5) $\frac{dC_{A1}}{dt} = \frac{1}{\tau_1}(C_{A0} - C_{A1}) - K_1 C_{A1}$

$\frac{dC_{B1}}{dt} = -\frac{1}{\tau_1}(C_{B1}) + K_1 C_{A1}$

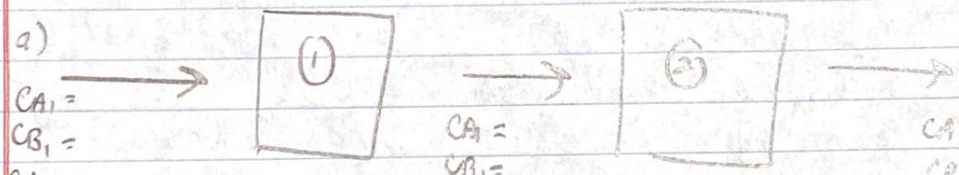
$dC_{A2}/dt = \frac{1}{\tau_2} C_{A1} - 1/\tau_2 C_{A2} - K_2 C_{A2}$

$dC_{B2}/dt = 1/\tau_2 C_{B1} - 1/\tau_2 C_{B2} + K_2 C_{A2}$

$\tau_1 = 10$ min
$\tau_2 = 3$ min
$K_1 = 0.15$ /min
$K_2 = 0.14$ /min
$C_{A0} = 0.4$

* Total volumes of both reactors are in steady state.

a)



$C_{A1} =$
$C_{B1} =$
$C_{A2} =$
$C_{B2} =$

$C_{A1} =$
$C_{B1} =$
$C_{A2} =$
$C_{B2} =$

$C_{A1} =$
$C_{B1} =$
$C_{A2} =$
$C_{B2} =$

→ C_{A1}: $\frac{dN_{A1}}{dt} = N_{A1in} - N_{A1out} - N_{A1cons}$

$\frac{dC_{A1}}{dt}(V_{tank}) = C_{A1in} V_{in} - C_{A1out} V_{out} - K C_{A1} V_{tank}$

$\boxed{\frac{dC_{A1}}{dt} = \frac{1}{\tau}(C_{A0} - C_{A1}) - K_1 C_{A1}}$

C_{B1}: $\frac{dN_{B1}}{dt} = N_{B1in}^{0} - N_{B1out} - N_{B1cons} + N_{B1gen}$

$\frac{dC_{B1}}{dt} V_{tank} = -C_{B1} V_{in} + K C_{B1gen}$

$= -C_{B1} V_{in} + K C_{A1}$

$\boxed{\frac{dC_B}{dt} = -\frac{1}{\tau}(C_{B1}) + K_1 C_{A1}}$

* $C_{A1} = C_{B1}$ con gen

C_{A2}: $\frac{dN_{A2}}{dt} = N_{A2in} - N_{A2out} + N_{A2gen}^{0} - N_{A2cons}$

$\frac{dC_{A2}}{dt} V_{tank} = C_{A1in} \dot{V}_{in} - C_{A2out} \dot{V}_{out} - K_2 C_{A2} V_{tank}$

$\boxed{\frac{dC_{A2}}{dt} = \frac{1}{\tau_2} C_{A1} - \frac{1}{\tau_2} C_{A2} - K_2 C_{A2}}$

C_{B2}: $\frac{dN_{B2}}{dt} = N_{B1in} - N_{B2out} + N_{B2gen} - N_{B2cons}^{0}$

$\frac{dC_{B2}}{dt} V_{tank} = C_{B1} \dot{V}_{in} - C_{B2} \dot{V}_{out} + C_{B2}(K_2) V_{tank}$

$\boxed{\frac{dC_{B2}}{dt} = \frac{1}{\tau_2} C_{B1} - \frac{1}{\tau_2} C_{B2} + K_2 C_{A2}}$

b) C_{A_1} : $0 = -\frac{1}{\tau}(0.4 - C_{A_1}) - kC_{A_1}$

$= -0.1(0.4) + 0.1 C_{A_1} - kC_{A_1}$

$= -0.04 - 0.25 C_{A_1}$

$\boxed{C_{A_1} = 0.16}$

C_{B_2} : $0 = -\frac{1}{10} C_{B_1} + 0.15(0.16)$

$\boxed{C_{B_1} = 0.24}$

C_{A_2} : $0 = \frac{1}{3} C_{A_1} - \frac{1}{3} C_{A_2} - 0.1 C_{A_2}$

$0 = \frac{1}{3}(0.16) - \frac{1}{3} C_{A_2} - 0.1 C_{A_2}$

$C_{A_2}(\frac{1}{3} + 0.1) = 0.053$

$\boxed{C_{A_2} = 0.113}$

C_{B_2} : $0 = \frac{1}{3}(0.24) - \frac{1}{3}(C_{B_2}) + (0.1)(0.113)$

$0 = 0.08 - C_{B_2}/3 + 0.0562$

$\boxed{C_{B_2} = 0.387}$