Serrata Ohm's Law Demonstrator

Introduction:

Ohm's Law:

The relationship between voltage, current and resistance in a circuit is defined by Ohm's law, which may be: simply stated as: 'when a voltage is applied to a resistive circuit the current in Amperes will be proportional to the voltage and inversely proportional to the resistance in Ohms'. This relationship is represented mathematically be the formula:

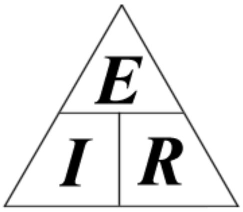
$$E = I \times R$$

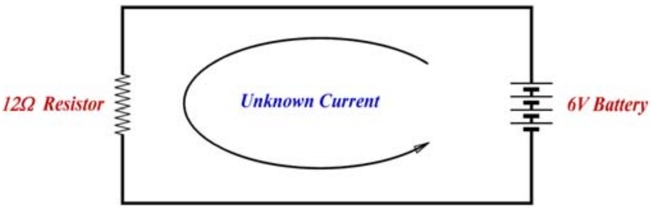
where E is in Volts, I is in Amps and R is in Ohms.

this can be turned around to look like:

$$I = \frac{E}{R} \qquad R = \frac{E}{I}$$

If you find these difficult to remember, you may find the diagram on the right helpful: Simply cover the value you are looking for with your fingertip and the formula you require remains exposed. For example: In a circuit consisting of a 6V battery and a 12 ohm resistor, we wish to find the current passing through the resistor.





Because we want to know"', cover it with your fingertip. The formula to find is then shown as E divided by R. Substituting values, we know E is 6 Volts and R is 12 Ohms; therefore the current is 6 divided by 12 = 0.5 Amps. Suppose we knew the voltage and current (we could measure these with a multimeter) but the resistor value had been rubbed off. Using the same triangle above, we cover R and find the formula R equals E divided by I. Therefore, R equals 6 divided by 0.5 - or 12 ohms. It agrees with the above answer! Now try one yourself. We know I is 0.5A, and we know the resistor is 12 ohms. But we are not sure about the battery voltage. ***How do you work it out?***

Power in a circuit:

When a current passes through a component, energy is given off in the form of heat. Normally, we associate resistors with this action: that's part of their job. We often need to know how much power is being given off by a resistor - and we find this out by using a formula derived from Ohm's Law. This formula says that power dissipated is equal to the voltage across the component multiplied by the current through it; or

$$W = E \times I$$

where W is in Watts, E is in Volts and I is in Amps.

This formula, too, can be turned around if required:

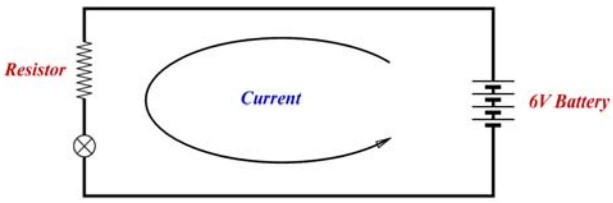
$$E = \frac{W}{I} \qquad I = \frac{W}{E}$$

For example:

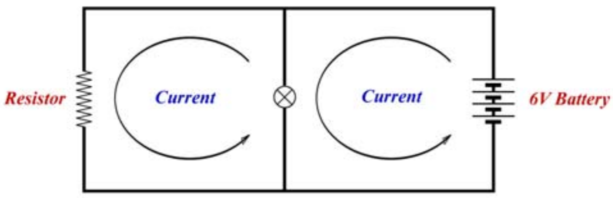
In the circuit above, E is 6 volts and I is 0.5 Amps. Therefore, the power dissipated would be 6 x 0.5 = 3 Watts. We would have to use a resistor capable of dissipating at least 3 Watts - we would probably use a 5W type.

Series and Parallel Circuits:

In all circuits, combinations of components are used to achieve various effects. It is often essential to be able to work out the equivalent values of components connected together. To do this, one must be able to work out whether the components are connected in 'series' or 'parallel' - or a combination of both.
In a series circuit, current flowing from the battery must pass through all the components. Because of this, the current is the same



through all components.



In a parallel circuit, the current can take a number of different paths - so currents are not identical through various 'legs' of the circuit.

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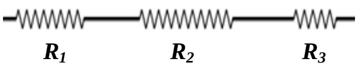
Resistors in series:

Resistors in a series circuit are simply added together to find the total resistance. In other words, a 10 ohm, 150 ohm and 1000 ohm resistors connected in series would be the equivalent of a single 1,160 ohm resistor. The formula is:

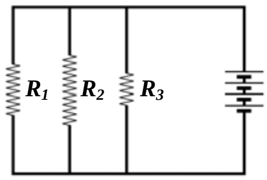
$$R_T = R_1 + R_2 + R_3 + \ldots$$



Resistors in parallel:

Resistors in a parallel circuit are a little more difficult. Here the reciprocals are added together to give the reciprocal of the total. The formula to use is:

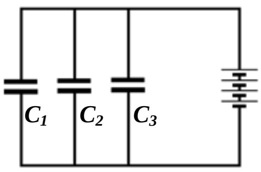
$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots$$



Capacitors in parallel:

Capacitors behave exactly the opposite to resistors: when capacitors are in parallel, you add them:

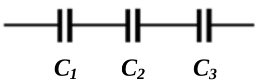
$$C_T = C_1 + C_2 + C_3 + \ldots$$



Capacitors in series:

Capacitors in series, on the other hand, are similar to resistors in parallel: you add the reciprocals:

$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \cdots$$



Two resistors in parallel or capacitors in series:

A much simpler formula can be used if there are only two resistors in parallel or capacitors in series, It is:

$$R_T = \frac{R_1 \text{ x } R_2}{R_1 + R_2}$$

(For capacitors simply replace R with C).

OHMS LAW-SERIES/PARALLEL CIRCUIT DEMONSTRATOR BOARD

The Board is supplied ready to operate and has 5 x MES batten holders mounted with removable plated connectors secured by knurled nuts. Series or parallel circuits can easily be set up simply by re-arranging the connectors.

The effects of applying current (max voltage 6VDC) can be observed and appropriate measurements taken.

Use of a digital multimeter is preferred as some bench meters tend to drain excessive current from the circuit, thereby detracting from the desired results.

The unit should be stored in plastic covers away from heat and moisture.

The theory provided with the apparatus will support full and efficient use of this apparatus.