

YAKEEN NEET 2.0

2026

Some Basic Concept of Chemistry

Physical Chemistry


Lecture -09

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Topics to be covered

- 1 Revision of Last Class
- 2 Laws of Chemical Combination
- 3 Empirical Formula & Molecular Formula
- 4  Trick for fast calculation
- 5 MPQ (Magarmach Practice Questions) & Home work from Modules



Rules to Attend Class




- ✓ 1. Always sit in a peaceful environment with headphone and be ready with your copy and pen.
- ✓ 2. Never ever attend a class from in between or don't join a live class in the middle of the chapter.
- ✓ 3. Make sure to revise the last class before attending the next class & always complete your home work.
- ✓ 4. Never ever engage in chat whether live or recorded on the topic which is not being discussed in current class as by doing so u can be blocked by the admin team or your subscription can be cancelled.



Rules to Attend Class



- ✓ 5. Try to make maximum notes during the class if something is left then u can use the notes pdf after the class to complete the remaining class.
- ✓ 6. Always ask your doubts in doubt section to get answer from faculty. Before asking any doubt please check whether same doubt has been asked by someone or not.



There is one big flaw in your Preparation that's name is Backlog ? What do we say to Backlog ?



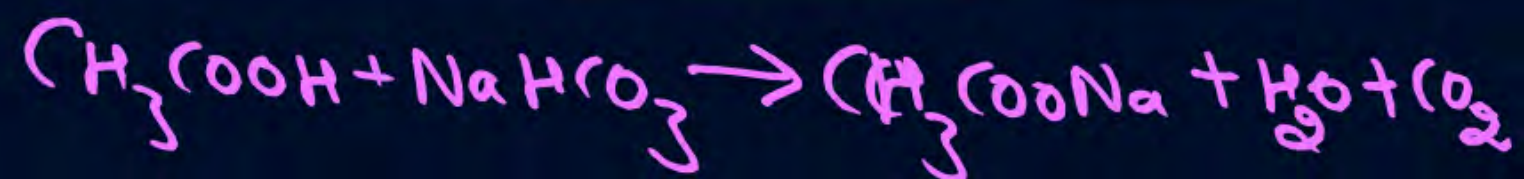
NOT TODAY !!!



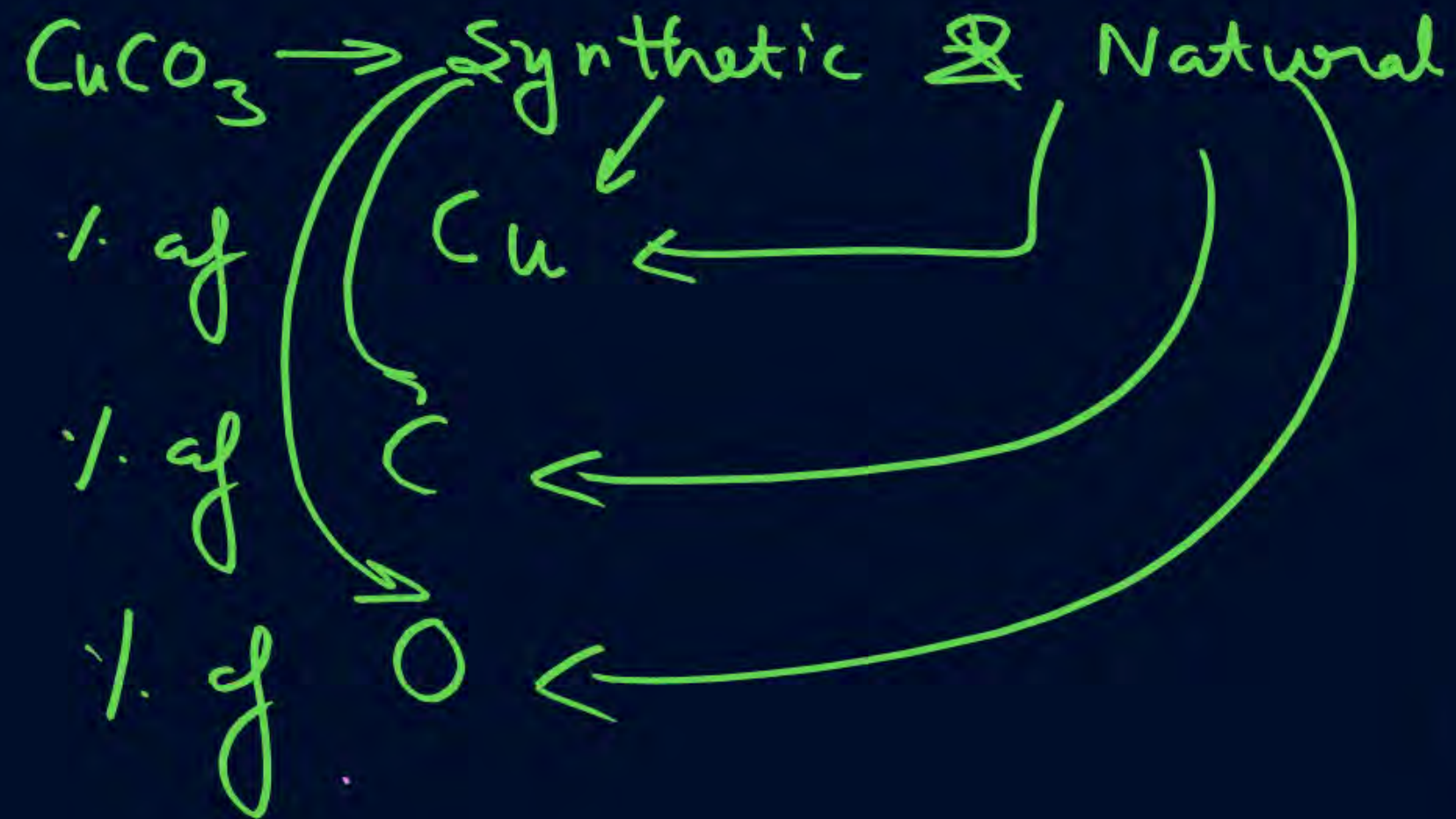
Revision of Last class

$$\% \text{ by mass} = \frac{\text{mass}}{\text{Total mass}} \times 100$$

$$\% \text{ by Volume} = \frac{\text{Volume}}{\text{Total Volume}} \times 100$$



Law of Constt. Composition.



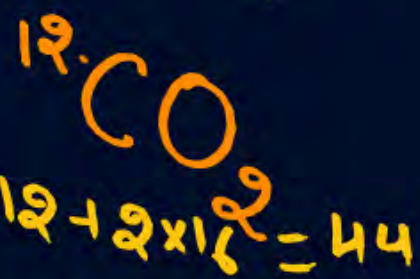
2 atoms of H
+
1 atom of O



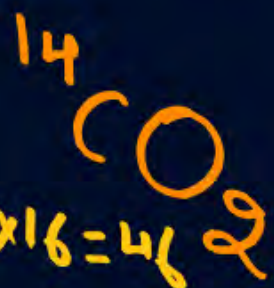
Limitations of Law of Constant Composition

- **X** The law is not applicable if an element exists in different isotopes which may be involved in the formation of the compound. For example, in the formation of the compound CO_2 , if C-12 isotope combines, the ratio of C : O is 12 : 32, but if C-14 isotope combines, the ratio of C : O is 14 : 32.

If different isotopes taken \rightarrow % of element not same.



$$\% \text{ of C} = \frac{12}{44} \times 100$$



$$\% \text{ of C} = \frac{14}{46} \times 100$$





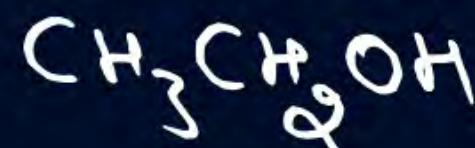
Limitations of Law of Constant Composition

- X The elements may combine in the same ratio but the compounds formed may be different. For example, in the compounds, C_2H_5OH and CH_3OCH_3 (both having same molecular formula viz. C_2H_6O) the ratio of $C : H : O = 24 : 6 : 16 = 12 : 3 : 8$ by mass.

in case of isomers \rightarrow %age same but compound different.



&



$$\% \text{age of C} = \frac{24}{24+6+16} \times 100$$

=

$$\% \text{age of C} = \frac{24}{24+6+16} \times 100$$

but Compd. same.

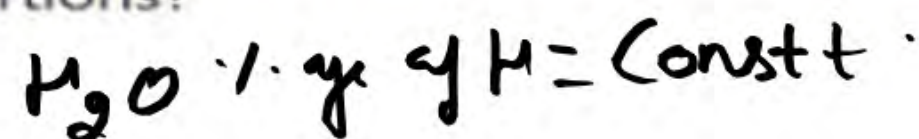
Q1 Which of the following are true about the Law of Definite Proportions?

(A) ~~X~~ It applies only to compounds made from non-metals.

(B) ~~✓~~ The mass ratio of elements in a pure compound is constant.

(C) ~~✓~~ Cupric carbonate from any source will always show the same % of copper, carbon, and oxygen.

(D) ~~X~~ Joseph Proust gave the law using cuprous chloride.



Q2 MPQ

Column I

(A) Joseph Proust

(B) Fixed elemental ratio

(C) Natural sample

(D) Different composition

Column II

(P) Law of Multiple Proportions

(Q) Cupric Carbonate

(R) Law of Definite Composition

(S) Mixtures

Choose the correct matching:

Q3

Mark the following statements True or False:

- (i) The law holds even when samples are obtained from different geographical regions. **T**
- (ii) It contradicts Dalton's Atomic Theory. **F**
- (iii) It applies only to ionic compounds. **F**
- (iv) Cupric carbonate has different composition when made in lab. **F**

Question

MIT

.l. of element remain same.



2.16 g of copper metal when treated with nitric acid followed by ^{heat} ignition of the nitrate gave 2.70 g of copper oxide. In another experiment 1.15 g of copper oxide upon reduction with hydrogen gave 0.92 g of copper. Show that the above data illustrate the Law of Definite Proportions.

Ans Copper + Nitric acid \longrightarrow Copper nitrate $\xrightarrow{\Delta}$ Copper oxide
2.16g. 2.70g

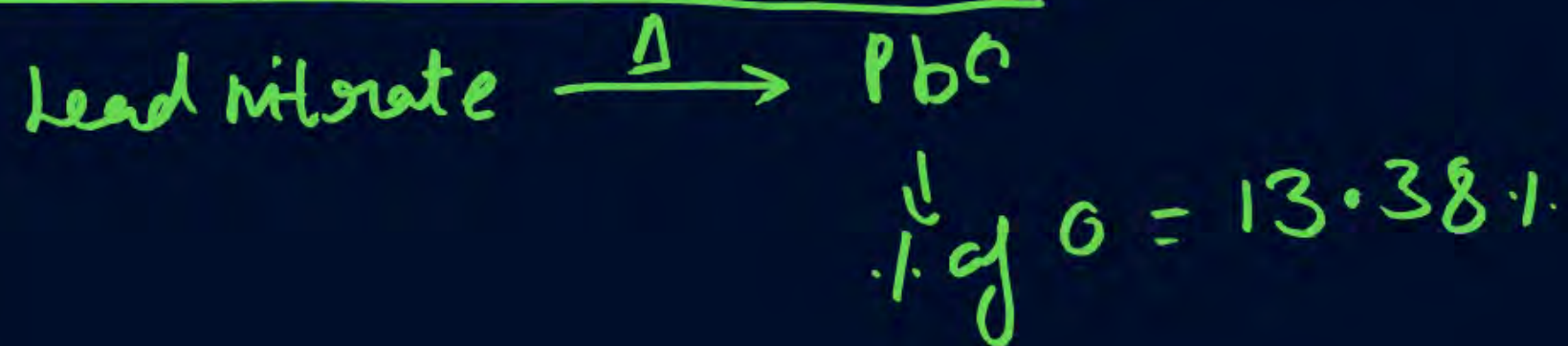
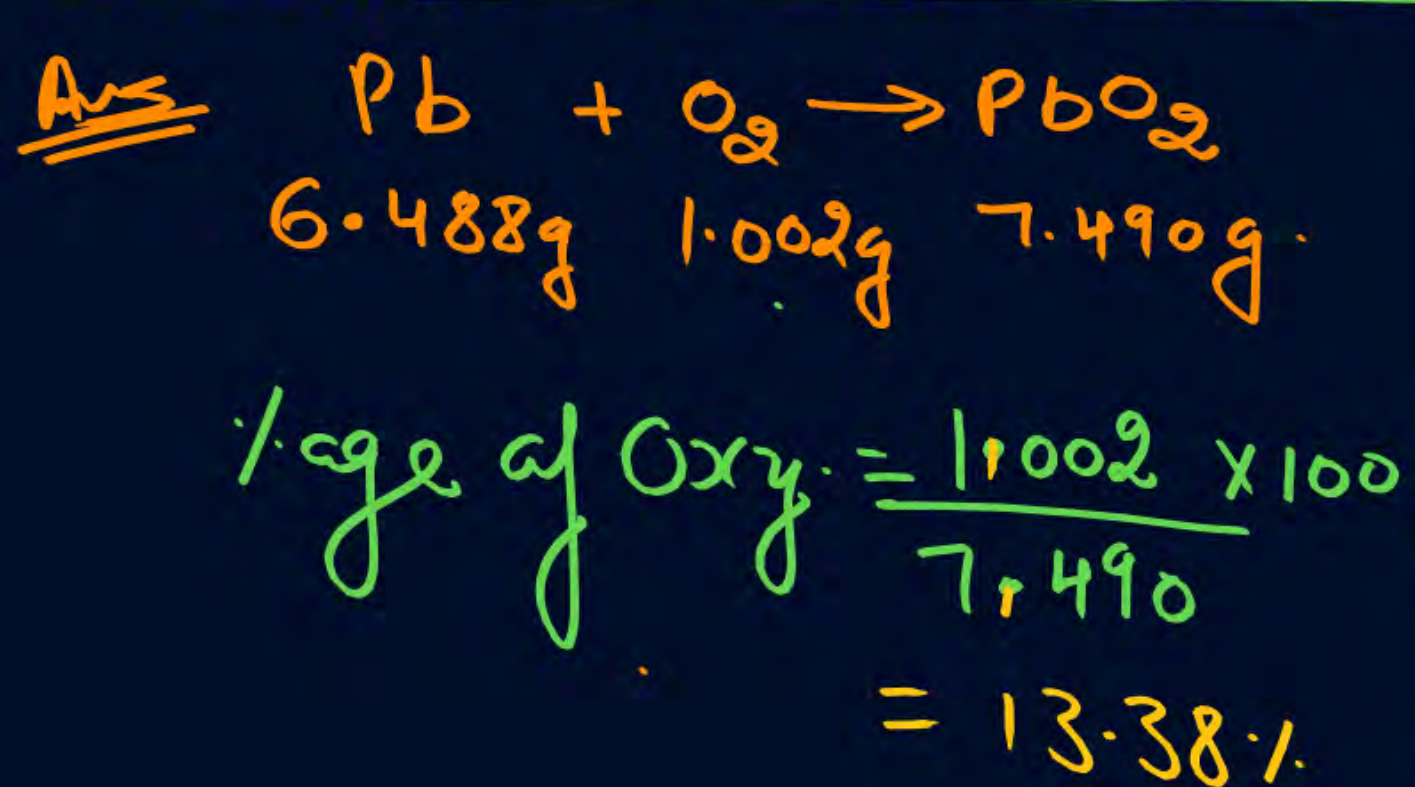
$$\% \text{ of Cu} = \frac{2.16}{2.70} \times 100 \approx 80\% \quad \bigg| \quad \% \text{ of Cu} = \frac{0.92}{1.15} \times 100 \approx 80\%$$

Copper oxide + $\text{H}_2(\text{g}) \longrightarrow$ Copper + water.
1.15g 0.92g

Question



6.488 g of lead combine directly with 1.002 g of oxygen to form lead peroxide (PbO_2). Lead peroxide is also produced by heating lead nitrate and it was found that the percentage of oxygen present in lead peroxide is 13.38 percent. Use these data to illustrate the law of constant composition.





Law of Multiple Proportions (Dalton)

16✓
O, 1
H



(2 elements react to form two or more compounds)

if we fix mass of 1 element)

the mass of 2nd element reacted will form simple ratio

NCERT

H + O

fix mass of O = 16g

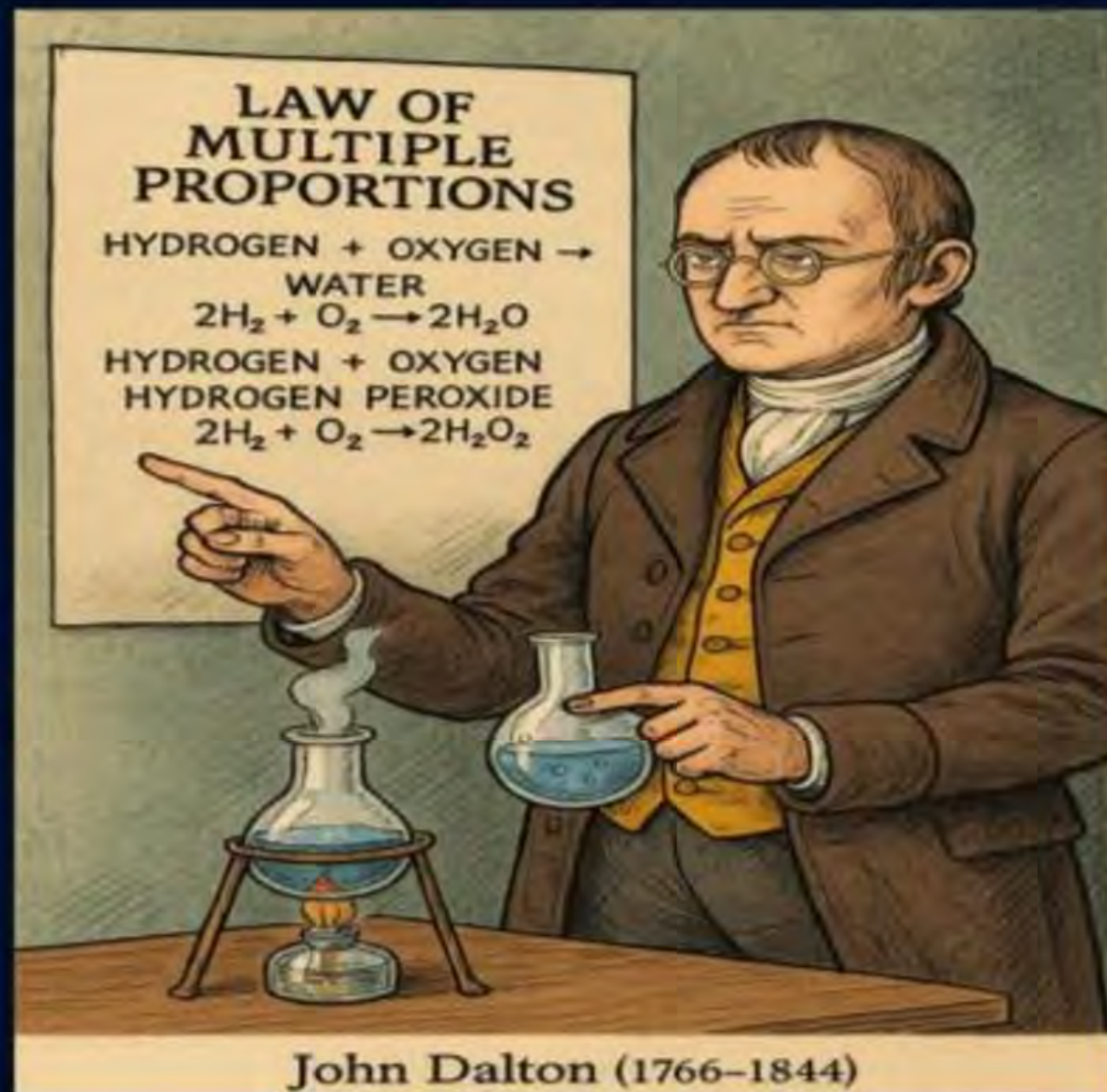
→ H₂O

16g of O
2g of H

→ H₂O

32g of O react H₂ = 2g
16g of O react H₂ = 1g

H₂O H₂O₂
H : H
2 : 1



John Dalton (1766–1844)

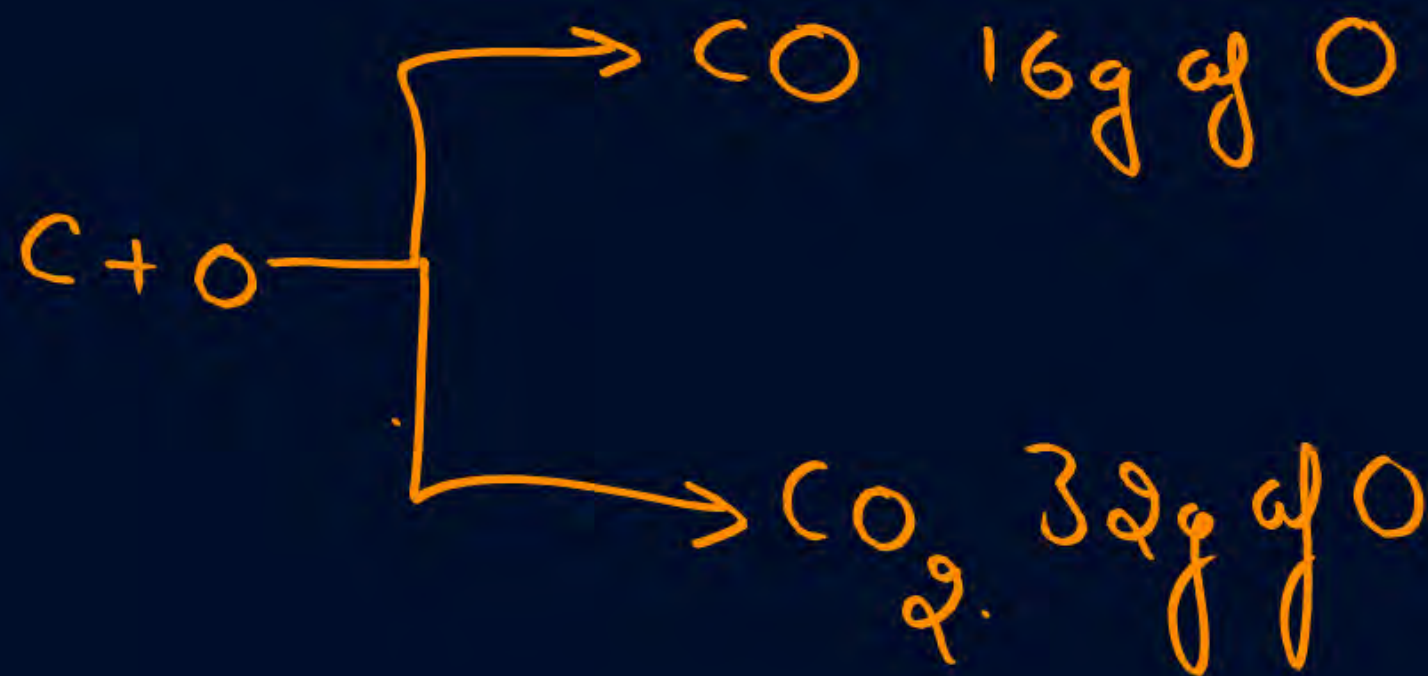
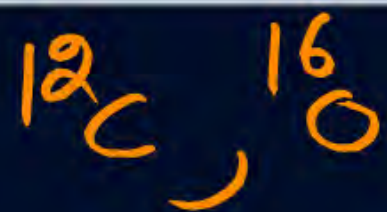


Law of Multiple Proportions (Dalton)

For Example:

C & O

Let us fix mass of carbon = 12 g



For Example: $\frac{14}{N}, \frac{16}{O}$

N and O

Let us fix mass of N = 14 g



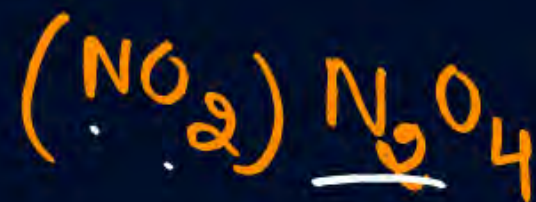
8 g



16 g



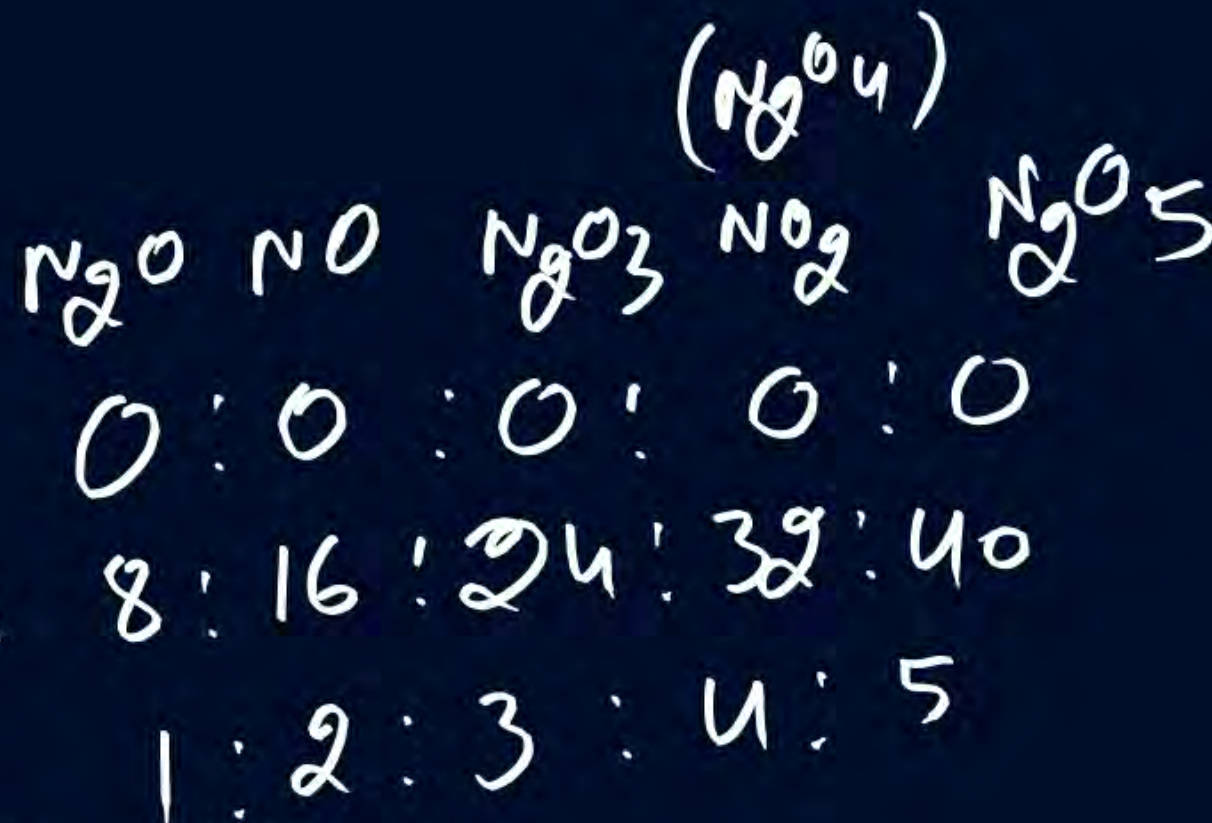
24 g



32 g



40 g



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mass fix 1 element

mass find 2 element react \rightarrow simple ratio

Question



A and B combine to form 4 compounds P, Q, R, S

fix mass A = 1g.

0.6 g A + 0.8 g B → 1.4 g of P

$$\frac{0.6}{1} \text{ g A} \rightarrow \frac{0.8}{0.6} = \frac{4}{3}$$

9 g A + 24 g B → 33 g

$$\frac{24}{9} \text{ g B} = \frac{8}{3}$$

40 g A + 160 g B → 200 g R

$$\frac{160}{40} \text{ g B} = 4$$

18 g A + 93.6 g B → 111.6 g S

$$\frac{93.6}{18} \text{ g B} = 5.2$$

Show that it follows law of multiple proportions.

$$\begin{array}{cccc} \text{B} & : & \text{B} & : & \text{B} & : & \text{B} \\ \frac{4}{3} & : & \frac{8}{3} & : & 4 & : & 5.2 \end{array}$$

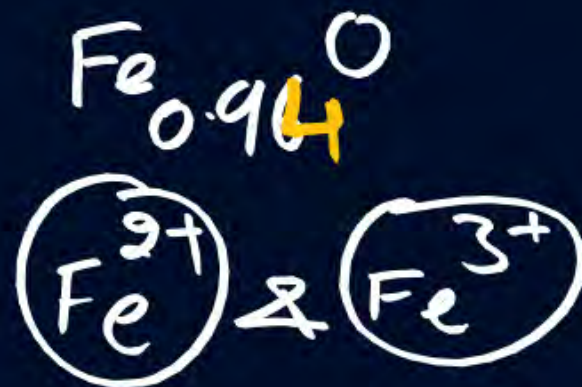
$$\begin{array}{cccc} \text{B} & : & \text{B} & : & \text{B} & : & \text{B} \\ \frac{1.33}{1.33} & : & \frac{2.66}{1.33} & : & \frac{4}{1.33} & : & \frac{5.2}{1.33} \\ 1 & : & 2 & : & 3 & : & 4 \end{array}$$



Limitations of the Law of Multiple Proportions



① Stoichiometric Compds applicable, Non-Stoichiometric Compds. $\frac{5.14}{30}$ not applicable.



↓
Variable Valency

② generally Org. Compds not applicable
due to Catenation. for ex: C_5H_{12}, C_6H_{14}

^{12}C

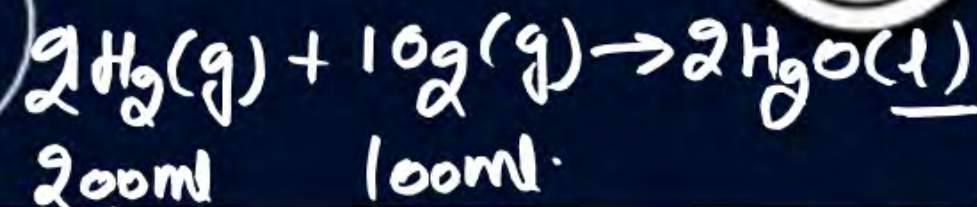
mass fix H = 1g.

$$\begin{array}{l|l} \begin{array}{l} 60g \leftarrow 12g \\ 5 = \frac{60}{12} \leftarrow 1g \end{array} & \begin{array}{l} 72g \leftarrow 14g \\ 72 \leftarrow 14g \end{array} \end{array}$$

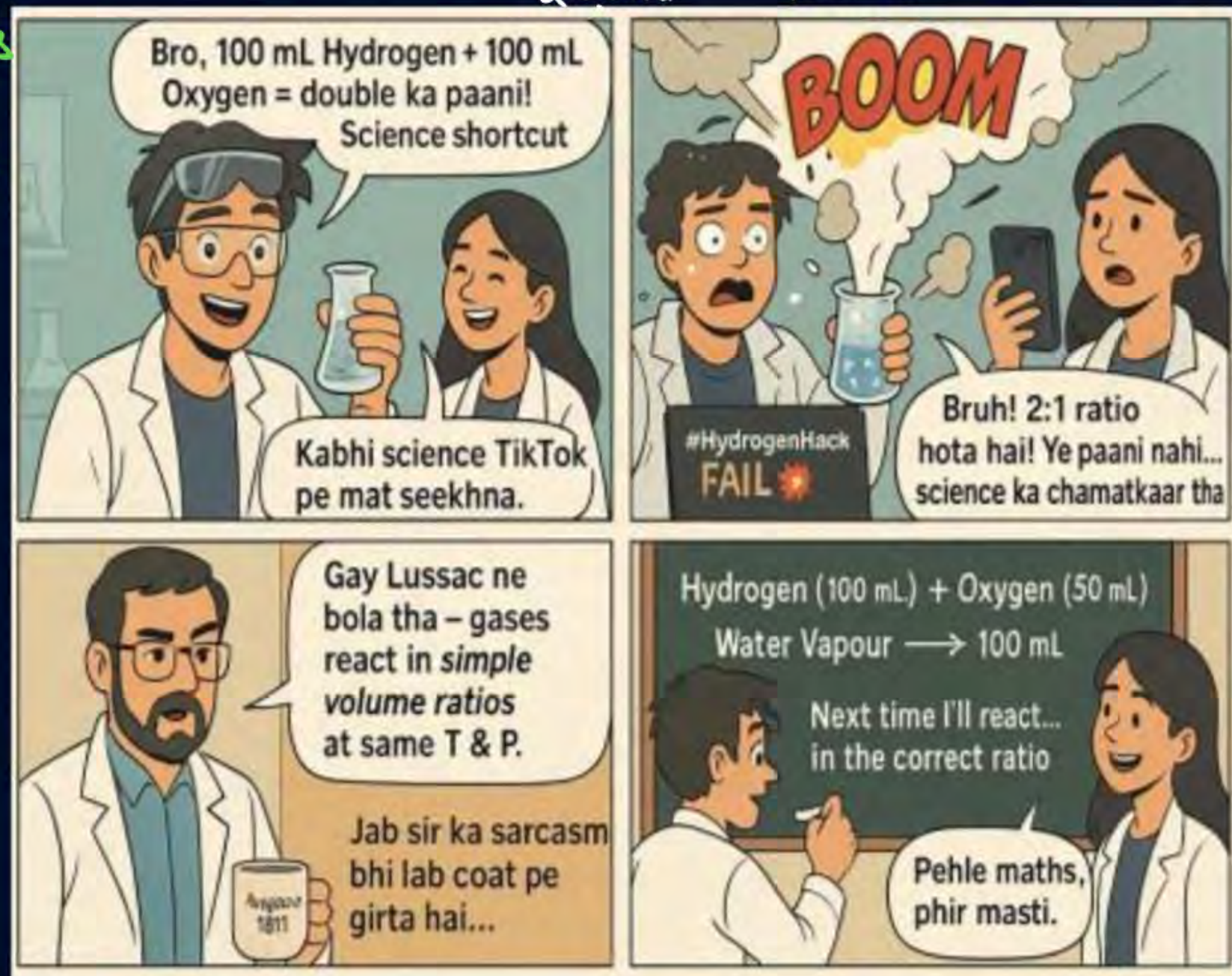
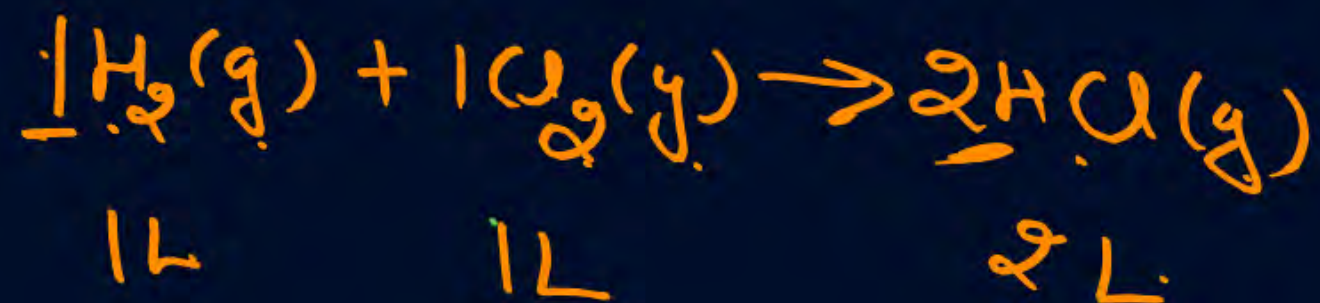


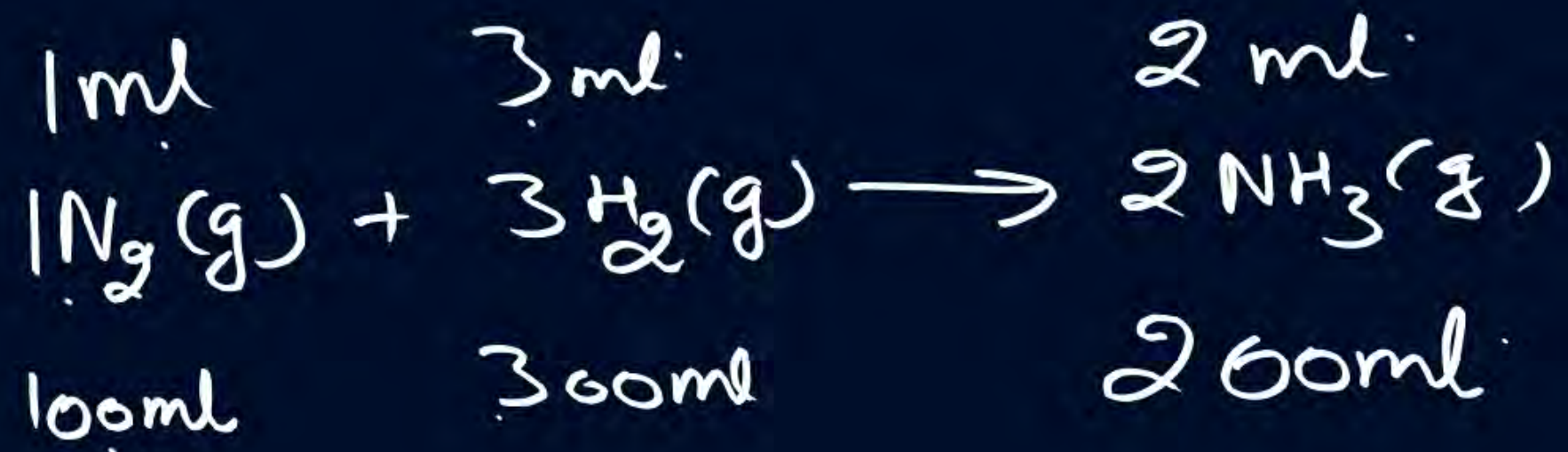


Gay Lussac's Law of Gaseous Volumes



gases react form gaseous products
at same T & P, their ^{form} volume simple
ratio of each other.





Who proposed the law of gaseous volumes?

- a) Avogadro
- b) Boyle
- c) Charles
- ☒ d) Gay Lussac

In which year was Gay Lussac's law proposed?

- a) 1803
- ☒ b) 1808
- c) 1811
- d) 1823

According to Gay Lussac's Law, gases combine in a ratio of their:

- a) Masses
- b) Molar masses
- ☒ c) Volumes
- d) Densities

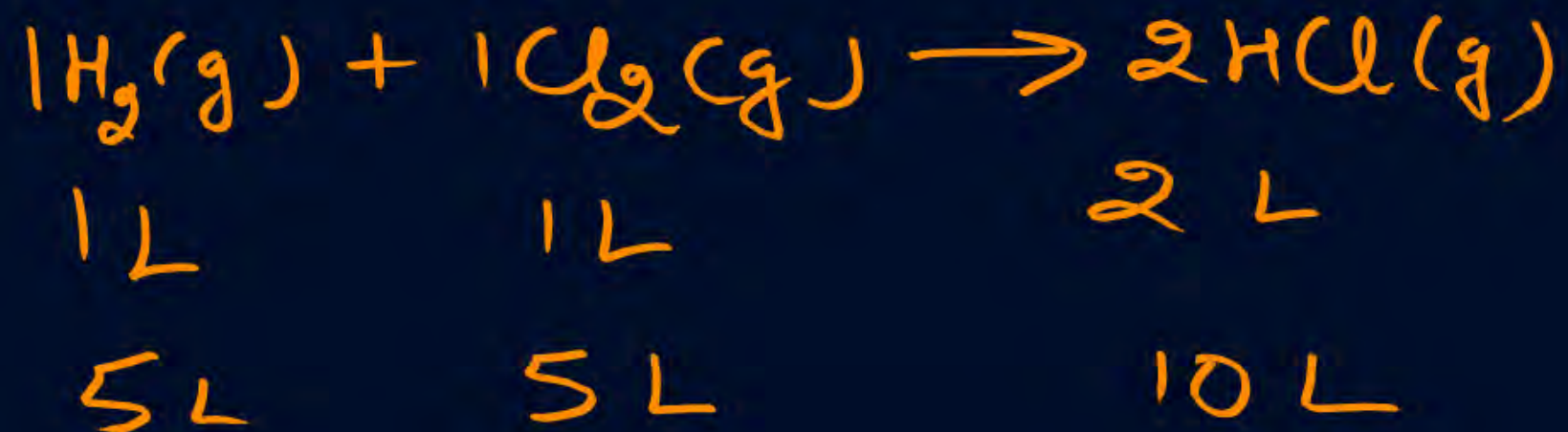
Which scientist's work later explained Gay Lussac's Law in 1811?

- a) Boyle
- ☒ b) Avogadro
- c) Dalton
- d) Newton

Gay Lussac's Law holds true when gases are at:

- a) Different temperatures and pressures
- b) High temperatures only
- ☒ c) Same temperature and pressure
- d) Low pressure only

If 5 L of $\text{H}_2(\text{g})$ combine with 5 L of $\text{Cl}_2(\text{g})$ to form $\text{HCl}(\text{g})$. Find volume of $\text{HCl}(\text{g})$ formed.

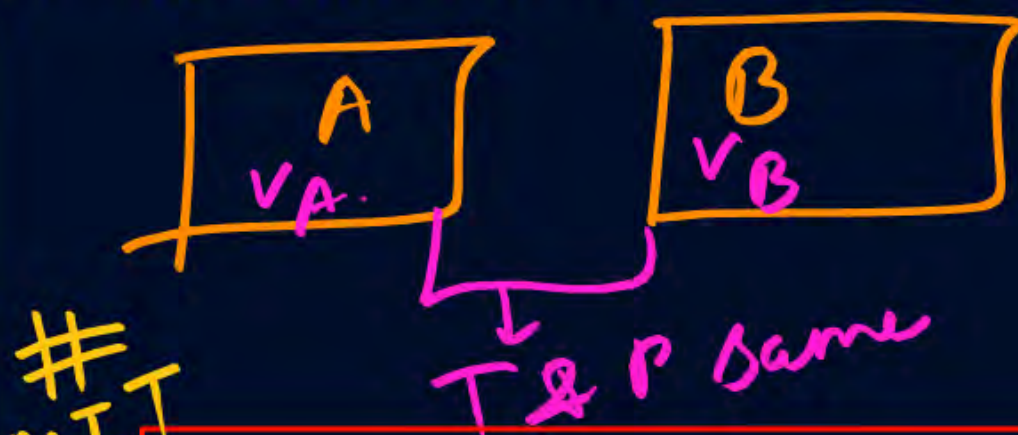




Avogadro's Law



At the same temperature and pressure, ratio of volume of gas is equal to ratio of number of moles of molecules.



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$$\frac{V_A}{V_B} = \frac{n_A}{n_B} = \frac{(\text{molecules})_A}{(\text{molecules})_B}$$



What does Avogadro's Law state?

- a) Equal volumes of gases have equal masses
- ☒ b) Equal volumes of all gases at the same temperature and pressure contain equal number of molecules
- c) Equal volumes of gases occupy same mass
- d) Equal number of molecules occupy equal weight

Who proposed the distinction between atoms and molecules?

- a) Dalton
- b) Cannizzaro
- c) Gay Lussac
- ☒ d) Avogadro

Why was Avogadro's theory initially not accepted widely?

- a) It was too complex
- b) It lacked mathematical proof
- ☒ c) Molecules containing two atoms were not recognised
- d) Avogadro never published it

When was the first international chemistry conference held that revived Avogadro's ideas?

- a) 1811
- b) 1830
- ☒ c) 1860
- d) 1900

When was the first international chemistry conference held that revived Avogadro's ideas?

- a) 1811
- b) 1830
- c) 1860
- d) 1900

Who presented the importance of Avogadro's work at the Karlsruhe Conference?

- a) Joseph Proust
- ☒ b) Cannizzaro
- c) Gay Lussac
- d) Lavoisier

If in two containers of $N_2(g)$ and $O_3(g)$ having volume 5L and 20 L at same temperature and pressure. Find

(i) Ratio of number of moles.

(ii) Ratio of number of molecules.

(iii) Ratio of number of atoms of gas

$$V_{N_2} = 5L \quad | \quad V_{O_3} = 20L$$

$$\frac{\text{molecule}_{N_2}}{\text{molecule}_{O_3}} = \frac{V_{N_2}}{V_{O_3}} = \frac{n_{N_2}}{n_{O_3}} = \frac{5}{20} = \frac{1}{4}$$

$$\frac{\text{atoms of } N_2}{\text{atoms of } O_3} = \frac{1 \times 2}{4 \times 3} = \frac{2}{12} = \frac{1}{6}$$

Question



Equal masses of oxygen, hydrogen and methane are taken in identical conditions. What is the ratio of the volumes of the gases under identical conditions?

A 16 : 1 : 8

☒ B 1 : 16 : 2

C 1 : 16 : 8

D 2 : 16 : 1

$$\begin{aligned} n_{O_2} : n_{H_2} : n_{CH_4} \\ \frac{1}{32} : \frac{1}{2} : \frac{1}{16} \\ \frac{\frac{1}{32}}{\frac{1}{32}} : \frac{\frac{1}{2}}{\frac{1}{32}} : \frac{\frac{1}{16}}{\frac{1}{32}} \\ 1 : 16 : 2 \end{aligned}$$



Empirical Formula (E.F.) & Molecular Formula (M.F.)



M.F. → actual formula of molecule.

C_6H_6 → M.F. of Benzene.

N_2H_4 → Hydrazine.

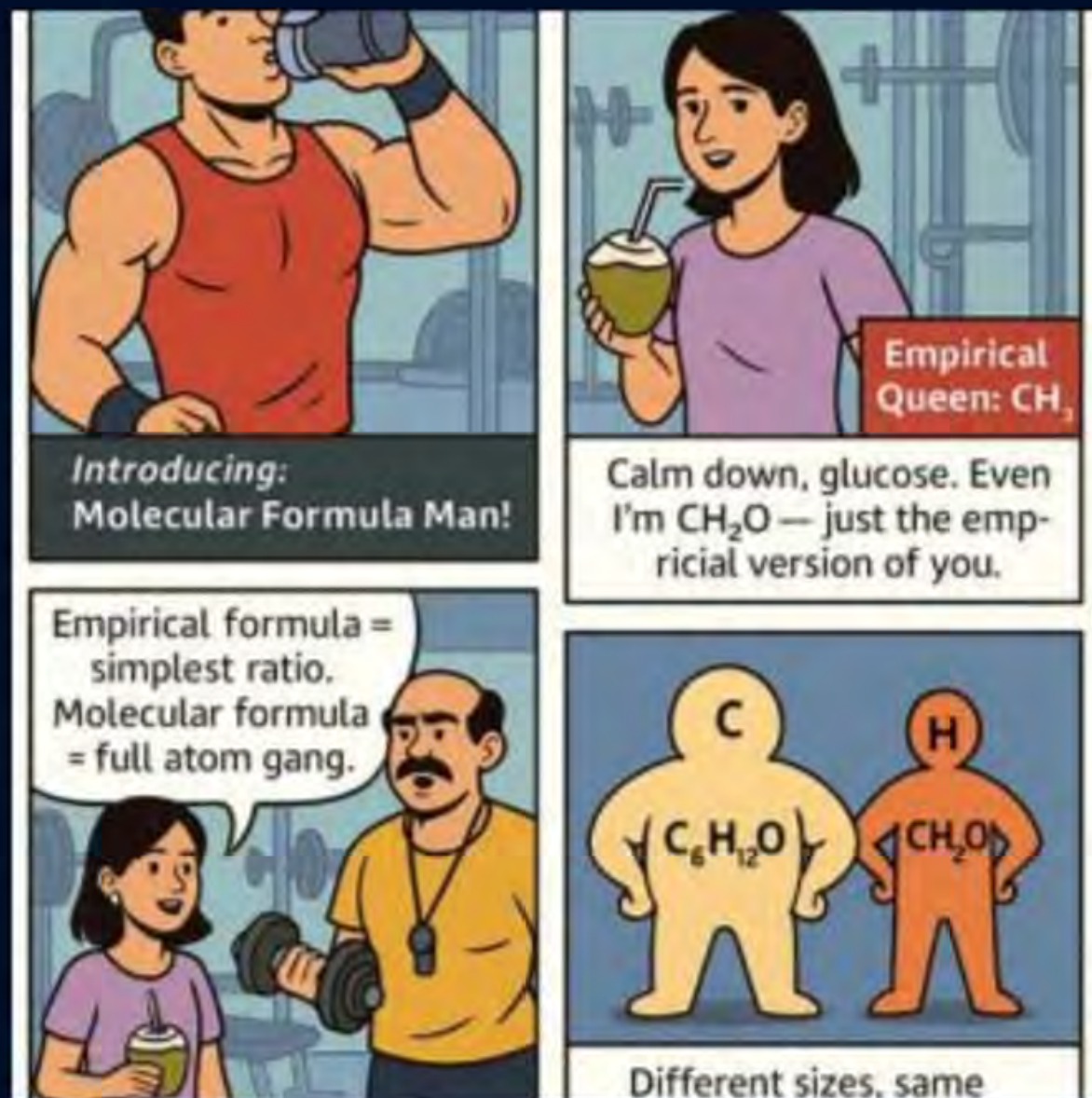
NH_3 → Ammonia.

E.F. → simplest formula of molecule.

CH → E.F. of Benzene.

NH_2 → Hydrazine.

NH_3 → Ammonia.



Molecule	Molecular Formula	Empirical Formula
Ethane	C_2H_6	CH_3
Glucose	$C_6H_{12}O_6$	CH_2O
Pentene	C_5H_{10}	CH_2
Ammonia	NH_3	NH_3

How to find E.F.

A, B & C are three elements

#MIT

①

$$A \frac{1 \text{ age}}{G.A.M.} \quad B \frac{1 \text{ age}}{G.A.M.} \quad C \frac{1 \text{ age}}{G.A.M.}$$

②

$$A_p B_q C_r \quad \underline{p} < \underline{q} < \underline{r}$$

③

$$\frac{A_p}{p} = \frac{B_q}{p} = \frac{C_r}{p} = t$$

④

$A B_s C_t$ if s & t not integer
multiply suitable integer
to convert into integer.

$$\left(A_1 B_{2.5} C_5 \right) \times 2$$

$$A_2 B_5 C_{10}$$

$$\left(A_{1.33} B_1 C_3 \right) \times 3$$

$$A_4 B_3 C_9$$

#MIT

$$\textcircled{4} \text{ M.F.} = (\text{E.F.}) \underline{x}$$

$$\textcircled{5} \text{ } x = \frac{\text{M.F. mass}}{\text{E.F. mass}}$$

M.F.

$$\text{C}_6\text{H}_{12}\text{O}_6$$
$$6 \times 12 + 12 \times 1 + 6 \times 16$$
$$= 180$$

12
C
1
H
16
O

$$x = \frac{180}{30} = 6$$

E.F.

$$\text{CH}_2\text{O}$$

$$1 \times 12 + 2 \times 1 + 1 \times 16 = 30$$



QUESTION – (AIIMS 2006)

The empirical formula of a compound is CH_2O . Its molecular weight is 180. The molecular formula of compound is:

- ☐ A $\text{C}_4\text{H}_4\text{O}_4$
- ☐ B $\text{C}_3\text{H}_6\text{O}_3$
- ☒ C $\text{C}_6\text{H}_{12}\text{O}_6$
- ☐ D $\text{C}_5\text{H}_{10}\text{O}_5$

$$\text{M.F. mass} = 180$$

$$x = \frac{180}{30} = 6$$

$$\text{E.F.} = \text{CH}_2\text{O}$$

$$1 \times 12 + 2 \times 1 + 1 \times 16 = 30$$

$$\text{M.F.} = (\text{E.F.})_x$$

$$= (\text{CH}_2\text{O})_x$$

$$= (\text{CH}_2\text{O})_6 = \text{C}_6\text{H}_{12}\text{O}_6$$

Question



A compound contains 4.07% hydrogen, 24.27% carbon and 71.65% chlorine. Its molar mass is 98.96 g. What are its empirical and molecular formulas?

$$\begin{array}{ccc} \text{C} & \text{H} & \text{Cl} \\ \frac{24.27}{12} & \frac{4.07}{1} & \frac{71.65}{35.5} \end{array}$$

$$\text{M.F. mass} = 98.96$$

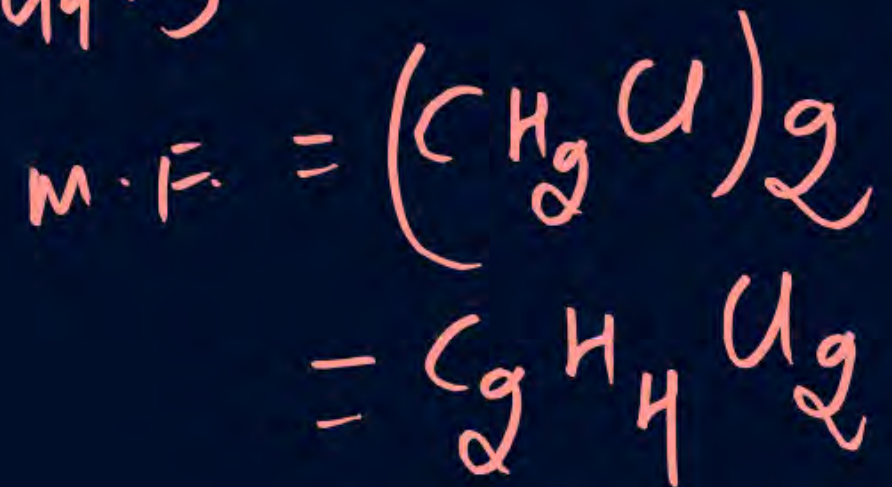
$$x = \frac{98.96}{49.5} \approx 2$$

$$\begin{array}{ccc} \text{C} & \text{H} & \text{Cl} \\ \frac{2.04}{2.04} & \frac{4.07}{2.04} & \frac{2.04}{2.04} \end{array}$$

E.F. =



$$\text{E.F. mass} = 12 + 2 + 35.5 = 49.5$$

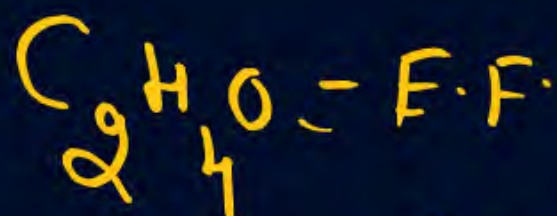


The elemental composition of a compound is 54.2% C, 9.2% H and 36.6% O. If the molar mass of the compound is 132 g mol^{-1} , the molecular formula of the compound is: [Given: The relative atomic mass of C : H : O = 12 : 1 : 16]



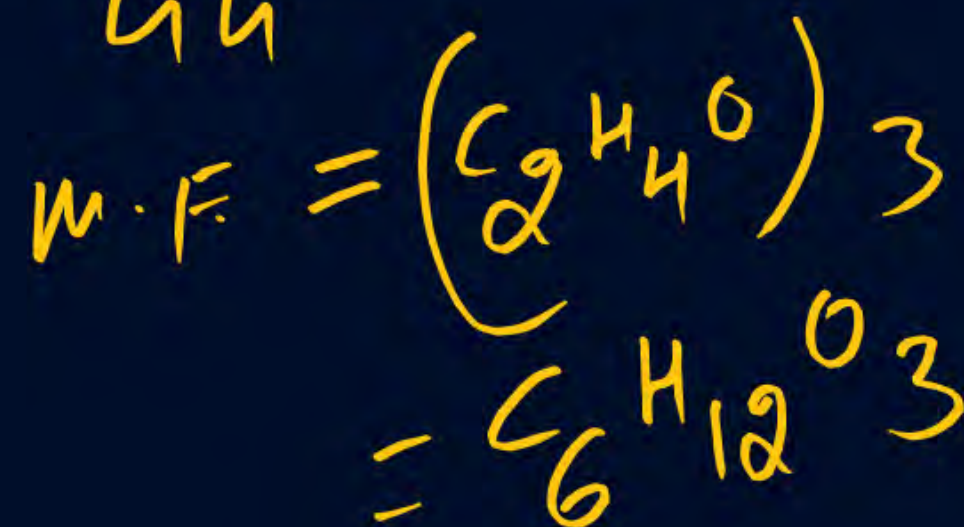
$$\begin{array}{ccc} \text{C} & \text{H} & \text{O} \\ \frac{54.2}{12} & \frac{9.2}{1} & \frac{36.6}{16} \end{array}$$

$$\begin{array}{ccc} \text{C} & \text{H} & \text{O} \\ \frac{4.52}{2.28} & \frac{9.2}{2.28} & \frac{2.28}{2.28} \end{array}$$



$$2 \times 12 + 4 + 16 = 44$$

$$x = \frac{132}{44} = 3$$



The hydrated salt $\text{Na}_2\text{CO}_3 \cdot x\text{H}_2\text{O}$ undergoes 63% loss in mass on heating and becomes anhydrous. The value of x is:

A 10

B 12

C 8

D 18

A gas is found to contain 2.34 grams of nitrogen and 5.34 grams of oxygen.
Simplest formula of the compound is:

- A** N_2O
- B** NO
- C** N_2O_3
- D** NO_2

An element A is tetravalent and another element B is divalent. The formula of the compound formed from these elements will be:

- A** A_2B
- B** AB
- C** AB_2
- D** A_2B_3

A compound used in making nylon, is 43.8% oxygen. There are four oxygen atoms per molecule. What is the molecular weight of compound?

- A** 36
- B** 116
- C** 292
- D** 146

The most abundant element 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 H atoms are replaced by H atoms is

- A** 15 kg
- B** 37.5 kg
- C** 7.5 kg
- D** 10 kg

Join official Telegram Channel to get revision link for tomorrow at 6 a.m.





Home work from modules

Prarambha \rightarrow 8, 9, 37 to 44

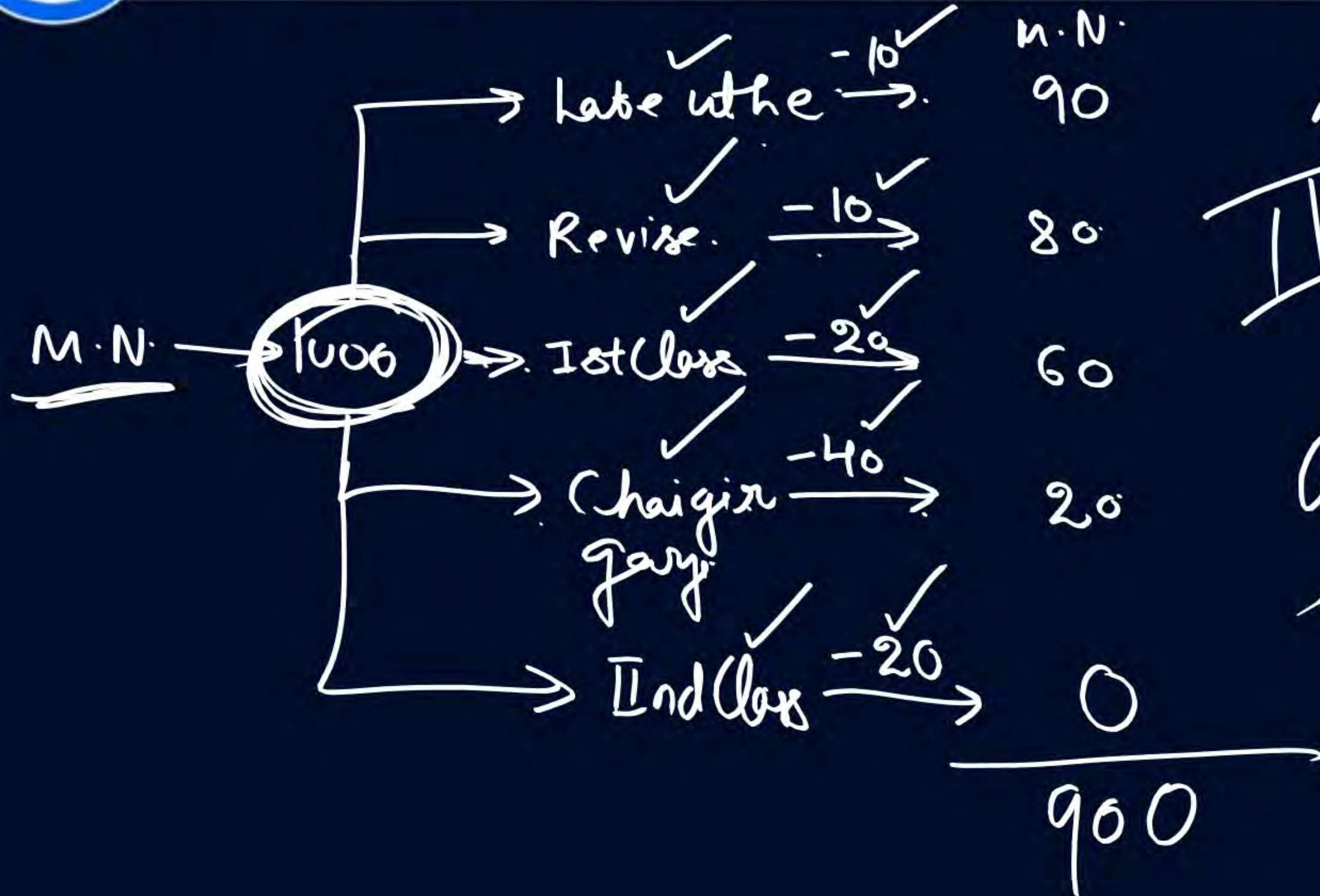
Prabal \rightarrow 16, 17,

Parikshit \rightarrow 10

pyq \rightarrow 5



Tricks . Preparation.



10 → 8 → 2
II Ind Class
↓ motivation
900



Magarmach Practice Questions (MPQ)



QUESTION – (AIIMS 1999)

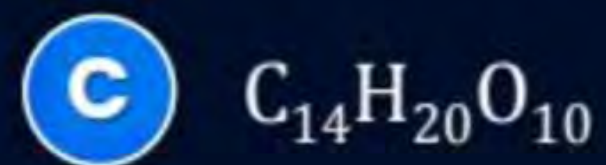
60 g of organic compound on analysis gave following results C = 24 g, H = 4 g and O = 32 g. The empirical formula of compound is:

- A** CH_2O
- B** CH_2O_2
- C** $\text{C}_2\text{H}_2\text{O}$
- D** $\text{C}_2\text{H}_2\text{O}_2$

Determine the empirical formula of Kevlar, used in making bullet proof vests, is 70.6% C, 4.2% H, 11.8% N and 13.4% O:



An organic compound has 42.1% carbon, 6.4% hydrogen and remainder is oxygen. If its molecular weight is 342, then its molecular formula is :



Two oxides of metal contain 27.6% & 30% of oxygen. If the formula of first oxide is M_3O_4 . Find formula of second oxide.

Number of hydrogen atoms per molecule of a hydrocarbon A having 85.8% carbon is _____ (Given : Molar mas of A = 84 g mol^{-1})

Compound A contains 8.7% Hydrogen 74% Carbon and 17.3% Nitrogen. The molecular formula of the compound is,

Given : Atomic masses of C, H and N are 12, 1 and 14 amu respectively.

The moalr mass of the compound A is 162 g mol^{-1} .

- A** $\text{C}_4\text{H}_6\text{N}_2$
- B** $\text{C}_2\text{H}_3\text{N}$
- C** $\text{C}_5\text{H}_7\text{N}$
- D** $\text{C}_{10}\text{H}_{14}\text{N}_2$

A metal chloride contains 55.0% of chlorine by weight. 100 mL vapours of the metal chloride at STP weight 0.57 g. The molecular formula of the metal chloride is (Given : Atomic mass of chlorine is 35.5 u)



THANK
YOU