PRAYAS

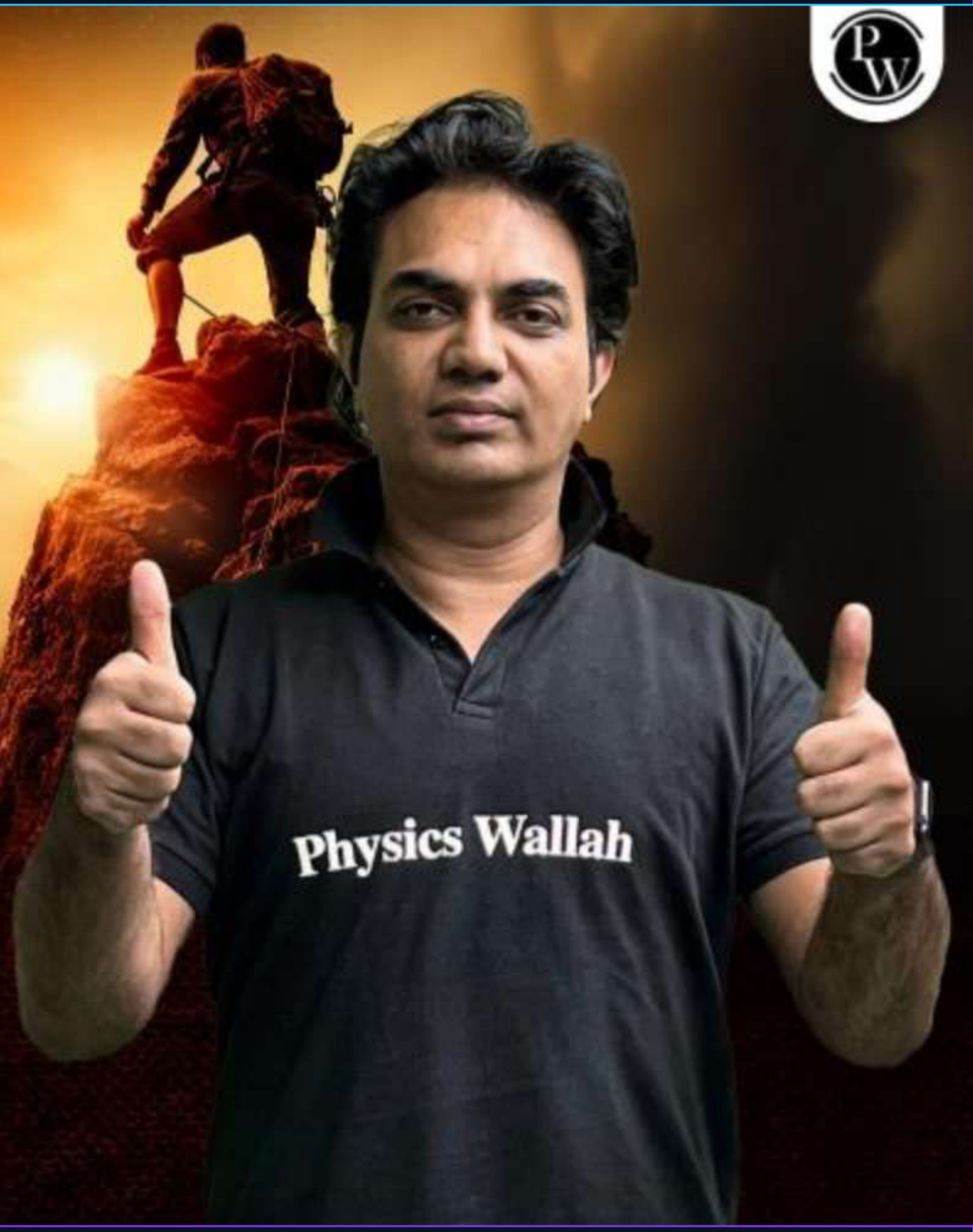
JEE 2026

PHYSICAL CHEMISTRY

SOLUTIONS

Lecture – 01

FAISAL RAZAQ



Topics to be covered

Vapour Pressure

$100\,g \xrightarrow{H_2O} 118\,g$ (Total H_2SO_4)

oleum

$^{*}H_2SO_4$ SO_3

$SO_3 + H_2O \longrightarrow {}^{*}H_2SO_4$

(free)

$H_2S_2O_7$

$^{*}H_2SO_4 + {}^{*}H_2SO_4 = 118\,g$

If Labelling of oleum = 118%

On dilution of 100 g of this oleum sample we get

118 g total H_2SO_4

$$1\,SO_3 + 1\,H_2O \rightarrow H_2SO_4$$

1 mol 1 mol

100 g ⟶ 118 g

↑ 18 g H_2O

(1 mol)

↓

80 g

$$\%\ \text{free } SO_3 = \frac{80}{100} \times 100 = 80\%$$

In an oleum sample Fuee SO_3 = 80%

moles of Fuee SO_3 in 100 g oleum sample = $\frac{80}{80}$ = 1 mol

$$SO_3 + H_2O \longrightarrow H_2SO_4$$

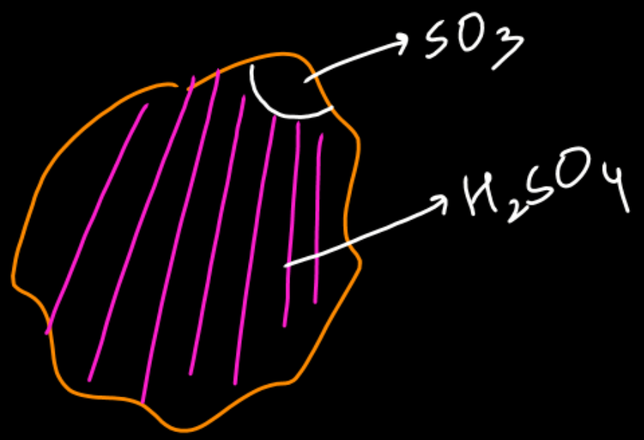
1 mol 1 mol

18 g

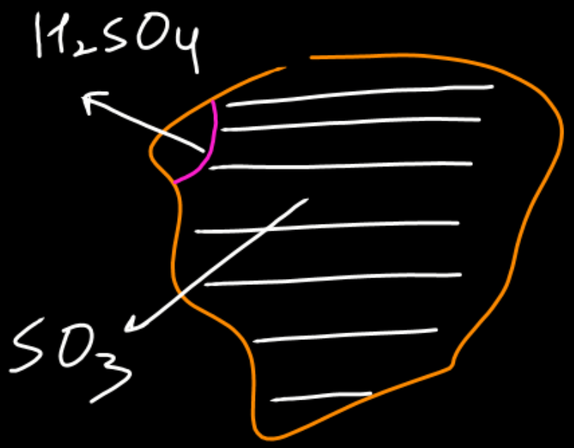
100 g + H_2O(18 g) → 118 g

% labelling = 118%

How to calculate range of labelling



$\simeq 100\,g\ H_2SO_4$



$\simeq 100\,g\ SO_3$

$\frac{100}{80} \times 98 = 122.5\%$

ATDB.uno

$$100\% < \text{Labelling} < 122.5\%$$

1 mol

$K_2Cr_2O_7 + HCl \longrightarrow KCl + CrCl_3 + Cl_2 + H_2O$

OA RA

1 — red^n — (n = 6)

14 mol HCl — 6 mol e^-

1 mol HCl — $\frac{6}{14} = \frac{3}{7}$ mol e^-

$6e^- + 1\,Cr_2O_7^{2-} \longrightarrow 2Cr^{+3}$

$n = \frac{3}{7}$

$2Cl^- \longrightarrow Cl_2 + 2e^-$ X 3

$1Cr_2O_7^{2-} + 6Cl^- \longrightarrow 3Cl_2 + 2Cr^{+3}$

$1K_2Cr_2O_7 + 6HCl \longrightarrow 3Cl_2 + 2CrCl_3 + 2KCl + 7H_2O$

14 HCl

Eq wt of HCl in the above $rxn = \frac{\text{Mol wt}}{n}$

$= \frac{36.5}{(3/7)}$

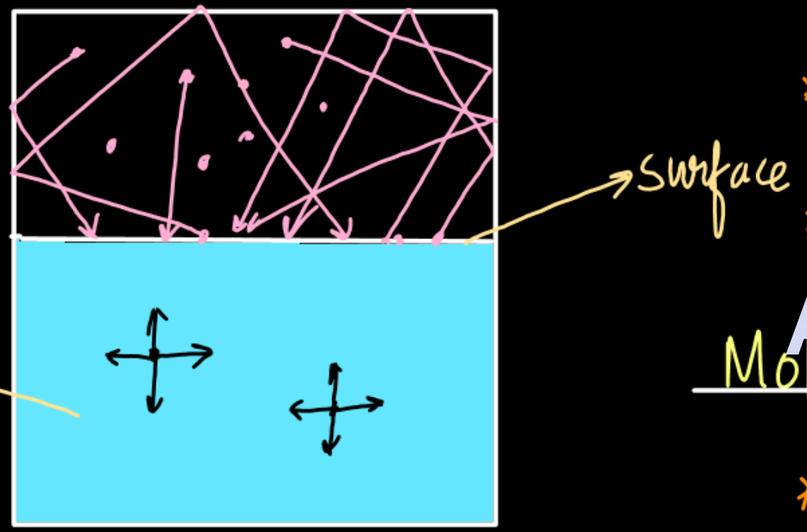
Question

$$\overset{+7}{KMnO_4} + \overset{-1}{HCl} \longrightarrow \overset{-1}{KCl} + \overset{+2\ -1}{MnCl_2} + \overset{0}{Cl_2} + H_2O$$

OA RA

Find out the equivalent wt of HCl in this redox rx?

Vapour Pressure of Pure Liquid



Molecules of liquid present in the bulk

* They are stable
* They are of less energy
* They are in equilibrium

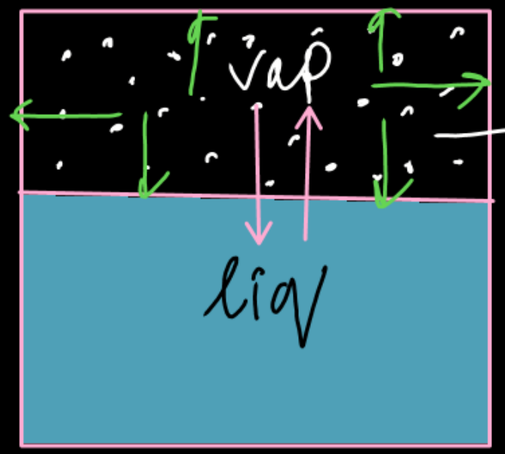
$F_{net} = 0$

Molecules of the liquid present at surface

* They are not stable
* They are of high energy
* Not in equilibrium

$F_{net} \neq 0$

$$\text{liq} \rightleftharpoons \text{vap} \qquad (\text{rate})_{\text{evap}} = (\text{rate})_{\text{cond}}$$

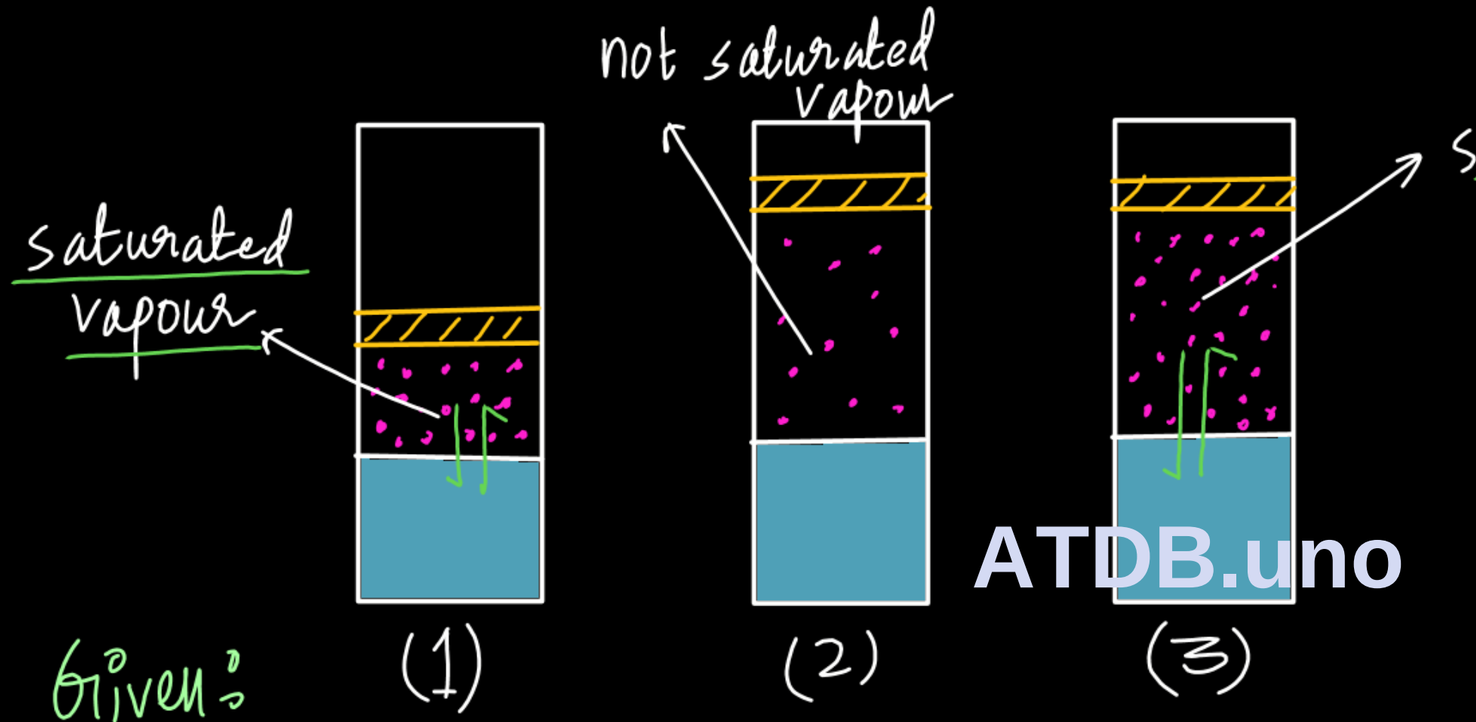


→ saturated vap.

(max no of moles of vap at given temp and volume)

"Pressure exerted by vapours when liq is in equilibrium with vapours is called V.P of that liquid at that particular temperature"

Question All the containers have same liquid at temperature T.



Given:

In container (1) Pressure of vapours = P_1

In container (2) Pressure of vapours = P_2

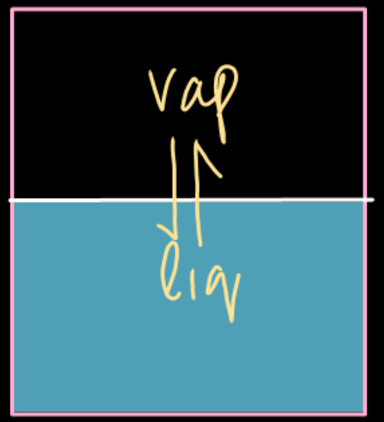
In container (3) Pressure of vapours = P_3

A) $P_1 = P_2$

B) $P_1 > P_2$

C) $P_2 < P_3$

D) $P_1 = P_3$



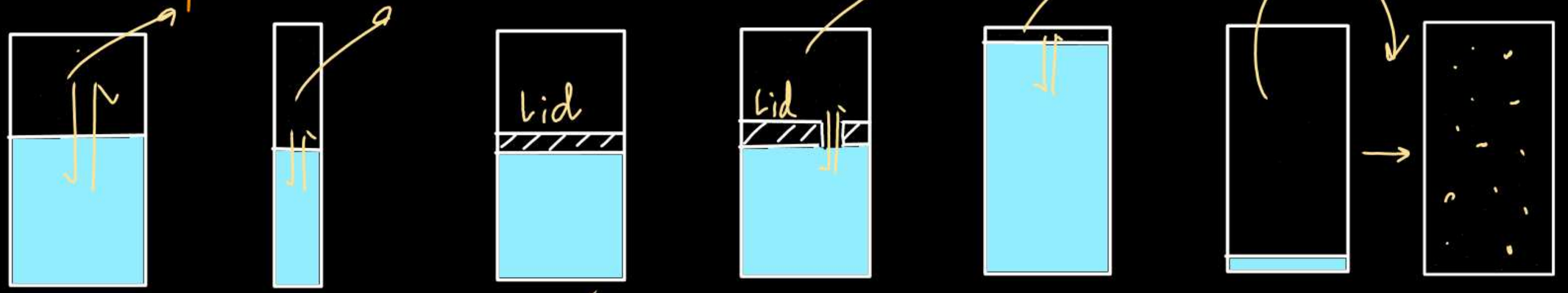
$liq \rightleftharpoons vap$

$K_p = P_{vap}$ [K_p = eq constant]

K_p is only and only temp dependent

Vapour pressure of Pure liq is only and only temperature dependent

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



(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.