LAKSHYA JEE

LAKSHYA KO HAR HAAL ME PAANA HAI

SOLUTION

By

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TODAY'S GOALS

- NON IDEAL SOLUTIONS
- AZEOTROPES

Non Ideal Solutions :-

(a) Solutions which do not obey Raoult's law at all temperature & pressure

(b) $A_2 + B_2 \rightleftharpoons A_2 - - - B_2$ solution

A_2 ⇌ solvent

$A_2 - - A_2$

B_2 ⇌ solute

$B_2 - - B_2$

when forces of interaction between solvent - solvent or solute - solute are not similar to as that of solution

Properties of Non-Ideal solution

(a) $P_S \neq P^\circ_A x_A + P^\circ_B x_B$

(b) $\Delta G_{mix.} = (-)ve$

(c) $\Delta S_{mix.} = (+)ve$

(d) $\Delta H_{mix.} \neq 0$

(e) $\Delta V_{mix.} \neq 0$

Non-Ideal solution, Types & Types of Non-Ideal S.

(a) Positive deviation :-

A_2 + B_2 ⟶ A_2 - - - B_2

A_2 ↓ solvent

B_2 ↓ solute

A_2 - - - A_2 ↓

B_2 - - - B_2 ↓

↓

F·O·I· strong

A_2 - ↓ - B_2

F·O·I·

weak

when forces of attraction b/w solvent - solvent or solute solute are strong but in solution they are weak.

Properties of Positiv

(a) $P_S > P^\circ_A x_A + P^\circ_B x_B$

(b) $\boxed{\Delta H_{mixing} = (+)ve}$

↓

Heat absorb by solution i.e. reaction is endothermic.

(c) $\Delta V_{mixing} = (+)ve$

(d) $\Delta G_{mix.} = (-)ve$

(e) $\Delta S_{mix.} = (+)ve$

for ex :-

(i) Acetone + (A) Alcohol

(ii) Acetone + (B) Benzene

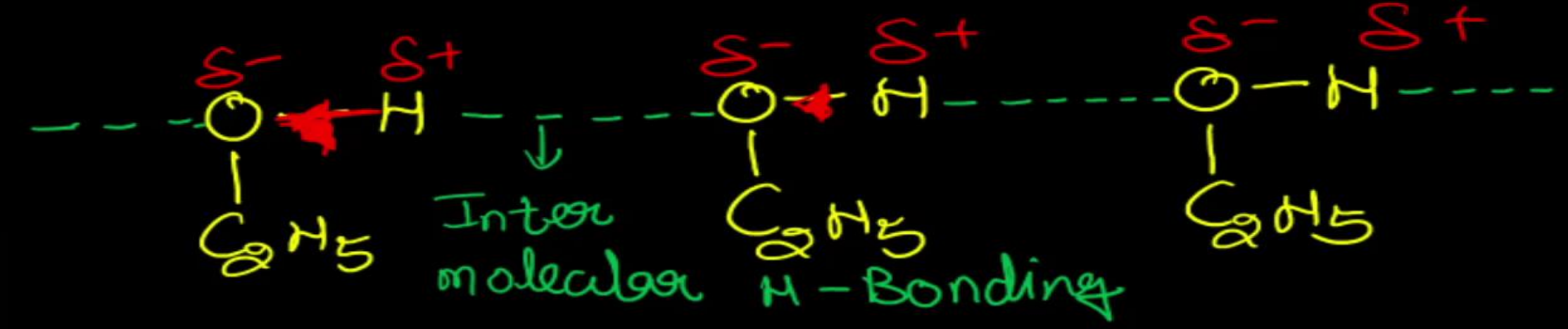
(iii) Acetone + (C) CS_2

(IV) alcohol + H_2O

(V) CCl_4 + $CHCl_3$

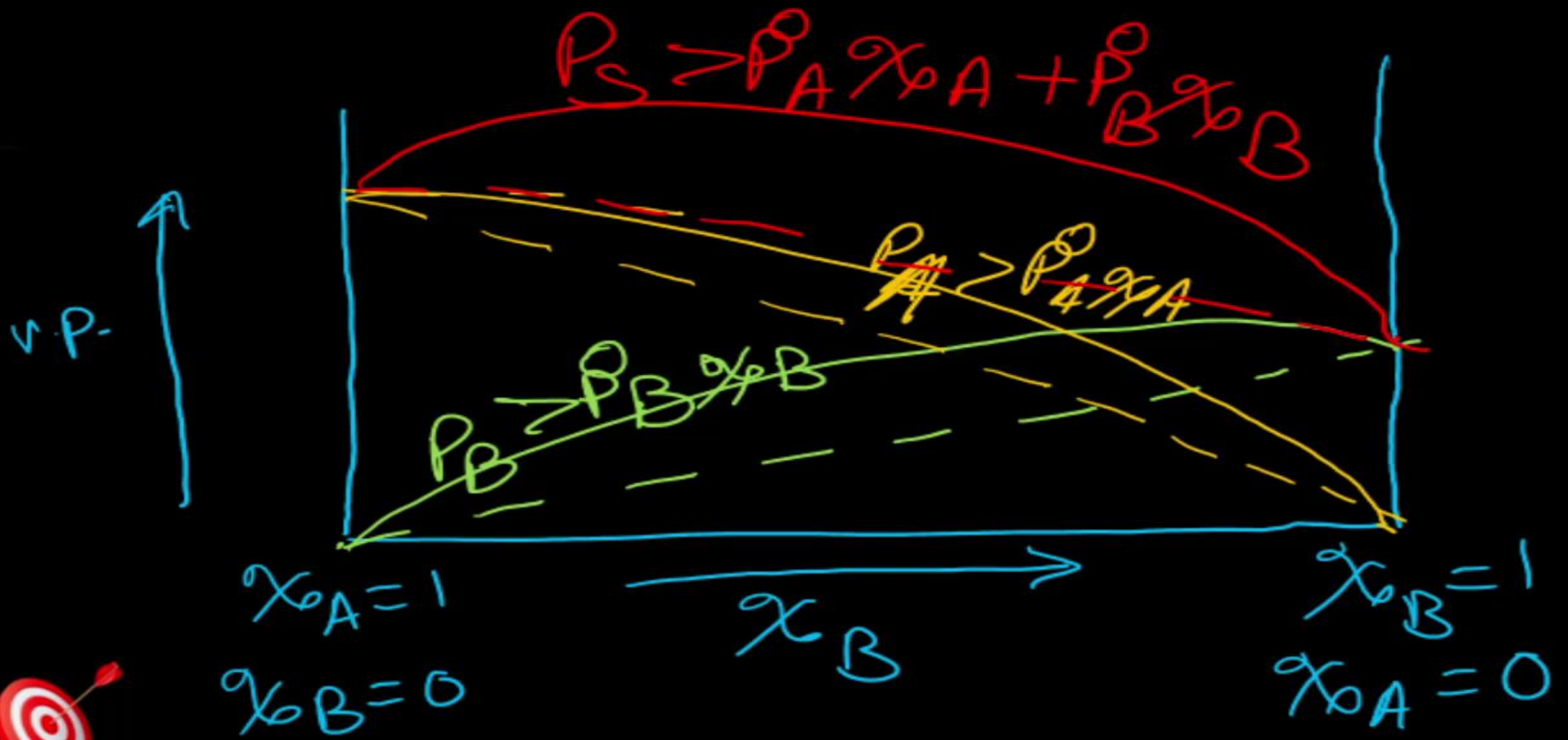
for ex :- Ethanol + Acetone

Ethanol C_2H_5OH

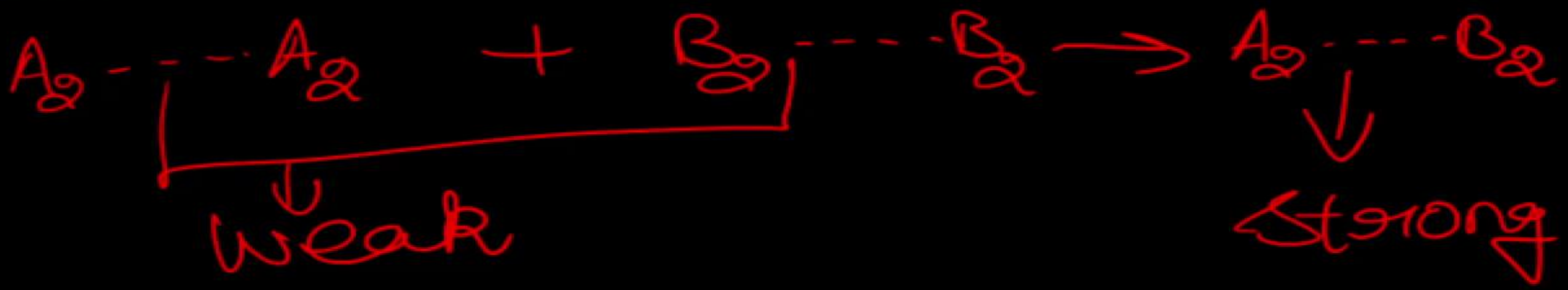


Ethanol has intermolecular H-Bonding which is strong. On adding acetone, forces of interaction weak therefore vapours will increase ∴ Vapour pressure will increase

Graph for (+)ve deviation :



Negative deviation :



Forces of attraction between solvent solvent or solute solute are weak & on mixing these attraction becomes

sl

Properties of Negative deviation.

(a) $P_S < P^\circ_A \chi_A + P^\circ_B \chi_B$

(b) $\boxed{\Delta H_{mixing} = (-)ve}$

↓

exothermic reaction

↓

Heat release ∴ Temperature in.

(c) $\Delta V_{mixing} = (-)ve$

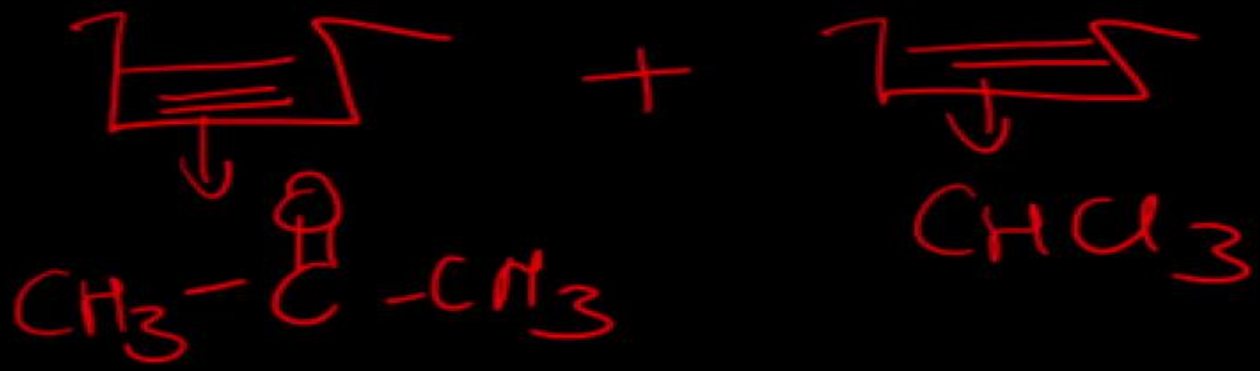
(d) $\Delta G_{mixing} = (-)ve$

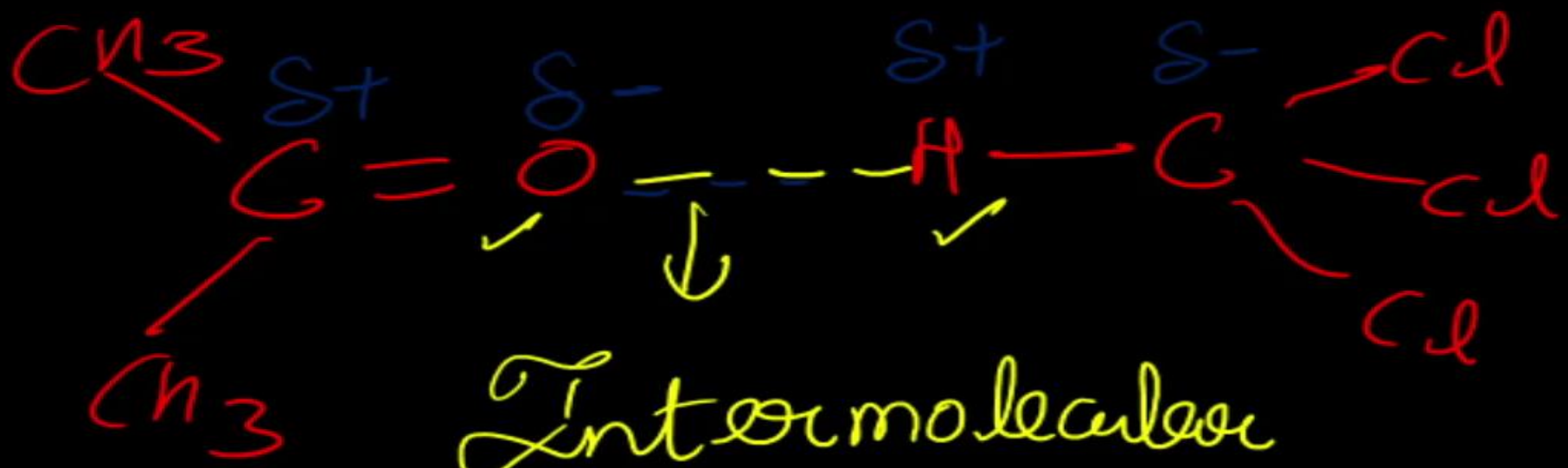
(e) $\Delta S_{mixing} = (+)ve$

for ex :- (a) acid + Water

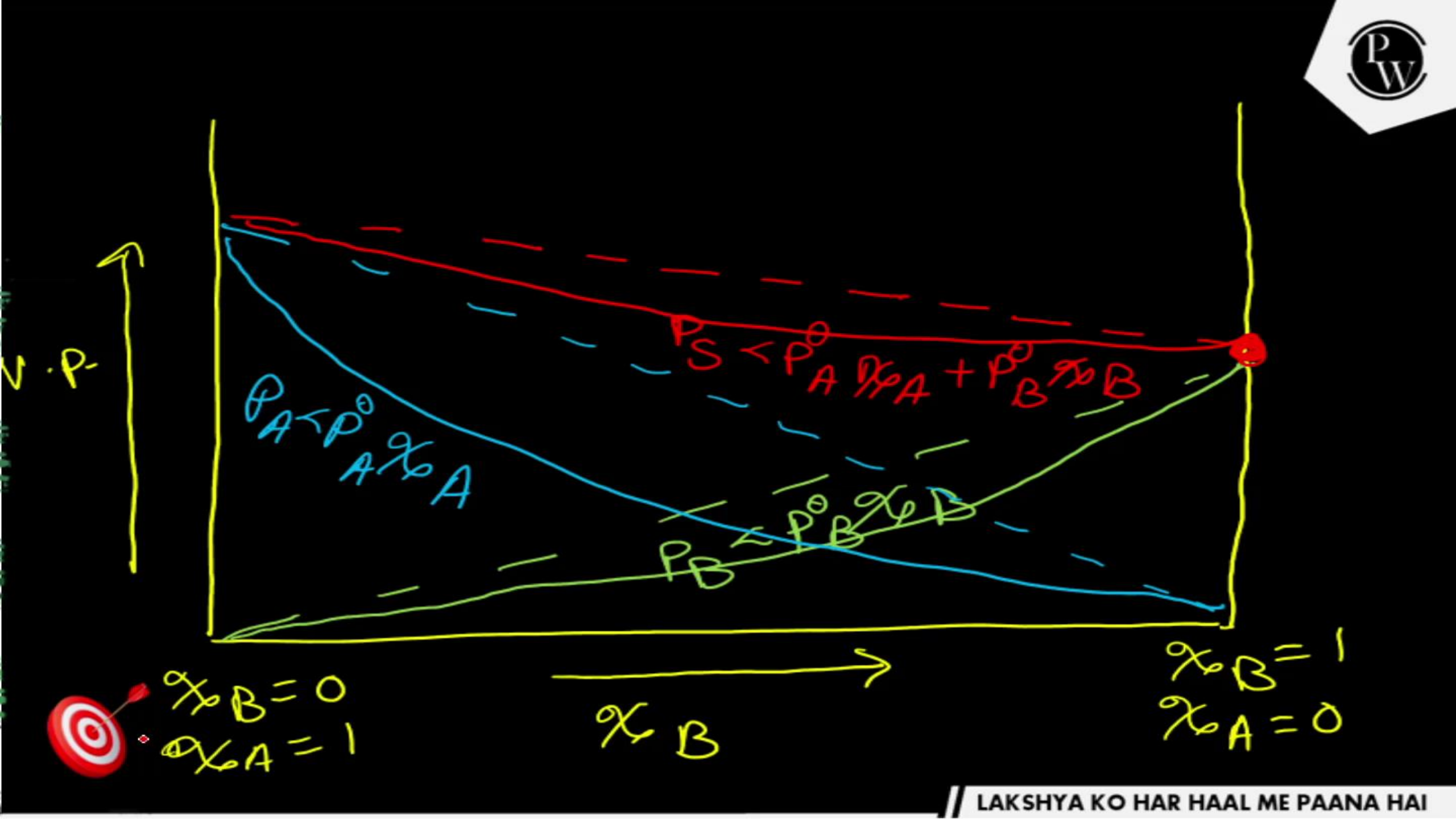
(b) Acetone + Chloroform

$CH_3-\overset{O}{\overset{\|}{C}}-CH_3$ $CHCl_3$



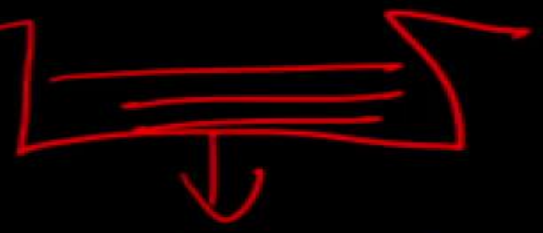


Intermolecular
H-Bond.


V.P.
$P_S < P^0_A \chi_A + P^0_B \chi_B$
$P_A < P^0_A \chi_A$
$P_B < P^0_B \chi_B$
$\chi_B = 0$
$\chi_A = 1$
χ_B
$\chi_B = 1$
$\chi_A = 0$

Azeotropes :

Mixture having definite composition & one boiling point.

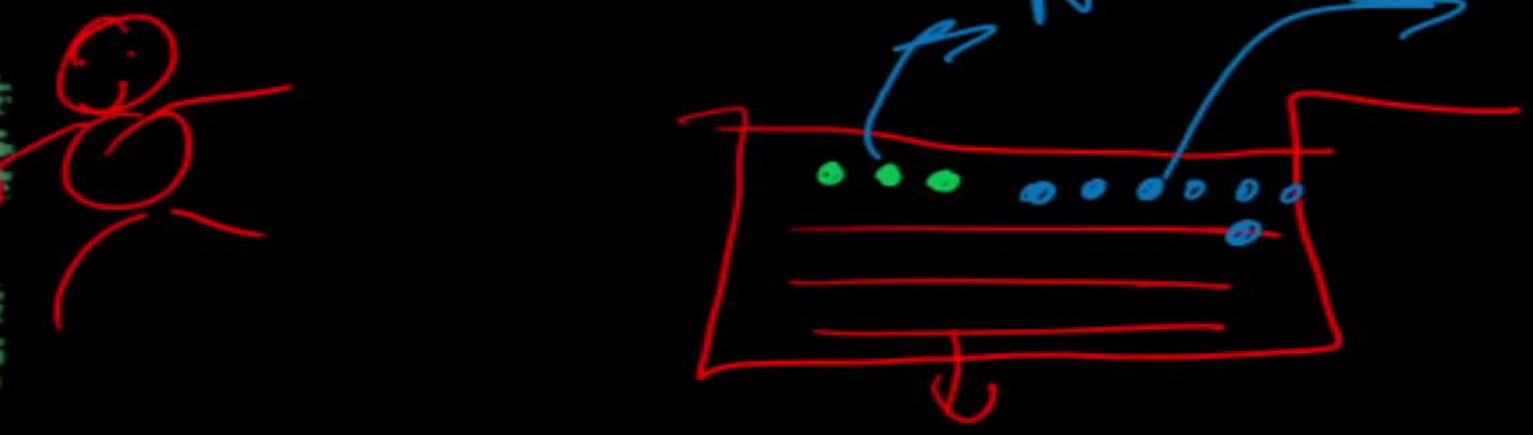


A + B

Rajan + Sonu + Monu

Twins

1 : 2



R : SM

3 : 6

1 : 2

R	:	SM
100	:	200

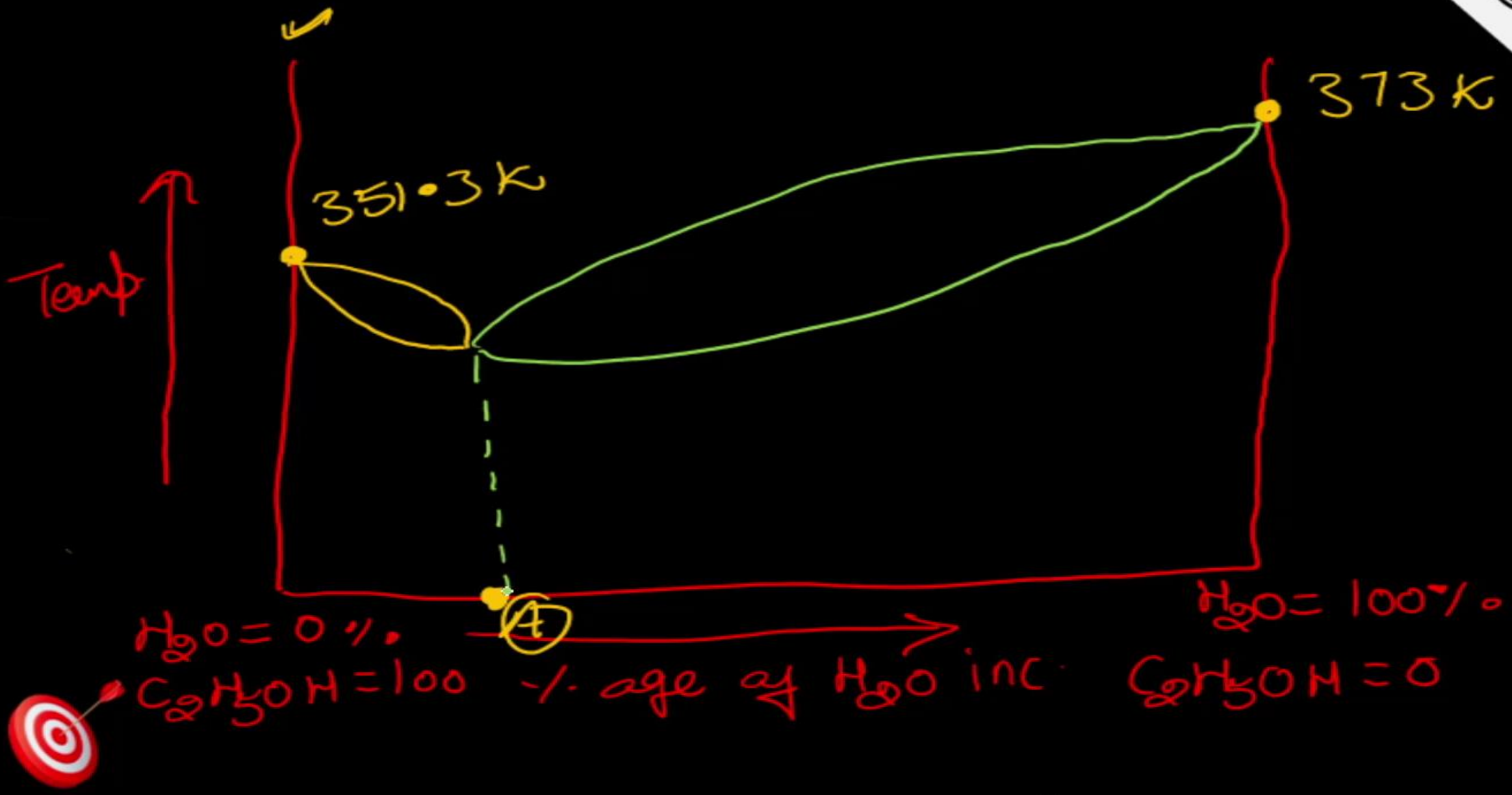
R	:	SM
97	:	194
1	:	2

Types of Azeotropes

(a) Minimum Boiling Azeotropes :-

B.Pt. of Azeotropes is less than B.Pt. of either Component.

examples of positive deviation are examples of Minimum.


373 K
351·3 K
Temp
$H_2O = 0\%$
$C_2H_5OH = 100$
A
% age of H_2O inc
$H_2O = 100\%$
$C_2H_5OH = 0$

at point A

% age of H_2O = 4.6%
% age of C_2H_5OH = 95.4%

Maximum Boiling Azeotropes :

all examples of negative deviation ⇒ B.Pt. of Azeotrope is ↓

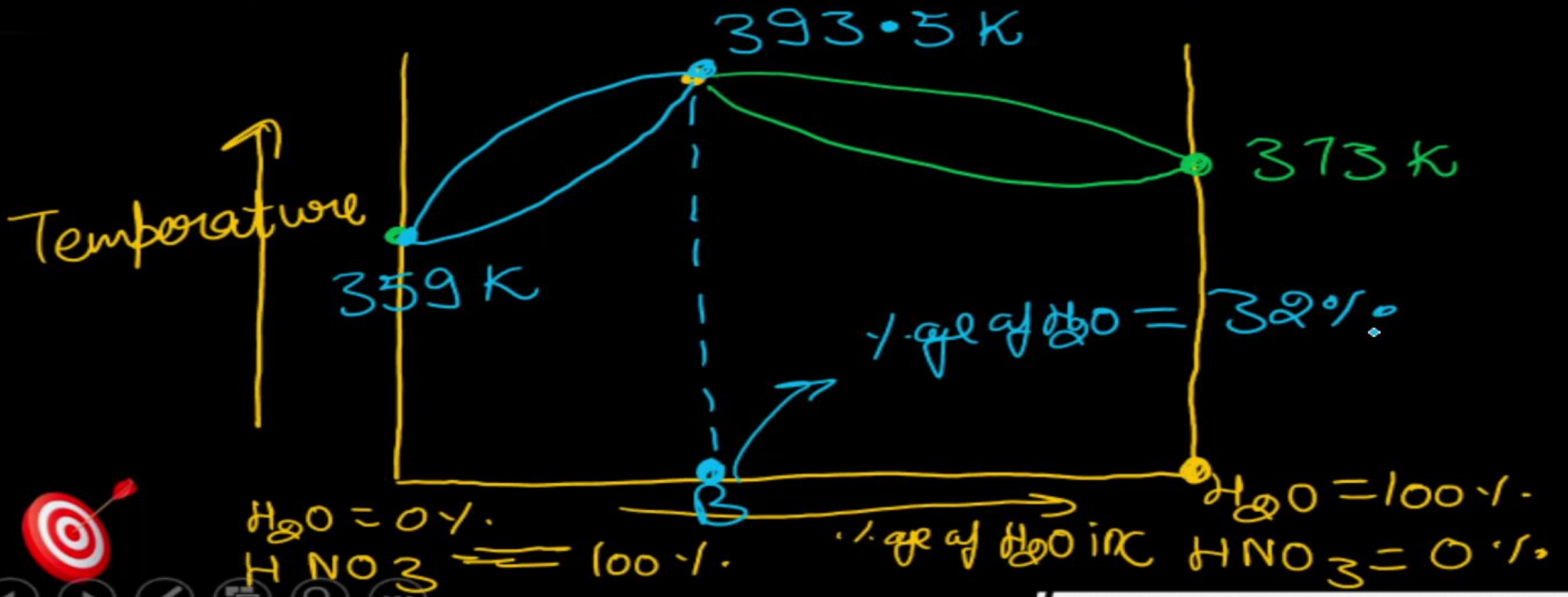
Which of the following solutions can have boiling point less than that of both the individual components?

(a) *n*-Hexane and *n*-Heptane

(b) HNO_3 and H_2O

(c) HNO_3 and H_2O

(d) C_2H_5OH and H_2O



Select the mixture in which volume of solution is less than 2 V mL on mixing V mL each of the two miscible liquids:

(a) $CCl_4 + CS_2$

(b) Benzene + Toluene

(c) $CH_3COCH_3 + CHCl_3$

(d) Hexane + Pentane

100 mL liquid chloroform is mixed with 100 mL liquid acetone at 25°C. Which of the following may be the final volume of resulting solution?

(a) 200 mL
(b) 203 mL
(c) 198 mL
(d) Any of these

$\Delta V_{mixing} = (-)ve$

Some liquids on mixing, form azeotropes. Which of the following is only incorrect statement regarding azeotropic binary mixture of liquids?

(a) The compositions in liquids and vapour phases are same.

(b) The boiling point of azeotropic mixture does not depend on external pressure.

(c) Solutions having large positive deviation form minimum boiling azeotrope at a specific composition.

(d) Solutions having large negative deviation form maximum boiling azeotrope at a specific composition.

The vapour pressures of pure liquids A and B are 400 and 600 mm Hg, respectively at 298 K. On mixing the two liquids, the sum of their initial volumes is equal to the volume of the final mixture. The mole fraction of liquid B is 0.5 in the mixture. The vapour pressure of the final solution, the mole fractions of components A and B in vapour phase, respectively are

[JEE Main 2019, 8 April Shift-I]

(a) 450 mm Hg, 0.4, 0.6

(b) 500 mm Hg, 0.5, 0.5

(c) 450 mm Hg, 0.5, 0.5

(d) 500 mm Hg, 0.4, 0.6

$P_A^\circ = 400$ mm of Hg

$P_B^\circ = 600$ mm of Hg

$\frac{Y_A}{Y_B} = \frac{P_A^\circ x_A}{P_B^\circ x_B}$

$x_B = 0.5$

$x_A = 0.5$

$Y_A = \frac{2}{5}$

$= \frac{400}{600} = \frac{2}{3}$

Liquid M and liquid N form an ideal solution. The vapour pressures of pure liquids M and N are 450 and 700 mm Hg, respectively, at the same temperature. Then correct statement is [JEE Main 2019, 9 April Shift-I]

x_M = mole fraction of M in solution;

x_N = mole fraction of N in solution;

y_M = mole fraction of M in vapour phase;

y_N = mole fraction of N in vapour phase

(a) $\frac{x_M}{x_N} > \frac{y_M}{y_N}$

(b) $\frac{x_M}{x_N} = \frac{y_M}{y_N}$

(c) $\frac{x_M}{x_N} < \frac{y_M}{y_N}$

(d) $(x_M - y_M) < (x_N - y_N)$

Ans $P^0_M < P^0_N$

$y_N > x_N$ — (1)

$x_M > y_M$ — (2)

$y_N x_M > x_N y_M$

$\frac{x_M}{x_N} > \frac{y_M}{y_N}$