Barem / Javítókulcs:

Problema 1. Feladat

a) (12 p) Conservare de moment cinetic in sistemul de referinta atasat pe mal / impulzusmegmaradás a parthoz rendelt koordinátarendszerben

$$(M+m)v = mv_{om} + Mv_{ba}$$

$$v_{ba} = 0 \Rightarrow v_{om} = \frac{M+m}{m}v = 10 \text{ m/s}$$

b) (10 p)

$$\Delta E = E_{final} - E_{initial} = \frac{mv_{om}^2}{2} - \frac{(M+m)v^2}{2} = 2400 \text{ J}$$

c) (11 p)

$$0 = v_0 - gt_{urcare} \Rightarrow t_{urcare} = \frac{v_0}{g} = 10 \text{ s}$$

$$t_{urcare} = t_{coborare} \Rightarrow t_{total} = 2t_{urcare} = 20 \text{ s}$$

d) (12 p)

$$F_{total} = F_{frecare} - m_{gl}g \Rightarrow F_{frecare} = F_{total} + m_{gl}g$$

$$\Delta E = \frac{m_{gl}v_0^2}{2} = F_{total}\Delta h \Rightarrow F_{total} = \frac{m_{gl}v_0^2}{2\Delta h} = 500 \text{ N}$$

$$F_{frecare} = F_{total} + m_{gl}g = 500,1 \text{ N}$$

Problema 2. Feladat

a) (10 p)

$$U_2 = \nu_2 C_V T_0$$

Nu se modifică energia internă deoarece nici nu_2 nici T_0 nu se schimbă/ Nem változik a belső energia, mivel sem a gaz mennyisége sem hőmérséklete nem változik.

b) (15 p)

$$p_i V_1 = \nu_1 R T_0; \quad p_i V_2 = \nu_2 R T_0 \Rightarrow \frac{\nu_1}{\nu_2} = \frac{V_1}{V_2} = \frac{5}{3}$$

$$p_f V_1' = \frac{3\nu_1}{5} R T_0; \quad p_f V_2' = \nu_2 R T_0 \Rightarrow \frac{V_1'}{V_2'} = \frac{3\nu_1}{5\nu_2} = 1$$

$$V_1' + V_2' = V_1 + V_2 = 8 \text{ l} \Rightarrow V_2' = 4 \text{ l} \Rightarrow$$

$$\Delta V_2 = V_2' - V_2 = 1 \text{ l}$$

c) (5 p)

$$V_1' = V_2' = S \cdot l \Rightarrow l = \frac{V_2'}{S} = \frac{4 \text{ dm}^3}{1 \text{ dm}^2} = 4\text{dm} = 40 \text{ cm}$$

Peretele se va stabili în mijlocul vasului cilindric, la 40 cm față de fundul vasului. / Az fal az edény közepén, annak aljától 40 cm-re áll meg.

d) (15 p)

$$p_i V_2 = p_f V_2' \Rightarrow p_f = \frac{V_2}{V_2'} p_i$$

$$\frac{\Delta p}{p_i} = \frac{p_f - p_i}{p_i} = \frac{V_2 - V_2'}{V_2'} = \frac{-1}{4}$$

Presiunea gazului scade cu 25% / a gáz nyomása 25%-al csökken.

Problema 3. Feladat

a) (10 p)

$$I_1 = \frac{E}{R_1 + R_4} = 1 \text{ A}$$

$$I_2 = \frac{E}{R_2 + R_3} = 1 \text{ A}$$

$$I = I_1 + I_2 = 2 \text{ A}$$

$$U_4 = I_1 R_4 = \frac{E R_4}{R_1 + R_4} = 4 \text{ V}$$

$$U_3 = I_2 R_3 == \frac{E R_3}{R_2 + R_3} = 3 \text{ V}$$

$$U = U_4 - U_3 = E\left(\frac{R_4}{R_1 + R_4} - \frac{R_3}{R_2 + R_3}\right) = 1 \text{ V}$$

b) (10 p)

$$\frac{1}{R_{ech}} = \frac{1}{R_1 + R_4} + \frac{1}{R_2 + R_3} \Rightarrow R_{ech} = \frac{(R_1 + R_4)(R_2 + R_3)}{R_1 + R_2 + R_3 + R_4} = 2,5 \ \Omega$$

c) (15 p)

$$P_3 = I_2^2 R_3 = 3 \text{ W}$$

$$P_4 = I_1^2 R_4 = 4 \text{ W}$$

$$\frac{P_3}{P_4} = \frac{3}{4}$$

d) (10 p)

$$U = E\left(\frac{R_4}{R_1 + R_4} - \frac{R_3}{R_2 + R_3}\right) \Rightarrow$$

$$\left(\frac{U}{E} + \frac{R_3}{R_2 + R_3}\right) R_1 = R_4\left(1 - \frac{U}{E} - \frac{R_3}{R_2 + R_3}\right) \Rightarrow$$

$$R_4 = \frac{\left(\frac{U}{E} + \frac{R_3}{R_2 + R_3}\right)}{\left(1 - \frac{U}{E} - \frac{R_3}{R_2 + R_3}\right)} R_1 = \frac{4,1}{0,9} = 4,(5) \ \Omega \Rightarrow$$

$$\Delta R_4 = 0,(5) \ \Omega$$

Problema 4. Feladat

a) (10 p)

$$\frac{1}{f_1} = \frac{n-1}{R} \Rightarrow f_1 = \frac{R}{n-1} = \frac{15}{0,5} = 30 \text{ cm}$$

b) (10 p)

$$\frac{1}{F} = \frac{1}{f_1} + C_2 \Rightarrow F = \frac{f_1}{1 + f_1 C_2} = \frac{30 \text{ cm}}{1 - 2 \cdot 0,3} = 75 \text{ cm}$$

c) (10 p)

$$p_2 = -p_1; \quad \frac{1}{p_2} - \frac{1}{p_1} = \frac{1}{F} \Rightarrow p_1 = -2F = -150 \text{ cm}$$

d) (15 p)

$$\frac{1}{f'} = (n_0 - 1)\left(\frac{1}{-R} - \frac{1}{R}\right) = \frac{-2(n_0-1)}{R} \Rightarrow f' = \frac{-R}{2(n_0-1)} = -22,6 \text{ cm}$$

$$\frac{1}{F'} = \frac{1}{f_1} + \frac{1}{f_1} + \frac{1}{f'} \Rightarrow F' = \frac{f_1 f'}{2f' + f_1} = 45 \text{ cm}$$

$$p_1 = -150 \text{ cm}; \frac{1}{F'} = \frac{1}{p_2} - \frac{1}{p_1} \Rightarrow p_2 = \frac{F' p_1}{F' + p_1} = 64,28 \text{ cm}$$