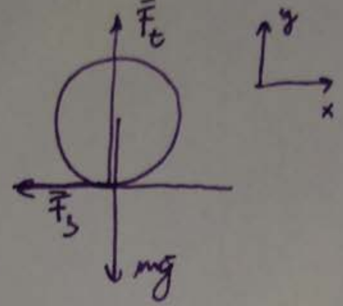
① a)



$\sum \bar{F} = m\bar{a}_{TKP}$

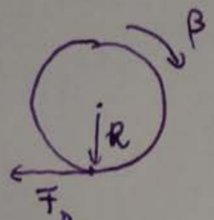
$\hookrightarrow \sum F_y = m a_y = 0 \quad F_t = mg$

$\hookrightarrow \sum F_x = m a_x \Rightarrow -F_s = ma$

$F_s = \mu F_t = \mu m g \Rightarrow \boxed{a_{TKP} = -\mu g}$

b) $v_{(t)} = v_0 + a t = \boxed{v_0 - \mu g t}$

c)



$\sum M = \Theta \beta$

$F_s \cdot R = \frac{2}{5} m R^2 \cdot \beta$

$\mu m g R = \frac{2}{5} m R^2 \cdot \beta \Rightarrow \boxed{\beta = \frac{5}{2} \frac{\mu g}{R}}$

d) $\omega_{(t)} = \beta \cdot t = \boxed{\frac{5}{2} \frac{\mu g}{R} \cdot t}$

e) Tiszta gördülés: $v(t_t) = \omega(t_t) \cdot R$

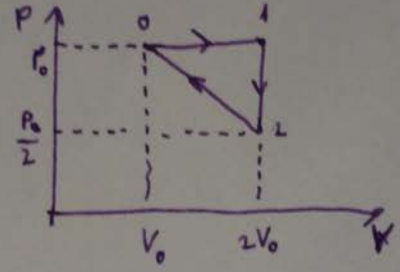
$v_0 - \mu g t_t = \frac{5}{2} \frac{\mu g}{R} \cdot t_t \cdot R \Rightarrow v_0 = \frac{7}{2} \mu g t_t$

$\boxed{t_t = \frac{2}{7} \frac{v_0}{\mu g}}$

f) $v_{(t_t)} = v_0 - \mu g t_t = v_0 - \mu g \cdot \frac{2}{7} \frac{v_0}{\mu g} = v_0 - \frac{2}{7} v_0 = \boxed{\frac{5}{7} v_0}$

② a) $P_0 V_0 = n R \cdot T_0 \Rightarrow \boxed{n = \frac{P_0 V_0}{R T_0}}$

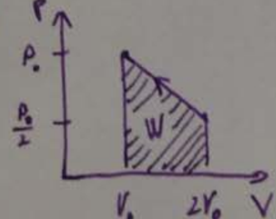
b)



c) $P_2 V_2 = n R T_2 \qquad T_2 = ?$

$\frac{P_0}{2} \cdot 2V_0 = n R \cdot T_2 \Rightarrow P_0 V_0 = \frac{P_0 V_0}{R T_0} \cdot R T_2 \Rightarrow \boxed{T_2 = T_0}$

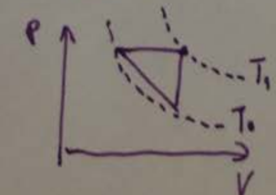
d)



$W = -\frac{\frac{P_0}{2} + P_0}{2} \cdot V_0 = \boxed{-\frac{3}{4} P_0 V_0}$

A gáz térfogata csökken, a környezet végez munkát a gázon.

e) E_{max}, ha $T = max \Rightarrow$ 1. állapot.



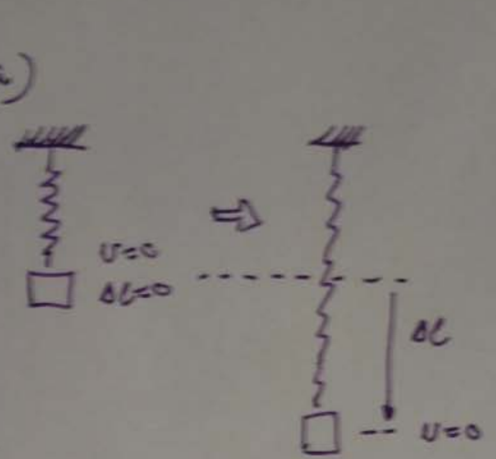
$T_1 = ? \qquad P_1 V_1 = n R T_1$

$P_0 \cdot 2V_0 = \frac{P_0 V_0}{n R} \cdot R T_1 \Rightarrow T_1 = 2 T_0$

$E_b = \frac{3}{2} n R T_1 = \frac{3}{2} \cdot \frac{P_0 V_0}{n R} \cdot R \cdot 2 T_0 = \boxed{3 P_0 V_0}$

③

a) Mech. energia megmaradás

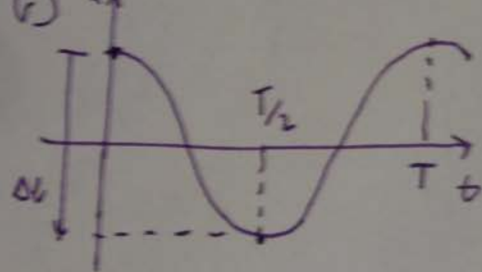


$$\frac{1}{2}m\cdot 0^2+\frac{1}{2}k\cdot 0^2+mg\cdot 0=\frac{1}{2}m\cdot 0^2+\frac{1}{2}k\Delta l^2-mg\Delta l$$

$$mg\Delta l=\frac{1}{2}k\cdot\Delta l^2$$

$$\boxed{\Delta l=\frac{2mg}{k}}$$

b)



$$2A=\Delta l \Rightarrow \boxed{A=\frac{mg}{k}}$$

c) $t=\frac{T}{2}$ $\quad T=2\pi\sqrt{\frac{m}{k}}$ $\quad \boxed{t=\pi\sqrt{\frac{m}{k}}}$

d)

$$x_{(t)}=A\cos(\omega t)=\boxed{\frac{mg}{k}\cos\left(\sqrt{\frac{k}{m}}\cdot t\right)}$$

e) $a_{(t)}=\ddot{x}_{(t)}=-A\omega^2\cos(\omega t)$ $\quad a_{max}=A\omega^2$

$a_{max}=\frac{mg}{k}\cdot\frac{k}{m}=\boxed{g}$ a pálya legalsó és legfelső pontján

f) $v_{(t)}=\dot{x}_t=-A\omega\sin(\omega t)$ $\quad v_{max}=A\omega=\frac{mg}{k}\cdot\sqrt{\frac{k}{m}}=g\sqrt{\frac{m}{k}}$

$$E=\frac{1}{2}mv_{max}^2=\frac{1}{2}m\cdot g^2\cdot\frac{m}{k}=\boxed{\frac{m^2g^2}{2k}}$$