Barem / Javítókulcs:

Problema 1. Feladat

a) (10 p)

$$-v_{max} = -g\Delta t_1 \Rightarrow \Delta t_1 = \frac{v_{max}}{g} = 5\ s$$

$$h_1 = H - \frac{g\Delta t_1^2}{2} = 125\ m$$

$$\Delta h_1 = H - h_1 = 125\ m$$

b) (15 p)

$$0 = -v_{max} + a\Delta t_2 \Rightarrow a = \frac{v_{max}}{\Delta t_2}$$

$$0 = h_1 - v_{max}\Delta t_2 + \frac{a\Delta t_2^2}{2} = h_1 - v_{max}\Delta t_2 + \frac{v_{max}\Delta t_2^2}{2\Delta t_2} \Rightarrow$$

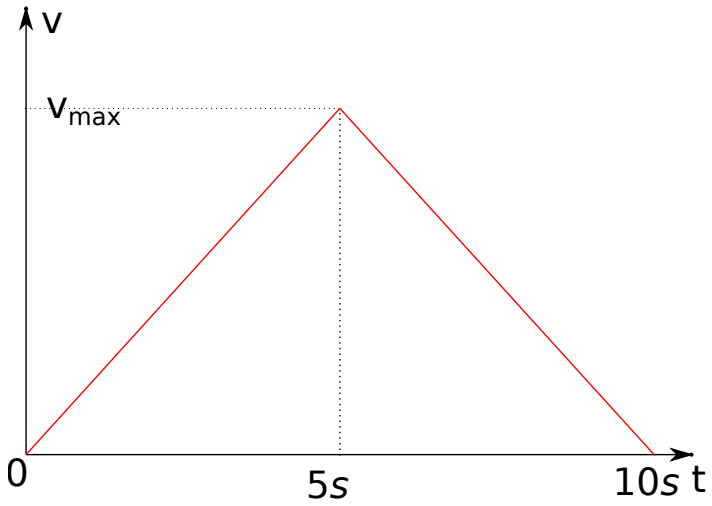
$$h_1 = \frac{v_{max}\Delta t_2}{2} \Rightarrow \Delta t_2 = \frac{2h_1}{v_{max}} = 5\ s$$

c) (10 p)

$$a = \frac{v_{max}}{\Delta t_2} = 10m/s^2$$

$$ma = F_f - mg \Rightarrow F_f = m(a+g) = 1000N$$

d) (10 p)



Problema 2. Feladat

a) (15 p) Din echilibrul fortelor ce actioneaza asupra pistonului / A dugattyura hato erok egyensulyabol

$$(p_0 + \Delta p)S = mp + p_0 S \Rightarrow \Delta p = \frac{mg}{S} = 3kPa$$

$$p_i = p_0 + \Delta p = 103kPa$$

$$p_i V_0 = \nu_i R T_0 \Rightarrow \nu_i = \frac{p_i V_0}{R T_0} \simeq 0.041mol$$

b) (10 p) Transformare izobara / izobar atalakulas

$$\frac{V_0}{T_0} = \frac{V_1}{T_1} \Rightarrow T_1 = \frac{V_1}{V_0} T_0 = 1,5 T_0 = 450K$$

c) (10 p)

$$C_p = C_V + R = \frac{7}{2}R$$

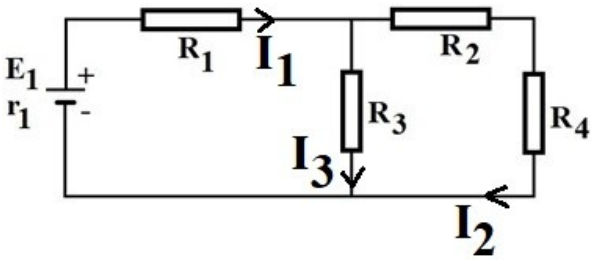
$$Q = \nu_i C_p \Delta T = \nu_i C_p (T_1 - T_0) = \frac{p_i V_0}{RT_0} \frac{7R}{2} \frac{T_0}{2} = \frac{7}{4} p_i V_0 = 180,25J$$

d) (10 p) Din cauza incalzirii lente pistonul nu “sare” din vas / a lassu melegites miatt a dugattyu az edeny tetejen marad.

$$p_i V_{max} = \nu_f R T_2 \Rightarrow \nu_f = \frac{p_i V_{max}}{RT_2} \simeq 0,031mol$$

Problema 3. Feladat

a) (15p)



$$R_{24}=R_2+R_4=3k$$

$$R_{234}=\frac{R_3\cdot R_{24}}{R_3+R_{24}}=1.5k$$

$$R_{ext}=R_1+R_{234}=R_1+\frac{R_3\cdot\left(R_2+R_4\right)}{R_3+R_2+R_4}=2.45k$$

$$I_1=\frac{E_1}{R_{tot}}=\frac{E_1}{r_1+R_{ext}}=1.8mA$$

b) (10p)

$$U_1=I_1\cdot\left(R_1+r_1\right)=\frac{E_1\cdot\left(R_1+r_1\right)}{R_{tot}}$$

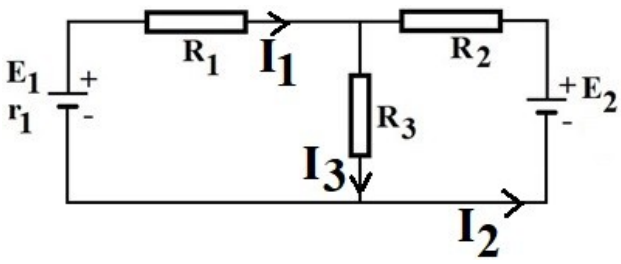
$$U_3=E_1-U_1=E_1\cdot\left(1-\frac{R_1+r_1}{R_{tot}}\right)=2.7V$$

$$W_3=\frac{U_3^2}{R_3}\cdot t=8.748J$$

c) (10p)

$$\eta=\frac{L_u}{L_t}=\frac{R_{ext}\cdot I_1^2\cdot t}{R_{tot}\cdot I_1^2\cdot t}=\frac{R_{ext}}{R_{tot}}=0.98=98\%$$

d) (10p)



Din legile lui Kirchhoff:

$$E_1 = I_1 \cdot (r_1 + R_1) + I_3 \cdot R_3$$

$$E_2 = I_2 \cdot R_2 + I_3 \cdot R_3$$

$$I_1 = I_3 - I_2$$

Găsim:

$$E_1 = I_3 \cdot (r_1 + R_1 + R_3) - I_2 \cdot (r_1 + R_1)$$

$$I_2 = \frac{E_2 - I_3 \cdot R_3}{R_2}$$

De unde:

$$E_1 = I_3 \cdot (r_1 + R_1 + R_3) - \frac{E_2 - I_3 \cdot R_3}{R_2} \cdot (r_1 + R_1)$$

Deci:

$$I_3 = \frac{E_1 \cdot R_2 + E_2 \cdot (r_1 + R_1)}{r_1 \cdot (R_2 + R_3) + R_1 \cdot R_2 + R_2 \cdot R_3 + R_1 \cdot R_3} = 0.954\, mA$$

Problema 4. Feladat

a) (10 p) $\gamma = -1/3; f = 15$ cm

$$\gamma = \frac{p_2}{p_1} \Rightarrow p_2 = \gamma p_1$$

$$\frac{-1}{p_1} + \frac{1}{p_2} = \frac{1}{f} = \frac{-1}{p_1} + \frac{1}{\gamma p_1} \Rightarrow p_1 = f\frac{1-\gamma}{\gamma} = -60cm$$

$$p_2 = \gamma p_1 = 20cm$$

Distanta obiect-imagine/ targy-kep tavolsag:

$$D = p_2 - p_1 = 80cm$$

b) (10 p) $p_1' = 64cm; y_1 = 1mm$

$$\frac{-1}{p_1'} + \frac{1}{p_2'} = \frac{1}{f} \Rightarrow p_2' = \frac{p_1' f}{p_1' + f} \simeq 19,6cm$$

$$D' = p_2' - p_1' = 83,6cm \Rightarrow$$

Imaginea se deplaseaza cu 3,6 cm crescand distanta obiect-imaginea / A keletkezo kep 3,6 cm-t mozdul el novelve a targy-kep tavolsagot.

$$y_2' = \frac{p_2'}{p_1'} y_1 = -0.30625mm$$

c) (10 p) $p_2'' = 16cm$

$$p_1'' = \frac{p_2'' f}{f - p_2''} = -240cm$$

Obiectul trebuie indepartat de lintila cu $p_1' - p_1'' = 176cm$ / Novelnunk kell a targy-lencse tavolsagot $p_1' - p_1'' = 176cm$-el.

d) (15 p) $\gamma^u = -1/2; p_1^u = -60$ cm

$$p_2^u = \gamma^u p_1^u = 30cm$$

$$f^u = \frac{p_2^u p_1^u}{p_1^u - p_2^u} = 20cm$$

$$\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right); \frac{1}{f^u} = (n_r - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \Rightarrow$$

$$\frac{f^u}{f} = \frac{n-1}{n_r - 1} \Rightarrow n_r = \frac{f}{f^u}(n-1) + 1 = 1,3$$

$$n_r = \frac{n}{n^u} \Rightarrow n^u = \frac{n}{n_r} = \frac{1,4}{1,3} \simeq 1,077$$