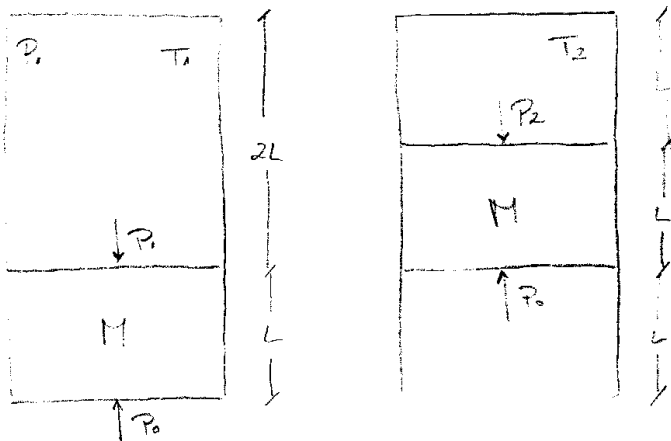


PAUTA PREQUISTA N°2:



$A = D$

1) DCL 1. $\sum F_y: P_1 A_T + M g = P_0 A_T \Rightarrow \boxed{P_1 = P_0 - \frac{M g}{A_T}}$

2) DCL 2. $\sum F_y: P_0 \frac{\pi D^2}{4} - P_2 \frac{\pi D^2}{4} - M g = M g$
 $\boxed{P_2 = P_0 - M g \frac{4}{\pi D^2}}$

$\Delta U = \hat{Q} - W$ or $\Delta U = C_V \Delta T M_{gas}$

$dW = -P_2 A dy \Rightarrow dW = -P_2 dV \Rightarrow W = -P_2 \Delta V$

$\therefore \boxed{M_{gas} C_V \Delta T = \hat{Q} + \left(P_0 - M g \frac{4}{\pi D^2} \right) \Delta V}$ (1)

Como $PV = n R_0 T \Rightarrow \frac{P_1 V_1}{T_1} = n R_0 = \frac{P_2 V_2}{T_2}$

$\Rightarrow \frac{P_1 \cancel{V_1}}{T_1} = \frac{P_2 \cancel{V_2}}{T_2} \Rightarrow 2 P_1 T_2 = P_2 T_1 \Rightarrow \boxed{T_2 = \frac{P_2 T_1}{2 P_1}}$ (2)

$$\textcircled{1} \text{ y } \textcircled{2} \quad \hat{Q}_1 = n_{\text{gas}} C_v (T_2 - T_1) - \left(P_0 - n g \frac{4}{\pi D^2} \right) \Delta V$$

$$\hat{Q}_1 = n_{\text{gas}} C_v \left(\frac{P_2 T_1}{2 P_1} - T_1 \right) - \left(P_0 - n g \frac{4}{\pi D^2} \right) \left(\frac{\pi D^2}{4} 2L - \frac{\pi D^2}{4} L \right)$$

$$\hat{Q}_1 = n_{\text{gas}} C_v \left(\frac{T_1}{2} - T_1 \right) - \left(P_0 - n g \frac{4}{\pi D^2} \right) \frac{\pi D^2}{4} L$$

Cálculo n_{gas} :

$$P_1 = P_1 R T_1 \Rightarrow P_1 = \frac{P_1}{R T_1} \quad V_1 = \frac{\pi D^2}{4} 2L$$

$$\Rightarrow n_{\text{gas}} = P_1 V_1 = \frac{P_1}{R T_1} \cdot \frac{\pi D^2}{4} \cdot 2L$$

Final:

$$\hat{Q}_1 = \frac{P_1}{R T_1} \cdot \frac{\pi D^2}{4} 2L C_v \left(\frac{T_1}{2} - T_1 \right) - \left(P_0 - n g \frac{4}{\pi D^2} \right) \frac{\pi D^2}{4} L$$

$$\hat{Q}_1 = -P_1 \frac{\pi D^2}{4} L \frac{C_v}{R} - P_1 \frac{\pi D^2}{4} L$$

$$\hat{Q}_1 = -P_1 \frac{\pi D^2}{4} L \left(\frac{C_v}{R} + 1 \right)$$

$$\boxed{\hat{Q}_1 = - \left(P_0 - n g \frac{4}{\pi D^2} \right) \frac{\pi D^2}{4} L \left(\frac{C_v}{R} + 1 \right)}$$

Evaluando.

$$P_0 = 101325 \frac{\text{kg}}{\text{m s}^2}$$

$$D = 0,3 \text{ m}$$

$$L = 0,2 \text{ m}$$

$$M = 0,1 \text{ kg}$$

$$\frac{C_v}{R} = \frac{5}{2}$$

$$\Rightarrow \hat{Q} = - \left(101325 \frac{\text{kg}}{\text{m s}^2} - 0,1 \text{ kg} \cdot 9,8 \frac{\text{m}}{\text{s}^2} \frac{4}{\pi (0,3)^2 \text{ m}^2} \right) \times \frac{\pi (0,3)^2 \text{ m}^2 \cdot 0,2 \text{ m}}{4} \times \left(\frac{5}{2} - 1 \right)$$

$$\hat{Q} = -101311 \frac{\text{kg}}{\text{m s}^2} \cdot 0,0212 \text{ m}^3$$

$$\hat{Q} = -2148 \text{ kg} \frac{\text{m}^2}{\text{s}^2}$$

$$\hat{Q} = -2148 \text{ J} = -513,13 \text{ cal}$$