# Voltage-Current Characteristics of a Resistor

**Ohm’s Law**

**Introduction**

When a voltage is applied across an electrical component the amount of current passing through it depends on its physical properties and determines if it is classed as an *insulator* or a *conductor*. The variation of current with voltage also depends on the particular component. Some components even respond differently, depending on which end is connected to the positive terminal of the battery.

In this experiment you will be investigating the voltage-current characteristics of a common electronic component – the humble *resistor*. C:\Users\Craig\Documents\Personal\ASTA Assist\Thumbnails\Ohm's law single resistor.png

If you don’t know already, find out the meaning of the coloured bands on the resistor and how to ‘read’ them.

In this experiment you will be using a 56 Ω (or similar) resistor.

**Equipment**

0 − 12V power supply, 2 digital multimeters, resistor, connecting wires, 2 alligator clips

**Method**

Construct the circuit below. Record the current for voltages from 0 to 8 volt settings of the power supply.

Note that the voltage settings on the power supply only give a rough guide and the voltmeter should be used to give a more accurate reading. Also, the current will be small, so use the milliamp scale. **Switch on, take your readings, switch off – to avoid “cooking” the resistor.**

A

V

Resistor

sample answers below for a 56 Ω resistor

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| voltage (V) | 0 | 1.83 | 3.29 | 4.77 | 6.44 |
| current (mA) | 0 | 30 | 58 | 86 | 116  plot these 2 |
| current (A) | 0 | 0.030 | 0.058 | 0.086 | 0.116 |

Now plot the voltage on the *y*-axis against the current (in ***amps***) on the *x*-axis as a scatter graph on an Excel spreadsheet and insert a trendline. Display the equation on the graph and set the intercept to be zero. Write the equation here: y = 54.947x + 0.0791

1. The gradient of the line of best fit is called the Resistance. Why?

The gradient is rise over run and in this case the rise is voltage and the run is current. Voltage over current equals resistance.

2. What is the value of the gradient of your graph rounded to 1 decimal place? Make sure you have plotted current **in amps**‼!

54.9 Ω (notice that the gradient has meaning in this experiment)

3. What is the independent variable in this investigation? voltage

Normally the independent variable is plotted on the *x*-axis. Why not in this case?

If voltage was on the x-axis and current on the y-axis, the gradient would **not** be the resistance. It has been done this way this time because the gradient has real meaning this way.

One of the end coloured bands on the resistor should be silver or gold. It shows the ‘tolerance’ of the

resistor. This means the actual value of the resistor (which you’ve determined from the gradient of your graph) might be different to its ‘nominal’ value by a set amount. A silver band means ±10%, a gold band means ±5%. So for a 56 Ω resistor with a silver band (10% of 56 = 5.6) it’s real value will be between (56 − 5.6) = 50.4 Ω and (56 + 5.6) = 61.6 Ω.

4. How different is your experimental value from the nominal value? (subtract them)

The difference is 56 − 54.9 = 1.1 Ω

5. What is this difference as a percentage of 56? Is it within the tolerance limit?

As a percentage = 1.1 ÷ 56 × 100% = 1.96 or 2% which is within the tolerance limit.

6. Explain how you could find the resistance of an unknown resistor.

Repeat the experiment for the unknown resistor and record its voltage and current values. Use the value gradient to determine its resistance.

7. Test out your method for an ‘unknown’ resistor supplied by your teacher (with masking tape over its colours). What value do you get for your resistor? Remove the masking tape after experimenting with it and decode the coloured bands. Were you correct? Show your results here.

Student answers will vary depending on which resistors they test