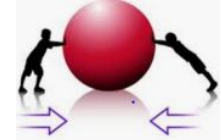




Key Vocabulary	
force	a push, pull, twist or turn
gravity	a pushing force exerted by the Earth, it attracts objects towards the centre of the Earth.
friction	the force between two moving surfaces
magnet	a material or object that produces a magnetic field, it attracts or repels magnetic objects
magnetism	the force of attraction and repelling caused by a magnet
poles	two sides of a magnet where the magnetism is strongest
attract	to pull towards (opposite of repel)
repel	To push away (the opposite of attract)
surface	The top layer of something
Magnetic field	an area around a magnet, or something functioning as a magnet, in which the magnet's power to attract things is felt
Contact force	Forces that act when two or more objects touch each other, eg friction
Non contact force	Forces that do not need contact. They can act at a distance, eg magnetic force

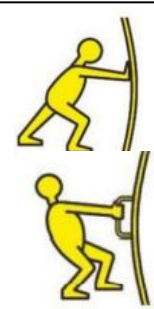
What are Forces?

- A force is the push or pull of an object in a particular direction.
- Forces are shown by arrows in diagrams.
- The bigger the arrow, the bigger the force.
- The direction of the arrow shows the direction of the force.



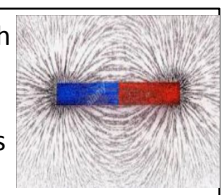
Pushes and Pulls

- A push is the force that moves an object away from something.
- A pull is the force that brings an object towards something.
- A push and a pull are opposite forces, moving objects in different directions.



Magnetic Field

A magnetic field is the area in which a magnetic force can be felt. A magnet will only attract or repel a magnetic object when it enters its magnetic field.

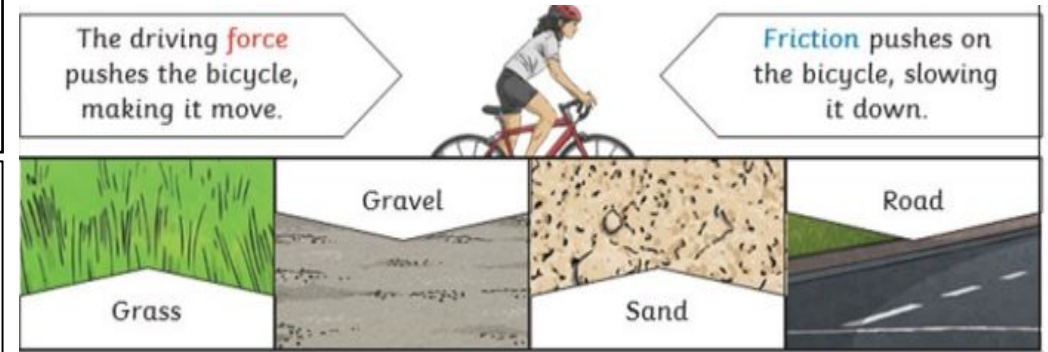


Focused Scientist – Mary Somerville
 Mary Somerville (1780-1872) was fascinated by magnets and carried out lots of experiments with them. She was also one of the first popular Science writers - selling many books in her lifetime. She was the first woman to be elected to the Royal.



Friction

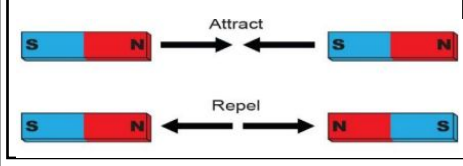
Different surfaces create different amounts of friction. The amount of friction created by an object moving over a surface depends on the roughness of the surface and the object, and the force between them.



Magnets

Magnets are objects or materials that produce a magnetic field and attract or repel magnetic objects.

The two ends of a magnet are known as the north pole (N) and the south pole (S). The same poles repel— opposite poles attract.

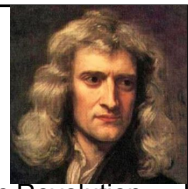


Different Types of Magnets

Bar Button Horseshoe

Cylindrical Ring Arc / Crescent

Focused Scientist – Sir Isaac Newton
 Isaac Newton was a physicist and mathematician who developed the principles of modern physics, including the laws of motion and is credited as one of the great minds of the 17th-century Scientific Revolution. Isaac Newton came up with the law of gravity after seeing an apple fall from a tree in his mother's garden.






Key Vocabulary	
rock	Solid mineral material forming part of the surface of the earth and other similar planets.
minerals	minerals come from broken down rock.
magma	molten rock that is formed in very hot conditions inside the earth
permeable	allows liquids to pass through it
impermeable	does not allow liquids to pass through it.
fossil	The remains of a prehistoric plant or animal embedded in rock.
porous	Something that has many small holes in it, which water and air can pass through
decaying	gradually being destroyed by a natural process
palaeontology	the study of fossils as a guide to the history of life on Earth.
soil	the substance on the surface of the earth in which plants grow
bedrock	the solid rock in the ground which supports all the soil above it.
grain	A grain of something such as sand or salt is a tiny hard piece of it.

Focused Scientist – Mary Anning (1799 –1847)

Mary Anning was an English fossil collector, dealer, and palaeontologist who became known around the world for important finds she made in Jurassic marine fossil beds in the cliffs along the English Channel at Lyme Regis in the county of Dorset in Southwest England.



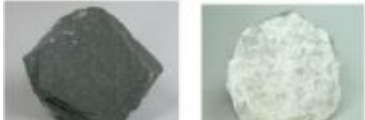


Types of Rocks

Igneous Rocks - are very hard, dark and heavy. They are formed when molten magma from a volcano cools down. They have crystalline appearance. Examples: **granite and pumice**.

Metamorphic Rocks - are rocks which have been changed over time by pressure or heat. Fossils can be found in metamorphic rocks if plants and animals have been trapped in the rocks. They are hard but can be damaged by acids. Examples: **slate and marble**.

Sedimentary Rocks - are formed by sediment (which includes minerals, small pieces of plants and other organic matter) that is deposited over time. The sediment is compressed over a long period of time before it becomes solid layers of rock. Examples: **sandstone and chalk**.

What is Soil?


Soil is made from pieces of rock, minerals, decaying plants and water. When rock is broken down into small grains, soil is formed.

AIR – Oxygen, carbon dioxide, nitrogen etc.

ORGANIC MATTER – Living and dead plants and animals.

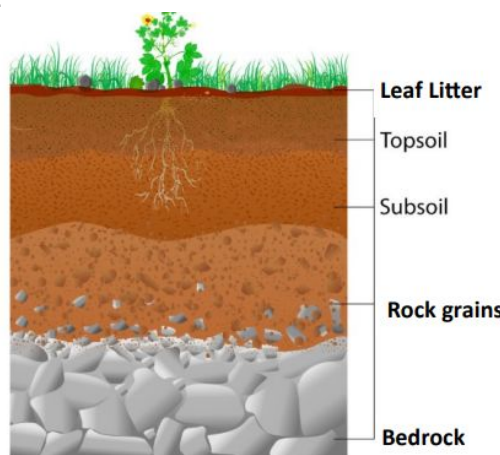
WATER – Air and water fill the gaps between particles of soil.

MINERALS – From broken down rock.



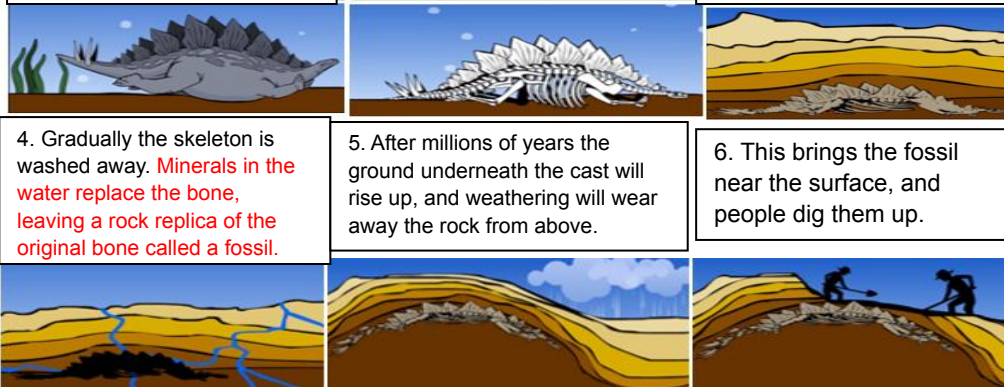
Different Layers of Soil

There are layers of soil: above the soil is leaf litter and recently decaying plants. As the soil becomes deeper, the rock grains become larger until bedrock is reached.



Fossilisation

1. An animal (such as a dinosaur or fish) dies and falls to the bottom of the ocean.
2. The animal rots away leaving just the hardest parts – bones or shell.
3. This becomes buried by small particles of rock called sediment.
4. Gradually the skeleton is washed away. **Minerals in the water replace the bone, leaving a rock replica of the original bone called a fossil.**
5. After millions of years the ground underneath the cast will rise up, and weathering will wear away the rock from above.
6. This brings the fossil near the surface, and people dig them up.





Key Vocabulary	
Roots	These anchor the plant into the ground and absorb water and nutrients from the soil.
Stem	This holds the plant up and carries water and nutrients from the soil to the leaves. A stem is the trunk of the tree.
Leaves	These make food for the plant using sunlight and carbon dioxide from the air
Flowers	These make seeds to grow into new plants. Their petals attract pollinators to the plant
Nutrients	These substances are needed by a living thing to grow and survive. Plants get nutrients from the soils and also make their own food in their leaves
Reproduction	The process by which a living organism creates copies of itself.
Germination	When a seed starts to grow
Pollination	The process by which pollen is transferred to the female parts of the plant which means the plants can make seeds and reproduce.
Pollinator	Animals or insects which carry pollen between plants. Examples include birds, bees and bats.
Fertilisation	When pollen joins with the ovule (egg), a new seed is created
Seed Dispersal	A method of moving the seeds away from the parent plant so that the seeds have the best chance of survival.
Life-cycle	The different stages of life for a living thing.

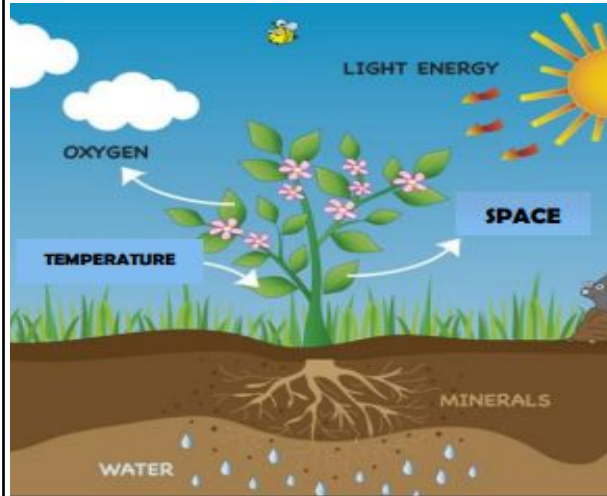
Focused Scientist – Katherine Esau

A Russian-born American botanist (1898-1997) who did ground breaking work on the structure and workings of plants. Her book Plant Anatomy is a classic in the field.



What does a plant need to grow?

Plants need air, water, sunlight, nutrients from the soil, room to grow, sustainable temperature.



The amount of each of these may vary depending on the type of plant. For example, cacti need less water than other plants.

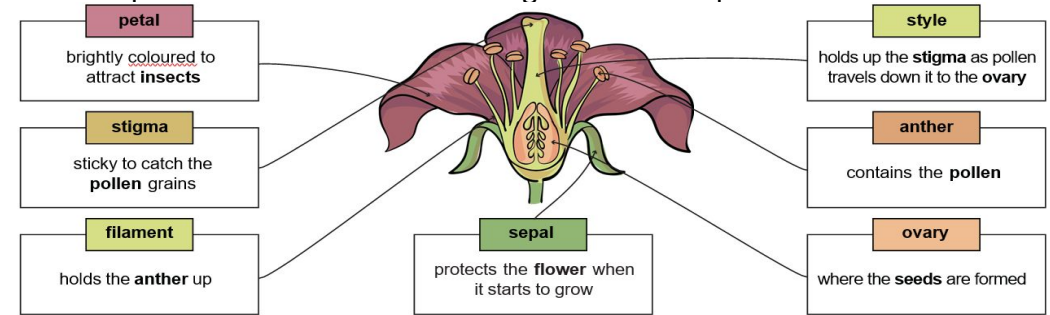
- A plant that is kept in a dark place will grow tall and spindly, as it searches for light.
- A plant that is not watered will have a weak stem. Its leaves will dry up and eventually it will die.
- A plant that is not given enough space will have stunted growth, and may die if it cannot reach enough light.
- A seed will not germinate at all if the temperature is too cold.

How do plants reproduce?

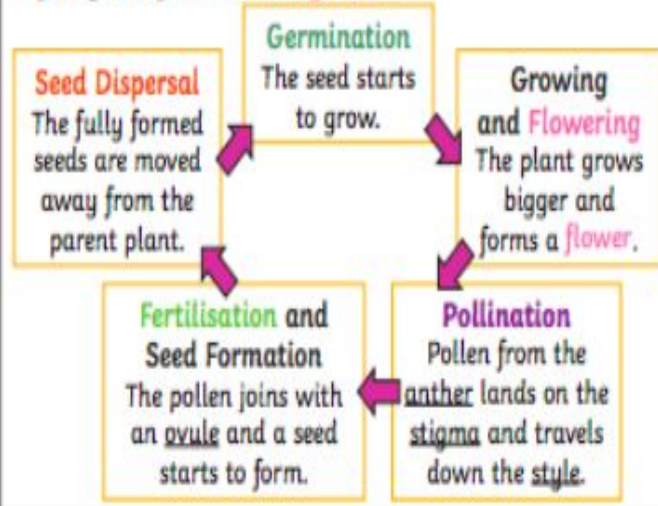
Pollination - Pollen is carried by insects or blown by the wind from one flower to another. This process is called **pollination**.

Fertilisation - Pollen sticks to the flower and then travels to the ovary where it fertilises egg cells (**ovules**) to make seeds. This process is called **fertilisation**.

Seed Dispersal - The seeds are scattered by animals or the wind. This process is called dispersal. Some of the seeds will grow into new plants.



Life Cycle of a Flowering Plant



Seed Dispersal

Seeds can be dispersed by:





Key Vocabulary	
Energy	The property that gives us strength
Nutrition	Food necessary for health and growth
vitamins	Substances found in foods that keep you healthy
digest	When food in the stomach is broken down
backbone	the column of small linked bones down the middle of your back . Also known as a spine.
bones	the hard parts inside your body which form your skeleton
contract	to make smaller by drawing together; shrink or make tighter.
elbow	the bend or joint between the upper arm and the lower arm
endoskeleton	the internal skeleton of an animal, especially the bony skeleton of vertebrates
exoskeleton	the protective or supporting structure covering the outside of the body of many animals
joints	the junction between two or more bones
muscles	something inside your body which connects two bones and which you use when you make a movement
organs	a part of your body that has a particular purpose
Heart	Muscle that pumps blood around the body
relax	When a part of your body relaxes, or when you relax it, it becomes less stiff or firm
skeleton	the framework of bones in your body
vertebrates	a creature which has a spine

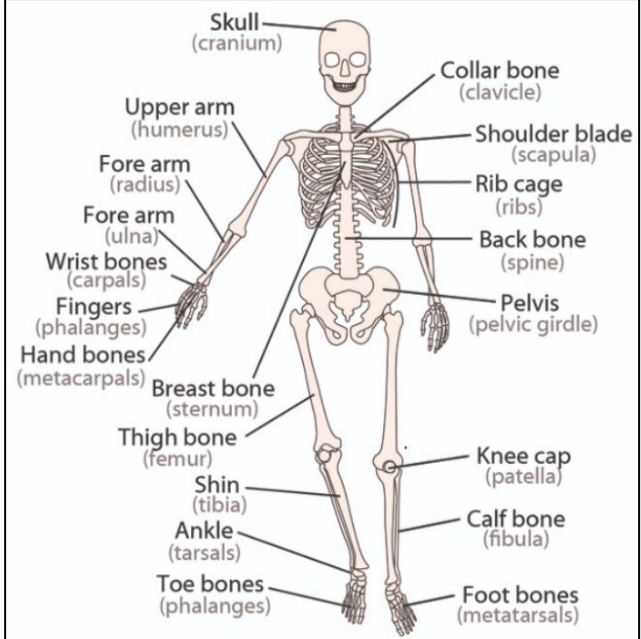
Food and Nutrients



Animals, including humans, cannot make their own food. They get the nutrition they require to live through the foods they eat. It is important for humans to have a balanced diet, with the correct amount of food from each food group.

Carbohydrates: Give us energy (pasta, bread, potatoes)
Proteins: Help our bodies to repair themselves (meat, fish)
Fats: Help store energy (butter, cheese, fried food)
Dairy: Important source of calcium (milk, cheese, yoghurt)
Fruits and vegetables: Full of vitamins, minerals and fibre

Human Skeleton



Skeletons do three important jobs

- Protect organs inside the body
- Allow movement
- Support the body and stop it from falling on the ground


Focus Scientists – Elsie Widdowson
 Elsie Widdowson (1906-2000) was a British dietician and nutritionist who loved experiments. She wrote a book which told us for the first time what energy and nutrition was in different foods. She also played a key role in wartime rationing.



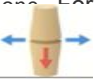
Joints

Joints are where bones meet - they allow our bodies to move.


A **hinge joint** – like the hinge of a door – allows bending and straightening in one direction only. For example, elbow and knee joints



The joints between the vertebrae are called **gliding joints**, where one part of a bone slides over another bone. For example, wrists and ankle joints

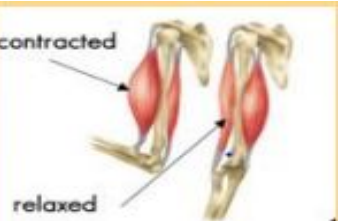


A **ball and socket joint** allows rotational movement. For example, shoulder and hip joints



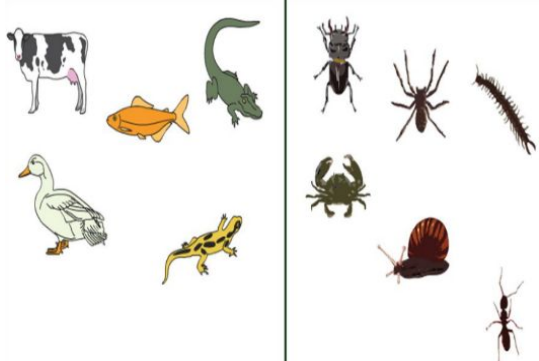
Muscles

Skeletons move because bones are attached to muscles. When a muscle **contracts** (bunches up), it gets shorter and so pulls up the bone it is attached. When a muscle **relaxes**, it goes back to its normal size.



Vertebrates and Invertebrates

Vertebrates are animals that have a backbone. These skeletons are called endoskeletons - this means that the skeletons are on the inside of the bodies. These skeletons grow with the bodies.



Invertebrate are animal without a backbone. When the skeleton exists outside the body, it is called an exoskeleton. An exoskeleton is a covering that supports and protects animals. These have to be shed and a new skeleton is grown.



Key Vocabulary	
light	a brightness that lets you see things.
dark	the absence of light.
emits	to emit a sound or light means to produce it.
mirror	a flat piece of glass which reflects light, so that when you look at it you can see yourself reflected in it
reflect	sent back from the surface and not pass through it.
opaque	if an object or substance is opaque, you cannot see through it.
translucent	if a material is translucent, some light can pass through it.
transparent	If an object or substance is transparent, you can see through it.
shadows	a dark shape on a surface that is made when something stands between a light and the surface
source	where something comes from
surface	the flat top part of something or the outside of it.
absorb	take in or soak up

What is light?

Light is a type of energy that lets us see things.



If there is no light then it is dark and we can not see anything.



Focused Scientist – Ibn al-Haytham

Ibn al-Haytham was born in 965BC in what is now present day Iraq. He was the first person to prove that we see because light reflects off objects and into our eyes. He was also one of the first thinkers to use a scientific method.



Shadows

When light is blocked by an opaque object, a dark shadow is formed. An opaque material blocks light so we can't see through it or shine a light through it.

When light is shone onto a transparent object, the light travels through it, we can see through it and it makes a very faint shadow.

When light is shone onto a translucent object, some of the light travels through it, we can see bright light sources through it and it makes a fairly dark shadow.

Light Sources

- A light source is something that emits light by burning, electricity or chemical reactions.
 - Burning light sources include the Sun, flames from a fire and stars.
 - Electric lights include lamps, car headlights and street light.
 - Lights that are caused by chemical reactions are much less common.
 - This happens when different chemicals react and light is a product of that reaction.
- Examples can include glow sticks and fire flies.



Shiny surfaces reflect light



Matt surfaces don't reflect light very well.



Sunlight

- The light from the sun can be dangerous.
- It can damage our eyes. We must never look directly at the sun.
- We can protect our eyes by wearing sunglasses or sunhats in bright sunlight.





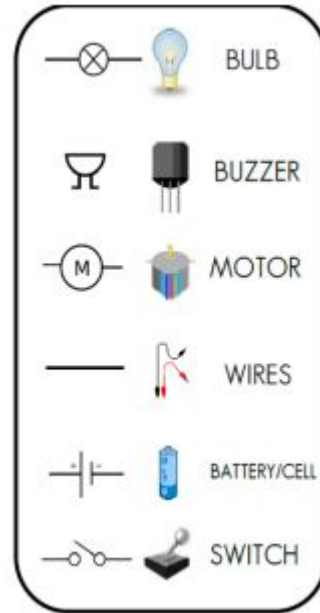
Key Vocabulary	
circuit	A complete route which an electric current can flow around.
current	A flow of electricity through a wire
battery	A small device that provides power for electrical items.
cell	A device used to generate electricity. A battery is an example of a cell.
conductor	Any material that electricity can pass through or along.
insulator	Any material that electricity cannot pass through or along.
buzzer	An electrical device that makes a buzzing Sound.
motor	A device that changes electrical energy into Movement.
wire	A long thin piece of metal that carries an electrical current often covered in plastic for safety.
voltage	An electrical force that makes electricity move through a wire, measured in volts (V).
socket	A device on a wall that you can plug electrical equipment into.
electricity	A form of energy used for lighting, heating, making sound and making machines work.

How does a circuit work?

In a series circuit all the components are joined together and the electricity can only flow in one direction. You must learn the different symbols for the different components. Switches can be used to open and close circuits.

However, a circuit will not work properly if:

- the cells aren't connected correctly (+ to - not ++ or --)
- a component isn't working or there's no bulb;
- the circuit has gaps
- one of the components acts as an insulator.



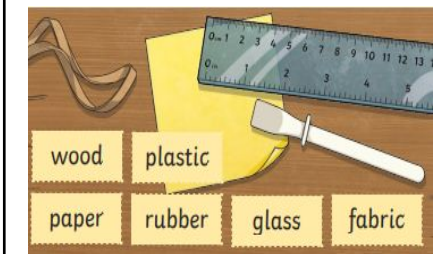
Electrical Conductors

An electrical conductor lets electricity pass through it. They are often metal (e.g. iron, copper and gold) but also include carbon and water. As our bodies are 18% carbon, electricity is very dangerous to us and because water is a very good conductor of electricity we mustn't use electrical appliances near it!



Electrical Insulators

An insulator doesn't let electricity pass through it, e.g. wood, leather and plastic. Plastic is used to cover electrical wires because it is a good insulator.



Creation and Uses of Electricity

Electricity can be created in a number of different ways, for example:

- Burning fossil fuels (oil, gas, etc.) in power stations;
- Using solar power generated from the sun;
- Using wind power from wind turbines;
- Using water power (hydropower).

Electricity is used to power numerous household appliances, for example laptops, TVs, fridges, microwaves, toasters, ovens and lights/ lamps. Life would be very different without it!



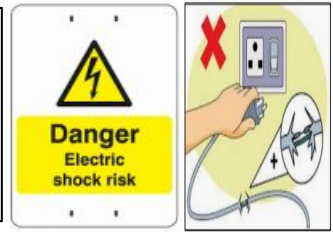
Focused Scientist – Thomas Edison

Thomas Edison was born in 1847 and died in 1931. He lived in the state of New Jersey in the United States of America (USA) He is known as one of the greatest inventors in history. He invented the light bulb, the phonograph (which could record and play sound) and an early video camera called the Kinetograph. The films were then watched on a Kinetoscope which he also invented.



Electrical Safety

Electricity can be dangerous if not used properly. It can cause shocks, burns and even death. There are electrical dangers both in the home and outdoors.



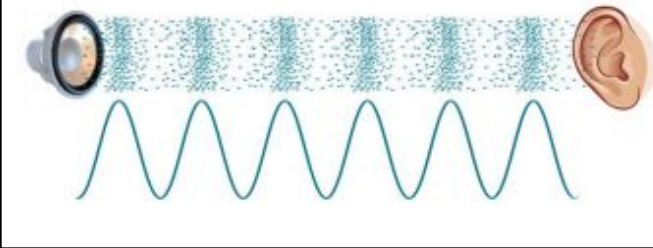


Key Vocabulary

sound source	Where sound comes from. A sound source will produce vibrations
vibrations	invisible waves that move quickly
frequency	How many vibrations are made in one second
energy	Sound energy is a type of energy that we can hear
Sound waves	invisible waves that travel through air, water, and solid objects as vibrations
volume	how loud or quiet a sound is
transmit	to pass from one place or person to another.
pitch	how high or low a sound is
insulation	material that stops the travel of energy (including sound)
medium	something that makes it possible to transfer energy from one location to another.
amplitude	a measure of the strength of a sound wave
travel	how something moves around

How do we hear?

The sound waves travel to the ear and make the eardrums vibrate. Messages are sent to the brain which recognises the vibrations as sounds.



Pitch

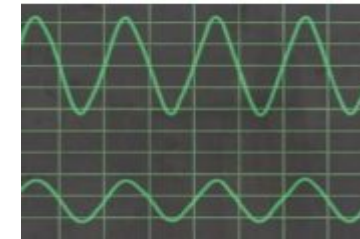
The pitch of a sound is how high or low it is. A squeak of mouse has a high pitch A roar of a lion has a low pitch.



A high pitch sound is made because it has a high frequency. The sound source vibrates many times a second.

Volume of a sound

The louder the sound, the bigger the vibration. The closer you are to the source of a sound, the louder the sound will be. The further away you are from the source of a sound, the quieter the sound will be. The size of the vibration is called the **amplitude**. Quieter sounds have a smaller amplitude, and louder sounds have a bigger amplitude.



How does sound travel ?

Sound can travel through **solids, liquids and gases**. Sound travels as a wave, vibrating the particles in the medium it is travelling in. Sound travels much slower than light, whether in air or in water. You often hear things after you see them, for example, you see the lightning before you hear the thunder.

Absorbing Sounds

If you lived near a noisy building site, you would not want to hear the sounds of the machines! You would need to find a way to absorb the sounds so your house remained quiet and peaceful. This is called **soundproofing, insulating** the sound

Focused Scientist – Alexander Graham Bell

Alexander Graham Bell was a Scottish scientist who invented the telephone in 1876. He formed the Bell Telephone Company in 1887.



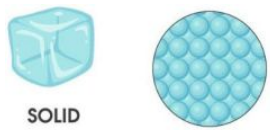


Key Vocabulary

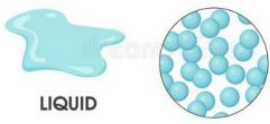
matter	Objects that take up space and have a mass and called matter. Everything around you is made up of matter.
solid	a solid holds its shape and has a fixed volume.
liquid	a liquid fills up the shape of the bottom of a container. It forms a pool and also has a fixed volume.
gas	a gas can escape from an unsealed container. It fills up the space that it is in and does not have a fixed volume.
melting point	the temperature at which a given solid will melt.
thermometer	an instrument for measuring and indicating temperature.
Celsius	a scale of temperature on which water freezes at 0 degrees and boils at 100 degrees under standard conditions.
condensation	Changing from a gas to a liquid.
evaporation	Changing from a liquid to a gas.
precipitation	liquid or solid particles that fall from a cloud as rain, sleet, hail or snow.
Water cycle	the cycle of processes by which water circulates between the earth's oceans, atmosphere, and land.
Water vapour	water in the gaseous state, especially when due to evaporation at a temperature below the boiling point.
Freezing	When a liquid turns to a solid as it has reached its freezing point. These can differ depending on the substance.

Solids, Liquids and Gases


SOLIDS -Solids hold their shape -Solids are rigid -Solids have a fixed volume
Examples include ice cubes, rock, glass and most metals.



LIQUIDS -Liquids do not hold their shape. They are not rigid -However, they have a fixed volume. Examples include water, oil, blood and milk.



GASES -Gases do not hold their shape. They are not rigid -They do not have a fixed volume. Examples include oxygen, carbon dioxide and helium.

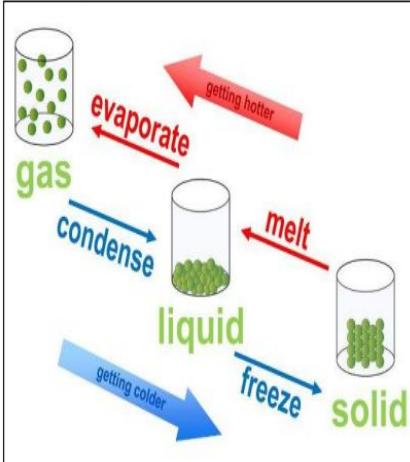


Changing State of Matter

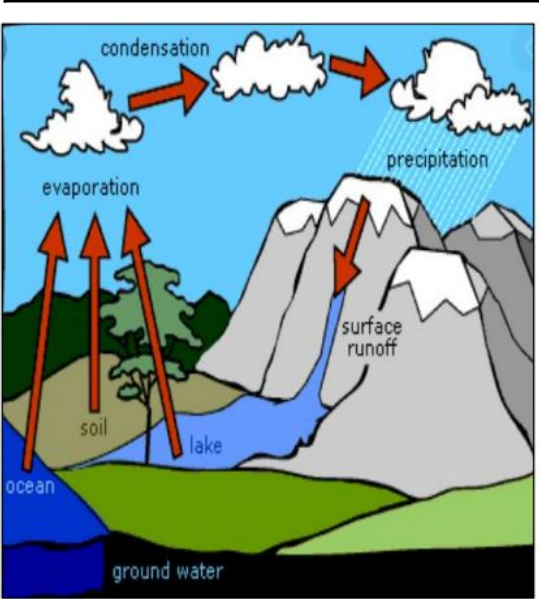
States of matter can change, depending upon the temperature of the matter.
Melting is the process of changing a solid into a liquid.

Evaporation is the process of changing a liquid into a gas.

Condensation is the process of changing a gas into a liquid.
Freezing is the process of turning a liquid into a solid.




Water Cycle




1. Water from lakes, puddles, rivers and seas is **evaporated** by the sun's heat, turning it into **water vapour**.
2. This **water vapour** rises, then cools down to form water droplets in clouds (**condensation**).
3. When the **droplets** get too heavy, they fall back to the earth as rain, sleet, hail or snow (**precipitation**).

Focused Scientist – John Dalton 1766 - 1844
John Dalton FRS was an English chemist, physicist and meteorologist. He is best known for introducing the atomic theory into chemistry, and for his research into colour blindness, which he had.



In 1803 he proposed matter is made up of atoms that are indivisible and indestructible.

Focused Scientist – Robert Boyle 1627–1691
Robert Boyle FRS was an Anglo-Irish natural philosopher, chemist, physicist, alchemist and inventor.

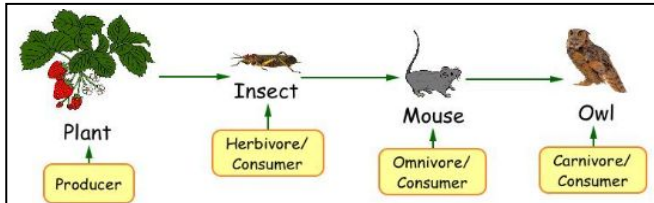


Boyle discovered that the volume of a gas decreases with increasing pressure and vice versa—the famous Boyle's law.

Key Vocabulary

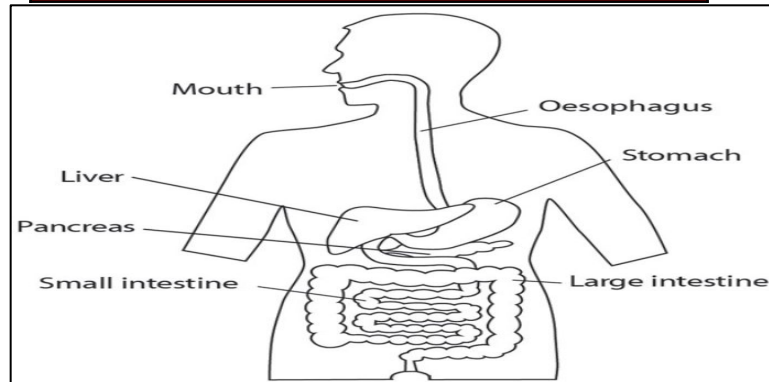
omnivore	Person or animal eats all kinds of food, including both meat and plants.
carnivore	An animal that eats meat.
herbivore	An animal that only eats plants.
digest	When food in the stomach is broken down.
nutrition	Food necessary for health and growth.
saliva	The watery liquid that forms in your mouth and helps you to chew and digest food.
organ	A part of your body that has a particular purpose.
absorb	soak up or take in.
oesophagus	The part of your body that carries the food from the throat to the stomach.
intestines	The tubes in your body through which food passes when it has left your stomach.
muscles	Something inside your body which connects two bones and which you use when you make a movement.
stomach	The organ inside your body where food is digested before it moves into the stomach.
decay	Gradually destroyed by a natural process
enamel	The hard white substance that forms the outer part of a tooth.
incisor	The teeth at the front of your mouth which you use for biting into food.
molar	The large, flat teeth towards the back of your mouth that you use for chewing food.
premolar	Two situated on each side of both jaws between the first molar and the canine.
plaque	A substance containing bacteria that forms on the surface of your teeth.

Food Chain



Food chains show the relationships between plants and animals when they are eaten. When a living thing is eaten the energy from it is passed to the animal that has eaten it. The arrows show the transfer of energy.

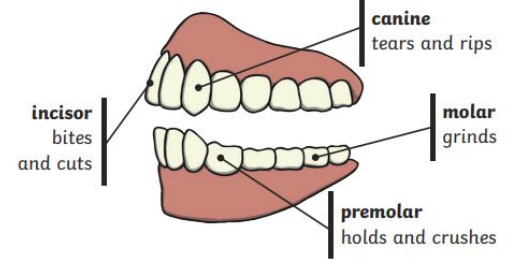
Digestive System



- The smell of food triggers saliva to be produced.
- The digestive system begins with the mouth and teeth where food is ingested and chewed.
- Saliva is mixed with food which helps to break it up.
- When the food is small enough to be swallowed, it is pushed down the oesophagus by muscles to the stomach
- In the stomach food is mixed further.
- The mixed food is then sent to the small intestine which absorbs nutrients from the food.
- Any leftover broken down food then moves into the large intestine.
- The food minus the nutrients arrives in the rectum where muscles turn it into faeces. It is stored here until it is pushed out by the anus. This is called excretion.

Human Teeth

- Teeth are used for cutting and chewing food.
- They start the digestive process which gives us the energy we need to live.
- Humans look after their teeth by brushing flossing and ensuring that they do not eat foods high in sugar.
- Not looking after teeth can lead to an increase in plaque and tooth decay.



- Canines are pointed for tearing and ripping food - these are usually used when chewing meat.
- Incisors are shovel shaped and help bite lumps out of and cutting food.
- Premolars and molars are flat and they grind and crush.

When do our teeth grow?

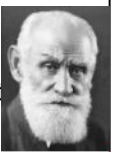
Birth – 20 baby teeth / 7 years – Baby teeth fall out and adult teeth push through. / 21years – 32 adult teeth.

Looking after our teeth

- Brush twice a day
- Use mouthwash
- Floss your teeth
- Avoid lots of sugar in our diet

Focus Scientists – Ivan Pavlov

Ivan Pavlov (1849-1936) Ivan Pavlov worked to unveil the secrets of the digestive system, but he also studied what signals the phenomena, such as the secretion of saliva through his famous Pavlov's dog experiments.



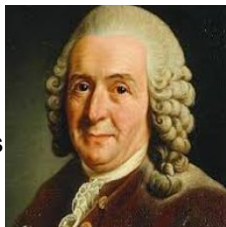


Key Vocabulary	
vertebrate	animals which have a backbone/spine
invertebrate	animals which do not have a backbone/spine
classification	grouping living things by looking at similarities and differences
habitat	where a plant or animal lives
environment	the surroundings or conditions in which an animal or plant lives
deforestation	the action of clearing a wide area of trees
unique	being the only one of its type.
Food chain	a series of living beings in which each serves as food for the next.
producer	a living thing that makes its own food.
consumer	a living thing that cannot make its own food and so received its energy through consuming (eating) other plants or animals
mammals	any animal that has hair and feeds its babies with milk from the mother.
organism	an individual living thing, such as a plant, an animal, or a bacteria.

Focused Scientist

Carl Linnaeus (1707 –1778)

Carl Linnaeus was a Swedish botanist, zoologist, taxonomist and physician who classified living things by their physical characteristics. He is known as the "father of modern taxonomy".



How can environments change?

Habitats can change throughout the year and this can have an effect on the plants and animals living there. Humans can have positive effects on the environment, e.g. nature reserves, but instead often damage it.

Man-made threats to the environment

Air-pollution from cars, e.g. carbon monoxide, and the burning of fossil fuels. Water pollution through industrial waste and farm fertilisers that can pollute rivers and streams. Rubbish—Plastic and household waste ends up on the streets, in the sea or in rubbish dumps, destroying habitats and wildlife.



Life Processes

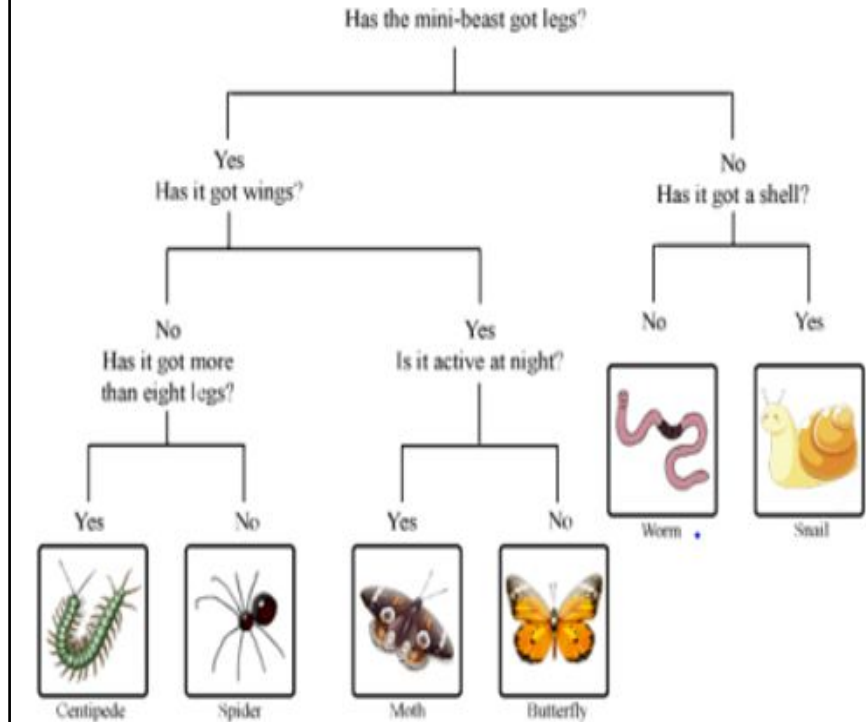
To stay alive and healthy, all living things need certain conditions that let them carry out the seven life processes:

- Movement
- Respiration
- Sensitivity
- Nutrition
- Growth
- Reproduction
- Excretion

Classification Key

A classification key is used to group and sort characteristics of living things (animals and plants).

Answer the questions and follow the lines depending on whether the answer is yes or no.





Key Vocabulary	
materials	the matter or substance that objects are made of.
reversible changes	a change that can be changed back again. Melting and heating are examples of reversible changes.
irreversible changes	a change that cannot be changed back again. Burning or mixing a liquid with bicarbonate of soda are examples of irreversible changes.
soluble	able to be dissolved.
insoluble	impossible to dissolve, esp. in a given liquid.
solution	a mixture that contains two or more substances combined evenly.
dissolve	when a substance is mixed with a liquid and the substance disappears.
evaporate	to turn from liquid into gas; pass away in the form of vapour.
conductor	the ability of a material to conduct either heat or electricity.
insulator	a non-conductor of electricity or heat.
permeable	a substance that a gas or liquid can pass through.
thermal	relating to or caused by heat or by changes in temperature.
transparent	an object you can see through

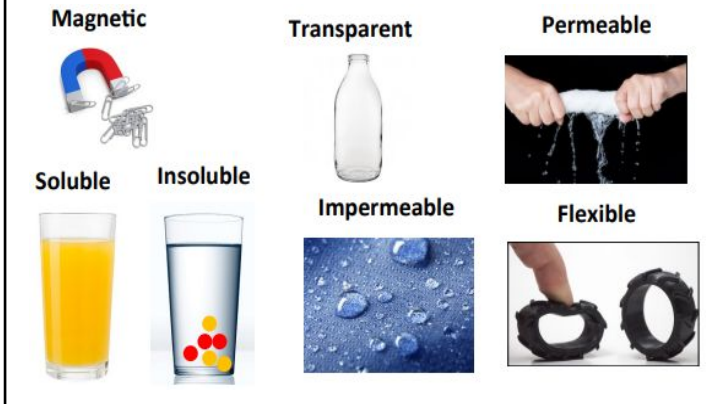
Thermal and Electrical Conductor and Insulator

An **electrical conductor** lets electricity pass through it, e.g. water, carbon, iron, copper and gold. An insulator doesn't let electricity pass through it, e.g. wood, leather, plastic. Materials which are good **thermal conductors** allow heat to move through them easily. Thermal insulators do not let heat travel through them easily. E.g. flasks or woollen.

Comparing and Grouping Materials

Materials can be compared and grouped together on the basis of their properties including:

- Hardness – how hard or soft a material is
- Solubility – whether a material can dissolve
- Transparency – whether it allows light to pass through
- Conductivity (electrical or thermal) – whether it allows heat or electricity to carry through
- Response to magnets – whether it is magnetic



Reversible and Irreversible Changes

There are many ways in which materials can be changed, for example through heating, cooling, or mixing with other substances.

-Some changes can be reversed (e.g. the material can be returned to its previous form). These are known as reversible changes. An example of this is the freezing of water into ice – it can be melted to become water again.



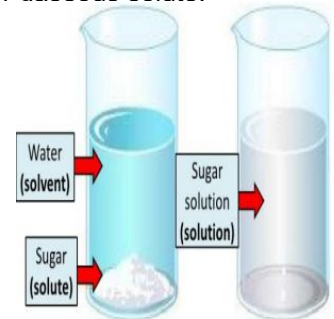
Other changes are irreversible. This means that that the changes cannot be 'undone.' Examples of this include cooking, baking, frying and burning materials.

For example, you can fry a raw egg to cook it. You can't return it back to a raw egg again. - Changes that involve the formation of new materials (e.g. mixing cement) are not normally reversible.



Solutions and Separation

A **solvent** is a substance that dissolves a solid, liquid, or gaseous solute. A **solute** is the substance dissolved in the solvent. When it dissolves, it looks as though it has disappeared, but in fact it has been broken down to become a part of the liquid. For example, salt water. You cannot see the salt, and the **solution** will remain if left alone. Some mixtures and solutions can be separated, e.g. through processes such as **sieving, filtering & evaporating**. Salt and water can be separated by Evaporation.



Focused Scientist – Ruth Benerito (1916 – 2013)

Ruth Benerito was an American chemist. She is best known for developing wrinkle-free cotton fabric. She also invented a fat mixture that could provide nutrients through the veins of patients who could not eat.



Ahmed Zewali – (1946 – 2016)

He was known as the father of femtochemistry which is the study of chemical reactions over very short periods. He was the first Egyptian scientist to win a Nobel prize.





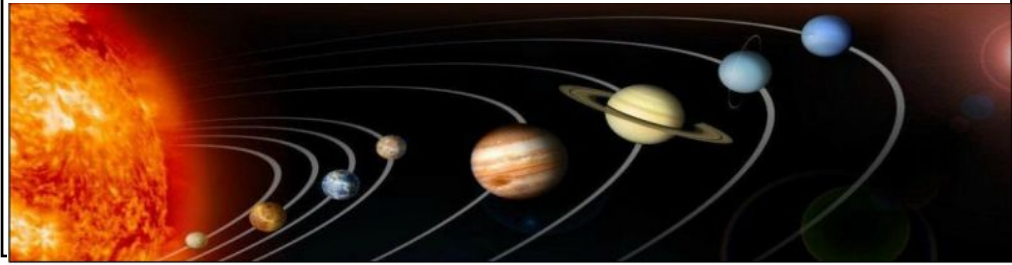
Key Vocabulary	
Solar System	the Sun and all the planets that go round it
Galaxy	an extremely large group of stars and planets. Our galaxy is called the Milky Way.
Planet	a large, round object in space that moves around a star
Time Zone	one of the areas into which the world is divided where the time is calculated as being a particular number of hours behind or ahead of GMT (Greenwich Mean Time)
Celestial body	any naturally occurring object in space.
Orbit	a repeating path which one object takes around another.
Asteroid	A rock that orbits the sun in a belt between Mars and Jupiter
Axis	An imaginary line through the middle of something (i.e. a planet)
Meteorite	A rock from outer space that has landed on Earth.
Comet	A bright object with a long tail that travels around the sun
universe	The whole of space and all of the stars, planets and other forms of matter and energy in it.
Leap Year	a year which has 366 days. The extra day is the 29th February. There is a leap year every four years

Focused Scientist - Galileo (1564 – 1642)
Galileo was a professor of mathematics in Italy. He invented the optical telescope. He was the first person to be able to observe celestial objects.



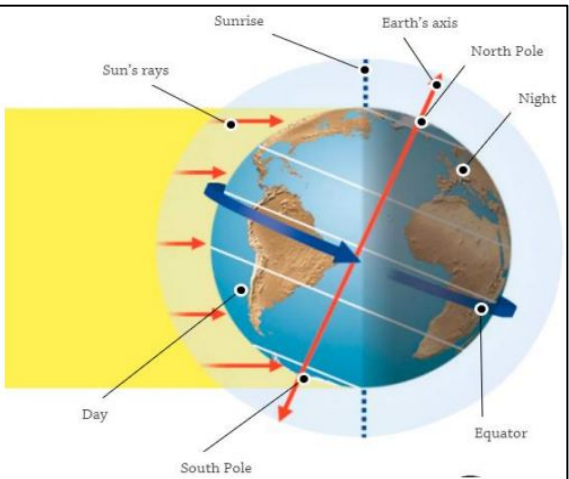
The Solar System

- There are 8 planets in our Solar System (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune). Pluto is a dwarf planet.
- They all orbit the Sun, which is a star, and they all have moons.
- The first four planets are relatively small and rocky, while the four outer planets are gas giants (Jupiter and Saturn) or ice giants (Uranus and Neptune). There are also asteroids, meteoroids and comets in the Solar System.
- The Solar System is in a galaxy called the Milky Way. The galaxy is in the universe



What causes day and night?

The Earth rotates on its axis anti-clockwise and makes a complete rotation over 24 hours (a day). This makes it appear as the Sun moves through the sky but the Earth's rotation causes day and night. Different parts of the Earth experience daylight at different times - this means that it is morning, afternoon and night in different places. This is also the reason why we have time zones. Because of the Earth's tilt, the poles experience 24 hours of sunlight in the summer, and very few hours of sunlight in the winter. As the Earth rotates, shadows that are formed change in size and orientation.



The Earth and the Moon

The moon orbits Earth in an oval-shaped path whilst it spins on its axis. At different times in the month the moon appears to be different shapes, this is because the sun lights up different parts of the moon as the moon moves around the Earth.



The Sun and the Moon

The earth, sun and moon are approximately **spherical** in shape. The earth **orbits** the sun. The moon **orbits** the earth.





Key Vocabulary	
Gravity	a pushing force exerted by the Earth, it attracts objects towards the centre of the Earth.
friction	the force between 2 moving surfaces.
air resistance	the force that air exerts on a moving object
water resistance	the force that water exerts on a moving object.
streamlined	when an object is shaped to minimise the effects of air or water resistance.
Up thrust	is a force that pushes objects up, usually in water.
buoyancy	An object is buoyant if it floats. This is because the weight of the object is equal to the upthrust
mass	A measure of the amount of matter in an object (measured in grams and kilograms)
weight	the measure of the force of gravity on an object, measured in Newtons (N)
mechanism	A part, often consisting of a set of smaller parts, which performs a particular function.
fulcrum	The point where a lever turns (also called a pivot).
matter	anything that has weight and takes up space.
Newton meter	a piece of equipment that is used to measure the forces acting on an object.

Forces in Action

There are a number of different forces that affect us in our daily lives:

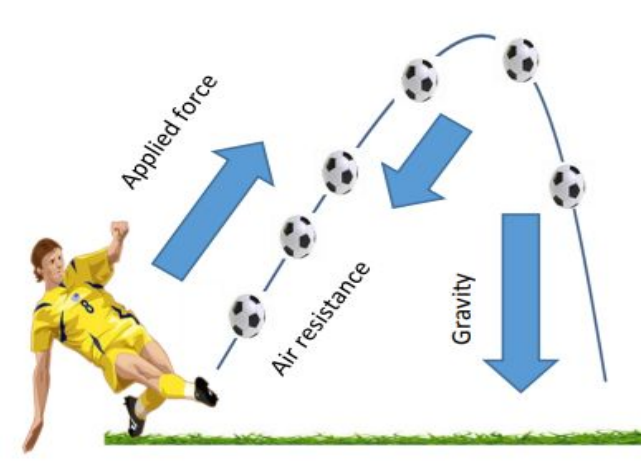
Applied force: The force placed on an object by a living creature.

Friction: the 'sticking' force that occurs when an object moves over another.


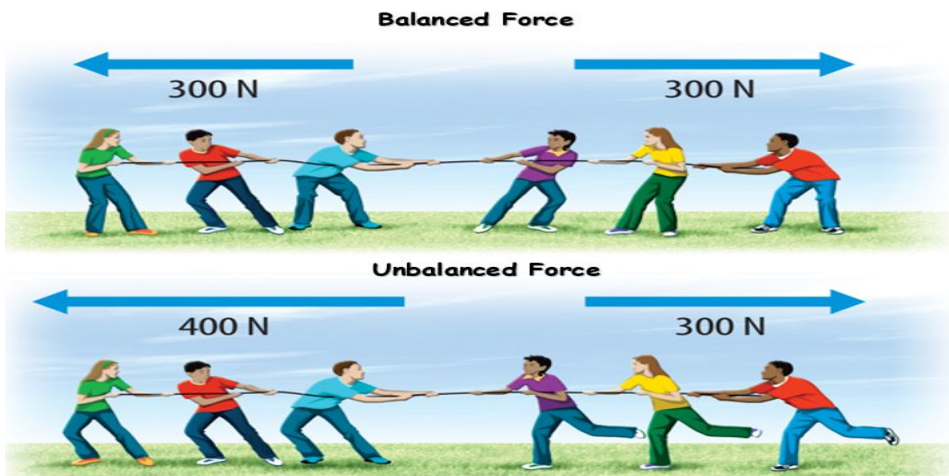
Air resistance is a type of friction force that pulls against an object travelling through the air. Some objects are more 'streamlined', meaning that the air pulls on them less, and they travel faster.

Water resistance is the friction force on objects floating or moving in water.

Surface resistance is the friction force of objects moving across a surface.



FORCE METER – is marked in Newtons and measures the weight of an object.

What are examples of mechanisms?



Levers allow us to do heavy work with less effort. For example, trying to pick up a large heavy box is difficult, however if a lever is used it becomes much easier to move it.


Pulleys also allow us to do heavy work - objects are attached to ropes and pulley wheels, and so instead of lifting heavy object upwards, we can pull on the pulley rope downwards.

Gears are toothed wheels. Their 'teeth' can fit into each other so that when the first wheel turns, so does the next one. This allows forces to move across a surface.

Springs can be stretched by pulling them or squashed by pushing them. The greater the force pulling or pushing the spring, the greater the force the spring uses to move back to its normal shape.


Focused Scientist – Isaac Newton

Isaac Newton studied Science and philosophy at the University of Cambridge. He discovered the idea of forces acting upon objects on Earth. Discovered gravity acts upon objects on Earth. For every action there is and equal and opposite reaction.



Focused Scientist – Galileo Galilei

Was a professor of mathematics in Italy. Discovered the idea of air resistance and how it effects the rate the objects fall. He discovered that all objects, no matter their mass, would fall at the same rate in a vacuum.



Key Vocabulary	
life cycle	The series of changes that an animal or plant passes through from the beginning of its life until its death.
life processes	There are seven processes that tell us that living things are alive.
reproduction	when an animal or plant produces one or more individuals similar to itself.
amphibian	a class of animals that live the first part of their lives in the water and the last part on the land.
metamorphosis	a person or thing develops and changes into something completely different.
Inherit	receive from one's parents.
bird	a warm-blooded egg-laying vertebrate animal with wings, feathers and a beak.
insect	a small animal that has 6 legs.
mammal	a warm-blooded vertebrate animal, has hair or fur and give birth to live young. Females secrete milk for their young.
offspring	a person's child or children.
genes	carry information that determine your traits (features and characteristics).
infancy	the period of your life when you are a very young child.
adolescence	the period of your life in which you develop from being a child into being an adult.
adulthood	the state of being an adult.
fertilisation	male and female gametes meet to form an embryo or seed

Life Processes

There are 7 things that all living things do. These are called life processes.

'MRS GREN' will help you remember!

Movement
Respiration
Sensitivity

Growth
Reproduction
Excretion
Nutrition

Mrs Gren

Example Life Cycles

Amphibians

Birds

Insects

Plant

Mammals

Vegetative Reproduction

Flowering plants use Pollination to make seeds, which grow to make new plants. However, some flowering plants use vegetative propagation (grafting, cuttings) to make new plants. Unlike pollination, this reproduction only needs one parent plant to make new plants.

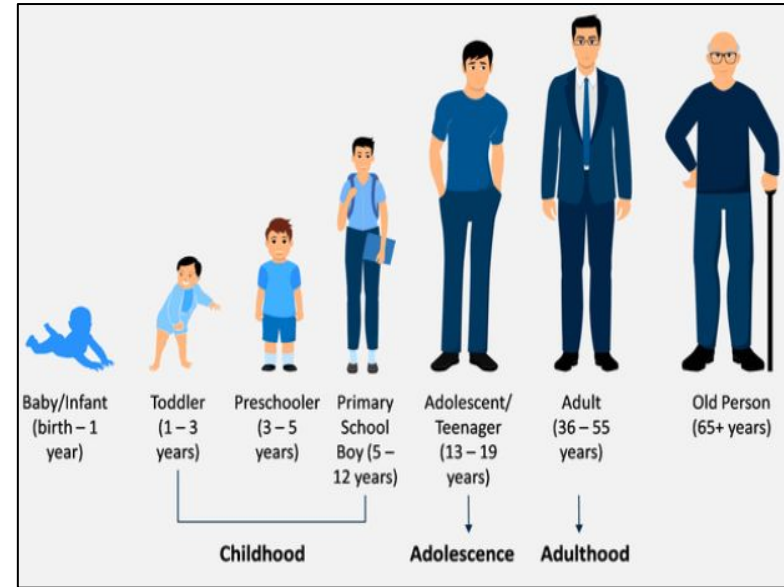
Focused Scientist Jane Goodall
Jane Goodall is an English primatologist and anthropologist. She is considered the world's foremost expert on chimpanzees, after 60 years studying the social and family interactions of wild chimpanzees.



Key Vocabulary	
life cycle	The series of changes that an animal or plant passes through from the beginning of its life until its death.
life processes	There are seven processes that tell us that living things are alive.
reproduction	when an animal or plant produces one or more individuals similar to itself.
growth	an increase in something
independent	If someone is independent, they do not need help or money from anyone else.
development	the gradual growth or formation of something
mature	When a child or young animal matures, it becomes an adult
offspring	a person's children or an animal's young
toddler	a young child who has only just learned to walk
infancy	the period of your life when you are a very young child.
adolescence	the period of your life in which you develop from being a child into being an adult.
puberty	the stage in someone's life when their body starts to become physically mature
adulthood	the state of being an adult.

The main stages of the human life cycle

- **newborn** - this is a baby that has just been born.
- **infancy** - this is a period of rapid change. Many toddlers learn to walk and talk at this stage.
- **childhood** - children learn new things as they grow. They become more independent.
- **adolescence** - this is when the body starts to change and prepare itself for adulthood. Hormonal changes take place over a few years. This is also known as puberty.
- **early adulthood** - this is when humans are usually at their fittest and strongest.
- **middle adulthood** - changes such as hair loss may happen. There are also some hormonal changes again and the ability to reproduce decreases.
- **late adulthood** - there is a decline in fitness and strength.



Height

Height is largely determined by DNA. However, environmental factors such as nutrition and exercise can affect growth during development. As children get older, they need good nutrition and plenty of exercise to help their bodies make the hormones they need to grow.



Focused Scientist – Rosalind Franklin (1920 - 1958)
 Rosalind Franklin British scientist best known for her contributions to the discovery of the DNA, a constituent of chromosomes that serves to encode genetic information. Franklin also contributed new insight on the structure of viruses helping to lay the foundation for the field of structural virology.



There is **not** an exact length of time for each stage because everybody is different. Some people begin a new stage **earlier** or **later** than others. It doesn't matter as we are all **unique** and hit each stage eventually.



Focused Scientist – Robert Winston
 Robert Winston (b.1940) is a professor who researched and presented the TV show Child of our Time, which looked at how children grow and change in the first 20 years of their lives.





Key Vocabulary	
evolution	a process of change that takes place over many generations, during which species of animals, plants, or insects slowly change some of their physical characteristics
adaptation	a change in structure or function that improves the chance of survival for an animal or plant within a given environment
species	a class of plants or animals whose members have the same main characteristics and are able to breed with each other
inherit	If you inherit a characteristic you are born with it, because your parents or ancestors also had it.
characteristics	the qualities or features that belong to them and make them recognisable
mutation	characteristics that are not inherited from the parents or ancestors and appear as new characteristics.
fossil	the remains or impression of a prehistoric plant or animal embedded in rock and preserved in petrified form
extinct	a species that is no longer existing.
palaeontology	the branch of science concerned with

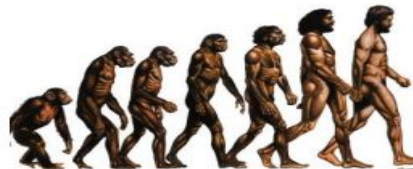
Focused Scientist – Charles Darwin

Charles Darwin was an English scientist best known for his theory of evolution. He was a geologist who travelled across the world in 1831 on the HMS Beagle. He studied many animals and plants on his travels and came up with the idea of natural selection (the strongest survive and evolve).

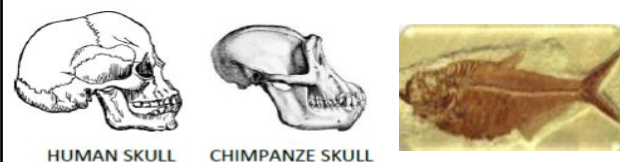


Evolution

Evolution is the gradual process by which different kinds of living organism have developed from earlier forms over millions of years. Scientists have proof that living things are continuously evolving – even today!



Fossils



HUMAN SKULL CHIMPANZEE SKULL

Fossils are the remains of living things which inhabited the world millions of years ago. They are formed in sedimentary rocks (sand, mud and pebbles squashed under layer, after layer over time) and plants/animals get trapped in these layers, revealing their shape.

(Focused Scientist - Mary Anning)

Mary Annings lived in the seaside town of Lyme-Regis. She found 'curiosities' which she later found out were fossils. She made many incredible discoveries. She is remembered as one of the greatest fossil hunters ever.








Inheritance

When parents have offspring, they pass on their physical traits. The offspring inherit their parents' qualities. This means that most offspring look like their parents but they are not identical. The offspring may take characteristics from the father, the mother or a mixture of both.

Traits you can inherit	Traits you can't inherit
<ul style="list-style-type: none"> • eye/hair/skin colour • shape of nose • size of feet • height 	<ul style="list-style-type: none"> • a good singing voice • ability to play football • drawing skill

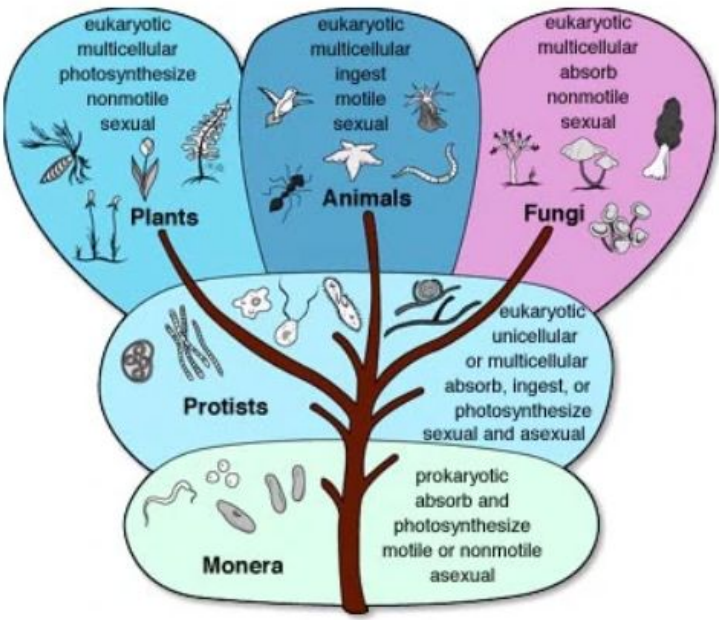
Adaptation

Adaptations are any physical or behavioural characteristics of an animal that help it to survive in its environment. Living things are adapted to their habitats. This means that they have special features that help them to survive. It's not just animals that are adapted to their environment, plants are too. A cactus is well adapted for survival in the desert. They have long roots to collect water from a large area and a stem that can store water for a long period of time. The animals and plants in one habitat are suited to live there and may not be able to survive in other habitats. When a habitat changes, the animals and plants that live there are affected

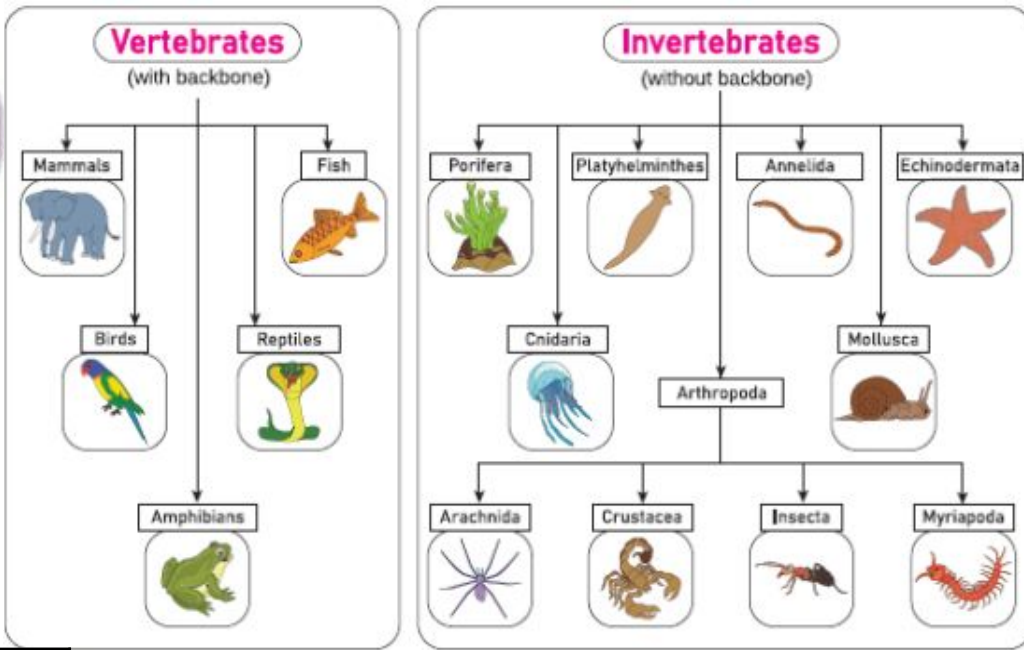
Living Things	Habitat	Adaptive Traits
Polar bear 	arctic 	Its white fur enables it to camouflage in the snow.
camel 	desert 	It has wide feet to make it easier to walk in the sand
Cactus 	desert 	It stores water in its stem.

Key Vocabulary	
classification	The arrangement of organisms into orderly groups based on their similarities and presumed evolutionary relationships.
species	A group of living organisms consisting of similar individuals capable of exchanging genes or interbreeding.
classification key	a series of questions about the organism's physical characteristics.
habitat	where a plant or animal lives
environment	the surroundings or conditions in which an animal or plant lives
taxonomy	The science of naming, identifying and classifying organisms.
fungi	A classification or group of living organisms. This means they are not animals, plants, or bacteria.
Micro-organism	An organism that is so small that it is microscopic (invisible to the naked eye)
virus	a small infectious agent that multiples within the living cells of a host.

The Kingdoms of Living Things

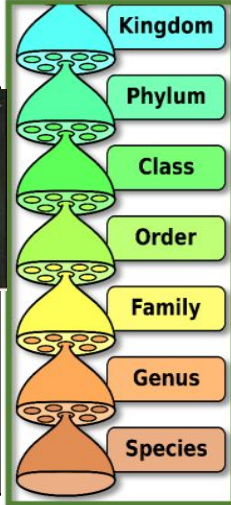


Classification of Animals



The Linnaean Classification System

Scientists believe that there could be as many as 10 million different species on Earth! Scientists sort and group living things according to their similarities and differences. Linnaeus is the father of taxonomy, which is the system of classifying and naming organisms. One of his contributions was the development of a hierarchical system of classification of nature. This system includes eight taxa: domain, kingdom, phylum, class, order, family, genus, and species.

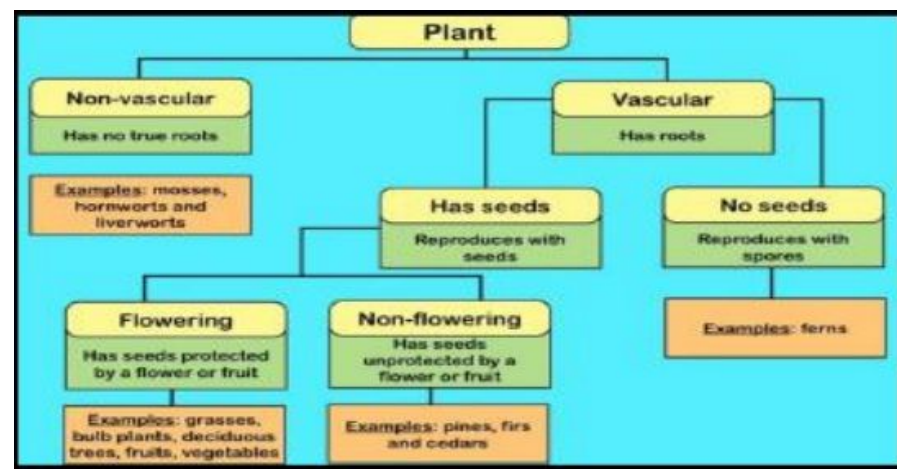


Micro-organisms

Microorganisms are very tiny living things. They are so small that they are not visible to the naked eye, so a microscope is needed to see them. Microorganisms can be found all around us. They can live on and in our bodies, in the air, in water and on the objects around us. They can be found in almost every habitat.



Classification of Plants





Key Vocabulary	
Light	the natural agent that stimulates sight and makes things visible.
Reflection	the throwing back by a body or surface of light, heat or sound without absorbing it.
Ray	a beam of light given off by a light source
Prism	when light passes through a different object and its direction changes.
Periscope	An apparatus consisting of a tube of attached to a set of mirrors or prisms through which an observer can see things that are otherwise out of sight.
Refraction	the bending of light as it passes from one substance to another with the bending caused by the difference in density between two substances.
Spectrum	a band of colours, as seen in rainbows, produced by separation of the components of light by their different degrees of refraction.
Light Source	something that provides light, whether it be a natural or artificial source of light (e.g. the sun, a torch).
Opaque	an object which does not allow light to pass through (e.g. wood).
Translucent	an object which allows some light to pass through it. It may be possible to see some unclear images through the object (tissue paper).
Transparent	an object which allows light to pass through it so that objects behind it can be easily seen (glass).
Shadow	a dark area or shape produced by a body coming between rays of light and a surface.

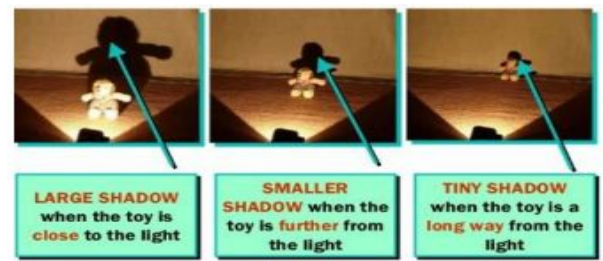
What is light and how does it behave?

Light is a form of energy made up of photons, which allows us to see things. Light travels very quickly and appears to travel in straight lines (rays) but when passing through transparent materials such as water and glass, light bends or turns – known as **refraction**.



Shadows

Because light travels in straight lines, when there is an opaque object blocking the light, a shadow is formed. □ These shadows have the same shape as the objects that cast them. The size of a shadow changes as the light source moves.

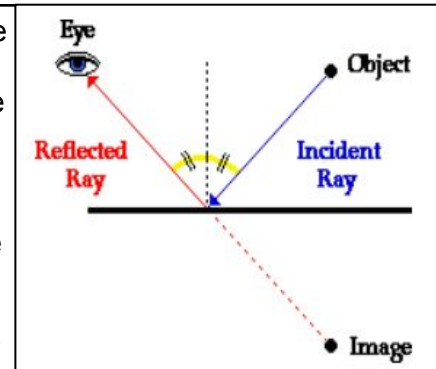


Focused Scientist – Sir Isaac Newton
 Sir Isaac Newton (1643-1727) studied Science and philosophy at the University of Cambridge. Among other things he discovered when light travels through a prism it is refracted and this proves that white light is made up of the colours of the rainbow.



The Law of Reflection

In the diagram, the ray of light approaching the mirror is known as the **incident ray** (labelled **I** in the diagram). The ray of light that leaves the mirror is known as the **reflected ray** (labelled **R** in the diagram). At the point of incidence where the ray strikes the mirror, a line can be drawn perpendicular to the surface of the mirror. This line is known as a **normal line** (labelled **N** in the diagram). The normal line divides the angle between the incident ray and the reflected ray into two equal angles. The angle between the incident ray and the normal is known as the **angle of incidence**. The angle between the reflected ray and the normal is known as the **angle of reflection**.



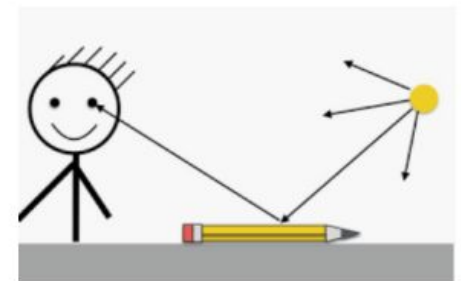
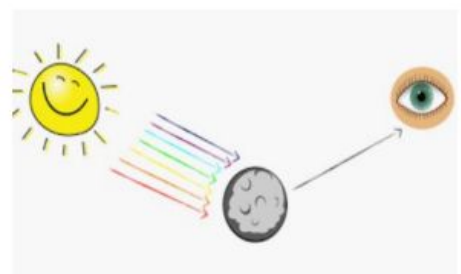
How We See Things

We see things because...

- they are a light source, sending light into our eyes, or
- light is reflected from a light source off them and into our eyes.

When the light enters our eyes, we see the object!

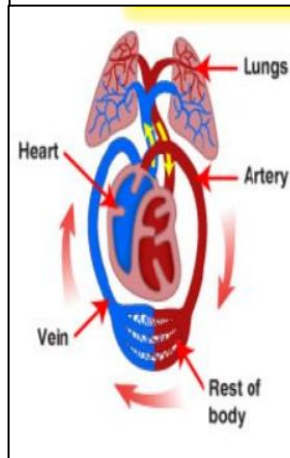
For example, we see The Sun because it is a light source, sending light into our eyes. However, the Moon is not luminous (does not produce its own light). We see it because light from The Sun reflects off it into our eyes. After light reflects off objects, it continues to travel in a straight line, but in a new direction



Key Vocabulary	
arteries	tubes in your body that carry oxygenated blood from your heart to the rest of your body.
atrium	the part of the heart that receives blood from the veins.
blood vessels	narrow tubes that your blood flows through.
carbon dioxide	a gas produced by animals and people breathing out.
Circulatory system	the system responsible for circulating blood through the body, that supplies nutrients and oxygen to the body and removes waste products such as carbon dioxide
Deoxygenated blood	blood that does not contain oxygen
heart	the organ in your body that pumps blood around the body .
lungs	two organs in your chest which fill with air when you breathe in. They oxygenate the blood and remove carbon dioxide from it.
nutrients	substances that help animals and plants grow
pulse	the regular beating of blood through your body. How fast or slow your pulse rate is depends on how active you are
respiration	inhaling oxygen-rich air and exhaling air filled with carbon dioxide
veins	a tube in your body that carries deoxygenated blood to your heart from the rest of your body.
ventricle	the part of the heart from which blood passes into the arteries.
capillaries	the part of the heart from which blood passes into the arteries.

The Circulatory System

The circulatory system is made up of the **heart, lungs and blood vessels**. Arteries carry oxygenated blood from the heart to the rest of the body. Veins carry deoxygenated blood from the body to the heart. Nutrients, oxygen and carbon dioxide are exchanged via the **capillaries**.



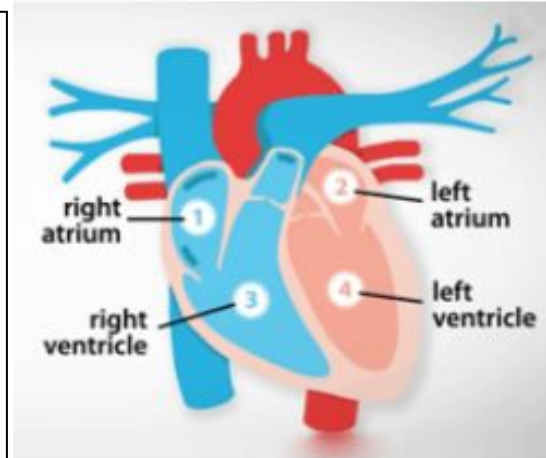
Healthy diet and Exercise

- A healthy and balanced diet and regular exercise is important in helping the body to function.
- Exercise can:
 - tone our muscles and reduce fat.
 - increase fitness.
 - make you feel physically and mentally healthier.
 - strengthens the heart.
 - improves lung function.
- Some choices, such as smoking and drinking alcohol can be harmful to our health.
- Tobacco can cause short-term effects such as shortness of breath, difficulty sleeping and loss of taste and long-term effects such as lung disease, cancer and death.
- Alcohol can cause short-term effects such as addiction and loss of control and long-term effects such as organ damage, cancer and an earlier death.

The Heart

The heart is composed of four chambers; the right **atrium**, the right **ventricle**, the left **atrium** and the left **ventricle**. How often your heart pumps is called your **pulse**.

Blood:
 Transports oxygen and nutrients to the lungs and tissues
 Forms blood clots to prevent blood loss
 Carries cells to fight infection
 Brings waste products to organs
 Regulates body temperature



The Function of the Heart

- Deoxygenated blood flows into the heart from the body through the veins.
- This blood is pumped out of the lungs through the pulmonary artery.
- Blood is then the oxygenated in lungs
- Blood returns to the heart through the pulmonary veins.
- The oxygenated blood is then pumped out of the heart through the aorta.
- The blood travels around the body delivering oxygen and nutrients to the organs.

Focused Scientist – Barbara Casadei

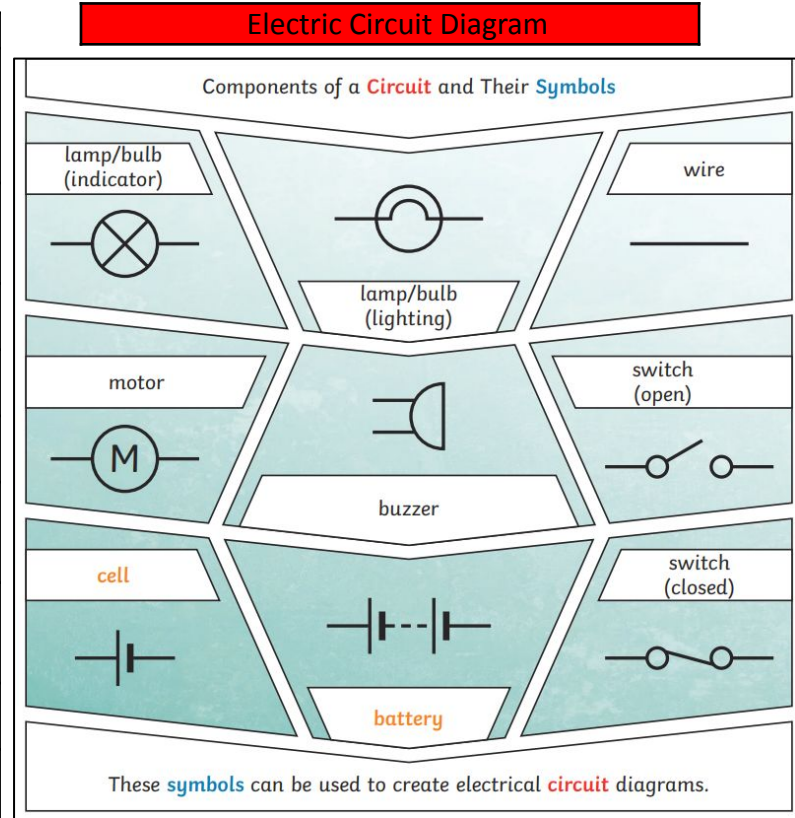
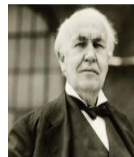
Barbara Casadei is a British Heart Foundation Professor and an Honorary Consultant Cardiologist at the John Radcliffe Hospital in Oxford. She is a researcher helping the British Heart Foundation find cures for cardiovascular conditions.





Key Vocabulary	
battery	A container consisting of one or more cells where chemical energy is converted into electricity and used as a source of power.
bulb	A glass bulb which provides light by passing an electrical current through a filament.
buzzer	An electrical device that makes a buzzing noise and is used for signalling.
cell	a single unit used for converting chemical or solar energy into electricity.
circuit	a complete path which an electric current can flow around.
switch	a small control for an electrical device which you use to turn the device on or off.
electricity	a form of energy that can be carried by wires and is used for heating and lighting, and to provide power for devices.
motor	a device that uses electricity or fuel to produce movement.
amp	the measurement of how much electricity is flowing through a circuit measured using an Ammeter.
volts	a unit of electrical force.
components	the parts that something is made of
current	a flow of electricity through a wire or circuit.

Focused Scientist - Thomas Edison (1847 – 1931)
 Thomas Edison lived in the state of New Jersey the United State of America (USA). He is known as one of the greatest inventors in history. He invented the light bulb, the phonograph (which could record and play sound) and an early video camera called the Kinetograph.



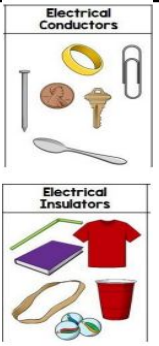
Electrical Safety



What are electrical conductors and insulators?

An electrical conductor lets electricity pass through it. They are often metal (e.g. iron, copper and gold) but also include carbon and water. As our bodies are 18% carbon, electricity is very dangerous to us and because water is a very good conductor of electricity we mustn't use electrical appliances near it!

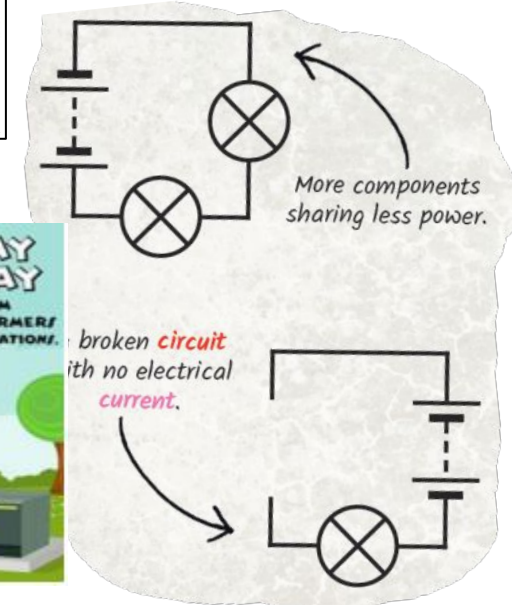
An insulator doesn't let electricity pass through it, e.g. wood, leather and plastic. Plastic is used to cover electrical wires because it is a good insulator.



Focused Scientist - Hertha Ayrton (1854–1923)
 Hertha Ayrton was a British suffragist, physicist, mathematician and inventor at a time when few women had access to opportunities in science, technology, engineering and mathematics. She was the first professionally recognised female electrical engineer.



Series Circuit



Series Circuit
 A **circuit** that has only one route for the **current** to take. If more bulbs or buzzers are added, the power has to be shared and so they will be dimmer or quieter. If just one part of this series **circuit** breaks, the **circuit** is broken and the flow of **current** stops.