Chapter 10. Empirical, Molecular & structural formulae

Q1.

Sol: Let the Molecular formula is Fe_2S_X

Then Molecular wt. $= 2 \times 56 + 32x = 112 + 32x$

A/q, % of Fe = 46.5%

$$\frac{112}{112+32x} \times 100 = 46.5$$

$$\Rightarrow 112 + 32x = \frac{11200}{46.5} = 240.86$$

$$32\,x = 128.86 \quad \Rightarrow x = \frac{128.86}{32} = 4$$

$\therefore$ Molecular formula will be Fe_2S_4.

So the simplest form of formula which will be the empirical formula is FeS_2

Q2.

Sol: Let the molecular formula if iron oxide is Fe_2O_X

A/q, $Fe_2O_X + H_2 \longrightarrow 2Fe + H_2O$

1.60 g 1.12 g

$\because$ 1.60 g of Fe_2O_X contain 1.12 g of Fe

$$\therefore 1 \longrightarrow \frac{1.12}{1.60}$$

$$\therefore (112 + 16x) \longrightarrow \frac{1.12}{1.60} \times (112+16x)$$

We know that (112 + 16x) g of compound contains 112 g of Fe

$$\therefore \frac{1.12}{1.60} \times (112+16x) = 112$$

$$112 + 16x = 160 \quad \Rightarrow x = 3$$

$\therefore$ Molecular formula = Fe_2O_3 $\Rightarrow$ Empirical formula = Fe_2O_3

Q3.

Sol: Let the formula of A = CH_X

A/q, % of H = 25%

$$\Rightarrow \frac{x}{12+x} \times 100 = 25 \quad \Rightarrow \frac{x}{12+x} = \frac{1}{4} \quad \Rightarrow x = 4$$

$\therefore$ Empirical formula of A = CH_4

Let the empirical formula of B = CH_y

A/q, % of H = 14.3%

$$\therefore \frac{y}{12+y} \times 100 = 14.3 \quad \Rightarrow \frac{y}{12+y} = \frac{14.3}{100}$$

$$100y - 14.3\,y = 12 \times 14.3$$

$$\Rightarrow y = \frac{12 \times 14.3}{85.7} = 2$$

$\therefore$ Empirical formula of B = CH_2

Let the empirical formula of C = CH_Z

A/q, % of H = 7.7%

$$\therefore \frac{Z}{12+Z} \times 100 = 7.7 \quad \Rightarrow (100-7.7)\,Z = 12 \times 7.7 \quad \Rightarrow Z = 1.00$$

$\therefore$ Empirical formula of C = CH

Q4.

Sol:

Element	Wt ratio	Mole ratio = $x/_{n}$	$xn/_{xsmallest}$
C H N	9 1 3.5	$9/_{12} = 0.75$ $1/_{1} = 1$ $3.5/_{14} = 0.25$	$0.75/_{0.25} = 3.0$ $1/_{0.25} = 4.0$ $\frac{0.25}{0.25} = 1.0$

$\therefore$ Empirical formula = C_3H_4N

Empirical wt = 54g

$\therefore$ n = $\text{Mol.wt}/_{\text{emp.wt}} = 108/_{54} = 2$

$\therefore$ Molecular formula = $(C_3H_4N)_2 = C_6H_8N_2$

(Note:- % ratio by wt. of Nitrogen should be given 3.5 not 3)

Q5.

Sol: Let the hydrated iron sulphate is $FeSO_4.XH_2O$

Mol. wt. of hydrated salt = 56 + 96 + 18x = (152 + 18x) g

Now (152 + 18x) g of $FeSO_4.XH_2O$ contain 18x g of water

$$\therefore 1 \text{ ―――――――――― } \frac{18x}{(152+18x)}$$

$$\therefore 2 \text{ ―――――――――― } \frac{18x}{152+18x} \times 2 = 0.9065$$

$$\Rightarrow \frac{18x}{152+18x} = \frac{0.9065}{2}$$

$\Rightarrow$ 36 x = 137.788 + 16.317 x $\Rightarrow$ 19.683 x = 137.788

X = 7

$\therefore$ Formula of the hydrated salt = $FeSO_4 = 7H_2O$

(Note:- In question it should be specified that Fe(II) sulphate is hydrated. I have assumed so to Solve the problem.

Q6.

Sol:

Element	% by wt	$\frac{\text{\% by wt}}{\text{At.wt}} = x$	$X/X_{smallest}$
C	64.4%	$\frac{64.4}{12} = 5.4$	$5.4/0.54 = 10$
H	5.5%	$\frac{5.5}{1} = 5.5$	$5.5/0.54 = 10$
Fe	29.9%	$\frac{29.9}{56} = 0.54$	$\frac{0.54}{0.54} = 1$

$\therefore$ Empirical formula = $C_{10}H_{10}Fe$ **Ans**

Q7.

Sol: Let the hydrated $BaCl_2$ is $BaCl_2.XH_2O$

M.w. of $(BaCl_2.XH_2O) = 137 + 71 + 18x = (208 + 18x)$

$\because$ $(208 + 18x)$ g of $BaCl_2 . XH_2O$ contains 208 g of anhydrous $BaCl_2$

$\therefore 1$ ———————— $\frac{208}{(208+18x)}$

$\therefore 1.763$ ———————— $\frac{208}{(208+18x)} \times 1.763 = 1.505$

$\Rightarrow \frac{208}{208+18x} = \frac{1.505}{1.763} = 0.8535$

$\Rightarrow 208 = 177.56 + 15.6x$

$\Rightarrow x = \frac{30.44}{15.34} = 2$

$\therefore$ Formula of the hydrated salt = $BaCl_2.2H_2O$.

Q8.

Sol: From ideal gas equation

$PV = nRT$

$\Rightarrow 0.658 \times 40.7 \times 10^{-3} = \frac{0.0553}{M.W.} \times 0.0821 \times 373$

$\Rightarrow M.W = \frac{0.0553 \times 0.0821 \times 373}{0.658 \times 40.7 \times 10^{-3}} = 63g$

% of B = 85.7%

$\frac{x}{63} \times 100 = 85.7\%$ $\Rightarrow X = 54$ g

$\therefore$ no. of Boron atoms = $\frac{54g}{10.8g} = 5$

Wt of hydrogen = $63 - 54 = 9$

$\therefore$ no. of hydrogen atoms = $\frac{9}{1} = 9$

$\therefore$ Molecular formula of Boron hydride = B_5H_9

Q9.

Sol: Let the gas is C_XN_Y

$$C_XN_Y + 2O_2 \longrightarrow xCO_2 + \frac{Y}{2}N_2$$

1 volume 2 volume $\longrightarrow$ 2 volume 1 volume

From reaction : x = 2

$$\frac{y}{2} = 1 \Rightarrow Y = 2$$

$\therefore$ The gas is C_2N_2 **Ans**

Q10.

Sol: Let the compound is $C_XH_YN_Z$

$$(1)\ \underbrace{C_XH_YN_Z + \left(x + \frac{y}{4}\right)O_2}_{9\text{ vol}} \longrightarrow \underset{4\text{vol.}}{xCO_2} + \underset{6\text{vol}}{\frac{y}{2}H_2O} + \underset{2\text{vol}}{\frac{Z}{2}N_2}$$

Let V vol. of $C_XH_YN_Z$ is present in 9 volume of $C_XH_YN_Z$ & O_2.

Then volume of O_2 required for complete combustion of $C_XH_YN_Z = \left(x + \frac{Y}{4}\right)V$

Now $V + \left(x + \frac{y}{4}\right)V = 9$ --- (1)

Also from balanced reaction , we have

$$\left.\begin{aligned} XV &= 4 \\ \frac{y}{2}V &= 6 \\ \frac{Z}{2}V &= 2 \end{aligned}\right\} \text{-------- (2)}$$

(1): $\Rightarrow V + XV + \frac{y}{4}V = 9$

From (2): $V + 4 + 3 = 9$ $\Rightarrow$ $Y = 9 - 7 = 2$ vol

$\therefore$ Volume of $C_XH_YN_Z$ = 2 vol

Volume of $O_2 = 9 - 2 = 7$ vol **Ans**

$\therefore$ Molecular formula of compound = $C_2H_6N_2$ **Ans**

Q11.

Sol: Let the hydrocarbon is C_XH_Y

Volume at NTP = 1.12 lit

$\therefore$ no of moles $= \frac{1.12}{22.4} = \frac{0.1}{2}$

$C_xH_Y \longrightarrow x\,CO_2 \quad + \quad \frac{Y}{2}H_2O$

$\frac{0.1}{2}$ mole $\quad$ 2.2 g $\quad$ 1.8 g

$\frac{2.2}{44} = \frac{0.1}{2} \qquad \frac{1.8}{18} = 0.1$ moles

So $x = 1$ & $\frac{y}{2} = 2 \Rightarrow Y = 4$

$\therefore$ Hydrocarbon is CH_4 **Ans**

Mol. wt = 16

Wt of 1.12 lit of $CH_4 = \frac{0.1}{2} \times 16 = 0.8\,g$ **Ans**

Volume of O_2 required $= \left(x + \frac{y}{14}\right)1.12\,lit = \left(1 + \frac{y}{4}\right)1.12\,lit = 2.24\,lit$ **Ans**

Q12.

Sol: Let the compound is $C_XH_YO_ZN_W$

Organic compound + $O_2 \xrightarrow{\Delta} CO_2 + H_2O + N_2$

0.21 g $\quad$ 0.462 g $\quad$ 0.125 g

Since wt. of each atom remain conserved

So, wt of C in 0.462 g of CO_2 = wt of C in 0.21 g of organic Compound

$\frac{12}{44} \times 0.462\,g$ = wt of C in 0.21 g of organic compound

$\therefore$ % of C $= \frac{\frac{12}{44} \times 0.462}{0.21} \times 100 = 60\%$

Wt of H in 0.1215 g of H_2O = wt of h in 0.21 g of organic compound

% of H $= \frac{\frac{2}{18} \times 0.1215}{0.21} \times 100 = 6.43\%$

Also, organic compound + NaOH $\xrightarrow{\text{distillation}} NH_3$

0.104 g

$NH_3 + H_2SO_4 \longrightarrow (NH_4)_2SO_4$

15 ml & $\frac{1}{20}$ N

meq of NH_3 = meq of $H_2SO_4 \Rightarrow$ mmole of $NH_3 \times 1 = 15 \times \frac{1}{20}$

$\frac{\text{wt } NH_3}{17} \times 1000 = \frac{3}{4}$ => $\text{wt } NH_3 = \frac{3\times17}{4000}$ g

$\therefore$ wt. of N present in this wt of $NH_3 = \frac{14}{17}\times\frac{3\times17}{4000} = \frac{42}{4000}$

$\therefore$ % of N $= \frac{1.05\times10^{-2}}{0.104}\times100 = 10$

$\therefore$ % of oxygen = 100 – (%C + %H + %N) = 100 – (60 + 6.4 + 10) = 23.6%

Element	% by wt	$\frac{\text{\% by wt}}{\text{At.wt}} = Xi$	$\frac{Xi}{X_{smallest}}$
C	60	$\frac{60}{12} = 5$	$5/0.72 = 7$
H	6.4	$\frac{6.4}{1} = 6.4$	$\frac{6.4}{0.72} = 9$
N	10	$\frac{10}{14} = 0.72$	$\frac{0.72}{0.72} = 1$
O	23.6	$\frac{23.6}{16} = 1.47$	$\frac{1.47}{0.72} = 2$

So, empirical formula will be $C_7H_9NO_2$ **Ans**

Q13.

Sol: Organic compound + $CuO + O_2 \longrightarrow CO_2 + H_2O$

1.0 g 1.239g 0.1269 g

$\Rightarrow$ % of C $= \frac{12/44 \times 1.239}{1} \times 100 = 33.7\%$

$\Rightarrow$ % of H $= \frac{\frac{2}{18}\times0.1269}{1}\times100 = 1.41\%$

Organic compound + NaOH $\xrightarrow{H_2SO_4}$ NH_3

2g excess

NH_3 + H_2SO_4 $\longrightarrow$ $(NH_4)SO_4$ + H_2SO_4

50 ml (remained)

1.0 N 500 ml

↓

25 ml

25ml solution + NaOH $\longrightarrow$ complete neutralisation

21.8 ml & 0.05 N

meq of H_2SO_4 remained in 25 ml = meq of NaOH used = 21.8 × 0.05

$\therefore$ meq of H_2SO_4 remained in 500 ml = 21.8 × 0.05 × 500/25 = 21.8

meq of H_2SO_4 reacted with $NH_3 = 50 \times 1 - 21.8 = 28.2$

$\therefore$ meq of $NH_3 = 28.2$

$$\frac{wt}{17/1} \times 1000 = 28.2 \quad \Rightarrow wt = \frac{28.2 \times 17}{1000}$$

$$\therefore \text{ t of Nitrogen} = \frac{28.2 \times 17}{1000} \times \frac{14}{17} = 0.3948$$

$$\Rightarrow \% N = \frac{0.3948}{2} \times 100 = 19.74$$

% of O = 100 – (% C + % H + % N) = 100 – (33.7 + 1.41+19.74)

% of O = 45.15%

Element	% by wt	$\frac{\%\text{ by wt}}{\text{At wt}} = Xi$	$\frac{xi}{x_{smallest}}$
C	33.7	$\frac{33.7}{12} = 2.82$	$\frac{2.82}{1.41} = 2$
H	1.41	$\frac{1.41}{1} - 1.41$	$\frac{1.41}{1.41} = 1$
O	45.15	$\frac{45.15}{16} = 2.82$	$\frac{2.82}{1.41} = 2$

$\therefore$ Empirical formula of the compound = C_2HNO_2

Q14.

Sol: Organic compound $\xrightarrow{O_2/\Delta}$ CO_2 + H_2O

0.2614 g   0.2324 g   0.0950 g

$$\Rightarrow \% \text{ of C} = \frac{\frac{12}{44} \times 0.2324}{0.2614} \times 100 = 24.20\% \quad \& \quad \% \text{ of H} = \frac{2/18 \times 0.0950}{0.2614} \times 100 = 4\%$$

Organic compound $\longrightarrow$ AgCl

0.1195 g   0.347 g

$$\Rightarrow \% \text{ of Cl} = \frac{\frac{35.5}{143.5} \times 0.347}{0.1195} \times 100 = 71.8\%$$

Element	% by wt	$\frac{\%\text{ by wt}}{\text{At.wt}}$
C	24.2	$\frac{24.2}{12} = 2$
H	4	$\frac{4}{1} = 4$
Cl	71.8	$\frac{71.8}{35.5} = 2$

Empirical formula = $C_2H_4Cl_2$

Now, vapour density = 49.5 $\Rightarrow$ $\therefore$ Mol. wt = 49.5 × 2 = 91 g

Empirical wt = 12 × 2 + 1 × 4 + 35.5 × 2 = 99 g

$\therefore n = \frac{\text{Mol.wt}}{\text{emp.wt}} = \frac{99}{99} = 1 \Rightarrow \therefore$ Molecular formula = $C_2H_4Cl_2$ **Ans**

Q15.

Sol: acid $\longrightarrow$ CO_2 + H_2O

0.2 g   0.195 g   0.04 g

$$\Rightarrow \% \text{ of C} = \frac{0.195 \times \frac{12}{44}}{0.2} \times 100 = 26.6\% \quad \& \quad \% \text{ of H} = \frac{\frac{2}{18} \times 0.04}{0.2} \times 100 = 2.22\%$$

% of O = 100 – (% C + %H) = 100 – (26.6 + 2.22) = 71.2%

Elements	% by wt	$\frac{\%\text{by wt}}{\text{At.wt}} = X_i$	$\frac{X_i}{X_{smallest}}$
C	26.6	$\frac{26.6}{12} = 2.22$	1
H	2.22	$\frac{2.22}{1} = 2.22$	1
O	71.2	$\frac{71.2}{16} = 4.44$	2

$\therefore$ Empirical formula = CHO_2

Empirical wt = 12 + 1 + 16 × 2 = 45

Now for acid to be dibasic, it must have two H – atom

$\therefore$ Mol. formula = $(CHO_2)_2 = (COOH)_2$ **Ans**

Q16.

Sol: Organic base $\longrightarrow$ CO_2 + H_2O

0.10 g   0.2882 g   0.0756 g

$$\Rightarrow \% \text{ of C} = \frac{12/44 \times 0.2882}{0.10} \times 100 = 78.6\% \quad \& \quad \% \text{ of H} = \frac{2/18 \times 0.0756}{0.10} \times 100 = 8.4\%$$

0.2 g of base $\longrightarrow N_2$

21.8 ml at 15°C & 760 mm pressure

$$\Rightarrow n_{N_2} = \frac{PV}{RT} = \frac{\frac{760}{760} \times 21.8 \times 10^{-3}}{0.0821 \times 288} = 0.92 \times 10^{-3}$$

$$\therefore W_{N_2} = n_{N_2}.M.w_{N_2} = 0.92 \times 10^{-3} \times 28 = 0.0258 \text{ g}$$

$$\% \text{of N} = \frac{0.0258}{0.2} = 13\%$$

∴ Element	% by wt	$\frac{\%\text{ by wt}}{\text{At.wt}} = X_i$	$\frac{X_i}{X_{smallest}}$
C	78.6	$\frac{78.6}{12} = 6.55$	$\frac{6.55}{0.93} = 7$
H	8.4	$\frac{8.4}{1} = 8.4$	$\frac{8.4}{0.93} = 9$
N	13	$\frac{13}{4} = 0.93$	$\frac{0.93}{0.93} = 1$

∴ Empirical formula = C_7H_9N **Ans**

Q17.

Sol: Organic compound $\xrightarrow{O_2/\Delta}$ CO_2 + H_2O

0.1688 g   0.454 g   0.0663 g

$$\Rightarrow \%\text{ of C} = \frac{\frac{12}{44}\times 0.454}{0.1688}\times 100 = 73.35\% \quad \& \quad \%\text{ of H} = \frac{\frac{2}{18}\times 0.0663}{0.1668}\times 100 = 4.42\%$$

Organic compound + HNO_3 + $BaCl_2$ $\longrightarrow$ $BaSO_4$

0.1254 g   0.1292 g

$$\Rightarrow \%\text{ of S} = \frac{\frac{32}{(10-37+32+16\times 4)}\times 0.1292}{0.1254}\times 100 = 14.15\%$$

$\Rightarrow$ % of O = 100 – (% C + % H + %S)

= 100 – (73.35 + 4.42 + 14.15) = 8.88%

Element	% by wt	$\frac{\%\text{by wt}}{\text{At.wt}} = X_i$	$\frac{X_U}{X_{smallest}}$
C	73.35	$\frac{73.35}{12} = 6.1125$	$\frac{6.1125}{0.442} \approx 14$
H	4.42	$\frac{4.42}{1} = 4.42$	$\frac{4.42}{0.442} = 10$
O	8.88	$\frac{8.88}{16} = 0.55$	$\frac{0.55}{0.442} = 1$
S	14.15	$\frac{14.15}{32} = 0.442$	$\frac{0.442}{0.442} = 1$

∴ Empirical formula = $C_{14}H_{10}SO$ **Ans**

∴ Element	% by wt	$\frac{\text{\% by wt}}{\text{At.wt}} = X_i$	$\frac{X_i}{X_{smallest}}$
C	78.6	$\frac{78.6}{12} = 6.55$	$\frac{6.55}{0.93} = 7$
H	8.4	$\frac{8.4}{1} = 8.4$	$\frac{8.4}{0.93} = 9$
N	13	$\frac{13}{4} = 0.93$	$\frac{0.93}{0.93} = 1$

∴ Empirical formula = C_7H_9N **Ans**

Q17.

Sol: Organic compound $\xrightarrow{O_2/\Delta}$ CO_2 + H_2O

0.1688 g   0.454 g   0.0663 g

$$\Rightarrow \text{\% of C} = \frac{\frac{12}{44} \times 0.454}{0.1688} \times 100 = 73.35\% \quad \& \quad \text{\% of H} = \frac{\frac{2}{18} \times 0.0663}{0.1668} \times 100 = 4.42\%$$

Organic compound + HNO_3 + $BaCl_2$ $\longrightarrow$ $BaSO_4$

0.1254 g   0.1292 g

$$\Rightarrow \text{\% of S} = \frac{\frac{32}{(10-37+32+16\times4)} \times 0.1292}{0.1254} \times 100 = 14.15\%$$

$$\Rightarrow \text{\% of O} = 100 - (\text{\% C} + \text{\% H} + \text{\%S})$$

$$= 100 - (73.35 + 4.42 + 14.15) = 8.88\%$$

Element	% by wt	$\frac{\text{\%by wt}}{\text{At.wt}} = X_i$	$\frac{X_U}{X_{smallest}}$
C	73.35	$\frac{73.35}{12} = 6.1125$	$\frac{6.1125}{0.442} \approx 14$
H	4.42	$\frac{4.42}{1} = 4.42$	$\frac{4.42}{0.442} = 10$
O	8.88	$\frac{8.88}{16} = 0.55$	$\frac{0.55}{0.442} = 1$
S	14.15	$\frac{14.15}{32} = 0.442$	$\frac{0.442}{0.442} = 1$

∴ Empirical formula = $C_{14}H_{10}SO$ **Ans**

Q18.

Sol:

Element	% by wt	$\frac{\%\text{ by wt}}{\text{At.wt}} = X_i$	$\frac{X_i}{X_{smallest}}$
C	92.3	$\frac{92.3}{12} = 7.7$	$\frac{7.7}{7.7} = 1$
H	7.7	$\frac{7.7}{1} = 7.7$	$\frac{7.7}{7.7} = 1$

$\therefore$ Empirical formula = CH $\Rightarrow$ Empirical wt = 13

Now, Mol. wt = 26 $\Rightarrow \therefore n = \frac{\text{Mol.wt}}{\text{Emp.wt}} = \frac{26}{13} = 2$

$\therefore$ Molecular formula = $(CH)_2 = C_2H_2$

$$C_2H_2 + Br_2 \longrightarrow \underset{92.5\%\,Br}{\text{compound}}$$

There is no need for any other information

Mol. formula : C_2H_2 $\Rightarrow$ Structural formula: $CH \equiv CH$. **Ans**

Q19.

Sol:

element	%by wt	$\frac{\%\text{by wt}}{\text{At.wt}} = X_i$	$\frac{X_i}{X_{smallest}} = Y_i$	$Y_i \times 2$
C	52.2	$\frac{52.2}{12} = 4.350$	$\frac{4.350}{1.24} = 3.5$	7
H	3.7	$\frac{3.7}{1} = 3.7$	$\frac{3.7}{1.24} = 3$	6
Cl	44.1	$\frac{44.1}{35.5} = 1.24$	$\frac{1.24}{1.24} = 1$	2

$\therefore$ Empirical formula : $C_7H_6Cl_2$

For compound to be aromatic, it must have C_6H_5 component

So the compound is $C_6H_5CHCl_2$

$$C_6H_5CHCl_2 + KMno_4 \longrightarrow \text{acid} \longrightarrow \text{sodium salt} \xrightarrow{\text{Sodalime distillation}} C_6H_6$$

The reaction implies that the organic acid is C_6H_5COOH.

Q 20.

Sol: Hydrocarbon $\longrightarrow C_5H_{10}Br_2$

(A)

$$\xrightarrow[\text{KMnO}_4]{\text{Dilute alkaline}} C_5H_{12}O_2$$

$$\xrightarrow{\text{Ozonolysis}} CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-CH_3 + CH_3-CHO$$

reaction implies that structural formula of A is

$$\begin{array}{ccc} CH_3 & & CH_3 \\ & \backslash \quad / & \\ & C=C & \\ & / \quad \backslash & \\ CH_3 & & H \end{array} \quad \textbf{Ans}$$

Q21.

Sol: $A \xrightarrow{\text{OZonolysis}} CH_3-\overset{\overset{\large O}{||}}{C}-CH_3 + \text{Aldehyde}$

Reaction implies that, Aldehyde $\xrightarrow[\text{easily}]{[O]}$ acid

Since aldehyde is easily oxidising, so it should be / can be

$$\begin{array}{l} CH_3 \\ \quad \backslash \\ \quad\; CH-CH=O \\ \quad / \\ CH_3 \end{array}$$

$$\therefore \text{A is} \quad \begin{array}{ccc} CH_3 & & CH_3 \\ \backslash & & / \\ & C=CH-CH & \\ / & & \backslash \\ CH_3 & & CH_3 \end{array} \quad : A \qquad \text{Acid is} \quad \begin{array}{cc} CH_3 & H \\ \backslash & / \\ & C \\ / & \backslash \\ CH_3 & COOH \end{array} \quad : B$$

$$B \xrightarrow{Br_2/P} C \qquad\qquad C \xrightarrow{\text{hydrolysis}} D$$

$$\text{C will be} \quad \begin{array}{cc} CH_3 & Br \\ \backslash & / \\ & C \\ / & \backslash \\ CH_3 & COOH \end{array} \quad : C \qquad \text{D will be} \quad \begin{array}{cc} CH_3 & OH \\ \backslash & / \\ & C \\ / & \backslash \\ CH_3 & COOH \end{array} \quad : D$$

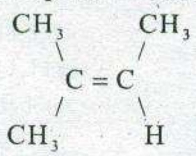
Q22.

Sol:

Element	% by wt	$\frac{\%\text{ by wt}}{\text{At.wt}} = X_i$	$\frac{X_i}{X_{smallest}} = Y_i$	$Y_i \times 7$
C	91.3	$\frac{91.3}{12} = 7.6$	$\frac{7.6}{7.6} = 1$	$\frac{7.6}{7.6} = 1$
H	8.7	$\frac{8.7}{1} = 8.7$	$\frac{8.7}{7.6} = 1.14$	$1.14 \times 7 = 8$

$\therefore$ Empirical formula C_7H_8

Since compound is aromatic & it gives 3 diff-^{n} monochloroderivatives, so it must be reaction implies that structural formula of A is



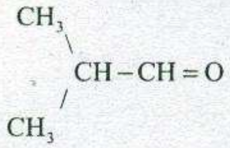
Ans

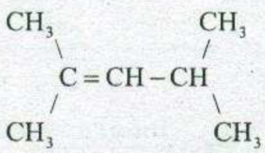
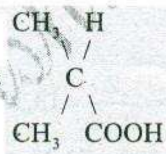
Q21.

Sol: $A \xrightarrow{\text{OZonolysis}} CH_3-\overset{\overset{O}{\|}}{C}-CH_3 \quad + \text{Aldehyde}$

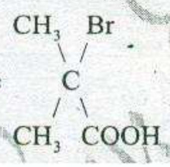
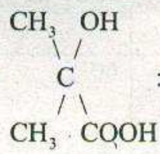
Reaction implies that, Aldehyde $\xrightarrow[\text{easily}]{[O]}$ acid

Since aldehyde is easily oxidising, so it should be / can be



$\therefore$ A is  : A Acid is  : B

$B \xrightarrow{Br_2/P} C$ $C \xrightarrow{\text{hydrolysis}} D$

C will be  : C D will be  : D

Q22.

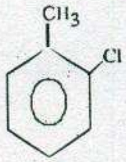
Sol:

Element	% by wt	$\frac{\%\text{ by wt}}{\text{At.wt}} = X_i$	$\frac{X_i}{X_{smallest}} = Y_i$	$Y_i \times 7$
C	91.3	$\frac{91.3}{12} = 7.6$	$\frac{7.6}{7.6} = 1$	$\frac{7.6}{7.6} = 1$
H	8.7	$\frac{8.7}{1} = 8.7$	$\frac{8.7}{7.6} = 1.14$	$1.14 \times 7 = 8$

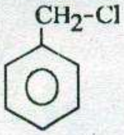
$\therefore$ Empirical formula C_7H_8

Since compound is aromatic & it gives 3 diff-^{n} monochloroderivatives, so it must be

$C_6H_5CH_3 : A$

C.    D. 

Since B on oxidation gives a monobasic acid which on distillation with sodalime gave Benzene, so it will be

C.  : B

Q23.

Sol: Organic compound $\longrightarrow CO_2 + H_2O$

A (0.15 g)   0.33 g   0.18 g

$$\Rightarrow \% \text{ of C} = \frac{\frac{12}{44}\times 0.33}{0.15}\times 100 = 60\%$$

$$\Rightarrow \% \text{ of H} = \frac{\frac{2}{18}\times 0.18}{0.15}\times 100 = \frac{2}{0.15} = 13.33\%$$

% of O = 100 – (60 + 13.33) 100 – 73.33 = 26.67%

Since compound A undergoes dehydration, it must have –OH group, so have oxygen atom.

Element	% by wt	$\frac{\%\text{ by wt}}{\text{At.wt}} = X_i$	$\frac{X_i}{X_{smallest}}$
C	60	$60/12 = 5$	$5/1.667 = 3$
H	13.33	$\frac{13.33}{1} = 13.33$	$\frac{13.33}{1.668} = 8$
O	26.67	$\frac{26.67}{16} = 1.668$	$\frac{1.668}{1.668} = 1$

So Empirical formula = C_3H_8O

Empirical wt = 12 × 3+8+16 = 60 = Mol.wt

∴ Molecular formula = empirical formula = C_3H_8O

∴ A will be $CH_3CH_2CH_2-OH \xrightarrow{\text{Dehydration}} CH_3-CH=CH_2$ (B)

$\downarrow HIO_4 / AgOH$

$CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3$ (C)

Q24.

Sol: $A \xrightarrow{AgNO_3}$ white ppt.

Mol.wt-108

%C = 88.89%

%H = 11.11%

$A \xrightarrow{\text{Hydrogenation}} B$

Mol. wt = 108   Mol. wt = 112

$A \xrightarrow{\text{Oxidation}}$ Acid $\xrightarrow{\text{Decarboxylation}}$ Cyclohexane

Mol.wt = 128 C_6H_{12}

So acid will be $C_6H_{11}-COOH$

Now A gives a white ppt with $AgNO_3$, so it must have terminal triple bond,

$\therefore$ A will be $C_6H_{11}-C\equiv CH \quad \Rightarrow$ Mol. wt $= 12\times 8+12 = 108$ g

B will be $C_6H_{11}-CH_2-CH_3, \quad \Rightarrow$ Mol. wt $= 12\times 8+16 = 112$ g

Q25.

Sol: $X \xrightarrow{\text{Sodium}}$ No reaction

(contains C, H & O)   So it can't have acid or alcohol

$X \xrightarrow{Br_2}$ No reaction

$X \xrightarrow{\text{Schift reagent}}$ No reaction

So it can't be aldehyde and ketone, it can be only ether.

Further x $\xrightarrow{HIO_4}$ only are product, so it must be symmetrical ether

$Y \xrightarrow{\text{Hodrolysis}} Z \xrightarrow{I_2/P_4\,(\text{red})} Y$

$Z \xrightarrow[\text{Oxidation}]{KMnO_4}$ Carboxylic acid., (Eq.wt = 60) It has – COOH group

Wt of – COOH group = 12+ 16 × 2 + 1 = 45 g

So it can have only CH_3 unit attached to – COOH group. So acid is CH_3-COOH.

$$\left.\begin{array}{l}\text{So Z will be } CH_3-CH_2-OH \\ \text{Y will be } CH_3-CH_2-I \\ \text{X will be } CH_3-CH_2-O-CH_2-CH_3\end{array}\right\}\textbf{Ans}$$

$$C_2H_5-O-C_2H_5+2HI \longrightarrow 2C_2H_5I + H_2O$$

Q26.

Sol: For compounds

$$\text{no. of moles} = \frac{\text{volume}}{\text{Molar.vol}} = \frac{\text{wt}}{\text{Mol.wt}} \Rightarrow \frac{448}{22400} = \frac{1.64}{\text{Mol.wt}} \Rightarrow \text{Mol.wt} = \frac{164}{2} = 82\text{g}$$

Element	% by wt	$\frac{\%\text{ by wt}}{\text{At.wt}} = X_i$	$\frac{X_i}{X_{smallest}} = X_i$	$Y \times 3$
C	87.8%	$\frac{87.8}{12} = 7.316$	$\frac{7.316}{7.316} = 1$	$1 \times 3 = 3$
H	12.19%	$\frac{12.19}{1} = 12.19$	$\frac{12.19}{7.316} = 1.66$	$1.66 \times 3 = 5$

Empirical formula $= C_3H_5$ $\Rightarrow$ Empirical wt $= 12 \times 3 + 5 = 41$

$$n = \frac{\text{Mol.wt}}{\text{emp.wt}} = \frac{82}{41} = 2$$

$\therefore$ Molecular formula $= (C_3H_5)_2 = C_6H_{10}$

C_6H_{10} : U.F. factor $= \frac{14-10}{2} = 2$ $\therefore$ So one triple bond or two double bonds

Now $C_6H_{10} \xrightarrow{HgSO_4} C_6H_{12}O$ $\Rightarrow C_6H_{10}$ has a triple bond

Further $C_6H_{10} \xrightarrow{AgNO_3}$ No reaction $\Rightarrow$ C_6H_{10} has internal triple bond

$\therefore C_6H_{10} \xrightarrow{\text{hydrogenation}} CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_2-CH_3$

$\Rightarrow C_6H_{10}$ is $CH_3-\underset{\underset{CH3}{|}}{CH}-C\equiv C-CH_3$

Ans

Q27.

Sol: no.of moles $= \frac{\text{volume}}{\text{Mol.volume}} = \frac{\text{wt}}{\text{Mol.wt}} \Rightarrow \frac{67.2}{22400} = \frac{0.369}{\text{Mol.wt}}$

$$\text{Mol.wt} = \frac{0.369 \times 22400}{67.2} = 123\text{g}$$

$A \xrightarrow{NaOH} B \xrightarrow[250^0 C]{Al_2O_3} C$ (neutral compound)

$B \xrightarrow{300\ C}$ D(hydrocarbon)

$D \xrightarrow{HBr}$ An isomer of A

$D \xrightarrow{H_2SO_4/H_2O} E$

A is a monobromoderivatives with Mol.wt. 123

Wt of hydrocarbon = (123 – 80)+1 = 43 + 1 = 44

$\therefore$ hydrocarbon has 3 carbon & 8 hydrogen $= 12 \times 3 + 8 = 44g$

A : $CH_3 - CH_2 - CH_3$

Monobromodevatives : $CH_3 - CH_2 - CH_2 - Br$

B : $CH_3 - CH_2 - CH_2 - OH$

C $\because$ $C_3H_7O - C_3H_7$ (At lower temperature intermolecular dehydration occur)

D: $CH_3 - CH = CH_2$ (At higher temperature intramolecular dehydration occur)

E: $(CH_3)_2CH - OH$

Q28.

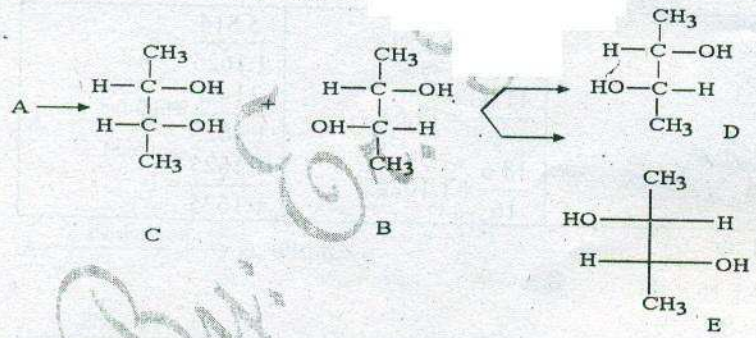
Sol: $C_4H_{10}O_2 \xrightarrow{Na} H_2$ gas

0.90 g   224 ml at NTP = 0.01 moles

Since compound reacts with Na to give H_2, so it must have – COOH group or –OH group.

Now u.f. $= \dfrac{10-10}{2} = 0$

Compound has –OH groups



Q29.

Sol:

Element	% by wt	$\dfrac{\%\text{ by wt}}{\text{At wt}} = X_i$	$\dfrac{X_i}{X_{smallest}}$
C	76.6	$\dfrac{76.6}{12} = 6.38$	$\dfrac{6.38}{106} = 6$
H	6.38	$\dfrac{6.38}{1} = 6.38$	$\dfrac{6.38}{1.06} = 6$
O	17.02	$\dfrac{17.02}{16} = 1.06$	$\dfrac{1.06}{1.06} = 1$

$\therefore$ Empirical formula = C_6H_6O

Empirical wt. $= 12 \times 6 + 6 + 16 = 72 + 22 = 94$

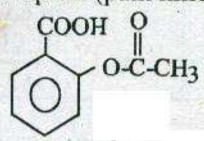
Mol. Wt. $=$ V. d. $\times 2 = 47 \times 2 = 94$ g

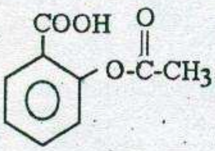
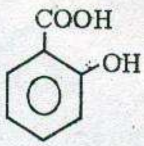
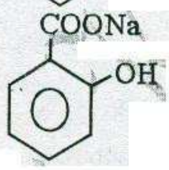
$\therefore$ Molecular formula = empirical formula = 94 g

$A \xrightarrow{\text{ags.Fecl}_3}$ characteristic colour.

$A \xrightarrow[\text{NaOH}]{CO_2+\Delta} B \xrightarrow{\text{acidification}} C \xrightarrow{\text{acetylechloride}} D$

Aspirin (pain killer)



D:  C:  B:  A:  : C_6H_6O

Q30.

Sol:

Element	% by wt	$\frac{\%\text{ by wt}}{\text{At.wt}}$	$\frac{X_i}{X_{smallest}}$
C	69.77	$\frac{69.77}{12} = 5.814$	$\frac{5.814}{1.1625} = 5$
H	11.63	$\frac{11.63}{1} = 11.63$	$\frac{11.63}{1.1625} = 10$
O	18.6	$\frac{18.6}{16} = 1.1625$	$\frac{1.1625}{1.1625} = 1$

$\therefore$ Empirical formula : $C_5H_{10}O$

Empirical wt $= 12 \times 5 + 10 + 16 = 86$

$\therefore$ Mol. wt = empirical wt = 86

$\therefore$ Mol . formula = empirical formula = $C_5H_{10}O$

$C_5H_{10}O \xrightarrow{\text{Fehling's sol}-^n}$ doesn't reduce

$\xrightarrow{\text{iodo form test}}$ so it has $-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-$ unit or $CH_3-CH(OH)-$ unit

$\therefore$ U.f. factor $= \frac{12-10}{2} = 1$ $\therefore$ So it has ketone group unit

So possible structure are $CH_3-CO-C_3H_7$ & $C_2H_5-CO-C_2H_5$ **Ans**

Q31.

Sol: On oxidation X gives acid, so it must have CHO, -OH or Ketone group. In other word, oxygen will be present in it

Element	% by wt	$\frac{\%\text{ by wt}}{\text{At.wt}} = X_i$	$\frac{X_i}{X_{smallest}}$
C	54.54	$\frac{54.54}{12} = 4.545$	$\frac{4.545}{2.27} = 2$
H	9.09	$\frac{9.09}{1} = 9.09$	$\frac{9.09}{2.27} = 4$
O	36.37	$\frac{36.37}{12} = 2.27$	$\frac{2.27}{2.27} = 1$

$\therefore$ Empirical formula : C_2H_4O

Empirical wt $= 12 \times 2 + 4 + 16 = 44$ g = Mol.wt

$\therefore$ Molecular formula = empirical formula = C_2H_4O

U. F. Factor $= \frac{6-4}{2} = 1$

So it is an aldehyde: $CH_3\text{–}CHO$ **Ans**

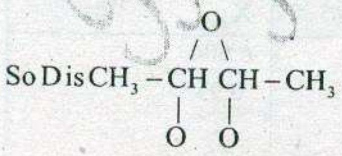
Q 32.

Sol: $A \xrightarrow[\text{reaction}]{\text{haloform}}$ so A has $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-$unit

$A \xrightarrow{\text{Reduction}}$ B, will have $CH_3-\overset{\overset{\displaystyle OH}{|}}{CH}-$unit

$B \xrightarrow{H_2SO_4} C \longrightarrow D$ (Monozonide)

$D \xrightarrow{\text{hydrolysis}}$ acetaldehyde



C is $CH_3-CH=CH-CH_3$

B is $CH_3-\overset{\overset{\displaystyle OH}{|}}{CH}-CH_2-CH_3$

A is $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-CH_2-CH_3$

Q33.

Sol:

Element	% by wt	$\frac{\%\text{by wt}}{\text{At wt}} = X_i$	$\frac{X^i}{X_{smallest}}$
C	62.06%	$\frac{62.06}{12} = 5.17$	$\frac{5.17}{1.72} = 3$
H	10.35%	$\frac{10.35}{1} = 10.35$	$\frac{10.35}{1.72} = 6$
O	27.59%	$\frac{27.59}{16} = 1.72$	$\frac{1.72}{1.72} = 1$

$\therefore$ Empirical formula = C_3H_6O Empirical Weight = $12\times3+6+16 = 58$ = Mol.wt.

$\therefore$ Molecular formula = Empirical formula = C_3H_6O

$$A(C_3H_6O) \xrightarrow{\text{Reuction}} B\ (C_3H_8O) \xrightarrow[\text{test}]{\text{gives}\quad\text{iodoform}}$$

U.F = 1

So, B has $CH_3-\underset{}{\overset{OH}{\overset{|}{C}}}H-$unit

So B is $CH_3-\overset{OH}{\overset{|}{C}}H-CH_3$ & A is $CH_3-\overset{O}{\overset{||}{C}}-CH_3$ **Ans**

$$CH_3-\overset{OH}{\overset{|}{C}}H-CH_3 \xrightarrow{\text{dehydration}} CH_3-CH=CH_2 \quad (\text{Mol .wt} = 42)$$

C: $CH_3-CH=CH_2$ **Ans**

Q34.

Sol: Reaction implies that compound has oxygen atom present in it now

Element	% by wt	$\frac{\%\text{by wt}}{\text{At.wt}} = X^i$	$\frac{X^i}{X_{smallest}}$
C	79.25	$\frac{79.25}{12} = 6.604$	$\frac{6.604}{0.95} = 7$
H	5.56	$\frac{5.56}{1} = 5.56$	$\frac{5.56}{0.95} \approx 6$
O	15.19	$\frac{15.19}{16} = 0.95$	$\frac{0.95}{0.95} = 1$

$\therefore$ Empirical formula : C_7H_6O

Since compound is aromatic, so it will have C_6H_5 unit.

Now the compound can be C_6H_5CHO only.

X: C_6H_5CHO

$$C_6H_5CHO \xrightarrow[\text{undergo Canizzaro's reaction}]{\text{alkali/NaOH}} \underset{(Y)}{C_6H_5CH_2OH} + C_6H_5COONa$$

$$C_6H_5COONa \leftarrow \underset{(Z)}{C_6H_5COOH}$$

Q35.

Sol: X

Aromatic compound

Element	%by wt	$\frac{\%\text{by wt}}{\text{At.wt}} = X_i$	$\frac{X^i}{X_{smallest}}$
C	58.5	$\frac{58.5}{12} = 4.875$	$\frac{4.875}{0.814} = 6$
H	4.1	$\frac{4.1}{1} = 4.1$	$\frac{4.1}{0.814} = 5$
O	26	$\frac{26}{16} = 1.625$	$\frac{0.625}{0.814} = 2$
N	11.4	$\frac{11.4}{14} = 0.814$	$\frac{0.814}{0.814} = 1$

So the empirical formula is $C_6H_5NO_2$ since the compound is aromatic, so it has C_6H_5 unit Which is present in empirical formula. This implies that Molecular formula will be some as empirical formula

$\therefore X : C_6H_5NO_2$

$X \xleftarrow{HNO_3} Y$;   So Y is C_6H_6

$$\underset{(X)}{C_6H_5NO_2} \xrightarrow{\text{Reduction}} C_6H_5NH_2\ (Z)$$

Q36.

Sol:

Element	% by wt	$\frac{\%\text{by wt}}{\text{At.wt}} = X'$	$\frac{X_i}{X_{Smallest}}$
C	61.01	$\frac{61.01}{12} = 5.084$	$\frac{5.084}{1.696} = 3$
H	15.25	$\frac{15.25}{1} = 15.25$	$\frac{15.25}{1.696} = 9$
N	23.74	$\frac{23.74}{14} = 1.696$	$\frac{1.696}{1.696} = 1$

So the empirical formula is C_3H_9N

$$X \xrightarrow{HNO_2} \underset{(Y)}{\text{alcohol}} \xrightarrow{\text{oxidation}} Z$$

X is the an amine

Z: v.d. = 29, M.w = 58, gives iodoform test

So it has $CH_3-\overset{\overset{O}{\|}}{C}-$unit

(since x has 3 carbon, So Z will also have)

So Z can be $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$

$$Y:\ CH_3-\overset{\overset{OH}{|}}{CH}-CH_3 \qquad X:\ CH_3-\overset{\overset{NH_2}{|}}{CH}-CH_3$$

Q 37.

Sol: $A \xrightarrow{\text{Reduction}}$ Primary amine (B)

So A has Nitro group, so it has oxygen atom present in it

% of O = 100 – (% C + %H + %N)

= 100 – (32 + 6.66 + 18.67) = 42.67

Element	% by wt	$\frac{\%\text{by wt}}{\text{At wt}} = X_i$	$\frac{X_i}{X_{smallest}}$
C	32	$\frac{32}{12} = 2.66$	$\frac{2.66}{1.33} = 2$
H	6.66	$\frac{6.66}{1} = 6.66$	$\frac{6.66}{1.33} = 5$
N	18.67	$\frac{18.67}{14} = 1.33$	$\frac{1.33}{1.33} = 1$
O	42.67	$\frac{42.67}{16} = 2.66$	$\frac{2.66}{1.33} = 2$

So the empirical formula will be $C_2H_5NO_2$

$B \xrightarrow{\text{Nitrous acid}}$ ethyl alcohol (C_2H_5OH)

So B is $C_2H_5NH_2$

So A is $C_2H_5NO_2$ (which is coming as empirical formula)

$$C_2H_5.NH_2 \xrightarrow[KOH]{CHCl_3} C_2H_5.NC\ (C)$$

$$\downarrow \text{Reduction}$$

$$C_2H_5-NH-CH_3$$

Q38.

Sol: A gives Lucas test in 5-10 minutes, then it will be secondary hydroxide.

$$\underset{6\ g}{A} + \text{Na metal} \longrightarrow \underset{\substack{1120\text{ ml at NTP}\\ \frac{0.1}{2}}}{H_2\uparrow}$$

Also A contain one oxygen atom per molecule, so it has one –OH group.

So the compound will give only one H-atom, so $\frac{1}{2}H_2$ molecule.

New $\frac{1}{2}$ mole of H_2 is produced by 1 mole

So $\frac{0.1}{2}$ ——————— 0.1 mole

$$\text{moles} = \frac{\text{wt}}{\text{Mol.wt}} \Rightarrow 0.1 = \frac{6}{\text{Mol.wt}} \Rightarrow \text{Mol.wt} = \frac{6}{0.1} = 60\text{g}$$

So the compound can have 3 carbon atom –one oxygen atom & 8 hydrogen atom,

So A is $CH_3-\underset{\substack{|\\ OH}}{CH}-CH_3$ **Ans**

Q39.

Sol:

Element	% by wt	$\frac{\%\text{ by wt}}{\text{At wt}} = X_i$	$\frac{X_i}{X_{smallest}}$
C	68.32	$\frac{68.32}{12} = 5.69$	$\frac{5.69}{0.71} = 8$
H	6.4	$\frac{6.4}{1} = 6.4$	$\frac{6.4}{0.71} = 9$
Cl	25.26	$\frac{25.26}{35.5} = 0.71$	$\frac{0.71}{0.71} = 1$

Empirical formula of A = C_8H_9Cl.

Empirical wt. = $12\times 8 + 9 \times 35.5 = 140.5$ = Mol.wt

So Molecular formula = empirical formula = C_8H_9Cl

$$A\ (C_8H_9Cl) \xrightarrow[\text{dilute acid}]{\text{hydrolysis}} B\ (C_8H_{10}O) \xrightarrow{\text{oxidation, Mild condition}} C_8H_8O\ (C)$$

$$\downarrow$$

$$C_6H_5-\underset{\substack{|\\ CH_3}}{C}=N-NH-C_6H_5 \quad (D)$$

Since it +ve iodoform test

So hydrazine must have $CH_3-\overset{\overset{N}{\|}}{C}-\text{unit}$

So D must be $C_6H_5-\underset{\underset{CH_3}{|}}{C}=N-NH-C_6H_5$

$C: C_6H_5-\underset{\underset{CH_3}{|}}{C}=O$ $\quad B: C_6H_5-\underset{\underset{CH_3}{|}}{CH}=OH$ $\quad A: C_6H_5-\underset{\underset{CH_3}{|}}{CH}=Cl$

Q40.

Sol: W ($C_2H_6 + C_2H_5OH$) = 10 g

Let x g of C_2H_5OH is present in the mix

Since only ethanol reacts with Na, So

$$C_2H_2OH + Na \longrightarrow C_2H_5ONa + \frac{1}{2}H_2$$

200 ml At 27^0C & 760 mm Hg

$$nH_2 = \frac{\frac{760}{760}\times 200\times 10^{-3}}{0.0821\times 300} = \frac{0.2}{0.0821\times 300} = 8.12\times 10^{-3}$$

$\therefore$ moles of $C_2H_5OH = 2\times$ mole of $H_2 = 0.01624$

$$\therefore \frac{wt}{(24+6+16)g} = 0.01624$$

Wt = 0.747 g

$$\therefore \% \text{ by wt} = \frac{0.747}{10}\times 100 = 7.47\% \qquad \textbf{Ans}$$

Q41.

Sol: W($C_2H_5OH + CH_3CHO$) = 0.535 g

Let x g of CH_3CHO is present in the mixture

$$2CH_3CHO + 2\text{Fehling solution} \longrightarrow 2CH_3COOH + Cu_2O$$

X g $\qquad (Cu^{2+}) \qquad$ 1.2 g

2 mole of $CH_3CHO \equiv$ 1mole of Cu_2O

⇨ moles of $CH_3CHO = \frac{1}{2}$ (moles of Cu_2O produced) $= \frac{1}{2}\left(\frac{1.2}{63.5\times 2+16}\right) = \frac{1}{2}\left(\frac{1.2}{143}\right)$

$$\frac{Wt\, CH_3CHO}{Mol.wt} = 8.39\times 10^{-3}\times \frac{1}{2}$$

$$Wt\, CH_3CHO = \frac{1}{2}\times 8.39\times 10^{-3} x(24+14+16) = \frac{0.369}{2} g = 0.1845 g$$

$$\therefore \% \text{ of } CH_2CHO = \frac{0.1845}{0.535}\times 100 = 34.5\% \qquad \textbf{Ans}$$

Q42.

Sol:

Element	% by wt	$\frac{\%\text{ by wt}}{\text{At wt}} = X_i$	$\frac{X_i}{X_{smallest}}$
C	49.32	$\frac{49.32}{12} = 4.11$	$\frac{4.11}{1.37} = 3$
H	9.59	$\frac{9.59}{1} = 9.59$	$\frac{9.59}{1.37} = 7$
N	19.18	$\frac{19.18}{14} - 1.37$	$\frac{1.37}{1.37} = 1$
O	21.91	$\frac{21.91}{16} = 1.37$	$\frac{1.37}{1.37} = 1$

So Empirical formula : C_3H_7NO

$A \xrightarrow[\text{Boiled}]{\text{NaOH}} NH_3 + \text{Salt} \xrightarrow{\text{acidification}}$ monobasic Nitrogen free acid (B)

So A is an amide $\qquad\qquad C_2H_5COOH$

$A : C_2H_5 - \overset{\overset{\Large O}{\|}}{C} - NH_2 \qquad B : C_2H_5 - COOH$

Q43.

Sol: (I) (II)

$[Pd\ C_XH_YN_Z](ClO_4)_2 \longrightarrow [Pd\ C_XH_YZ_Z](CNS)_2$

30.15% C $\qquad$ 40.412% C

5.06% H $\qquad$ 5.94% H

Let M is the Mol. wt of (1)

Mol. wt of (II) = $M - 2.(35.5 + 64) + (12 + 14 + 32) \times 2 = M - 199 + 116 = (M - 83)$ g

Now

$106 + 12x + y + 14Z + 199 = M$ —— (1)

In (I)

% of C = 30.15%

$\frac{12x}{M} \times 1000 = 30.15 \quad \Rightarrow x = \frac{30.15M}{1200}$ ---(2)

% of H = 5.06%

$\frac{y}{M} \times 100 = 5.06 \quad \Rightarrow y = \frac{5.06M}{100}$ —— (3)

In (2) % of H

$$\frac{y}{M-83}\times 100 = 5.94 \quad \Rightarrow y\ \frac{(5.94)(M-83)}{100} ----(4)$$

(3) & (4): $\Rightarrow$ $5.06\,M = 5.94 - 5.94\times 83$

$$M = \frac{5.94\times 83}{0.88} = 560$$

$$y = \frac{5.06\times 560}{100} = 28$$

$$x = \frac{30.15\times 560}{1200} = 14 \qquad \textbf{Ans}$$

From (I) $106 + 12\times 14 + 28 + 13\times Z = 560 - 199$

$$14Z = 560 - 199 - 106 - 12\times 14 + 28$$

$$Z = 59/14 = 4 \qquad \textbf{Ans}$$