2do PARCIAL – 2do SEMESTRE – 2019

PROB 1 – $nR = 33{,}26$ J/K

1-2 ISOTERMO

2-3 $P(V) = \alpha V$

3-1 ADIABÁTICO.

$\alpha = \frac{P_2}{V_2} = 4$ KJ $\qquad T_2 = \frac{P_2 V_2}{nR} = 1082$ K

| | P | V | T |
|---|---|---|---|
| ① | 70,4K | 0,511 | 1082 |
| ② | 12K | 3,00 | 1082 |
| ③ | 8,9K | 2,23 | 600 |

PARTE 1) $P_1 V_1^\gamma = P_3 V_3^\gamma$

$T_1 V_1^{\gamma-1} = T_3 V_3^{\gamma-1}$

$\ln\left(\frac{T_1}{T_3}\right) = (\gamma-1)\ln\left(\frac{V_3}{V_1}\right) \rightarrow \gamma = 1{,}4$

PARTE 2) $P_3 V_3 = nRT_3$ ; $P_3 = \alpha V_3$ $\Rightarrow$ $\alpha V_3^2 = nRT_3$

$V_3 = 2{,}23\ m^3$

$P_1 = \frac{nRT_1}{V_1} = 70{,}41$ KPa

$P_3 = \alpha V_3 = 8{,}92$ KPa

$V_1 = \frac{V_3}{4{,}37} = 0{,}511\ m^3$

a) $Q_{12} = +nRT_1 \ln\left(\frac{V_2}{V_1}\right) = 65$ KJ $\qquad Q_{23} = \Delta U - W_{23}$ / $\Delta U = \frac{5}{2}nR(T_3 - T_2) = -40$ KJ

$W_{23} = -\int_2^3 P(V)\,dV = +\alpha\left(\frac{V_3^2}{2} - \frac{V_3^2}{2}\right) = 8{,}05$ KJ $\qquad Q_{23} = -48$ KJ

b) $\eta_{MT} = 1 - \frac{|Q_L|}{|Q_H|} = 1 - \frac{48}{65} = 26\%$

c) $\Delta S_u = \frac{|Q_L|}{T_L} - \frac{|Q_H|}{T_H} = 20$ J/K.

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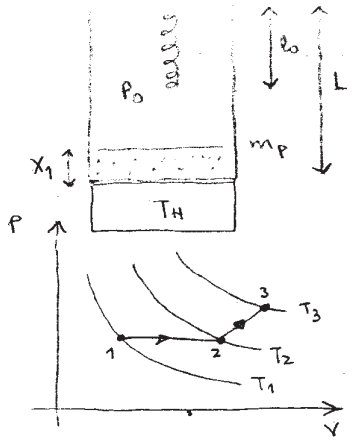
PROB 2 – $L = 4{,}00$ m $\quad A = 0{,}05\ m^2$ $\quad x_0 = 1{,}00$ m $\quad k = 1440$ N/m




a) $V_1 = Ax_1 = 0{,}02\ m^3 \qquad P_1 = P_0 + \frac{m_P g}{A} = 121$ KPa

$T_1 = 20°C = 293{,}15$ K. $\qquad nR = \frac{P_1 V_1}{T_1} = 8{,}255$ J/K.

$P_2 = P_1 = 121$ KPa $\qquad V_2 = Ax_2 = 0{,}05\ m^3 \quad (x_2 = 1{,}0\text{m})$.

$T_2 = \frac{P_2 V_2}{nR} = 733$ K.

$P_3 = P_2 + \frac{k\Delta z}{A} = 138$ KPa $\qquad V_3 = Ax_3 = 0{,}08\ m^3 \quad (x_3 = 1{,}6\text{m})$

b) $T_3 = \frac{P_3 V_3}{nR} = 1337$K. $\rightarrow$ $T_H \gg T_3$

c) $Q_{12} = \frac{5}{2}nR(T_2 - T_1) = 9{,}08$ KJ $\qquad Q_{23} = \overbrace{\frac{3}{2}nR(T_3 - T_2)}^{7{,}48\text{ KJ}} - W_{23} = 11{,}37$ KJ

$W_{23} = -P_2(V_3 - V_2) - \frac{k}{2A^2}(V_3 - V_2)^2 = -3{,}63 - 0{,}26 = -3{,}89$ KJ

d) $\Delta S_u = \Delta S_G + \Delta S_R = \underbrace{\underbrace{\frac{3}{2}nR\ln\left(\frac{T_3}{T_1}\right)}_{18{,}80} + \underbrace{nR\ln\left(\frac{V_3}{V_1}\right)}_{11{,}44}}_{30{,}24} - \underbrace{\frac{|Q_T|}{T_3}}_{15{,}3} = 15$ J/K

PROB 3. $n = 2$ $c_p = 4R$ $c_v = 3R$ $T_{1G} = 45°C = 318K$.

$m = 0,02\ kg$ $T_{1A} = -25°C = 248K$

(H) $T_f = 0°C$. $Q_G = nc_v (T_f - T_{1G}) = -2,245\ kJ$

$T_f = 273K$ $Q_G = -Q_H$ / $Q_H = mc_p (T_f - T_{1A}) + m' \ell_L = -Q_G$

$$m' = \frac{-Q_G - mc_p (T_f - T_{1A})}{\ell_L} = 3,44\ gr \checkmark \quad T_f = 0°C = 273K$$

$$\Delta S_u = +nc_v \ln\left(\frac{T_f}{T_{1G}}\right) + \frac{m' \ell_L}{T_f} + mc_p \ln\left(\frac{T_f}{T_{1A}}\right) = 0,8 \quad J/K.$$