P-11-6

a) $A \longrightarrow B + C$

$$C_A = C_T \frac{F_A}{F_T}$$

$$\theta_I = \frac{F_I}{F_A}$$

$$C_T = C_A + C_I$$

$$F_T = F_A + F_I$$

$$C_{A0_1} = (C_{A0} + C_{I0}) \frac{F_{A0}}{F_{A0} + F_{I0}}$$

$$C_{A0_1} = \frac{C_{A0} + C_{I0}}{\theta_I + 1}$$

b) Mole balance

$$\frac{dX}{dV} = \frac{-r_A}{F_{A0}} \quad \text{— (1)}$$

rate law

$$-r_A = kC_A \quad \text{— (2)}$$

Stoichiometry

$$C_A = C_{A0_1}\left(\frac{1-X}{1+\epsilon X}\right)\frac{T_0}{T} \quad \text{— (3)}$$

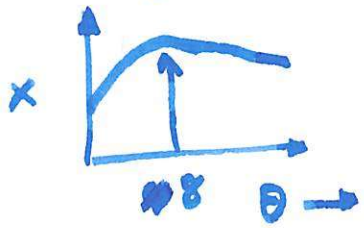
$$\epsilon = \delta y_{A0} \qquad \delta = 1 \quad \text{— (4)}$$

$$y_{A0} = \frac{F_{A0}}{F_{T0}} = \frac{1}{1+\theta_I} \quad \text{— (5)}$$

$$T = \frac{-\Delta H_{Rx} \cdot X + (C_{pA} + C_{pI}\,\theta_I)\,T_o}{C_{pA} + C_{pI}\,\theta_I} \quad -(6)$$

Solve (1) numerically using eq. 2 to 6.

Plot X Vs θ

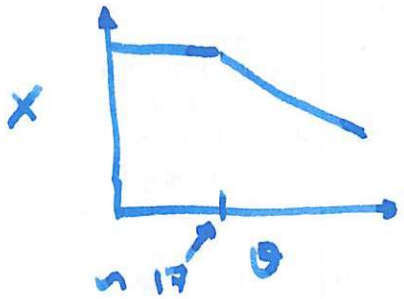


c) There is a maximum at θ = [illegible]

when θ is small : adding inerts keeps T low → favors endothermic rxn.

when $\theta > 8$: Too much inert → reaction rate lowers.

d) Only the sign of heat of reaction will change.



→ Max conversion occurs at θ [illegible] < 8

→ No advantage of adding inert