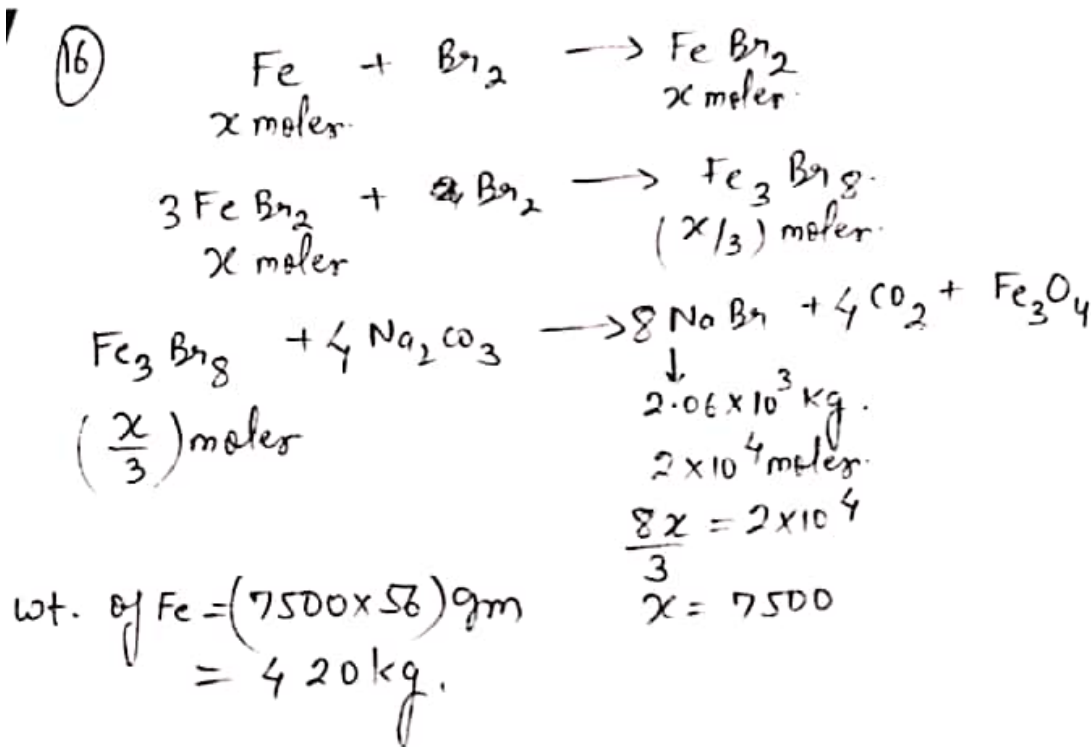
- (A) 420 gm                      (B) 420 kg                      (C)  $4.2 \times 10^5 \text{ kg}$                       (D)  $4.2 \times 10^8 \text{ gm}$

If the yield of (ii) is 60% & (iii) reaction is 70% then mass of iron required to produce  $2.06 \times 10^3 \text{ kg NaBr}$

- (A)  $10^5 \text{ kg}$                       (B)  $10^5 \text{ gm}$                       (C)  $10^3 \text{ kg}$                       (D) None

If yield of (iii) reaction is 90% then mole of  $\text{CO}_2$  formed when  $2.06 \times 10^3 \text{ gm NaBr}$  is formed

- (A) 20                      (B) 10                      (C) 9                      (D) 440



$$\textcircled{8} \quad m_{\text{pure liq.}} = \frac{1000}{MW}$$

$$m_{\text{ethanol}} = \frac{1000}{.46} < m_{\text{H}_2\text{O}} = \frac{1000}{18}$$

$$\textcircled{9} \quad \begin{aligned} \text{A)} \quad 100 \text{ gm soln. has} &= 80 \text{ gm NaOH} \\ 50 \text{ gm} \quad \text{---} \quad &= 40 \text{ gm NaOH} \end{aligned}$$

$$\text{B)} \quad \therefore 100 \text{ ml. soln. has} = 80 \text{ gm NaOH}$$

$$\therefore \frac{50}{1.2} \text{ ml. soln. has} = \frac{80}{100} \times \frac{50}{1.2} \text{ gm} \quad \left[ d = \frac{W}{V} \Rightarrow 1.2 = \frac{50}{V} \right]$$

$$= 33.33 \text{ gm}$$

$$\text{C)} \quad 1000 \text{ gm soln. has} = 20 \times 40 = 800 \text{ gm}$$

$$\therefore 50 \text{ gm} \quad \text{---} \quad = \frac{800}{1000} \times 50 = 40 \text{ gm}$$

$$\text{D)} \quad 1000 \text{ gm soln. has} = 5 \times 40 = 200 \text{ gm}$$

$$\therefore 50 \text{ gm} \quad \text{---} \quad = \frac{200}{1000} \times 50 = 10 \text{ gm}$$

## O - II (Conc. Terms)

i) '2 M'  $\text{MgCl}_2$  can be understood as:

1 l (1000 ml) solution contains 2 moles  $\text{MgCl}_2$

(1000 x 1.09) gm solution contains (2 x 95) gm  $\text{MgCl}_2$

1090 gm solution has 190 gm  $\text{MgCl}_2$ .

wt. of solvent (H<sub>2</sub>O) = 1090 - 190 = 900 gm.

$$\text{molality } (\text{MgCl}_2) = \frac{2}{\frac{900}{1000}} = \frac{2000}{900} = \frac{20}{9}$$

$$\text{molality of } \text{Cl}^- = 2 \times m(\text{MgCl}_2) = 2 \times \frac{20}{9} = 4.44$$

$$X_{\text{MgCl}_2} = \frac{2}{2 + \frac{900}{18}} = \frac{2}{52} = 0.03846$$

$$M = \frac{\frac{w}{V} \% \times 10}{M_{\text{solute}}} \Rightarrow 2 = \frac{\frac{w}{V} \% \times 10}{95}$$

$$\frac{w}{V} \% = 19\%$$

$$\text{ppm} = \frac{190}{1090} \times 10^6 = 0.1743 \times 10^6 \text{ ppm} \\ = 17.43 \times 10^4 \text{ ppm.}$$

## Q-II (Conc. Terms):

1)

$$M_{H_2O_2} = \frac{56.75}{11.35} = 5M; \quad d = \frac{530 \text{ gm}}{\text{litre}}$$

$$d = 0.53 \frac{\text{gm}}{\text{ml}}$$

'5M' means:

1 litre (1000 ml) solution contains 5 mole  $H_2O_2$   
530 gm solution  $\longrightarrow$   $5 \times 34$  (170 gm)  $H_2O_2$

$$5 = \frac{\frac{w}{V} \% \times 10}{M_{\text{solute}}} \Rightarrow 5 = \frac{\frac{w}{V} \% \times 10}{34}$$

$$\frac{w}{V} \% = 17$$

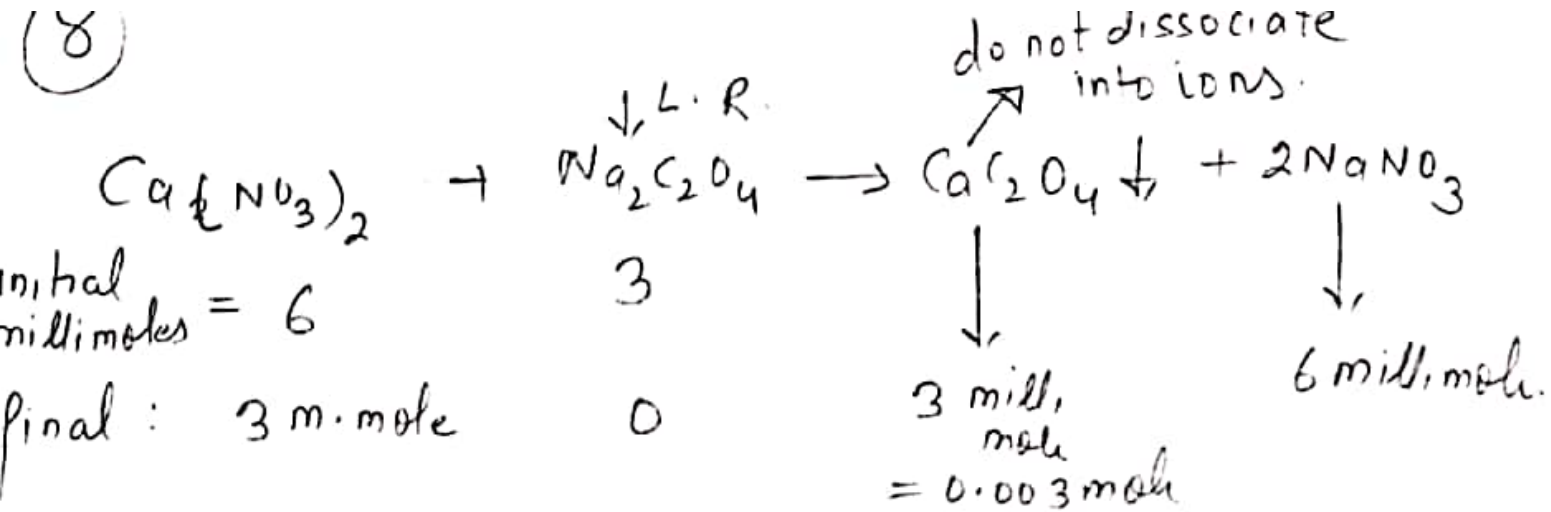
530 gm solution has 170 gm  $H_2O_2$

$$\text{wt. of solvent} = 530 - 170 = 360 \text{ gm.}$$

$$x_{H_2O_2} = \frac{5}{5 + \frac{360}{18}} = \frac{5}{5 + 20} = 0.2$$

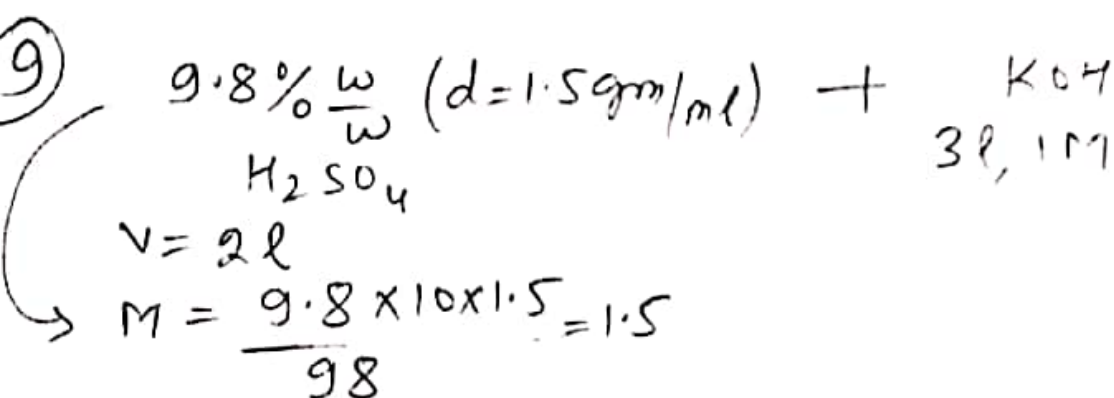
$$\text{molality} = \frac{5}{\frac{360}{1000}} = \frac{5000}{360} = \frac{125}{9}$$



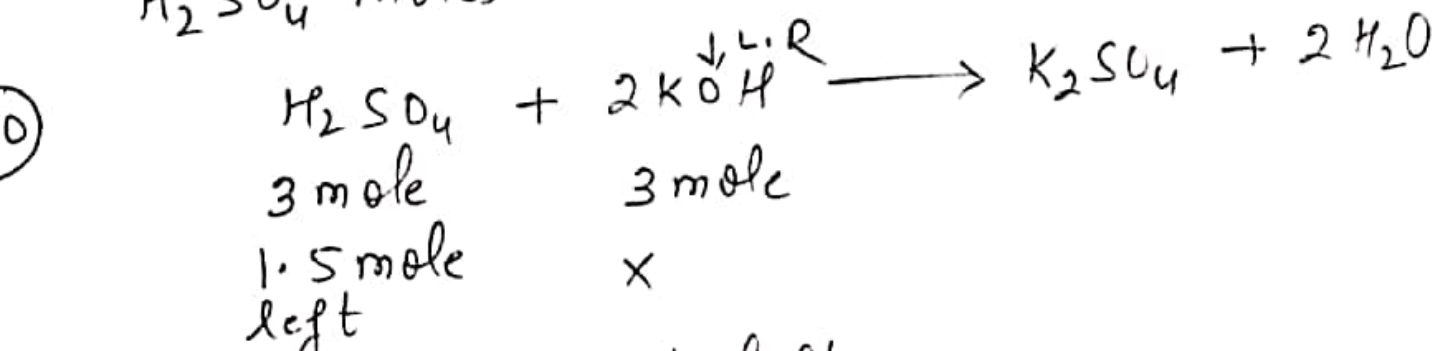


$$[\text{Ca}^{+2}]_{\text{final}} = \frac{3}{150} = 0.02 \text{ M}$$

$$[\text{C}_2\text{O}_4^{-2}]_{\text{final}} = 0$$



$$\text{H}_2\text{SO}_4 \text{ moles} = M \times V = 1.5 \times 2 = 3.$$



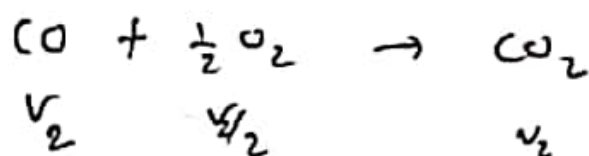
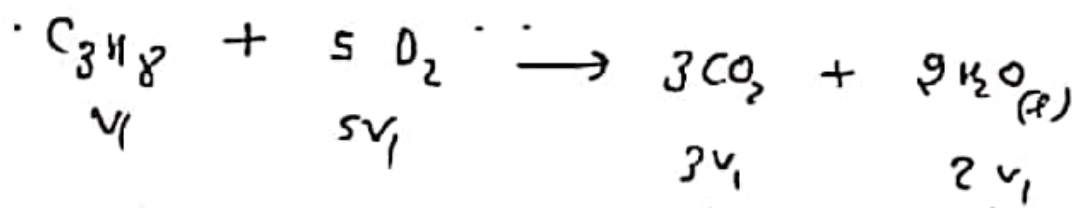
1.5 mole  $\text{H}_2\text{SO}_4$  is left:

So:  $\text{H}^+$  moles from  $\text{H}_2\text{SO}_4 = 1.5 \times 2 = 3$

$$[\text{H}^+] = \frac{3}{5} \text{ M.}$$

2

(14)



$$V_1 + V_2 = 20 \quad \text{--- (1)}$$

$$3V_1 + V_2 = 40$$

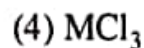
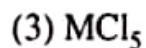
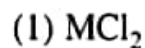
$$V_2 = 10 \text{ ml.}$$

$$V_2 = 10 \text{ ml.}$$

$$\begin{aligned} \text{Vol. contraction} &= \left( 6V_1 + \frac{3V_2}{2} \right) - (3V_1 + V_2) = 3V_1 + \frac{1}{2}V_2 \\ &= 35 \text{ ml.} \end{aligned}$$

JEE MAINS SOLUTION \_\_\_\_\_

A transition metal M forms a volatile chloride which has a vapour density of 94.8. If it contains 74.75% of chlorine the formula of the metal chloride will be [AIEEE 2012 (Online)]



(2)  $\text{V.D} = 94.8$  ;  $\text{Mol wt} = 94.8 \times 2 = 189.6$   
 $\text{wt of \% Cl} = \frac{74.75}{100} \times 189.6 = 141.726 \text{ gm.}$   
 $\text{No. of Cl mol} = \frac{141.726}{35.5} \approx 4.$   
 $\text{MCl}_4$

The ratio of number of oxygen atoms (O) in 16.0 g ozone ( $O_3$ ), 28.0 g carbon monoxide (CO) and 16.0 g oxygen ( $O_2$ ) is :-

(Atomic mass : C = 12, O = 16 and Avogadro's constant  $N_A = 6.0 \times 10^{23} \text{ mol}^{-1}$ )

[AIEEE 2012 (Online)]

(1) 3 : 1 : 1

(2) 1 : 1 : 2

(3) 3 : 1 : 2

(4) 1 : 1 : 1

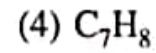
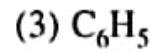
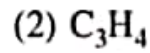
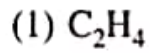
2)

$$\text{No. of O-atoms in } 16\text{g } O_3 = \frac{16}{48} \times 3 \times N_A$$

$$\text{No. of O-atoms in } 28\text{g CO} = \frac{28}{28} \times 1 \times N_A$$

$$\text{No. of O-atoms in } 16\text{g } O_2 = \frac{16}{32} \times 2 \times N_A$$

A gaseous hydrocarbon gives upon combustion 0.72 g of water and 3.08 g of  $\text{CO}_2$ . The empirical formula of the hydrocarbon is [JEE(Main)-2013]



$$\begin{aligned} \text{C}_x\text{H}_y + \text{O}_2 &\longrightarrow x\text{CO}_2 + \frac{y}{2}\text{H}_2\text{O} \\ &\quad \begin{array}{cc} 3.08 \text{ gm} & 0.72 \text{ gm} \\ \frac{3.08}{44} \text{ moles} & \frac{0.72}{18} \text{ mole} \\ 0.07 \text{ mole} & 0.04 \text{ mole} \end{array} \\ \frac{x}{y/2} = \frac{0.07}{0.04} &\Rightarrow \frac{x}{y} = \frac{7}{8} \end{aligned}$$

Emp. formula =  $\text{C}_7\text{H}_8$

The ratio of masses of oxygen and nitrogen in a particular gaseous mixture is 1 : 4. The ratio of number of their molecule is :

[JEE(Main)-2014]

(1) 1 : 8

(2) 3 : 16

(3) 1 : 4

(4) 7 : 32

19)

	$O_2$	:	$N_2$
mass :	1	:	4
mole :	$\frac{1}{32}$	:	$\frac{4}{28}$
molecule :	$\frac{1}{32} \times N_A$	:	$\frac{4}{28} \times N_A \Rightarrow 7 : 32$



In Carius method of estimation of halogens, 250 mg of an organic compound gave 141 mg of AgBr. The percentage of bromine in the compound is :

(Atomic mass Ag = 108; Br = 80)

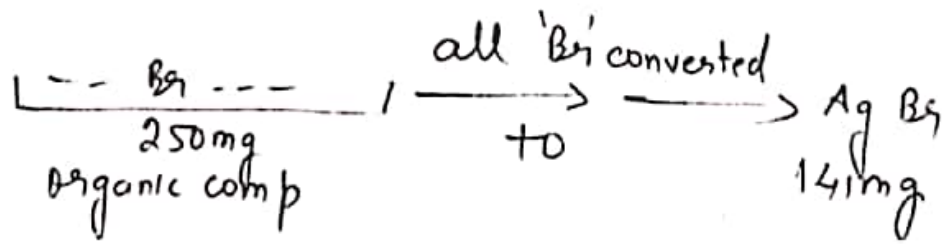
[JEE(Main)-2015]

(1) 48

(2) 60

(3) 24

(4) 36



$$\text{m.moles of AgBr} = \text{m.moles of Br} = \frac{141}{188}$$

$$\text{mg. of Br} = \frac{141}{188} \times 80 = 60 \text{ mg.}$$

$$\% \text{ Br} = \frac{60}{250} \times 100 = 24\%$$

The most abundant elements by mass in the body of a healthy human adult are :

Oxygen (61.4%) ; Carbon (22.9%), Hydrogen (10.0%) ; and Nitrogen (2.6%). The weight which a 75 kg person would gain if all  $^1\text{H}$  atoms are replaced by  $^2\text{H}$  atoms is [JEE(Main)-2017]

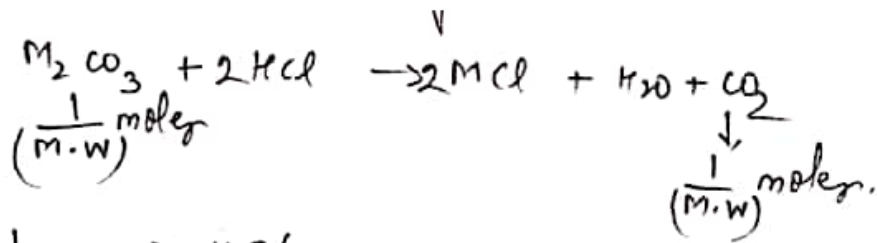
- (1) 15 kg                      (2) 37.5 kg                      (3) 7.5 kg                      (4) 10 kg

(16)  $\overset{\text{J(M)}}{10\% \text{ of } 75 \text{ kg} = 7.5 \text{ kg. is } ^1_1\text{H}}$   
if replaced by  $^2_1\text{H}$  then wt =  $(7.5 \times 2) = 15 \text{ kg}$   
So gain is = 7.5 kg

1 gram of a carbonate ( $M_2CO_3$ ) on treatment with excess HCl produces 0.01186 mole of  $CO_2$ . the molar mass of  $M_2CO_3$  in  $g\ mol^{-1}$  is :-

[JEE(Main)-2017]

- (1) 1186                      (2) 84.3                      (3) 118.6                      (4) 11.86

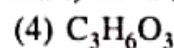
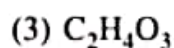
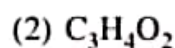
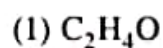


$$\frac{1}{M.W} = 0.01186$$

$$M.W = 84.3$$

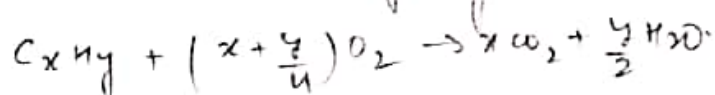
The ratio of mass percent of C and H of an organic compound ( $C_xH_yO_z$ ) is 6 : 1. If one molecule of the above compound ( $C_xH_yO_z$ ) contains half as much oxygen as required to burn one molecule of compound  $C_xH_y$  completely to  $CO_2$  and  $H_2O$ . The empirical formula of compound  $C_xH_yO_z$  is

[JEE(Main)-2018 (offline)]



(13)  $C_xH_yO_z$ :  $\frac{12x}{y} = \frac{6}{1} \Rightarrow \boxed{y = 2x}$

To burn 1 molecule of  $C_xH_y$



$$O_2 = \left(x + \frac{y}{4}\right); O = 2\left(x + \frac{y}{4}\right)$$

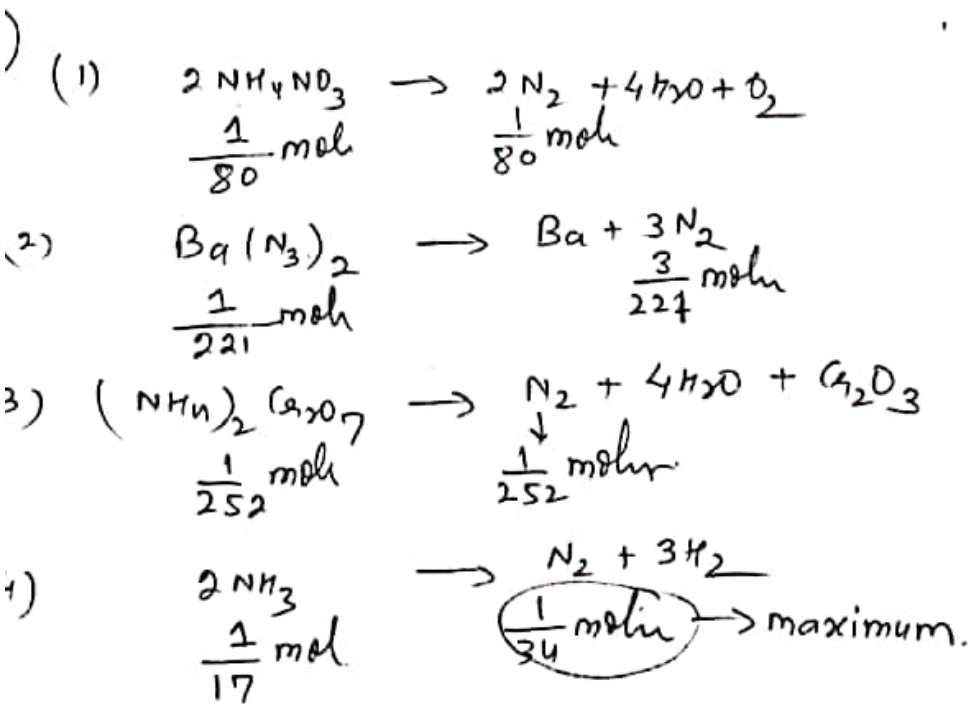
$$z = \frac{2\left(x + \frac{y}{4}\right)}{2} \Rightarrow \boxed{z = x + \frac{y}{4} = \frac{3x}{2}}$$

From given options:  $C_2H_4O_3 \rightarrow$  Emp. form

14. For per gram of reactant, the maximum quantity of  $N_2$  gas is produced in which of the following thermal decomposition reactions ?  
[JEE(Main)-2018 (online)]

(Given : Atomic wt. - Cr = 52u, Ba = 137u)

- (1)  $2NH_4NO_3(s) \rightarrow 2N_2(g) + 4H_2O(g) + O_2(g)$   
 (2)  $Ba(N_3)_2(s) \rightarrow Ba(s) + 3N_2(g)$   
 (3)  $(NH_4)_2Cr_2O_7(s) \rightarrow N_2(g) + 4H_2O(g)$   
 (4)  $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$



An unknown chlorohydrocarbon has 3.55% of chlorine. If each molecule of the hydrocarbon has one chlorine atom only; chlorine atoms present in 1 g of chlorohydrocarbon are :

(Atomic wt. of Cl = 35.5 u; Avogadro constant =  $6.023 \times 10^{23} \text{ mol}^{-1}$ ) [JEE(Main)-2018 (online)]

- (1)  $6.023 \times 10^{21}$       (2)  $6.023 \times 10^{23}$       (3)  $6.023 \times 10^{20}$       (4)  $6.023 \times 10^9$

15) wt. of Cl =  $\left( \frac{3.55}{100} \times 1 \right)$   
in 1 gm of compound

mole of Cl =  $\frac{3.55 \times 1}{100 \times 35.5}$

No. of Cl-atoms =  $\frac{3.55}{100 \times 35.5} \times 6.023 \times 10^{23}$   
 $= 6.023 \times 10^{20}$

(11)

$$\begin{aligned} C_2 &= \frac{n_2 \times d \times 1000}{(n_1 M_1 + n_2 M_2)} \\ &= \frac{d \times \frac{n_2}{n_1 + n_2} \times 1000}{\frac{n_1}{n_1 + n_2} M_1 + \frac{n_2}{n_1 + n_2} M_2} \\ &= \frac{d n_2 \times 1000}{(1 - n_2) M_1 + n_2 M_2} \\ &= \frac{1000 d n_2}{M_1 + n_2 (M_2 - M_1)} \end{aligned}$$

(Dividing numerator and denominator by  $n_1 + n_2$ )

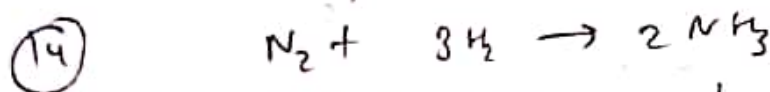
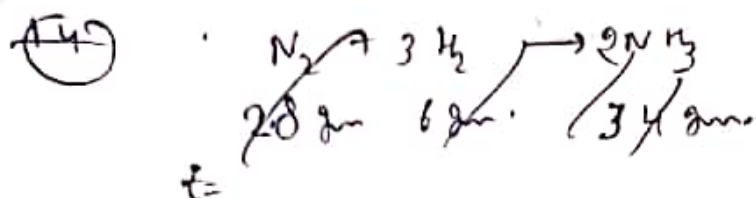


(12)  $M = \frac{5.6}{11.2} = 0.5 M \quad \left[ M = \frac{\text{Vol. strength}}{11.2} \right]$

mass % =  $\frac{0.5 \times 34}{1000} \times 100 = 1.7 \%$

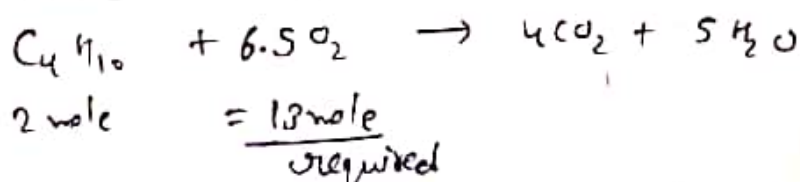
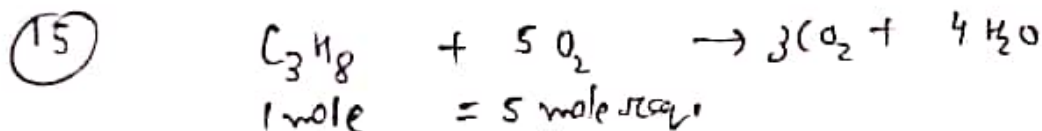
(13) Molar Mass of  $H = 100 \text{ gm}$

$M = \frac{S \times V_1}{100 \times 2} = 2.5 \times 10^{-3}$



$t = 0 \quad \frac{9.8 \times 1000}{98} = \frac{1000}{2}$   
 $= 100 \quad = 500$

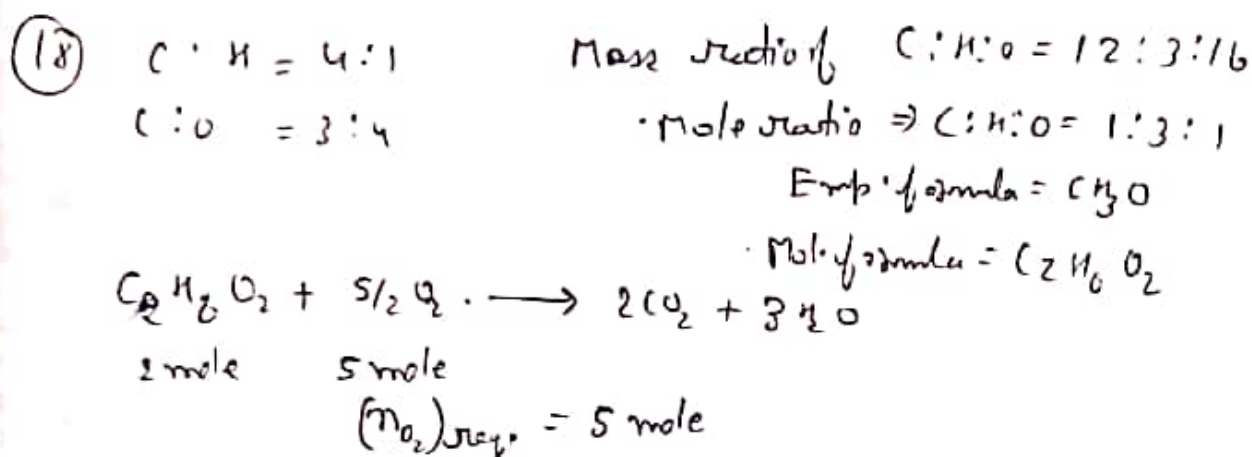
$\downarrow$   
 $2 \text{ mole}$   
 $= 3400 \text{ gm.}$   
 $= 3.4 \text{ kg.}$



min. no of mole =  $5 + 13 = 18 \text{ mole.}$

16)  $S^2Cl : S^2Cl$   
 let mole ratio  $x : 1$   
 $M_{avg} = 35.5 = \frac{x(35) + 1(37)}{x+1} \Rightarrow x = 3$

17) % of Br =  $\frac{(MW)_{Br}}{(MW)_{org}} \times \frac{W_{Br}}{W_{organic}} \times 100$   
 $= \frac{80}{188} \times \frac{0.12}{0.15} \times 100 = 34.04\%$

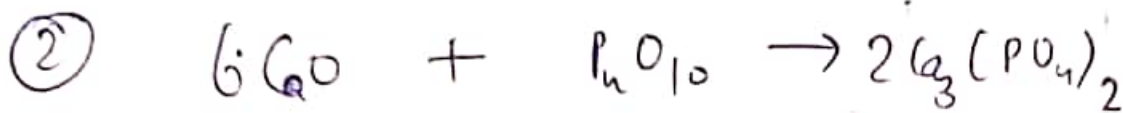


19) % mass of water =  $\frac{x \times 18}{265} \times 100 = 13.5$   
 $x = 2$   
 $[C_8(H_2O)_4H_2] \cdot 2H_2O$

# JEE ADVANCE SOLUTION \_\_\_\_\_

### IEEE Advance

$$1) \therefore \text{mole of } e^- = \frac{1000}{9.1 \times 10^{-31}} \times 6.02 \times 10^{23}$$
$$= \frac{6.023}{9.108} \times 10^{54}$$



$$W = 346756 = \frac{852}{284}$$
$$= 1008 \text{ gm} = 3 \text{ mole}$$

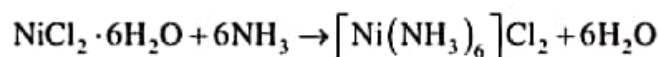
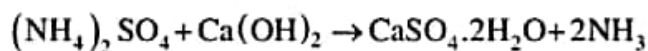
③

$$\begin{aligned} \text{May} &= \frac{5 \times 54 + 90 \times 56 + 5 \times 57}{100} \\ &= 55.95 \end{aligned}$$

## JEE-Advance

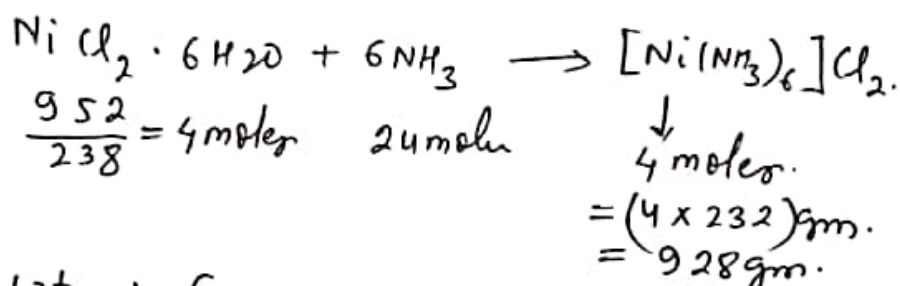
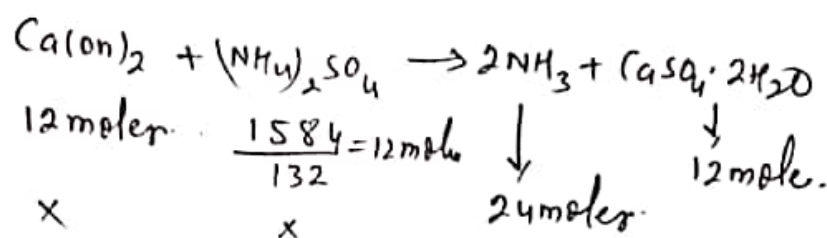
The ammonia prepared by treating ammonium sulphate with calcium hydroxide is completely used by  $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$  to form a stable coordination compound. Assume that both the reactions are 100% complete. If 1584 g of ammonium sulphate and 952g of  $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$  are used in the preparation, the combined weight (in kg) of gypsum and the nickel-ammonia coordination compound thus produced is \_\_\_\_.

[JEE 2018]



(Atomic weights in  $\text{g mol}^{-1}$ : H = 1, N = 14, O = 16, S = 32, Cl = 35.5, Ca = 40, Ni = 59)

D

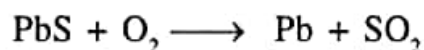


$$\text{wt of } \text{CaSO}_4 \cdot 2\text{H}_2\text{O} = 12 \times 172 = 2064 \text{ gm}$$

$$\text{wt of } [\text{Ni}(\text{NH}_3)_6]\text{Cl}_2 = 928 \text{ gm}$$

$$\text{Total wt} = 2992 \text{ gm}$$

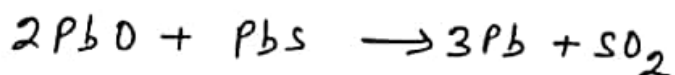
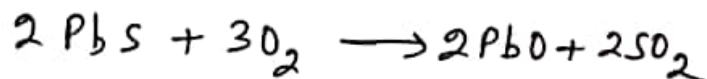
Galena (an ore) is partially oxidized by passing air through it at high temperature. After some time, the passage of air is stopped, but the heating is continued in a closed furnace such that the contents undergo self-reduction. The weight (in kg) of Pb produced per kg of  $O_2$  consumed is \_\_\_\_\_.



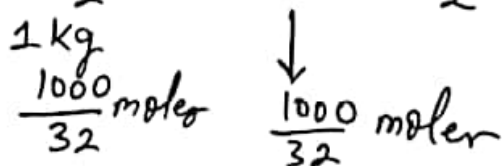
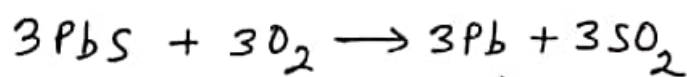
[JEE 2018]

(Atomic weights in  $g\ mol^{-1}$  : O = 16, S = 32, Pb = 207)

2

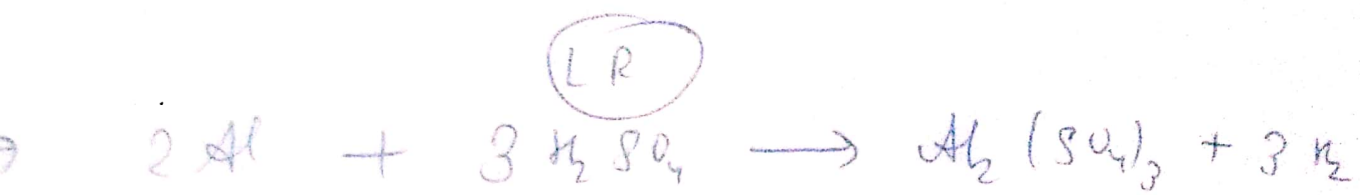


Net  
reaction



$$\text{wt in kg of Pb} = \frac{207}{32} = 6.47 \text{ kg}.$$





$$n = \frac{5.4}{77}$$

$$= 0.2$$

$$= \frac{50 \times 5}{1000}$$

$$= 0.25$$

$$\downarrow$$

$$= \frac{8}{3} \times 0.25 = 0.25$$

$$V_{\text{H}_2} = 0.25 \times 0.0821 \times 300$$

$$= 6.15 \text{ L}$$