

1. Kondensatornetzwerk

$$C_1 = 450 \text{ nF}; \quad C_2 = 300 \text{ nF}; \quad C_3 = 600 \text{ nF}; \quad C_4 = 100 \text{ nF}; \quad U = 120 \text{ V}$$

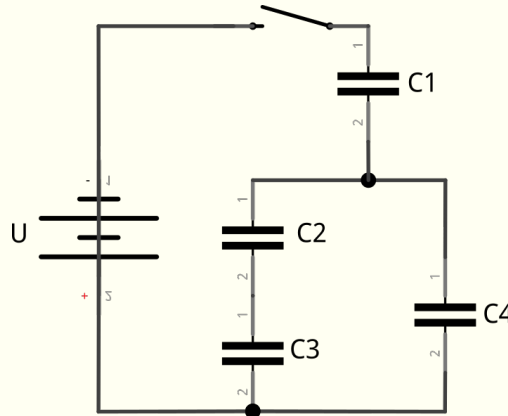
$$C_{ges} = \frac{c_1 \left(\frac{C_2 C_3}{C_2 + C_3} + C_4 \right)}{c_1 + \frac{C_2 C_3}{C_2 + C_3} + C_4} = 180 \text{ nF}$$

$$U_1 = U \frac{C}{C_1} = \underline{\underline{48 \text{ V}}}$$

$$U_2 = U_4 \frac{C_3}{C_3 + C_2} = \underline{\underline{48 \text{ V}}}$$

$$U_3 = U_4 \frac{C_2}{C_2 + C_3} = \underline{\underline{24 \text{ V}}}$$

$$U_4 = U - U_1 = \underline{\underline{72 \text{ V}}}$$



2. Wickelkondensator

$$k = \frac{1}{4\pi\epsilon_0}; \quad d = 2.0 \cdot 10^{-5} \text{ m}; \quad b = 0.02 \text{ m}; \quad C = 100 \text{ nF}; \quad \epsilon = 2.3$$

$$(a) \quad \omega = \sqrt{\frac{mgl}{I}}$$

$$I = \frac{1}{12} m(a^2 + h^2) + ml^2 = 0.12 \text{ kg m}^2$$

$$\omega_a = \sqrt{\frac{mgl}{I}} = \underline{\underline{6.37 \text{ rad/s}}}$$

$$(b) \quad F = -m\omega^2 x; \quad \Delta x = x_1 - x_2$$

3. Ladungsträger

(a) $r = 1.85 * 10^{-4} \text{ m}; \quad I = 1 \text{ A}$

$$n = \frac{N_A \rho_{Cu}}{M_{Cu}}$$

$$v_D = \frac{I}{ne\pi r^2} = \underline{\underline{2.75 * 10^{-3} \text{ m/s}}}$$

(b) $L = 10 \text{ m}$

$$t = \frac{L}{v} = \underline{\underline{3630.97 \text{ s}}}$$

(c) A constant Potential means a constant Electric field

(d) Drift velocity sinks when the conductor gets heated because a higher temperature means higher resistance. On a microscopic level this means that the electrons bump into more Obstacles and their path is more obstructed.

(e) $I = \frac{U}{R} = \frac{UA}{\rho L}$

i. $I_1 = \frac{UA}{\rho L}$

ii. $I_2 = \frac{3}{4} \frac{UA}{\rho L}$

iii. $I_3 = \frac{UA}{\rho L}$

$\Rightarrow \underline{\underline{I_2 < I_1 = I_3}}$

4. Ladungstransport

$$L = 1 \text{ m}; \quad d = 0.001 \text{ m}; \quad I = 1 \text{ A}$$

(a) $R = \frac{L}{\sigma_{el} A} = \frac{U}{I}; \quad \sigma_{el} = 6 * 10^7 \text{ } \Omega/\text{m}$

$$R = \frac{4L}{\sigma_{el} \pi d^2} = \underline{\underline{0.021 \text{ } \Omega}}$$

$$U = RI = \underline{\underline{0.021 \text{ V}}}$$

$$(b) \quad \rho = 9000 \text{ kg/m}^3; \quad M = 0.064 \text{ kg/mol}; \quad V = \frac{Ld^2\pi}{4}$$

$$n = \frac{\rho N_A V}{M} = 6.62 * 10^{22}$$

$$n_{el} = n = \underline{\underline{6.62 * 10^{22}}}$$

$$v_D = \frac{IL}{n_{ele}} = \underline{\underline{9.43 * 10^{-5} \text{ m/s}}}$$

$$(c) \quad \delta\omega = \omega_b - \omega_a$$

$$0 = \cos\left(\frac{1}{2}\delta\omega t\right)$$

$$t = \frac{2 \arccos(0)}{\delta\omega} = \underline{\underline{50.29 \text{ s}}}$$