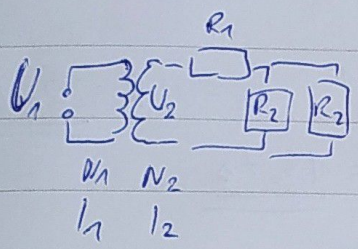
2. IZPIT - REŠITVE

① 

a) $\frac{U_1}{N_1} = \frac{U_2}{N_2} \rightarrow N_1 = \frac{U_1}{U_2} \cdot N_2 = \frac{230V}{12V} \cdot 21 = 403$ **5T**

b) $\frac{1}{R_{N1}} = \frac{1}{R_2} + \frac{1}{R_2} = \frac{2}{R_2} \rightarrow R_{N1} = \frac{R_2}{2} = R_1$

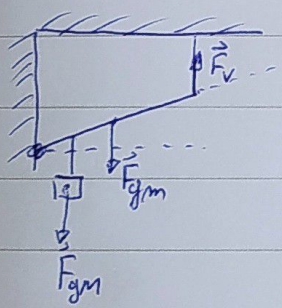
$R_N = R_1 + R_{N1} = 2R_1 = 2\Omega$ **5T**

c) $P_2 = U_2 I_2 = \frac{U_2^2}{R_N} = 72W$ **5T**

5T ZA VSE PRAVILNE ŠT. REZULTATE

d) $I_1 N_1 = I_2 N_2$

$I_1 = I_2 \frac{N_2}{N_1} = \frac{U_2}{R_N} \frac{N_2}{N_1} = 0,31A$ **5T**

② 

$\Sigma \vec{M} = 0$ **5T**

$\Sigma M = 0 = M_M + M_m + M_v$

$M_m = M \cdot g \cdot \frac{l}{4} \sin(90° - \alpha)$ **5T**

$M_m = mg \frac{l}{2} \sin(90° - \alpha)$ **5T**

$M_v = F_v \cdot l \cdot \sin(90° - \alpha)$ **5T**

$Mg \frac{l}{4} \sin(90° - \alpha) + mg \frac{l}{2} \sin(90° - \alpha) = F_v \cdot l \sin(90° - \alpha) \quad / : l \quad : \sin$

$F_V = \frac{1}{4} Mg + \frac{1}{2} mg = \underline{\underline{150N}} \quad (147N)$ **5T**

M = 40kg

m = 10kg

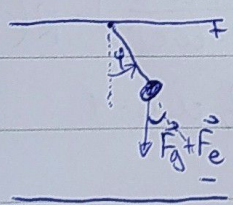
③ d = 0,2m

l = 0,1m

e = +3μAs

U = 20kV

m = 0,01kg



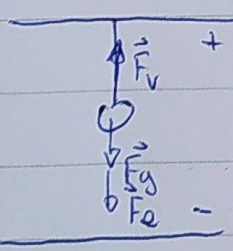
$M = -l \cdot (F_g + F_e) \cdot \sin\varphi \approx -l\left(mg + e\frac{U}{d}\right) \cdot \varphi$ **5T**

$M = J\ddot{\varphi} = -l\left(mg + e\frac{U}{d}\right)\varphi$

$\ddot{\varphi} + \frac{l\left(mg + e\frac{U}{d}\right)}{ml^2} \varphi = 0$ **5T**

$\omega = \sqrt{\frac{mg + e\frac{U}{d}}{ml}} = 20Hz$

$t_0 = \frac{2\pi}{\omega} = 0,31s$ **5T**



$F_v = F_g + F_e = mg + eE = mg + e\frac{U}{d} = 0,4N$

5T **5T**

④ $m = 1200\,kg$

$R = 10\,m$

$\omega_0 = 0\,s^{-1}$

$\omega(t_1 = 10\,s) = ?$

$t_2(N = 3) = ?$

a) $\alpha = 0{,}2\,s^{-2}$

$\omega(t) = \omega_0 + \alpha \cdot t, \quad \omega(t_1 = 10\,s) = 2\,s^{-1} \quad v_t = \omega \cdot R = 20\,m/s$ 5T

$\varphi(t) = \varphi_0 + \omega_0 t + \frac{\alpha t^2}{2} \rightarrow t_2 = \sqrt{\frac{2\varphi}{\alpha}} = 13{,}7\,s$ 5T

($\varphi_0 = 0$, $\omega_0 = 0$)

$N = 3 \dots \varphi = 3 \cdot 2\pi$

b) $P = 2\,kW$

$W_k(t) = P \cdot t \qquad \omega(10\,s) = 0{,}58\,s^{-1} \rightarrow v_t = \omega \cdot R = 5{,}8\,m/s$ 5T

$\frac{J\omega(t)^2}{2} = P \cdot t$ 5T

$\omega(t) = \sqrt{\frac{2Pt}{mR^2}}$

$\omega(t) = \frac{d\varphi}{dt}$

$d\varphi = \omega(t)\,dt' \quad / \int$

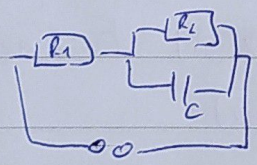
$\int_{\varphi_0}^{\varphi(t)} d\varphi = \int_0^t \omega(t')\,dt'$

$\varphi(t) = \sqrt{\frac{2P}{mR^2}} \int_0^t \sqrt{t}\,dt' = \sqrt{\frac{2P}{mR^2}} \cdot \frac{t^{3/2}}{\frac{3}{2}}$ 5T

$t^{3/2} = \frac{3}{2}\varphi(t) \cdot \sqrt{\frac{mR^2}{2P}}$

$t = \left(\frac{3}{2} \cdot 3 \cdot 2\pi \sqrt{\frac{mR^2}{2P}}\right)^{2/3} = 28{,}8\,s$

⑤ $\tau = RC$



$\frac{1}{Z_{N1}} = \frac{1}{R_2} + \frac{1}{\frac{1}{i\omega C}} = \frac{1 + i\omega RC}{R} \Rightarrow Z_{N1} = R\,\frac{1 - i\omega\tau}{1 + \omega^2\tau^2}$

U_g 5T

$Z_N = R_1 + Z_{N1} = R\left(1 + \frac{1 - i\omega\tau}{1 + (\omega\tau)^2}\right) = R\left(1 + \frac{1}{1 + \omega^2\tau^2} - i\,\frac{\omega\tau}{1 + \omega^2\tau^2}\right)$

$|Z_N| = R\sqrt{\left(1 + \frac{1}{1 + \omega^2\tau^2}\right)^2 + \left(\frac{\omega\tau}{1 + \omega^2\tau^2}\right)^2} = \frac{\sqrt{10}}{2} R = 1{,}58\,\Omega \quad \omega\tau = 1$

5T

$tg\,\delta = \frac{Im(Z_N)}{Re(Z_N)} = \frac{\frac{\omega\tau}{1 + \omega^2\tau^2}}{1 + \frac{1}{1 + \omega^2\tau^2}} = \frac{1/2}{3/2} \Rightarrow \delta = 18{,}4°$

b) $U_c = ? \quad U_c^0 e^{i(\omega t + \alpha)}$

$U_c = U_c^0 e^{i(\omega t + \delta)} e^{i\alpha}, \quad \alpha = ?$

$U_g - U_{R1} = U_c$ **5T**

$U_g - R \cdot I_g = U_c$

$U_g - R \cdot \frac{U_g}{Z_N} = U_c$

$U_c = U_g \left(1 - \frac{R}{Z_N}\right) = U_g \left(1 - \frac{R}{|Z_N|} e^{-i\delta}\right) = U_g \left(1 - \frac{R}{|Z_N|}(\cos\delta + i\sin\delta)\right)$

$U_c = U_g \underbrace{\left(1 - \frac{R}{|Z_N|}\cos\delta + i\frac{R}{|Z_N|}\sin\delta\right)}_{|\tilde{Z}|}$; $|\tilde{Z}| = \sqrt{\left(1 - \frac{R}{|Z_N|}\cos\delta\right)^2 + \left(\frac{R}{|Z_N|}\sin\delta\right)^2}$

$= 0{,}45$

$tg\alpha = \frac{\frac{R}{|Z_N|}\sin\delta}{1 - \frac{R}{|Z_N|}\cos\delta} = 0{,}50$, $\alpha = 26{,}6°$ **5T**

c)

$P_{R2} = \frac{U_c^\circ \cdot I_{R2}^\circ}{2} \cdot \underbrace{\cos\beta}_{1}$

$I_{R2}^\circ = \frac{U_c^\circ}{R_2}$ $\quad U_c^\circ = U_g^\circ \cdot 0{,}45 = 0{,}45\,V$

$P_{R2} = \frac{U_c^\circ \cdot U_c^\circ}{2R_2} = 0{,}1\,W$ **5T**