

Datos generales

$$m_{\text{piston}} = 102,5 \text{ [kg]}$$

$$D_{\text{piston}} = 0,16 \text{ [m]}$$

$$A = \pi \cdot \frac{D_{\text{piston}}^2}{4} \text{ [m}^2\text{]}$$

$$m_w = 0,15 \text{ [kg]}$$

$$z_1 = 0,4 \text{ [m]}$$

$$z_2 = 1,5 \text{ [m]}$$

$$T_h = 650 + 273 \text{ [K]}$$

$$P_{\text{atm}} = 100 \text{ [kPa]}$$

$$g = 9,81 \text{ [m/s}^2\text{]}$$

Estado 1

$$P_1 = 3 \cdot 100$$

$$\text{Vol}_1 = A \cdot z_1$$

$$v_1 = \frac{\text{Vol}_1}{m_w}$$

$$x_1 = \mathbf{x} (\text{water} ; P = P_1 ; v = v_1)$$

$$T_1 = \mathbf{T} (\text{water} ; P = P_1 ; v = v_1)$$

$$u_1 = \mathbf{u} (\text{water} ; P = P_1 ; v = v_1)$$

$$s_1 = \mathbf{s} (\text{water} ; P = P_1 ; v = v_1)$$

Estado 2

$$P_2 = P_{\text{atm}} + P_p$$

$$P_p = \frac{m_{\text{piston}} \cdot g}{A \cdot 1000}$$

$$\text{Vol}_2 = A \cdot z_2$$

$$v_2 = \frac{\text{Vol}_2}{m_w}$$

$$x_2 = \mathbf{x} (\text{water} ; P = P_2 ; v = v_2)$$

$$T_2 = \mathbf{T} (\text{water} ; P = P_2 ; v = v_2)$$

$$s_2 = \mathbf{s} (\text{water} ; P = P_2 ; v = v_2)$$

$$u_2 = \mathbf{u} (\text{water} ; v = v_2 ; P = P_2)$$

Densidad del liquido

$$P_1 = P_{\text{atm}} + P_p + P_{\text{liq};1}$$

$$P_{\text{liq};1} = \frac{\rho_{\text{liq}} \cdot g \cdot (z_2 - z_1)}{1000}$$

Calor aportado

$$Q - W = \Delta U$$

$$W = \left[(P_{\text{atm}} + P_p) \cdot (z_2 - z_1) + \frac{\rho_{\text{liq}}}{1000} \cdot g \cdot (z_2 \cdot (z_2 - z_1) - 1/2 \cdot (z_2^2 - z_1^2)) \right] \cdot A$$

$$\Delta U = m_w \cdot (u_2 - u_1)$$

$$Q_{\text{in}} = \frac{Q}{0,92}$$

Entropia generada

$$\Delta S = \frac{Q_{\text{in}}}{T_h} - \frac{Q_{\text{out}}}{T_c} + \sigma$$

$$\Delta S = m_w \cdot (s_2 - s_1)$$

$$T_c = \frac{T_1 + T_2}{2} + 273$$

$$Q_{\text{out}} = 0,08 \cdot Q_{\text{in}}$$

SOLUTION

$$A = 0,02011 \text{ [m}^2\text{]}$$

$$g = 9,81 \text{ [m/s}^2\text{]}$$

$$P_2 = 150 \text{ [kPa]}$$

$$Q = 18,16 \text{ [kJ]}$$

$$\sigma = 0,02747 \text{ [kJ/K]}$$

$$T_2 = 111,4 \text{ [}^\circ\text{C]}$$

$$u_2 = 821,4 \text{ [kJ/kg]}$$

$$v_2 = 0,2011 \text{ [m}^3\text{]}$$

$$z_1 = 0,4 \text{ [m]}$$

$$\Delta S = 0,04486 \text{ [kJ/K]}$$

$$m_{\text{piston}} = 102,5 \text{ [kg]}$$

$$P_{\text{atm}} = 100 \text{ [kPa]}$$

$$Q_{\text{in}} = 19,74 \text{ [kJ]}$$

$$s_1 = 2,134 \text{ [kJ/kgK]}$$

$$T_c = 395,5 \text{ [K]}$$

$$\text{Vol}_1 = 0,008042 \text{ [m}^3\text{]}$$

$$W = 4,976 \text{ [kJ]}$$

$$z_2 = 1,5 \text{ [m]}$$

$$\Delta U = 13,18 \text{ [kJ]}$$

$$m_w = 0,15 \text{ [kg]}$$

$$P_{\text{liq};1} = 150$$

$$Q_{\text{out}} = 1,579 \text{ [kJ]}$$

$$s_2 = 2,433 \text{ [kJ/kgK]}$$

$$T_h = 923 \text{ [K]}$$

$$\text{Vol}_2 = 0,03016 \text{ [m}^3\text{]}$$

$$x_1 = 0,08688 \text{ [-]}$$

$$D_{\text{piston}} = 0,16 \text{ [m]}$$

$$P_1 = 300 \text{ [kPa]}$$

$$P_p = 50,01 \text{ [kPa]}$$

$$\rho_{\text{liq}} = 13899 \text{ [kg/m}^3\text{]}$$

$$T_1 = 133,6 \text{ [}^\circ\text{C]}$$

$$u_1 = 733,5 \text{ [kJ/kg]}$$

$$v_1 = 0,05362 \text{ [m}^3\text{]}$$

$$x_2 = 0,1727 \text{ [-]}$$