Resistance

Resistance

- Resistance is opposition to the flow of current. A high resistance means it is harder for current to flow through. A low resistance means current will flow through more easily.

- Resistance is measured in **Ohms (Ω).**

Ohm's Law

- Ohm's law states that current is directly proportional to potential difference at a constant temperature.

Voltage = Current x Resistance

V = I x R

- **Where:**

V = Voltage (Volts)

I = Current (Amps)

R = Resistance (Ω)

- Resistance of some resistor and component change like filament lamp or diode etc

- When electric charge flow through a lamp, it transfer energy to the thermal energy store of lamp. Due to this energy transfer the lamp get heat up.

- Resistance is directly proportional to Temperature and current. As temperatures increase, resistant and current also increases.

- For diodes: Resistant depend on the direction of the current, Current flow in one direction happily but if it is reversed, resistance gets high.

Types of Resistors

- Resistance in the circuit slows down the flow of charge (the current). For any given voltage, a higher resistance means a lower current. Resistance is measured in **ohms (Ω)**.

- There are two different types of **resistors**, which are both able to slow down the current in a circuit:
  - **Fixed resistors** – fixed resistors have a constant value. Therefore, the resistance provided by a fixed resistor is constant.
  - **Variable resistors** – variable resistors do not have a fixed value – they can change their value as the current changes.

- **Components** in a circuit, such as lamps, will act as **variable** resistors. They are variable because their resistance will change depending on the current that flows through them.

Investigating the Resistance of Circuits

We can investigate the **factors** affecting resistance of circuits using the following method.

Method

1. **Construct a circuit** by Using an ammeter, voltmeter, switch and a variable resistor, set up the circuit shown below. Add a length of wire to the circuit, which should be movable as shown below.

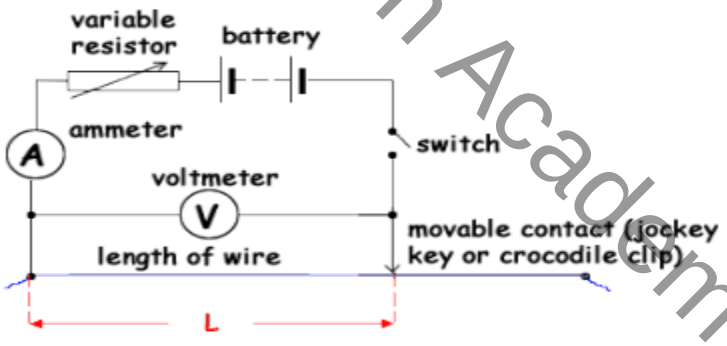

Fig 3. Example of a Constructed Circuit for This Experiment. There is a voltmeter, ammeter, resistor, switch and battery. The voltmeter is attached in parallel, whereas the other components are in series.

2. **Place the length of wire on a metre ruler.**The wire should stay at a constant temperature throughout the experiment.
3. **Measure 10cm of wire and** Attach crocodile clips on either end of the 10cm, so it is part of the circuit. .
4. **Record the current and pd (potential difference).** After closing the switch and completing the circuit, you can measure the current through the wire using the ammeter

and the pd across the wire using the voltmeter. Record the current in amps and the potential difference in volts.

5. **Calculate the resistance.** Now that you have the current and potential difference, you can calculate the resistance. Do this by rearranging V = IR into R = V / I. Record the resistance in ohms.

6. **Change the length of wire.** Once you have made the recordings for the 10cm length of wire, measure out a new section of wire. The new section should be 20cm. Repeat again step 4.

7. **Repeat the steps 3 to 6 of the experiment** with a slight alteration. Every time you repeat the experiment you should increase the length of wire by 10 cm. Record your results in a table like this

Length of wire (cm)	Current (Amps)	PD (Volts)	Resistance (Ohms)
10			
20			
30			

Table 2. Example Results Table for This Experiment.

8. **Repeat the experiment at least 6 times with different lengths**

9. **Plot a graph,** we can split a graph of wire length (x axis) against resistance (y axis). This graph should be a straight line through the origin. Here is an example graph:

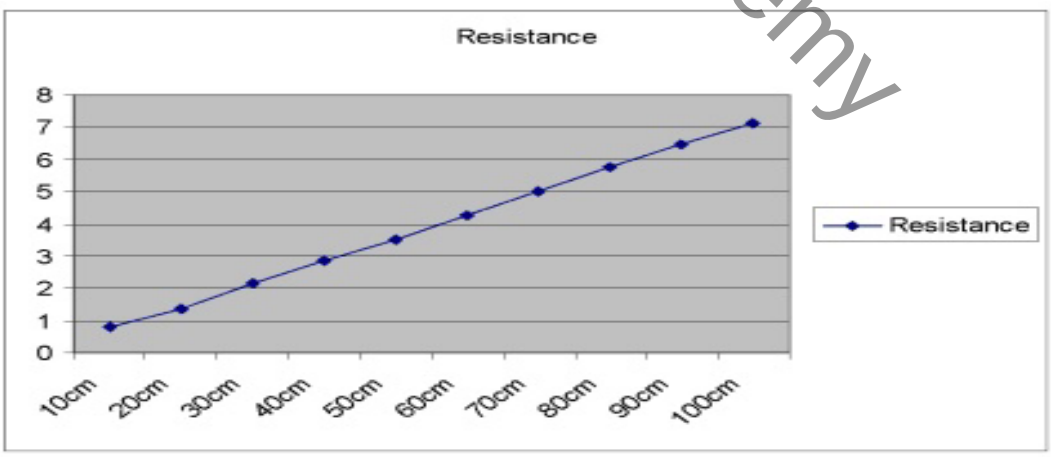

Table 3. Example Results Graph for This Experiment.

Current-Voltage Graphs——I-V characteristics

- **Ohm's Law** is a special relationship between current and potential difference of a component.
- The **term I-V graph refer** to graph which shows how current (I) flowing through component changes as the potential difference is increases.

Ohmic Conductor

- An **Ohmic conductor** is one that obeys Ohm's Law. As previously mentioned, Ohm's Law will give a straight line through origin, as shown in the **current-voltage graph** below.

- This graph would be produced by a **linear** circuit. A linear circuit is one which produces a straight line graph and obeys Ohm's Law.

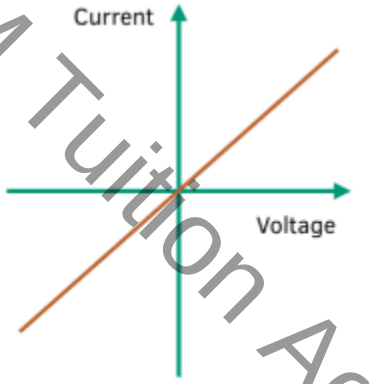

Fig 1. Current-Voltage Graph For an Ohmic Conductor. This is a straight line graph, through the origin. Therefore current is directly proportional to the voltage (assuming a constant temperature and resistance).

Filament Lamp

- Filament lamp has a filament inside it. As the **temperatures** of the filament increases, the **resistance** of the filament lamp will also increase.

- This graph would be produced by a **non-linear circuit**. A non linear circuit is one which does not produce a straight line current-voltage graph, but instead produces a curved line

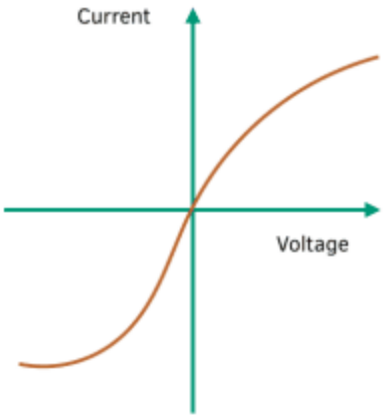

Fig 2. Current-Voltage Graph For a Filament Lamp.

Diodes

- **Diodes** are unique, since they only allow current to flow through them in one direction. The reason behind this is to do with resistance.

- Within a diode, there are 2 pathways of resistance. One has **very low resistance**, whilst the other has **very high resistance**. Current always flows through the path with the least resistance.
- This graph would be produced by a **non-linear circuit.** Remember, non linear circuit is one which produces a curved line.

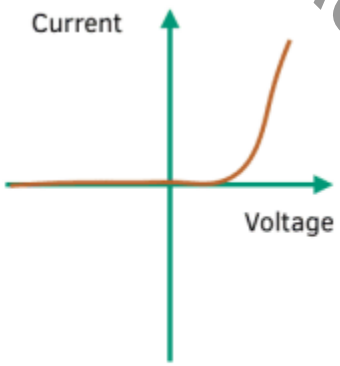

Fig 3. Current-Voltage Graph For a Diode. The graph shows that increasing the voltage one way will lead to a rise in current (after a certain voltage). However increasing the voltage the other way does not lead to a rise in current. The diode only works one way.