

## 5.2. Oersted's experiment – vertical version (or Ampere's experiment)

**Aim:** to investigate that an electric current produces a magnetic field.

**Apparatus:** from the Low-Tech kit you will need:

- brass wire,
- 4.5 V battery,
- 4 compasses,
- 4 crocodiles,
- 2 cables,
- plexi table with short legs,
- universal stand.

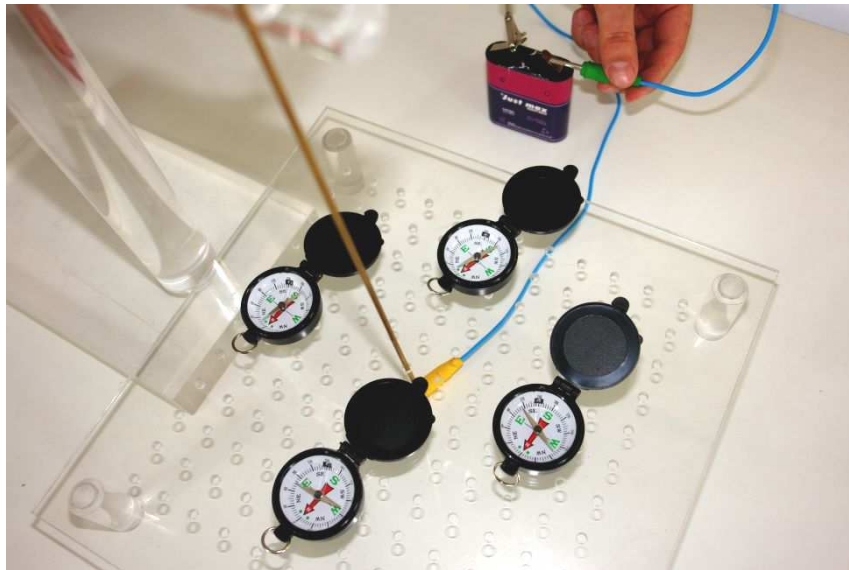


Photo 1. The set-up for presentation vertical version of Oersted's experiment.

### **Procedure:**

We place four compasses around a vertical straight brass wire, which is part of an electrical circuit. When the electrical circuit is open we see that all compasses needles are in the north-south direction. Now close the circuit. What happens to the compass needles?

### **Explanation:**

When we close the circuit and the brass wire carrying an electric current, the compass needles turn with respect to circles around the wire. In this experiment we show that electric current could be the source of a magnetic force, and that the magnetic field lines form circles.

The Ampere's part of the experiment is that the intensity of the field falls down as the inverse of the distance from the wire, and is proportional to the current, as follows:

$$B = \frac{\mu_0 I}{2\pi r} ,$$

where  $\mu_0$  is the permeability of free space. This is a general formulation of Ampere's law applied for a circular symmetry. As the direction of the current matches as well, if current in two wires are opposite, the field is null.