**Electricity & Energy**

**Electric Circuits**

**Summary**

Electrical **charge** is a property of particles. Electrons have negative charge and protons have positive charge.

Objects with similar charges **repel** each other. Objects with opposite charges **attract** each other.

**Electric fields** exist round electrical charges. (The arrows show the direction in which positive charges experience a force)

**Charge, Current & Time**

$$current=\frac{charge}{time}$$

$$I=\frac{Q}{t}$$

$$Q=It$$

$$t=\frac{Q}{I}$$

C

A

s

*I*

*Q*

*t*

Charge is measured in **coulombs** (C).

Electric charges experience a force in an electric field.

When electric charges move there is said to be an electric **current.**

Current is the rate of flow of electric charge.

Current is measured in **amperes** (A).

Current can pass through a conductor because there are charges (e.g. electrons) that are free to move. Metals are good conductors of electricity.

Direct current (**d.c.**) is when the current is always in the same direction. Batteries supply d.c.

Alternating current (**a.c.**) is when the current changes direction every fraction of a section. The mains supply in the UK is 230 V a.c. with a frequency of 50 Hz.

The difference between a.c. and d.c. can be observed by connecting the supplies to an oscilloscope.



d.c.

a.c.

The **potential difference** (voltage) across a component is a measure of the energy transferred by each unit of charge.

Potential difference (voltage) is measured in **volts** (V).

Electrical components can be connected in either **series** or **parallel**.

**Measuring current**

In order to measure the current in a component an **ammeter** should be placed in **series** with the component.

**Measuring voltage**

In order to measure the voltage across a component a **voltmeter** should be connected in **parallel** with the component.

A

V

**Parallel circuits**

In a parallel circuit the sum of the currents in each branch of the circuit is equal to the current in the supply.

$$I\_{S}=I\_{1}+I\_{2}+…$$

The voltages across parallel branches in the circuit are the same.

$$V\_{S}=V\_{1}=V\_{2}=…$$

*Vs*

*Is*

*V2*

*I2*

*V1*

*I1*

*Vs*

*V2*

*V1*

*Is*

*I1*

*I2*

**Series circuits**

There is only one path for current in a series circuit, so the current is the same at all points.

$$I\_{S}=I\_{1}=I\_{2}=…$$

The sum of the voltages across components in series is equal to the supply voltage.

$$V\_{S}=V\_{1}+V\_{2}+…$$