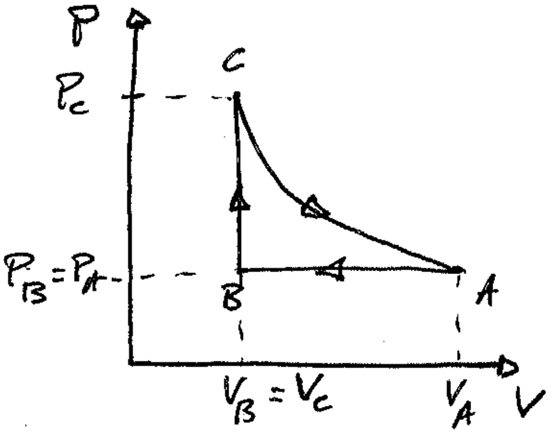
FISICA 2 - 2º PARCIAL - 30/11/2018

Ej. 1

a)



$$n = \frac{P_A V_A}{R T_A}$$

$n = 5,14$ moles

$$\gamma = \frac{c_p}{c_v} = \frac{7/2 R}{5/2 R} = \frac{7}{5} = 1,4$$

AB → A P cte $\quad P_A = P_B = P_0 + \frac{mg}{A} = 100,98 \, kPa$

BC → A V cte $\quad T_A = 473 \, K$

CA → Adiabático $\quad T_B = 293 \, K$

b) $\frac{V_A}{T_A} = \frac{V_B}{T_B} \Rightarrow \boxed{V_B = 0,124 m^3}$

2) $\frac{P_C}{T_C} = \frac{P_B}{T_B} \Rightarrow T_c = T_B \cdot \frac{P_c}{P_A} \Rightarrow \boxed{T_c = 572,2 \, K}$

3) $P_A V_A^{\gamma} = P_c V_c^{\gamma} \Rightarrow \boxed{P_c = 197,2 \, kPa}$

$$P_c = P_A \left(\frac{V_A}{V_B}\right)^{\gamma}$$

c) $W_{AB} = - P_A (V_B - V_A) = 7,68 \, kJ \ \underline{\underline{> 0}}$

$W_{BC} = 0$

$W_{CA} = W_{adiab} = \frac{nR}{\gamma - 1}(T_A - T_c) = -10,6 \, kJ \ \underline{\underline{< 0}}$

$$W_{Neto} = W_{AB} + W_{BC} + W_{CA} \Rightarrow \boxed{W_{Neto} = -2{,}9 \text{ kJ}}$$

d) $\Delta S_{gas} = \Delta S_{AB} + \Delta S_{BC} + \underbrace{\Delta S_{CA}}_{=0} \approx 0$ p/ ciclo! (Adiabático)

$$\Delta S_{AB} = \int n\, c_p \frac{dT}{T} = n \frac{7}{2} R \ln\left(T_B/T_A\right) = \underline{\underline{-71{,}6 \text{ J/K}}}$$

$$\Delta S_{BC} = \int n\, c_v \frac{dT}{T} = n \frac{5}{2} R \ln\left(T_C/T_B\right) = \underline{\underline{71{,}4 \text{ J/K}}}$$

$$\Delta S_{Fuente} = \frac{-Q_{AB}}{T_2} - \frac{Q_{BC}}{T_3} = 98{,}6 - 38{,}5 = 60{,}1$$

$$Q_{AB} = n\, c_p (T_B - T_A) = -26\,909{,}4 \text{ J}$$

$$Q_{BC} = n\, c_v (T_C - T_B) = +29\,792{,}6 \text{ J}$$

$$\Delta S_U = \underbrace{\Delta S_{gas}}_{\approx 0} + \Delta S_{FU} \Rightarrow \boxed{\Delta S_U = 60{,}1 \text{ J/K}}$$

Ej 2 → Tanto comp. A como comp. B sufren procesos isotérmicos, debido al contacto térmico permanente de las fuentes.

A: He,

$\gamma = \frac{c_p}{c_v} = \frac{5/2 R}{3/2 R} = \frac{5}{3}$ $\quad m_{He} = 100 g$

$M_{He} = 4{,}0$ g/mol *

B: N_2,

$m_{N_2} = 200 g$

$\gamma = \frac{7/2 R}{5/2 R} = \frac{7}{5}$

$M_{N_2} = 28{,}0$ g/mol

a) $(V_A^i + V_B^i) = (V_A^f + V_B^f)$ → Conservación del Volumen

$$P_A^i = \frac{m_{He} R T_A}{M_{He} V_A^i} \qquad P_B^i = \frac{m_{N_2}}{M_{N_2}} \frac{R T_B}{V_B^i}$$

$$\boxed{P_A^i = 62325 \text{ Pa}} \qquad \boxed{P_B^i = 26.711 \text{ Pa}}$$

$$P_A^i V_A^i = P_A^f V_A^f \qquad P_B^i V_B^i = P_B^f V_B^f$$

Estado final en eq. mecánico: $P_B^f = P_A^f = P$

$$\frac{P_A^i}{P_B^i} = \frac{V_A^f}{V_B^f} \Rightarrow V_B^f = \frac{P_B^i}{P_A^i} \cdot V_A^f$$

$$V_B^f + V_A^f = 2 \Rightarrow V_A^f \left(\frac{P_B^i}{P_A^i} + 1 \right) = 2$$

$$\boxed{V_A^f = 1,4 \text{ m}^3} \Rightarrow \boxed{V_B^f = 0,6 \text{ m}^3}$$

b) $\Delta S_A = \dfrac{Q_A}{T_A}$; $\Delta S_B = \dfrac{Q_B}{T_B}$

$$\Delta U = 0 \Rightarrow Q = -W_{isot} = nRT \ln\left(\frac{V_f}{V_i}\right)$$

$Q_A = 20.971$ J , $Q_B = -13.645$ J

$$\boxed{\Delta S_A = 69,9 \text{ J/K}} \qquad \boxed{\Delta S_B = -30,3 \text{ J/K}}$$

Ej 3

$$\eta_c = 1 - \frac{100}{700}$$ → Eficiencia de una Maq. de Carnot para las fuentes

$$\boxed{\eta_c \simeq 0{,}857}$$

$$\eta_v = 1 - \frac{300}{800}$$ → Eficiencia de la máq. Verdadera

$$\boxed{\eta_v = 0{,}625}$$

Como $\eta_v < \eta_c$ ⇒ Maq. Verdadera es irreversible, por lo tanto NO puede funcionar como refrigerador.

Ej 4 3 posibilidades:

I) $T_{eq} < 100°$ ⇒ No se evapora nada

II) $T_{eq} = 100°$ ⇒ Se evapora una fracción

III) $T_{eq} > 100$ ⇒ Se evapora toda

a, b)

I) $Q_{Fe} + Q_a = 0$; $Q = mc\Delta T$

$$\rho_{Fe}(\pi r^2 L)\cdot c_{Fe}\,(T - T_i^{Fe}) + m_a c_a (T - T_i^a) = 0$$

$$T_{eq} = \frac{\rho_{Fe}(\pi r^2 L)\cdot c_{Fe}\, T_i^{Fe} + m_a c_a T_i^a}{\rho_{Fe}(\pi r^2 L)\, c_{Fe} + m_a c_a}$$

$$\boxed{T_{eq} = 96{,}8\ °C}$$ NO se evapora nada.

c) $\rho_f = \dfrac{M_{Fe}}{V_f}$ $\quad M_{Fe} = \rho_i V_i$

$$\rho_f = \frac{V_i}{V_f} \cdot \rho_i \qquad \rho_f = \frac{\rho_i}{1 + 3\alpha \Delta T}$$

$$V_f = V_i (1 + 3\alpha \Delta T)$$

$$\boxed{\rho_f = 7.917{,}7 \ Kg/m^3}$$