

1. Kondensatornetzwerk

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

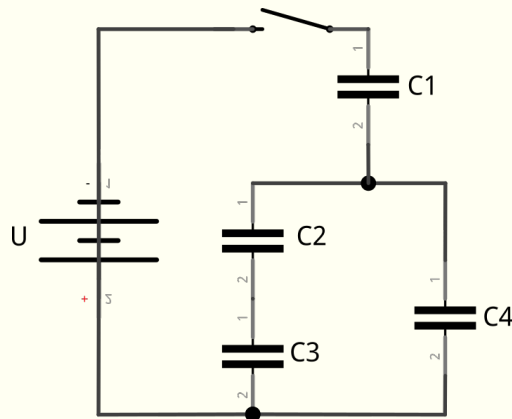
$$C_{ges} = \frac{c_1 \left(\frac{C_2 C_3}{C_2 + C_3} + C_4 \right)}{C_1 + \frac{C_2 C_3}{C_2 + C_3} + C_4} = 180 \text{ nF}$$

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

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

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

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



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)

$$C = \frac{2\epsilon\epsilon_0 l b}{d} = 100 \text{ nF}$$

$$l = \frac{C d}{2\epsilon\epsilon_0 b} = \underline{\underline{2.46 \text{ m}}}$$

(b)

$$V = r^2 \pi b = l d b$$

$$r = \sqrt{\frac{l d}{\pi}} = \underline{\underline{4.0 \cdot 10^{-3} \text{ m}}}$$

3. Ladungsträger

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

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

$$v_D = \frac{I}{ne\pi r^2} = \underline{\underline{6.85 \cdot 10^{-4} \text{ m/s}}}$$

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

$$t = \frac{L}{v_D} = \underline{\underline{14589.2 \text{ s}}}$$

(c) Since the Driftvelocity is proportional to the Electric Field and a constant Potential implies a constant Electric Field; thus a constant Driftvelocity is reached.

(d) Driftvelocity 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. $I_2 = \frac{1}{3} \frac{UA}{\rho L}$

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) $R = \frac{L}{\sigma_{el} A} = \frac{U}{I}; \quad \sigma_{el} = 6 \cdot 10^7 \text{ 1/(\Omega m)}$

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

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

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

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

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

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

$$(c) \quad \sigma = \frac{J}{E}; \quad J = nq\mu E; \quad \mu = 2 \text{ cm}^2/\text{Vs}; \quad n = 400 \text{ 1/cm}^3$$

$$\sigma = \frac{J}{E} = nq\mu = \underline{\underline{1.28 * 10^{-14} \text{ 1}/(\Omega \text{ m})}}$$