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$$CO + 3H_2 \rightarrow CH_4 + H_2O$$

$X = 0{,}1 \qquad r_{CO} = 4 \cdot 10^{-7} \frac{mol}{g\,s}$

1a)

$$F_{A0} - F_A - r_A V = 0$$

I) $$r_A = \frac{F_{A0} - F_A}{V} = \frac{X F_{A0}}{V}$$

II) $$\frac{F_{H_2O}}{F_{CO,0}} = 8$$

III) $$p\,\Phi_v = F_0 RT$$

III) $$\Phi_v = \frac{(F_{CO,0} + F_{H_2,0})RT}{p}$$

II) $$F_{H_2,0} = 8F_{CO,0}$$

III) $$\Phi_v = \frac{9F_{CO,0}RT}{p}$$

I) $$F_{CO,0} = \frac{r_A V}{X}$$

IV) $$SV := \frac{\Phi_v}{V}$$

I → III : V) $$\Phi_v = \frac{9\left(\frac{r_A V}{X}\right)RT}{p}$$

V → IV : VI) $$SV = \frac{9 r_A RT}{Xp} = 1{,}565 \cdot 10^{-6}\ s^{-1}$$

1b)

$$H_2 + 2* \underset{k_+}{\overset{k_-}{\rightleftharpoons}} 2H*$$

I) $r_{ads} = k_+ P_{H_2} C_v^2$

II) $r_{des} = k_- C_{H*}^2$

I + II ; III) $r = k_+ P_{H_2} C_v^2 - k_- C_{H*}^2$

IV) $C_t = C_v + C_{H*}$

IV → III : V) $r = k_+ P_{H_2} (C_t - C_{H*})^2 - k_- C_{H*}^2$

Likevekt: $r = 0$, $k = \frac{k_+}{k_-}$

$$\rightarrow C_{H*}^2 = k P_{H_2} (C_t - C_{H*})^2$$

$$C_{H*} = \sqrt{k P_{H_2}} (C_t - C_{H*})$$

$$C_{H*} \left(1 + \sqrt{k P_{H_2}}\right) = \sqrt{k P_{H_2}} C_t$$

$$\frac{1}{C_{H*}} = \frac{1}{\sqrt{k P_{H_2}} C_t} + \frac{1}{C_t}$$

$$\frac{1}{C_{H*}} = \frac{1}{C_t} + \frac{1}{\sqrt{k} C_t} \frac{1}{\sqrt{P_{H_2}}}$$

$n_{H_2} = \frac{P V_{H_2}}{RT}$, Skalarer Sinn at C_{H*} er: $\frac{mol}{g_{kat}}$

og P_{H_2} er: Pa. plotter $\frac{1}{C_{H*}}$ mot $\frac{1}{\sqrt{P_{H_2}}}$ (rettlinjet)

For $b = \frac{1}{C_t} = 10489 \frac{g_{kat}}{mol}$

$C_t = 9{,}5 \cdot 10^{-5} \frac{mol}{g_{kat}}$ er konsentrasjon av aktive Seter

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1c) 1) $CO_{(g)} + 2S \underset{}{\overset{k_1}{\rightleftharpoons}} C^* + O^*$

2) $O^* + H_{2(g)} \overset{k_2}{\rightleftharpoons} H_2O_{(g)} + S$

3) $C^* + H_{2(g)} \overset{k_3}{\rightleftharpoons} CH_2^* + S$ (r.d.s.)

4) $CH_2^* + H_{2(g)} \overset{k_4}{\rightleftharpoons} CH_{4(g)} + S$

①, ② og ④ er ved likevekt (PSSH):

I) $0 = k_1^+ P_{CO} C_v^2 - k_1^- C_{C^*} C_{O^*}$

II) $0 = k_2^+ C_{O^*} P_{H_2} - k_2^- P_{H_2O(g)} C_v$

III) $r = k_3^+ C_{C^*} P_{H_2} - k_3^- C_{CH_2^*} C_v$

IV) $0 = k_4^+ C_{CH_2^*} P_{H_2} - k_4^- P_{CH_4} C_v$

V) $C_t = C_v + C_{C^*} + C_{O^*} + C_{CH_2^*}$

VI) $1 = \theta_v + \theta_C + \theta_O + \theta_{CH_2}$, $\theta_i = \frac{C_{i^*}}{C_t}$, $[C_i] = \frac{mol}{g_{kat}}$

IV) $\theta_{CH_2} = \frac{P_{CH_4}\theta_v}{P_{H_2} K_4}$, $K_i = \frac{k_i^+}{k_i^-}$

II) $\theta_O = \frac{P_{H_2O}\theta_v}{P_{H_2} K_2}$

II → I: VII) $0 = k_1^+ P_{CO} \theta_v^2 - k_1^- \theta_C \left(\frac{P_{H_2O}\theta_v}{P_{H_2} K_2}\right)$

VII) $\theta_C = \frac{P_{CO}\theta_v}{P_{H_2O}} P_{H_2} K_2 K_1$

IV, II, VI → V: VIII) $1 = \theta_v + \theta_v \left(\frac{P_{CO}P_{H_2}}{P_{H_2O}} K_1 K_2 + \frac{P_{H_2O}}{P_{H_2} K_2} + \frac{P_{CH_4}}{P_{H_2} K_4}\right)$

VII) $\theta_v = \left(1 + \frac{P_{CO}P_{H_2}}{P_{H_2O}} K_1 K_2 + \frac{P_{H_2O}}{P_2 K_2} + \frac{P_{CH_4}}{P_{H_2} K_4}\right)^{-1}$

IV, VI, VIII → III: VIII)

VIII) $r C_t = \left(k_3^+ \frac{P_{CO} P_{H_2}^2}{P_{H_2O}} K_1 K_2 - k_3^- \frac{P_{CH_4}}{P_{H_2} K_4} \theta_v\right) \theta_v$

← dette kan holt sikkert forenkles videre...