

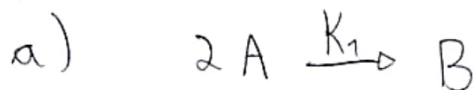
# Exercício CQCR 1

## Demanda 1

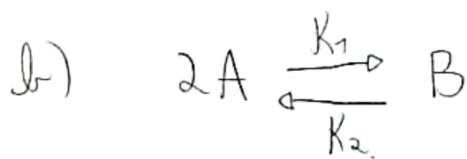
Inac Miranda Comargos

RA: 2018 10484

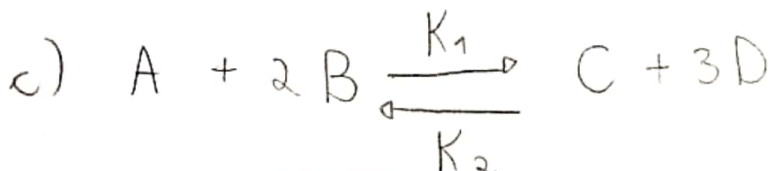
# Exercício 1: Desenvolva as taxas de todos os elementos.



$$\begin{aligned} \bullet -R_A &= K_1 C_A^2 \\ \bullet -R_B &= -K_1 C_A^2 \end{aligned}$$



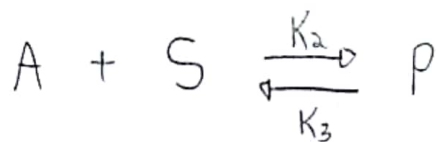
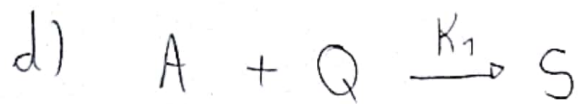
$$\begin{aligned} \bullet -R_A &= K_1 C_A^2 - K_2 C_B \\ \bullet -R_B &= -K_1 C_A^2 + K_2 C_B \end{aligned}$$



$$\begin{aligned} \bullet -R_A &= K_1 C_A C_B^2 - K_2 C_C C_D^3 \\ \bullet -R_B &= K_1 C_A C_B^2 - K_2 C_C C_D^3 \end{aligned}$$

$$\bullet -R_C = -K_1 C_A C_B^2 + K_2 C_C C_D^3$$

$$\bullet -R_D = -K_1 C_A C_B^2 + K_2 C_C C_D^3$$

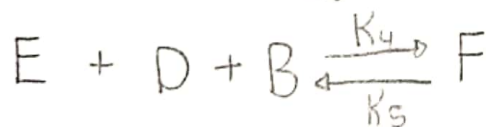
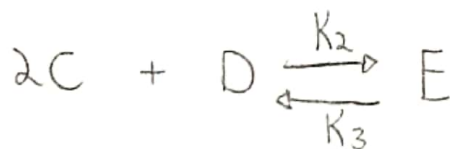
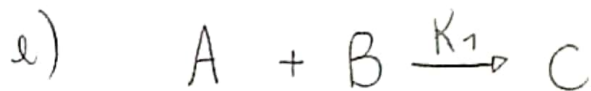


$$\bullet -R_A = K_1 C_A C_Q + K_2 C_A C_S - K_3 C_P$$

$$\bullet -R_Q = K_1 C_A C_Q$$

$$\bullet -R_S = -K_1 C_A C_Q + K_2 C_A C_S - K_3 C_P$$

$$\bullet -R_P = -K_2 C_A C_S + K_3 C_P$$

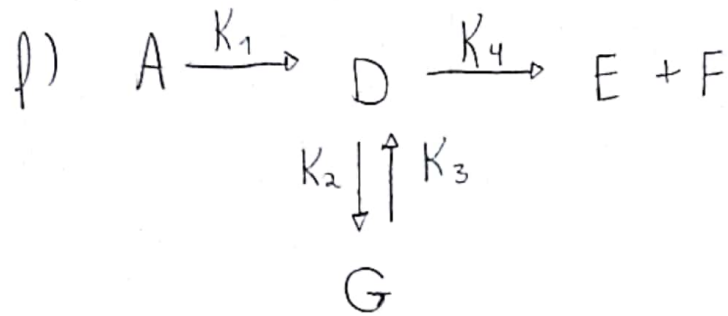


$$\bullet -R_A = K_1 C_A C_B$$

$$\bullet -R_B = K_1 C_A C_B + K_4 C_E C_D C_B - K_5 C_F$$

$$\bullet -R_C = -K_1 C_C + K_2 C_C^2 C_D - K_3 C_E$$

- $-R_D = K_2 C_C^2 C_D - K_3 C_E + K_4 C_E C_D C_B - K_5 C_F$
- $-R_E = -K_2 C_C^2 C_D + K_3 C_E + K_4 C_E C_D C_B - K_5 C_F$
- $-R_F = -K_4 C_E C_D C_B + K_5 C_F$

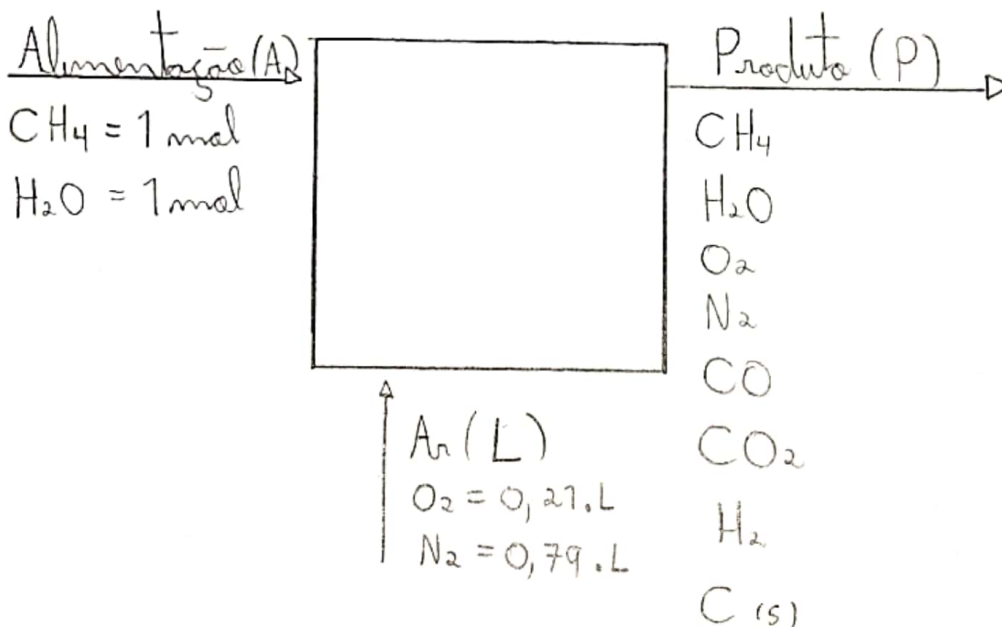


- $-R_A = K_1 C_A$
- $-R_D = -K_1 C_A + K_2 C_D - K_3 C_G + K_4 C_D$
- $-R_G = -K_2 C_D + K_3 C_G$
- $-R_E = -K_4 C_D$
- $-R_F = -K_4 C_D$

# Exercício 2: A produção de hidrogênio a partir da reforma a vapor do metano pode ser considerada como o sistema de reações descrito abaixo.

Para uma alimentação formada por 1 mol de metano, 1 mol de vapor d'água e 0,74 mols de ar, determine a composição da corrente gasosa de saída:

- Analisando:



- Reações:

- Reação 1:  $\text{CH}_4 + \text{H}_2\text{O} \longrightarrow \text{CO} + 3\text{H}_2$
- Reação 2:  $\text{CO} + 3\text{H}_2 \longrightarrow \text{CH}_4 + \text{H}_2\text{O}$
- Reação 3:  $\text{CO} + \text{H}_2\text{O} \longrightarrow \text{CO}_2 + \text{H}_2$
- Reação 4:  $\text{CO}_2 + \text{H}_2 \longrightarrow \text{CO} + \text{H}_2\text{O}$
- Reação 5:  $\text{CO} + \text{H}_2 \longrightarrow \text{C}_{(s)} + \text{H}_2\text{O}$
- Reação 6:  $\text{C}_{(s)} + \text{H}_2\text{O} \longrightarrow \text{CO} + \text{H}_2$
- Reação 7:  $\text{C}_{(s)} + \text{O}_2 \longrightarrow \text{CO}_2$

- Resolvendo (Número de mols final dos elementos é):

•  $\text{CH}_4$ :

$$\cdot m_{\text{CH}_4} = m_{\text{io}} - \xi_1 + \xi_2, \quad \cdot m_{\text{io}} = 1 \text{ mol}$$

•  $\text{H}_2\text{O}$ :

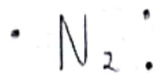
$$\cdot m_{\text{H}_2\text{O}} = m_{\text{io}} - \xi_1 + \xi_2 - \xi_3 + \xi_4 + \xi_5 - \xi_6$$

$$\cdot m_{\text{io}} = 1 \text{ mol}$$



$$m_{O_2} = m_{iO} - \xi_7$$

•  $m_{iO} = 0,1554 \text{ mol}$



$$m_{N_2} = m_{iO}$$

•  $m_{iO} = 0,5846 \text{ mol}$



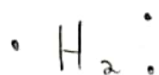
•  $m_{iO} = 0$

$$m_{CO} = m_{iO} + \xi_1 - \xi_2 - \xi_3 + \xi_4 - \xi_5 + \xi_6$$



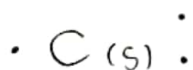
$$m_{CO_2} = m_{iO} + \xi_3 - \xi_4 + \xi_7$$

•  $m_{iO} = 0$



$$m_{H_2} = m_{iO} + 3\xi_1 - 3\xi_2 + \xi_3 - \xi_4 - \xi_5 + \xi_6$$

•  $m_{iO} = 0$



$$m_C = m_{iO} + \xi_5 - \xi_6 - \xi_7$$

•  $m_{iO} = 0$

- A composição final dos elementos na corrente gaseosa é:

•  $n_{OT} = 2,74 \text{ mol}$

•  $V_{T1} = 2$

•  $V_{T2} = -2$

•  $V_{T3} = 0$

•  $V_{T4} = 0$

•  $V_{T5} = 0$

•  $V_{T6} = 0$

•  $V_{T7} = -1$

$$\{ n_T = n_{OT} + 2\xi_1 - 2\xi_2 - \xi_7 \}$$

- Composição: (Resposta final)

•  $CH_4$ : 
$$y_{CH_4} = \frac{1 - \xi_1 + \xi_2}{2,74 + 2\xi_1 - 2\xi_2 - \xi_7} //$$

•  $H_2O$ : 
$$y_{H_2O} = \frac{1 - \xi_1 + \xi_2 - \xi_3 + \xi_4 + \xi_5 - \xi_6}{2,74 + 2\xi_1 - 2\xi_2 - \xi_7} //$$



•  $O_2$ :

$$y_{O_2} = \frac{0,1554 - \xi_7}{2,74 + 2\xi_1 - 2\xi_2 - \xi_7}$$

///

•  $N_2$ :

$$y_{N_2} = \frac{0,5846}{2,74 + 2\xi_1 - 2\xi_2 - \xi_7}$$

///

•  $CO$ :

$$y_{CO} = \frac{\xi_1 - \xi_2 - \xi_3 + \xi_4 - \xi_5 + \xi_6}{2,74 + 2\xi_1 - 2\xi_2 - \xi_7}$$

///

•  $CO_2$ :

$$y_{CO_2} = \frac{\xi_3 - \xi_4 + \xi_7}{2,74 + 2\xi_1 - 2\xi_2 - \xi_7}$$

///

•  $H_2$ :

$$y_{H_2} = \frac{3\xi_1 - 3\xi_2 + \xi_3 - \xi_4 - \xi_5 + \xi_6}{2,74 + 2\xi_1 - 2\xi_2 - \xi_7}$$

///

•  $C(s)$ :

$$y_C = \frac{\xi_5 - \xi_6 - \xi_7}{2,74 + 2\xi_1 - 2\xi_2 - \xi_7}$$

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