Monkton Wood Academy

Ks3 Science

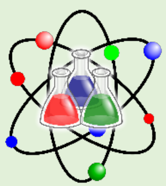
Scientific method

1. What is science?

- Science is about finding explanations for why things happen or what makes things work.
- An **explanation** is not a guess, there has be some basis for it.
- Careful **observation**, including **measurement** where possible, can suggest what may be happening.
- In some cases it is possible to make a change and observe what happens.

2. Hypothesis and prediction

- A **hypothesis** is a possible **explanation** or reason for why something happens.
- A **prediction** is what a scientist thinks will happen if **the independent variable** in an experiment is changed.



3. Variables

- The **independent variable** is the variable the scientist changes to observe what happens.
- The **dependent variable** is the one which is measured to see if changing the independent variable had an effect.
- The **control variables** are kept constant so that the result can only be the effect of changing the independent variable.

4. Repeats, repeatable and reproducible

- **Repeating** an experiment enables us to calculate an **average** and shows the experiment is **repeatable**. A measurement is **repeatable** if the same scientist uses the same method and gets the same result.
- What people expect to happen can influence what they observe. It is good for the same experiment to be **repeated** by a different person. If they get the same result then the measurement is **reproducible**.

5. Recording data

- Data should be recorded during any practical work; this is normally in a table. Tables should have:
  - **Clear headings** with **units**
  - **Independent variable** in the first column
  - **No units** in the body of the table
  - Consistent number of **decimal places**

6. Graphs

- Data can be displayed in a graph to help identify **trends** or **correlations**.
- Data points should be marked with a **cross.** The plotted points should **fill at least half the paper**.
- **Axes** should be **labelled** with the **variable** and the **unit**.
- The **line of best fit** can ignore **anomalous data** and can form a **curve,** not just a straight line.

7. Averages and decimal places

- Calculating an **average** in science usually involves finding the **mean**, but can also include the **mode** or **median** value.
- When calculating a mean, make sure the answer never has more **decimal places** than any of the data values you used.
- When rounding up, use the **deciding digit** to decide whether to round up or down.

8. Conclusion and evaluation

- A **conclusion** contains a **description** and **explanation** of any **trends** or **patterns** in the data. It also looks back at the **hypothesis** and related **prediction** to see if they were correct.
- An **evaluation** looks at the data to see how **precise** or **accurate** it is. It identifies any **anomalous** data and identifies sources of **error** in the method.

1. Magnetic Materials

Most materials are not **magnetic**, but some are. A magnetic material can be magnetised or will be attracted to a magnet. These metals are magnetic:

- Iron
- Cobalt
- nickel

Steel is mostly iron, so steel is magnetic too.

26	27	28
Fe	Co	Ni
Iron	Colbalt	Nickel

2. Permanent magnets

A bar magnet is a **permanent magnet**. This means that its magnetism is there all the time and cannot be turned on or off. A bar magnet has two magnetic poles:

- **north pole** (or north-seeking pole)
- **south pole** (or south-seeking pole)

3. Attract or repel?

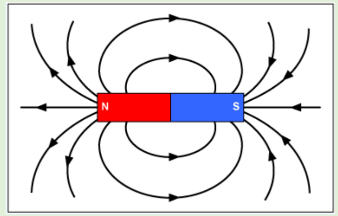
Magnets have two poles, a North pole (N) and a South pole (S).

- **opposite poles attract** (N and S)
- **like poles repel** (N and N, OR S and S)

How can you test if a piece of metal is actually a magnet? Seeing if it sticks to a magnet is not a good test, because unmagnetised iron, steel, cobalt and nickel objects will also do this. So you can only show that an object is a magnet if it **repels a known magnet**.

4. Magnetic fields

A magnet creates a **magnetic field** around it. You cannot see a magnetic field, but you can observe its effects. A force is exerted on a magnetic material brought into a magnetic field. The force is a **non-contact force** because the magnet and the material do not have to touch each other.



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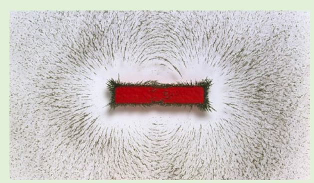
KS3 Science

Magnetism

5. More Magnetic Fields

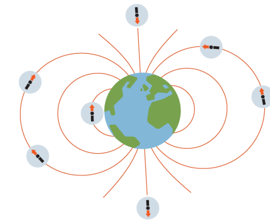
Although we cannot see magnetic fields, we can detect them using iron filings and plot them with a plotting compass

- field lines point from north to south pole
- field lines are more concentrated at the poles.
- The magnetic field is strongest at the poles, where the field lines are most concentrated.



6. The Earth's Magnetic Field

The Earth behaves as if it contains a giant magnet. It produces a magnetic field in which the field lines are most concentrated at the poles. This magnetic field can be detected using magnetic materials or magnets.



7. Navigating with a compass

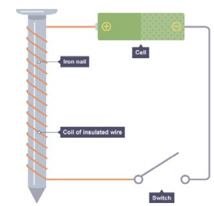
A compass comprises:

- a magnetic needle mounted on a pivot (so it can turn freely)
- a dial to show the direction

The north pole (north-seeking pole) of the compass needle points towards the Earth's north pole. If the needle points to the N on the dial, you know that the compass is pointing north. This lets you navigate outdoors using a map.

8. Electromagnets – extra content

When an electric current flows in a wire, it creates a magnetic field around the wire. This effect can be used to make an **electromagnet**. A simple electromagnet comprises a length of wire turned into a coil and connected to a battery or power supply.



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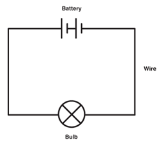
KS3 Science
Electricity and Circuits

1. Electric current

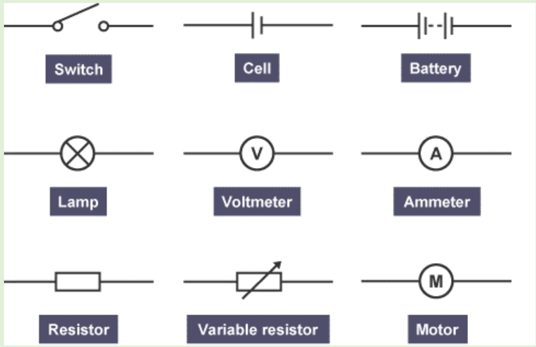
An **electric current** is a flow of charge, and in a wire this will be a flow of electrons. We need two things for an electric current to flow:

- something to transfer energy to the electrons, such as a battery or power pack
- a complete path for the electrons to flow

To do something useful with the electric current, you need to put an electrical component into the circuit (such as a lamp), that can use the current in a useful way

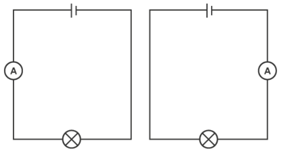


2. Circuit symbols



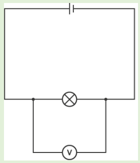
3. Current

Current is a measure of how much electric charge flows through a circuit. The more charge that flows, the bigger the current.
Current is measured in amperes (amps), the symbol is A.
To measure the current flowing through a component in a circuit, you must connect the ammeter **in series** with it.
Current is not used up in a circuit



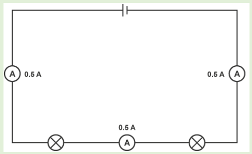
4. Potential difference

Potential difference is a measure of the difference in energy between two parts of a circuit. The bigger the difference in energy, the bigger the potential difference.
Potential difference is measured in **volts**, the symbol is V.
Potential difference is measured using a device called a **voltmeter**, unlike an ammeter, you must connect the voltmeter **in parallel** to measure the potential difference across a component in a circuit.



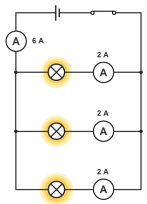
5. Series circuits

A series circuit contains components connected one after the other, like the episodes of a series on TV.
In series circuits, if one component fails, all the components stop working.
Current is the same everywhere in a series circuit.
Current is shared between the Components in a series circuit.
Series circuits use less wire than parallel circuits.



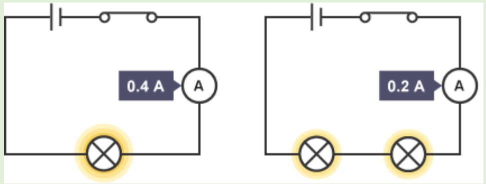
6. Parallel Circuits

Components in parallel circuits are connected on different branches of the circuit.
If one component connected in parallel fails, the other components are not affected.
Current is shared between the components in a parallel circuit.
Parallel circuits are useful if you want to switch components on and off independently, our homes are wired this way.



7. Resistance

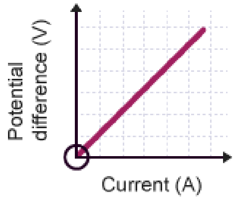
The wires and the other components in a circuit reduces the flow of charge through them. This is called resistance.
The unit of **resistance** is the **ohm**, and it has the symbol Ω
Resistance increases if you add more components to a circuit.



8. Calculating resistance

The equation for calculating resistance is:
Resistance = current x potential difference

If you plot a graph of current against potential difference for a wire, you get a straight line.



1. Safety


Irritant


Corrosive

- When handling acids and alkalis in the lab we need to take safety precautions, for example wearing goggles.
- Concentrated Acid is corrosive, and will destroy skin cells.
- Dilute acids have lots of water added, they are an irritant and cause redness or blistering of the skin.

2. Acids (pH 1-6)

- **Acids** are a family of chemicals, examples are lemon juice, vinegar and Coca Cola. There is also acid in our stomach.
- Acids contain Hydrogen (H^+) ions.
- **Strong acids** like hydrochloric acid are very corrosive this means they destroy skin cells and cause burns.
- **Weak acids** like vinegar are safe to eat but are still irritant to sensitive parts of the body.

3. Alkalis (pH 8-14)

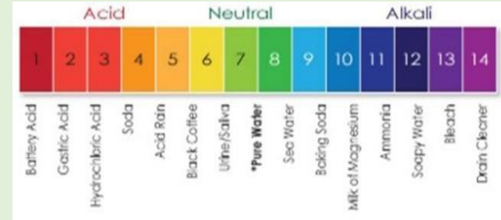
- Alkalis, are a family of chemicals that have a soapy feel, they are also corrosive, examples of these are toothpaste, soap and oven cleaner.
- Alkalis contain Hydroxide (OH^-) ions.
- Alkalis are bases that dissolve in water. Therefore not all bases are alkalis.

KS3 Science

Acids & Alkalis

4. pH Scale

- The pH scale measures the strength of acids and alkalis, it runs from 0-14
- neutral solutions are pH 7 exactly
- acidic solutions have pH values less than 7
- alkaline solutions have pH values more than 7
- the closer to pH 0 you go, the more strongly acidic a solution is
- the closer to pH 14 you go, the more strongly alkaline a solution is



5. pH Indicators

- **Indicators** are chemicals that show whether a substance is an **acid or an alkali**
- There are many different indicators, for example **litmus paper and universal indicator**
- There are also natural indicators such as **red cabbage**

6. Neutralisation

- A chemical reaction happens if you mix together an acid and a base. The reaction is called **neutralisation**. A neutral solution is made if you add just the right amount of acid and base together.
- Neutralisation reactions form **salts** the name of the salt depends on the name of the acid, and the metal in the base
- Hydrochloric acid makes **"chlorides"**, Nitric acid make **"nitrates"**, Sulphuric acid makes **"sulphates"**

General equations for neutralisation reactions:

Acid + Metal Hydroxide → Salt + Water

Acid + Metal Oxide → Salt + Water

Acid + Metal Carbonate → Salt + Water + Carbon dioxide

Farmers use lime (calcium oxide) to neutralise acid soils. Your stomach contains hydrochloric acid, too much of this causes indigestion. Antacid tablets contain bases to neutralise the extra acid.
Wasp stings are alkaline, they can be neutralised using vinegar.