NURTURE COURSE

EUDIOMETRY

EUDIOMETRY

KEY CONCEPTS

EUDIOMETRY :

Eudiometry or gas analysis involves the calculations based on gaseous reactions or the reactions in which at least two components are gaseous, in which the amounts of gases are represented by their volumes, measured at the same pressure and temperature. Some basic assumptions related with calculations are:

1. Gay-Lussac's law of volume combination holds good. According to this law, the volumes of gaseous reactants reacted and the volumes of gaseous products formed, all measured at the same temperature and pressure, bear a simple ratio.

N_2 (g) + $3H_2$ (g) $\longrightarrow$ $2NH_3$ (g)
1 vol. 3 vol. 2 vol.

Problem may be solved directly is terms of volume, in place of mole. The stoichiometric coefficients of a balanced chemical reactions gives the ratio of volumes in which gaseous substances are reacting and products are formed, at same temperature and pressure.

2. The volumes of solids or liquids is considered to be negligible in comparison to the volume of gas. It is due to the fact that the volume occupied by any substance in gaseous state is even more than thousand times the volume occupied by the same substance in solid or liquid states.

$2H_2$ (g) + O_2 (g) $\longrightarrow$ $2H_2O$ (*l*)
2 mole 1 mole 2 mole
2 vol. 1 vol. 0 vol.

3. Air is considered as a mixture of oxygen and nitrogen gases only. It is due to the fact that about 99% volume of air is composed of oxygen and nitrogen gases only.

4. Nitrogen gas is considered as a non- reactive gas. It is due to the fact that nitrogen gas reacts only at very high temperature due to its very high thermal stability. Eudiometry is performed in an eudiometer tube and the tube can not withstand very high temperature. This is why, nitrogen gas can not participate in the reactions occurring in the eudiometer tube.

5. The total volume of non-reacting gaseous mixture is equal to sum of partial volumes of the component gases ***(Amagat's law)***.

$V = V_1 + V_2 +$.....

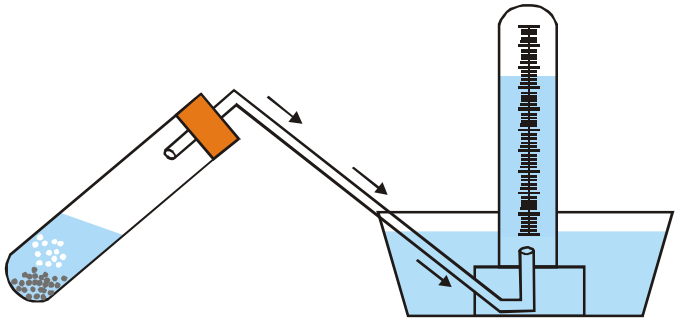
Partial volume of gas in a non-reacting gasesous mixture is its volume when the entire pressure of the mixture is supposed to be exerted only by that gas.

6. The volume of gases produced is often given by certain solvent which absorb contain gases.

Solvent	Gases absorb
KOH	CO_2, SO_2, Cl_2
Ammonical Cu_2Cl_2	CO
Turpentine oil	O_3
Alkaline pyrogallol	O_2
water	NH_3, HCl
$CuSO_4/CaCl_2$	H_2O

EUDIOMETER

An eudiometer is a laboratory device that measures the change in volume of a gas mixture following a physical or chemical change.



Scheme of eudiometer

To use a eudiometer, it is filled with water, inverted so that its open end is facing the ground (while holding the open end so that no water escapes), and then submersed in a basin of water. A chemical reaction is taking place through which gas is created. One reactant is typically at the bottom of the eudiometer (which flows downward when the eudiometer is inverted) and the other reactant is suspended on the rim of the eudiometer, typically by means of a platinum or copper wire (due to their low reactivity). When the gas created by the chemical reaction is released, it should rise into the eudiometer so that the experimenter may accurately read the volume of the gas produced at any given time. Normally a person would read the volume when the reaction is completed

SOLVED EXAMPLE

Ex.1 ***10 ml of CO is mixed with 25 ml air (20% O_2 by volume) in a container at 1 atm. Find final volume (in ml) of container at 1 atm after complete combustion. (Assume that temperature remain constant).***

Sol. $\overset{10\,ml}{CO} + \frac{1}{2}\overset{5ml}{O_2} \longrightarrow \underset{10\,ml}{CO_2}$

$V_f = V_{CO_2}$ + Volume of remaining air = 10 + 20 = 30 ml

Ex.2 ***A 3 L gas mixture of propane (C_3H_8) and butane (C_4H_{10}) on complete combustion at 25°C produced 10 L CO_2. Assuming constant P and T conditions what was volume of butane present in initial mixture ?***

Sol. $C_3H_8(g) + 5O_2 \longrightarrow 3CO_2(g) + 4H_2O(l)$

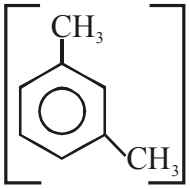
x L 3x L

$C_4H_{10}(g) + \frac{13}{2}O_2(g) \longrightarrow 4CO_2(g) + 5H_2O(l)$

(3-x) L 4(3 – x) L

from question $3x + 4(3 - x) = 10 \Rightarrow x = 2$

$\therefore$ Volume of butane , $C_4H_{10} = (3 - x) = 1$ L

Ex.3 ***100 ml gaseous meta Xylene***  ***undergoes combustion with excess of oxygen at room temperature and pressure. Volume contraction / expansion (in ml) during reaction is :***

Sol. $C_4H_{10}(g) + \frac{21}{2}O_2(g) \longrightarrow 8CO_2(g) + 5H_2O(l)$

100 ml	$\frac{21}{2}\times 100 = 1050\text{ml}$	800 ml	0

$\therefore$ Conctraction in volume = (100 + 1050) – 800 = 350 ml

Ex.4 ***30 ml gaseous mixture of methane and ethylene in volume ratio X : Y requires 350 ml air containing 20% of O_2 by volume for complete combustion. If ratio of methane and ethylene changed to Y : X. What will be volume of air (in ml) required for complete reaction under similar condition of temperature and pressure.***

Sol. $CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O\ (l)$

V_1ml $\quad 2V_1$ml $\quad V_1$ml $\quad 0$

$C_2H_4(g) + 3O_2(g) \longrightarrow 2CO_2(g) + 2H_2O\ (l)$

V_2ml $\quad 3V_2$ml $\quad 2V_2$ml $\quad 0$

For given data : $V_1 + V_2 = 30$

and $2V_1 + 3V_2 = 350 \times \frac{20}{100} = 70$

$\therefore\ V_1 = 20\ ,\ V_2 = 10$

For required data : $V_1 = 10$ and $V_2 = 20$

$\therefore$ Volume of O_2 required = $2V_1 + 3V_2 = 80$ ml and volume of air required = $80 = \frac{100}{20} = 400\text{ml}$

Ex.5 ***An alkene upon combustion produces $CO_2(g)$ and $H_2O(g)$. In this combustion process if there is no volume change occurs then the no. of C atoms per molecule of alkene will be :***

Sol. $C_nH_{2n}(g) + \frac{3n}{2}O_2(g) \rightarrow nCO_2(g) + nH_2O(g)$

if there no volume changes i.e. $\Delta_{ng} = 0$

$$(n + n) - \left(1 + \frac{3n}{2}\right) = 0 \Rightarrow n = 2$$

Ex.6 ***A gaseous hydrocarbon (C_xH_y) requires 6 times of its own volume of O_2 for complete oxidation and produces 4 times of its volume of CO_2. Find out the volume of x + y.***

Sol. $C_XH_y + \left(x + \frac{y}{4}\right) O_2 \longrightarrow XCO_2 + \frac{y}{2}H_2O(l)$

Vol a $\quad a\left(x+\frac{y}{4}\right) \quad ax$

Given that : $a(x + y/4) = 6a$
vol of CO_2 = 4 vol of C_xH_y
$ax = 4\ (a)$
$x = 4 \quad ...(2)$

from (1) $x + \frac{y}{4} = 6$
$\therefore\ x + y = 4 + 8 = 12$

Ex.7 ***On heating 60 ml mixture containing equal volume of chlorine gas and it's gaseous oxide, volume becomes 75 ml due complete decomposition of oxide. On treatment with KOH volume becomes 15 ml. What is the formula of oxide of chlorine ?***

Sol. Let oxide of Cl is Cl_xO_y
So in 60 mL $\Rightarrow$ 30 mL Cl_xO_y and 30 mL Cl_2.
Now,

$Cl_xO_y \longrightarrow \frac{x}{2}Cl_2 + \frac{y}{2}O_2$
30mL

$\frac{30.x}{2}$mL $\quad \frac{30.y}{2}$mL

Given :

$75 = 30 + \frac{30x}{2} + \frac{30y}{2} \quad \Rightarrow \quad x + y = 3$ .....(i)

KOH absorbs Cl_2 and volume becomes 15 mL so,

$(75 - 15) = V_{Cl_2} = 30 + \frac{30x}{2} \quad \Rightarrow \quad x = 2$ and $y = 1$

So the oxide : Cl_2O

Ex.8 ***5 L of A (g) & 3 L of B(g) measured at same T & P are mixed together which react as follows***

$$2A(g) + B(g) \rightarrow C(g)$$

What will be the total volume (in litre) after the completion of the reaction at same T & P.

Sol. $2A(g) + B(g) \longrightarrow C(g)$
5L $\quad$ 3L
L.R. is A

So, volume of C produced = $\frac{1}{2}\times 5$ = 2.5 L

and, volume of B reacted = $\frac{1}{2}\times 5$ = 2.5 L
So, volume fo B remained = 3 – 2.5 = 0.5 L
Hence, $V_{total} = V_C + V_B = 2.5 + 0.5 = 3$ L

EXERCISE # S-I

1. 20 ml propane gas (C_3H_8) is burnt completely in excess of air. The volume of CO_2 gas formed is.

2. What volume of O_2(g) is needed for complete combustion of 40 ml ethane gas (C_2H_6) ?

3. 10 ml of CO is mixed with 25 ml air having 20% O_2 by volume. What would be the final volume if none of CO and O_2 is left after the reaction?

4. Calculate the volume of CO_2 evolved by the combustion of 50 ml of a mixture containing 40% C_2H_4 and 60% CH_4 (by volume)

5. 10 moles of a mixture of CO (g) and CH_4(g) was mixed with 22 moles of O_2 gas and subjected to sparking. Find the moles of gas absorbed when the residual gases are passed through alc. KOH.

6. 60 ml of a mixture of nitrous oxide and nitric oxide was exploded with excess of hydrogen. If 38 ml of N_2 was formed, calculate the volume of NO gas in the mixture.

7. When 100 ml of a $O_2 - O_3$ mixture was passed through turpentine, there was reduction of volume by 20 ml. If 100 ml of such a mixture is heated, what will be the increase in volume?

8. 20 ml of a mixture of C_2H_2 and CO was exploded with 30 ml of oxygen. The gases after the reaction had a volume of 34 ml. On treatment with KOH, 8 ml of oxygen remained. Calculate the volume of C_2H_2 in the mixture.

9. 10 ml of a mixture of CO, CH_4 and N_2 exploded with excess of oxygen gave a contraction of 6.5 ml. There was a further contraction of 7 ml, when the residual gas treated with KOH. Volume of CO, CH_4 and N_2 respectively is

10. 10 ml of a mixture of CH_4, C_2H_4 and CO_2 were exploded with excess of air. After explosion and further cooling, there was contraction of 17 ml and after treatment with KOH, there was further reduction of 14 ml. What is the composition of the mixture?

11. 10 ml of an oxide of nitrogen produce 20 ml NO_2 and 5 ml O_2 on complete decomposition. The oxide of nitrogen is-

12. Find the nature of hydrocarbon for which volume of oxygen required for combustion is 1.5 times volume of carbon dioxide produced.

13. A gaseous alkane is exploded with O_2. The volume of O_2 required for complete combustion and the volume of CO_2 formed after combustion are in 7 : 4 ratio. What is the molecular formula of alkane ?

14. 20 ml of a gaseous hydrocarbon (A) was exploded with excess of O_2 in an eudiometer tube. On cooling, the volume was reduced by 50 ml. On further treatment with KOH, there was a further contraction of 40 ml. The molecular formula of hydrocarbon A is :

15. When a certain quantity of oxygen was ozonised in a suitable apparatus, the volume decreased by 4 ml. On addition of turpentine the volume further decreased by 8 ml. All volumes were measured at the same temperature and pressure. From these data, if formula of ozone is O_x then find x.

EXERCISE # S-II

1. A 20 ml mixture of C_2H_4 and C_2H_2 undergoes sparking in gas eudiometer with just sufficient amount of O_2 and shows contraction of 37.5 ml. Volume (in ml) of C_2H_2 in the mixture is.

2. 1120 ml of ozonised oxygen ($O_2 + O_3$) at 1 atm & 273K weighs 1.76 gm. Find the reduction in volume on passing this through alkaline pyrogallol solution is -

3. Balanced chemical equation is given as following :

$C_2H_5OH(\ell) + 3O_2(g) \longrightarrow 2CO_2(g) + 3H_2O(\ell)$

What value of the volume in litre of CO_2 (g) measured at 200 K and 1 atm, produced from the combustion of 0.25 mole of C_2H_5OH (ℓ) ? [Use R = 0.08 L atm mol^{-1} K^{-1}]

4. 40 ml of a mixture of C_2H_2 and CO is mixed with 100 ml of O_2 gas and the mixture is exploded. The residual gases occupied 104 ml and when these are passed through KOH solution, the volume becomes 48 ml. All the volume are at same temperature and pressure. Determine the composition of original mixture.

5. 10 mL of gaseous organic compound containing C, H and O only was mixed with 100 mL of O_2 and exploded under identical conditions and then cooled. The volume left after cooling was 90 mL. On treatment with KOH a contraction of 20 mL was observed. If vapour density of compound is 23, if molecular formula of the compound is $C_xH_yO_z$, then find (x + y + z).

EXERCISE # O-I

Single correct

1. 10 ml CH_4 gas is burnt completely in air (O_2 = 20%, by volume). The minimum volume of air needed is -

(A) 20 ml (B) 50 ml (C) 80 ml (D) 100 ml

2. 20 ml of a mixture of C_2H_4 and C_2H_6 gases is burnt completely in excess of O_2. The volume of CO_2 gas formed is :

(A) 20 ml (B) 40 ml (C) 80 ml (D) 30 ml

3. $C_6H_5OH\ (g) + O_2\ (g) \longrightarrow CO_2\ (g) + H_2O\ (l)$

Magnitude of volume change if 30 ml of C_6H_5OH (g) is burnt with excess amount of oxygen, is

(A) 30 ml (B) 60 ml (C) 20 ml (D) 10 ml

4. When 20 ml mixture of O_2 and O_3 is heated, the volume becomes 29 ml and disappears in alkaline pyragallol solution. What is the volume percent of O_2 in the original mixture?

(A) 90% (B) 10% (C) 18% (D) 2%

5. The % by volume of C_4H_{10} in a gaseous mixture of C_4H_{10}, CH_4 and CO is 40. When 200 ml of the mixture is burnt in excess of O_2. Find volume (in ml) of CO_2 produced.

(A) 220 (B) 340 (C) 440 (D) 560

6. A mixture of C_2H_2 and C_3H_8 occupied a certain volume at 80 mm Hg. The mixture was completely burnt to CO_2 and H_2O(l). The pressure of CO_2 was found to be 230 mm Hg at the same temperature and volume. The fraction of C_2H_2 in mixture is

(A) 0.125 (B) 0.5 (C) 0.85 (D) 0.25

7. 20 mL of a mixture of CO and H_2 were mixed with excess of O_2 and exploded & cooled. There was a volume contraction of 23 mL. All volume measurements corresponds to room temperature (27°C) and one atmospheric pressure. Determine the volume ratio $V_1 : V_2$ of CO and H_2 in the original mixture

(A) 6.5 : 13.5 (B) 5 : 15 (C) 9 : 11 (D) 7 : 13

8. An ideal gaseous mixture of ethane (C_2H_6) and ethene (C_2H_4) occupies 28 litre at 1atm, 0°C. The mixture reacts completely with 128 gm O_2 to produce CO_2 and H_2O. Mole fraction of C_2H_6 in the mixture is–

(A) 0.6 (B) 0.4 (C) 0.5 (D) 0.8

9. For a chemical reaction occuring at constant pressure and temperature.

$2A(g) + 5B(g) \longrightarrow C(g) + 2D(g)$

(A) contraction in volume is double the volume of A taken if B is taken in excess.

(B) contraction in volume is more than the volume of B taken if A is in excess.

(C) volume contracts by 20 mL if 10 mL A is reacted with 20 mL B.

(D) no change in volume due to reaction

10. One litre of CO_2 passed over hot coke the volume becomes 1.4 litres then the composition of products will not be (At NTP)

(A) $V_{CO_2} : V_{CO} = 3:4$ (B) $V_{CO_2} = 1.6\,ltr.$ (C) $n_{CO_2} : n_{CO} = 3:4$ (D) % V of CO $= \frac{400}{7}$

11. 10 ml of a compound containing 'N' and 'O' is mixed with 30 ml of H_2 to produce H_2O (l) and 10 ml of N_2 (g). Molecular formula of compound if both reactants reacts completely, is

(A) N_2O (B) NO_2 (C) N_2O_3 (D) N_2O_5

12. An alkane on complete combustion with O_2 shows 50% of volume contraction. Molecular formula of alkane is -

(A) C_4H_{10} (g) (B) CH_4 (g) (C) C_2H_6 (g) (D) C_3H_8 (g)

13. 20 mL of a gaseous hydrocarbon was exploded with 120 mL of oxygen. A contraction of 60 mL was observed, and a further contraction of 60 mL took place when KOH was added. What is the formula of the hydrocarbon :

(A) C_3H_6 (B) C_3H_8 (C) C_2H_6 (D) C_4H_{10}

14. When a definite volume of a gaseous alkyne (C_nH_{2n-2}) is burnt completely in excess of air, a contraction in volume equal to twice the volume of alkyne burnt occured. The value of 'n' is -

(A) 10 (B) 6 (C) 3 (D) 20

15. Each volume of a gaseous organic compound containing C, H and S only produce 1 volume CO_2, 2 volume H_2O vapours and 1 volume SO_2 gases on complete combustion. The molecular formula of compound is -

(A) CH_2S (B) CH_4S (C) C_2H_4S (D) C_2H_6S

EXERCISE # O-II

Single correct :

1. A 2 L sample of a gaseous hydrocarbon is burnt in excess oxygen. The only products of the reaction are 8L of $CO_2(g)$ and 10L of $H_2O(g)$, all at 100ºC and 1 atm pressure. The formula of the hydrocarbon is -

(A) C_5H_{12} (B) C_4H_5 (C) C_4H_{10} (D) C_8H_{10}

2. 1120 ml of ozonised oxygen ($O_2 + O_3$) at 1 atm & 273K weighs 1.76 gm. The reduction in volume on passing this through alkaline pyrogallol solution is -

(A) 896 ml (B) 224 ml (C) 448 ml (D) 672 ml

3. **Statement-1 :** When a gaseous hydrocarbon is burnt in excess of oxygen and the products of combustion are cooled to the orignal temperatrue and pressure, a contraction in volume occurs.

Statement-2 : The contraction in volume is solely due to the liquifaction of water vapour.

(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

(C) Statement-1 is true, statement-2 is false.

(D) Statement-1 is false, statement-2 is true.

4. **Statement-1 :** For the same volume of gaseous alkane, alkene and alkyne having same number of carbon atoms, the volume of oxygen needed for complete combustion is maximum for alkane.

Statement-2 : The number of hydrogen atoms is maximum in alkane.

(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.

(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.

(C) Statement-1 is true, statement-2 is false.

(D) Statement-1 is false, statement-2 is true.

More than one correct:

5. Two gases A and B which react according to the equation

$$aA_{(g)} + bB_{(g)} \longrightarrow cC_{(g)} + dD_{(g)}$$

to give two gases C and D are taken (amount not known) in an Eudiometer tube (operating at a constant Pressure and temperature) to cause the above.

If on causing the reaction there is no volume change observed then which of the following statement is/are correct.

(A) (a + b) = (c + d)

(B) average molecular mass may increase or decrease if either of A or B is present in limited amount.

(C) Vapour Density of the mixture will remain same throughout the course of reaction.

(D) Total moles of all the component of mixture will change.

6. 20 ml mixture of C_3H_8 and CO gas when burnt in excess of oxygen produce 40 ml CO_2 gas. Choose the correct statement(s). (Volume of gases measured under same T & P)

(A) Volume of C_3H_8 in the mixture is 15 ml

(B) Volume of CO in the mixture is 10 ml

(C) Total volume contraction due to combustion is 35 ml.

(D) The volume of oxygen used for combustion is 75 ml

7. 10 ml of a gaseous mixture containing C_2H_x and C_3H_8 exactly requires 40 ml O_2 for complete combustion and produces 25 ml CO_2 and 30 ml H_2O vapour. The correct information (s) is/are -

(A) Total volume contraction = 5 ml

(B) Volume contraction due to combustion of C_2H_x = 0

(C) x = 4

(D) Volume of C_2H_x in the initial mixture = 5 ml

8. 100 ml mixture of CO and CO_2 mixed with 30 mL of O_2 and sparked in eudiometer tube. The residual gas after treatment with aq. KOH has a volume of 10 mL which remains unchanged when treated with alkaline pyrogallol. If all the volumes are under the same conditions, point out **correct** options(s):

(A) The volume of CO that reacts, is 60 mL

(B) The volume of CO that remains unreacted, is 10 mL

(C) The volume of O_2 that remains unreacted, is 10 mL

(D) The volume of CO_2 that gets absorbed by aq.KOH, is 90 mL.

Paragraph for Q.9 to Q.11

For the given series of reaction

$$4NH_3\,(g) + 5O_2\,(g) \longrightarrow 4NO\,(g) + 6H_2O\,(l)$$

$$2NO\,(g) + O_2\,(g) \longrightarrow 2NO_2\,(g)$$

9. If 20 ml of NH_3 is mixed with 100 ml of O_2. Volume contraction at the completion of above reactions is

(A) 20 ml (B) 85 ml (C) 35 ml (D) 100 ml

10. To obtain maximum mass of NO_2 from a given mass of a mixture of NH_3 and O_2, the ratio of mass of NH_3 to O_2 should be

(A) $\frac{4}{7}$ (B) $\frac{17}{56}$ (C) $\frac{17}{40}$ (D) None of these

11. Total volume of O_2 used if 20 ml NH_3 is mixed with 100 ml O_2

(A) 40 (B) 60 (C) 35 (D) None of these

Table type question :

Column-I (Gas taken)		Column-II (O_2 needed for complete combustion)		Column-III (Contraction in volume)	
(1)	20 ml C_2H_4	(i)	60 ml	(I)	50 ml
(2)	25 ml C_3H_4	(ii)	100 ml	(II)	40 ml
(3)	30 ml C_2H_6	(iii)	70 ml	(III)	75 ml
(4)	35 ml CH_4	(iv)	105 ml	(IV)	70 ml

All volumes are measured at 25ºC and 1 atm.

12. Which of the following is correct match -

(A) 1 – i – II (B) 1 – iii – IV (C) 2 – iv – II (D) 2 – ii – III

13. Which of the following is correct match -

(A) 3 – iii – III (B) 3 – iv – III (C) 4 – iii – III (D) 4 – iv – IV

14. Which of the following is incorrect **(One or more than one correct)**

(A) 2 – ii – I (B) 4 – iii – IV (C) 3 – iv – IV (D) 1 – iii – II

Match the column :

15. Gaseous alkane (C_nH_{2n+2}) exploded with oxygen. Ratio of the mol of O_2 for complete combustion to the mole of CO_2 formed is given in column-I & in column II formula is given.

Column-I		Column-II	
(A)	7 : 4	(P)	C_3H_8
(B)	2 : 1	(Q)	C_4H_{10}
(C)	5 : 3	(R)	C_2H_6
(D)	13 : 8	(S)	CH_4

ANSWER-KEY

EXERCISE # S-I

1.	**Ans. 60 ml**	**2.**	**Ans. 140 ml**	**3.**	**Ans. 30 ml**
4.	**Ans. 70 ml**	**5.**	**Ans. (10)**		
6.	**Ans. NO = 44 ml ; N_2O = 16 ml**			**7.**	**Ans. 10 ml**
8.	**Ans. C_2H_2 = 6 ml, CO = 14 ml**			**9.**	**Ans. 5 ml, 2 ml, 3 ml**
10.	**Ans. CH_4 = 4.5 ml, CO_2 = 1.5 ml**			**11.**	**Ans. (N_2O_5)**
12.	**Ans. (alkene)**			**13.**	**Ans. (C_2H_6)**
14.	**Ans. (C_2H_6)**			**15.**	**Ans. (3)**

EXERCISE # S-II

1.	**Ans. (5)**	**2.**	**Ans. (896 ml)**	**3.**	**Ans. (8)**
4.	**C_2H_2 = 16 ml, CO = 24 ml**	**5.**	**C_2H_6O**		

EXERCISE # O-I

1.	**Ans. (D)**	**2.**	**Ans. (2)**	**3.**	**Ans. (B)**
4.	**Ans. (B)**	**5.**	**Ans. (C)**	**6.**	**Ans. (A)**
7.	**Ans. (D)**	**8.**	**Ans. (B)**	**9.**	**Ans. (A)**
10.	**Ans. (B)**	**11.**	**Ans. (C)**	**12.**	**Ans. (D)**
13.	**Ans. (B)**	**14.**	**Ans. (C)**	**15.**	**Ans. (B)**

EXERCISE # O-II

1	**Ans. (C)**	**2.**	**Ans. (A)**	**3.**	**Ans. (C)**
4.	**Ans. (A)**	**5.**	**Ans. (A,C)**	**6.**	**Ans. (B,C)**
7.	**Ans. (B,C,D)**	**8.**	**Ans. (A,B,D)**	**9**	**Ans. (C)**
10.	**Ans. (B)**	**11.**	**Ans. (C)**	**12.**	**Ans. (A)**
13.	**Ans. (B)**	**14.**	**Ans. (C,D)**		

15. **Ans. A - R ; B - S ; C - P ; D - Q**