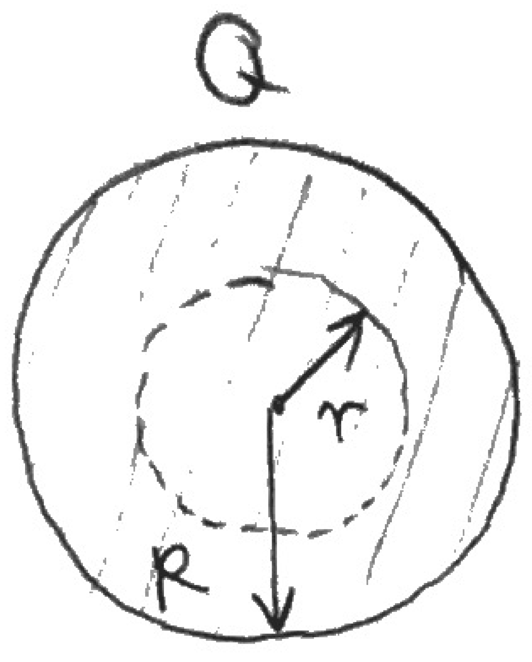
Pót ZH megoldások

1.)



A gömb töltéssűrűsége: $\varrho = \dfrac{Q}{\frac{4\pi}{3} R^3}$.

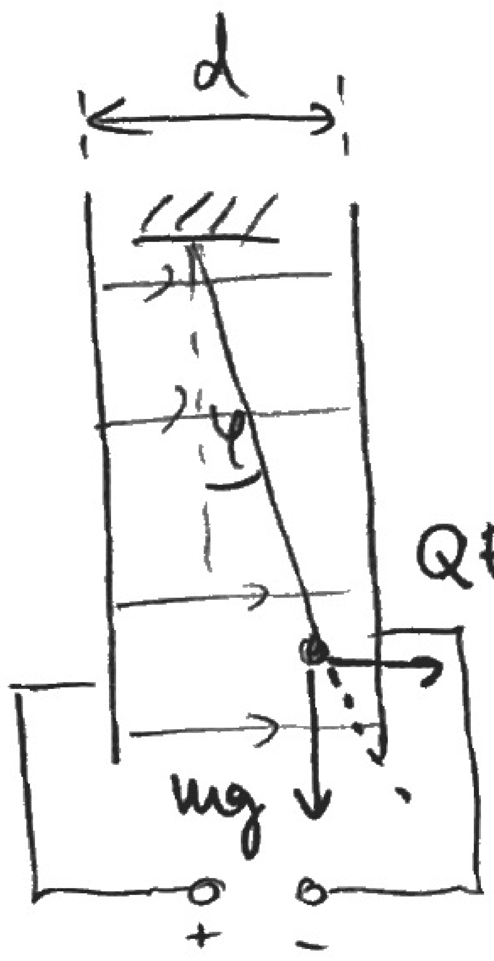
Gauss-törvény:

$$E \cdot 4\pi \cancel{r^2} = \frac{1}{\varepsilon_0} \cdot \frac{4\pi}{3} r^{\cancel{3}} \varrho \, ,$$

innen a térerősség:

$$E = \frac{1}{4\pi\varepsilon_0} \cdot \frac{Q}{R^3} \cdot r = 8992 \ V/m \approx 9 \ \frac{kV}{m}$$ (B)

2.)



$\tan\varphi = \dfrac{QE}{mg}$, ahol $E = \dfrac{U}{d}$.

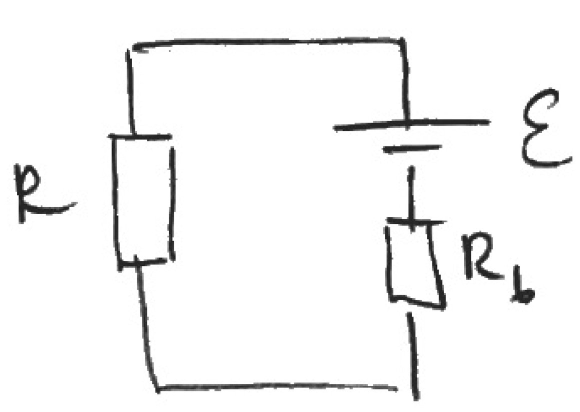
Ebből:

$$U = \frac{mg\,d}{Q} \tan\varphi = 25461 \ V \approx 25{,}5 \ kV$$ (C)

3.)

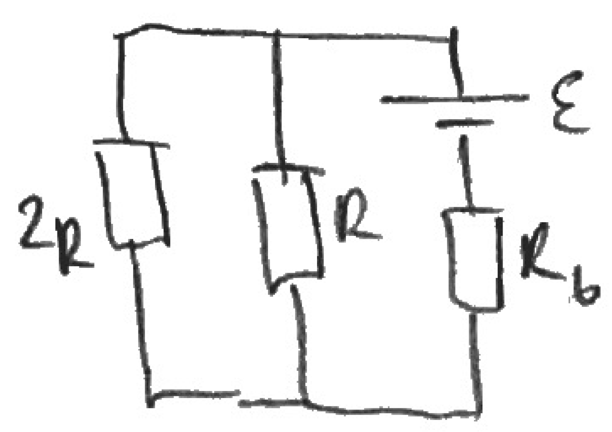
$$Q_1 = C_1 U \rightarrow Q_2 = \varepsilon_r C_1 U \rightarrow U' = \frac{Q_2}{C_1} = \varepsilon_r U = 3 \cdot 24 \ V = 72 V$$ (B)

4.)



$I_1 = \dfrac{\varepsilon}{R + R_b}$

nyitott



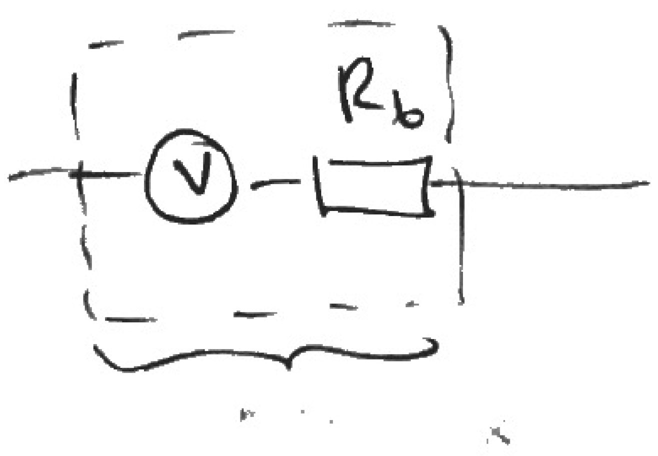
zárt

$I_2 = \dfrac{\varepsilon}{\frac{2R}{3} + R_b} \Rightarrow \dfrac{I_2}{I_1} = \dfrac{R + R_b}{\frac{2R}{3} + R_b}$

$$R_b = \frac{1 - \frac{2}{3}\frac{I_2}{I_1}}{\frac{I_2}{I_1} - 1} R$$

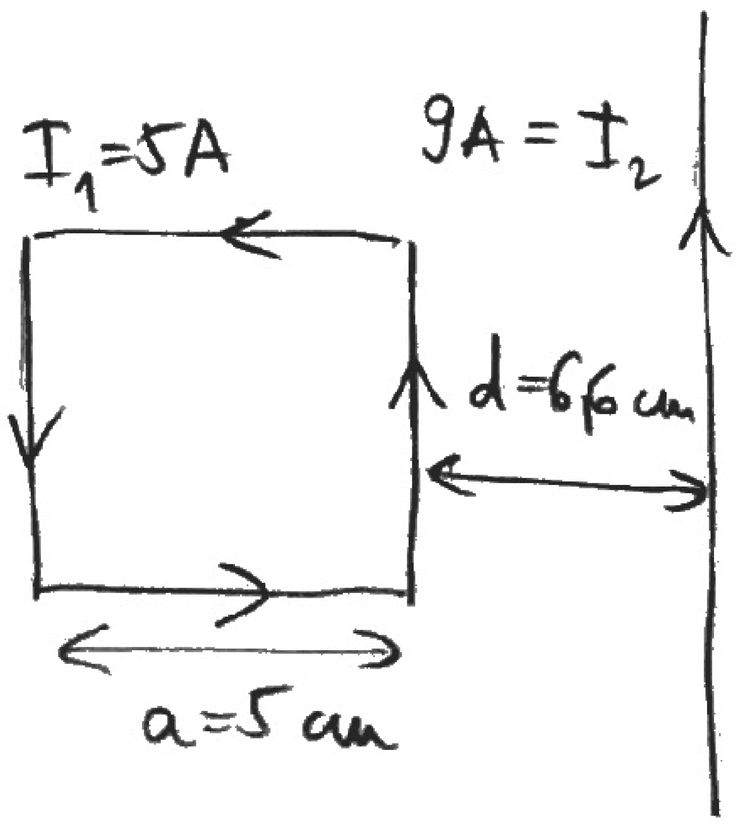
$$R_b = \frac{I_1 - \frac{2}{3} I_2}{I_2 - I_1} R = 0{,}495 \ \Omega \approx 0{,}5 \ \Omega$$ (A)

5.)



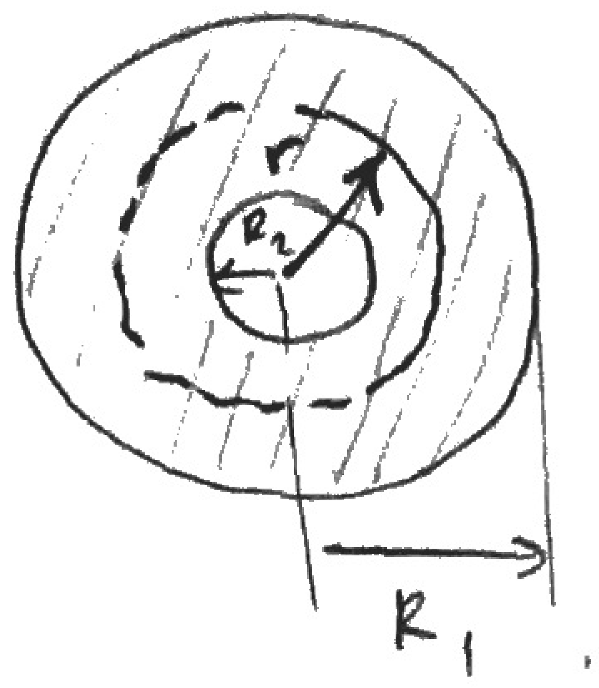
$$\left.\begin{aligned} I_{max} &= \frac{5 V}{800 \Omega} \\ I_{max} &= \frac{1000 V}{800 \Omega + R_x} \end{aligned}\right\} \quad R_x = \frac{800 \Omega \cdot 1000 V}{5 V} - 800 \Omega = 159 \ k\Omega$$ (B)

6.)



$$F = \frac{\mu_0 I_2 I_1 a}{2\pi} \left(\frac{1}{d} - \frac{1}{d+a} \right) = 2{,}94 \cdot 10^{-6} N$$ (A)

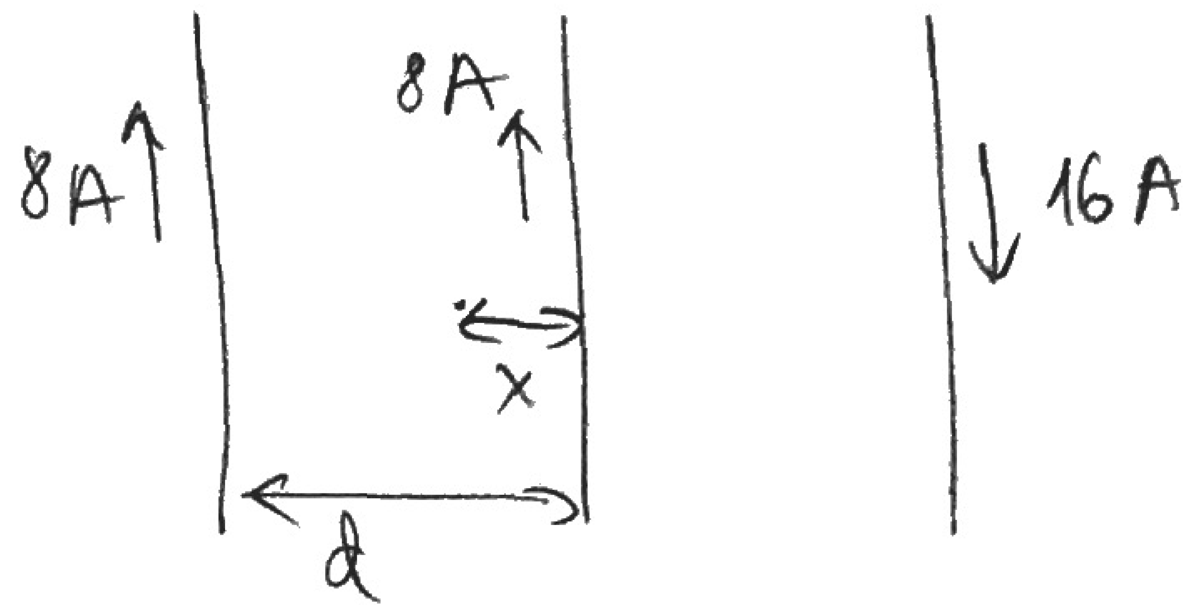
7.)



$j = \dfrac{I}{\pi(R_1^2-R_2^2)}$, Ampère-tv: $\mu_0 j \cancel{\pi}(r^2-R_2^2) = 2\cancel{\pi} r \cdot B$

$$B = \frac{\mu_0 I}{2\pi}\,\frac{r^2-R_2^2}{R_1^2-R_2^2}\cdot\frac{1}{r} = 5{,}56\cdot 10^{-6}\,T$$ C

8.)



$$\frac{1}{d-x} - \frac{1}{x} + \frac{2}{d+x} = \emptyset \qquad /(d-x)(d+x)x$$

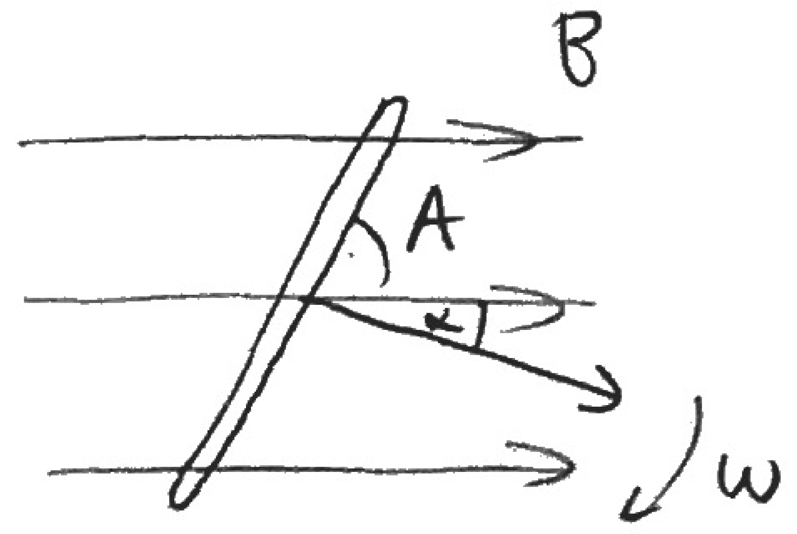
$$(d+x)x - d^2+x^2 + 2x(d-x) = \emptyset$$

$$xd + x^2 - d^2 + x^2 + 2xd - 2x^2 = \emptyset$$

$$3xd = d^2$$

$$x = d/3 = 2\,cm$$ B

9.)



$$\Phi(t) = BA\cos(\omega t)$$

$$U_i = -\frac{d\Phi}{dt} = BA\omega\sin(\omega t) = B a^2 \omega \sin(\omega t)$$

$$U_i(\alpha = 45^\circ) = \frac{\sqrt{2}}{2} B a^2 \omega = 0{,}25\ V$$ ~~D~~ C