Nishant Jindal

Q. find y_A, y_B & P_T if 1 mol liq A is mixed with 3 mol liq B. Given $P_A^\circ = 20$ torr $P_B^\circ = 10$ torr.

$\boxed{X_A = 1/4}$ $\boxed{X_B = 3/4}$

$$P_T = \frac{1 \times 20 + 3 \times 10}{4} = 12.5$$

$\boxed{y_A \times 12.5 = 1/4 \times 20}$

$\boxed{y_A = 0.4}$ $\boxed{y_B = 0.6}$

$\boxed{y_B P_T = X_B P_B^\circ}$

$$\frac{y_A}{y_B} = \frac{X_A}{X_B} \times \frac{P_A^\circ}{P_B^\circ} = \frac{1}{3} \times \frac{20}{10}$$

$$\frac{y_A}{y_B} = \frac{2}{3}$$

$y_A = 0.4$

$y_B = 0.6$

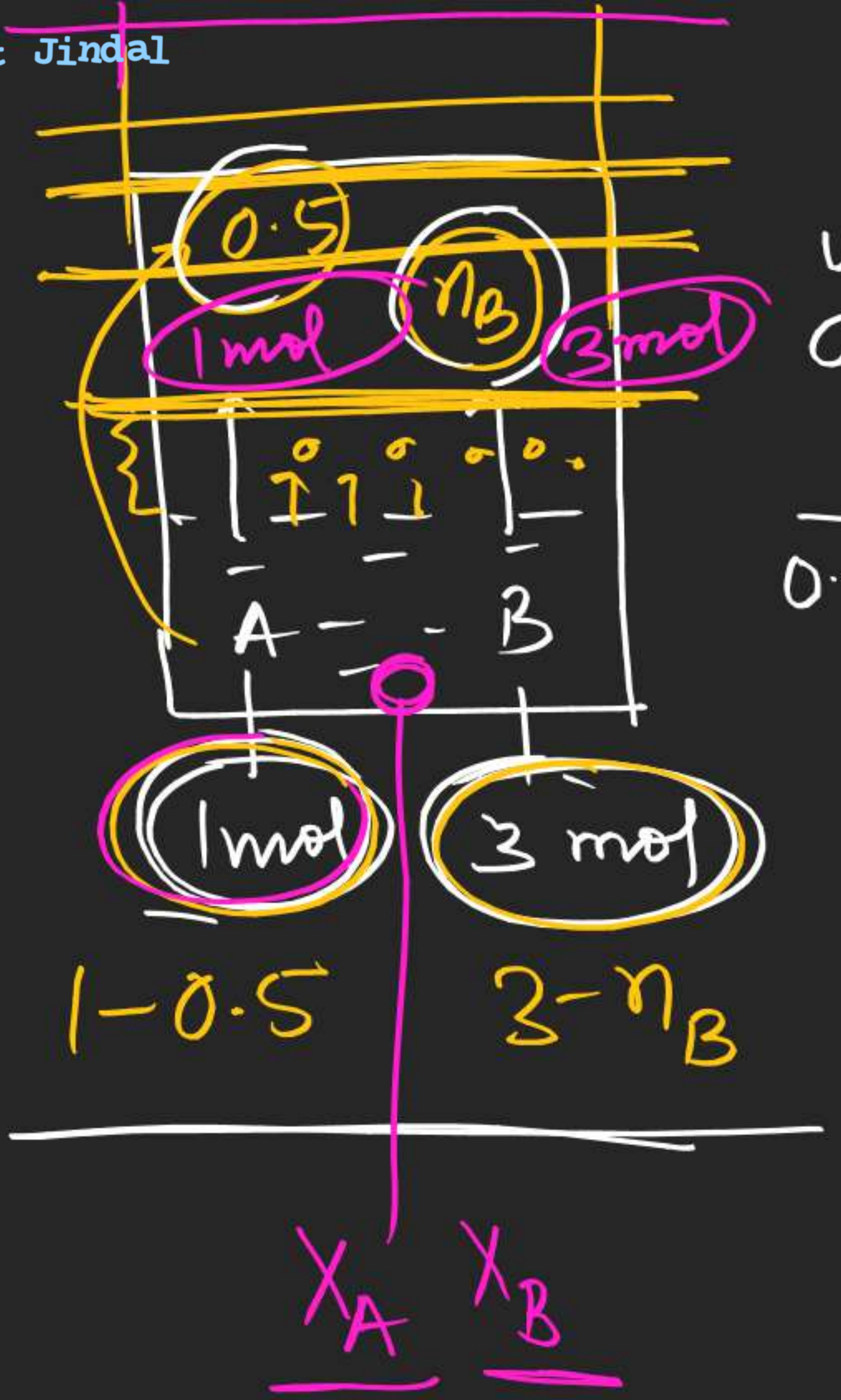
If A is more volatile

$P_A^\circ > P_B^\circ$ $P_T < P_A^\circ$

$y_A P_T = X_A P_A^\circ$

$\boxed{y_A > X_A}$ $\boxed{y_B < X_B}$

But y_A may greater than or less than y_B



$$y_A P_T = X_A P_A^0$$

$$\frac{0.5}{0.5+n_B} P_T = \frac{0.5}{3.5-n_B} \times P_A^0$$

$$y_B P_T = X_B P_B^0$$

$$\frac{n_B}{0.5+n_B} P_T =$$

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Q. 1 mol each of liq A & B are mixed

Given $P_A^0 = 75$ $P_B^0 = 25$ torr.

① y_A, y_B & P_T when 1st bubble of vapour is formed.

② X_A, X_B, y_A, y_B & P_T when 0.5 mol A is vapourised

③ X_A, X_B, y_A, y_B & P_T when last drop of liq is left to vapourise.

$X_A = 0.5$ $X_B = 0.5$

$$\frac{y_A}{y_B} = \frac{0.5}{0.5} \times \frac{P_A^0}{P_B^0} = \frac{3}{1}$$

$y_A = 3/4$

$y_B = 1/4$

$$P_T = X_A P_A^0 + X_B P_B^0 = 50$$

②

	A	B
	0.5	$n_B = 0.25$
	0.5	$1 - n_B$

$1 - n_B$ → 0.75

$$\frac{0.5}{0.5 + n_B} P_T = \frac{0.5}{1.5 - n_B} \times 75$$

$$\frac{n_B}{0.5 + n_B} P_T = \frac{1 - n_B}{1.5 - n_B} \times 25$$

$y_A = 2/3$

$y_B = 1/3$

$X_A = \frac{0.5}{1.25} = 0.4$

$X_B = 0.6$

$$\frac{0.5}{n_B} = \frac{0.5}{1 - n_B} \times \frac{3}{1}$$

$$1 - n_B = 3 n_B$$

$$n_B = 0.25$$

$$\underline{P_T = 45}$$

③ $y_A = 1/2$ $y_B = 1/2$

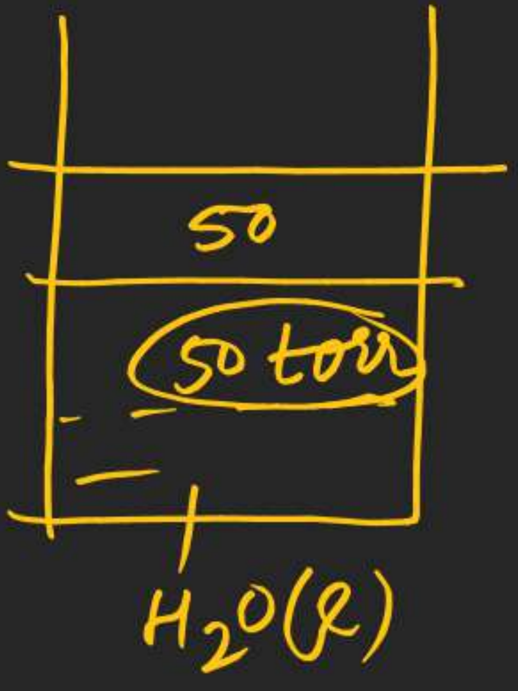
$$\frac{1/2}{1/2} = \frac{X_A}{X_B} \times \frac{75}{25} = 1$$

$X_A = 1/4$

$X_B = 3/4$

$P_T = 37.5$

	x_A	x_B	y_A	y_B	P_T
(i)	0.5	0.5	0.75	0.25	50
(ii)	0.4	0.6	0.66	0.33	45
(iii)	0.25	0.75	0.5	0.5	37.5



$$P_T = x_A P_A^0 + x_B P_B^0$$

As a solution vapourises it vapour pressure (P_T) decreases because mole fraction more volatile substance in remaining liquid sol^n decreases

Difference in vapourisation of pure liq & its solution:→

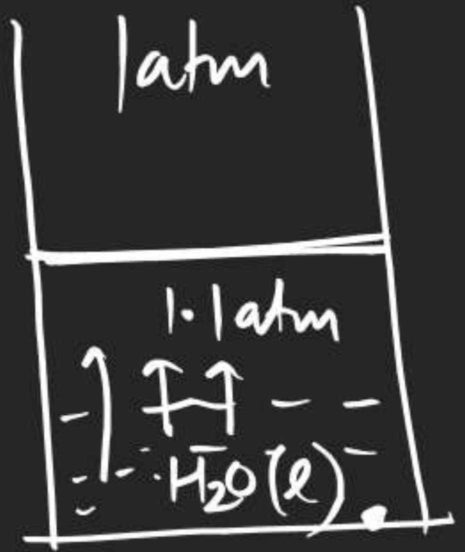
Boiling point:— Temperature at which vapour pressure equal to the external pressure. or

Temperature at which liq and gas are in eqlbm.

1 atm 400 K only gas

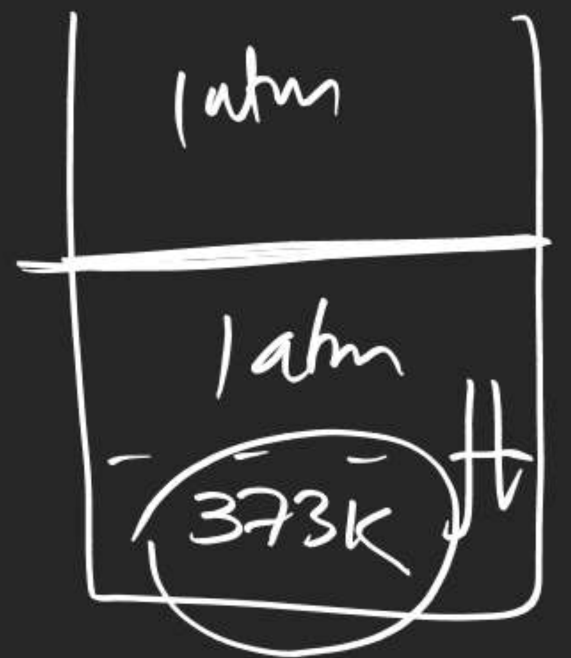
1 atm 300 K only liq

1 atm 373 K liq + gas



400K
vap pr = 1.1 atm

300K
vap pr = 0.5 atm



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0 – I   4 — 22

5 – I   5 — 11

5 – II   11

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31 1.51 $pH=3$ $MnO_4^- \rightarrow Mn^{2+}$

$+ 8H^+ + 5e^-$

$Cl^-/Cl_2 = -1.36$

$Br^-/Br_2 = -1.07$

$I^-/I_2 = -0.54$

27 $nF\dfrac{dE}{dT} = \Delta S$

$\Delta G = -nF(2)$

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① $\frac{1}{\Lambda_m}$ vs $c\Lambda_m$

$$K_a = \frac{c\alpha^2}{1-\alpha} \qquad \alpha = \frac{\Lambda_m}{\Lambda_m^\infty}$$

$$K_a = \frac{c\left(\Lambda_m/\Lambda_m^\infty\right)^2}{1-\Lambda_m/\Lambda_m^\infty}$$

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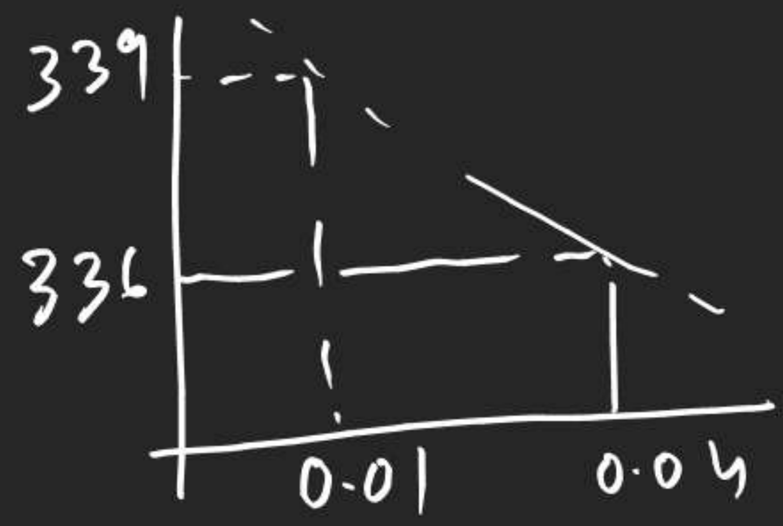
③ $m + n + p$

$$\Lambda^{\infty}_{U_m Y_p} = m\Lambda^{\infty}_{U} + p\Lambda^{\infty}_{Y} = 250$$

$$\Lambda^{\infty}_{V_m X_n} = m\Lambda^{\infty}_{V} + n\Lambda^{\infty}_{X} = 440$$

$$\Lambda^{\infty}_{Z_m X_n} = m\Lambda^{\infty}_{Z} + n\Lambda^{\infty}_{X} = 340$$



$$\Lambda^{\infty}_{m} = 340$$

$$\boxed{m, n, p}$$

④ $\Delta G = -2 \times 96500 \times 1.23 \times 10^{-3} \times 0.7$

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(13) $\Lambda^{\infty}_{X^-} = \Lambda^{\infty}_{Y^-}$

$$\Lambda^{\infty}_{m}(HX) = \Lambda^{\infty}_{m}(HY)$$

$$\frac{\Lambda_m(HX)}{\Lambda_m(HY)} = \frac{1}{10} = \frac{\alpha_1 \cancel{\Lambda^{\infty}_{m}(HX)}}{\alpha_2 \cancel{\Lambda^{\infty}_{m}(HY)}}$$

$$\frac{K_{a_1} = c_1\alpha_1^2}{K_{a_2} = c_2\alpha_2^2}$$

Q. find P_T if $y_A = 0.5$

$P_A^o = 30$ torr $\quad P_B^o = 10$ torr

$$\frac{y_A P_T}{y_B P_T} = \frac{x_A P_A^o}{x_B P_B^o}$$

$$1 = \frac{0.5}{0.5} = \frac{x_A}{x_B} \times \frac{30}{10}$$

$$\frac{1}{3} = \frac{x_A}{x_B} \qquad x_A = 1/4$$

$$x_B = 3/4$$

$$P_T = \frac{30 + 30}{4} = 15$$

$$x_A + x_B = 1$$

$$\frac{y_A P_T}{P_A^o} + \frac{y_B P_T}{P_B^o} = 1$$

$$\boxed{\frac{y_A}{P_A^o} + \frac{y_B}{P_B^o} = \frac{1}{P_T}}$$