



Să se rezolve LA ALEGERE 2 din cele 4 PROBLEME propuse:

**Problema 1. Feladat**

**a) (15 p)**

Conservare impuls/Impulzusmegmaradás:

$$0 = mv - Mv_1$$

Energia pierdută prin recul/A puska visszalökődése miatt elveszett energia:

$$E_{rec} = \frac{Mv_1^2}{2},$$

energia generată de explozie/ Elsüléskor felszabadult:

$$E_{tot} = \frac{Mv_1^2}{2} + \frac{mv^2}{2}$$

Deci/Így:

$$R = \frac{E_{rec}}{E_{tot}} = \frac{\frac{Mv_1^2}{2}}{\frac{Mv_1^2}{2} + \frac{mv^2}{2}} = \frac{Mv_1^2}{Mv_1^2 + mv^2} = \frac{Mv_1^2}{Mv_1^2 + \frac{(mv)^2}{m}} = \frac{Mv_1^2}{Mv_1^2 + \frac{(Mv_1)^2}{m}} = \frac{m}{M+m} = 0.01$$

**b) (15 p)**

Teorema variației energiei mecanice (variația energiei mecanice este lucrul mecanic al forțelor neconservative) / Az anyagi pont teljes mechanikai energiájának változása egyenlő a súrlódási erő munkájával:

$$0 - \frac{Mv_1^2}{2} = -\mu Mgd \Rightarrow v_1^2 = 2\mu gd \Rightarrow v_1 = \sqrt{2\mu gd} = 4 \text{ ms}$$

$$v = \frac{Mv_1}{m} = 396 \text{ ms}$$

**c) (15 p)**

Din conservarea energiei și a impulsului, viteza talerului va fi egală cu  $v$ . / Impulzus- és energiamegmaradás miatt a tányér kezdeti sebessége szintén  $v$ .

Conservarea energiei mecanice/ A rugó összenyomásakor felírható az energiamegmaradás:

$$\frac{mv^2}{2} = k \frac{x^2}{2} \Rightarrow k = \frac{mv^2}{x^2}$$

**Problema 2. Feladat**

**a) (10 p)**

$$T_B = T_A = 600 \text{ K}, T_C = T_A/2 = 300 \text{ K},$$

$$\rho_B = \rho_A/2 = 0.5 \text{ kg/m}^3, \rho_C = \rho_A/2 = 0.5 \text{ kg/m}^3:$$

$$\frac{p_A V_A^2}{T_A} = \frac{p_C V_C^2}{T_C} \Rightarrow T_C = T_A \frac{V_A}{V_C} = \frac{T_A}{2} = 300 \text{ K}$$

$$\rho_B = \frac{M}{V_B} \Rightarrow \rho_B = \rho_A \frac{V_A}{V_B} = \frac{\rho_A}{2} = 0.5 \text{ kg/m}^3$$

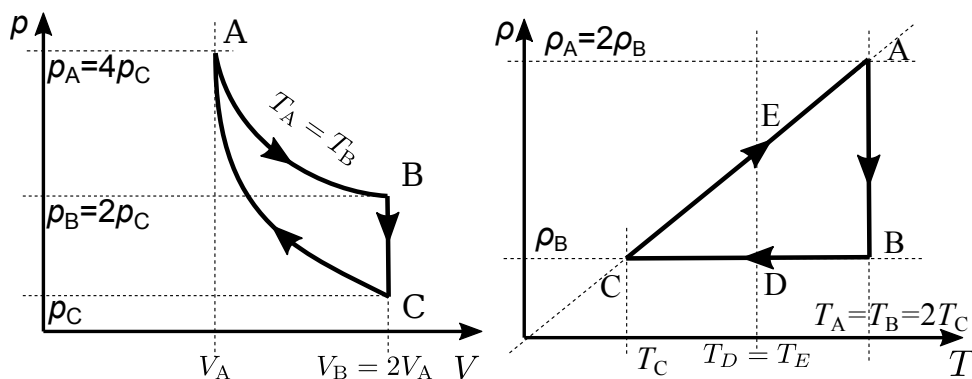
$$\rho_C = \frac{M}{V_C} \Rightarrow \rho_C = \rho_B = 0.5 \text{ kg/m}^3$$

b) (10 p)

AB:  $T = \text{const.}$ , BC:  $\rho = \text{const.}$ , CA:  $\rho \propto T$ :

$$pV^2 = \text{const.} \Rightarrow VT = \text{const.} \Rightarrow \rho = \frac{M}{V} \propto T$$

$$\frac{pV}{T} = \text{const.}$$



c) (15 p)

$T_E = T_D \Rightarrow \rho_D = \rho_B = 0.5 \text{ kg/m}^3$ ,  $\rho_E = \frac{3}{2}\rho_C = 0.75 \text{ kg/m}^3$ :

$$\begin{aligned} \rho_E &= aT_E \\ \rho_C &= aT_C \end{aligned} \Rightarrow \rho_E = \frac{3}{2}\rho_C = 0.75 \text{ kg/m}^3$$

d) (10 p)

$Q_{CA} = \Delta U_{CA} + L_{CA} > 0$ :

$$\Delta U_{CA} = \frac{i}{2}\nu R(T_A - T_C) = \frac{3}{4}\nu RT_A$$

$$|L_{CA}| < |L_{AB}| = \nu RT_A \ln\left(\frac{V_B}{V_A}\right) = \nu RT_A \ln 2$$

$$Q_{CA} = \Delta U_{CA} + L_{CA} = \Delta U_{CA} - |L_{CA}| > \Delta U_{CA} - |L_{AB}| = \nu RT_A \left(\frac{3}{4} - \ln 2\right) > 0$$

**Problema 3. Feladat**

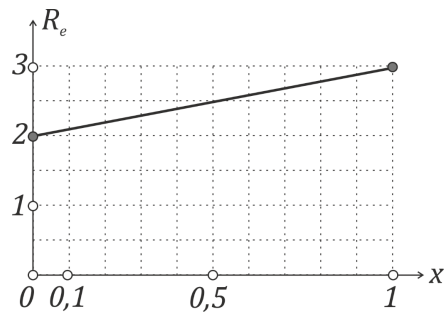
a) (10 p)

$$R_1 \parallel R_2 \Rightarrow R_{12} = \frac{R_1 R_2}{R_1 + R_2} \Rightarrow R_{12} = \frac{3\Omega \cdot 6\Omega}{3\Omega + 6\Omega} = 2\Omega$$

b) (15 p)

$$R_e = R_{12} + R_{AC}; R_{AC} = k \cdot x; \Rightarrow R_e = R_{12} + k \cdot x$$

$$R_{AB} = R = k \cdot l \Rightarrow k = \frac{R}{l} \Rightarrow R_e = R_{12} + \frac{R}{l}x$$



$$R = 1\Omega; l = 1 \text{ m}; k = 1\Omega/\text{m} \Rightarrow R_e = 2 + 1 \cdot x, x \in [0, 1]$$

c) (10 p)

$$I = \frac{R}{r + R_e}$$

$$C \rightarrow A : x = 0; R_e = R_{12} \Rightarrow I_A = \frac{E}{r + R_{12}}$$

$$C \rightarrow B : x = l; R_e = R_{12} + R \Rightarrow I_B = \frac{E}{r + R_{12} + R}$$

$$r = \frac{I_B}{I_A - I_B} R - R_{12}$$

d) (10 p)

$$I_1 R_1 = I_2 R_2 = I R_{12}$$

$$I_1 = I \frac{R_{12}}{R_1}$$

$$I_2 = I \frac{R_{12}}{R_2}$$

$$\frac{I_1}{I_2} = \frac{R_2}{R_1} \neq f(x)$$

**Problema 4. Feladat**

a) (13 p)

$$p_1 = -20 \text{ cm}$$

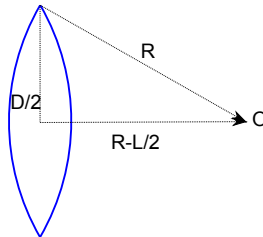
$$\gamma = \frac{y_2}{y_1} = \frac{-p_2}{p_1} \Rightarrow p_2 = -p_1 \Rightarrow p_2 = 20 \text{ cm}$$

$$\frac{1}{p_2} - \frac{1}{p_1} = \frac{1}{f} \Rightarrow f = \frac{p_1 p_2}{p_1 - p_2} = 10 \text{ cm}$$

$p_2 > 0 \Rightarrow$  imagine formată este reală/ valós kép keletkezik

b) (12 p)

$$\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right); R_1 = R; R_2 = -R \Rightarrow \frac{1}{f} = \frac{2(n-1)}{R} \Rightarrow R = 2(n-1)f = 10 \text{ cm}$$



$$\left(R - \frac{L}{2}\right)^2 = R^2 - \frac{D^2}{4} \Rightarrow L = 2\left(R - \sqrt{R^2 - \frac{D^2}{4}}\right) = 0.404 \text{ cm}$$

c) (10 p)

$$\gamma = -2 = \frac{p'_2}{p'_1} \Rightarrow p'_2 = -2p'_1$$

$$\frac{1}{p'_2} - \frac{1}{p'_1} = \frac{1}{f} \Rightarrow 1 - \frac{1}{2p'_1} - \frac{1}{p'_1} = \frac{1}{f} \Rightarrow p'_1 = -\frac{3f}{2} = -15 \text{ cm}$$

Trebuie sa mutam lentila spre obiect cu 5 cm / A lencsét a tárgy fele kell mozdítani 5 cm-el.

d) (10 p)

$$R' = 2(n' - 1)f = 14 \text{ cm}$$

$$L' = 2\left(R' - \sqrt{R'^2 - \frac{D^2}{4}}\right) = 0.287 \text{ cm}$$