Today's Goal

Raoult's Law

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Ideal Solution

Raoult’s Law

Case 1 – For Liquid – Liquid solution (Both Volatile)

For a solution of volatile liquids, the partial vapour pressure of each component of the solution is directly proportional to its mole fraction present in solution

Graph

Case 2 – For Solid-Liquid solution (only liquid volatile)

The partial vapour pressure volatile component in the solution is directly proportional to its mole fraction.

Graph

Mole Fraction in Vapour Phase

Q.1 The vapour pressure of two liquids P and Q are 80 and 60 torr, respectively. The total vapour pressure of solution obtained by mixing 3 moles of P and 2 moles of Q would be [AIIMS 2012]

A. 140 torr

B. 20 torr

C. 68 torr

D. 72 torr

Q.2 P_A and P_B are the vapour pressures of liquid components, A and B, respectively of an ideal binary solution. If X_A represents the mole fraction of component A, the total pressure of the solution will be [CBSE AIPMT]

A. $P_A + X_A (P_B - P_A)$

B. $P_A + X_A (P_A - P_B)$

C. $P_B + X_A (P_B - P_A)$

D. $P_b + X_A (P_A - P_B)$

Q.3 At a given temperature, the vapour pressure in mm of Hg of a solution of two volatile liquids A and B is given by equation $P = 120 - 80\ X_B$.
Calculate V.P of pure A and B at same temperature

Q.4 The V.P of pure liquid A and B are 450 and 700 mm of Hg. Find out composition of liquid mixture if total vapour pressure is 600 mm of Hg. Find composition of vapour phase also ? [CBSE 2013]

Ideal Solution

Definition

The solutions which obey Raoult’s law over the entire range of concentration are known as ideal solutions.

Properties of Ideal Solution

1. $\Delta_{mix} H = 0$, $\Delta_{mix} V = 0$, $\Delta_{mix} P = 0$
2. $\Delta_{mix} S > 0$, $\Delta_{mix} G < 0$
3. If the intermolecular attractive forces between the A-A and B-B are nearly equal to those between A-B, this leads to the formation of ideal solution.
4. A perfectly ideal solution is rare, but some solutions are nearly ideal in behaviour.
5. Example –
   n-hexane and n-heptane, bromoethane and chloroethane, benzene and toluene

Q.5 For an ideal solution, the correct option is [NEET 2019]

A. $\Delta_{mix} S = 0$ at constant T and P

B. $\Delta_{mix} V \neq 0$ at constant T and P

C. $\Delta_{mix} H = 0$ at constant T and P

D. $\Delta_{mix} G = 0$ at constant T and P

Q.6 Which one is not equal to zero for an ideal solution ?

[NEET Phase-2 2016]

A. $\Delta P_{mix} = P_{obeserved} - P_{Raoult}$

B. $\Delta H_{mix} = 0$

C. $\Delta S_{mix} > 0$

D. $\Delta V_{mix} = 0$