CURRENT ELECTRICITY

- Current Electricity is the flow of charge from one location to another.

- For an electric current to flow between two points we need a **Potential Difference** between the points and a charge carrier.

- Charge carriers – anything with a charge eg electrons in a metal or ions in a liquid or gas. If there are no charge carriers free to move in a material then it will be an insulator.

- **Potential Difference** (PD) – a difference in the charge between two points. The potential difference is measured in **volts (V)** – the volt tells us the work done moving every charge between the points. (A trolley on a slope will roll downhill due to the potential difference between one end of the slope and the other)

- **Current** – current is the measure of the rate of flow (how much) of the charges between the points, it is measured in **amps (A)**

- **Resistance** – Most materials resist the flow of electricity to some extent, this resistance to the flow of electricity is measured in **ohms (Ω)**. Resistance to the flow of current uses up energy from the battery, this is usually converted into heat – eg in a bulb or heating element.

- Resistance is calculated by dividing the voltage by the current

$$R = V/I$$

  - Voltage is measured with a voltmeter
  - Resistance is measured with a ohmmeter
  - Current is measured with an ammeter
  - A multimeter is a meter that can be switched to all of the above.

Voltmeters and ohmmeter's are connected in parallel while ammeters are connected in series.

Effects of an electric current

1 Heating (in bulb or cooker element & fuses)
2 Magnetic (electromagnet and electric motors)
3 Electrolysis (chemical effect of electricity – electrolysis of water, electroplating)

AC / DC

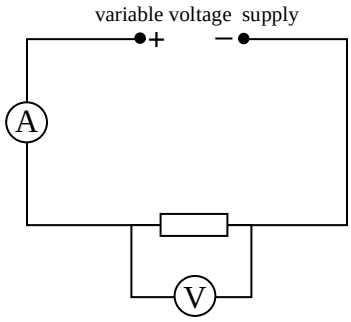
Alternating **C**urrent changes direction constantly – mains electricity from a generator

Direct **C**urrent flows in one direction only – eg from a battery

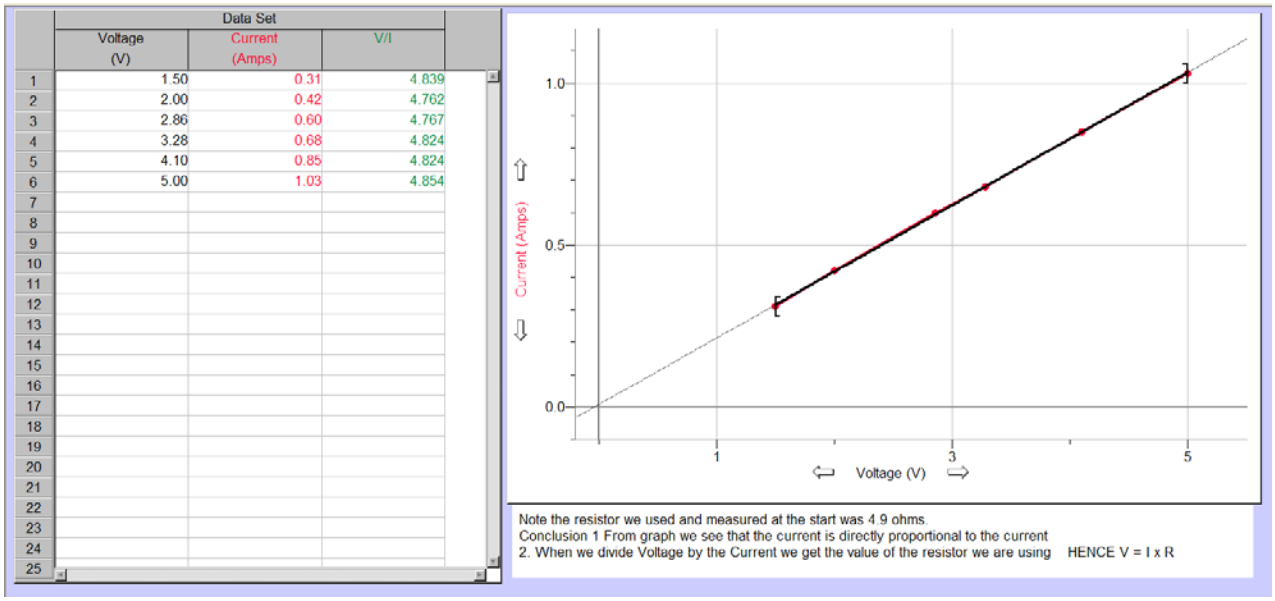
A **fuse** prevents too high a current flowing in circuit. It has a thin wire that melts breaking the circuit if too high a current flows

A **Circuit breaker** is a modern version of a fuse, it is a switch that opens if too high a current flows. An electromagnet opens the switch when the current is too high.

Experiment: Relation between Voltage Current and Resistance.



1. Measure (or note) the resistance of a resistor
2. Connect the resistor in the circuit shown
3. Measure the value of voltage, V, and the, I.
4. Change the voltage and repeat the measurements.
5. Record the readings in a table and plot the graph of V against I
6. Calculate the value of V divided by I in your table
7. Repeat for different resistors.



	Data Set		
	Voltage (V)	Current (Amps)	V/I
1	1.50	0.31	4.839
2	2.00	0.42	4.762
3	2.86	0.60	4.767
4	3.28	0.68	4.824
5	4.10	0.85	4.824
6	5.00	1.03	4.854

Conclusion

The graph is a straight line through the origin showing that current is directly proportional to voltage

$$V \propto I$$

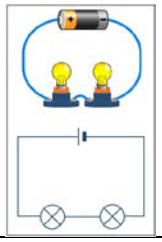
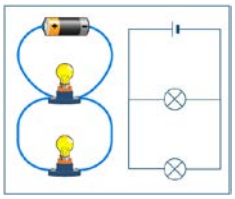
We also see that V/I = resistance used

Hence V/I = R

or $V = I \times R$ [also known as Ohms Law]

NOTE: we will only get these results as long as the ***temperature of the resistor stays the same***. We keep it constant by keeping the current low or by cooling it in water.

SERIES & PARALLEL CIRCUITS

Bulbs connected in series will be dimmer than a single bulb and if one blows the other will not work either.	Bulbs in parallel will be brighter, and if one blows the other still works
	

ELECTRICAL POWER

Electrical power is measured in Watts (W)

The unit the ESB (Electric Ireland) use to measure electrical power used in the home is the **kilowatt Hour**.

Units Used = Power in **kW** × Time in **Hours**

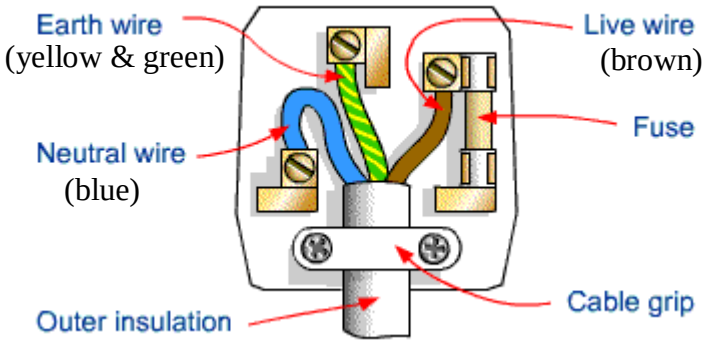
Cost = Power in **kW** × Time in **Hours** × Cost of 1 unit

or

Cost = Units Used × Cost of 1 unit

Note 500W = 0.5 kW, 1500 W = 1.5 kW etc.

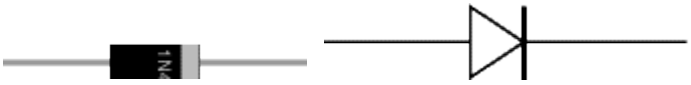
Wiring a plug



The earth wire provides a path for electricity to flow safely to earth if a fault develops.
The Fuse prevents too high a current flowing. A wire in the fuse melts and breaks if the current is too high. [Circuit Breakers do the same job, but can be quickly reset]
Note Mains Voltage is 230 volts

ELECTRONICS
Electronics is the branch of physics dealing with electrical circuits that involve active electrical components such as diodes etc.

The Diode
A diode is a electronic device that allows current to flow in one direction only (used in many electronic devices, eg to convert AC to DC in a transformer)



Light emitting diode
A Light emitting diode is a diode that emits light – it uses much less power than an ordinary bulb (used as on/off indicators on radios, TV's etc and also in small torches)

Light dependant resistor

Light dependant resistor is a resistor whose resistance changes with the amount of light falling on it – the more light the lower its resistance (it is used to control street lights)