

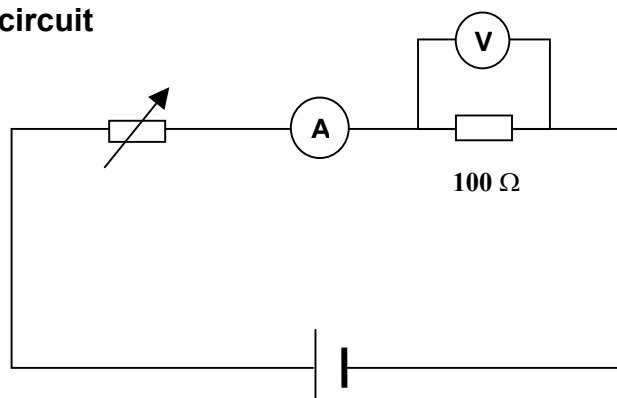
Investigation Ohm's Law

Ohm's Law is an important law concerning the conduction of electricity by metals. It is particularly relevant to the functioning of electrical sensors. Here we will use the CBL unit to explore Ohm's Law.



Materials

TI Graphing Calculator with DataMate program installed	4 cables
CBL2 interface	4.5V battery
Voltage probe	4 crocodile clips
Multimeter	Rheostat
	4.5W light bulb plus holder

Set up the following circuit



Starting the DataMate Program and setting up



1. Use the following steps to start the DataMate program on your calculator:
Press **APPS**, then press the calculator key for the number that precedes **DATAMATE**. Press **ENTER**.
An introductory screen will appear, followed by the main screen.
2. Plug the Voltage Probe into channel **CH 1** on the CBL2 interface.
3. Start the DataMate program. Press **CLEAR** to reset the program. DataMate will detect the auto-ID sensor, set the data collection parameters, and display the current sensor reading.
4. Press **1: SETUP** and using the cursor buttons,  or  (be patient it's a bit sluggish!) select **MODE** press **ENTER** (scroll up to get to the last item on the menu).
5. In the **SELECT MODE** menu choose **3: EVENTS WITH ENTRY**.
6. Press **1: OK** to return to the main screen.

Collecting data

1. Set the multimeter to 200mA with the cables connected to COM and the mA sockets. Adjust the rheostat so that the meter reads 22mA.
2. Select **2: START** to begin data collection. Press **ENTER** to record your first voltage measurement. Then enter the current 22. Press **ENTER** again.
3. Change the current using the rheostat to 26mA and press **ENTER**. Then type in the current 26. Press **ENTER** again and you will find the calculator producing an autoscaled scattergram of the measurements.

4. Continue to take measurements at 2mA intervals.
5. You may stop data collection at any time by pressing the **STO→** key.
6. Store your data if you are satisfied with it or to repeat an experimental run return to the main screen by pressing **ENTER**. Repeat the experiment using a resistor of a different value. Is there any difference in the relationship between current and voltage?
7. A light bulb is a resistor.
 What happens to the thin wire of the light bulb when electricity flows through it?
 Use a light bulb in place of the resistor in the circuit. Repeat the experiment and record the relationship between the current and the voltage in the same way as before and store your data.

Analysing the data

1. Describe the overall shape of the line set out by the scattered points on the graph. (Is it linear or curved? Which way does the trend go?)
2. Use the cursor keys  or  to examine the data points and record the voltage for each of the different currents used.
3. Theoretically there is a relationship between the voltage, the resistance and the current:

$$\mathbf{V=IR}$$

Where: **V** is the voltage, **I** is the current and **R** is the resistance.

Do your results follow this relationship?

Was it the same for the different values of the resistor?

Was it the same for the light bulb?

4. If you find a difference between your measurements and those predicted by the equation, there are two possibilities, either there is an error in the experiment or the equation is incorrect.
 Search for possible sources of error.
 List as many sources of error as you can find.
5. If there is time repeat the experiment trying to eliminate or minimise as much as possible the errors in the experiment.