

YAKEEN 2.0



NEET 2024



- Subject – Physical Chemistry
- Chapter – Mole Concept



Lecture No.-10

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Today's *Targets*



Revision of Last Class



Molarity, Molality, Mole Fraction



Home work Discussion



Home Work



Rules to attend class

→ Key to NEET 2024




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.
- Rule* 3. Make sure to revise the last class before attending the next class & always complete your home work along with DPP.
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.
7. Don't watch the videos in high speed if you want to understand better.

A man with dark curly hair and a beard, wearing a dark jacket, is speaking to a woman with long blonde hair. The scene is dimly lit, with a warm, brownish tone.

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

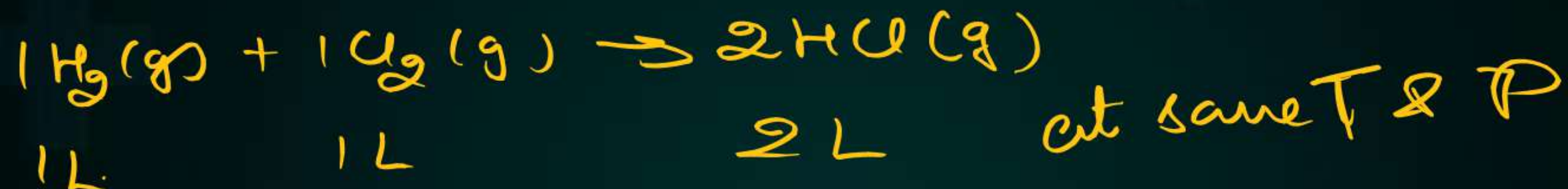
A man with dark curly hair and a beard, wearing a dark jacket, is pointing his finger at a woman with long blonde hair. The scene is dimly lit, with a warm, brownish tone.

NOT TODAY !!!



Revision of Last Class

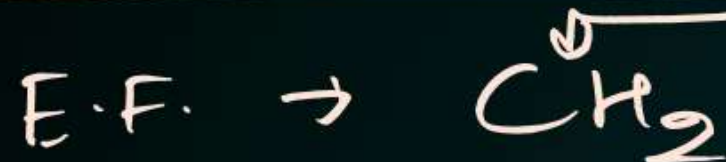
① Gay Lussac's law



② Avogadro's law.

$$\frac{\text{Vol. of gas A}}{B} = \frac{\text{moles of gas A}}{B} = \frac{\text{molecules of gas A}}{B}$$

③ Empirical formula. C_2H_4



④ Molecular formula



⑤ Relation b/w E.F. & M.F.

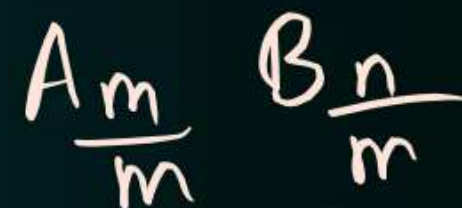
$$M.F. = (E.F.)_x$$

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

Find E.F.

① $\frac{A_{\%age}}{\text{at. mass}} = m \quad B_{\%age} = n$
 $\frac{\%age}{\text{at. mass}}$

② Divide it by smallest $m < n$.



$A \quad \frac{B_n}{n}$ Convert into integer



Solutions



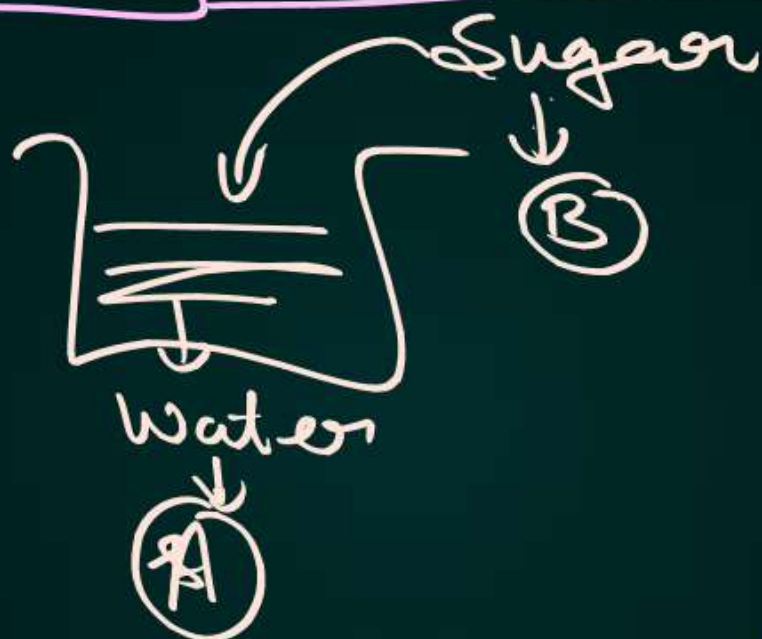
Binary solution. \rightarrow 2 Component solution.

Solvent \rightarrow A
 \downarrow

W_A = mass or weight of solvent (A)

M_A = Molar mass (G.M.M.) of solvent (A)

n_A = moles of solvent = $\frac{W_A}{M_A}$



Solute \rightarrow B

W_B = mass or weight of solute (B)

M_B = Molar mass (G.M.M.) of solute (B)

n_B = moles of solute (B) = $\frac{W_B}{M_B}$

two liquids mix \rightarrow ethanol + water



quantity more \rightarrow solvent \rightarrow A

less \rightarrow solute \rightarrow B



Molarity (M)

#MIT

$$M = \frac{\text{moles of solute}(n_B)}{\text{Volume of solution (L)}}$$

$$M = \frac{W_B \times 1000}{M_B \times \text{Vol. of sol}^n (\text{ml})}$$

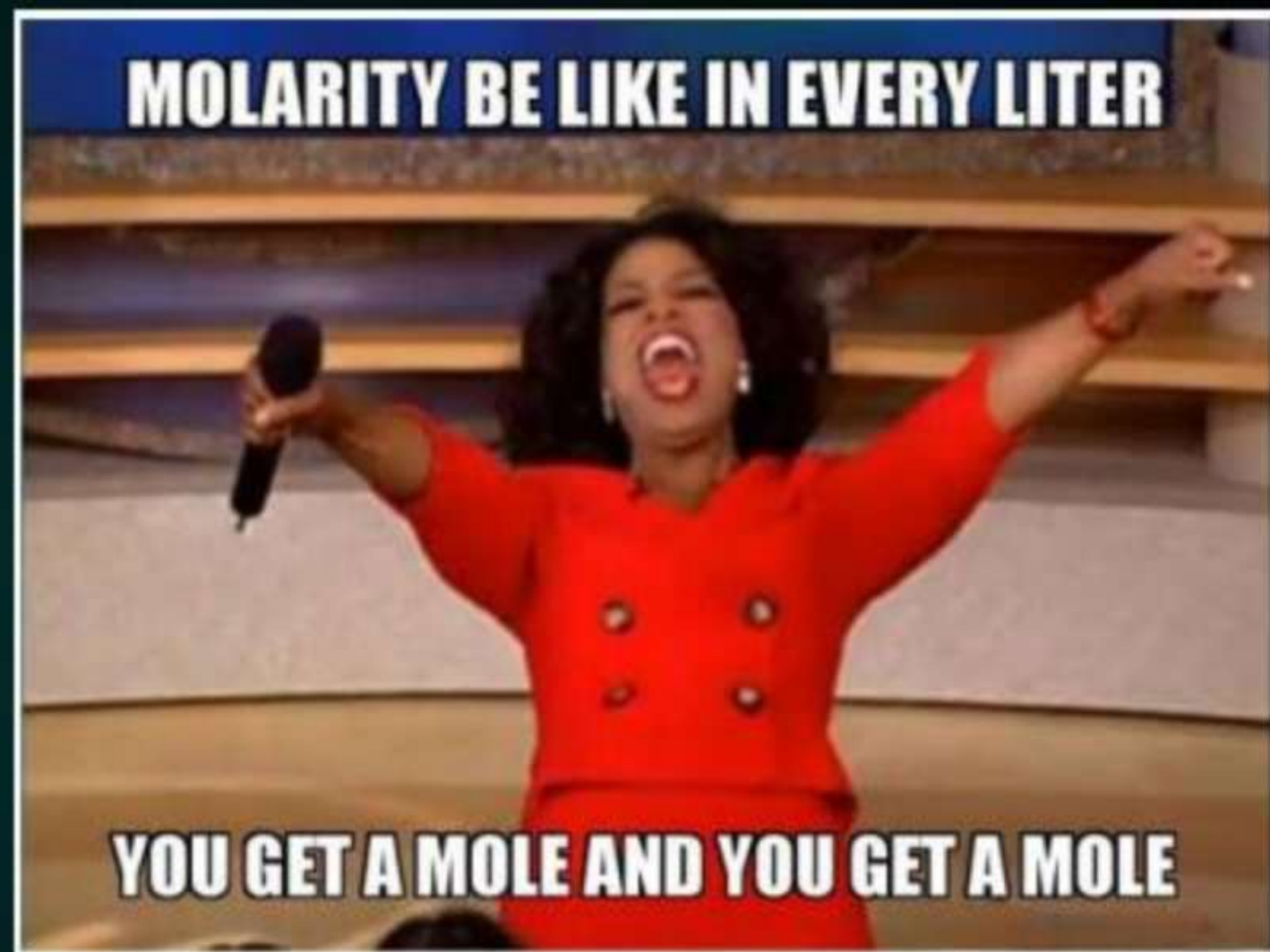
4 L of solution \rightarrow 20 moles of solute

1 L $\xrightarrow{\quad\quad\quad} \frac{20}{4} = 5 \text{ M}$

$$1 \text{ L} = 1000 \text{ ml} = 1000 \text{ cm}^3 = 1000 \text{ c.c.} = 1 \text{ dm}^3$$

$$1 \text{ ml} = 1 \text{ cm}^3 = 1 \text{ c.c.}$$

Unit of molarity = mol L^{-1} or mol/L or molar



Moles of Solute (n_B)	Volume of solution (in L)	Molarity
4	1	$\frac{4}{1} = 4$
12 ✓	2 ✓	$\frac{12}{2} = 6$
27	9	$\frac{27}{9} = 3$

Question



Calculate the molarity of NaOH in the solution prepared by dissolving its 4 g in enough water to form 250 mL of the solution. If molar mass of NaOH is 40 g.

Ans 0.4 M

NaOH \rightarrow solute \rightarrow B

$$W_B = 4 \text{ g}$$

$$M_B = 40 \text{ g}$$

$$n_B = \frac{4}{40} = \frac{1}{10}$$

$$V \text{ of sol}^n = 250 \text{ ml}$$

$$\underline{\hspace{2cm}} = \frac{250}{1000} = \frac{1}{4} \text{ L}$$

$$M = \frac{1 \times 4}{10 \times 1} = 0.4 \text{ M}$$

Question



If the concentration of glucose ($C_6H_{12}O_6$) in blood is 0.72 gL^{-1} , the molarity of glucose in blood is $\dots \times 10^{-3} \text{ M}$. (Nearest integer) [Given: Atomic mass of C = 12, H = 1, O = 16 u]

Ans glucose is 0.72 g/L

0.72 g of glucose is present in 1 L of Blood.

\downarrow
Solute $\rightarrow B$

$$w_B = 0.72$$

$$M_B = 6 \times 12 + 12 \times 1 + 6 \times 16 = 180 \text{ g}$$

\downarrow
 $C_6H_{12}O_6$

$$M = \frac{0.72}{180 \times 1} = \frac{72}{18 \times 1000} = \frac{4}{250}$$

$$M = \frac{1}{250} = \frac{1}{25} \times 10$$

$$M = 0.4 \times 10^{-1} \text{ M}$$

$$= 4 \times 10^{-3} \text{ M}$$

Question



6.02×10^{20} molecules of urea are present in 100 mL of its solution. The concentration of urea solution is : (NEET PYQ)

A 0.001 M

☒ B 0.01 M

C 0.02 M

D 0.1 M

$$n_B = \frac{6.02 \times 10^{20}}{6.02 \times 10^{23}} = \frac{1}{1000}$$

$$V \text{ of sol}^n \text{ in L} = \frac{100}{1000} = \frac{1}{10} \text{ L}$$

$$M = \frac{1 \times 10^{-3}}{1000 \times 1} = 10^{-2} \text{ M} \\ = 0.01 \text{ M}$$



Formality (F)

↓

Ionic Compounds \Rightarrow solute

Molarity = Formality

$$F = \frac{\text{mass of solute}}{\text{Gr. F.M. of solute} \times \text{Vol. of sol}^n (\text{in L})}$$

Sugar $\rightarrow C_{12}H_{22}O_{11} \rightarrow$ Covalent Compd. \rightarrow solute
↓
Water \rightarrow solvent

↓
Molarity



$Na^+Cl^- \rightarrow$ Ionic Compd. \rightarrow solute \rightarrow Molarity
↓
Water \rightarrow solvent
 $=$ Formality

Q If 117g of NaCl is dissolved in 500ml of solⁿ.

find Formality or Molarity. if Gr. A. M. of Na = 23g
Cl = 35.5g

Ans
$$F = \frac{117 \times 1000}{58.5 \times 500} = 4(F)$$

$$\begin{aligned} \text{Gr. F. M. of } \text{Na}^+\text{Cl}^- &= 1 \times 23 + 1 \times 35.5 \\ &= 58.5g. \end{aligned}$$

Question



How many grams of NaOH should be dissolved to make 100 cm^3 of 0.15 M NaOH solution? If gram formula mass of NaOH is 40 g .

Ans $w_B = ?$ $V \text{ of sol}^n = 100 \text{ ml}$

G.F.M. of NaOH

$M = 0.15 \text{ M}$

or

Molar mass of $\text{NaOH} = 40 \text{ g}$

$$M = \frac{w_B \times 1000}{40 \times 100} = 0.15$$

$$w_B = 0.15 \times 4 = 0.6 \text{ g}$$

$$1 \text{ Kg} = 1000 \text{ g}$$



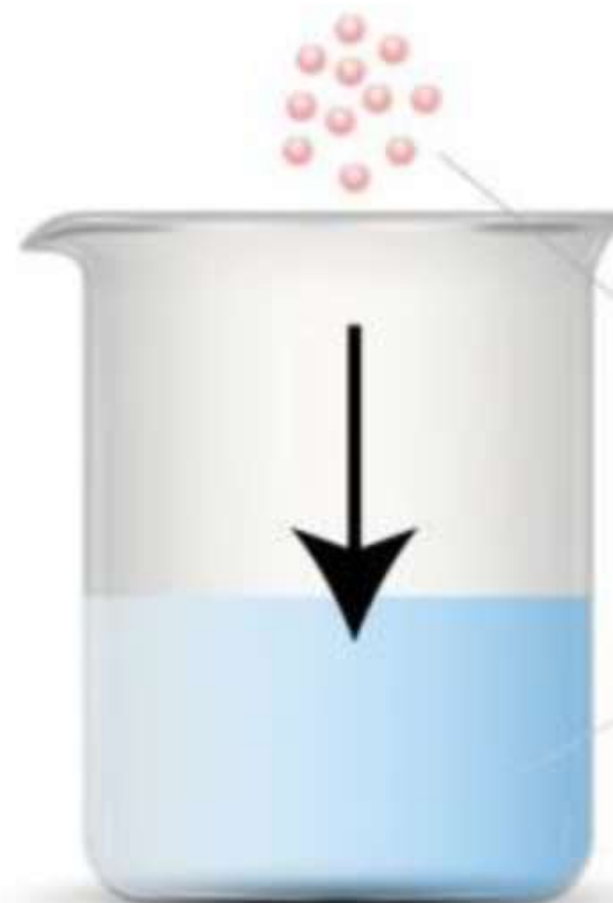
Molality (m)



$$m = \frac{\text{moles of solute } (n_B)}{\text{mass of solvent in Kg } (w_A)}$$

$$m = \frac{w_B \times 1000}{M_B \times w_A (\text{in g})}$$

unit of molality (m) = mol/Kg
or mol Kg⁻¹
or molal



Molality (m)

$\frac{\text{moles of solute}}{\text{kg of solvent}}$



Question



If 160 g of NaOH is present in 500 ml of water find molality if Molar mass of NaOH is 40 g.

Ans

NaOH \rightarrow solute \rightarrow (B)

$$w_B = 160 \text{ g} \quad \left| \quad n_B = \frac{160}{40} = 4\right.$$

$$M_B = 40 \text{ g}$$

$$m = \frac{4 \times 2}{1} = 8 \text{ m}$$

Water \rightarrow Liquid \rightarrow solvent \rightarrow A

Vol. of water = 500 ml

d of water = 1 g/ml

$$W_A = 500 \times 1 = 500 \text{ g}$$

$$w_A = \frac{500}{1000} = \frac{5}{10} = \frac{1}{2} \text{ Kg}$$

Question



The molality of a urea solution in which 0.0100 g of urea, $[(\text{NH}_2)_2\text{CO}]$ is added to 0.3000 dm^3 of water at STP is

- ☒ A $5.55 \times 10^{-4} \text{ m}$
- ☐ B 33.3 m
- ☐ C $3.33 \times 10^{-2} \text{ m}$
- ☐ D 0.555 m

Urea \rightarrow solute $\rightarrow B$

$$w_B = 0.01 \text{ g}$$

$$M_B = 60 \text{ g}$$

$$V \text{ of water} = 0.3 \text{ dm}^3 = 0.3 \text{ L} = 0.3 \times 1000 \text{ ml} = 300 \text{ ml}$$

$$d \text{ of water} = 1 \text{ g/ml}$$

$$w_A = 300 \times 1 = 300 \text{ g}$$

$$w_A = \frac{300}{1000} = \frac{3}{10} \text{ Kg}$$

$$n_B = \frac{0.01}{60} = \frac{1}{6000} \quad M_B = 60 \text{ g}$$

$$m = \frac{10}{6000 \times 3} = \frac{1}{1800} \times 10^{-2}$$

$$\begin{array}{r} 18 \overline{) 100} \\ \underline{90} \\ 10 \end{array}$$

$$m = 0.05 \times 10^{-2} \text{ m}$$

$$= 5.55 \times 10^{-4} \text{ m}$$



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Mole fraction (x) ^{→ Chi}

$$\frac{x_B}{x_A} = \frac{n_B \times (\cancel{n_A + n_B})}{\cancel{n_A + n_B} \times (n_A)} = \frac{n_B}{n_A}$$



$$\text{Mole fraction of solute } (x_B) = \frac{n_B}{n_A + n_B}$$

$$\text{mole fraction of solvent } (x_A) = \frac{n_A}{n_A + n_B}$$

mole-fraction = $\frac{\text{moles}}{\text{ratio}}$

$$\frac{x_B}{x_A} = \frac{n_B}{n_A}$$

Mole fraction \Rightarrow No unit as it is ratio

$$x_A + x_B = 1$$
$$\frac{n_A}{n_A + n_B} + \frac{n_B}{n_A + n_B} = 1$$

$$\frac{\cancel{n_A} + \cancel{n_B}}{\cancel{n_A} + \cancel{n_B}} = 1$$

$$x_A = 1 - x_B$$

Question



If 3 moles of water is mixed with 1 mole of sugar. Find mole fraction of water and sugar?

↑
Solvent

Ans

$$n_A = 3$$

$$n_B = 1$$

$$x_A = \frac{3}{3+1} = \frac{3}{4}$$

$$x_B = 1 - x_A = 1 - \frac{3}{4}$$

$$= \frac{4-3}{4} = \frac{1}{4}$$

↓
Solute

$$x_B = \frac{1}{1+3} = \frac{1}{4}$$

138 g of ethyl alcohol is mixed with 72 g of water. The ratio of mole fraction of ethyl alcohol to water is if molar mass of ethyl alcohol is 46 g and of water is 18 g.

mass of ethyl alcohol = 138 g
Molar mass = 46 g

mass of water = 72 g
Molar mass = 18 g

$$\text{moles of ethyl alcohol} = \frac{138}{46} = 3$$

~~~~~ water =  $\frac{72}{18} = 4$

$$\frac{\text{mole fraction of ethyl alcohol}}{\text{water}} = \frac{\text{moles of Ethyl alcohol}}{\text{water}} = \frac{3}{4}$$

3 : 4

1:2

1:4

**1:1**



Result-Oriented.



Time-pass

↓  
Dopamine  
Oriented

↓  
Barbaad

↓  
Chat disable  
for 5 min.



# Mass Percent or Weight Percent (w/w%)

$\checkmark$  /  $\checkmark$   
 $\downarrow$       $\downarrow$   
 Solute     Solution  
 unit     unit  
 $\downarrow$       $\downarrow$   
 g     g

30 g of solute is present in

100 g of solution

$$\text{mass \% of solute} = \frac{\text{mass of solute}}{\text{Total mass of solution}} \times 100$$

Chemical  $\rightarrow$   $\text{HNO}_3$   $\rightarrow$  solute  
 30% by mass  
weight  
(w/w)  
 - - - -  
 - - - -  
 - - - -



## Relationship between % by mass and Molarity (M) and d of solution (g/ml)

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$$M = \frac{\% \text{ by mass} \times d \times 10}{M_B}$$

% by mass

d = density of solution in g/ml

 $M_B$  = Molar mass of solute in g.

## Question



The molarity of  $\text{HNO}_3$  in a sample which has density 1.4 g/mL and mass percentage of 63% is ..... (Molecular weight of  $\text{HNO}_3 = 63$ ) ✓

Ans  $M = \frac{63 \times 1.4 \times 10}{63} = 14 \text{ M}$

$M_B = 63 \text{ g}$





## % Age by Volume

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$V_s$  /  $V_i$   
 ↓      ↓  
 unit of    unit of  
 solute    solution

20 ml of solute is present in  
(acetic acid)

100 ml of solution

$$\text{Volume \% of solute} = \frac{\text{Volume of solute} \times 100}{\text{Volume of solution}}$$





## % Age by Strength

$w/v$

$\frac{w}{v}$   
unit of solute / unit of solution

10g of solute present in  
100 ml of solution

10% w/v  
or

10% by strength

10 Kg of solute  
1000 m<sup>3</sup> of solution





$$\% \text{ Age by strength of solute} = \frac{\text{mass of solute}}{\text{Volume of solution}} \times 100$$



# Question



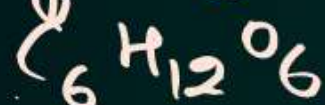
Find molality of 20% w/v of glucose if density of solution is 2g/ml.

Ans  $m = ?$

density (d) of solution = 2g/ml

20 g of solute present in 100 ml of solution  
(glucose)

$$w_B = 20g$$



$$M_B = 6 \times 12 + 12 \times 1 + 6 \times 16 = 180g$$

$$\text{mass of sol}^n = w_A + w_B$$

$$\text{mass of sol}^n = 100 \times 2 = 200g$$

$$200 = w_A + 20$$

$$200 - 20 = 180g = w_A$$

$$m = \frac{n_B}{w_A (\text{in Kg})}$$

$$m = \frac{100}{g \times 18} = \frac{100}{162} m$$

$$n_B = \frac{w_B}{M_B} = \frac{20}{180}$$

$$n_B = \frac{1}{9}$$

$$w_A = \frac{180}{100} Kg$$

$$w_A = \frac{18}{100} Kg$$





# Effect of Temperature on Concentration Terms

Concentration terms involving mass does not change with temp and conc. Terms involving volume change with temperature.

$$M = \frac{n_B}{V(L)} \rightarrow \text{will Change with Temp} \rightarrow \text{not a good method to represent conc.}$$

$$m = \frac{n_B}{\text{mass (in Kg)}} \rightarrow \text{will not Change with Temp} \rightarrow \text{Better method to represent conc. it does not Change with Temp.}$$

Mole fraction  $\rightarrow$  

#MIT



# Question



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  $NO_2$

E.F

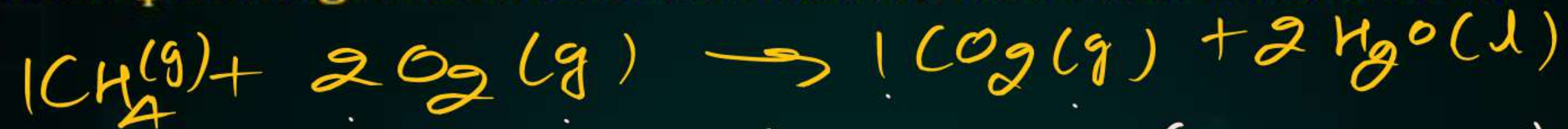
$$\begin{array}{r} 2.1 \\ 140 \overline{) 30.5} \\ \underline{280} \phantom{0} \\ 250 \phantom{0} \\ \underline{210} \phantom{0} \\ 400 \phantom{0} \\ \underline{350} \phantom{0} \\ 500 \phantom{0} \\ \underline{420} \phantom{0} \\ 800 \phantom{0} \\ \underline{700} \phantom{0} \\ 1000 \phantom{0} \\ \underline{980} \phantom{0} \\ 2000 \phantom{0} \\ \underline{1960} \phantom{0} \\ 4000 \phantom{0} \\ \underline{3920} \phantom{0} \\ 8000 \phantom{0} \\ \underline{7840} \phantom{0} \\ 16000 \phantom{0} \\ \underline{15680} \phantom{0} \\ 32000 \phantom{0} \\ \underline{31360} \phantom{0} \\ 64000 \phantom{0} \\ \underline{62720} \phantom{0} \\ 128000 \phantom{0} \\ \underline{125440} \phantom{0} \\ 256000 \phantom{0} \\ \underline{250880} \phantom{0} \\ 512000 \phantom{0} \\ \underline{501760} \phantom{0} \\ 1024000 \phantom{0} \\ \underline{1003520} \phantom{0} \\ 2048000 \phantom{0} \\ \underline{2007040} \phantom{0} \\ 4096000 \phantom{0} \\ \underline{4030080} \phantom{0} \\ 6553600 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\\ 362720000000 \phantom{0} \\ \underline{356376463360} \phantom{0} \\ 725440000000 \phantom{0} \\ \underline{712752926720} \phantom{0} \\ 1450880000000 \phantom{0} \\ \underline{1425505853440} \phantom{0} \\ 2901760000000 \phantom{0} \\ \underline{2851011706880} \phantom{0} \\ 5803520000000 \phantom{0} \\ \underline{5702023413760} \phantom{0} \\ 10607040000000 \phantom{0} \\ \underline{10404046827520} \phantom{0} \\ 21214080000000 \phantom{0} \\ \underline{20808093655040} \phantom{0} \\ 42428160000000 \phantom{0} \\ \underline{41616187310080} \phantom{0} \\ 84856320000000 \phantom{0} \\ \underline{83232374620160} \phantom{0} \\ 169716640000000 \phantom{0} \\ \underline{166464749240320} \phantom{0} \\ 339433280000000 \phantom{0} \\ \underline{332929498480640} \phantom{0} \\ 678866560000000 \phantom{0} \\ \underline{665858996961280} \phantom{0} \\ 1357733120000000 \phantom{0} \\ \underline{1331717993922560} \phantom{0} \\ 2715466240000000 \phantom{0} \\ \underline{2663435987845120} 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## Question



If 1 L of  $\text{CH}_4$  undergoes combustion find the volume of contraction.

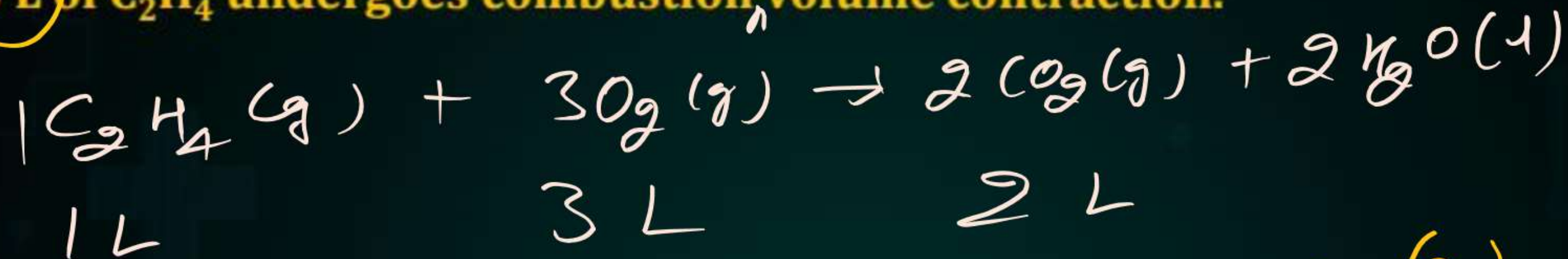


$$\begin{aligned}\text{Vol. Contraction for 1 L} &= (1\text{L} + 2\text{L}) - (1\text{L}) \\ &= 3\text{L} - 1\text{L} = 2\text{L}\end{aligned}$$

## Question



If 5 L of  $C_2H_4$  undergoes combustion, <sup>find</sup> volume contraction.



$$\begin{aligned} \text{Vol. contraction for 1 L of } C_2H_4 &= (1 + 3) - (2) \\ &= 4 - 2 = 2 L \end{aligned}$$

$$\underline{\hspace{10em}} 5 L \hspace{1em} \Rightarrow 2 L \times 5 = 10 L$$





## Home Work

**AA DEKHEN ZARA**



**KISME KITNA HAI  
DUM**

The density of a solution prepared by dissolving 120 g of urea (mol. mass = 60 u) in 1000 g of water is 1.15 g/mL. The molarity of this solution is

A

0.50 M

B

1.78 M

C

1.02 M





D

2.05 M



**Assertion:** Molecular formula shows the exact number of different types of atoms present in a molecule of a compound.

**Reason:** Molecular formula can be obtained directly from empirical formula which represents the simplest whole number ratio of various atoms present in a compounds.

-  **A** If both assertion and reason are true and reason is the correct explanation of assertion.
-  **B** If both assertion and reason are true and reason is not the correct explanation of assertion.
-  **C** If assertion is true but reason is false.
-  **D** If both assertion and reason are false



**Assertion:** The reactant which is present in larger amount limits the amount of product formed is called limiting reagent.

**Reason:** Amount of product formed does not depend upon the amount of reactants taken.

A

If both assertion and reason are true and reason is the correct explanation of assertion.

B

If both assertion and reason are true and reason is not the correct explanation of assertion.

C

If assertion is true but reason is false.

D

If both assertion and reason are false



A solution is made by dissolving 49 g of  $\text{H}_2\text{SO}_4$  ( molar mass of Sulphuric acid is 98 g ) in 250 mL of water. The molarity of the solution prepared is:

A

2 M

B

1 M

C

4 M

D

5 M

What is the concentration of copper sulphate (in  $\text{mol L}^{-1}$ ) if 80 g of it is dissolved in enough water to make a final volume of 3 L? ( molar mass of copper sulphate is 159.5 g )

A

0.0167

B

0.167

C

1.067

D

10.67



**Assertion: Molarity of a solution does not depend upon temperature whereas molality depends.**

**Reason: Molarity and molality both depend only on the number of moles of solute particles.**

- A** If both assertion and reason are true and reason is the correct explanation of assertion.
- B** If both assertion and reason are true and reason is not the correct explanation of assertion.
- C** If assertion is true but reason is false.
- D** If both assertion and reason are false



## How to increase Your Focus ?

- 1 Use Pen Technique - discussed in chapter 1 Lecture 2 ✓
- 2 Use Ear Plugs while Studying - discussed in chapter 1 Lecture 3 ✓



## How to increase Your Efficiency ?

- Use Pomodoro technique - discussed in chapter 1 Lecture 5 ✓





## How to stop Overthinking ?

- Use appointment method - discussed in chapter 1 Lecture 10

↓  
Sofa → 10 p.m. to 10:15 p.m. → appointment  
↓  
overthinking



**Thank** *You*