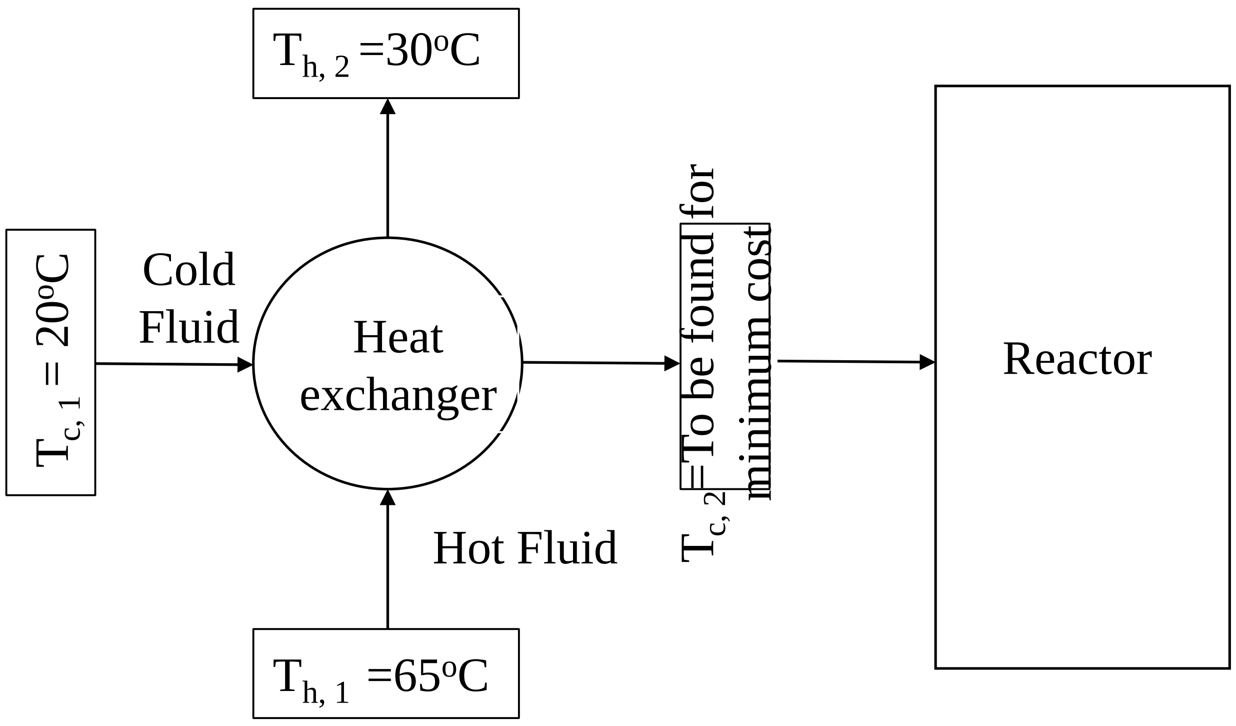
Objective Function



$$V = \frac{v_o X_A}{k(1 - X_A)} \quad \& \quad k = 2.5\, e^{\left(\frac{-3500}{T}\right)} \text{ where } T = T_{c,2} + 273 \text{ K}$$

$$Q = \underset{\textbf{kJ/s}}{M_c C_{p,c}(T_{c,2} - T_{c,1})} = \underset{\textbf{kJ/s}}{M_h C_{p,h}(T_{h,1} - T_{h,2})} = \underset{\textbf{J/s}}{UAF\Delta T_{lm}}$$

$$\Delta T_{lm} = \frac{(T_{h,2} - T_{c,1}) - (T_{h,1} - T_{c,2})}{\ln\dfrac{(T_{h,2} - T_{c,1})}{(T_{h,1} - T_{c,2})}}$$

$U = 400$ W/m^2. K
$F = 0.8$
$X_A = 0.8$

$$PC_{reactor} = \$17,000\, \underset{\textbf{m}^3}{V}^{0.85} \ [\$]$$

$$PC_{exchanger} = \$12,000\, [\underset{\textbf{m}^2}{A}]^{0.57} \ [\$]$$

$$(A/P) = \frac{i(i+1)^n}{(i+1)^n - 1} \ [1/y]$$

$i = 7\%$ and $n = 12$ years

$$UC = \$50,00,000\, [\underset{\textbf{kJ/h}}{Q}] \ [\$/h]$$

Cold Fluid:

$\rho = 1{,}000$ kg/m^3, $C_p = 4.18$ kJ/kg °C

$v_0 = 0.0053$ m^3/s; $M_c = \rho_{\text{cold fluid}} \times v_0$

$$\text{Cost} = \sum_{i=1}^{2} PC_i \times (A/P) + UC \ [\$/y]$$

Hot Fluid:

$\rho = 920$ kg/m^3, $C_p = 2.2$ kJ/kg °C

Bounds for $T_{c,2}$ is [55.1 64.9]