Lista 4 Fenômenos.

1) $m_A = 1200\,kg$

$v = 75\,\frac{km}{h}$ | $v = 15\,\frac{km}{h}$

$m_c = 2500\,kg$

$v = 0\,\frac{km}{h}$ | $v = 10\,\frac{km}{h}$

$\Delta U = ?$

$$\Delta E \Rightarrow \Delta U + \Delta E_p^{\,0} + \Delta E_c = Q - W$$

* Sistema Isolado $Q = 0$ e $W = 0$

$$\Delta E_c = -\Delta U$$

$$\frac{1}{2} m \left(v_f^2 - v_i^2\right)_A + \frac{1}{2} m \left(v_f^2 - v_i^2\right)_C = -\Delta U$$

$$\frac{1}{2} 1200 \left(4{,}2^2 - 20{,}8^2\right)_a + \frac{1}{2} 2100 \left(2{,}8^2 - 0^2\right)_c = -\Delta U$$

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$$600\,(17{,}64 - 432{,}64)_A + 1210\,(7{,}7) = -\Delta U$$

$$-249000 + 9800 = -\Delta U$$

$$\boxed{\Delta U = 239.200\,J} \qquad \Delta U \cong 240\,kJ$$

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2. $m = 1kg$

$v = 6 \frac{km}{s}$

$t = 0°C$

$T_1 = 4000K$

$c = 0,42 kJ/kgK$

$L = 355 kJ/kg$

$m = ?$

$$Q = \Delta E = \Delta E_c + \Delta U$$

$$Q = \frac{1}{2} m (v_2^2 - v_1^2) + mc(T_2 - T_1)$$

$$Q = \frac{1}{2} 1 (0^2 - 6000^2) + 1.0,42k (273 - 4000)$$

$$Q = 0,5 \cdot 36.10^6 + 0,42k (-3727)$$

$$Q = 18.10^6 - 15.10^6$$

$$Q = -19,6 MJ$$

$$Q = mL$$

$$m = \frac{Q}{L}$$

$$m = \frac{19,6 10^6}{355k}$$

$$m = 55,21kg$$

3 $m = 2kg$

$V_1 = 2,0 m^3$

$V_2 = 1,2 m^3$

$p = 120kPa - cte$

$\Delta U = -8 kJ$

$Q = ?$

$$W_{1-2} = \int_1^2 p dV = p \int_1^2 dv$$

$$W_{1-2} = p (V_2 - V_1) = 120k (1,2 - 2,0)$$

$$W_{1-2} = 120k . (-0,8)$$

$$W_{1-2} = -96 kJ$$

$$\Delta U = Q - W \quad Q = \Delta U + W$$

$$Q = -8 - 96 = -104 kJ$$

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4) $Q_1 = +10\,kJ$ $\quad \Delta U_1 = 20\,kJ$ $\quad W_1 = ?$

$Q_2 = +30\,kJ$ $\quad W_2 = ?$

$Q_3 = -5\,kJ$ $\quad \Delta U_3 = -20\,kJ$ $\quad W_3 = ?$

— ciclo $\Rightarrow$ $\Delta U = 0$

$\Delta U_1 + \Delta U_2 + \Delta U_3 = 20 + \Delta U_2 - 20 = 0$

$\Delta U_2 = 0$

2.º Processo $\Rightarrow$ $Q_2 = \Delta U_2 + W_2$

$Q_2 = W_2 = +30\,kJ$

3.º Processo $\Rightarrow$ $W_3 = Q_3 - \Delta U_3$

$W_3 = -5 + (-20) = 15\,kJ$

1.º Processo $\Rightarrow$ $W_1 = Q_1 - \Delta U_1$

$W_1 = 10 - 20 = -10\,kJ$

Ciclo Total $Q_T = \Sigma Q = 35\,kJ$

$\Delta U = 0$

$W_T = Q_T - \Delta U$

$W_T = 35\,kJ$

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5) $V = 0,5\ m^3$

$k = 1,4$

$R = 0,286\ \frac{kJ}{kg\,k}$

$p_1 = 7,0\ MPa$

$t = 250°C + 273 = 523k$

$P_2 = 400\ kPa$

$m = ?$

$m_D = m_F + m_P$

$PV = mRT$

$m = \frac{PV}{RT}$

$m_F = \frac{7.0.10^6.0,5}{286.523}$

$m_F = 23,4\ kg$

$\frac{T_2}{T_1} = \left(\frac{P_2}{P_1}\right)^{\frac{k-1}{k}}$ $\quad T_2 = \left(\frac{400}{7000}\right)^{\frac{1,4-1}{1,4}} \cdot 523$

$T_2 = \left(\frac{P_2}{P_1}\right)^{\frac{k-1}{k}} \cdot T_1$ $\quad T_2 \left(\frac{4}{70}\right)^{0,2857} \cdot 523$

$\boxed{T_2 = 230,86k}$

$m_F = \frac{P_2 V_2}{RT_2}$

$m_F = \frac{400.10^3.0,5}{0,286.10^3.231} = 3,027\ kg$

$m_D = 23,4 - 3,03 \simeq 20,4\ kg$

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7. GÁS IDEAL

$V_1 = 0{,}5\,m^3$

$T_1 = 340\,k$

$P = cte$

$T_2 = 290\,k$

	P	T	V
INICIAL	120 kPa	340k	$0{,}5\,m^3$
FINAL	120 kPa	290k	?

a) $V_2 = ?$

b) $W = ?$

c) $Q = ?$

a) $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$ $\quad \frac{V_1}{T_1} = \frac{V_2}{T_2}$

$\frac{0{,}5}{340} = \frac{V_2}{290}$ $\quad V_2 = 0{,}426\,m^3$

b) $W_{1-2} = \int_1^2 P\,dV = p(V_2 - V_1)$

$W_{1-2} = 120k\ (0{,}426 - 0{,}5)$

$W_{1-2} = -8{,}8\,kJ$

c) $\Delta U = m\,C_v\,\Delta T$

$\Delta U = 1 \cdot 0{,}52k\,(290 - 340)$

$\Delta U = -26\,kJ$

$Q = \Delta U + W$

$Q = -26 + (-8{,}8)$

$\boxed{Q = -34{,}8\,kJ}$

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8. SISTEMA ADIABÁTICO

$P_1 = 140\ kPa$

$T_1 = 280\ K$

$m = 0,13\ kg$

$W_s = -18,3\ kJ$

$T_2 = 420\ K$

$Q = ?$

$W_M = ?$

$W_T = ?$

$\Delta U = ?$

$\Delta H = ?$

$R = 286\ \frac{J}{kg\,K}$

$c_p = 1,0035\ \frac{kJ}{kg\,K}$

$c_v = 0,7165\ \frac{kJ}{kg\,K}$

$pV = mRT$

$V_1 = \frac{mRT_1}{P_1}$

$V_1 = \frac{0,13 \cdot 286 \cdot 280}{140\ k}$

$\boxed{V_1 = 0,0746\ m^3}$

$V_2 = \frac{0,13 \cdot 286 \cdot 420}{140\ k}$

$\boxed{V_2 = 0,111\ m^3}$

$W_{MEC} = p(V_2 - V_1)$

$W_{MEC} = 140\ k\,(0,111 - 0,0744)$

$W_{MEC} = 5,124\ kJ$

$W_{TOTAL} = W_{EIXO} + W_{MEC}$

$W_T = -18,3 + 5,124$

$\boxed{W_T \cong 13,1\ kJ}$

$\Delta U = m c_v \Delta T$

$\Delta U = 0,13 \cdot 0,7165k\,(420 - 280)$

$\Delta U = 13,04\ kJ$

ADIABÁTICO $Q = 0$ ou $\Delta U = -W$

$\Delta U = -(W_{EIXO} + W_{MEC})$

$\Delta U = -(-18,3 + 5,12) \cong 13,2\ kJ$

$\Delta H = m c_p \Delta T$

$\Delta H = 0,13 \cdot 1,0035 \cdot k\,(420 - 280)$

$\Delta H = 18,26\ kJ$

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