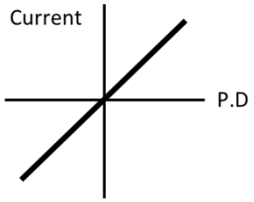
P2 Knowledge Organiser – 4.2.1 – Electricity

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

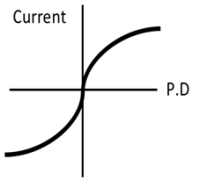
Resistors

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



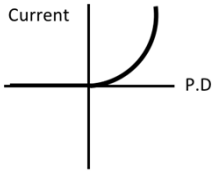
Filament Lamp

The resistance increases as the temperature increases.



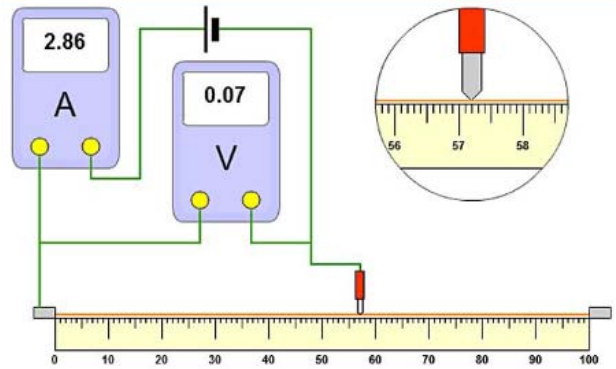
Diode

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



Required practical

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



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

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

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 = *R*1 + *R*2**

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 × Time

P2 Knowledge Organiser – 4.2.1 – Electricity

Direct and Alternating Potential Difference

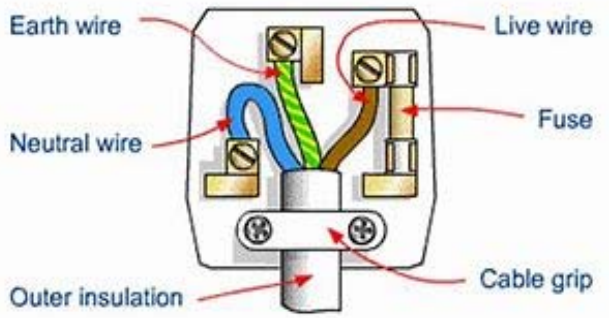
Mains electricity is an ac supply. In the United Kingdom the domestic electricity supply has a frequency of 50 Hz and is about 230 V.

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.

Energy Transferred = Power x Time

Energy Transferred = Charge x 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

Power

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

Power = Potential Difference x Current

Power = (Current)^2 x Resistance

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**.

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