

Year 11 Science Knowledge Booklet

Term 4

Name:

Class:

Year 11 Knowledge and Pillars Test Timetable and Workbook Deadlines		
28 th February	B7/C6	B7
14 th March	C7/P6	C7
28 th March	C6/P6	P7





Science Homework 1

Complete the first section of the Exam Practice workbook identified on the front of this Knowledge Organiser ready for the Knowledge Quiz.

Big questions:

What is the difference between a pure substance and a formulation?

How can we separate pure substances?

How do we test for common gases?

How has the Earth's atmosphere changed over time?

Why are scientists concerned about rising CO₂ levels?

Why is methane production a concern?

What other pollutants can harm the environment?

How is water made safe to drink?

What practical techniques can be used to show that drinking water is not a pure substance?

What are the common techniques used to extract metals from their ores?

What techniques are required to extract metal from low-grade ores? (Higher only)

Why are life cycle assessments useful in industry?

Key vocabulary

Atmosphere	A layer of gases surrounding the Earth
Bioleaching	Uses bacteria to produce leachate solutions that contain metal compounds from which metal can be isolated
Chromatography	A separation technique that splits substances based on their relative attraction to either the mobile phase or stationary phase
Climate change	A change in global / regional climate patterns. This is the general weather conditions over a long period of time
Formulation	A formulation is a mixture that has been designed as a useful product. They are made useful components in carefully measured quantities
Greenhouse effect	The trapping / retention of heat by the atmosphere due to presence of gases such as carbon dioxide, methane and water vapour
Life cycle assessments	Process used to identify the environmental impact of products over each stage in the course of its production, use and disposal
Phytomining	Uses plants to absorb metal compounds, which are then harvested burnt and the metal compounds isolated
Pollutant	A harmful chemical released into the environment.
Potable water	This is water which is suitable and safe to drink. It is not pure water as it has other dissolved substances
Pure	A pure element or compound is not mixed with any other substance, they melt and boil at specific temperatures

What is the difference between a pure substance and a formulation?

The majority of substances used in everyday life are mixtures, which means that they are made up of more than one type of substance that is not chemically bonded to the other.

Each substance has a specific melting/boiling point if it is pure, and mixtures retain many of the original properties of the individual substances. However, the melting / boiling points can be altered, like adding salt to water to lower the melting point or increase the boiling point.

In everyday life, many products are complex mixtures that require specific amounts of each substance to ensure consistency in the product. For example, medicines, foods and drinks, fuels and alloys.

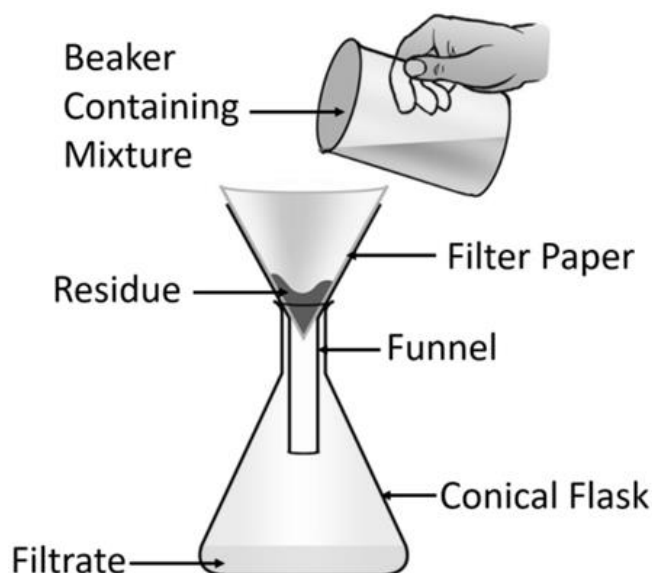
In a formulation, every chemical has been added in a carefully measured amount. Each chemical has a specific purpose in the formulation. With formulations, each component is there for a specific purpose. E.g in medicines the substance that is actually needed to treat a condition is referred to as the active ingredient.

How can we separate pure substances?

In mixtures, the different substances are not chemically bonded together. Because of this, they can often be separated by relatively simple techniques.

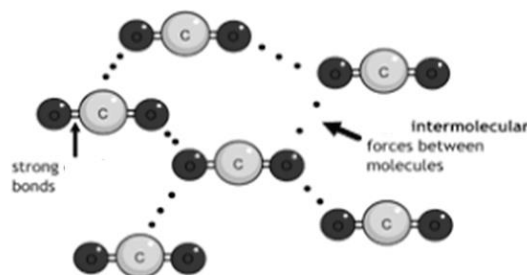
Filtration

- Filtration can be used to separate a liquid from an insoluble solid.
- It is also used to separate a solution from a solid that is mixed with it, but not dissolved.



Evaporation

- Evaporation is the process where a liquid turns into a gas.
- The intermolecular forces in the liquid are overcome and broken; separating the particles.

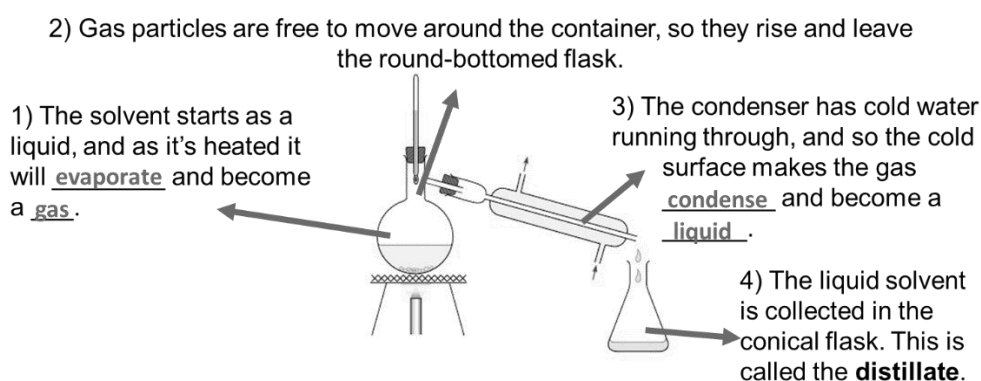


What is the difference between boiling and evaporation?

- Boiling occurs at the boiling point of a substance.
- It is typically accompanied by bubbling as the gas escapes the liquid.

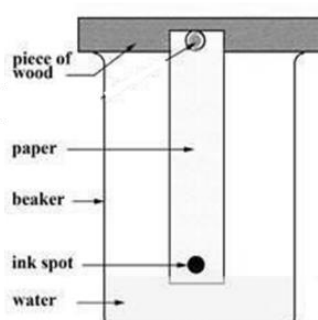
Distillation

- **Soluble solids and liquids** – the solvents will evaporate and leave the solid in the round-bottomed flask
- **Liquids of different boiling points** - the liquid with the lower boiling point will evaporate off; leaving the liquid with the higher boiling point in the round-bottomed flask.



Chromatography

- Chromatography is used as a way of checking to see if a substance is a mixture or pure, and as a means of comparing one unknown against known substances.
- If different solutions are mixed together, they can also be separated by their solubility.



How do we test for common gases?

You need to know how to test for some common gases.

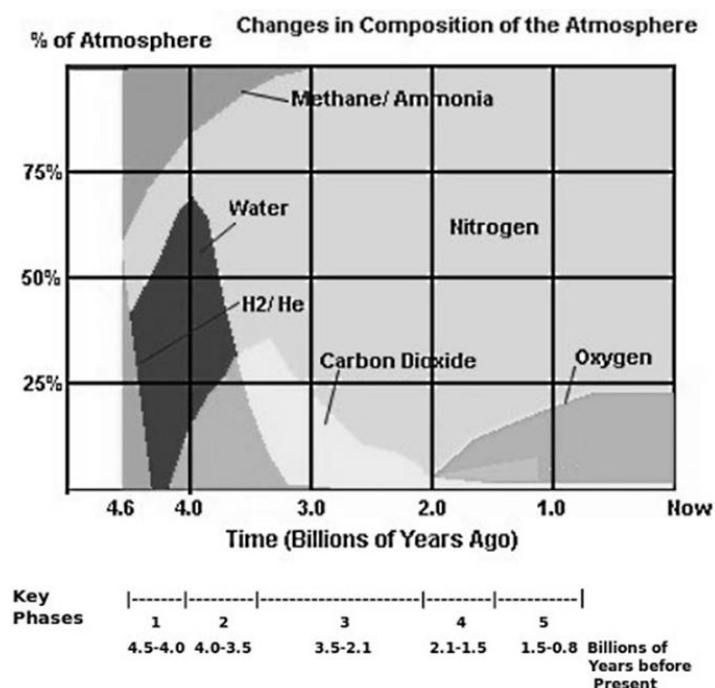
Test	Observation	Inference
Glowing splint held in a test tube	Splint relights	Oxygen is present
Lighted splint held in a test tube	Pop sound heard	Hydrogen is present
Gas bubbled through limewater	Limewater turns milky or cloudy white	Carbon dioxide is present
Damp litmus paper held in a test tube	Paper turns white	Chlorine is present

How has the Earth's atmosphere changed over time?

The atmosphere is the layer of gases surrounding the planet. It is essential for life, without it life wouldn't exist. The composition of the atmosphere has changed compared to the early atmosphere, and is still changing today due to human influences.

Earth's atmosphere is composed of about 78 percent nitrogen, 21 percent oxygen, 0.9 percent argon, and 0.1 percent other gases. Trace amounts of carbon dioxide, methane, water vapour, and neon are some of the other gases that make up the remaining 0.1 percent.

The Earth's atmosphere has not always been this way, it has been relatively constant for hundreds of millions of years.





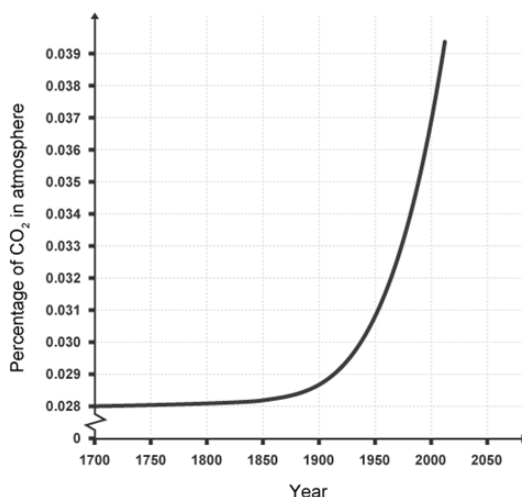
Science Homework 2

Complete the second section of the Exam Practice workbook identified on the front of this Knowledge Organiser ready for the Knowledge Quiz.

Why are scientists concerned with rising CO₂ levels?

Rising CO₂ levels are creating concern in the global community due to their impact on the Earth's atmospheric temperature. This is because CO₂ is an example of a greenhouse gas.

A greenhouse gas is any gaseous compound in the atmosphere that is capable of absorbing infrared radiation, thereby trapping and holding heat in the atmosphere. By increasing the heat in the atmosphere, greenhouse gases are responsible for the greenhouse effect, which ultimately leads to global warming.



How is water made safe to drink?

Water is essential for life. Water that is safe for humans to drink is called **potable water**. Potable water is not pure water because it almost always contains dissolved impurities.

For water to be potable, it must have sufficiently low levels of dissolved salts and microbes.

Most potable water in the UK is produced from naturally occurring fresh water by:

1. passing the water through filter beds to remove insoluble particles
2. sterilising the water to kill microbes

The methods used for sterilisation include chlorine, ozone and ultraviolet light.

What are the common techniques used to extract metals from their ores?

Unreactive metals, such as silver and gold, can be found in the Earth's crust in a pure form, un-combined to other elements. However, more reactive metals, such as aluminium and magnesium, will usually be found combined to another element in a compound. An **ore** is a rock that contains enough of the metal to make it economically worth extracting.

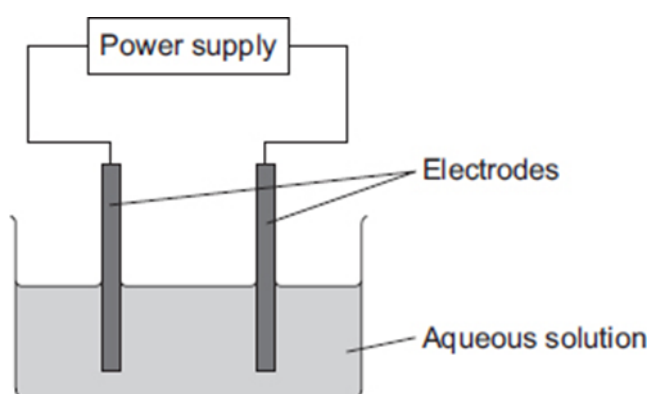
Extraction methods

The method of extracting a metal depends on its position in the reactivity series.

METAL	METHOD	REACTIVITY
POTASSIUM SODIUM CALCIUM MAGNESIUM ALUMINIUM	ELECTROLYSIS OF MOLTEN COMPOUNDS	↑
CARBON		
ZINC IRON COPPER SILVER GOLD	HEATING WITH CARBON VARIOUS CHEMICAL REACTIONS	

If a metal is **less reactive than carbon**, it can be extracted by reacting it with carbon in a displacement reaction.

Elements which are **more reactive than carbon** will be extracted using **electrolysis**. Aluminium is more reactive than carbon so it must be extracted from ores containing aluminium oxide using this method.

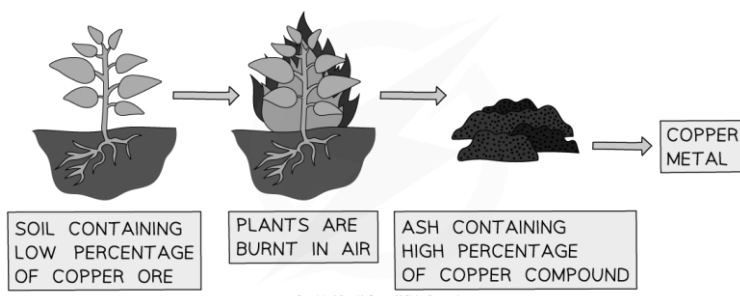


What techniques are required to extract metal from low-grade ores? (Higher only)

- Extraction of metal ores from the ground is only economically viable when the ore contains sufficiently high proportions of the useful metal, such as iron ores and aluminium ores.
- For low grade ores (ores with lower quantities of metals) other techniques are being developed to meet global demand.
- This is happening in particular with nickel and copper as their ores are becoming more and more scarce.
- Phytomining and bioleaching (bacterial) are two relatively new methods of extracting metals that rely on biological processes.
- Both of these methods avoid the significant environmental damage caused by the more traditional methods of mining.

Phytomining

This process takes advantage of how some plants absorb metals through their roots



Bioleaching

- Bioleaching is a technique that makes use of bacteria to extract metals from metal ores.
- Some strains of bacteria are capable of breaking down ores to form acidic solutions containing metals ions such as copper(II).
- The solution is called a leachate which contains significant quantities of metal ions.
- The ions can then be reduced to the solid metal form and extracted by displacement reactions or electrolysis.

Why are life cycle assessments useful in industry?

A life-cycle assessment or LCA analyses the impact of a manufactured product.

The main stages analysed as part of a life-cycle assessment are:

- **Raw Material Extraction**
- **Manufacturing & Processing**
- **Transportation**
- **Usage & Retail**
- **Waste Disposal**

The life-cycle assessment is a complex process and judgements are not exact. For example, people do not always follow the disposal advice from the manufacturer.

How to get the most out of your knowledge organiser:

- To get the most use out of the knowledge organisers you should be learning sections and then self-testing.
- There are several different things you can do
 - Look, cover, write, check, correct
 - Read through the organisers
 - Mind maps
 - Key spellings
 - Make a glossary
 - Missing out key words
 - Questions/answers answers/questions
 - Flash cards
 - Revision clock learning
 - Mnemonics

Science Learning Tools and wider study:

The Oak Academy – Online Science lessons

BBC Bitesize science

You tube channels:

Fuse school

Ted talks

Free science lessons

Primrose Kitten

Shows on Netfilx

Our planet

Tiny creatures

A life on our planet

Key knowledge question	Answer
In science what is a pure substance?	A pure element or compound is not mixed with any other substance, they melt and boil at specific temperatures
What is potable water?	This is water which is suitable and safe to drink.
Is potable water pure water?	It is not pure water as it has other dissolved substances in it.
How can we separate an insoluble solid from a liquid?	Filtration
Which gas makes up roughly 78% of our atmosphere?	Nitrogen
Give 2 examples of greenhouse gases?	Carbon dioxide and methane (others are involved).
What is an ore?	An ore is a rock that contains enough of the metal to make it economically worth extracting.
How are metals below carbon in the reactivity series extracted from their ores?	By reacting it with carbon in a displacement reaction.
How are metals above carbon in the reactivity series extracted from their ores?	They are extracted using electrolysis .
What is a life cycle assessment?	A life-cycle assessment or LCA analyses the impact of a manufactured product.



Science Homework 3

Complete the final section of the homework workbook identified on the front and learn the key knowledge questions and answers for all of the areas covered in this knowledge organiser ready for the end of term test.

Big questions:

- What is the difference between a magnet and a magnetic material?
- What do magnetic field patterns tell us?
- How are electromagnets made?
- What is the motor effect?
- How do electric motors work?

Key vocabulary

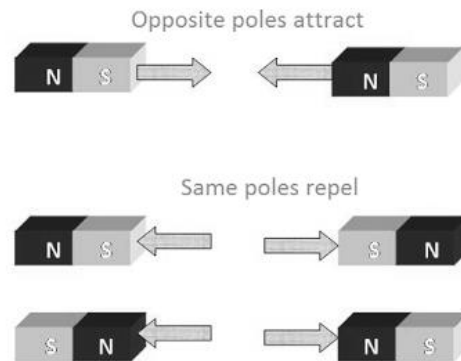
Commutator	A split ring of metal used to reverse the current applied to a motor every half turn. This keeps the motor spinning in one direction.
Electric motor	A device that uses electric current and permanent magnets to produce continuous motion.
Electromagnet	A magnet made by passing an electric current through a wire.
Induced magnetism	Magnetism that is created in a material when another magnet is brought near to it.
Magnetic field	The region around a magnet where the magnetic effect can be felt. Magnetic fields are shown as field lines drawn from the north to the south pole.
Magnetic material	A material that is attracted to a magnet. Magnetic materials can be used to make permanent or temporary magnets. Iron, steel, cobalt, nickel are magnetic materials.
Magnetic pole	The parts of a magnet where the magnetism is strongest . The north pole of a magnet is the pole that is attracted to the north pole of the Earth.
Motor effect	When a wire carrying an electric current is put near to the poles of a magnet the wire experiences a force. This is called the motor effect .
Permanent magnet	An object that attracts magnetic materials and attracts and repels other magnets. A magnet that does not lose its magnetism when the magnetizing force is removed. Steel, cobalt and nickel can be used to make permanent magnets.
Solenoid	An electromagnet made from a long, straight coil of wire. When a current flows the solenoid acts like a bar magnet.

What is the difference between a magnet and a magnetic material?

Magnets attract magnetic materials like iron, steel, cobalt and nickel.

Magnets attract and repel other magnets.

The magnetism is strongest at the poles. The poles are labelled north and south. The North pole is attracted to the north pole of the Earth.

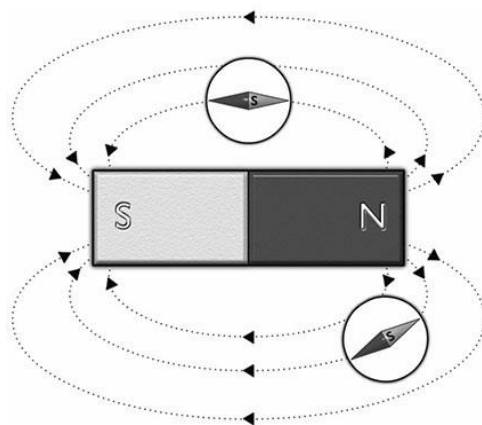


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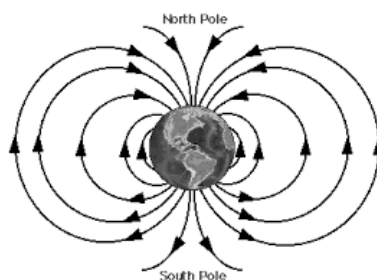
- What do magnetic field patterns tell us?

The region around a magnet where the magnetic force can be felt is called the magnetic field.

Plotting compasses can be used to show the pattern of a magnetic field.

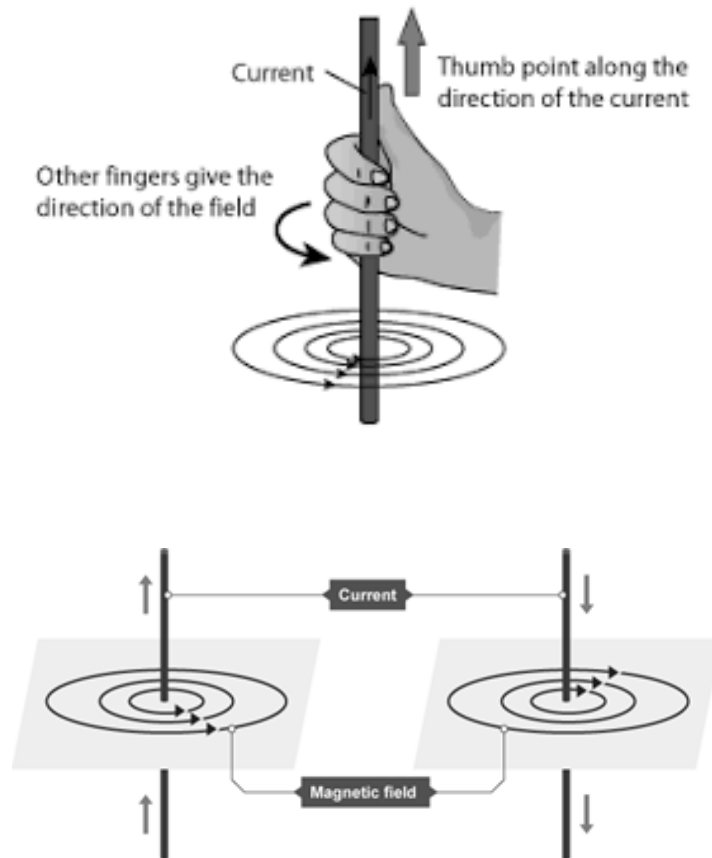


The **Earth's magnetic field** is similar to a bar magnet with the earth's North pole being a magnetic south pole.



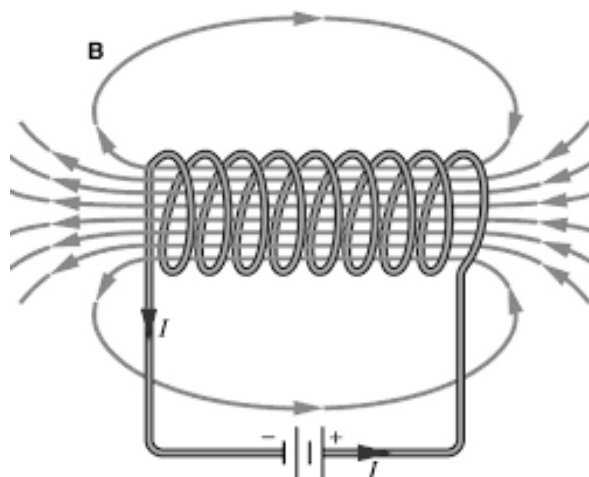
- How are electromagnets made?

A wire has a magnetic effect if a current is flowing in the wire. The field is circular around the wire. Its direction is given by the right-hand grip rule.



A **solenoid** is a long, straight coil of wire. When a current flows it has a magnetic field like a bar magnet.

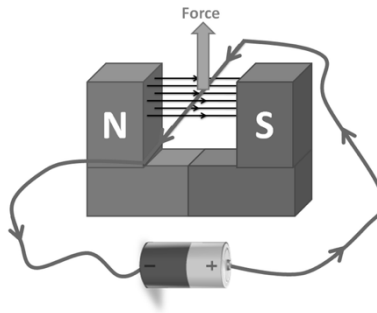
- Magnetic field similar to bar magnet.
- Field strongest where field lines closest.



- **What is the motor effect?**

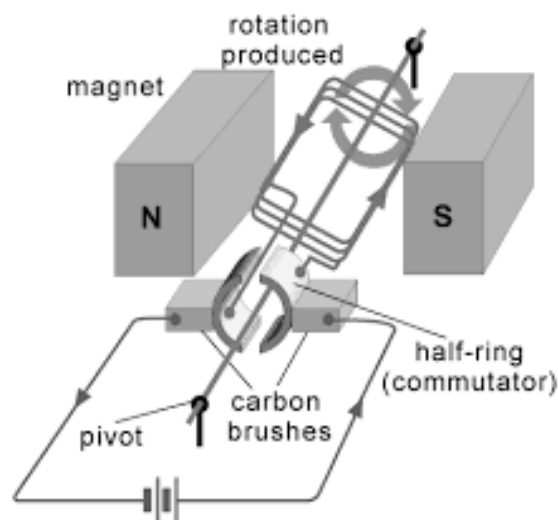
A wire carrying an electric current experiences a force in a magnetic field.

- The force is bigger if the current is bigger.
- The force is bigger if the magnetic field is stronger.
- The force is bigger if the wire is at right angles to the field lines.



- **How do electric motors work?**

- Current flows in the coil - the coil becomes magnetic.
- Flemings left hand rule gives direction of force.
- One side moves up, one side moves down.
- Split-ring commutator reverses the current flow to continue the spin past half-way.
- Motor is faster if more current; more turns of wire on the coils; stronger magnets.
- **AC motors** have slip rings. The current changes directions so no need for commutator.



Key knowledge question	Answer
What is a permanent magnet	A magnet that produces its own magnetic field
What is an induced magnet	A material that becomes magnet when it is placed in a magnetic field
The force between like poles of a magnet is _____?	Attractive (attraction)
The force between unlike poles of a magnet is _____?	Repulsive (repulsion)
Where is the magnetic field of a magnet strongest?	At the poles
Name three magnetic materials	Iron/steel, cobalt, nickel
Give two ways to show the magnetic field of a magnet	Iron filings, plotting compasses
Give one way to increase the strength of the magnetic field around a wire	increase the electric current
Give three ways to increase the strength of the magnetic field around a coil of wire (solenoid)	increase the current, increase the number of turns (coils), add an iron core
What do the first finger, second finger and thumb represent in Fleming's left hand rule	First finger: field, second finger: current, thumb: force
Give the equation that links force, magnetic flux density, current and length for a wire in a magnetic field.	Force = magnetic flux density x current x length $F = B I l$
Give three ways to increase the speed of an electric motor	increase the current, increase the number of turns (coils), increase the strength of the magnetic field, add an iron core

