NEISSE-ELEKTRO 2026
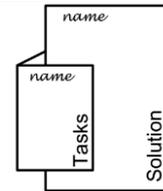
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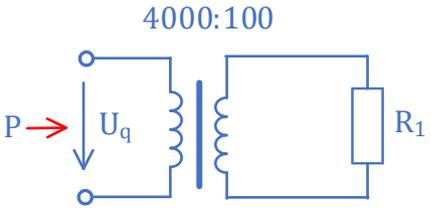| 1	2	3	4	5	Σ

Tasks for the final; 90 min; with formulary (English edition)
Please **use a separate sheet of paper** for each task.
Write your name and school on **each** of these papers.
At the end, fold your solution sheet according to the picture.

Task 1 (20 points)

Calculate the unknowns. Please support your calculations with appropriate formulas.

Circuit:	Parameter:	Unknown:
a)	$U_q = 10V$ $R_1 = 1\Omega$ $R_2 = 1\Omega$	$U = ?$
b)	$I_q = 10A$ $R_1 = 2\Omega$ $R_2 = 4\Omega$	$I = ?$
c)	$R_1 = 4\Omega$ $R_2 = 4\Omega$ $R_3 = 2\Omega$ $R_4 = 1\Omega$ $R_5 = 2\Omega$	$R_{ab} = ?$
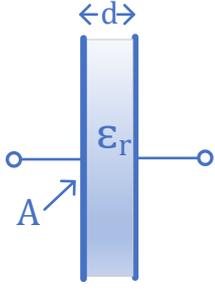
d)	$d = 5 \cdot 10^{-12}$ m $A = 0{,}1129$ m^2 $\varepsilon_r = 5{,}000$	$C = ?$
e)	$U_q = 400$V $R_1 = 1\Omega$	$P = ?$

Task 2 (20 points)

For the electrical circuit from Figure 2, please calculate:

a) An equivalent resistance R_r observed from clamps a-b on the right side of the circuit
b) An equivalent resistance R_l observed from clamps a-b on the left side of the circuit
c) Equivalent resistance R_{ab} observed from clamps a-b
d) The voltage U_1 on the clamps a-b
e) The current I flowing between the left and the right side of the circuit

The parameters are: $U_{q1} = 60$V, $U_{q2} = 40$V, $R_1 = 4\Omega$, $R_2 = 6\Omega$, $R_3 = 10\Omega$, $R_4 = 2\Omega$, $R_5 = 3\Omega$, $R_6 = 6\Omega$, $R_7 = 3\Omega$
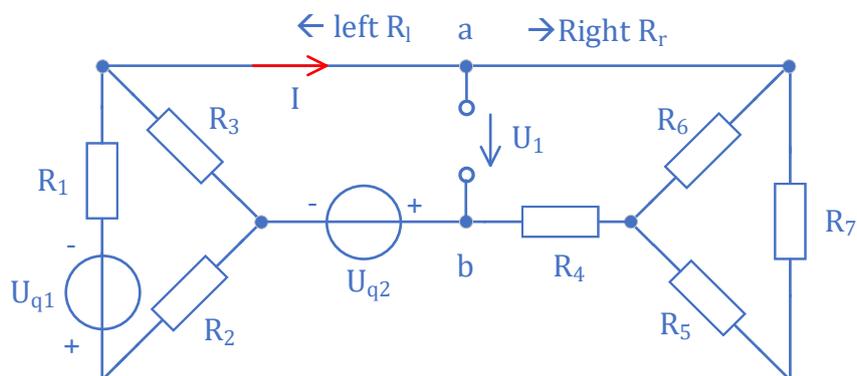

Figure 2

Task 3 (20 points)

For the circuit from Figure 3 calculate following quantities:

    a) Voltages and currents in all light bulbs
    b) Resistances of all light bulbs
    c) Power for each light bulb
    d) Sum up the power generated by the source **U**
    e) Calculate the resistance R_b for one equivalent light bulb which replaces all four light bulbs in the given circuit

Please assume that the internal resistance of amperemeter is close to zero and the internal resistance of voltmeter is infinite.
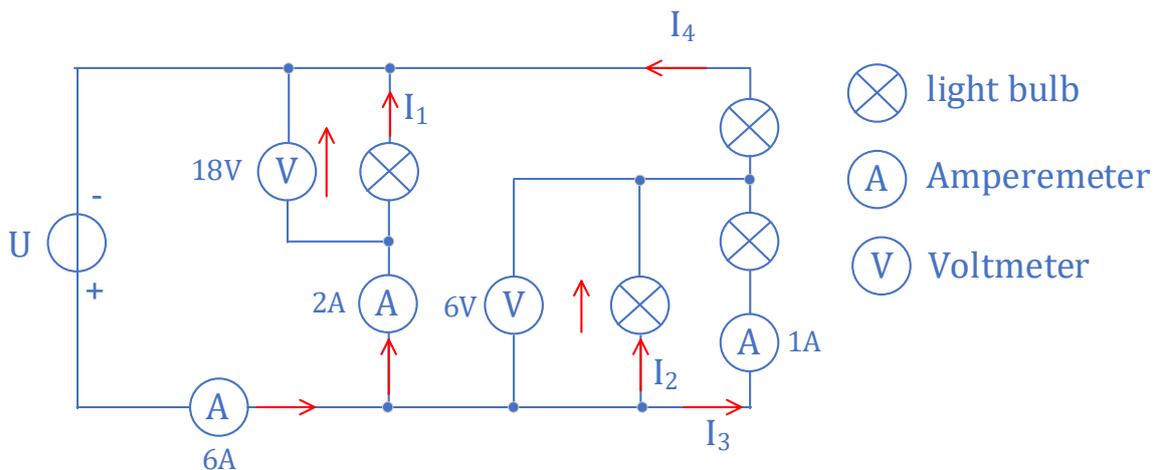

Figure 3

Task 4 (20 points)

The initial condition (t_0=0) for the capacitor **C** is U_c = 0V. The charge and discharge process of capacitor **C** is executed by switches S_1 and S_2. The charging process starts after closing the switch S_1 (see Figure 4b) while switch S_2 is open (see Figure 4c). The discharging process happens while the switch S_1 is open and S_2 closed.
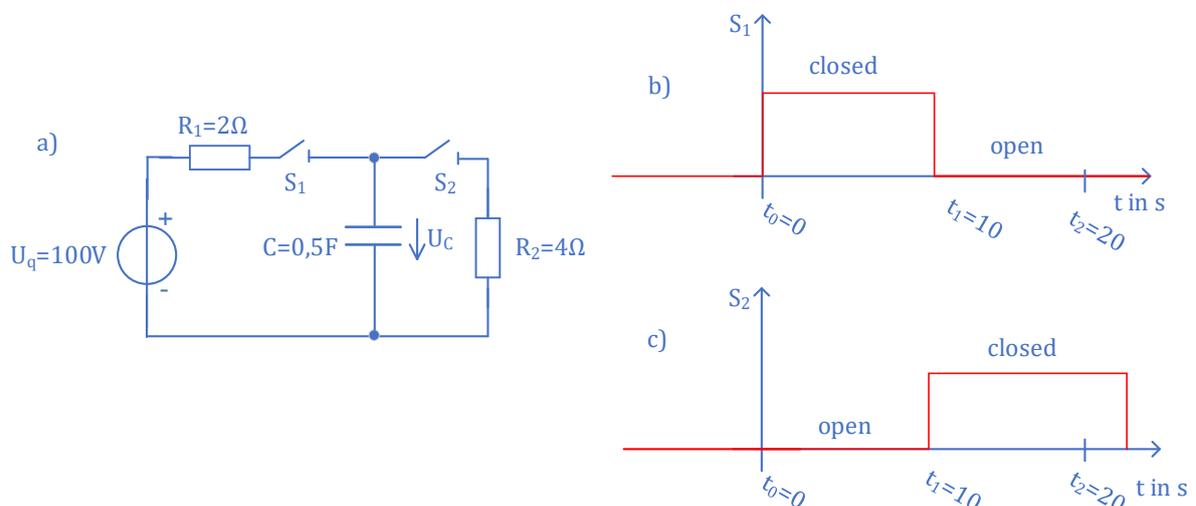

Figure 4

a) Draw the circuit for the charging of the capacitor **C**
b) Draw the circuit for the state of capacitor discharging
c) Calculate the time after the capacitor voltage achieves a half of its maximum value during the charging process
d) Plot the voltage U_c across the capacitor during switching process in time interval from 0 to 20s

Task 5 (20 points)

The biggest passenger airplane Airbus 380-800 with a wingspan of 80m is flying with constant speed of 720 km per hour. After 20km, the airplane changes the altitude and continues its flight on the high of 5km. During this manoeuvre the airplane flies the distance of 10km. The earth magnetic field strength is presented in Figure 5b. The earth magnetic field strength is at right angle to the distance d.
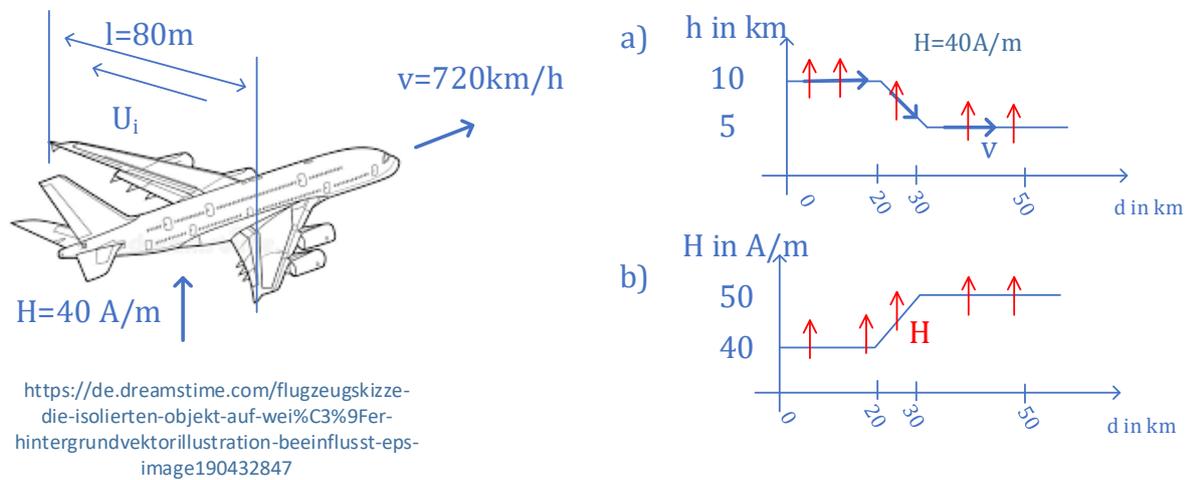

Figure 5

a) Under the assumption that earth magnetic field strength **H** is constant from 0 to 50km and equals 40 A/m, calculate the voltage U_i between wings and draw the voltage diagram in function of **d** (distance) of the airplane
b) Under assumption that during the altitude change the earth magnetic field changes as well (see Figure 5b), calculate and draw the voltage in a second diagram in function of distance