

Answer on Question #42218, Chemistry, Physical Chemistry

Question:

At 25°C, A and B have vapor pressures of 0.200 and 0.330 atm respectively. If the mol fraction of A in the liquid phase is 0.400, the vapor pressure of the solution at 25°C is:

Answer:

The total pressure in system can be calculated by the following equation:

$$P = \frac{P_A^* P_B^*}{P_A^* + (P_B^* - P_A^*) y_A}$$
$$y_A = \frac{x_A P_A^*}{x_A P_A^* + x_B P_B^*} = \frac{x_A P_A^*}{x_A P_A^* + (1 - x_A) P_B^*}$$

where P_A^* and P_B^* are vapor pressures of A and B respectively, y_A is the mole fraction of A in gas phase, x_A is the mole fraction of A in liquid phase.

$$y_A = \frac{0.4 \cdot 0.2}{0.4 \cdot 0.2 + 0.6 \cdot 0.33} = 0.2878$$

$$P = \frac{0.2 \cdot 0.33}{0.2 + (0.33 - 0.2)0.2878} = 0.280 \text{ atm}$$