Science Knowledge Organisers

Year 8 PC3 (June Exam)

Kettering science Academy

What is a 'knowledge organiser'?

A knowledge organiser is simply a collection of the all of the information which your teacher would like you to be able to **recall** from a particular topic. That means that it **does not have everything on it** for a unit of study but it does have **the most essential things to learn.**

A knowledge organiser has lots of facts and definitions on it. Did you know that there is as many new words in studying science as there is in studying a language?

A knowledge organiser does **not develop skills**, so good revision will involve **lots of practice questions** as well as learning the content of these organisers.

What do I do with it?

For most of us, the first thing that we learned at school in reception was our phonics sounds. We learned them by repetition – seeing them again and again until the association between the sound and the image stuck. We need to do the same thing with these knowledge organisers!

Your teacher will probably be using knowledge organisers as you are taught. They will be referred to in class and you should have regular small tests on what you have learned.

Our knowledge organisers are deliberately broken into small lesson sized chunks for you to learn. Typically a teacher may ask you to 'learn box 2 and 3' for a homework.

By the time you come to an assessment – an exam or test – you should already be familiar with the knowledge organisers and already know some of it. They can then be relearned as a part of the revision and assessment preparation procedure.

Retrieval Practice

A key part of learning anything is the act of trying to remember. In class, your teacher will be helping you to do this by asking lots of questions and setting quizzes. **The more often you try to remember something the more likely you are to remember it**. With knowledge organisers you can achieve the same thing at home.

Why are we doing this?

Research has shown that **the more you know** the **more you can learn.** By being able to recall the facts, you are able to understand more complicated ideas because you **already know what the key words mean.** You will also already have a set of ideas in your mind that the new ideas can connect to (this is often referred to as a **schema**).

What are the best techniques for memorising using a knowledge organiser?

READ COVER WRITE

Make sure you are working somewhere quiet and that you have something to write with and some paper. Focus on learning on part of the knowledge organiser only, for example box one. Read through it carefully several times. When you think you've got it, cover over the knowledge organiser and write it all down. Then check what you've been able to remember. Read the bits that you could not recall, cover and write again.

TEST ME

Once you have learned the sections, its time to see if you can remember larger amounts.

Ask a friend or family member to test you on the content of the knowledge organiser page. They don't need to be experts – only to say whether you have remembered it correctly.

TEST EACH OTHER

If you are revising with class mates, testing each other is great. By doing this you are thinking about what you need to know when you are answering questions but also when you are checking to see if your class mate is right. This works well on video calls!

MAKING FLASH CARDS

Some students find making flash cards really helps. You are thinking about what needs to be learned as you write! But don't fall into the trap of writing them and never using them! Once written they should be used regularly – you can test yourself with them or test each other!

Spaced Learning

All of the techniques work best when they are done **little and often**. Aim to repeat something you have learned a week – studies have shown that once you learn something, if you see it again after a week recall is better long term. Then again after a month… and so on.

Application

Once you have memorised some of the information, or have made a good start, it's a good idea to start trying to **use that knowledge**. Websites like **Seneca** and **Educake** provide great banks of questions for this.

7A Cells, Tissues, Organs and Systems

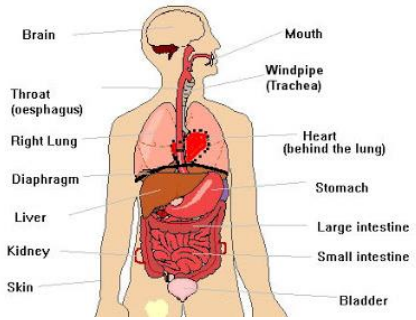
1. Life Processes

Life Processes	If something can do all 7 life processes it is considered a 'living thing' They are; movement, reproduction, sensitivity, growth, respiration, excretion and nutrition.
Organism	A living thing.
Movement	Being able to move from place to place or move part of themselves.
Reproduction	Being able to make more living things like themselves.
Sensitivity	Being able to sense and react to things around them.
Growth	Being able to increase in size.
Respiration	Being able to release energy through respiration.
Excretion	Being able to get rid of waste materials.
Nutrition	Taking in substances (such as food) to help carry out the other processes.

2. Organs

Organ	A part of animals or plants that does an important job- made up of different tissues.
Function	The job or role something has.
Brain	Controls the body.
Skin	The bodies biggest organ- used for protection and sensing things.
Lungs	Take in oxygen for respiration and excrete carbon dioxide.
Heart	Pumps blood around the body.
Liver	Makes and destroys substances.
Kidneys	Clean the blood and produce urine to excrete waste.
Bladder	Stores urine.
Stomach	Breaks up food.
Small Intestine	Breaks up food and absorbs it.
Large Intestine	Removes water from unwanted food.
Rectum	Stores faeces (waste material)

Human Organs



Leaf	Traps sunlight to make food for a plant.
Stem	Carries substances around a plant.
Root	Holds the plant in place and takes in water and other substances.
Photosynthesis	The process by which a plant makes its own food.

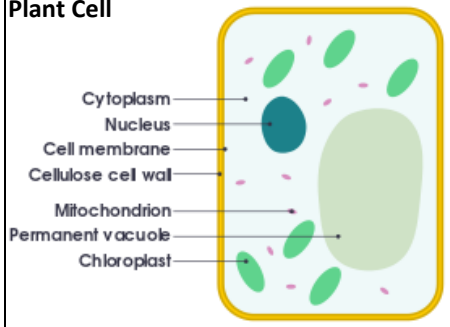
3. Tissues

Tissues	Groups of the same cells doing the same job- make up organs.
The Heart	Made up of muscle tissue so it can move and pump the blood as well as fat tissue to protect it.
Root Hair Tissue	Small hairs on the outside of roots which help to take in as much water as possible.
Xylem Tissue	The tissue which carries water up through plants from the roots.

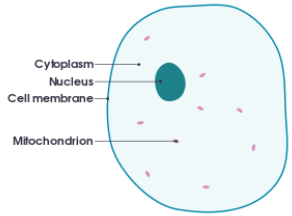
4. Cells

Cells	The basic units from which all tissues and living things are made from.
Specialised	When something has features that allow it to do a particular job.
Cell Surface Membrane	Controls what enters and leaves the cell.
Nucleus	Controls the cell.
Cytoplasm	Jelly like substance where chemical reactions happen.
Mitochondria	(*mitochondrion- singular*) Where respiration happens.
Chloroplasts	Make food for the plant using photosynthesis- contains chlorophyll.
Cell Wall	Strengthens and supports the cell- made of cellulose.
Vacuole	Storage space filled with cell sap.

Plant Cell



Animal Cell



5. Organ Systems

Organ Systems	A collection of organs working together.
Circulatory System	*Heart, blood vessels* Carries oxygen and nutrients around the body.
Digestive System	*Gullet, stomach, intestines* Breaks down food and takes nutrients into the blood.
Locomotor System	*Muscles, bones* Enables the body to move.
Urinary System	*Kidneys, bladder* Gets rid of waste materials produced in the body.
Breathing System	*Lungs, trachea* Allows exchange of gases between blood and lungs.
Nervous System	*Brain, nerves, spinal cord* Allows the body to sense things and react to them.
Water Transport System	*Roots, stem, leaves* Transports water around the plant.

Lesson	Memorised?
1. Life Processes	
2. Organs	
3. Tissues	
4. Cells	
5. Organ Systems	

7F Acids and Alkalis

1. Hazards

Hazard	Something that could cause harm.
Risk	The chance that a hazard will cause harm.
Hazard Symbols	Internationally agreed symbols representing the type of risk from using a substance.
	**Dangerous to Environment** Can cause long term damage to animal and plant life.
	**Toxic** Poisonous and can cause death if taken into the body.
	**Corrosive** Attacks certain substances like metals, stonework & skin.
	**Explosive** Heating may cause an explosion.
	**Flammable** These substances catch fire easily.
	**Caution** similar to toxic/corrosive but less serious- may cause skin irritation
Diluted	Dangerous substances are mixed with water to make them less dangerous.

2. Indicators

Indicator	A substance that changes colour in solutions of different acidity/alkalinity.
Litmus	An indicator made from a type of lichen.
Acid	Turns litmus indicator **red**.
Alkali	Turns litmus indicator **blue**.
Neutral	A substance that is neither acidic or alkaline.
Red Cabbage	Can be used as an indicator.

3. Acidity and Alkalinity

pH Scale	A scale measuring acidity and alkalinity in numbers.

The pH Scale

Acid	pH lower than 7- the lower the number the more acidic.
Neutral	pH of 7
Alkali	pH higher than 7- the higher the number the more alkaline.
Universal Indicator	Indicator that gives a range of colours depending on the pH.
Acid Rain	Rainwater more acidic than usual due to pollution.

4. Neutralisation

Neutralisation	A reaction where an acid and alkali are mixed together forming a neutral substance.
Chemical Reaction	A change in which one or more new substance is formed.
Word Equation	Used to model chemical reactions.
Reactants	The starting substances- written on left of word equation.
Products	The new substances made- written on right of word equation.
Neutralisation General Word Equation Acid + alkali → salt + water	
Neutralisation Word Equation Example Hydrochloric acid + sodium hydroxide → sodium chloride + water	
Salts	Formed when acids and alkalis react. Different acids and alkalis will form different salts.
Sodium Chloride	The chemical name for common/table salt.

5. Neutralisation in Daily Life

Base	Any substance that neutralises an acid forming a salt and water.
Alkali	A soluble base
Antacids	Remedy for indigestion that neutralise the stomach acid
Antacid Word Equation Example Magnesium hydroxide + hydrochloric acid → magnesium chloride + water	
Toothpaste	Contains bases that neutralise acids in your mouth from food that you eat.
Bee Sting Remedy	A bee sting, being acidic can be treated with a weak alkali like baking soda.
Wasp Sting Remedy	A wasp sting, being alkali, can be treated with a weak acid like vinegar.
Cleaning Metals	Acids clean the rust off metals using a neutralisation reaction.
Waste Gases	Acidic waste gases from industries are sprayed with calcium hydroxide to neutralise them.

Lesson	Memorised?
1. Hazards	
2. Indicators	
3. Acidity & Alkalinity	
4. Neutralisation	
5. Neutralisation in Daily Life	

7I Energy

1. Energy from Food	
Energy	Needed to live, helps us to grow and repair our bodies, move and keep warm. Food is a source of energy.
Joule	A unit for measuring energy.
Kilojoule	1000J = 1kJ
Diet	The food that a person eats.
Weight	The amount of force with which gravity pulls things- measured in Newtons (N).
Balanced Diet	Eating a variety of foods to provide all the things that the body needs.
Nutrients	Substances needed from food.

2. Energy Stores and Transfers	
Transferred	When energy is moved from one store into another.
Forces	A push, pull or twist and a type of energy transfer.
Electricity	A way of transferring energy through wires.
Other Energy Transfers	By heating, sound and light.
Stored	When energy is captured within an object and can be moved to another store by energy transfers.
Chemical Energy	Energy stored in chemicals (such as food, fuel and batteries).
Kinetic Energy	Energy stored in moving things.
Thermal Energy	Energy stored in hot objects.
Strain Energy	Energy stored in stretched or squashed objects. Also called elastic potential energy.
Gravitational Potential Energy	Energy stored in objects in high places that can fall down.
Nuclear Energy	Energy stored inside materials (also called atomic energy).
Law of Conservation of Energy	The idea that energy can never be created or destroyed, only transferred from one store to another.

3. Fuels	
Fuel	A substance that contains a store of chemical or nuclear energy that can easily be transferred.
Nuclear Fuels	Used in nuclear power stations to generate electricity.
Uranium	A radioactive metal that can be used as a nuclear fuel.
Generate	To produce electricity.
Fossil Fuels	A fuel formed from the dead remains of organisms over millions of years.
Coal	A fossil fuel made from the remains of plants.
Oil	A fossil fuel made from the remains of microscopic dead plants and animals that lived in the sea.
Natural Gas	A fossil fuel made from the remains of microscopic dead plants and animals that lived in the sea.
Non-Renewable	An energy resource that will run out because we cannot renew our supplies of it.
Renewable	An energy resource that will never run out (such as solar power)
Biofuels	A fuel made from plants or animal droppings.
Hydrogen	Can be used as a fuel by combining with oxygen from the air to produce electricity.

4. Other Energy Resources	
Solar Power	Generating electricity using energy from the Sun.
Solar Panel	Flat plats that use energy from the Sun to heat water.
Solar Cell	Flat panels that use energy transferred by light from the Sun to produce electricity.
Solar Power Station	A large power station using the Sun to heat water to make steam which then generates electricity.
Wind Turbine	Generates electricity using energy transferred from the wind.
Hydroelectric Power	Electricity generated by moving water turning turbines and generators.
Geothermal Power	Electricity generated using heat from rocks underground.
Photosynthesis	Carbon dioxide + water → glucose + oxygen

5. Using Resources	
Fossil Fuel Advantages	Cheap compared to the others and convenient to use in cars/vehicles.
Fossil Fuel Disadvantages	Non-renewable Releases polluting gases when burnt.
Nuclear Advantages	No polluting gases generated.
Nuclear Disadvantages	Non-renewable Very expensive Dangerous waste materials
Renewable Advantages	No polluting gases Renewable
Renewable Disadvantages	Most not available all the time and only available in specific locations.
Climate Change	Fossil fuels are making the earth warmer due to the carbon dioxide given off when they are burnt.
Efficiency	How much of the energy transferred by a machine is useful.
Using Less Fossil Fuels	Using efficient appliances, insulating homes, public transport/walking/cycling

Lesson	Memorised?
1. Energy from Food	
2. Energy Stores and Transfers	
3. Fuels	
4. Other Energy Resources	
5. Using Resources	

8B Plants and their Reproduction

1. Classification and Biodiversity

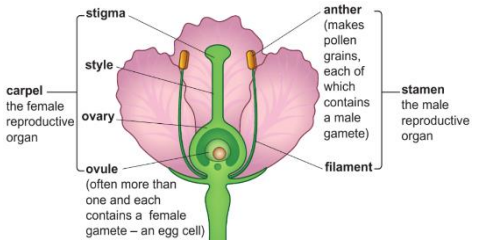
Classification	Sorting organisms into groups based on their characteristics.
Kingdoms	The five largest groups (each can be split into smaller groups)- *animals, fungi, protoctists, prokaryotes and plants*.
Plants	Members of the plant kingdom have cellulose cell walls, are multicellular and make their own food.
Scientific Name	We give organisms scientific names using the names of the last two groups- the genus and the species.
Scientific Name Advantages	Scientific names are agreed around the world so there is no confusion. Some species have the same common name in different places.
Biodiversity	The number of difference species in an area.
Advantages of High Biodiversity	Recover faster from disasters and useful substances can be found (medicines).
Extinct	When an organism dies out completely.

2. Types of Reproduction

Sexual Reproduction	Two organisms breeding to produce offspring.
Hybrids	The offspring of two different species- they are not fertile.
Fertile	Can produce offspring.
Inherited Variation	Characteristics inherited from parents (due to DNA).
Gametes	Sex cells
Zygote	The fertilised egg cell formed when the male and female gamete join.
Asexual Reproduction	Reproduction involving only one parent- produces offspring identical to the parent (clones).
Runners	An example of asexual reproduction used by strawberry plants. They spread over the ground and sprout roots to grow new identical plants.
Tubers	An example of asexual reproduction used by potato plants. They are underground stems (potatoes) that contain a store of food that can grow into a new plant.
Using Asexual Reproduction	Gardeners take cuttings of leaves/stems to grow new plants quickly and cheaply.

3. Pollination

Plant Reproductive System



Pollen	Male gamete that ripens inside the anthers.
Pollination	The pollen grain carried away and transferred to the stigmas of another plant can be by animals/wind/water/
Plant Adaptations for Animal Pollination	Brightly coloured petals, nice scent and nectar attract animals (mainly insects). The structure also makes it easier for animals to pick up / leave pollen grains.
Plant Adaptations for Wind Pollination	Pollen is smooth and light to float through air. large anthers and stigmas hang outside the flower to catch the wind.
Self-Pollination	Pollen grains from a plant land on the stigma of the same plant.
Cross-Pollination	Pollen transferred from one plant to another.

4. Fertilisation and Dispersal

Pollen Tube	Formed when a pollen grain reaches a stigma of the same species. It grows down to the ovule.
Fertilisation	The egg cell and the male gamete from the pollen grain join together to form a zygote.
Cell Division	The process by which the cell splits into two.
Embryo	Formed when the cells divide again and again.
Seed	The ovule becomes a seed. Inside the seed is the embryo and a food source.
Seed Coat	Hart outer coating of seed to protect it.
Germinate	The seed starts to grow.
Fruit	The ovary swells up and forms the fruit around the seed.
Seed Dispersal	The spreading of seeds away from the parent plant.
Attracting Animals	Fruits are fleshy, soft, juicy and taste good to attract animals for seed dispersal.
Egested	Seeds are passed out by animals in their faeces.
Other Seed Dispersal Methods	Wind, water and explosions- useful so that new plants aren't in competition with the parent plant.

5. Germination and Growth

Resources	What a plant needs to grow/germinate.
Respiration	The process of releasing energy from glucose.
Respiration Word Equation	glucose + oxygen → carbon dioxide + water
Dormant	Slow life processes but still alive- such as in a seed.
Photosynthesis	A process that plants use to make their own food.
Photosynthesis Word Equation	carbon dioxide + water ⟶ glucose + oxygen
Starch	Glucose is converted to starch to store it.
Chloroplasts	Traps light energy needed for photosynthesis.
Interdependent	Organisms that depend on one another.

Lesson	Memorised?
1. Classification & Biodiversity	
2. Types of Reproduction	
3. Pollination	
4. Fertilisation & Dispersal	
5. Germination & Growth	

8F The Periodic Table

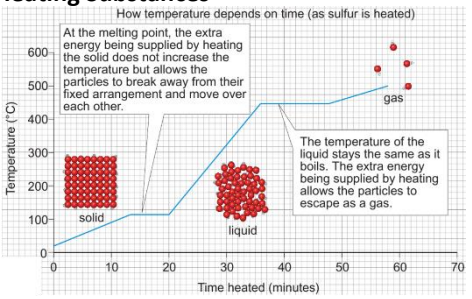
1. Dalton's Atomic Model	
Matter	All things are made of matter.
John Dalton	(1766-1844) An English chemist.
Dalton's Atomic Theory	• all matter is made up of atoms. • atoms in an element are identical. Each element has its own type of atom. • atoms cannot be destroyed or created. • In compounds each atom is always joined to a fixed number of other atoms. • atoms rearrange during chemical reactions to form new substances.
Atoms	Small particles that all matter is made up of.
Element	A substance made up of one kind of atom.
Compound	Contains atoms of two or more different elements chemically joined together.
Physical Properties	The properties that describe a substance on its own. *(colour, strength, density, etc.)*
Physical Changes	A change in which no new substances are formed.
Symbols	Letters used to represent the elements. *e.g. C represents Carbon*

2. Chemical Properties	
Chemical Properties	How a substance reacts with other substances.

Hypothesis	An idea about how something works that can be tested using experiments.
Prediction	What you think will happen in experiment and why.
Conserving Mass	The mass of the products of a reaction will be the same as the mass of the reactants.
Chemical Formulae	The combination of symbols and numbers that shows how many atoms of different element are in a particular molecule. *e.g. water is H_2O*
Ratio	Comparison of the proportion of two quantities *e.g. in water there are 2 hydrogens for every oxygen, the ratio is 2:1*

3. Mendeleev's Table	
Johann Döbereiner	(1780-1849) German chemist who highlighted some groups of 3 elements had similar physical / chemical properties.
John Newlands	(1837-1898) English chemist who ordered elements by the mass of atoms and noticed every 8th element has similar properties.
Dmitri Mendeleev	(1834-1907) Russian chemist who published the first periodic table by ordering elements by increasing masses of their atoms forming groups of similar properties.
Gaps	Mendeleev left gaps in his table for undiscovered elements and predicted their properties.

Group	A vertical column in the Periodic Table- contains elements with similar properties.
Alkali Metals	Group 1 Very reactive metals, they even react with water.
Halogens	Group 7 React with most metals to form solid compounds.
Noble Gases	Group 0 Unreactive gases

4. Physical Trends	
Melting Point	When a substance changes from a solid into a liquid
Boiling Point	When a substance changes from a liquid into a gas.
Freezing Point	When a substance changes from a liquid into a solid- the same as the melting point.
Heating Substances	
Periods	The horizontal rows in the Periodic table.
Transition Metals	Block of elements in the middle of the Periodic table- separates the eight main groups.
Metal Properties	High melting points, strong, flexible, malleable, shiny, good conductors.
Non-Metal Properties	Low melting points, brittle, dull, poor conductors.

5. Chemical Trends	
Alkali Metals & Water	Alkali metals produce metal hydroxides and hydrogen when reacting with water. *(sodium + water → sodium hydroxide + hydrogen)*
Alkali Metals & Oxygen	Alkali metals produce metal oxides when reacting with oxygen. *(lithium + oxygen → lithium oxide)*
Reactivity	How quickly / vigorously something reacts.
Alkali Metal Reactivity	As you move down the group the reactivity increases.
Oxides	Formed when elements react with oxygen.
Oxide Trends	When we dissolve oxides in water there is a trend in their pH. Further to the left of the Periodic table oxides formed are more alkaline. Further to the right they are more acidic.

Lesson	Memorised?
1. Dalton's Atomic Model	
2. Chemical Properties	
3. Mendeleev's Table	
4. Physical Trends	
5. Chemical Trends	

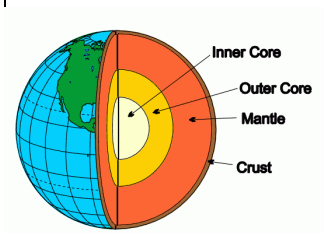
8H Rocks

1. Rocks and Their Uses

Geologist	A scientist who studies rocks and the Earth.
Rocks	Naturally occurring substances made up of different grains.
Grains	Made from one or more chemical compounds.
Minerals	The chemical compounds in rocks- rocks are mixtures of different minerals.
Texture	The combination of sizes and shapes of grains in a rock.
Interlocking Crystals	The grains all fit together with no gaps. They are hard and do not wear away easily.
Rounded Grains	Some rocks have rounded grains with gaps in between. They are not strong and can be worn away more easily.
Porous	Rounded grain rocks can absorb water because it gets into the gaps.
Permeable	Water can run through.
Cement	A building material made from limestone.
Gravel	A mixture of cement, sand and gravel.

2. Igneous and Metamorphic

The Structure of the Earth



Igneous Rocks	Formed when molten rock cools down *e.g. basalt, granite*
Magma	Molten rock
Lava	Magma that reaches the Earth's surface.
Small Crystals	Formed when molten rock cools down fast due to less time for particles to become ordered.
Large Crystals	Formed when molten rock cools down slowly due to more time for a large grid pattern to form.
Extrusive	Igneous rocks formed from cooling lava above the surface.
Intrusive	Igneous rocks formed underground.
Metamorphic Rocks	Formed by pressure and heat changing other rocks. *e.g. Schist, gneiss (both formed from granite) slate (from mudstone) and marble (from limestone)*
Metamorphic Rock Texture	Always made from interlocking crystals which may form coloured bands.

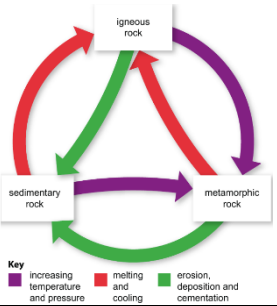
3. Weathering and Erosion

Weathering	When rocks are broken up by physical, chemical or biological processes.
Chemical Weathering	When rocks are broken up by chemical reactions. *e.g. gases in air making rainwater slightly acidic which then reacts with minerals in rock wearing them away.*
Biological Weathering	When rocks are broken up by living organisms. *e.g. growing plants splitting rocks apart with their roots.*
Physical Weathering	When rocks are broken up by physical processes. *e.g. changes in temperature causing expansion and contraction over time, cracking rocks.*
Expanding	Rocks get bigger when they are heated.
Contracting	Rocks get smaller when they are cooled.
Freeze-Thaw Action	Water gets into cracks in rocks, freezes, expands and then forces the crack to get bigger.
Erosion	The movement of loose and weathered rock.
Abrasion	When rock fragments bump into each other and are worn away.
Sediment	Bits of rock and sand in streams or rivers.
Glacier	Rivers of ice that move slowly but can transport large pieces of rock.

4. Sedimentary Rocks

Sedimentary Rocks	Formed when layers of sediment build up over time followed by compaction then cementation. *e.g. sandstone, mudstone*
Compaction	Pressure forces water out from the gaps between grains squashing the grains closer together.
Cementation	Dissolved minerals between the gaps act as a glue and 'cement' the grains together.
Sedimentary Rock Texture	They are always made from rounded grains. Properties depend on the type of sediment that forms them.

The Rock Cycle



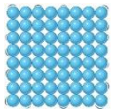
5. Materials in the Earth

Native State	Metals found as pure elements in rocks.
Ores	Rocks that contain enough of a metal / metal compound to be worth mining.
Extracting Ores	Ores are obtained by mining, then crushed and chemical reactions used to obtain the metal.
Mining Problems	Damages the environment by destroying habitats and causes pollution.
Rare Metals	Hard to obtain which makes them expensive.
Recycling	Using a material again.
Recycling Advantages	Cuts down on pollution from mining and landfill sites, allows supplies to last longer and requires less energy.

Lesson	Memorised?
1. Rocks and their Uses	
2. Igneous and Metamorphic	
3. Weathering and Erosion	
4. Sedimentary Rocks	
5. Materials in the Earth	

8I Fluids

1. The Particle Model

States of Matter	The three forms that a substance can be in; solid, liquid or gas.
Solid Properties	Do not flow, fixed shape, fixed volume, cannot be compressed
Liquid Properties	Can flow, no fixed shape, fixed volume, cannot be compressed
Gas Properties	Can flow, no fixed shape, no fixed volume, can be compressed
Particle Theory	Used to explain the different properties and observations of solids, liquids and gases.
Solid Particle Properties	Fixed arrangement of particles held closely together that cannot move over each other but vibrate. 
Liquid Particle Properties	Held closely together but not in a fixed arrangement and can move over each other. 
Gas Particle Properties	Far apart from each other and free to move about in all directions. 
Diffusion	The movement of particles spreading out and mixing with each other without anything moving them.
Brownian Motion	An erratic movement of small specks of matter caused by being hit by the moving particles that make up liquids or gases.
Expanding	Materials expand when heated because the particles vibrate more, taking up more space.
Contract	Materials contract when cooled because the particles vibrate less and take up less space.
Density	The mass of a certain volume of a material. $density = \frac{mass}{volume}$

2. Changing State

Changes of State	Changing from one state of matter to another. Physical changes because no new chemicals are made.
Melting	Turning from a solid to a liquid- occurs at melting point
Freezing	Turning from a liquid to a solid- occurs at freezing point
Condensing	Turning from a gas into a liquid.
Sublimation	Turning from a solid to a gas.
Evaporation	Turning from a liquid into a gas. Can occur at the surface of a liquid at any temperature.
Boiling	When evaporation occurs within a liquid- occurs at the boiling point
Pure	A substance made up of a single type of atom or compound.
Pure Substances Changing State	Occurs at a set temperature. The temperature stays constant when changing state as bonds are broken or made.
Mixtures Changing State	Occurs over a range of temperatures as it contains substances with different melting/boiling points.
Water	Contracts as it is cooled up until 4°c and then it expands slightly. Ice takes up more space than water and is less dense

3. Pressure in Fluids

Fluids	Liquids and Gases
Pressure	The force of particles hitting things- comes from all directions in gases and liquids.
Pressure Units	**Pascals (Pa)** One pascal is the force of one newton on every square metre.
Atmospheric Pressure	The pressure of the air- 100,000 Pa
Tyres	Contain air under high pressure because they are pumped with extra air causing more particles to hit the inside walls.
Temperature	Pressure in fluids increases as you increase temperature because particles move faster and hit the walls of the container harder.
Volume	If you compress a gas into a smaller volume the pressure increases because the particles hit the walls more.
Pressure From Above	As you go down the ocean there is more water above you so pressure increases. As you go up a mountain there is less air above you so pressure decreases.

4. Floating and Sinking

Upthrust	The force of water pushing upwards.
Weight	The amount of force with which gravity pulls on a mass.
Water	The density of water is 1 g/cm^3
Floating	If something has a density less than water it will float in water.
Sinking	If something has a density greater than water it will sink in water.
Air	The density of air at sea level is around 0.001 g/cm^3
Hot Air Balloons	Fly because the overall density of the balloon is less than the air around it.

5. Drag

Drag	A resistance force acting on an object to slow it down.
Water Resistance	Type of drag that occurs in water.
Air Resistance	Type of drag that occurs in air.
Friction	Partly causes the drag on a moving object.
Streamlined	Smooth shape to reduce air / water resistance.
Speed	The faster an object is moving, the greater the drag.
Balanced Forces	Equal forces acting in opposite directions.
Engine	Forward force of an engine needs to balance the drag.

Lesson	Memorised?
1. The Particle Model	
2. Changing State	
3. Pressure in Fluids	
4. Floating & Sinking	
5. Drag	

8J Light

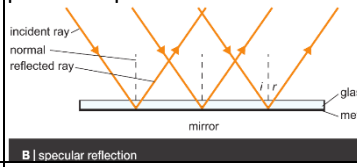
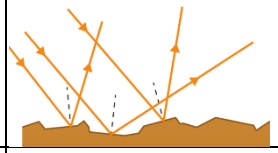
1. Light on the move

Vacuum	A completely empty space, containing no particles.
Matter	All things are made of matter. There are three states of matter: solid, liquid, gas.
Longitudinal wave	A wave where the particles vibrate in the same direction as the wave is travelling. 
Transverse wave	A wave where the vibrations are at right angles to the direction the wave is travelling. 
Ray	A narrow beam of light, or an arrow on a diagram representing the path of light and the direction in which it is travelling.
Transparent	A material that light can travel through without scattering. (Note: transparent substances may be coloured or colourless.)
Transmit	To pass through a substance.
Reflect	To bounce off a surface instead of passing through it or being absorbed.
Absorb	'To soak up' or 'to take in'.

Translucent	Material that lets light through but scatters it. You cannot see things clearly through translucent materials.
Opaque	Material that does not let light through. It is not possible to see through an opaque substance.
Scattered	Scattering occurs when light or other energy waves pass through an imperfect medium (such as air filled with particles of some sort) and are deflected from a straight path.
Reflected ray	A ray of light bouncing off a mirror.
Source	Where a sound wave or other wave begins.
Image	A picture that forms in a mirror or on a screen, or is made by a lens. You see an image when looking down a microscope.
Pinhole camera	A piece of apparatus that forms an image of an object on a screen when light rays travel through a tiny hole in the front
Shadow	A place where light cannot get to, because an opaque object is blocking the light.

2. Reflection

Plane mirror	A smooth, flat mirror.
Ray box	A piece of equipment that produces a narrow beam of light.
Ray tracing	A method of investigating what happens to light by marking the path of a light ray.

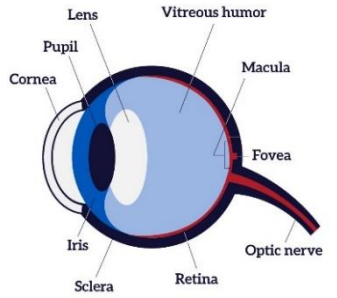
Ray diagram	A diagram that represents the path of light using arrows.
Normal	An imaginary line at right angles to the surface of a mirror or other object where a ray of light hits it.
Incident ray	A ray of light going towards the mirror or other object.
Reflected ray	A ray of light bouncing off a mirror.
Angle of incidence	The angle between an incoming light ray and the normal.
Angle of reflection	The angle between the normal and the ray of light leaving a mirror.
Specular reflection	When light is reflected evenly, so that all reflected light goes off in the same direction. Mirrors produce specular reflection.  B | specular reflection
Diffuse reflection	Reflection from a rough surface, where the reflected light is scattered in all directions. 
Law of reflection	The angle of incidence is equal to the angle of reflection.

3. Refraction

Refraction	The change in direction when light goes from one transparent material to another.
Interface	The boundary between two materials.

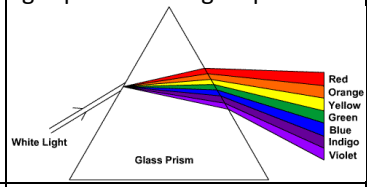
Lens	A curved piece of glass or other transparent material that can change the direction of rays of light.
Converging lens	A lens that makes rays of light come together.
Angle of refraction	The angle between the normal and a ray of light that has been refracted.
Focal point	The place where parallel rays of light are brought together by a converging lens.
Focal length	The distance between the centre of the lens and the focal point.

4. Cameras and eyes

Digital camera	A camera that uses electronics to record an image.
Sensor	An instrument that detects something. In a digital camera, the sensors detect light and change it to electrical signals.
Memory card	Part of a digital camera that stores the images.
Aperture	A hole in a camera that controls how much light goes to the sensor.
Shutter	A device that shields and protects the sensor in a digital camera. It opens when the picture is taken.
Human eye	

Retina	The part at the back of the eye that changes energy transferred by light into nerve impulses.
Pupil	The hole in the front of the eye that light can pass through.
Rod cell	A cell in the retina that detects low levels of light. It cannot detect different colours.
Cone cell	A cell in the retina that detects different colours of light.
Cornea	The transparent front part of the eye, which covers the iris and pupil.
Iris	The coloured part of the eye.
Optic nerve	The nerve that takes impulses from the retina to the brain.
Primary colour	One of three colours that are detected by the cone cells in our eyes. The primary colours are red, green and blue.
Secondary colour	A colour made when two primary colours mix. The secondary colours are magenta, cyan and yellow.

5. Colour	
White light	Normal daylight, or the light from light bulbs, is white light.
Frequency	The number of vibrations (or the number of waves) per second. Different frequencies of light have different colours.
Spectrum	The seven colours that make up white light.

Dispersion	The separating of the colours in light, for example when white light passes through a prism. 
Prism	A block of clear, colourless glass or plastic. Usually triangular.
Filter (physics)	Something that only lets certain colours through and absorbs the rest.

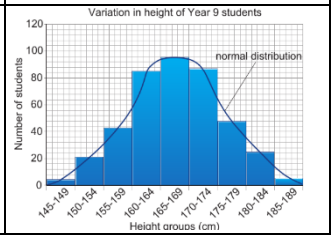
Lesson	Memorised?
1. Light on the move	
2. Reflection	
3. Refraction	
4. Cameras and eyes	
5. Colour	

9A Genetics and Evolution

1. Environmental Variation

Environment	An organisms surroundings - affected by physical environmental factors and living organisms.
Characteristics	The features of an organism.
Variation	The differences between characteristics of organisms.
Environmental Variation	Variation caused by an organism's environment *e.g. hairstyle*
Continuous Variation	Variation that can have any value between two points *e.g. height, mass*
Discontinuous Variation	Variation that can only have a value from a limited set of values *e.g. eye colour*
Classification	Sorting organisms into groups.
Species	The smallest group an organism is classified into. Members of the same species can reproduce together and produce fertile offspring.

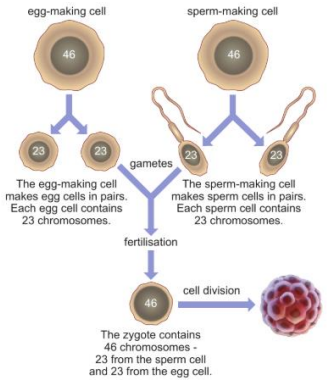
2. Inherited Variation

Inherit	Offspring / children get a mixture of characteristics from their parents.
Inherited Variation	The variation in characteristics inherited from parents *e.g. blood group*
Genetic Information	The instructions for inherited characteristics stored inside the nuclei of cells.
Gametes	Sex cells (sperm and egg)
Sexual Reproduction	Two gametes fuse together during fertilisation.
Zygote	Fertilised egg cell formed during fertilisation. Contains genetic material from both parents.
Normal Distribution	Bell shape usually given by plotting characteristics that show continuous variation.
Normal Distribution Example	

3. DNA

Watson and Crick	Used data from themselves and other scientists to build the first model of DNA in 1953.
Rosalind Franklin	Took x-ray images of DNA and showed it was a spiral structure.
Chromosomes	DNA is found in structures called chromosomes inside nuclei of cells.
Human DNA	Human cell nuclei contain 46 chromosomes (23 pairs).
Genes	A gene is a section of DNA /a chromosome.
Sex Chromosomes	Determines sex of offspring. Girls have two X chromosomes, boys have an X and a Y.
Cell Division	The splitting of a parent cell to form two daughter cells.

Zygote Formation



4. Genes and Extinction

Adaptations	Features of an organism to help it survive in its habitat.
Ecosystem	All the physical environmental factors and living organisms in a habitat.
Endangered	When a species is at risk of becoming extinct.
Extinct	When a species no longer exists.
Competition	Organisms fighting over the resources that are available.
Native	A species that has always lived in an area.
Squirrels	Red squirrels are native to the UK and grey squirrels came to the UK in the 1870's. Grey squirrels can store more fat to survive the winter and can digest unripe acorns unlike red squirrels. This has meant grey populations have increased leaving less food for red squirrels.
Biodiversity	The number of different species within an area.
Preserving Biodiversity	Banning hunting, set up nature reserves, start breeding programmes and gene banks.
Gen Banks	Storing parts of organisms (seeds, gametes etc.) to grow if they become extinct.

5. Natural Selection

Natural Selection	A change in the environment causes certain characteristics to be 'selected' to pass on to the next generation.
Peppered Moths	Most peppered moths were pale in the 1850's. Then factories started churning out soot, turning trees black. Birds could now easily spot the pale moths to eat them. More black moths survived and reproduced, increasing their numbers. This is an example of natural selection.
Evolution	A change over time in the characteristics of organisms.
New Species	As populations evolve they can become new species.
Darwin's Theory of Evolution	Charles Darwin and Alfred Russel Wallace developed a hypothesis that natural selection causes evolution.

Lesson	Memorised?
1. Environmental Variation	
2. Inherited Variation	
3. DNA	
4. Genes and Extinction	
5. Natural Selection	

9B Plant Growth

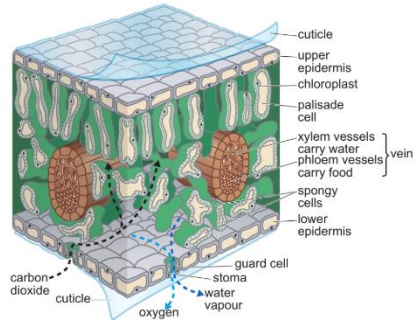
1. Reactions in Plants

Reactants	The substances that take part in a chemical reaction.
Products	The new substances made in a chemical reaction.
Photosynthesis	A process that plants use to make their own food.
Photosynthesis Word Equation	carbon dioxide + water ⟶ glucose + oxygen
Chloroplasts	Where photosynthesis occurs inside plant cells.
Chlorophyll	A substance inside chloroplasts that captures the light energy needed for photosynthesis.
Limiting Factor	A variable that slows down the rate of photosynthesis.
Aerobic Respiration	The process by which living organisms release energy stored in glucose.
Aerobic Respiration Word Equation	glucose + oxygen → carbon dioxide + water
Phloem	The vessels inside plants that transport glucose.

2. Plant Adaptations

Adaptations	Features that something has to enable it to do a certain job.
Root Adaptations	They are branched and spread out, helping them to get a large volume of water.
Root Hair Cells	Increase the surface area of roots so that more water can be absorbed.
Xylem	The vessels inside plants that transport water.
Uses of Water	- photosynthesis - keeping leaves cool - filling up cells to keep them expanded and firm
Palisade Cells	Cells in a leaf adapted to carry out photosynthesis by having lots of chloroplasts.
Cuticle	A waxy layer on the outside of a leaf that stops them from losing too much water.
Stomata	Small holes in a leaf that open and close to allow gas exchange.
Guard Cells	The cells that open and close the stomata.
Gas Exchange	The swapping of different gases from inside the leaf and the atmosphere.

Structure of a Leaf



3. Plant Products

Lipids	Insoluble substances that include fats and oils.
Uses of Lipids	- Found in the cuticle, making it waterproof - make parts of the cell like cell membranes - energy store found in seeds
Polymer	A substance made up of a long chain of repeating groups of atoms (monomers).
Starch	A polymer formed by linking together glucose molecules.
Uses of Starch	Stored in the chloroplast until photosynthesis stops then broken down into sugars to be transported. It can then be converted to starch and stored in storage organs or used to make cellulose.
Testing for Starch	Iodine solution will turn blue-black is starch is present.
Proteins	Polymer formed by joining long chains of amino acids.
Nitrates	Needed to make amino acids.
Germination	Water and oxygen enter seed allowing molecules to move around. Enzymes released that digest starch into glucose which enters the embryo allowing it to respire and grow.

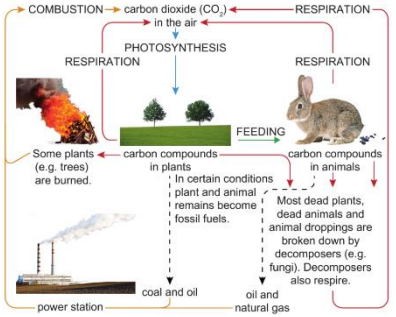
4. Growing Crops

Yield	The amount of useful product you get from a crop.
Increasing Yield	Forests are cut down, hedgerows removed, machines used
Fertilisers	Contain mineral salts that plants need to grow.
Decomposers	Microorganisms that break down manure and release mineral salts.
Pesticides	Kill pests
Insecticides	Kill insect pests
Fungicides	Kill fungi that cause plant disease
Herbicides	Kill weeds (weedkillers) that compete with crops for resources- they are selective so only kill the weeds
Variety	Group of plants bred for a certain characteristic.
Cross-Breeding	Breeding different varieties together to produce offspring with characteristics of both.
Selective Breeding	Choosing organisms to breed based on the characteristics that you want in the offspring.

5. Farming Problems

Fertiliser Problems	Can wash into rivers causing fast growth of algae which blocks out the light causing plants to die. Decomposers break down dead material using up oxygen.
Pesticide Problems	Some do not break down in the environment (they are persistent) so move up the food web.
Varieties Problems	They are identical so a disease will affect them all. Biodiversity is reduced.

The Carbon Cycle



Lesson	Memorised?
1. Reactions in Plants	
2. Plant Adaptations	
3. Plant Products	
4. Growing Crops	
5. Farming Problems	

9F Reactivity

1. Types of Explosion

Explosion	Sudden increase in volume of gas and huge transfer of energy to the surroundings.
Physical Changes	Changes where no new substances were made.
Chemical Reaction	Changes where one or more new substances are made.
Flammable	A substance that catches fire easily.
Reactants	The starting substances- written on left of word equation.
Products	The new substances made- written on right of word equation.
Gas Pressure	The force gas particles exert by hitting the walls of the container they are in.
Increasing Gas Pressure	• Increasing number of particles • Decreasing size of container • Increasing temperature

2. Reactivity

Reactivity Series	List of metals in order of reactivity
Metals & Water	React to form metal hydroxides and hydrogen. *sodium + water → sodium hydroxide + hydrogen*
Metals & Acids Word Equation	metal + acid → salt + hydrogen *magnesium + sulfuric acid → magnesium sulfate + hydrogen*
Naming Salts	The first word in the salt is the metal the second depends on the acid used.
Hydrochloric Acid	Forms salts ending in chloride
Sulfuric Acid	Forms salts ending in sulfate
Nitric Acid	Forms salts ending in nitrate
Metals & Oxygen	React to form metal oxides *Zinc + oxygen → zinc oxide*
Oxidation	Reaction in which a substance gains oxygen.

Reactivity Series

Metal	Reaction with oxygen in air	Reaction with cold water	Reaction with dilute acid
potassium	🔥	🔥	💥
sodium	🔥	✓✓✓	💥
lithium	🔥	✓✓	✓✓✓
calcium	🔥	✓✓	✓✓✓
magnesium	🔥	✓	✓✓
aluminium	✓✓✓	●●●	✓✓
zinc	✓✓	●●●	✓✓
iron	✓✓	●●●	✓
tin	✓	●●●	✓
lead	✓	●●●	✓
copper	✓	✗	✗
mercury	●●●	✗	✗
silver	●●●	✗	✗
gold	✗	✗	✗
platinum	✗	✗	✗

Increasing reactivity

Key

💥 explosive	🔥 can catch fire	✓✓✓ reacts very quickly
✓✓ reacts quickly	✓ reacts	●●● slow or partial reaction
✗ no reaction		

Rust	Formed by the corrosion of iron and steel.
Preventing Rust	Use a barrier such as paint/ plastic/oil to keep away air/water
Sacrificial Protection	More reactive metals are attached to react with water & oxygen instead of the iron.

3. Energy and Reactions

Oxygen	Often needed in many chemical reactions that cause explosions.
Oxidising Agent	A substance that provides oxygen to oxidise another substance.
	**Oxidising** The hazard symbols for substances which are oxidising.
Potassium Nitrate	Oxidising agent mixed with powdered charcoal to make gunpowder.
Oxygen Test	Oxygen will relight a glowing splint.
Surface Area	Small pieces of solid have a greater surface area over which a chemical reaction can occur. Explosives react more quickly if the solid fuel is broken into tiny pieces.
Energy	Cannot be created or destroyed only transferred and stored.
Exothermic Reactions	Energy stored in the reactants is transferred to the surroundings. *e.g. combustion, neutralisation*
Endothermic Reactions	Energy is transferred from the surroundings to the reactants *e.g. thermal decomposition*
Hydrocarbon	Compound containing only hydrogen and carbon. *e.g. methane (CH_4)*

4. Displacement

Displacement Reaction	Reaction where a more reactive metal displaces (takes the place of) a less reactive one.
Displacement Reaction Word Equation	Aluminium + iron oxide→aluminium oxide + iron
Thermite Reaction	Displacement reaction between aluminium and iron oxide.
Energy	Thermite reaction needs an input of energy by lighting a fuse.
Thermite Reaction Uses	Used on a large scale to join two sections of railway track as molten iron runs into the gap and solidifies.
Solutions	Displacement reactions also occur in solutions. *e.g. zinc in copper sulfate*

5. Extracting Metals

Native State	When a metal is found in the Earth as an element.
Ore	Rock that contains enough of a metal/metal compound to be worth mining.
Extracting Iron	Iron is found as iron oxide. Oxygen is removed by heating with carbon.
Extracting Iron Word Equation	Iron oxide + carbon → iron + carbon dioxide
Reduced	When a substance has lost oxygen.
Electrolysis	Used to extract reactive metals (e.g. aluminium) from their ores using electricity.
Extracting Aluminium Word Equation	Aluminium oxide → aluminium + oxygen
Potassium - Aluminium	Extracted through electrolysis
Zinc - Copper	Extracted by heating with carbon.
Silver- Platinum	Found in native state.

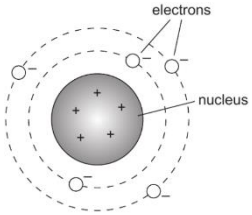
Lesson	Memorised?
1. Types of Explosion	
2. Reactivity	
3. Energy & Reactions	
4. Displacement	
5. Extracting Metals	

9J Force Fields and Electromagnets

1. Force Fields

Force Field	The area around something where a non-contact force can affect things.
Non-Contact Force	A force which can affect something from a distance.
Magnetic Field	The space around a magnet where it can affect magnetic materials or other magnets.
Repel	To push away. Two of the same poles will repel each other.
Attract	To draw together. A north and a south pole will attract each other.
Earth's Magnetic Field	Protects the Earth from charged particles emitted by the Sun
Mass	The amount of matter that something is made up of- measured in grams / kilograms.
Gravitational Field	The space around any object with mass where its gravity attracts other masses.
Gravitational Field Strength	The force with which a gravitational field pulls on each kilogram of mass. Earths gravitational field strength is approximately 10 N/Kg.
Weight	The amount of force with which gravity pulls things. Measured in Newtons. Weight = mass x gravitational field strength
Gravitational Potential Energy (GPE)	Energy stored in objects in high places that can fall down.

2. Static Electricity

Static Electricity	A positive or negative charge on an insulating material caused when rubbing transfers electrons from one material to another.
Nucleus	The central part of an atom- has a positive charge.
Electrons	Small particles moving around the nucleus in an atom- have a negative charge
Atom	
Charges	Something with a charge of static electricity can attract uncharged objects. Two charged objects can attract or repel each other.
Electric Field	The space around an object with a charge of static electricity where it can affect other objects.

3. Current Electricity

Electric Current	The flow of electrons in a circuit.
Current in Series	The current is the same everywhere in a series circuit.
Current in Parallel	The current through the cell splits up when it comes to a junction in a parallel circuit.
Ammeter	Connected in series and used to measure the current flowing through a circuit- measured in amperes (A).
Voltage	How much energy is transferred by electricity by a cell / component.
Voltmeter	Connected in parallel and used to measure the voltage of a component- measured in volts (V)

4. Resistances

Resistance	How difficult it is for electricity to flow through something.
Resistors	A component that makes it difficult for electricity to flow. Used to reduce the size of the current in a circuit.
Factors Affecting Resistance	Increasing the length of a wire or decreasing the thickness will increase the resistance.
Insulators	Do not conduct electricity- they have very high resistances.
Ohms	The units for measuring resistance- Ω
Calculating Resistance	Voltage = current x resistance

5. Electromagnets

Electromagnets	A coil of wire with electricity flowing in it that has a magnetic field around it.
Increasing Electromagnet Strength	Increasing the number of coils. Increasing the current in the wire. Using a magnetic material as a core.
Relays	A small current is used to switch on a circuit that carries a much bigger currne.t
Motor Effect	The force produced when a wire carrying a current is placed in a magnetic field.
Electric Motor	A coil of wire in a magnetic field. The coil spins when a current flows through it.

Lesson	Memorised?
1. Force Fields	
2. Static Electricity	
3. Current Electricity	
4. Resistances	
5. Electromagnets	