PRAYAS

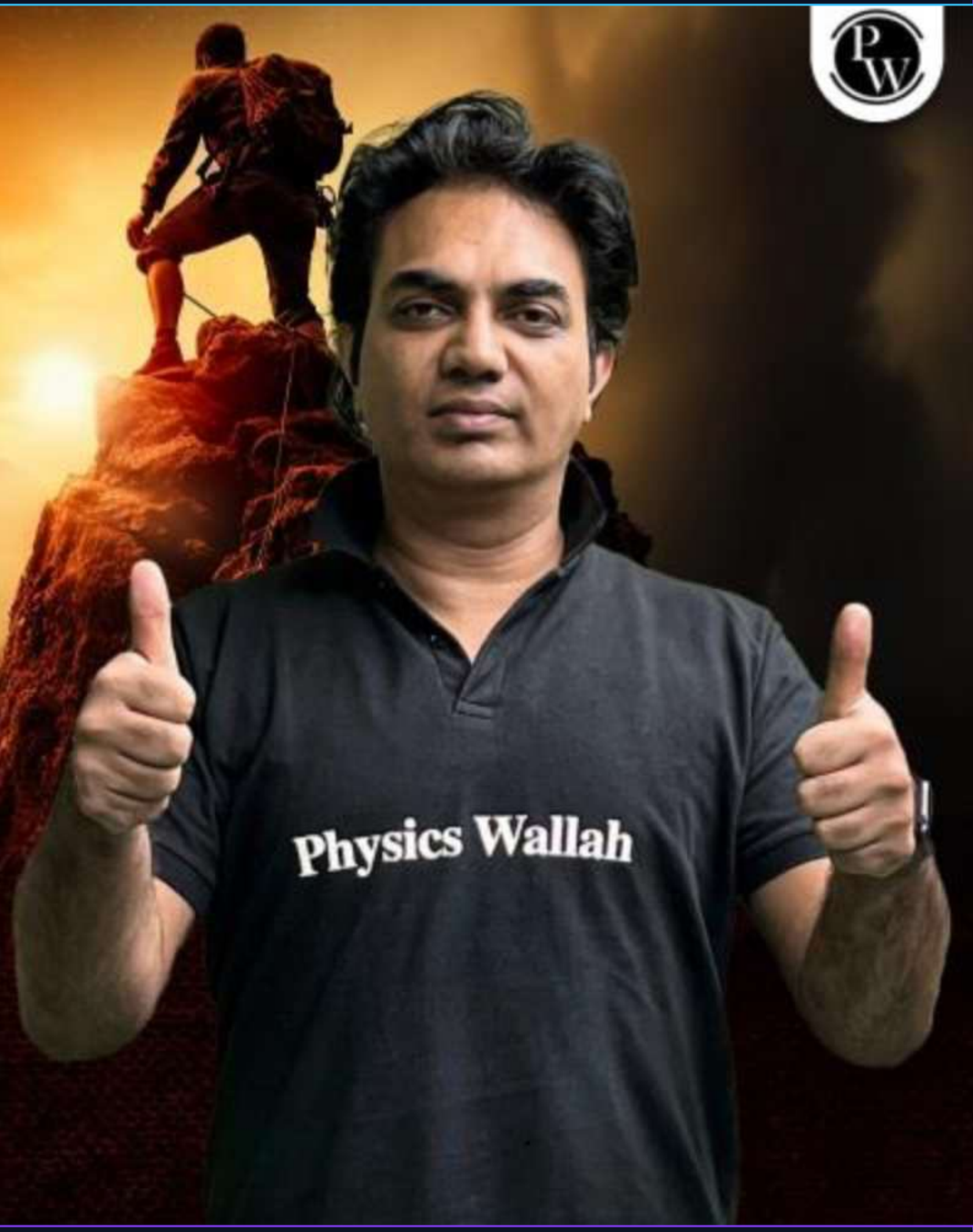
JEE 2026

PHYSICAL CHEMISTRY

SOLUTIONS

Lecture – 02

FAISAL RAZAQ



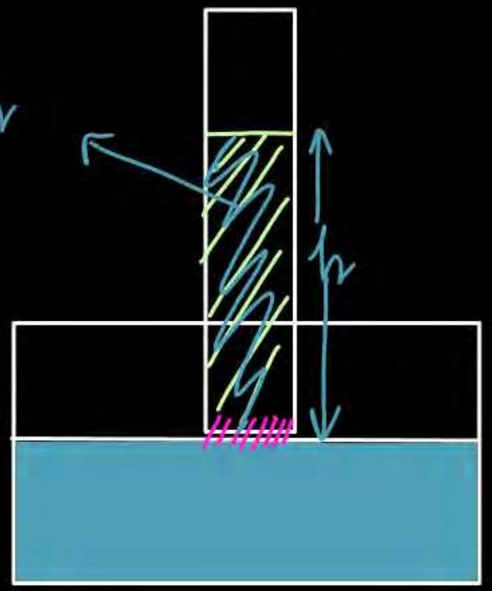
Topics to be covered

A Vapour Pressure

gm/L ⟶ Molarity = $\frac{M}{L}$ = $\frac{M}{L}$ (Molarity)

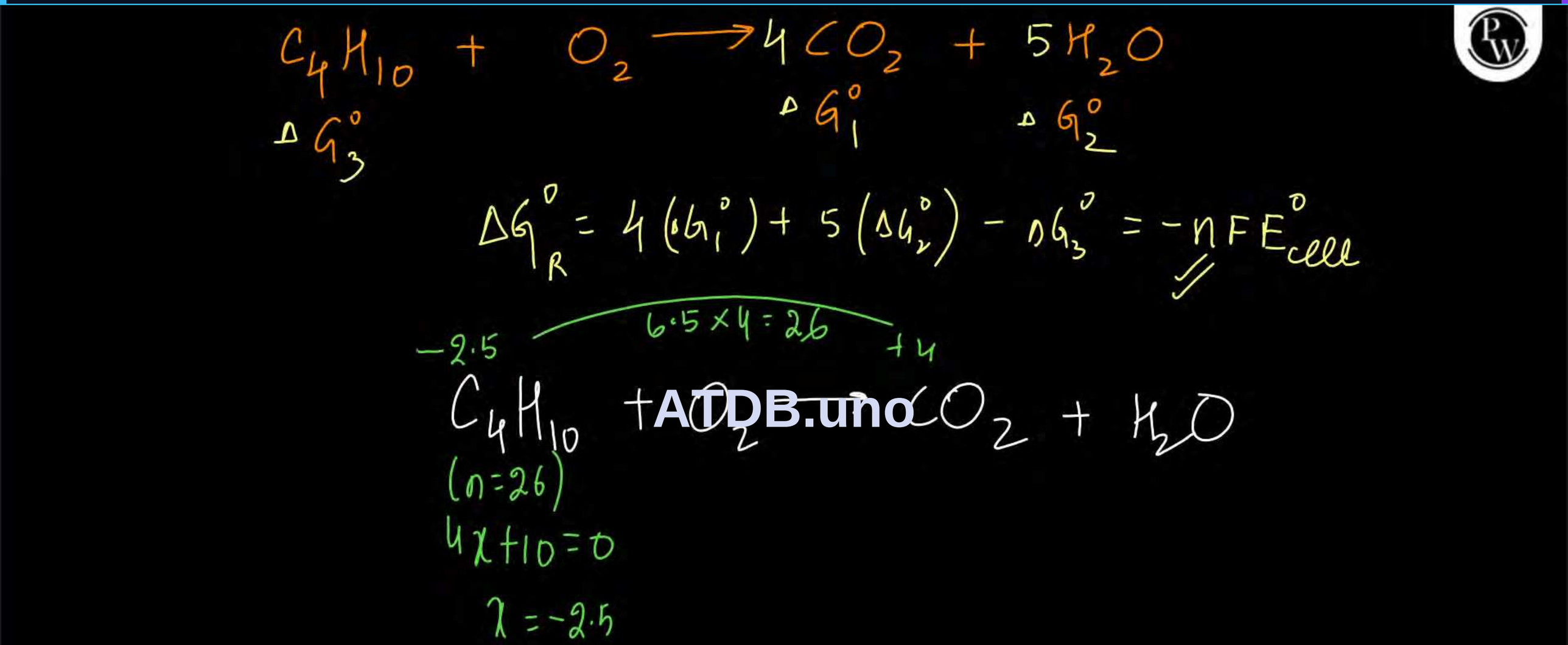
C

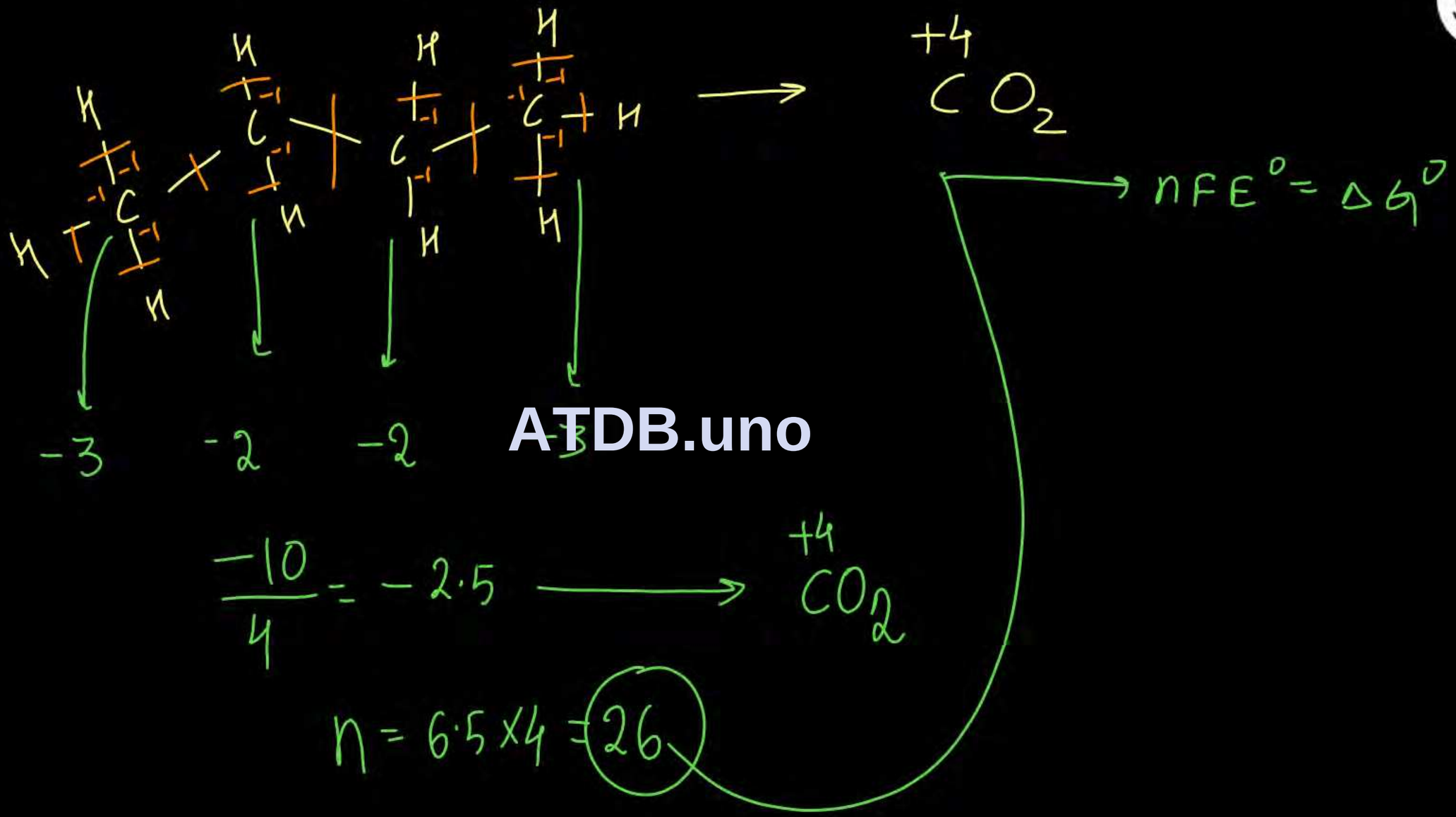
Strength



hdg = Osmotic pressure = CRT

$hdg = CRT$

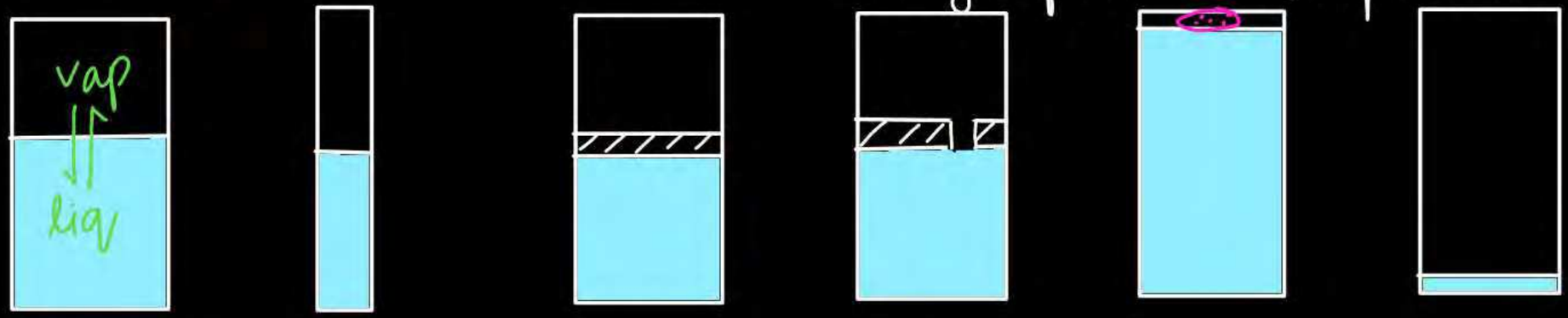




Question for which of these container V.P is maximum at temperature T?

$liq \rightleftharpoons vap$; $K = P_{vap}$ = Vapour Pressure

$\therefore$ K only depends on temperature



(1) ✓ (2) ✓ (3) ✗ (4) ✓ (5) ✓ (6) ✗

K.B. Irrespective of the amount of the liquid and the shape of container, the vapour pressure of liquid is constant at a particular temperature.

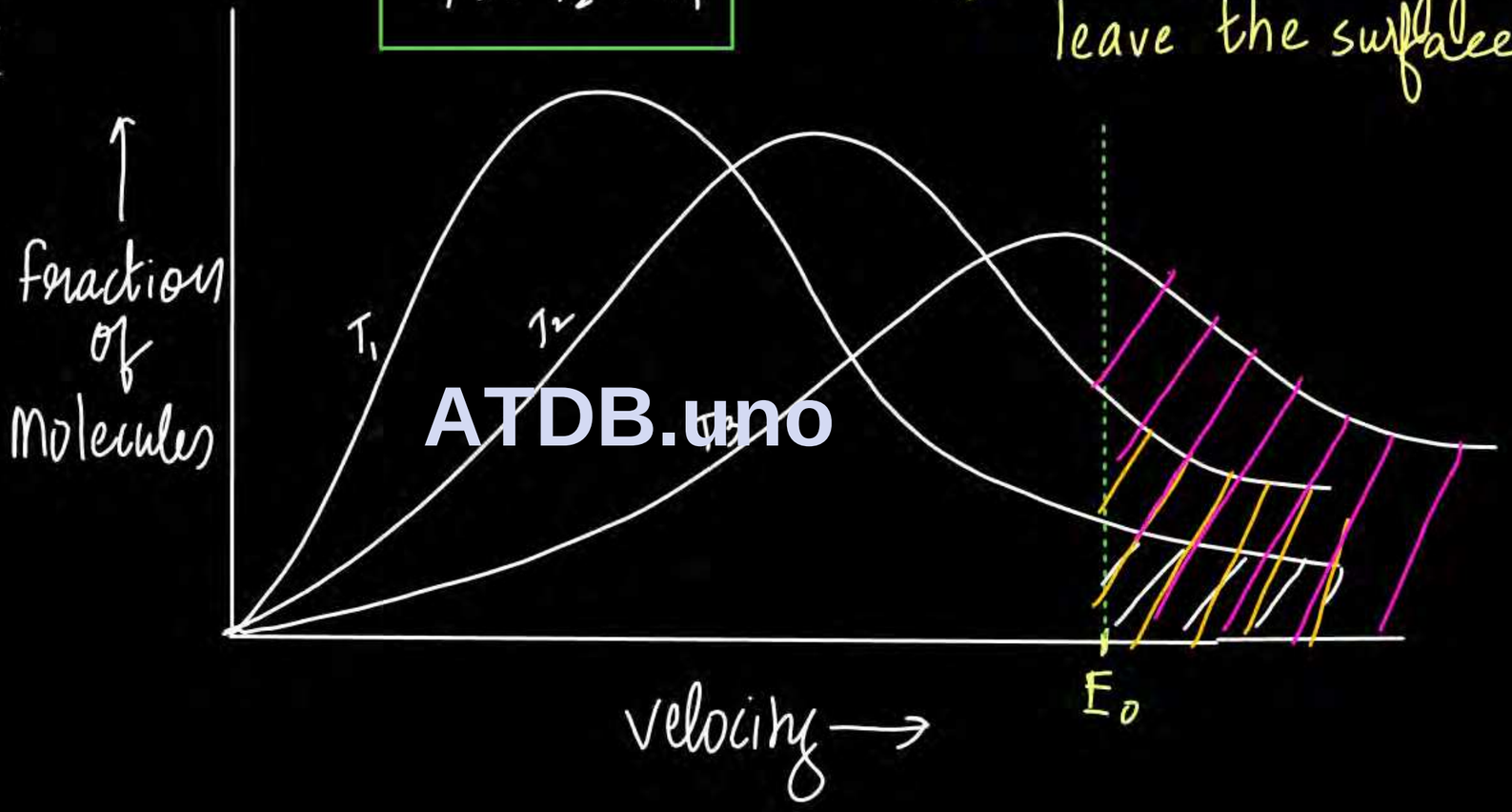
Provided the liquid is sufficient enought to form that liq $\rightleftharpoons$ vap equilibrium.

Why Vapour Pressure of a Pure liquid depends only on T

$T_3 > T_2 > T_1$

E_0 = minimum energy required to leave the surface of liquid.

Explaination 1

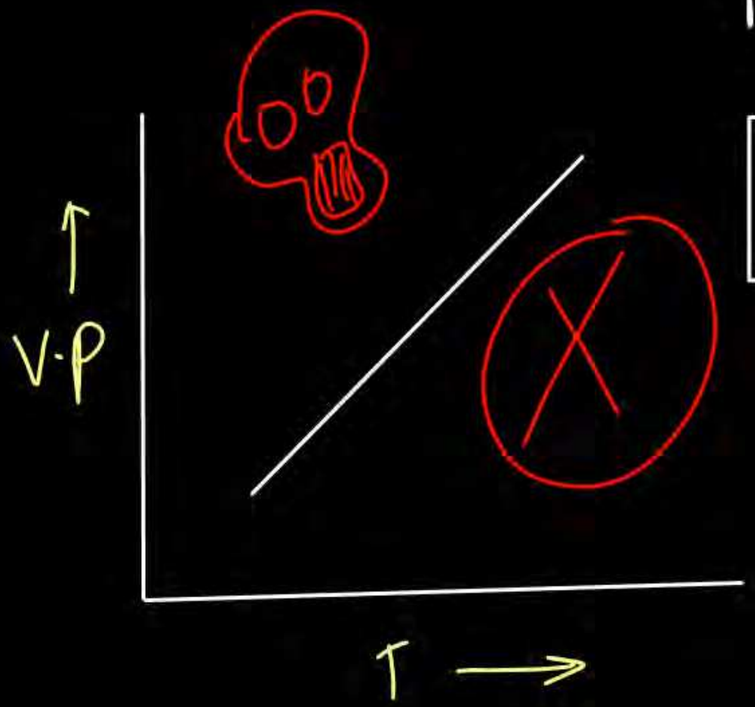


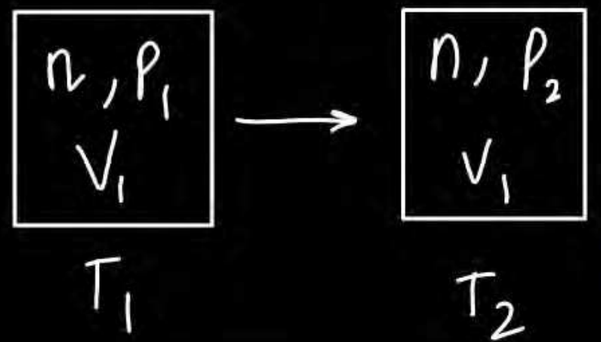
Explaination - 2

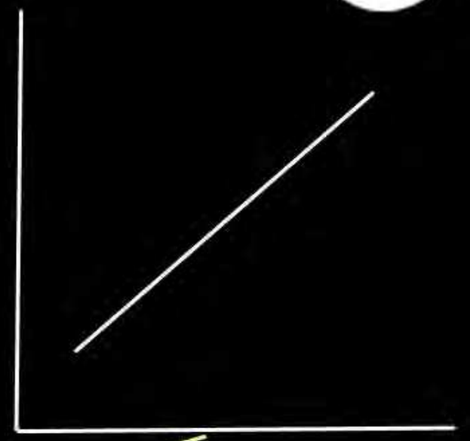
$$PV = nRT$$

$$P = \frac{nRT}{V}$$

$$P \propto T$$







$$T_2 > T_1$$

$$P_2 > P_1$$

⇒ when n & V are constant.

Ab aaega Maza

Statement 1 : Vapour Pressure increases on increasing the T.

Statement 2 : Vapour Pressure linearly depends on T.

$$\text{liq} \rightleftharpoons \text{Vap.} \quad ; \quad \boxed{K = V \cdot P}$$

$$\log \frac{K_{T_2}}{K_{T_1}} = \frac{\Delta H}{2.303R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$$

$$\log \frac{(V \cdot P)_{T_2}}{(V \cdot P)_{T_1}} = \frac{\Delta H}{2.303R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$$

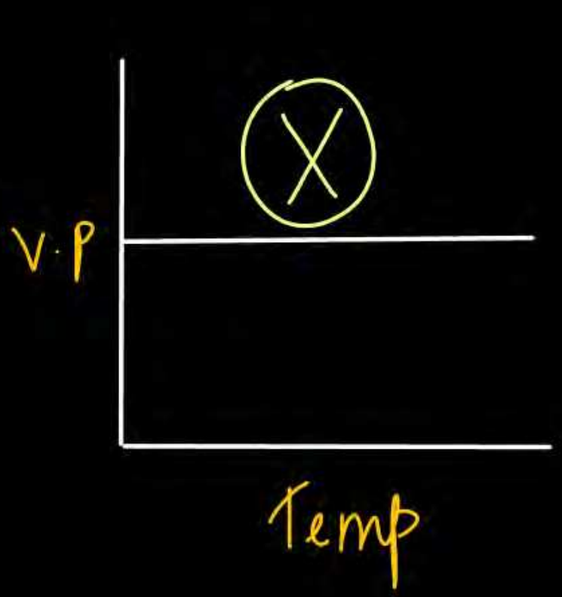
K.P.

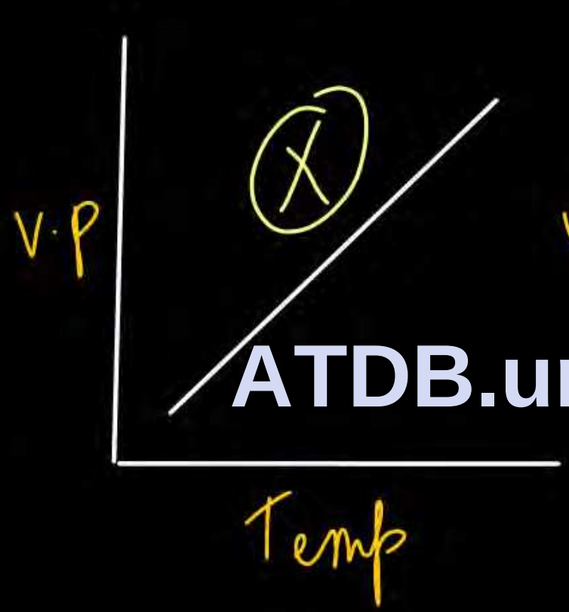
Vapour pressure of a pure liquid depends on T exponentially.

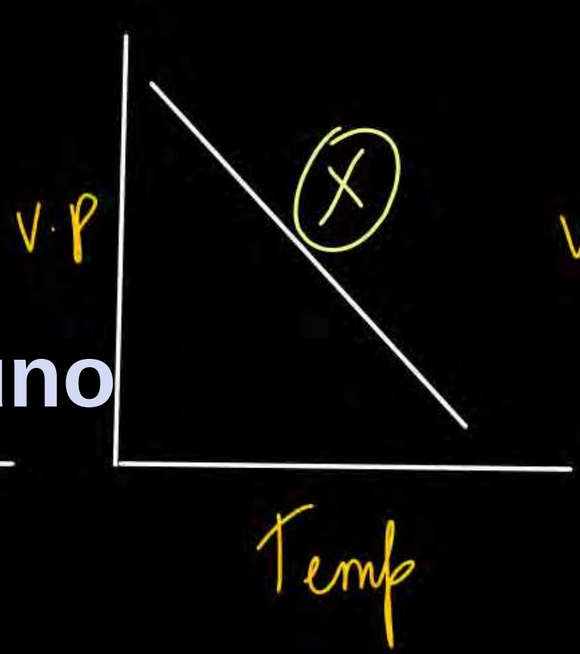
Note: Exponential variations are large variations.

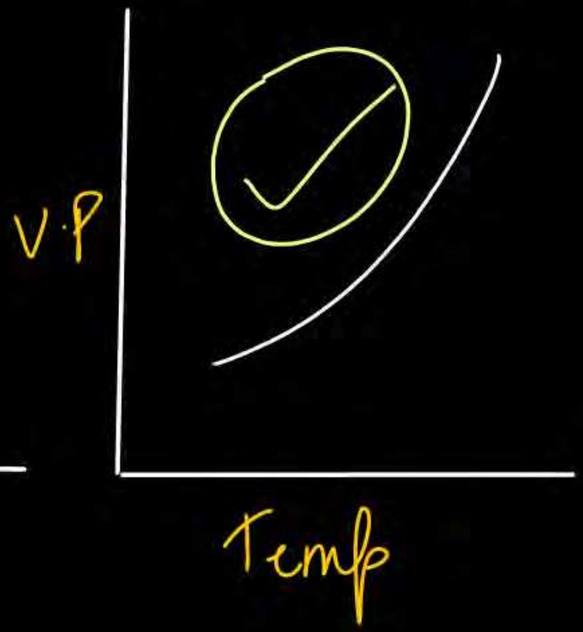
Question

Graph between V.P of Pure liquid and T









K.B. Conclusions

* Vapour pressure of a pure liquid is only temp. dependent.
* Irrespective of the amount of liquid and shape of container, Vapour Pressure is constant at a particular T.
* Liquid should be sufficient enough to make liq $\rightleftharpoons$ vap
* Vapour Pressure depends on temperature exponentially.
* $\log \frac{P_{T_2}}{P_{T_1}} = \frac{\Delta H}{2.303R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$

Question

Multi correct

Vapour pressure of pure liquid is 1.5 atm at 350 K. If its V.P at 500 K is P then -

(A) ~~P = 1.0 atm~~

(B) ~~P < 1.5 atm~~

(C) P > 1.5 atm

(D) ~~Hume nahin pata~~ 😊

(E) ~~2.143 atm~~

(F) > 2.143 atm

$P \propto T$

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

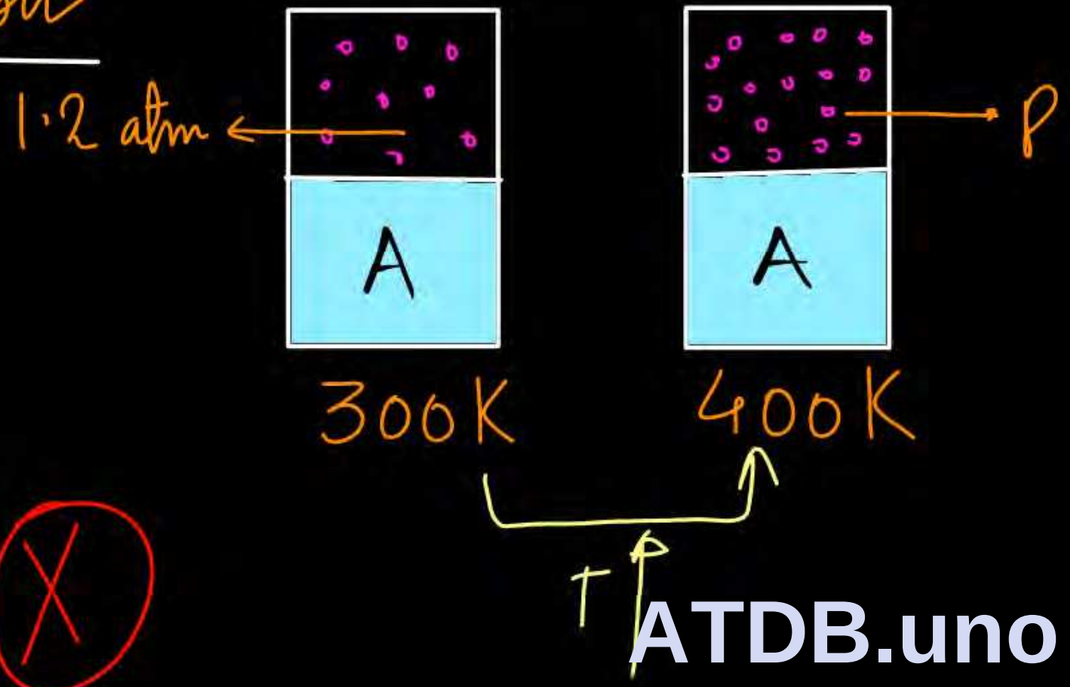
$$\frac{1.5}{350} = \frac{P_2}{500}$$

$$P_2 = \frac{500 \times 1.5}{350}$$

$$= 2.143 \text{ atm}$$

Ans: (C), (F)

Question



Find out the V·P of liq. A at 400K.

(A) ~~1·10 atm~~

(B) ~~1·60 atm~~

(C) 1·80 atm

(D) ~~1·20 atm~~

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

$$\frac{1·2}{300} = \frac{P_2}{400}$$

$$P_2 = 1.6 \text{ atm}$$

Aus : (C)

Question Calculate the V.P of pure water at 60°C. V.P at 100°C is 1.0 atm and ΔH_{vap} of water = 9800 cal/mol.

$$\log \frac{1}{P} = \frac{9800}{2.303} \left[\frac{1}{333} - \frac{1}{373} \right]$$

$$P = 0.6851 \text{ atm}$$

$R = 8.314 \text{ J/K-mol}$

$R = 1.98 \text{ cal/K-mol}$

$R = 0.0821 \text{ atm-L/K-mol}$

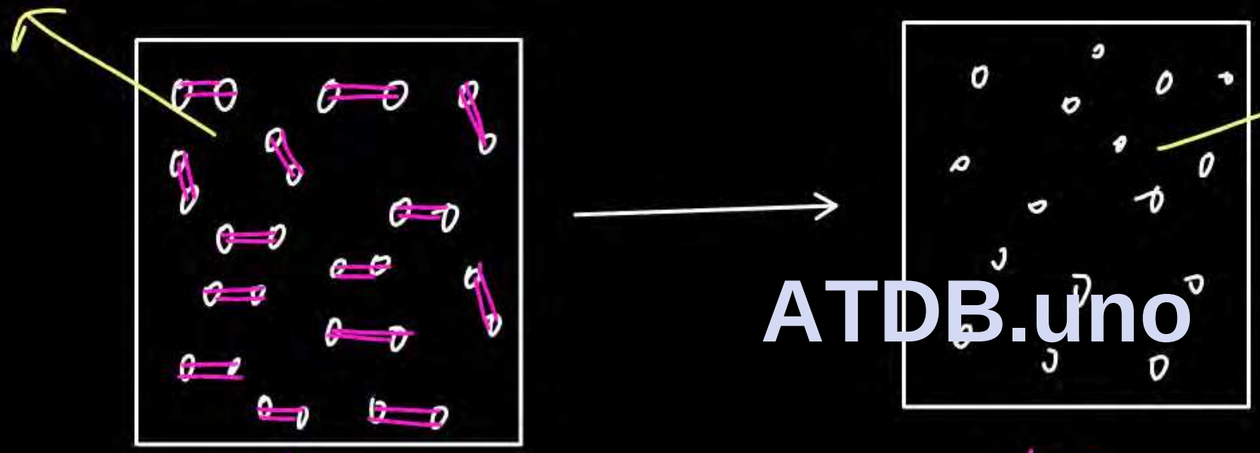
Ans: 0·6851 atm

Question Vapour Pressure of liquid nickel at 1606°c is 0·100 torr, whereas at 1805°c it V·P is 1·000 torr. At what temperature does the liquid have V·P 2·500 torr?

Ans: 2169 K

Vapour Pressure of two liquids at temperature T

There exists Force of attraction



There exist almost negligible Force of attraction between molecules

Liq.

Vap

L.B.

More the (FOA) between molecules in vapour phase lesser will be the V.P of the liq at a particular temperature.

Forces between molecules

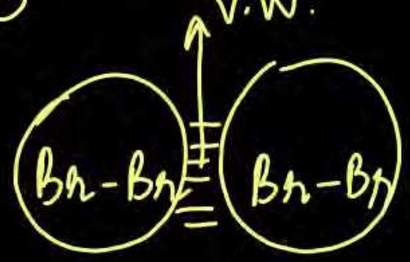
δ+ δ− - - - Na^+

Ionic force > ion-dipole > Hydrogen bond

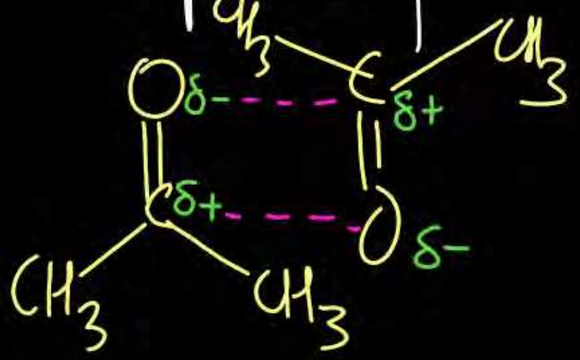
$Na^+ \equiv Br^-$

$Na^+ = = H_2O$

H_2O - - - - H_2O



dipole-dipole > dipole-induced dipole > Vander Waal force

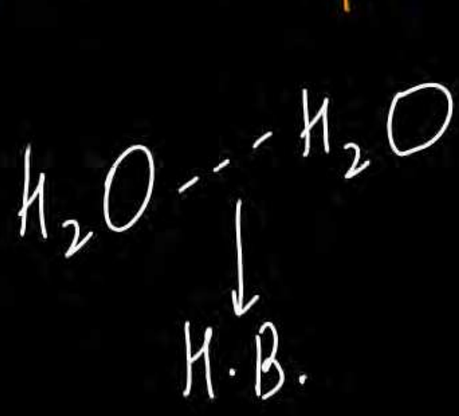


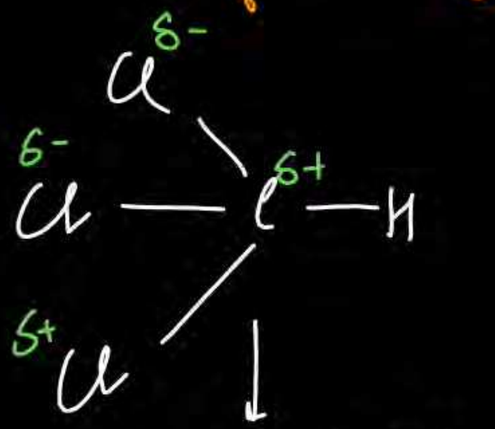
δ+ δ−

Br-Br - - - H_2O

This is due to Molecular weight in non polar molecules.

Question Compare the V.P of $CHCl_3$ and H_2O at T.





dipole-dipole

Force of Att ↑ V.P ↓

H.B > dipole-dipole

$V.P_{H_2O} < V.P_{CHCl_3}$ (at T)

Question The quantity which changes with temperature is

[Jan -2024 Mains]

(1)

A) Molality

B) Mole fraction

C) Molarity

D) Mass percentage

Ans—(C)

Question

(2)

Volume of 3M NaOH (Molecular weight = 40 g/mol) which can be prepared from 84 gm of NaOH is ____ $\times 10^{-1}$ dm^3.

[Jan-2024 Mains]

Ans – (7)

Question

(13)

A solution of H_2SO_4 is 31.4% H_2SO_4 by mass and has a density of 1.25 gm/ml. The molarity of the H_2SO_4 solution is ____ M (nearest integer).

[Jan-2024 Mains]

Ans-(4)

Question

(4)

Molality of 0·8 M H_2SO_4 solution (density = 1·06 g/ml) is ____ $\times 10^{-3}$ m.

[Jan-2024 Mains]

Ans-(815)

Question

(5) The mass of sodium acetate (CH_3COONa) required to prepare 250 ml of 0.35 M aqueous solution is _____ gm. (Molar mass of CH_3COONa = 82.02 g/mol)

[Jan-2024 Mains]

Ans-(7)

Question 6

If a substance 'A' dissolves in a solution of a mixture of 'B' and 'C' with their respective number of moles as n_A, n_B and n_C, mole fraction of 'C' in the solution is

[Jan - 2024 Mains]

A) $\frac{n_C}{n_A \times n_B \times n_C}$

C) $\frac{n_C}{n_A - n_B - n_C}$

B) $\frac{n_C}{n_A + n_B + n_C}$

D) $\frac{n_B}{n_A + n_B}$

Ans–(B)

Question

(7) The molarity of 1 L orthophosphoric acid (H_3PO_4) having 70% purity by weight (sp. gr = 1.54 g/ml) is _____ M. (Molar mass H_3PO_4 = 98 g/mol)

[Jan - 2024 Mains]

Ans-(11)

Question (8)

The molarity of an aqueous solution containing 5.85g NaCl in 500 ml water is

[Apr-2024 Mains]

A) 20

B) 0.2

C) 2

D) 4

Ans-(B)

Question (9)

The density of 'x' M solution of NaOH is 1·12 g/ml. while in molality the concentration of solution is 3 molal. Then 'x' is

[Apr-2024 Mains]

A) 3·5

B) 3·0

C) 3·8

D) 2·8

Ans-(B)

Question

(10)

Molality of 3M aqueous solution of NaCl is (given density of NaCl solution = 1.25 g/mL)

[Apr-2024 Mains]

A) 2.9 m

B) 2.79 m

C) 1.9 m

D) 3.85 m

Ans - (B)

Question 11

Molality of an aqueous solution of urea is 4.44 m. The mole fraction of urea in solution is $x \times 10^{-3}$

Value of x is _____ (integer).

[Apr - 2024 Mains]

Ans - (74)

Question 12

A solution is prepared by adding 1 mole ethyl alcohol in 9 mole of water. The mass percentage of solute in solution is _____ (integer).

[Apr - 2024 Mains]

Ans-(22)

Redox H.W. Module

(Prabal, Prarambh complete)