

# task\_tb6pi8dgh0m2e2pw\_with\_calculation

## Student Group

First Name	Surname	Matrikel Nr.

## Table of Contents

Exercise E1 Charging Capacitors (written test, approx. 16 % of a 60-minute written test, WS2022) .....	2
--	---

Charging Capacitors, dc network analysis, pure resistor network simplification, delta wye transformation, exam ee1 WS2022

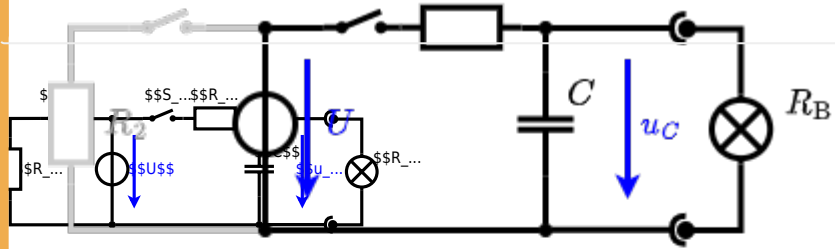
**Exercise E1 Charging Capacitors**  
**(written test, approx. 16 % of a 60-minute written test, WS2022)**

The circuit (with the real solution) consists of a voltage source  $U = 12 \text{ V}$ , a switch  $S_1$ , a resistor of  $R_1 = 20 \text{ }\Omega$  and a capacitor of  $C = 100 \text{ }\mu\text{F}$ . The voltage across the capacitor is again  $0 \text{ V}$  at the moment  $t_0 = 0 \text{ s}$  when the switch  $S_1$  is closed. Calculate the voltage  $u_c(t_2)$  across the capacitor at  $t_2 = 1 \text{ ms}$  after closing the switch.

**Solution**  
 To solve this, first create an equivalent linear voltage source from  $U$ ,  $R_1$ , and  $R_B$ .

The equivalent voltage source is  $U_s = U \cdot \frac{R_B}{R_1 + R_B} = 6 \text{ V}$  and the internal resistance is  $R_{int} = R_1 \parallel R_B = 10 \text{ }\Omega$ .

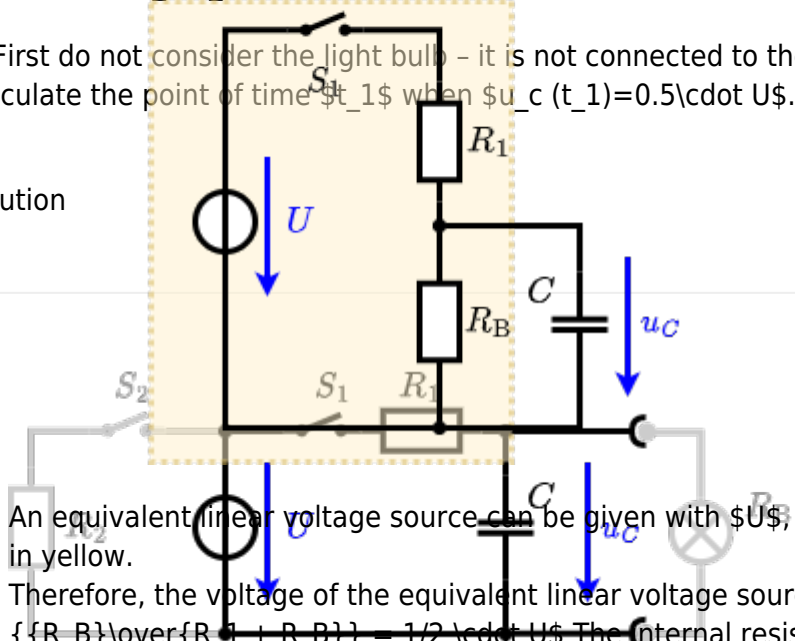
On an alternative view, one can try to create an equivalent linear voltage source again. Then, the internal resistance is given by substituting the ideal voltage source is again short-circuiting  $R_1$ .



The circuit contains a voltage source  $U = 12 \text{ V}$ , a switch  $S_1$ , a resistor of  $R_1 = 20 \text{ }\Omega$  and a capacitor of  $C = 100 \text{ }\mu\text{F}$ . The switch  $S_2$  to an additional consumer  $R_2$  will be considered to be open for the first asks. At the moment  $t_0 = 0 \text{ s}$  the switch  $S_1$  is closed, the voltage across the capacitor is  $u_c(t_0) = 0 \text{ V}$ .

First do not consider the light bulb - it is not connected to the RC circuit. Calculate the point of time  $t_1$  when  $u_c(t_1) = 0.5 \cdot U$ .

**Solution**



An equivalent linear voltage source can be given with  $U_s$ ,  $R_1$ , and  $R_B$  as seen in yellow. Therefore, the voltage of the equivalent linear voltage source is:  $U_s = U \cdot \frac{R_B}{R_1 + R_B} = 6 \text{ V}$ . The internal resistance is given by substituting the ideal voltage source with its resistance ( $= 0 \text{ }\Omega$ , short-circuit).

The following formula describes the current  $i(t)$  in a series R-L circuit with a DC voltage source  $U_0$  and a resistor  $R$  and an inductor  $L$  in series. The current  $i(t)$  is given by:

The following formula describes the current  $i(t)$  in a series R-L circuit with a DC voltage source  $U_0$  and a resistor  $R$  and an inductor  $L$  in series. The current  $i(t)$  is given by:

From: <https://wiki.mexle.org/> - MEXLE Wiki

Permanent link: [https://wiki.mexle.org/electrical\\_engineering\\_1/task\\_tb6pi8dgh0m2e2pw\\_with\\_calculation?rev=1680242524](https://wiki.mexle.org/electrical_engineering_1/task_tb6pi8dgh0m2e2pw_with_calculation?rev=1680242524)

Last update: 2023/03/31 08:02

