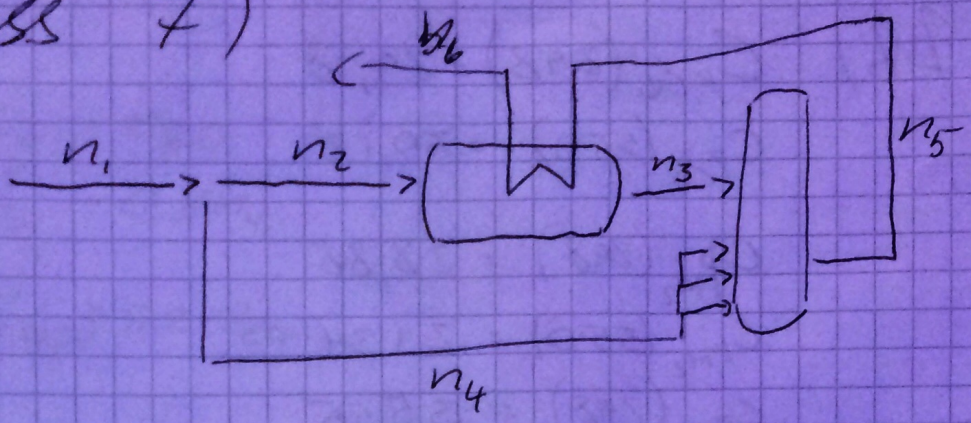
Prosess 7)

1a)



Sammensetning n_1: $x'_{CO} = 0{,}25$ $x'_{H_2} = 0{,}55$ $x'_{CH_4} = 0{,}15$ $x'_{N_2} = 0{,}05$

$CO + H_2 \rightarrow CH_3OH$ $\quad X_{CO} = 0{,}20$

$$\xi = \frac{n_{omsatt(A)}}{\nu_A} \quad A = CO \rightarrow \quad \xi = \frac{-0{,}20 n'_{CO}}{-1} = 0{,}20 n'_{CO}$$

$$n^5_{CO} = n'_{CO} - 0{,}20 n'_{CO} = 0{,}8 n'_{CO}$$

$$n^5_{H_2} = n'_{H_2} - 0{,}20 n'_{CO}$$

$$n^5_{CH_3OH} = 0 + 0{,}20 n'_{CO}$$

$$n^5_{CH_3} = n'_{CH_3}$$

$$n^5_{N_2} = n'_{N_2}$$

$$n_5 = \sum n^5_i = 0{,}8(0{,}25 n_1) + (0{,}55 n_1 - 0{,}2 \cdot 0{,}25 n_1) + 0{,}2(0{,}25 n_1) + 0{,}15 n_1 + 0{,}05 n_1$$

$$n_5 = 0{,}95 n_1$$

$$x^5_{CO} = \frac{n^5_{CO}}{n_5} = \frac{0{,}8 \cdot 0{,}25 n_1}{0{,}95 n_1} = 0{,}21$$

$$x^5_{H_2} = \frac{0{,}55 n_1 - 0{,}20 \cdot 0{,}25 n_1}{0{,}95 n_1} = 0{,}53$$

$$x^5_{CH_3OH} = \frac{0{,}20 \cdot 0{,}25 n_1}{0{,}95 n_1} = 0{,}05$$

$$x^5_{CH_3} = \frac{0{,}15 n_1}{0{,}95 n_1} = 0{,}16$$

$$x^5_{N_2} = \frac{0{,}05 n_1}{0{,}95 n_1} = 0{,}05$$

1b) $C_{P_{CO}}(298) = 29,18$

$C_{P_{CO}}(550) = 30,12$

$C_{P_{H_2}}(298) = 28,88$

$C_{P_{H_2}}(550) = 27,34$

$C_{P_{CH_4}}(298) = 35,55$

$C_{P_{CH_4}}(550) = 49,66$

$C_{P_{N_2}}(298) = 29,18$

$C_{P_{N_2}}(550) = 29,85$

$C_{P_{CH_3OH}}(298) = 43,85$

$C_{P_{CH_3OH}}(550) = 63,24$

$\bar{C}_{P_3} = \sum x_i^3 \bar{C}_{P_i} = 31,015 \frac{kJ}{mol\,K}$, se utskrift av terminal

$\bar{C}_{P_5} = \sum x_i^5 \bar{C}_{P_i} = 32,62 \frac{kJ}{mol\,K}$, se utskrift av terminal

1c) $CO + 2H_2 \rightarrow CH_3OH \quad \Delta H = -90\ kJ/mol$

$H_3 = \Delta_f H^\circ(CO)_{0,25} + \bar{C}_{P_3}(500k - 298k)$

$H_3 = -111\ kJ/mol_{(0,25)} + 6,3\ kJ/mol$

$H_3 = -21,45\ kJ/mol$

$H_4 = \Delta_f H^\circ(kJ/mol\ CO) = -111\ kJ/mol \cdot 0,25$

$H_4 = -27,75\ kJ/mol$

$H_5 = \Delta_f H^\circ(CO) \cdot 0,21 + \Delta_f H^\circ(CH_3OH)_{0,05} + \bar{C}_{P_6}\,\Delta T$

$H_5 = -111 \cdot 0,21 + -201 \cdot 0,05 + 32,85(550 - 298)$

$H_5 = -25,1\ kJ/mol$

1c) $x H_3 + (1-x) H_4 =$

$x n_1 H_3 + (1-x) n_1 H_4 = 0{,}95 n_1 H_5$

$x(-21{,}45\,kJ) + (1-x)(-27{,}75\,kJ) = 0{,}95(-25{,}08\,kJ$

$6{,}3x\,kJ - 27{,}75\,kJ = -23{,}826\,kJ$

$x = 0{,}63$

63% av n_1 må gjennom varmevekslaren

1d) Balanse over varmevekslaren:

$H_2 + H_5 = H_3 + H_6$ | setter $\Delta H° = 0$ for alle komponenter, fordi det ikke skjer noen reaksjon.

$0 + \bar{C}_{P_5}(550-298) = \bar{C}_{P_3}(500-298) + \bar{C}_{P_6}\Delta T$

$8278\,J/mol = 6264\,J/mol + \bar{C}_{P_6}\Delta T$

$\bar{C}_{P_6}\Delta T = \frac{1600}{0{,}95}$

$\bar{C}_{P_6}(550 - T_2) = 1684\,J$

Løser numerisk med python:

$T_2 = 500\,K$