SCIENCE

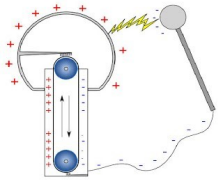
Year 8: Electricity and magnetism

1) Charge

- **Charge** is a property of a substance.
- Particles can have charge. The type of charge can be either **positive** or **negative.**
- The size of the charge is measured in **Coulombs.** The unit of this is **C**.

  For example an electron has a very, very small negative charge of -1.6×10^{-19} Coulombs

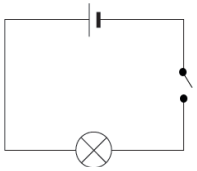
- Objects such as hair, balloons can be "**charged up**" by rubbing them with an **insulator**.



- A van der Graaf machine demonstrates this by charging up a metal dome until it is positively charged.

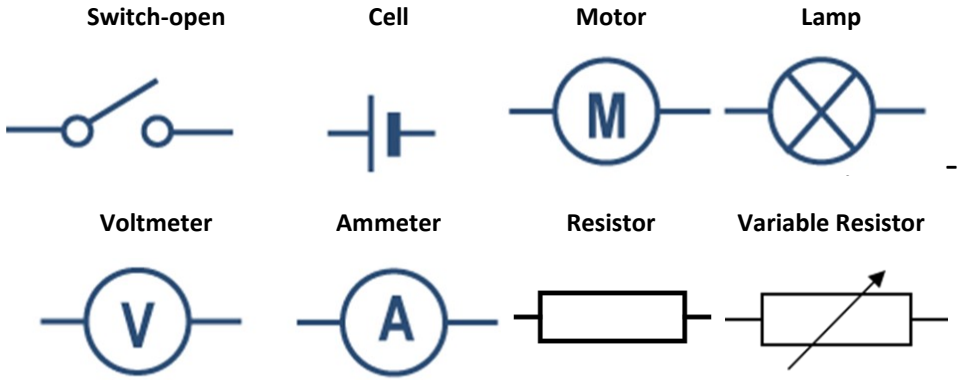
2) Circuit symbols

- Electrical circuits are represented using **circuit diagrams.**



- The different **components in circuits** are represented with different symbols.

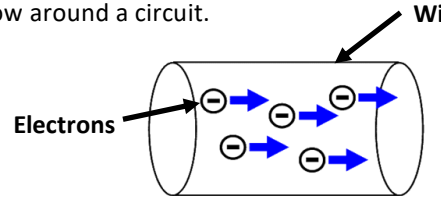
Here are the ones you **need** to memorise:



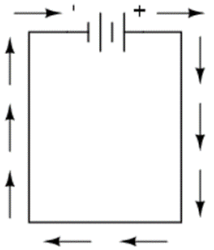
Keyword	Meaning	Keyword	Meaning
Charge	A property of an object that can be either positive, negative or neutral, measured in Coulombs (C)	**Series circuit**	A circuit which contains no branches, it is one closed loop, so current can only take one route around the circuit
Electron	is part of an atom which has a very tiny negative	**Parallel circuit**	A circuit which contains branches meaning current has more than one possible route to take around the circuit
Insulator	An object that doesn't conduct electricity, i.e. plastic, wood, rubber.	**Magnet**	An object that can repel another magnet and attracts magnetic materials
Component	A part of a circuit	**Magnetic**	An object that can be attracted to a magnet
Current	The rate at which charges flow measured in Amperes (A)	**Pole**	The end of a magnet, it will be either north or south
Ammeter	A device for measuring the size of the current.	**Magnetic field**	The area around a magnet in which a magnetic object will feel a force

3) Current

- **Current** is a measure of how quickly charges flow around a circuit.
- In a wire charges that flow are called electrons.



- It is measured in **Amperes (Amps)** using an **ammeter.**



- In an electrical circuit, **conventional current** flows from the positive side of the cell to the negative side of the cell.

RGS SCIENCE

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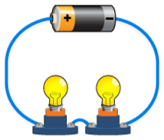
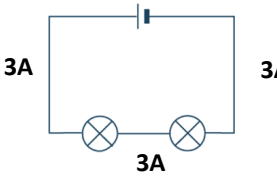
4) Series circuits

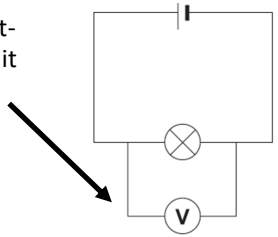
- A series circuit is an electrical circuit in which the wires and **components** are linked together in one **closed loop.**





- In this type of circuit the current is the **same** all the way around.
- This means wherever you place an ammeter in the circuit the reading will always be the same number.

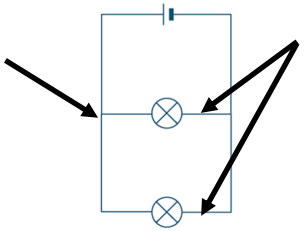
- Here is another example of a series circuits. (Note: The voltmeter doesn't allow current to flow through it so this circuit is still a series circuit).
- **We ignore the measuring equipment when deciding if something is a series circuit or not.**
- If one component in a Series circuit breaks, for example a lamp, then the current stops flowing round the circuit.



6) Parallel circuits

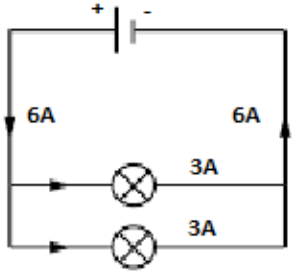
- A **parallel circuit** is an electrical circuit in which the wires and components are linked together but there are **junctions** and **branches**.

Junction—here the current splits and goes down either branch



Branches—how much current flows down each branch depends on what is in each branch.

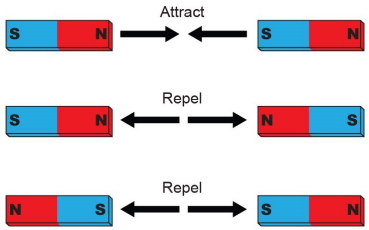
- If a component on one branch of a **parallel circuit** breaks, then a component on another branch will keep on working. This is because there is another route for the **electrons** to flow.
- **Current** is not the same all the way round a **parallel circuit**. This means that it does depend where you put your **ammeter** in the circuit.
- The current in the branches of a parallel circuit add up to be the same as the total current before the junction.
- E.g. 6A flows from the cell, when it reaches the junction this 6A will split in two.
- In this case half of the current has flowed through each branch.
- When the branches meet up at the next junction the current re-combines.
- The current along each branch is **not always** shared equally.



5) Magnets

- Magnets are special metals that attract magnetic materials.
- The three magnetic elements are Iron, Nickel and Cobalt. The alloy steel is also magnetic because it is a mixture of carbon and iron.
- All of these materials will attract to a magnet.

26	27	28
Fe	Co	Ni
Iron	Colbalt	Nickel



- If you bring a North pole and a South pole together they will attract.

Unlike poles attract

- If you bring two of the same poles together e.g. two south poles together or two north poles together they **repel** each other.

Like poles repel

- There are 2 types of Magnet:
- **Permanent magnet**—Materials that produce their own magnetic field.

E.g. bar magnets in Science or Fridge magnets

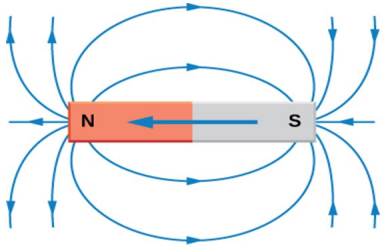
- **Induced magnet**—Materials that can temporarily become magnets in the magnetic field of something else.

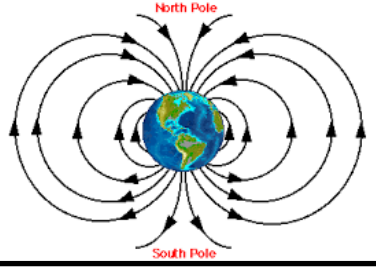
E.g. iron filings, paper clip or an electromagnet

7) Magnetic fields

- Surrounding a magnet is an area called a **magnetic field**. Inside this field other magnets and/or magnetic objects will feel a **force**.

This is the shape of the field around a simple **bar magnet**.



- The arrows on the lines show the direction the force will act on a compass (i.e. a compass will always point to the south pole of a magnet)
- The distance between the magnetic field lines shows how strong the magnetic field is. (the closer the lines are together the stronger the magnetic filed)
- The magnetic field is stronger at the **poles** where the field lines are most concentrated.

- The Earth has a **magnetic field**.
- The magnetic field is similar to that of a bar magnet, it is this field that compasses detect.
- Compasses have an iron needle in them which is free to rotate. It lines itself up with the Earth's magnetic field and shows which way Geographical north is.