

Homework 12

Last class we have discussed a general way how we can calculate all the currents and voltage drop in any circuit of voltage sources and the resistors. We can do that using two simple rules and the Ohm's law. These rules are:

1. Sum of the currents in any circuit node is zero. Currents flowing into the nodes and out of the nodes should have different sign.

The explanation of this rule is quite simple: the charge which flows into the node has to be equal the charge which flows out. Otherwise, the charge of the node would increase infinitely with time.

2. Sum of the voltage drops along any closed loop of the circuit has to be zero. You can choose the direction (clockwise or counterclockwise – again it is arbitrary). Then, moving along the loop in the direction you have chosen, you sum up all the “voltage drops” along the loop. The sign of the voltage drop or the voltage source must be chosen according to the following way: the voltage on a resistor is positive if you are moving along the current and negative if you are moving against the current. The voltage of the voltage source is positive if , going around the loop you meet “plus” first.

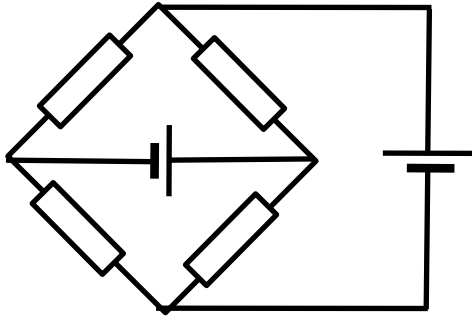
If we assume that the sum of the voltages around a close loop is nonzero and equals ΔU , then as the charge q moves around this loop and returns to the starting point it earns the potential energy $P=q \Delta U$. But the potential energy depends only on the position of the object and does not depend on the way we use to bring the object to this position, so ΔU has to be zero.

These rules are known as **Kirchhoff circuit laws**. They named after German physicist Gustav Kirchhoff.



Gustav Kirchhoff (1824-1887)

1. Both voltage sources are 2V, all resistors are 2 Ohm. Find all the currents:



2. Find voltage between the points A and B.

