

# task\_cgeyprm6oboukcci\_with\_calculation

## Student Group

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## network simplification, exam ee1 SS2023

### Exercise E1 Pure Resistor Network Simplification (written test, approx. 12 % of a 60-minute written test, SS2023)

The circuit below contains a voltage source  $U_0$  and three resistors  $R_1$ ,  $R_2$  and  $R_3$ . Calculate the voltage at node  $K$ , when switch  $S$  is closed.

Result

The values in the circuit are

Solution

- $R_1 = 60 \text{ } \Omega$

- $R_2 = 40 \text{ } \Omega$

- $R_3 = 10 \text{ } \Omega$

The voltage divider formed by  $R_1$  and  $R_2$  has the same proportionality as the voltage

divider formed by  $R_1$  and  $R_3$ . Therefore, the potential of  $K$  is the same as for  $K'$ .

There will be no current flow through  $R_3$ . The resistance does not create a voltage drop and therefore does not interfere with the circuit.

1. Calculate the voltage at node  $K$ , when switch  $S$  is open.  
It might be beneficial to redraw the circuit first.

Solution

Rearranging the circuit one can get:

Once the switch  $S$  is opened, the upper part is a parallel circuit. Therefore,  $R_{\text{eq}}$  is given as: 
$$R_{\text{eq}} = (R_1 + R_2) \parallel (R_1 + R_2) + R_4 = \frac{1}{2} \cdot (R_1 + R_2) + R_4 = \frac{1}{2} \cdot (60 \Omega + 40 \Omega) + 100 \Omega$$

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Last update: **2023/07/24 20:24**

