IEQB Ficha 2 - Resolução Variáveis de Processo

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Conteúdo

Questão 1

$$m_{\text{vol}} = 6.59\,\text{g s}^{-1}\,\frac{1}{0.659\,\text{g cm}^{-3}} = 10\,\text{cm}^3\,\text{s}^{-1}$$

Questão 2 $m\,\text{vol} = 100\,\text{ml min}^{-1}$

2 - a) $t = 25\,°\text{C}$

$$m\,\text{mol min}^{-1} = 100\,\text{ml min}^{-1}\,\frac{\text{m}^3}{1000\,\text{l}}\left(\frac{\text{c}}{10^{-2}}\right)^3 *$$

$$* \frac{1.595\,\text{g}}{\text{cm}^3}\,\frac{\text{mol}}{154\,\text{g}} \cong 1.04\,\text{mol min}^{-1}$$

2 - b) $t = 300\,°\text{C},\ p = 1\,\text{atm}$

$$\text{mol min}^{-1} = 100\,\text{ml min}^{-1}\,\frac{\text{m}^3}{1000\,\text{l}}\left(\frac{\text{c}}{10^{-2}}\right)^3 *$$

$$* \frac{\text{mol K}}{82.05\,\text{cm}^3\,\text{atm}}\,\frac{1\,\text{atm}}{(300 + 273.15)\,\text{K}} \cong$$

$$\cong 2.126\,\text{mmol min}^{-1}$$

Questão 3

%	O_2	CO	CO_2	N_2
g	16	4	17	63
mol	15.2	4.4	11.8	68.6

(i) $g_{\text{Total}}/\text{mol}_{\text{Total}}$

$$= \frac{100\,\text{g}_{\text{Total}}}{16\,\text{g}_{O_2}\dfrac{\text{mol}_{O_2}}{32\,\text{g}_{O_2}} + 4\,\text{g}_{CO}\dfrac{\text{mol}_{CO}}{28\,\text{g}_{CO}} + 17\,\text{g}_{CO_2}\dfrac{\text{mol}_{CO_2}}{44\,\text{g}_{CO_2}} + 63\,\text{g}_{N_2}\dfrac{\text{mol}_{N_2}}{28\,\text{g}_{N_2}}} \cong 30\,\text{g}_{\text{Total}}/\text{mol}_{\text{Total}}$$

(ii) O_2

$$16\,\%\text{g}_{O_2}\,\frac{1\,\text{mol}_{O_2}}{32\,\text{g}_{O_2}}\,\frac{30.5\,\text{g}_{\text{Total}}}{\text{mol}_{\text{Total}}} \cong 15.2\,\%\,\text{mol}_{O_2}$$

(iv) CO_2

$$17\,\%\text{g}_{CO_2}\,\frac{1\,\text{mol}_{CO_2}}{44\,\text{g}_{CO_2}}\,\frac{30.5\,\text{g}_{\text{Total}}}{\text{mol}_{\text{Total}}} \cong 11.8\,\%\,\text{mol}_{CO_2}$$

(iii) CO

$$4\,\%\text{g}_{CO}\,\frac{1\,\text{mol}_{CO}}{28\,\text{g}_{CO}}\,\frac{30.5\,\text{g}_{\text{Total}}}{\text{mol}_{\text{Total}}} \cong 4.4\,\%\,\text{mol}_{CO}$$

(v) N_2

$$63\,\%\text{g}_{N_2}\,\frac{1\,\text{mol}_{N_2}}{28\,\text{g}_{N_2}}\,\frac{30.5\,\text{g}_{\text{Total}}}{\text{mol}_{\text{Total}}} \cong 68.6\,\%\,\text{mol}_{N_2}$$

Questão 4

$$m\,\frac{\text{g}_{\text{Total}}}{\text{mol}_{\text{Total}}} = 21\,\%\frac{\text{vol}_{O_2}}{\text{vol}_{\text{Total}}}\,\frac{P\,\text{Vol}_{\text{Total}}}{n_{\text{Total}}\,R\,T}\,\frac{n_{O_2}\,R\,T}{P\,\text{Vol}_{O_2}}\,\frac{32\,\text{g}_{O_2}}{\text{mol}_{O_2}}+$$

$$+79\,\%\frac{\text{vol}_{N_2}}{\text{vol}_{\text{Total}}}\,\frac{P\,\text{Vol}_{\text{Total}}}{n_{\text{Total}}\,R\,T}\,\frac{n_{N_2}\,R\,T}{P\,\text{Vol}_{N_2}}\,\frac{28\,\text{g}_{N_2}}{\text{mol}_{N_2}} \cong 29\,\frac{\text{g}_{\text{Total}}}{\text{mol}_{\text{Total}}}$$

Questão 5

- $[a] = 0.5\,\mathrm{mol\,l^{-1}}$
- $d = 1030\,\mathrm{kg\,m^{-3}}$
- $m_{\mathrm{vol}} = 1.25\,\mathrm{m^3\,min^{-1}}$
- $m_{\mathrm{mol}} = 98\,\mathrm{g\,mol^{-1}}$

5 - a)

$$[a]\,\mathrm{kg\,m^{-3}} = 0.5\,\mathrm{mol\,l^{-1}}\,\frac{1000\,\mathrm{l}}{\mathrm{m^3}}\,\frac{98\,\mathrm{g}}{\mathrm{mol}} \cong 196\,\mathrm{kg\,m^{-3}}$$

5 - b)

$$m_{\mathrm{g}}\,\mathrm{kg\,s^{-1}} = 1.25\,\frac{\mathrm{m^3}}{\mathrm{min}}\,\frac{\mathrm{min}}{60\,\mathrm{s}}\,\frac{1030\,\mathrm{kg}}{\mathrm{m^3}} \cong 21.5\,\mathrm{kg\,s^{-1}}$$

5 - c)

$$\alpha\%\,\mathrm{g_a/g_{Total}} = 0.5\,\frac{\mathrm{mol}}{\mathrm{l}}\,\frac{1000\,\mathrm{l}}{\mathrm{m^3}}\,\frac{\mathrm{m^3}}{1030\,\mathrm{kg}}\,\frac{98\,\mathrm{g}}{\mathrm{mol}} \cong$$
$$\cong 4.76\,\%\,\mathrm{g_a/g_{Total}}$$

Questão 6

%	N_2	CO_2	O_2	H_2O	Total (mol)
mol	60.0	15.0	10.0	15.0	100.0
mol$_{\mathrm{seco}}$	70.6	17.6	11.8	-	85.0

(i) $\mathrm{mol_{Total\,Seco}/mol_{Total}}$

$$\frac{60.0\,\%\,\mathrm{mol_{N_2}} + 15.0\,\%\,\mathrm{mol_{CO_2}} + 10.0\,\%\,\mathrm{mol_{O_2}}}{\mathrm{mol_{Total}}}\,100\,\mathrm{mol_{Total}} = 85.0\,\mathrm{mol_{Total\,Seco}}$$

(ii) $\mathbf{N_2}$

$$60.0\,\%\,\frac{\mathrm{mol_{N_2}}}{\mathrm{mol_{Total}}}\,\frac{100.0\,\mathrm{mol_{Total}}}{85.0\,\mathrm{mol_{Total\,Seco}}} \cong 70.6\,\%\,\mathrm{mol_{N_2}}$$

(iii) $\mathbf{CO_2}$

$$15.0\,\%\,\frac{\mathrm{mol_{CO_2}}}{\mathrm{mol_{Total}}}\,\frac{100.0\,\mathrm{mol_{Total}}}{85.0\,\mathrm{mol_{Total\,Seco}}} \cong 17.6\,\%\,\mathrm{mol_{CO_2}}$$

(iv) $\mathbf{O_2}$

$$10.0\,\%\,\frac{\mathrm{mol_{O_2}}}{\mathrm{mol_{Total}}}\,\frac{100.0\,\mathrm{mol_{Total}}}{85.0\,\mathrm{mol_{Total\,Seco}}} \cong 11.8\,\%\,\mathrm{mol_{O_2}}$$

Questão 7

$$P_{(30\,\mathrm{m})}\,\mathrm{m\,H_2O} = 10.4\,\mathrm{m\,H_2O} +$$
$$+ 30\,\mathrm{m\,H_2O} \cong 40.4\,\mathrm{m\,H_2O}$$

Questão 8

$$\Delta P\,\mathrm{dynes/cm^2} = (1.05 - 1.00)\,\mathrm{g\,cm^{-3}}\,9.807\,\mathrm{m\,s^{-2}}\,*$$
$$* \,(382 - 374)\mathrm{mm} \cong 39.2\,\mathrm{dynes/cm^2}$$

Questão 9

$$Cp\,\frac{\mathrm{J}}{\mathrm{g\,^\circ C}} = \left(0.487 + 2.29*10^{-4}\,T\,^\circ\mathrm{F}\,\frac{1.8\,T\,^\circ\mathrm{C} + 32\,^\circ\mathrm{C}}{T\,^\circ\mathrm{F}}\right)\frac{\mathrm{Btu}}{\mathrm{lbm\,^\circ F}}\,\frac{1.06\,\mathrm{kJ}}{\mathrm{Btu}}\,\frac{\mathrm{lbm}}{454\,\mathrm{g}}\,\frac{1.8\,^\circ\mathrm{F}}{^\circ\mathrm{C}} =$$
$$= \left(2.35 + 17.3*10^{-3}\,T\,^\circ\mathrm{C}\right)\frac{\mathrm{J}}{\mathrm{g\,^\circ C}}$$