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TEZĂ LA FIZICĂ
Varianta A

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1. a) $Q = \Delta U + L$

$Q_{ad} = (\Delta U)_{ad} + L_{ad}$

$Q_{ad} = 0$

$(\Delta U)_{ad} = \Delta U = \frac{i}{2} \nu R \Delta T = \nu C_v \Delta T$

$L_{ad} = -\frac{i}{2} \nu R \Delta T = -\nu C_v \Delta T$ ✓

1

b) $\begin{cases} C_p = C_v + R \\ \gamma = \frac{C_p}{C_v} \end{cases} \Rightarrow \gamma = \frac{C_v + R}{C_v} \Rightarrow \gamma C_v = C_v + R \Rightarrow$

$\Rightarrow \gamma C_v - C_v = R \Rightarrow C_v(\gamma - 1) = R \Rightarrow C_v = \frac{R}{\gamma - 1}$

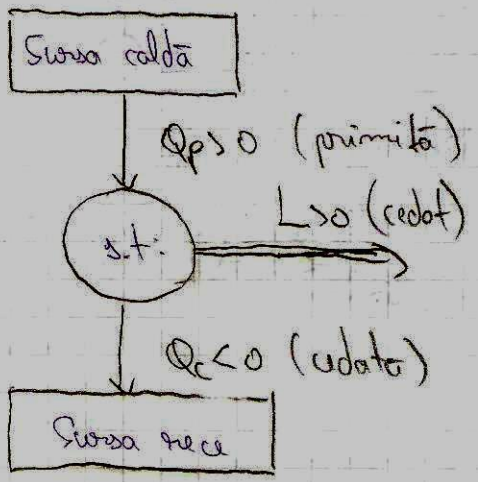
$C_p = \frac{R}{\gamma - 1} + R = \frac{R + \gamma R - R}{\gamma - 1} = \frac{\gamma}{\gamma - 1} \cdot R$

1

$C_v = \frac{R}{\gamma - 1}$ ✓

$C_p = \frac{\gamma}{\gamma - 1} R$ ✓

c)



$Q_p = L + |Q_c|$; $L = Q_p - |Q_c|$

$\eta = \frac{E_m \text{ (utilă)}}{E_c \text{ (consumată)}}$

1

$\eta = \frac{L}{Q_p} = \frac{Q_p + Q_c}{Q_p} = 1 - \frac{|Q_c|}{Q_p}$

2.

Transformarea	Definiție	Legi	
Izotermă	În transformarea izotermă presiunea și volumul variază invers proporțional	$pV = \nu RT = \text{constant} = C_T$	~~$Q = \Delta U + L$~~ ~~$Q_p = (\Delta U)_p + L_p$~~ ~~$Q_p = \nu c_p \cdot \Delta T$~~ ~~$(\Delta U)_p = \Delta U = \frac{i}{2}\nu R \Delta T =$~~ ~~$= \nu c_v \Delta T$~~ ~~$L_p = p \cdot \Delta V$~~
~~Izobară~~	~~În transformarea izob~~		$Q = \Delta U + L$ $Q_T = (\Delta U)_T + L_T$ $(\Delta U)_T = \Delta T = \frac{i}{2}\nu R \Delta T =$ $= 0$ $Q = L_T = \nu RT \cdot \ln\left(\frac{V_f}{V_i}\right)$
Izobară	În transformarea izobară volumul și temperatura variază direct proporțional	$\frac{V}{T} = \text{constant} = c_p = \frac{\nu R}{p}$	$Q = \Delta U + L$ $Q_p = (\Delta U)_p + L_p$ $Q_p = \nu c_p \cdot \Delta T$ $(\Delta U)_p = \Delta U = \frac{i}{2}\nu R \Delta T =$ $= \nu c_v \Delta T$ $L_p = p \cdot \Delta V$

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3. Se dau:

- gaz ideal biatomic $\Rightarrow i = 5 \Rightarrow$

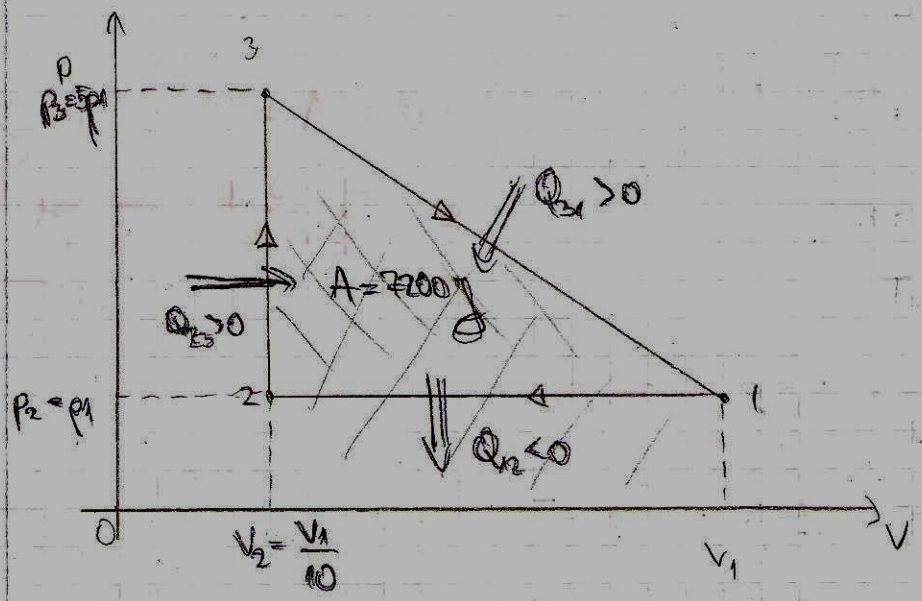
$$\begin{cases} c_v = \frac{5}{2}R = 2{,}5R \\ c_p = \frac{7}{2}R = 3{,}5R \\ \gamma = \frac{7}{5}R = 1{,}4R \end{cases}$$

$1 \to 2$: transformare izobară : $V_2 = \frac{V_1}{10}$

$2 \to 3$: transformare izocoră : $p_3 = 5p_2 = 5p_1$

$3 \to 1$: ~~trian~~ destindere liniară

a) Desen



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b)

Starea 1 $\begin{cases} p_1 \\ V_1 \\ T_1 \\ Q_1 = \nu = \frac{p_1 V_1}{RT_1} \end{cases}$ ✓

$pV = \nu RT$

$p_1 V_1 = \nu R T_1 \Rightarrow \nu = \frac{p_1 V_1}{RT_1}$

Starea 2 $\begin{cases} p_2 = p_1 \\ V_2 = \frac{V_1}{10} \\ T_2 = ? = \frac{T_1}{10} \\ Q_2 = \nu = \frac{p_1 V_1}{RT_1} \end{cases}$ ✓

$1 \Rightarrow 2$ izobară $\Rightarrow$

$\Rightarrow \frac{V_1}{T_1} = \frac{V_2}{T_2} \Rightarrow T_2 = \frac{T_1 \cdot V_2}{V_1} =$

$= \frac{T_1 \cdot \frac{V_1}{10}}{V_1} = T_1 \cdot \frac{V_1}{10} \cdot \frac{1}{V_1} = \frac{T_1}{10}$

Starea 3 $\begin{cases} p_3 = 5p_1 \\ V_3 = V_2 = \frac{V_1}{10} \\ T_3 = ? = \frac{T_1}{2} \\ Q_3 = \nu = \frac{p_1 V_1}{RT_1} \end{cases}$ ✓

$2 \Rightarrow 3$ izocoră $\Rightarrow$

$\Rightarrow \frac{p_2}{T_2} = \frac{p_3}{T_3} \Rightarrow T_3 = \frac{T_2 \cdot p_3}{p_2} =$

$= \frac{\frac{T_1}{10} \cdot 5p_1}{p_1} = \frac{T_1}{2}$

c) $L = A = 7200\ J$

$Q_p = ?$, $Q_c = ?$

$L_{net} = A = A$ triunghi $= \frac{4p_1 \cdot 9V_1}{2 \cdot 10} \rightarrow p_1V_1 = ?$

1→2 : izobară

$Q_p = \nu C_p \Delta T$

$Q_{12} = \frac{p_1V_1}{RT_1} \cdot 3{,}5R \cdot (T_2 - T_1)$

$Q_{12} = 3{,}5 \cdot \frac{p_1V_1}{T_1} \cdot \left(\frac{T_1}{10} - T_1\right) < 0$

$|Q_{12}| = 3{,}5 \cdot \frac{p_1V_1}{T_1} \cdot \left(T_1 - \frac{T_1}{10}\right) = 3{,}5 \cdot \frac{p_1V_1}{T_1} \cdot \frac{9T_1}{10} = 3{,}15\, p_1V_1$

2→3 : izocoră

$Q_v = \nu C_v \Delta T$

$Q_{23} = \frac{p_1V_1}{RT_1} \cdot 2{,}5R \cdot (T_3 - T_2)$

$Q_{23} = 2{,}5 \cdot \frac{p_1V_1}{T_1} \cdot \left(\frac{5}{2}\frac{T_1}{} - \frac{T_1}{10}\right) > 0$

$Q_{23} = 2{,}5 \cdot \frac{p_1V_1}{T_1} \cdot \frac{4T_1}{10} = p_1V_1$

3→1 : liniară

$Q = \Delta U + L$

$Q_{31} = (\Delta U)_{31} + L_{31}$

$(\Delta U)_{31} = \frac{i}{2} \nu R \Delta T_{31} = \frac{5}{2} \cdot \frac{p_1V_1}{RT_1} \cdot R \cdot \left(T_1 - \frac{T_1}{2}\right) =$

$= \frac{5}{2} \cdot \frac{p_1V_1}{T_1} \cdot \frac{T_1}{2} = 1{,}25\, p_1V_1$

$L_{31} = A_{trapez}$

$L_{31} = \frac{(5p_1 + p_1) \cdot \left(V_1 - \frac{V_1}{10}\right)}{2} = \frac{6p_1 \cdot \frac{9V_1}{10}}{2} = 2{,}7\, p_1V_1$

$Q_{31} = 1{,}25\, p_1V_1 + 2{,}7\, p_1V_1 = 3{,}95\, p_1V_1 > 0$

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3.

c) $Q_p = Q_{23} + Q_{31}$ -1

$Q_p = p_1 V_1 + 3{,}95\, p_1 V_1 = 4{,}95\, p_1 V_1 = ?$ numeric?

$|Q_c| = |Q_{12}| = 3{,}15\, p_1 V_1$; $Q_c = -3{,}15\, p_1 V_1 = ?$ numeric?

d) $\eta = ?$

$\eta = 1 - \frac{|Q_c|}{Q_p}$

$\eta = 1 - \frac{3{,}15\, p_1 V_1}{4{,}95\, p_1 V_1} = 1 - 0{,}63 = 0{,}37 = 37\,\%$

$\eta_C = 1 - \frac{T_r}{T_c}$

$T_r = T_2 = \frac{T_1}{10}$ 1

$T_c = T_1$

$\eta_C = 1 - \frac{\frac{T_1}{10}}{T_1} = 1 - \frac{T_1}{10} \cdot \frac{1}{T_1} = 0{,}9 = 90\,\%$

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