LAKSHYA JEE

LAKSHYA KO HAR HAAL ME PAANA HAI

LIQUID SOLUTIONS

by

PANKAJ SIR

LECTURE -II

CONCENTRATION TERMS

Mole Fraction (x)

↳ chi

\# Temp independent

Solution = Solute + Solvent

(B) (A)

$$x_A + x_B = 1$$

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

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

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

$$\text{Formality} = \frac{n_{ion}}{V_{soln(L)}}$$

Temp dependent

Relations Between Concentration Terms

① Relation b/w N and M

N → Normality

M → Molarity

$$N = M \times n.f$$

LAKSHYA KO HAR HAAL ME PAANA HAI

② Relation b/w m and x

m → molality

x → mole fraction

m = molality

x_B = mole fraction of solute

x_A = mole fraction of solvent

$M.W_A$ = mol. wt. of solvent

$$m = \frac{x_B}{x_A} \times \frac{1000}{M.W_A}$$

③ Relation b/w M and % $\frac{w}{w}$

M → Molarity

% $\frac{w}{w}$ → % by wt

M = Molarity

x = % $\frac{w}{w}$

$$M = \frac{10 \times d}{M \cdot W_B}$$

d = density of the sol^n (gm/mL)

$M \cdot W_B$ = mol. wt of Solute

④ Relation b/w M and m

M → Molarity

m → molality

M = Molarity

m = molality

$$M = \frac{md}{1 + \frac{m \cdot MW_B}{1000}}$$

d = density in gm/mL

MW_B = Mol. wt of Solute

The mole fraction of the solute in one molal aqueous solution is:

(A) 0.054 (B) 0.042

(C) 0.018 (D) 0.009

A → H_2O Solvent $MW_A = 18$

$m = 1$

$$m = \frac{x_B}{x_A} \times \frac{1000}{MW_A}$$

$x_A + x_B = 1$

$$1 = \frac{x_B}{1 - x_B} \times \frac{1000}{18}$$

$1 - x_B = x_B \times 55.5$

$1 = x_B \times 55.5 + x_B$

$1 = x_B(55.5 + 1)$

$1 = x_B \times 56.5$

$$x_B = \frac{1}{56.5}$$

Mole fraction of acetic acid in an aqueous sample is 0.1. The molality of the solution is

CH_3COOH ↳ $A \Rightarrow H_2O$ $MW_A = 18$

(A) 7.16 mol kg^{-1}

(B) 1.67 mol kg^{-1}

(C) 6.17 mol kg^{-1} ✓

(D) 5.25 mol kg^{-1}

$x_B = 0.1$ $m = ?$

$x_A + x_B = 1$

$x_A + 0.1 = 1$

$x_A = 0.9$

$$m = \frac{x_B}{x_A} \times \frac{1000}{MW_A}$$

$$m = \frac{0.1}{0.9} \times \frac{1000}{18}$$

$$= \frac{1}{9} \times 55.5 = \frac{55.5}{9} = 6.\text{ Some thing}$$

Which of the following concentration factor is affected by change in temperature ?

[AIEEE-2002]

(A) Molarity $M = \frac{n_B}{V_{soln}(L)}$

(B) Molality

(C) Mol fraction

(D) Weight fraction

$\left(\frac{w_B}{w_A + w_B}\right)$ → wt fraction of B

$\left(\frac{w_A}{w_A + w_B}\right)$ → wt fraction of A

The density (in g mL^{-1}) of a 3.60 M sulphuric acid solution that is 29% H_2SO_4 (Molar mass = 98 g mol^{-1}) by mass will be -

MW_B

$x = 29$

[AIEEE 2007]

(A) 1.64

(B) 1.88

(C) 1.22

(D) 1.45

$M = 3.6$

$d = ?$

$B \rightarrow H_2SO_4$

$x = 29$

$$M = \frac{10xd}{MW_B}$$

$$3.6 = \frac{10 \times 29 \times d}{98}$$

$$d = \frac{3.6 \times 98}{290} = 1.22 \frac{gm}{mL}$$

A sugar syrup of weight 214.2 grams contains 34.2 grams of sugar. The molal concentration is- [IIT-1988]

(A) 0.55 (B) 5.5

(C) 55 (D) 0.1

Sugar syrup = Sugar + other component
214.2 = 34.2 + 180

→ Sucrose $C_{12}H_{22}O_{11}$

$MW_B = 342$

m = molality

$w_{soln} = 214.2$ gm

$w_B = 34.2$ gm

$n_B = \frac{34.2}{342} = \frac{1}{10}$

$w_A = w_{soln} - w_B$

$= 214.2 - 34.2$

$= 180$ gm

$w_A = \frac{180}{1000}$ Kg

$$m = \frac{n_B}{w_{A(kg)}} = \frac{\frac{1}{10}}{\frac{180}{1000}}$$

$$= \frac{1}{10} \times \frac{1000}{180} = 0.55$$

The normality of 0.3 M phosphorous acid (H_3PO_3) is - [IIT- 1999]

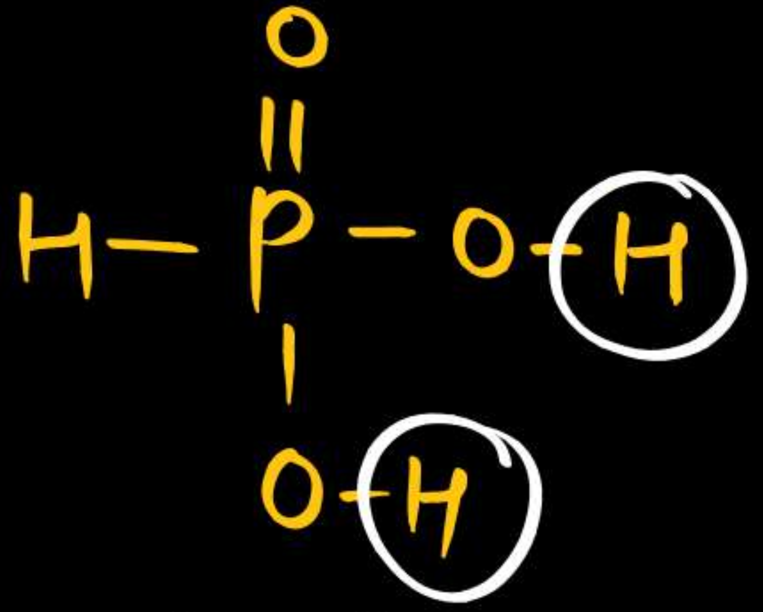
(A) 0.1
(B) 0.9
(C) 0.3
(D) 0.6 ✓

$M = 0.3$

$N = M \times n.f$

$N = 0.3 \times 2$

$N = 0.6$



$n.f = 2$

Increasing the temperature of an aqueous solution will cause -

A ⇒ H_2O

[IIT-1993]

(A) decrease in molality ✗

(B) decrease in molarity

(C) decrease in mole fraction ✗

(D) decrease in % (w/w) ✗

(Home work)

Q1 find M of 49 % $\frac{w}{v}$ H_3PO_4

Q.2 find molality of 49 % $\frac{w}{w}$ H_2SO_4.

Thank You Lakshyians