

## LIGHT BULBS

Contrary to ideal resistors, light bulbs do not follow Ohm's law, i.e. the current is not proportional to the applied voltage. The relation between the two quantities can be represented in a diagram (characteristic).

GOAL	You practise setting up simple circuits and measuring voltage and current.
DEVICES	<ul style="list-style-type: none"><li>▶ Power supply</li><li>▶ Light bulbs and sockets</li><li>▶ Cables</li><li>▶ Multimeters</li></ul>
PROCEDURE	<p>A Set up a simple circuit using the power supply (variable dc), a light bulb and two multimeters set up for current and voltage measurements, respectively.</p> <p>Ask your physics teacher to check the circuit before you switch on the power supply!</p> <p>B Measure the voltage across the light bulb and the current for at least ten different voltages. Do not increase the voltage beyond the rating of the light bulbs. Make a note of the precision of your readings.</p> <p>C Measure the characteristics of two other light bulbs.</p> <p>D Set up a circuit with two identical light bulbs in series. Measure the total and the partial voltage across the two light bulbs and the current flowing through them.</p> <p>E Connect the two light bulbs in parallel to the power supply and measure the voltage across them, the total and the partial currents.</p> <p>F Draw a schematic diagram for each of the four possible circuits with three identical light bulbs. Using your knowledge of electric circuits, order the light bulbs in every circuit by increasing brightness. Write down your educated guess in the journal.</p> <p>G Set up the four circuits in turn. Check your guess and, in every circuit, measure the total voltage and current and the partial voltage across every light bulb.</p>
ANALYSIS	<ol style="list-style-type: none"><li>1. Plot the current vs. voltage characteristic and the resistance vs. current characteristic for each of the three light bulbs from measurements B and C.</li><li>2. Determine linear fits for the resistance vs. current characteristics. Write down the fit parameters with correct units. Using the results, express the voltage as a function of the current. Make sure that you use reasonable labels and units for the quantities.</li><li>3. Using the characteristic in step 1, determine the theoretical value for the current through the two light bulbs in series. Compare it to the measured value.</li><li>4. In a similar way, determine the expected value for the current through the two light bulbs in parallel and compare the result to your measurement.</li><li>5. Calculate the partial voltages for the circuits in measurement F from the total voltage. Are the results compatible with the measured values?</li></ol> <p>HINT: For the circuit with a single light bulb in series to two light bulbs in parallel you can use the function from step 2.</p>
REQUIREMENTS	<p>If you write a short report on this experiment, work at least on steps 1 and 2 of the analysis. The complete interpretation is required for a full report.</p> <p>Hand in your report and the lab journal by Tuesday, 29 March 2011.</p>