TEQB – Teste 1 Resolução

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Conteúdo

Questão 1 2

Questão 1

Considere que tem 1 mol de um gás perfeito ($C_V = R\,5/2$)
...transições reversiveis entre eles.
...$P_1 = 6.1\,\mathrm{bar}$ e $T_1 = 400.8\,\mathrm{K}$.
...3→1 é adiabática, e a 2→3 é feita a $P = 1.5\,\mathrm{bar}$, com o trabálho associaido $W_{2\rightarrow 3} = 1400\,\mathrm{J}$.

1. $P_1 = 6.1\,\mathrm{bar}, T_1 = 400.8\,\mathrm{K}$
2. $P_2 = 1.5\,\mathrm{bar}$,
3. $P_3 = 1.5\,\mathrm{bar}$

Q1 a.

Calcule T_3.

$$T_3 = \frac{P_3\,V_3}{n\,R} = \frac{P_3\,V_1\,\sqrt[\gamma]{P_1/P_3}}{n\,R} = \frac{P_3\,\frac{n\,R\,T_1}{P_1}\;\sqrt[\gamma]{\frac{P_1}{P_3}}}{n\,R} = P_3\frac{T_1}{P_1}\;\sqrt[C_p/C_V]{\frac{P_1}{P_3}} =$$

$$= P_3\frac{T_1}{P_1}\;\sqrt[C_p/C_V]{\frac{P_1}{P_3}} = P_3\frac{T_1}{P_1}\;\sqrt[7/5]{\frac{P_1}{P_3}} = (1.5\ \mathrm{E}\,5)\frac{400.8}{6.1\ \mathrm{E}\,5}\;\sqrt[7/5]{\frac{6.1\ \mathrm{E}\,5}{1.5\ \mathrm{E}\,5}} \cong 268.45$$

Q1 b.

$$W_{1\to 3}$$

$$W_{1\to 3} = W_{1\to 2} + W_{2\to 3} = \int_1^2 P_{ext}\ \mathrm{d}V + W_{2\to 3} = P_2 \left(V_1 \left(\frac{P_1}{P_2} \right)^{5/7} - V_1 \right) + W_{2\to 3} =$$

$$= P_2 \, \frac{n\,R\,T_1}{P_1} \, \left(1 \left(\frac{P_1}{P_2} \right)^{5/7} - 1 \right) + W_{2\to 3} =$$

$$= (1.5\ \mathrm{E}\,5)\, \frac{(1)\,(8.314)\,(400.8)}{6.1\ \mathrm{E}\,5} \, \left(1 \left(\frac{6.1\ \mathrm{E}\,5}{1.5\ \mathrm{E}\,5} \right)^{5/7} - 1 \right) + 1400 \cong 2.81\,\mathrm{E}3$$

Q1 c.

T_2

Q2 a.

Calcule ΔS e ΔU associados a passagem de 150 g de n-hexano do estado (177.83 K, (l), 1.01 bar) ao estado (348.0 K, (g), 1.01 bar). (4 val)

(i)

ΔS

$$\Delta S_{(177.83\to 348.0)\,\mathrm{K},(l\to g),1.01\,\mathrm{bar}} = \begin{pmatrix} \Delta S_{(l),(1.77.83\to 341.48)\,\mathrm{K}} \\ +\Delta S_{(l\to g),(341.48)\,\mathrm{K}} \\ +\Delta S_{(g),(341.48\to 348.0)\,\mathrm{K}} \end{pmatrix} =$$

$$= \begin{pmatrix} \int n\, C_{p,(l)}\ \mathrm{d}T/T \\ +n\ \Delta H_{vap}/T_{vap} \\ +\int n\, C_{p,(g)}\ \mathrm{d}T/T \end{pmatrix} = \frac{m}{M} \begin{pmatrix} C_{p,(l)} \ln \frac{341.48}{177.83} \\ +\Delta H_{vap}/341.48 \\ +C_{p,(g)}\, ln \frac{348.0}{341.48} \end{pmatrix} =$$

$$= \frac{150}{84.17} \begin{pmatrix} (197) \ln \frac{341.48}{177.83} \\ +(28.9\ \mathrm{E}\,3)/341.48 \\ +(169)\, ln \frac{348.0}{341.48} \end{pmatrix} \cong 385.58$$

(ii)

ΔU

$$\Delta U = \Delta H - \Delta(P\,V) = \Delta H - P\,\left(V_{(s)} - V_{(l)}\right) =$$

$$= \Delta H - P\left(\left(\frac{n\,R\,T}{P}\right) - \left(\frac{m}{\rho_{(l)}}\right)\right) = \Delta H - m\left(\left(\frac{R\,T}{M}\right) - \left(\frac{P}{\rho_{(l)}}\right)\right) \cong$$

$$\cong 385.58 - (150\ \mathrm{E}-3)\left(\left(\frac{(8.314)\,348.0}{84.17\ \mathrm{E}-3}\right) - \left(\frac{1.01\ \mathrm{E}\,5}{0.640\ \mathrm{E}-3}\right)\right) =$$

$$= 385.58 - (150)\left(\left(\frac{8.314 * 348.0}{84.17}\right) - \left(\frac{1.01\ \mathrm{E}\,5}{0.640}\right)\right) \cong 23.67\,\mathrm{E}6$$

Q2 b.

Calcule o ΔU e ΔG associados à passagem de 150 g de n-hexano do estado (341.48 K, (g), 0.3 bar) ao estado (341.48 K, (l), 20 bar). (3.5 val)

(i)

ΔU

$$\Delta U = \Delta H - \Delta(P\,V) = \begin{pmatrix} \Delta H_{(g),(0.3\to 1.01)\,\mathrm{bar}} \\ +\,\Delta H_{(g\to l),1.01\,\mathrm{bar}} \\ +\,\Delta H_{(l),(1.01\to 20)\,\mathrm{bar}} \end{pmatrix} - (P_f\,V_f - P_i\,V_i) =$$

$$= \begin{pmatrix} 0\ (\text{gás pft a T cnt}) \\ +n\,(-\,\Delta H_{vap}) \\ \ldots \end{pmatrix} + P_i\,V_i - P_f\,V_f =$$

Q2 c.

Calcule o ΔH de fusão do n-hexano a 177.83 K e 1.01 bar. (2 val)