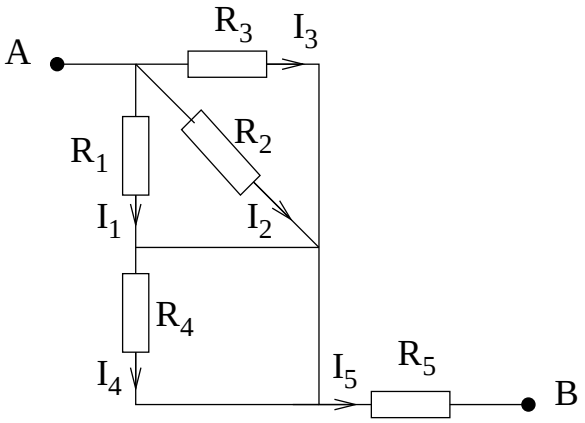
Institutt for fysikk, NTNU
TFY4155/FY1303: Elektrisitet og magnetisme
Vår 2004

Øving 11

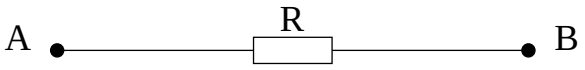
Guidance: Monday March 22
To be delivered by: Thursday March 25

Exercise 1

The figure below shows an electric circuit with 5 resistances R_j, $j = 1, .., 5$.



a) Determine the total resistance R between the points A and B, i.e.: Determine the resistance R in the equivalent circuit in the following figure:

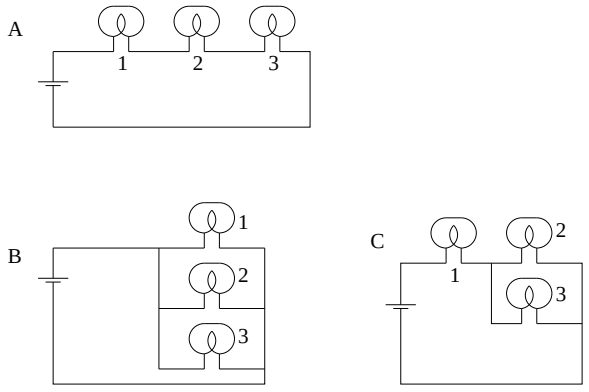


b) An ideal voltage source with electromotive force $\mathcal{E}$ is connected to the circuit so that $\Delta V = V_A - V_B = \mathcal{E}$. Determine the resulting currents I_j through each of the resistances R_j.
(Unless otherwise is specified, we always assume, in exercise like this one, that the connecting wires between the various resistances are *perfect conductors*, i.e., with zero resistance.)

c) Determine numerical values for I_j when $\mathcal{E} = 9$ V and $R_j = j\ \Omega$.
[A couple of answers: $I_1 = 0.89$ A, $I_5 = 1.62$ A]

Exercise 2

Three identical light bulbs 1, 2 and 3 are put together in three different circuits A, B and C, as shown in the figure. (The light bulbs can be viewed as identical resistances. Increased current implies increased light intensity.) The voltage source has the same emf in each of the three circuits.



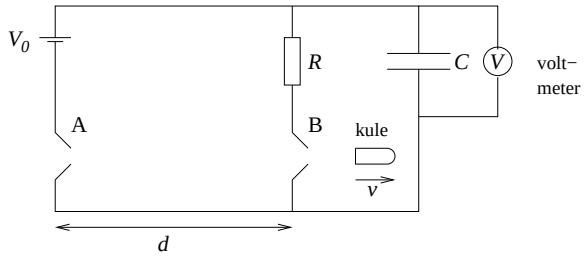
a) Compare the light intensity in bulb nr 1 in the three circuits. In which circuit is the intensity strongest, and where is it weakest?

b) What happens to the light in bulb nr 1 in each of the three circuits if bulb nr 3 is unscrewed?

Show your reasoning behind the answers.

Exercise 3

The circuit in the figure is supposed to be used to measure the speed of a fired bullet. Before the bullet is fired, there is a constant current in the circuit. The voltage source is $V_0 = 9$ V, the resistance $R = 250\ \Omega$ and the capacitance $C = 1\ \mu$F. The distance d is 10 cm. The bullet breaks the circuit first in the point A, then in the point B. Now, the volt meter V displays a potential difference of 4 V between the capacitor plates. How big was the speed of the bullet?



(A volt meter simply measures the potential difference between two points in a circuit without influencing the circuit. For example, no current runs through an ideal volt meter.)

[Answer: ca 493 m/s]