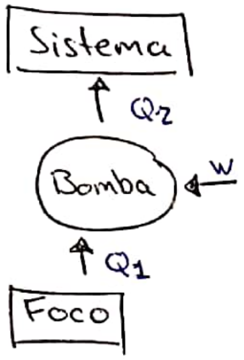
Entregable individual 2. Jorge González Perea. Grupo A. DNI: 51553561G

1.



$T_F = 20°C = 293'15\ K$ $\quad T_s = 90°C = 363'15\ K$

$T_{ext} = 20°C = 293'15\ K$

$\Delta S = -60\ J/K$ $\quad$ ¿W?

$dU = 0 \Rightarrow dU = \delta Q + \delta W \Rightarrow W = -Q = -(Q_1 - Q_2)$

Es reversible $\Rightarrow \Delta S_{sist} + \Delta S_F + \Delta S_{Bomba} = 0$

$$\Delta S_{sist} - \frac{Q_F}{T_F} + \cancel{\frac{Q_{Bomba}}{T_{Bomba}}}^{\,0} = 0 \Rightarrow \Delta S_{sis} - \frac{Q_1}{T_F} = 0 \Rightarrow \Delta S_{sist} = \frac{Q_1}{T_F} = 60\ J/K$$

$\boxed{Q_1 = 17.589\ J}$ $\quad \rightarrow \quad \delta Q^{rev} = C_v dT$ porque $dU_F = \delta Q_F^{rev}$, ya que $W_F = 0$

$$\Delta S_{sist} = \int_{T_1}^{T_2} \frac{\delta Q^{rev}}{T} = \int_{T_1}^{T_2} \frac{C_v\, dT}{T} = C_v \ln\left(\frac{T_2}{T_1}\right) \Rightarrow C_v = \frac{\Delta S_{sist}}{\ln\left(\frac{T_2}{T_1}\right)} = \frac{60}{\ln\left(\frac{363'15}{293'15}\right)} = 280'2\ J/K$$

$\boxed{Q_2 = C_v \Delta T = 19.614'11\ J}$ $\Rightarrow \boxed{W = -(Q_1 - Q_2) = 2.025'11\ J}$

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2. $C_p = ap^2T \qquad \alpha = \frac{T}{V} F(P) \qquad \kappa_T = a\frac{T^2}{V}$

a) $$\frac{\partial}{\partial P}\left(\frac{\partial V}{\partial T}\right)_P = \frac{\partial}{\partial T}\left(\frac{\partial V}{\partial P}\right)_T$$

$$\left.\begin{aligned} \alpha = \frac{1}{V}\left(\frac{\partial V}{\partial T}\right)_P &\Rightarrow \frac{\partial V}{\partial T} = V\alpha = TF(P) \\ \kappa_T = \frac{-1}{V}\left(\frac{\partial V}{\partial P}\right)_T &\Rightarrow \frac{\partial V}{\partial P} = -V\kappa_T = aT^2 \end{aligned}\right\} \frac{\partial}{\partial T}(aT^2) = \frac{\partial}{\partial P}(TF(P))$$

$$-2aT = T\frac{\partial}{\partial P}F(P) \Rightarrow \frac{\partial F(P)}{\partial P} = -2a \Rightarrow \boxed{F(P) = -2aP}$$

$$dS = \frac{\delta Q}{T} = C_p\frac{dT}{T} \Rightarrow S = \int ap^2T\frac{dT}{T} = ap^2T \Rightarrow \boxed{S(T,P) = ap^2T}$$ salvo cte.

b) $$dV = \left(\frac{\partial V}{\partial T}\right)_P dT + \left(\frac{\partial V}{\partial P}\right)_T dP = V\alpha dT - V\kappa_T dP \Rightarrow \frac{dV}{V} = \alpha dT - \kappa_T dP$$

$$\frac{dV}{V} = \frac{T}{V}\underbrace{(-2ap)}_{F(P)}dT - a\frac{T^2}{V}dP \Rightarrow dV = -2apT\,dT - aT^2dP$$

$$V = -2ap\frac{T^2}{2} - aT^2p = -aT^2p - aT^2p = -2aT^2p \Rightarrow \boxed{V(T,P) = -2aT^2p}$$ salvo cte.

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