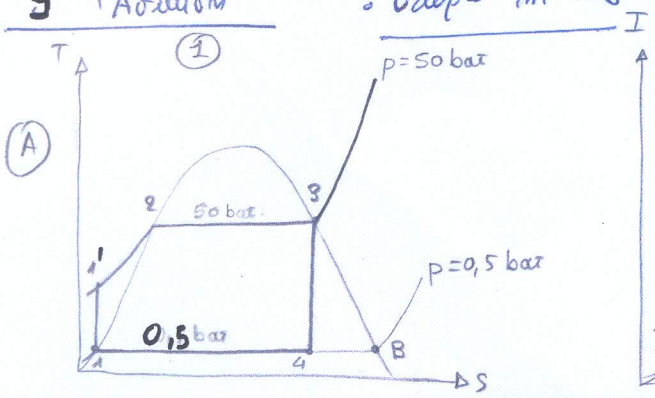
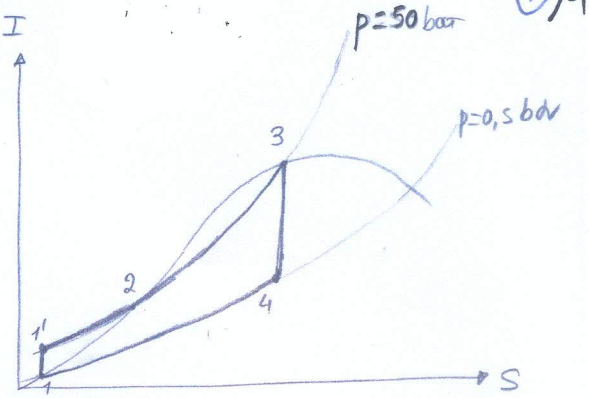
9ης Άσκηση : Δίνεται $m = 1\,kg$





Καταστατική μεταβολή κορεσμένου συστήματος στις περιοχές:

$p = 0,5\,bar$ $\xrightarrow{\text{ΠΙΝ. 5/ΕΕΛ. 301}}$ $t = 81,345\,^{\circ}C \Rightarrow T = 81,345 + 273 = 354,345\,^{\circ}K$

$v = v_1 = 0,0010301\ m^3/kg$

$s = v_B = 3,240\ m^3/kg$

$h_\sigma = h_1 = 340,56\ kJ/kg$ $\qquad r = 2305,4\ kJ/kg$

$h_v = h_B = 2646,0\ kJ/kg$

$s_\sigma = s_1 = 1,0912\ kJ/kg\,^{\circ}K$

$s_v = s_B = 7,5947\ kJ/kg\,^{\circ}K$

$p = 50\,bar$ $\xrightarrow{\text{ΠΙΝ. 5/ΕΕΛ. 302}}$ $t = 263,91\,^{\circ}C \Rightarrow T = 263,91 + 273 = 536,91\,^{\circ}K$

$v = v_2 = 0,0012858\ m^3/kg$

$s = v_3 = 0,03943\ m^3/kg$

$h_\sigma = h_2 = 1154,5\ kJ/kg$ $\qquad r = 1639,7\ kJ/kg$

$h_v = h_3 = 2794,2\ kJ/kg$

$s_\sigma = s_2 = 2,9206\ kJ/kg\,^{\circ}K$

$s_v = s_3 = 5,9735\ kJ/kg\,^{\circ}K$

(Β)

$$l_{αντλ.} = h_{1'} - h_1$$

$$h_{1'} = h_1 + v_1 \cdot (P_{1'} - P_1)$$

$$= 340,56 \left(\frac{kJ}{kg}\right) + 0,0010301 \left(\frac{m^3}{kg}\right) \cdot (50 - 0,5) \times 10^5 \times 10^{-3} \left(\frac{kJ}{kg}\right)$$

$$= 346,658 \ kJ/kg$$

$$l_{αντλ.} = 346,658 - 340,560 = 5,098 \ kJ/kg$$

(Γ) $q_{1'2} = h_2 - h_{1'}$ $h_2 = 1154,5 \ (kJ/kg)$

(Δ) $Q_1 = h_3 - h_2$

$$= (2794,2 - 1154,5) \ kJ/kg = 1639,7 \ kJ/kg$$

(Ε) $\eta = \frac{L_{στρ.}}{Q_1}$

$$l_{στρ.} = h_3 - h_4$$

Από το διάγραμμα (I-s) η κατακόρυφη 34 τέμνει την $p = 0,5 bar$ σε σημείο όπου:

$h_4 = 2065 \ kJ/kg$ $x_4 = 0,75$

ΕΠΙΒΕΒΑΙΩΣΗ ΤΙΜΩΝ h_4 και x_4.

Υπολογισμός x_4: η 34 = ιδανική αδιαβατική ⇒ ΙΣΟΕΝΤΡΟΠΙΚΗ:

$$S_3 = S_4 = S_1 + \frac{r}{T} \cdot x_4$$

$$5,9735 \ldots = 1,0912 + \frac{2305,4}{354,345} \cdot x_4 \Rightarrow$$

$$x_4 = \frac{5,9735 - 1,0912}{2305,4} \times 354,345 = 0,75.$$

h_4 = ενθαλπία ήγρασίας

$= h_1 + r \cdot x_4 =$

$= 349,56 + 2305,4 \cdot 0,75 =$

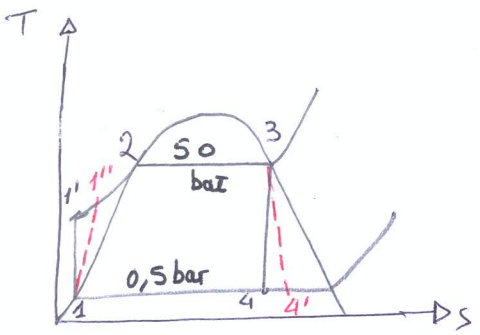
$= 2069,61$ kJ/kg

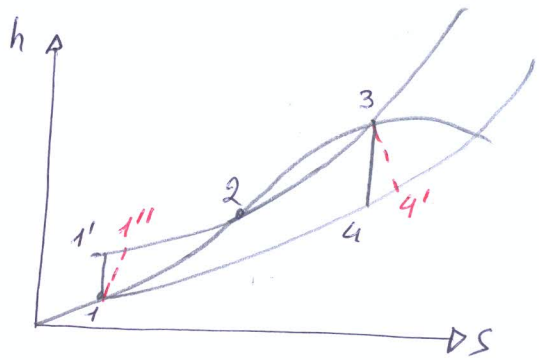
Λαμβάνονται: $x_4 = 0,75$, $h_4 = 2069,61$ kJ/kg

$$\eta_\theta = \frac{h_3 - h_4}{Q_1} = \frac{h_3 - h_4}{h_3 - h_1'} = \frac{2794,2 - 2069,61}{2794,2 - 346,658} =$$

$= 0,296 \Rightarrow 29,6\%$.

2. $\eta_{авст} = 0,82$ $\eta_{бтр.} = 0,85$





$$\eta_{австл.} = \frac{h_{1''} - h_{1'}}{h_{1'} - h_1} \qquad \eta_{бтр.} = \frac{h_3 - h_{4'}}{h_3 - h_4}$$

$$\eta_\theta = \frac{(h_3 - h_{4'}) - (h_{1''} - h_1)}{h_3 - h_{1''}}$$

$h_3 = 2794,2$ kJ/kg

$h_1 = 340,56$ kJ/kg

$h_4 = 2065$ kJ/kg

$h_{1'} = h_1 + v_1 \cdot (p_{1'} - p_1) = 345,658$ kJ/kg

$h_{4'} = h_3 - \eta_{бтр.} \cdot (h_3 - h_4) = 2174,38$ kJ/kg $< 2646,0 \frac{kJ}{kg} = (h_v)_{0,5(bar)}$

$h_{1''} = h_{1'} + \eta_{австл.} \cdot (h_{1'} - h_1) = 349,838$ kJ/kg

$\eta_\theta = 0,249 \rightarrow 24,9\%$