

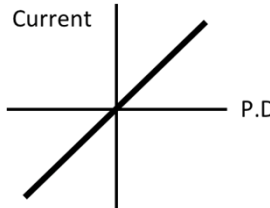
P2 Knowledge Organiser – 4.2.1 – Electricity



Component	Symbol	Component	Symbol
Open Switch		LED	
Closed Switch		Lamp	
Cell		Fuse	
Battery		Voltmeter	
Diode		Ammeter	
Resistor		Thermistor	
Variable Resistor		LDR	

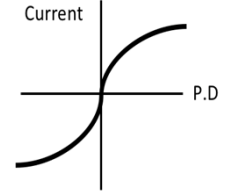
Resistors

- The current through an ohmic conductor (at a constant temperature) is **directly proportional** to the potential difference across the resistor.



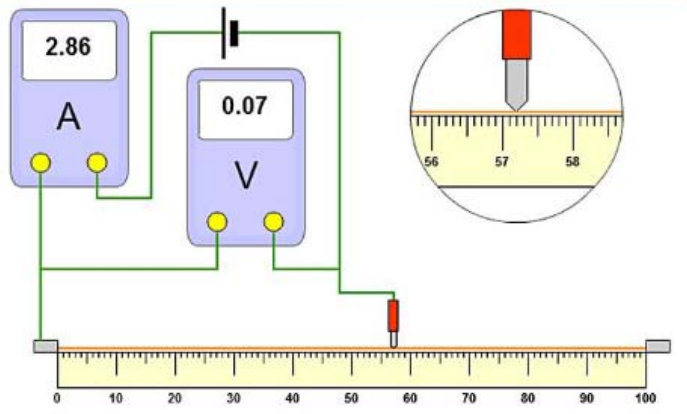
Filament Lamp

The resistance increases as the temperature increases.



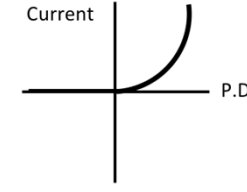
Required practical

- Independent variable** – Length of wire
- Dependent variable** – current and PD to calculate resistance
- Control variable** – Width of wire/ type of metal



Diode

The **current flows in one direction only**. The diode has a very high resistance in the reverse direction.



Current, Resistance and Potential Difference

- The current depends on the resistance and the potential difference
- The greater the resistance of the component the smaller the current for a given potential difference

Potential Difference = Current x Resistance
 $V=IR$

Series Circuits

- Current is the same at any point in the circuit
- The total **potential difference of the power supply is shared** between the components.
- Total resistance is the **sum of the resistance of each component:**
 $R_{total} = R1 + R2$

Parallel Circuits

- The **potential difference is the same**
- Current is shared** between each branch
- Total resistance of two resistors is less than the resistance of the smallest individual resistor.

Thermistors and Light Dependent Resistors

- Resistance of a thermistor **decreases as the temperature increases.**
- The resistance of an LDR **decreases as light intensity increases.**

Electrical Charge and Current

- Circuit must include a source of potential difference.
- Electric current is a flow of electrical charge.
- The size of the electric current is the rate of flow of electrical charge.**

Charge Flow = Current x Time

Quantity	Symbol	Unit
Charge	Q	C
Current	I	A
Time	t	s
Potential Difference	V	V
Resistance	R	Ω



Direct and Alternating Potential Difference

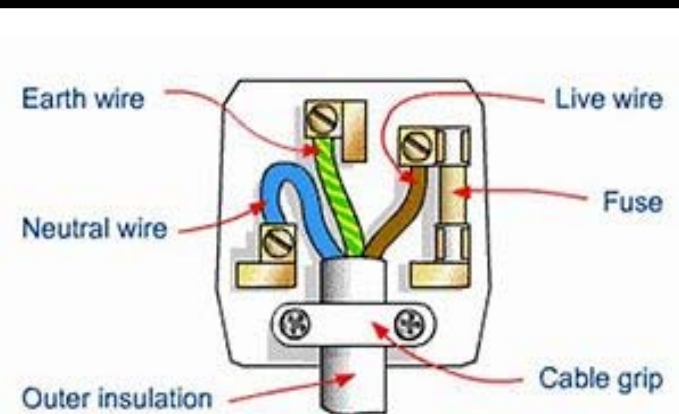
Mains electricity is an ac supply. In the United Kingdom the domestic electricity supply has a frequency of 50 Hz and is about 230 V.

Mains electricity

Most electrical appliances are connected to the mains using three-core cable. The insulation covering each wire is colour coded for easy identification:

- **Live Wire – Brown – Carries current**
- **Neutral Wire – Blue – Completes the circuit**
- **Earth Wire – Green and Yellow Stripes – safety wire to stop the appliance becoming live.**

The earth wire is at 0 V, it only carries a current if there is a fault.



Energy Transfers in Everyday Appliances

The amount of energy an appliance transfers depends on how long the appliance is switched on for and the power output of the appliance.

$$\text{Energy Transferred} = \text{Power} \times \text{Time}$$

$$\text{Energy Transferred} = \text{Charge} \times \text{Potential Difference}$$

Often the power of a domestic appliance is measured in kW. There are 1000W in 1kW.

Quantity	Symbol	Unit
Energy Transferred	E	J
Power	P	W
Charge	Q	C
Potential Difference	V	V
Current	I	A
Resistance	R	Ω

National Grid

- A system of cables and transformers that links power stations to consumers
- **Step-up transformers increase the potential difference** from the power station before reaching the cables.
- **Increasing the potential difference decreases the current, meaning less energy is wasted as heat**
- The transmission cables have a **low resistance**, meaning less energy is wasted as heat.
- **This increases the efficiency** of the National Grid.
- **Step-down transformers decrease the potential difference.** This must happen before the supply reaches consumer for safety.
- **For domestic homes the potential difference is decreased to 230V.**

Power

The rate of energy transfer (power) in any circuit is related to the potential difference across the circuit and the current through it.

$$\text{Power} = \text{Potential Difference} \times \text{Current}$$

$$\text{Power} = (\text{Current})^2 \times \text{Resistance}$$

Static electricity (TRIPLE)

- When insulating materials are rubbed together they become electrically charged
- **Negatively charged electrons are rubbed off one material onto another**
- The material that lost electrons becomes positively charged
- The material that gains electrons becomes negatively charged