Lecture 2
Electric Current

Review: electric charges

There are two types (*signs*) of electric charges, positive and negative. Opposite charges attract and charges with the same sign repel. Electric force between charges decreases with distance. *Conductors* are materials that allow charges propagate through them. *Insulators* do not.

Simple circuits

A *battery* has excess of positive charge on one side and excess of negative charge on another. When conductive elements are arranged in such a way that charge is able to flow from one side on of the battery to another *electric current* (current of charges) starts to flow, since opposite charges attract and they are able to move through conductors. Conventionally we say that current flows from positive pole of a battery to negative. Formal definition of *electric current*: rate with which charge is transferred.

There are two ways to connect any circuit elements together: *in series* and *parallel*. In the first case whatever current is flown to the first element is flown through the second, in the latter current splits into two. Think about analogy with a river.

Measurement of electric physical quantities

Ammeter measures *current*, *ohmmeter* measures *resistance*, *voltmeter* measures *potential difference* (*voltage*). Device that measures all three depending on a position of a switch is called multimeter. Unit of current is Ampere, of resistance is Ohm, and of voltage is Volt.

Voltage is like difference in height for a river. The larger the height difference the stronger the current in a river. When two batteries are connected in series there voltage is sum of the voltages. When two identical batteries are connected in parallel with poles of the same sign touching the voltage is the same, but they would work longer. It is not a good idea to connect to batteries in parallel with two opposite poles together.

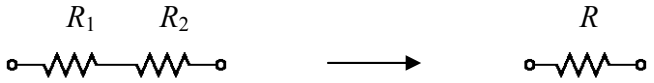
Resistance

Resistance is defined as a ratio of potential difference across an object over current that flows throw it (this is so called Ohm's law)

$$R = \frac{V}{I}$$

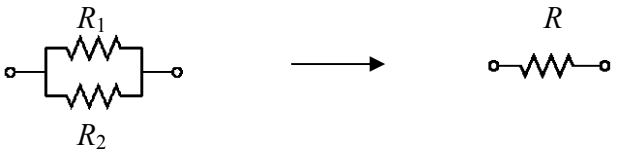
When resistors of two elements are known one can calculate effective resistance of an element that can be substituted instead of them and have the same effect on the circuit. When they are connected in series

$$R = R_1 + R_2$$



When they are connected in parallel

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$



Power used by a circuit that take voltage V and current I is

$$P = IV$$

For the power to be in Watts, current must be expressed in Amperes and voltage in Volts.

Suggested time line for the unit

Date	Unit.Procedure
Jan 31	1.6
Feb 2	1.6, 2 all, 3 part.
Jan 7	3 all, quiz