

2) Fluid, $T_0, \pi_0 \rightarrow T, \pi$



$$C_{A_0} = 100 \quad C_{B_0} = 200$$

$$T_0 = 400 \text{ K}, T = 300 \text{ K}, C_A = 20 \text{ mol/L}$$

$$\pi = 0.8 \pi_0$$

$$X_A, X_B, C_B = ?$$

SPECIES	INITIAL	CHANGE	FINAL
A	f_{A_0}	$-f_{A_0} X$	$f_{A_0}(1-X)$
B	f_{B_0}	$-f_{A_0} X$	$f_{B_0} - f_{A_0} X$
R	0	$3 f_{A_0} X$	$3 f_{A_0} X$
Total	$f_{A_0} + f_{B_0}$		$f_{A_0} + f_{B_0} + f_{A_0} X$

$$\frac{f_T}{f_{T_0}} = \left(1 + \frac{1}{3} X_A\right)$$

$$V = V_0 \left(1 + \frac{X_A}{3}\right) \frac{T}{T_0} \cdot \frac{P_0}{P}$$

$$V_{\text{exit}} = V_0 \left(1 + \frac{X_A}{3}\right) \frac{3 \cdot 5}{4 \cdot 4} = \frac{15}{16} V_0 \left(1 + \frac{X_A}{3}\right)$$

$$C_A = 20 \text{ mol/L} = \frac{f_A}{\frac{15}{16} V_0 \left(1 + \frac{X_A}{3}\right)} = \frac{f_{A_0} / V_0 (1 - X_A)}{\frac{15}{16} \left(1 + \frac{X_A}{3}\right)} = \frac{16 \cdot 100}{15} \frac{(1 - X_A)}{1 + \frac{X_A}{3}}$$

$$\frac{16}{3} (1 - X_A) = 1 + \frac{X_A}{3}$$

$$\frac{16}{3} - 1 = \frac{17}{3} X_A$$

$$X_A = \frac{13}{17} \quad X_A = \frac{13}{17}$$

$$X_B = \frac{F_{B_0} - F_B}{F_{B_0}} = \frac{F_{B_0} - F_{B_0} + F_{A_0} X_A}{F_{B_0}}$$

$$= \frac{1}{2} X_A = \frac{13}{36} \cdot \frac{13}{34}$$

$$C_B = \frac{F_{A_0} (2 - X_A)}{\frac{15}{16} V_0 \left(1 + \frac{X_A}{3}\right)} = \frac{\frac{16 \cdot 100}{15} \times \frac{17}{3}}{\frac{15}{16} \times \frac{32}{15}}$$

$$= 58.86 \text{ mol/L}$$

$$= 105 \text{ mol/L}$$