IEQB Teste 1

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Conteúdo

Questão 1

$$= 10.4 \, \text{m}_{\text{H}_2\text{O}} + 25 \, \text{m}_{\text{H}_2\text{O}} = 35.4 \, \text{m}_{\text{H}_2\text{O}}$$

Questão 2

(i) mol (Tot)/mol (Tot)

$$= \frac{67 \, \text{g}_{\text{N}_2}}{100 \, \text{g}_{\text{Tot}}} \frac{\text{mol}_{\text{N}_2}}{28 \, \text{g}_{\text{N}_2}} + \frac{14 \, \text{g}_{\text{CO}_2}}{100 \, \text{g}_{\text{Tot}}} \frac{\text{mol}_{\text{CO}_2}}{44 \, \text{g}_{\text{CO}_2}} + \frac{16 \, \text{g}_{\text{O}_2}}{100 \, \text{g}_{\text{Tot}}} \frac{\text{mol}_{\text{O}_2}}{32 \, \text{g}_{\text{O}_2}} + \frac{3 \, \text{g}_{\text{CO}}}{100 \, \text{g}_{\text{Tot}}} \frac{\text{mol}_{\text{CO}}}{28 \, \text{g}_{\text{CO}}} \cong 33 \, \text{mmol}_{\text{Tot}} \, \text{g}_{\text{Tot}}^{-1}$$

(ii) $[\mathbf{N_2}]$

$$\cong \frac{67 \, \text{g}_{\text{N}_2}}{100 \, \text{g}_{\text{Tot}}} \frac{\text{mol}_{\text{N}_2}}{28 \, \text{g}_{\text{N}_2}} \frac{\text{g}_{\text{Tot}}}{33 \, \text{mmol}_{\text{Tot}}} \cong$$
$$\cong 72 \, \% \, \text{mol}_{\text{N}_2}/\text{mol}_{\text{Tot}}$$

(iii) $[\mathbf{CO_2}]$

$$\cong \frac{14 \, \text{g}_{\text{CO}_2}}{100 \, \text{g}_{\text{Tot}}} \frac{\text{mol}_{\text{CO}_2}}{44 \, \text{g}_{\text{CO}_2}} \frac{\text{g}_{\text{Tot}}}{33 \, \text{mmol}_{\text{Tot}}} \cong$$
$$\cong 9.6 \, \% \, \text{mol}_{\text{CO}_2}/\text{mol}_{\text{Tot}}$$

(iv) $[\mathbf{O_2}]$

$$\cong \frac{16 \, \text{g}_{\text{O}_2}}{100 \, \text{g}_{\text{Tot}}} \frac{\text{mol}_{\text{O}_2}}{32 \, \text{g}_{\text{O}_2}} \frac{\text{g}_{\text{Tot}}}{33 \, \text{mmol}_{\text{Tot}}} \cong$$
$$\cong 15 \, \% \, \text{mol}_{\text{O}_2}/\text{mol}_{\text{Tot}}$$

(v) $[\mathbf{CO}]$

$$\cong \frac{3 \, \text{g}_{\text{CO}}}{100 \, \text{g}_{\text{Tot}}} \frac{\text{mol}_{\text{CO}}}{28 \, \text{g}_{\text{CO}}} \frac{\text{g}_{\text{Tot}}}{33 \, \text{mmol}_{\text{Tot}}} \cong$$
$$\cong 3.2 \, \% \, \text{mol}_{\text{CO}}/\text{mol}_{\text{Tot}}$$

Questão 3

% mol/mol	i	mol$_o$/mol$_i$ Tot	o
CH$_4$	9	1.4	1.6
O$_2$	19	4.4	5.1
CO	-	1.4	1.6
CO$_2$	-	6.3	7.3
N$_2$	72	72	84
Total	100	86	

(i)

$$= 9\,\%\,\mathrm{mol_{CH_4}}\,\frac{(7/2)\,\mathrm{mol_{O_2}}}{2\,\mathrm{mol_{CH_4}}} \cong 16\,\% > 16\,\%^*$$

* Aqui era 19 mas escrevi 16 na hora sem pensar

(ii) $[\mathbf{CH_4}]_o$

$$= [CH_4]_i - [CH_4]_i\,\frac{15\,\%\,\mathrm{mol_{CH_4}}}{\mathrm{mol_{CH_4}}} +$$

$$- [CH_4]_i\,\frac{70\,\%\,\mathrm{mol_{CH_4}}}{\mathrm{mol_{CH_4}}} =$$

$$= [CH_4]_i(1 - 15\,\% - 70\,\%) =$$

$$= 9\,\%\,(1 - 0.15 - 0.70) \cong 1.4\,\%\,\mathrm{mol_{CH_4}/mol_{Tot}}$$

(iii) $[\mathbf{CO}]_o$

$$= \frac{9\,\%\,\mathrm{mol_{CH_4}}}{\mathrm{mol_{Tot}}}\,\frac{15\,\%\,\mathrm{mol_{CH_4}}}{\mathrm{mol_{CH_4}}}\,\frac{1\,\mathrm{mol_{CO}}}{1\,\mathrm{mol_{CH_4}}} \cong$$

$$\cong 1.4\,\%\,\mathrm{mol_{CO/mol_{Tot}}}$$

(iv) $[\mathbf{CO_2}]_o$

$$= \frac{9\,\%\,\mathrm{mol_{CH_4}}}{\mathrm{mol_{Tot}}}\,\frac{70\,\%\,\mathrm{mol_{CH_4}}}{\mathrm{mol_{CH_4}}}\,\frac{1\,\mathrm{mol_{CO_2}}}{1\,\mathrm{mol_{CH_4}}} \cong$$

$$\cong 6.3\,\%\,\mathrm{mol_{CO_2/mol_{Tot}}}$$

(v) $[\mathbf{N_2}]_o$

$$= [N_2]_i = 72\,\%\,\mathrm{mol_{N_2}/mol_{Tot}}$$

(vi) $[\mathbf{O_2}]_o$

$$= [O_2]_i - \frac{9\,\%\,\mathrm{mol_{CH_4}}}{\mathrm{mol_{Tot}}}\,\frac{(3/2)\,\mathrm{mol_{O_2}}}{\mathrm{mol_{CH_4}}}\,\frac{15\,\%\,\mathrm{mol_{O_2}}}{\mathrm{mol_{O_2}}} - \frac{9\,\%\,\mathrm{mol_{CH_4}}}{\mathrm{mol_{Tot}}}\,\frac{2\,\mathrm{mol_{O_2}}}{\mathrm{mol_{CH_4}}}\,\frac{70\,\%\,\mathrm{mol_{O_2}}}{\mathrm{mol_{O_2}}} \cong$$

$$\cong 4.4\,\%\,\mathrm{mol_{O_2}/mol_{Tot}}$$

Questão 4

$$2\,C_2H_4 + O_2 \xrightarrow{\;70\,\%\,(\text{et})\;} 2\,C_2H_4O$$
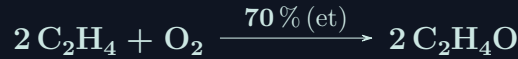
- $1 = 1i.1$
- $2 = 1i$

- $3 = 1o = 2i$
- $4 = 2o1$

- $5 = 2o2$
- $6 = 2o2.1 = 1i.2$

- $7 = 2o2.2$

% mol/mol	1i.1	1i	1o	2i	2o1	2o2	2o2.1	1i.2	2o2.2
C_2H_4		46	14		-				
O_2		52			-				
C_2H_4O		-			100				
Inértes	0.4	2			-				
Total (kmol h^{-1})					1600				

(i) Reagente Limitante

$$\frac{46\,\%\,\text{mol}_{et}}{\text{mol}_{tot}}\,\frac{\text{mol}_{O_2}}{2\,\text{mol}_{et}} = 26\,\%\,\text{mol}_{O_2}/\text{mol}_{Tot} <$$
$$< 52\,\%\,\text{mol}_{O_2}/\text{mol}_{Tot}$$
$$\therefore \text{ etileno é o reag limitante}$$

(ii) $m_{1o}\,[et]_{1o}$

$$= m_{1i}[et]_{1i}\,\frac{30\,\%\,\text{mol}_{et}}{\text{mol}_{et}} = m_{1i}\,46\,\% * 30\,\% \cong$$
$$\cong m_{1i}\,14\,\%\,\text{mol}_{et}$$

(iii) $m_{1o}\,[O_2]_{1o}$

$$= m_{1i}\,[O_2]_{1i} - m_{1i}\,[et]_{1i}\,\frac{70\,\%\,\text{mol}_{et}}{\text{mol}_{et}}\,\frac{\text{mol}_{O_2}}{2\,\text{mol}_{et}} =$$
$$= m_{11}\left(52\,\%\,\text{mol}_{O_2} - 46\,\%\text{mol}_{et}\,\frac{70\,\%\,\text{mol}_{et}}{\text{mol}_{et}}\,*\right.$$
$$\left.*\frac{\text{mol}_{O_2}}{2\,\text{mol}_{et}}\right) = m_{1i}\,20\,\%\,\text{mol}_{O_2}$$

(iv) $[C_2H_4O]_{1o}$

$$= m_{1o}\,[et]_{1o}\,\frac{70\,\%\,\text{mol}_{et}}{\text{mol}_{et}}\,\frac{2\,\text{mol}_{et}}{\text{mol}_{et}} = m_{1o}\,32\,\%\,\text{mol}_{C_2H_4O}$$

Q4 - a)

(i) $[et]_{1o}$

$$= [et]_{1i}\,\frac{30\,\%\,\text{mol}_{et}}{\text{mol}_{et}}\,\frac{m_{1o}}{m_{1i}} = 46\,\%\,\frac{30\,\%\,\text{mol}_{et}}{\text{mol}_{et}} \cong$$
$$\cong 14\,\%\,\text{mol}_{et}/\text{mol}_{Tot\,i}$$

(ii) $[O_2]_{1o}$

$$= \left([O_2]_{1i} - [et]_{1o}\,\frac{70\,\%\text{mol}_{et}}{\text{mol}_{et}}\,\frac{\text{mol}_{O_2}}{2\,\text{mol}_{et}}\right)\frac{m_{1o}}{m_{1i}} =$$
$$= 52\,\%\,\text{mol}_{O_2} - 46\,\%\,\text{mol}_{et}\,\frac{70\,\%\,\text{mol}_{et}}{\text{mol}_{et}}\,\frac{\text{mol}_{O_2}}{2\,\text{mol}_{et}} \cong$$
$$\cong 36\,\%\,\text{mol}_{O_2}/\text{mol}_{Tot\,i}$$

(iii) $[\mathbf{Inértes}]_{1o}$

$=$

(iii) $[\mathbf{Inértes}]_{1o}$