**Variable Resistance**

**Aim:** To investigate resistance and use a cool trick to make a dimmer switch.

**Materials:**

* 12 V DC power supply and switch
* red, green or yellow 'light emitting diode' (LED)
* 1 alligator clip
* 2 connecting wires
* smooth writing paper
* graphite pencil (2B or darker)

**Method:**

Plug one end of a wire into the positive (+) terminal of the power supply set on 10 V, and clip the other end to the long leg (the +) of your LED using the alligator clip.

Take the second wire and attach it to the negative (−) terminal of the power supply. **Briefly touch** the other end of this wire to the short leg (the −) of the LED to make sure it works. *Do not attach* the second clip to the LED as it could burn out your LED if linked together for too long.

On your paper, draw a box approximately 1 cm wide and 5 cm long and colour it in completely with your graphite pencil, making it as heavy and as dark as possible.

Now, **press** the short negative (−) leg of your LED to one end of the coloured-in box on the paper. **Press** the loose end of the second wire to the opposite end of the coloured-in box and slowly bring the wire closer towards the LED. What happens to the LED's light?

**Explanation:**

The diode in this activity emits light as electricity flows through it. The higher the electrical current, the brighter the light. However, too much current will cause the conducting material inside the diode to burn up, destroying the LED. What is needed is a simple way of controlling the amount of electricity passing through it. The answer ... ? A resistor, which reduces the current to a level that the LED can handle without burning out.

The box you drew acts as a **variable resistor**; the distance between the connections can change, changing the amount of graphite between them and hence changing the resistance to the flow of electricity.

The graphite in your pencil is little more than sheets of carbon atoms joined together in such a way that there are spare electrons available, allowing electricity to pass through. The longer the distance the electricity has to travel, the more graphite it needs to pass through, which reduces the current.

**Conclusion:**

In your workbook draw a circuit diagram for this experiment and write down what you have learned in this activity.

**Teacher’s Notes**

Resistance is measured in units called 'ohms' (pronounced like 'homes' without the 'h'). The law describing the relationship between ohms, volts (or electrical push) and the amps (current) is:

Ohms = Volts ÷ Amps

OR

Resistance = Voltage ÷ Current

You could now introduce the students to Ohm’s Law.

Different materials will conduct electricity differently. Graphite isn't as good at conducting electrons as most metals, so it is a good resistor. However, resistors can also be made out of long lengths of wire. The old style kettles had wire resistors inside them that heated up and caused the water to boil. The old style light globes had a wire filament in them that created the light.

Resistors have a vital role in any circuit by controlling the precise amount of current that passes through its components, stopping them from overheating.