**CHEM 3423 001 Spring 2026** **Name:**
**ID:**

**Worksheet #11**

1. Calculate the composition of the vapor in equilibrium at T=323K with a liquid solution of 0.5 mol fraction of A with 0.5 mol fraction of B. A and B are miscible. The vapor pressure of pure A at this temperature is 7.5 kPa, and that of pure B 2.5 kPa.

$$y_A = \frac{P_A}{P_A + P_B} = \frac{x_A P_A^*}{x_A P_A^* + x_B P_B^*} = \frac{0.5 P_A^*}{0.5 P_A^* + 0.5 P_B^*} = \frac{P_A^*}{P_A^* + P_B^*}$$

$$= \frac{7.5}{7.5 + 2.5}$$

$$= 0.75$$

$$y_B = 1 - y_A = 0.25$$

2. The ratio of a component A to that of water collected in a steam distillation is 2, when the mixture was boiled at at 344 K and 60 kPa. If the vapor pressure of water at this this temperature is 43.2 kPa, calculate the molar mass of A.

$$w = n \cdot M$$

$$\frac{w_A}{w_{H_2O}} = \frac{n_A M_A}{n_{H_2O} M_{H_2O}} \qquad \frac{P_A^* M_A}{P_{H_2O}^* M_{H_2O}} \Rightarrow M_A = \frac{P_{H_2O}^*}{P_A^*} \frac{w_A}{w_{H_2O}} M_{H_2O}$$

$$P = P_A^* + P_{H_2O}^* \Rightarrow P_A^* = P - P_{H_2O}^* = 60\,kPa - 43.2\,kPa = 16.8\,kPa$$

$$\Rightarrow M_A = \frac{43.2}{16.8} \cdot 2 \cdot 18.02\ g/mol$$

$$= 92.7\ g/mol = 0.0927\ kg/mol$$