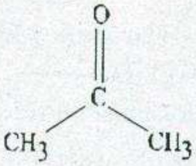
3. Eudiometry

Q1

Sol:



$- O_2$ (excess) $\longrightarrow 3CO_2 - 3H_2O$

(Acetone)

40 ml (given).

From the above balanced chemical equation

$\therefore$ 1 ml of acetone will produce 3 ml of CO_2

$\therefore 40$ ———————— $40 \times 3 = 120$ ml of $CO_2(g)$

$= 120$ ml of CO_2 (g); **Ans**

Q2.

Sol: $SO_2 \quad + \quad \frac{1}{2}O_2 \longrightarrow SO_3$

210 ml

Since 1 ml of SO_2 require $\frac{1}{2}$ ml of O_2

$\therefore 210$ ———————— $\frac{210}{2}$ ml of O_2

If x is the volume of air required,

Then $x \times 21\% =$ volume of oxygen (required)

$$x \times \frac{21}{100} = \frac{210}{2}$$

Volume of air $= x = \frac{1000}{2} = 500$ ml **Ans**

Q3.

Sol: $C_4H_{10}(g) + \left(4 + \frac{10}{4}\right)O_2(g) \longrightarrow 4CO_2(g) + 5H_2O$

2 lit

1st method

$\therefore$ 1 lit of C_4H_{10} will produce 4 lit of CO_2 (g)

$\therefore$ ———————————— 2×4 lit $= 8$ lit of CO_2 (g) **Ans**

2nd method

1 volume of $C_4H_{10}(g) \equiv 4$ volume of $CO_2(g)$

$4\times$ volume of $C_4H_{10}(g)$ = volume of $CO_2(g)$

$\therefore$ Volume of $CO_2(g) = 4\times 2$ lit $= 8$ lit **Ans**

Q4.

Sol:	$H_2(g)$ +	$Cl_2(g)$ $\longrightarrow$	$2HCl(g)$
Initially	12 lit	11.2 lit	0
After reac-^{n}	(12-11.2)lit	0	2×11.2 lit
	0.8 lit	0	22.4 lit

$\therefore V_{HCl(g)} = 22.4$ lit & Volume of $H_2(g) = 0.8$ lit **Ans**

Q5.

Sol: $C_3H_8(g) + \left(3+\frac{8}{4}\right)O_2 \longrightarrow 3CO_2 + 4H_2O$

Propane $(5O_2)$

Mass = 2.2 g

$$\text{Moles} = \frac{2.2\,g}{44\,g} = \frac{1}{20}$$

$$\text{Volume at NTP} = \frac{1}{20}\times 22.4\,\text{lit} = 1.12\,\text{lit}$$

$\therefore$ 1 volume of $C_3H_8 \equiv 5$ volume of O_2

Volume of $O_2 = 5\times$ volume of C_3H_8

$= 5\times 1.12$ lit $= 5.6$ lit **Ans**

Q6.

Sol: Let the hydrocarbon gas is C_XH_Y

$$C_XH_Y + \left(x+\frac{y}{4}\right)O_2 \longrightarrow xCO_2 + \frac{y}{2}O_2$$

0.5 lit (excess is taken) 2.5 lit 3 lit

1 volume of $C_xH_Y \equiv x$ volume of CO_2

Volume of CO_2 = X $\times$ volume of C_xH_y

2.5 lit = x $\times$ 0.5

X = 5

Also, 1 volume of $C_xH_y \equiv {}^{y}\!/_{2}$ volume of H_2O

$$\text{Volume of } H_2O = \frac{y}{2}\times \text{Volume of } C_xH_y$$

$$3\,\text{lit} = \frac{y}{2}\times 0.5\,\text{lit}$$

Y = 12. So hydrocarbon is C_5H_{12} **Ans**

Q7.

Sol: $V(H_2 + O_2) = 0.02$ lit

$$H_2 + \frac{1}{2}O_2 \longrightarrow H_2O$$

Let volume of H_2 (g) in mixture = x lit

$\therefore$ --------- O_2 (g)----------------- = (0.02 – x) lit

$\therefore$ From balanced chemical equation

	$2H_2(g)$ +	$O_2(g)$ $\longrightarrow 2H_2O$ (l)
Initially	x	0.02 –x
Finally	0	$(0.02-x) - x/2$

$\therefore$ Finally only O_2 remained & if x lit of H_2 consumed than $x/2$ lit of O_2 will get consumed.

$$(0.02 - x) - x/2 = 0.003$$

$$0.02 - \frac{3x}{2} = 0.003$$

$$\frac{3x}{2} = 0.02 - 0.003 = 0.017 \text{ lit}$$

$$x = 0.01333 \text{ lit}$$

$$\therefore \% \text{ of } H_2 = \frac{0.01333}{0.02} \times 100 = 56.6\% \quad \textbf{Ans}$$

$\%$ of $O_2 = 43.3$ % **Ans**

Q8.

Sol: $$C_xH_y + \left(x + \frac{y}{4}\right)O_2 \longrightarrow xCO_2 + \frac{y}{2}H_2O$$

12 ml 50 ml

$\therefore$ volume of O_2 (required to react with C_xH_y)

$$= \left(x + \frac{y}{4}\right)\text{volume of } C_xH_y = \left(x + \frac{y}{4}\right) \times 12 ----(1)$$

After reaction:

Volume of O_2 + volume of CO_2 = 21 ml ----------------------(2)

After passing over KOH, CO_2 is absorbed

Then volume of O_2 (remained) = 8 ml ----------------------(3)

$$(2) \Rightarrow \left\{50 - 12\left(x + \frac{y}{4}\right)\right\} + 12x = 32$$

$$50 - 12x - 3y + 12x = 32$$

$$50-3y=32 \Rightarrow y=\frac{50-32}{3}=6$$

$$(3)\Rightarrow 50-12\left(x+\frac{y}{4}\right)=8$$

$$\Rightarrow 50-12x-3y=8$$

$$\Rightarrow 50-12x-18=8$$

$$\Rightarrow 12x=32-8$$

$$x=\frac{24}{12}=2$$

$\therefore$ Hydrocarbon is C_2H_6 **Ans**

Note:- Volume of H_2O is not taken because the volume measured at temp. below 100^0C where it is liquid. However question doesn't specify it.

Q9.

Sol: $C_XH_Y + \left(x+\frac{y}{4}\right)O_2 \longrightarrow XCO_2 + \frac{y}{2}H_2O$

15 ml

Volume of O_2 = 21% of volume of air

$$=\frac{21}{100}\times 357=74.97\text{ ml}$$

$\therefore$ A/C to balanced chemical equation.

$$15\left(x+\frac{y}{4}\right)=75 \qquad \Rightarrow x+\frac{y}{4}=5------(1)$$

Volume of product(s) = 327 ml (at NTP).

Volume of air (remained) + Volume of CO_2 = 327 ml

$$282+x\times 15=327$$

$$15x=45$$

$$X=3$$

$$\therefore (1)\Rightarrow x+\frac{y}{4}=5 \quad \Rightarrow \frac{y}{4}=5-3=2 \qquad \Rightarrow y=8$$

$\therefore$ Hydrocarbon is $C_XH_Y = C_3H_8$ **Ans**

Q10.

Sol: $C_XH_YO_Z + \left(x+\frac{y}{4}-\frac{Z}{2}\right)O_2 \rightarrow xCO_2 + \frac{y}{2}H_2O$

0.9 gm 224 ml

$$\frac{0.9}{90}=\frac{1}{100}\text{ moles}$$

After the combustion

Volume of O_2 remained + volume of CO_2 = 560

$$\left\{224-224\left(x+\frac{y}{4}-\frac{z}{2}\right)\right\}+224x=560----(1)$$

Also volume after passing KOH = 112 ml

$\therefore$ volume of CO_2 absorbed = 560 -112 = 448 ml

$$224\text{ x ml} = 448\text{ ml}$$

$$X=\frac{448}{224}=2$$

Also,

$$224-224\left(2+\frac{y}{4}-\frac{z}{2}\right)-448=560$$

$$224-448-224\left(\frac{y}{4}-\frac{z}{2}\right)=112$$

$$-224-224\left(\frac{y}{4}-\frac{z}{2}\right)=112$$

$$\left(\frac{Z}{2}-\frac{y}{4}\right)-1=\frac{1}{2}-(2)$$

Also. Mol. Wt of $C_xH_yO_Z$ = 90

12 x + 1x y + 16 z = 90

24 + y + 16Z = 90

Y + 16 Z = 66 ---------(3)

(2) $\Rightarrow \frac{Z}{2}-\frac{y}{4}=\frac{3}{2}$

2Z – y = 6 ----------(4)

(3) + (4) $\Rightarrow$ 18Z = 72

$$Z=\frac{72}{18}=4$$

$\therefore$ Y = 8-6 = 2

$\therefore$ Molecular formula = $C_2H_2O_4$ **Ans**

Q11.

Sol: Let the gas is N_xO_Y (since it produces water & N_2 with H_2, SO it must contains N_2 & oxygen)

$$Y\,H_2 + N_xO_y \longrightarrow yH_2O + \frac{x}{2}N_2$$

1 volume 1 volume $\rightarrow$ 1 volume 1 volume

The given volume of product directly implies that

$Y = 1$

$\& \ x/2 = 1 \Rightarrow x = 2$

$\therefore$ Compound is $N_XO_Y = N_2O$ **Ans**

Q12.

Sol: Let the molecular formula is C_xH_y

$$C_XH_Y + \left(x + y/4\right)O_2 \longrightarrow xCO_2 + y/2\ H_2O.$$

5 ml (excess given = 30 ml)

Volume of O_2 (required reacting with 5 ml of C_XH_y)

$$= \left(x + \frac{y}{4}\right)5\,ml$$

A/q,

Volume of O_2 remained + volume of CO_2 = 25

$$30 - 5\left(x + y/4\right) + 5x = 25$$

$$30 - 5x - \frac{5y}{4} + 5x = 25$$

$$\frac{5y}{4} = 5 \Rightarrow y = 4$$

Also volume of CO_2 absorbed in CO_2 = 25 – 15 ml

$5x = 10$ ml

$X = 2.$

$\therefore$ Molecular formula = $C_xH_y = C_2H_4$ **Ans**

Q 13.

Sol: Let the formula of Ammonia is N_xH_y

$$N_XH_Y \longrightarrow \frac{x}{2}N_2 + \frac{y}{2}H_2$$

40 ml

A/q, final volume = 40 + 40 = 80 ml

$$\frac{x}{2} \times 40 + \frac{y}{2} \times 40 = 80$$

$$x + y = 4 - (1)$$

$$N_xH_Y + \frac{y}{4}O_2 \longrightarrow \frac{x}{2}N_2(g) + \frac{y}{2}H_2O(g)$$

40 ml 40 ml

Gases remained

$$40-\frac{y}{4}\times 40+40\frac{x}{2}=30$$

$$40-10y+20x=30$$

$$\therefore\ y-2x=1\ -(2)$$

$$\begin{array}{r} x+y=4 \\ y-2x=1 \\ \underline{+\quad -} \\ 3x=3 \\ x=1 \end{array}$$

$(1)\Rightarrow y=3$

$\therefore$ Molecular formula of ammonia = $N_XH_Y = NH_3$ **Ans**

Q 14.

Sol: Let the molecular formula is H_XS_Y

Mol. wt = 34

$x\times 1+32\times y=34$

$x+32\times y=34$ ------------(1)

$$H_xS_y(g)+Sn\longrightarrow \frac{x}{2}H_2+SnS$$

20 ml

A/q, volume of H_2 obtained = 20 ml

$$\frac{x}{2}\times 20=20 \quad\Rightarrow\quad x=2$$

$\therefore$ (1) $\Rightarrow$ y = 1

$\therefore$ Molecular formula = H_2S. **Ans**

Q 15.

Sol: Let molecular formula of Ozone = Ox

Let y ml of O_2 is taken from which XZ converted to ozone

$$XO_2\longrightarrow 2O_x$$

Decrement in volume = 40 ml

$(y-x.z)+2z=y-4$

$XZ-2Z=4-(1)$

Turpentine absorbs O_3

$\therefore$ Volume remained = $(Y-XZ)=y-4-8$

$XZ=12$

$\therefore$ (1) $\Rightarrow 12-2Z=4$

$2Z=8 \qquad Z=4$

$\therefore XZ = 12 \Rightarrow X \times 4 = 12 \Rightarrow x = 3$

$\therefore$ Molecular formula $O_x = O_3$ **Ans**

Q16.

Sol: Let volume of Ozone = x lit

Volume of oxygen = (1-x) lit

At 0^0C & 1 atm (NTP), molar volume = 22.4 lit

Wt of 1 lit = 1.5 g

$\therefore$ Wt of 22.4 lit = 1.5 $\times$22.4 = 33.6 g

$\therefore$ Mol wt of ozonised oxygen = 33.6 g

100 ml is reduced to 90 ml after passing over turpentine.

$\therefore$ volume of ozone absorbed = 10 ml

$\therefore$ 100 ml contain 10 ml of ozone

$\therefore$ 1000 ml ——— 100 ml of ozone.

$\therefore x = \frac{100}{1000}$ lit = 0.1 lit

$\therefore$ Volume of ozone in 1 lit mix = 0.1 lit

--- - -- ---- -oxygen - ------ -- -= 0.9 lit

$$\therefore Mol.wt = \frac{Mole\% \text{ of ozone mol.wt}_{ozone} + Mol\% \text{ of } O_2 \times M.w_{O_2}}{100}$$

$$33.6 = \frac{10 \times M.w_{ozone} + 90 \times 32}{100}$$

Mol.wt. of ozone = 48 g **Ans**

Q17.

Sol: Let the molecular formula of S = S_X

mole of S_X in 280 ml at NTP = $\frac{280}{22400}$

$$\therefore \text{wt of } S_X = \frac{28}{2240} \times 32x = 3.2\frac{1}{10}$$

$$X = \frac{224}{28} = 8$$

$\therefore$ Molecular formula of sulphur = S_8 **Ans**

Q18.

Sol:- $V(H_2) = 1$ lit & $V(O_2) = 1$ lit

	$2H_2$	+ $O_2 \longrightarrow$	$2H_2O(l)$
Before reaction	1 lit	1 lit	0
After reaction	0	$1 - \frac{1}{2}$ lit	1 lit

$\therefore$ Volume of O_2 remained = $\frac{1}{2}$ lit

$\therefore$ Moles of $O_2 = \frac{\frac{1}{2}}{22.4} = \frac{1}{44.8}$

$\therefore$ Wt. of $O_2 = \frac{1}{48.8} \times 32\,g = 0.7143\,g$

Also moles of H_2O produced from $\frac{1}{22.4}$ moles of $H_2 = \frac{1}{22.4}$

$\therefore$ Wt produced $= \frac{1}{22.4} \times 18 = 0.8036\,g$

At 100^0C, water becomes gas

$\therefore$ Total volume of gases $= 1 + \frac{1}{2} = \frac{3}{2}$ lit

$\therefore$ Pv = nRT

$$P = \frac{nRT}{V} = \frac{\left(\frac{1}{44.8} + \frac{1}{22.4}\right) \times 0.0821 \times 3}{\frac{3}{2}}$$

$= 1.0236$ atm $= 778$ mm of Hg **Ans**

Q19.

Sol: $V(C_2H_2 + CO) = 20$ ml

$VO_2 = 30$ mL

Let volume of $C_2H_2 = x$ mL

Volume of CO = (20-x) mL

$$C_2H_2 + \left(2 + \frac{2}{4}\right)O_2 \longrightarrow 2CO_2 + H_2O$$

$$C_2H_2 + \frac{5}{2}O_2 \longrightarrow 2CO_2(g) + H_2O$$

X mole of C_2H_2 requires $\frac{5x}{2}$ mL of O_2

$$CO + \frac{1}{2}O_2 \longrightarrow CO_2$$

(20 – x) mL of CO requires $\left(\frac{20-x}{2}\right)$ mL of O_2

1st method

$\therefore$ Total no. of moles of O_2 which reacted with C_2H_2 & CO

$= \frac{5x}{2} + \frac{(20-x)}{2} = (30-8)mL$ (30 mL is taken & 8 mL remained, So (30-8) mL reacted)

$5x + 20 - x = 44$

$20 + 4x = 44$

$4x = -20 + 44 = 24$

$X = 6$

2[nd] method

After the reaction, volume of CO_2 obtained + volume of O_2 = 34

After passing KOH, CO_2 get absorbed

A/q, volume of CO_2 absorbed = 34-8 = 26 mL

$2x + (20 - x) = 26$

$X = 26 - 20 = 6$ mL

$\therefore$ Volume of C_2H_2 = 6 mL **Ans**

Volume of CO = 20 -6 = 14 mL. **Ans**

Q20.

Sol: $V(N_2 + NO) = 25$ mL

Let volume of N_2 = x mL

Volume of NO = (25 –x) mL

$Cu + NO \longrightarrow CuO + \frac{1}{2}N_2(g)$ (N_2 is highly uncreative due to very strong triple bond It only react with Mg, Li etc)

(25-x)

Volume of N2 produced from NO gas = $\frac{(25-x)}{2}$

Volume of N_2 present from before = x mL

$\therefore$ A/q, $x + \frac{(25-x)}{2} = 20$

$2x + 25 - x = 40$

$X = 40 - 25 = 15$ mL

$\therefore$ Volume of N_2 = x = 15 mL

$\therefore$ % of $N_2 = \frac{15}{25} \times 100 = 60\%$

% of NO = $\frac{10}{25} \times 100 = 40\%$

Ans

Q21.

Sol: $V(H_2 + CH_4 + N_2) = 40$ mL

$VO_2 = 10$ mL

$H_2 + \frac{1}{2}O_2 \longrightarrow H_2O(l)$

$CH_4 + \left(1+\frac{4}{4}\right)O_2 \longrightarrow CO_2 + 2H_2O(l)$

$N_2 \longrightarrow$ No reaction

Let volume of H_2 = x mL

Volume of CH_4 = y mL

Volume of N_2 = {40 – (x+y)}

On cooling the gas remained

= CO_2(g) produced + N_2(g) + O_2 (remained)

$A/q,\ Y + \{40-(x+y)\} + 10 - \left\{\frac{x}{2}+2y\right\} = 36.5$

(with x mL of H_2, $x/2$ mL of O_2 reacts & with y mL of CH_4, 2y mL of O_2 reacts)

$40 - x + 10 - x/2 - 2y = 36.5$

$50 - \frac{3x}{2} - 2y = 36.5$

$50 - 36.5 = \frac{3x}{2} + 2y$

$\therefore \frac{3x}{2} + 2y = 13.5$

$3x + 4y = 27$ ----------(1)

After passing over KOH,

CO_2 will be absorbed

$\therefore$ y = 3 mL ----------(2)

After passing over pyrogallol,

O_2 will be absorbed.

$\therefore 10 - \left(x/2 + 2y\right) = 3/3$

$10 - 3/2 = x/2 + 2y$

$17 = x + 4y$ ----------(3)

Or from (2) & (3) X = 5

$\therefore$ Volume of H_2 = 5 mL

Volume of NH_4 = 3 mL

Volume of N_2 = 32 mL

$\therefore$ **% of CH_4** $= \frac{3}{40} \times 100 = 7.5\%$

% of H_2 $= 5/40 \times 100 = 12.5\%$

% of N_2 $= \frac{32}{40} \times 100 = 80\%$

Q22.

Sol: V($H_2 + CH_4 + CO + C_2H_4$ + non-combustible mixture) = 1000 lit

Volume % of H_2 = 50% $\Rightarrow$ volume Hz = 500 lit

Volume % of CH_4 = 35% $\Rightarrow$ volume CH_4 = 350 lit

Volume % of CO = 8% $\Rightarrow$ Volume CO = 80 lit

Volume % of non-combustible mixture = 5% $\Rightarrow$ volume = 50 lit

$H_2 + \frac{1}{2}O_2 \longrightarrow H_2O$

500 lit requires 250 lit of O_2

$$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$$

350 lit requires 350×2 = 700 lit of O_2

$$CO + \tfrac{1}{2}O_2 \longrightarrow CO_2$$

80 lit requires 80×2 = 160 lit of O_2

$$C_2H_4 + 3O_2 \longrightarrow 2CO_2 + 2H_2O$$

20 lit requires 60 lit of O_2

∴ Total volume of O_2 (required)

= 250 lit + 700 lit + 160 lit + 60 lit = 1170 lit

∴ If volume of air = x lit

Then $x \times 21\% = 1170 \Rightarrow x = \dfrac{1170 \times 100}{21} = 5571\,\text{lit} = 5.57\,m^3$ **Ans**

Q23.

Sol: $V(CO + H_2) = 38$ ml

Let volume of CO = x ml ∴ Volume of H_2 = (38- x) mL

$$CO + \frac{1}{2}O_2 \longrightarrow CO_2(g)$$

X mL of CO requires $x/2$ ml of O_2 & will produce x ml of CO_2

$$H_2 + \tfrac{1}{2}O_2 \longrightarrow H_2O(l)$$

(38-x) mL of H_2 requires $\left(\dfrac{38-x}{2}\right)$ ml of O_2 & will produce (38-x) ml of H_2O

A/q, Total volume after reaction = 29 ml

Volume of $CO_2(g)$ + Volume of O_2 remained = 29 mL

⇨ $x + 31 - \left\{ \dfrac{x}{2} + \dfrac{38-x}{22} \right\} = 29$

⇨ X + 31- 19= 29 ⇒ X + 12 = 29 => x = 17

∴ Volume of CO = 17 mL

Volume of H_2 = 38 – 17 = 21 ml

∴ % of CO = $\dfrac{17}{38} \times 100\% = 44.7\%$

% of H_2 = $\dfrac{21}{38} \times 100\% = 55.3\%$ **Ans**

Q24.

Sol: $P(CH_4 + C_2H_2) = 63$ mm of Hg

PCO_2 obtained = 69 mm of Hg (in the same volume)

(1) $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

(2) $C_2H_2 + \left(2 + \frac{2}{4}\right)O_2 \longrightarrow 2CO_2 + H_2O$

Let moles of $CH_4 = n_1$ & due to this pressure P_1 is exerted.

&Moles of $C_2H_2 = n_2$ & due to this pressure P_2 is exerted.

Then $P_1 + P_2 = 63$ mm of Hg ---------------------(1)

From equation (1) & (2)

moles of CO_2 produced from $CH_4 = n_1$

$\therefore$ Pressure exerted = P_1

moles of CO_2 produced from $C_2H_2 = 2n_2$

Pressure exerted = $2P_2$

A/q, $P_1 + 1P_2 = 69$ mm of Hg ---------------------(2)

(2) – (1)

$P_2 = 6$ mm of Hg

$P_1 = 57$ mm of Hg

$\therefore$ Fraction of methane = $\frac{n_1}{n_1 + n_2} = \frac{P_1}{P_1 + P_2} = \frac{57}{63} = 0.9$ **Ans**

Q25.

Sol: $V(CO + CH_4 + N_2) = 20$ mL

Let x ml of CO & y mL of CH_4 is present,

Then

$CO + \frac{1}{2}O_2 \longrightarrow CO_2$

$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

$\therefore$ Total moles of CO_2 produced = x + y = 14 ----------------------(1)

(Because volume reduction after KOH is passed is due to CO_2 absorption)

$\therefore$ Volume is reduced by 13 mL

If Z is the volume of O_2 taken.

Then

Initial volume = 20 + Z

Final volume = (20 +Z) – 13

Final volume = $V_{CO_2} + V_{O_2}$ remained + VN_2

$20 + Z - 13 = (x+y) + Z - \left(\frac{1}{2}x + 2y\right) + 20 - (x + y)$

$7 = x + y - \frac{1}{2}x - 2y + 20 - x - y$

$\frac{1}{2}x + 2y = 20 - 7 = 13$

$X + 4y = 26$ ----------------(2)

(2) – (1) 3y = 12 y = 4 mL
(1) ⇒ x = 10 mL

∴ Volume of CO = x ml = 10 mL. **Ans**
Volume of CH_4 = y mL = 4 mL

Q26.

Sol: Let x mL is the volume of H_2 present in mixture

$CuO + H_2 \rightarrow Cu + H_2O$

X mL → n moles corresponding to x ml

$Cu + \frac{1}{2}O_2 \longrightarrow CuO$

$n \longrightarrow \frac{x}{2}$ mL

moles will react with $\frac{x}{2}$ mL of O_2 under same condition of temp & pressure

∴ Volume of O_2 remained

$$100 - \left(x + \frac{x}{2}\right) = 84.5$$

$$\frac{3x}{2} = 15.5 \Rightarrow x = \frac{31}{3} = 10.33 \text{ mL}$$

Ans

Q27.

Sol: $SO_2 + \frac{1}{2}O_2 \xrightarrow{\text{catalyst}} SO_3$

given moles : 10 15 0

After reaction : $10 - x$ $15 - \frac{1}{2}x$ x

A/q, x = 8 moles

∴ moles of SO_2 which doesn't undergo reaction

= 10 – x = 10 – 8 = 2 moles

moles of O_2 which doesn't undergo reaction $= 15 - \frac{x}{2} = 15 - 4 = 11$ mole

Ans

Q28.

Sol: Volume of O_2 = x mL

Volume of O_3 (100 – x) mL

Since O_3 is absorbed by turpentine oil.

Volume of O_3 = (100 – x) = 20 ⇒ x = 80 mL

If the mixture is heated, O_3 will be decomposed

$$O_3 \xrightarrow{\Delta} \frac{3}{2}O_2$$

$$20 \text{ mL} \longrightarrow \frac{3}{2} \times 20 \text{ ml} = 30 \text{ mL}$$

$\therefore$ Total volume now, = 80 ml + 30 mL = 110 mL **Ans**

Q29.

Sol: Let the compound is $C_XH_YO_Z$

$$C_XH_YO_Z + \left(x + \frac{y}{4} - \frac{Z}{2}\right)O_2 \longrightarrow xCO_2 + \frac{Y}{2}H_2O$$

Initially	1 volume	2.5 volume
Finally	0	0

$$\therefore \left(x + y/4 - Z/2\right).1 = 2.5 ------(1)$$

Also x. 1 = 2 $\Rightarrow$ x = 2

(y/2).1 = 2 $\rightarrow$ y = 4

From (1) $\left(x + 4/4 - Z/2\right) = 2.5$

$$3 - \frac{Z}{2} = 2.5 \Rightarrow Z = 1$$

So, the compound is $\mathbf{C_2H_4O}$. **Ans**

Q30.

Sol: Moles of $(H_2 + O_2 + N_2) = 5.22 \times 10^{-4}$ moles

Pressure (total) = 67.4 mm of Hg

From the given data in the problem, it is clear that H_2 is in excess amount than the amount consumed in reaction.

Also let pressure due to H_2 = X mm of Hg

Pressure due to O_2 = y mm of Hg

$\therefore$ Pressure due to N_2 = 67.4 – (x+y)

$$H_2 + \frac{1}{2}O_2 \longrightarrow H_2O(l)$$

Initially	x	y	2y
Finally	(x-2y)	0	

From question,

PH_2(excess) + PN_2 = 14.3 mm ------------(1)

When oxygen is added, it consumes H_2, but then O_2 becomes in excess.

$$P_{O_2(excess)} + P_{N_2} = 14.3\text{ mm} \quad —— (2)$$

$\therefore$ Reaction implies that P(H_2 excess) = x-2y & PN_2 = 67.4 – (x+y)

$\therefore$ (1) $\Rightarrow x - 2y + 67.4 - (x+y) = 14.3$

$62.4 - 3y = 14.3$

$$y = \frac{67.4 - 14.3}{3} = 17.7 \text{ mm of Hg.}$$

Also when 30 mm of O_2 is added.

$$H_2 + \frac{1}{2}O_2 \longrightarrow H_2O$$

Initially	(x-2y)	30
Finally	**0**	$30 - \frac{1}{2}(x - 2y)$

$\therefore (2) \Rightarrow$ PO_2(excess) + PN_2 = 32.9 mm

$$\Rightarrow 30 - \frac{1}{2}(x - 2y) + 67.4 - (x + y) = 32.9$$

$$\Rightarrow 97.4 - x/2 + y - x - y = 32.9$$

$$\Rightarrow \frac{3x}{2} = 97.4 - 32.9 = 64.5$$

$$x = \frac{64.5 \times 2}{3} = 43 \text{ mm of Hg}$$

$\therefore PN_2 = 67.4 - (x + y)$

$67.4 - (43 + 17.7) = 6.7$ mm of Hg

$\therefore$ mole fraction of $H_2 = \frac{PH_2}{P_{total}} = \frac{43}{67.4} = 0.638$ **Ans**

mole fraction $O_2 = \frac{PO_2}{P_{total}} = \frac{17.7}{67.4} = 0.262$ **Ans**

mole fraction of $N_2 = \frac{6.7}{67.4} = 0.1$ **Ans**