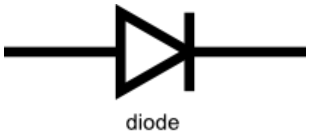
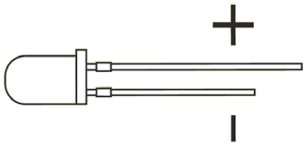
6.3 LEDs (experiment using breadboard)

Basic information and collecting ideas	The experiment provides students with the opportunity to learn about the light-emitting diode. If the students are not yet very familiar with working with a breadboard, you may need to recapitulate or even reintroduce the breadboard. You may also need to support the students with setting-up of the circuit on the electrical circuit on the breadboard. If the circuit on the breadboard is not working, check for common mistakes (see introduction into the breadboard). If you do not work with breadboard, see the alternative experiment using crocodile clip cables and only one LED.
Observing and documenting	**Breadboard set up:** After the students apply 3 V (closing the electrical circuit), one LED will light up. The second LED does not light up. After the students reverse the polarity of the power source, the second LED will light up and the LED which lit up before does not light up. **Crocodile clip set up:** the LED only lights up if inserted in one direction, but not if inserted in the other direction.
Analysing and reflecting	LED stands for “light-emitting diode”. LEDs are a particular type of diode which converts electrical energy to light. The similarity in function between the diode and the LED is reflected in the schematic symbols. As a diode, it has a positive lead and a negative lead. The positive lead of the LED is called the **“anode”** and is the longer leg. The other, negative lead of the LED is called the **“cathode”**. The negative lead can also be distinguished by the flat edge (which is particularly useful if someone has trimmed the legs). An LED inserted in the reverse direction blocks the flow of current. Like all diodes, LEDs cause a voltage drop in a circuit, but typically do not add much resistance. To prevent a circuit from shorting, you need to add a resistor in series. **Attention:** Usually an LED cannot be supplied with exactly the right voltage. Therefore you need to use a ballast (or protective) resistor to limit the voltage and prevent the LED from burning out.  diode  light emitting diode 

Additional information

In simplified terms, LEDs are like tiny light bulbs but require a lot less power to light up by comparison.

The ballast resistor can be calculated using the following formula:
R (Ω) = (supply voltage – LED voltage drop) / I of LED (A)

For example, using a 6 V battery and green LED with a typical voltage drop of 2.6 V and a current of 20 mA (0.02):

$$R = \frac{(6\ V - 2.6\ V)}{0.02\ A} = 170\ \Omega$$