

Animal Nutrition and the Skeletal System

Nutrition

Nutrition is a life process by which living things make or eat food and absorb its nutrients. Plants can make their own food. They make food in their leaves. Animals cannot make their own food. They need to find food to eat.

Carnivores, herbivores and omnivores

Animals can be carnivores that eat meat, herbivores that eat plant parts, or omnivores that eat both meat and plant parts.



Tigers are carnivores.



Deer are herbivores.



Badgers are omnivores.

Omnivorous humans

Humans are omnivores because they can eat both meat and plant parts. The fossils of ancient humans show that humans have always been omnivores because they have sharp teeth for tearing meat and flat teeth for grinding plants.



Different human diets

Even though humans are omnivores, some humans choose to eat other diets. People who eat plant parts and animal products, but no meat, follow a vegetarian diet. People who only eat plant parts and products made from plants follow a vegan diet.

Balanced diet

All humans need a balanced diet, whether they eat a typical omnivorous diet or are vegetarian or vegan. A balanced diet contains foods from different food groups in the right proportions. It provides the human body with the energy and nutrients it needs to grow and stay healthy. There are five main food groups:

Fruit and vegetables

Foods in this group contain vitamins and minerals that help the body to fight off diseases. They also contain fibre that is important for the health of our digestive system.



Carbohydrates

Foods in this group contain important nutrients and are the body's main source of energy. They also contain fibre.



Proteins

Foods in this group contain a nutrient called protein that helps the body build muscle and allows it to grow and repair.



Dairy and alternatives

Foods in this group contain a nutrient called calcium, an important mineral for healthy bones, nails and teeth.

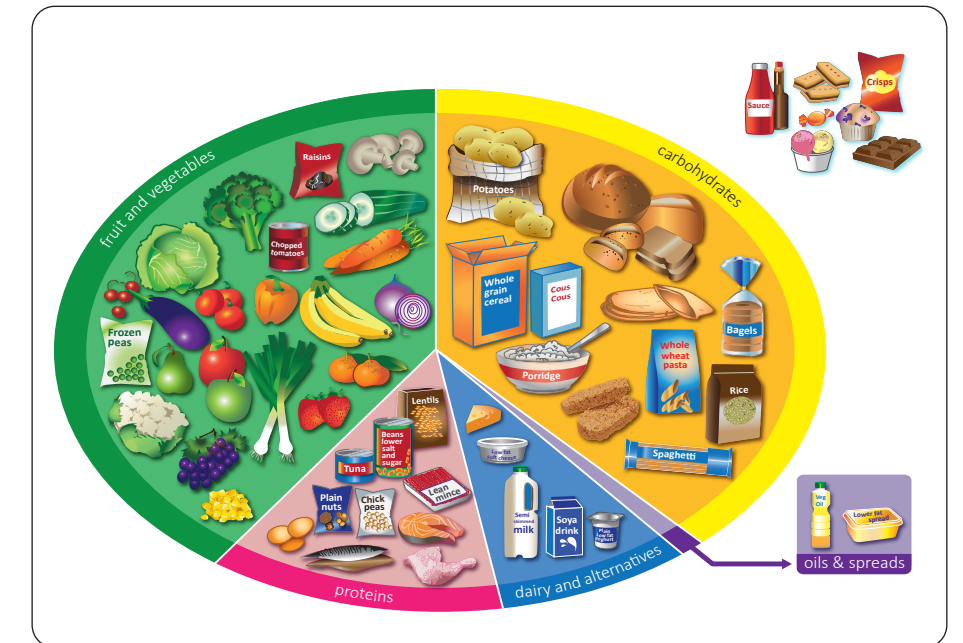


Oils and spreads

Foods in this group contain fat, which helps the body absorb certain vitamins and provides essential nutrients. However, oils and spreads should only be eaten in small amounts.



Eatwell guide



The Eatwell guide shows the proportions of foods from the five main food groups that humans should eat for a healthy, balanced diet. Sugary, salty and fatty foods are outside the Eatwell plate because they are not part of a balanced diet. Some humans do not eat this type of healthy, balanced diet. They either eat too much food, too little food or the wrong types of food. This can result in malnutrition, meaning poor nutrition, which causes health problems.

Seasonal changes in animals' diets

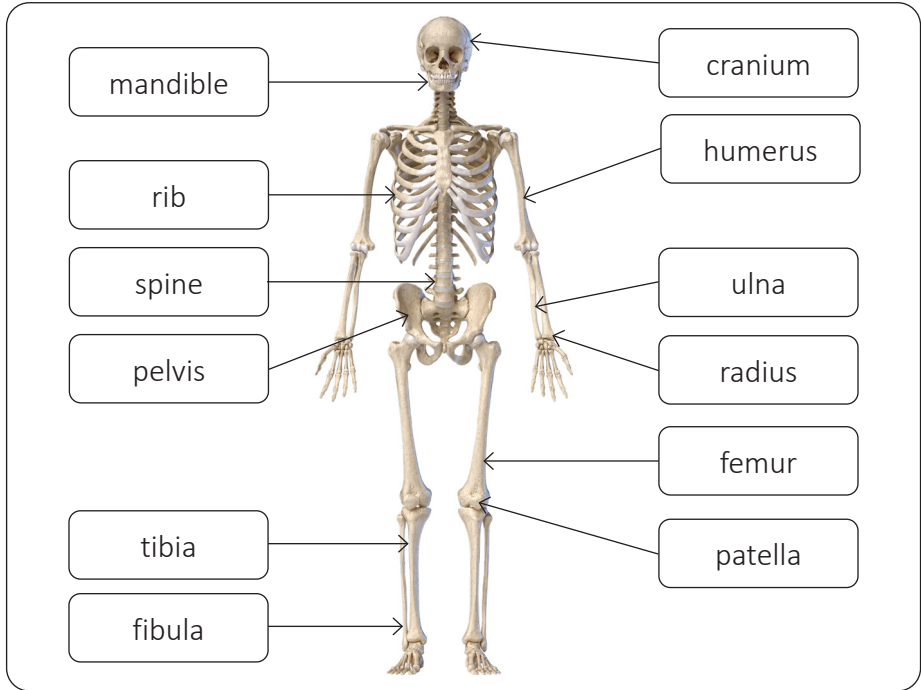
In the wild in the United Kingdom, animals' diets change over the year depending on the season. This is because certain foods become available and unavailable due to the weather and events that happen during spring, summer, autumn and winter.

For example, the barn swallow eats flying invertebrates in the United Kingdom in spring and summer but migrates to South Africa in the autumn, spending winter there because the weather is warmer and there are more flying invertebrates to eat in South Africa.



The human skeleton

The adult human skeleton is a frame of 206 bones that supports the body and gives it shape. It allows the body to move and protects soft, internal organs like the brain, heart and lungs.



major bones in the human skeleton

Most vertebrates have a similar skeleton to humans, with many of the same bones. However, the position or size of the bones vary in each skeleton.

Skeleton types

An **endoskeleton** is found inside all vertebrates. It grows with the body and offers support but no protection to the outside of the body. An **exoskeleton** is found outside the body of invertebrates. It offers protection for soft body parts but does not grow with the animal and does not support a large body size. Some invertebrates have no skeleton. They can squeeze into small spaces, but have no protection from injury.



A human has an endoskeleton.



A scorpion has an exoskeleton.



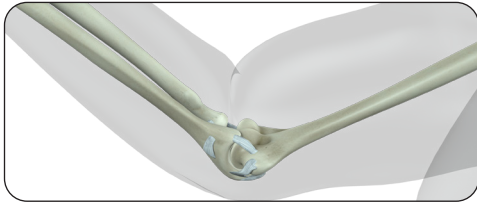
An octopus has no skeleton.

Joints

A joint is a place where two or more bones meet and connect. Vertebrate skeletons have many bones connected by joints to move and bend body parts in different directions. Three types of joints in the human skeleton include the:

Hinge joint

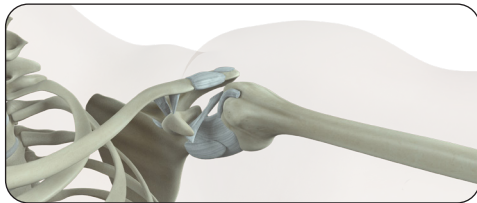
This joint can open and close in one direction only. The elbow joint is a hinge joint.



elbow joint

Ball and socket joint

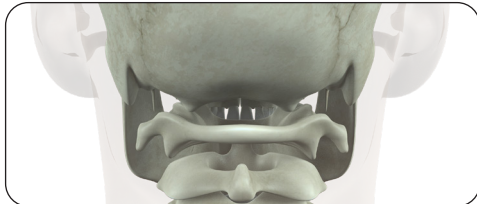
This joint allows movement in all directions. The shoulder joint is a ball and socket joint.



shoulder joint

Pivot joint

This joint only allows limited rotating movements. The top two spinal vertebrae form a pivot joint.

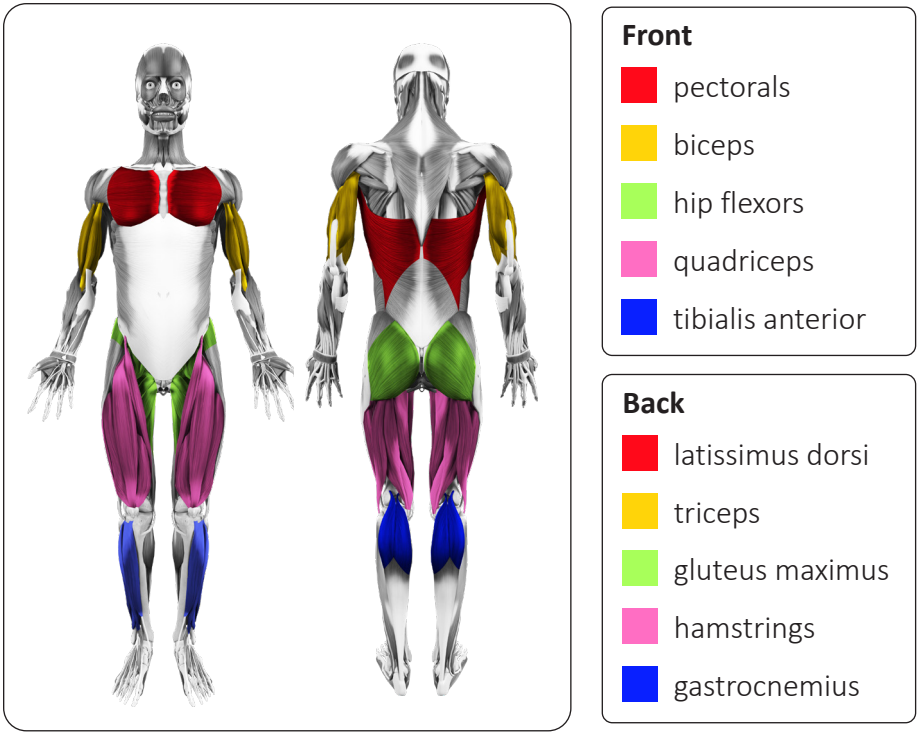


top two spinal vertebrae

Muscles

Muscles are soft tissue made up of many stretchy fibres. They allow the body to move, breathe and digest food. There are three main types of muscle in the human body: smooth muscle in the intestines, skeletal muscle attached to the skeleton and cardiac muscle in the heart.

Skeletal muscles are attached to the skeleton by flexible cords called tendons and work together in pairs, one contracting and one relaxing, to create specific movements.



muscle pairs in the human body

Glossary

invertebrate	An animal without a spine.
nutrient	A substance that plants and animals need to grow, live and stay healthy, including vitamins and minerals.
vertebrae	One of the small bones that form the spine.
vertebrate	An animal with a spine.



Forces and Magnets

What is a force?

A force is simply a push or a pull that makes something move. Forces act in pairs that oppose each other. Forces cause objects to move, change their speed or change their shape.



push



pull

Contact forces

Contact forces happen when two objects or bodies physically touch each other. Frictional forces are a type of contact force.



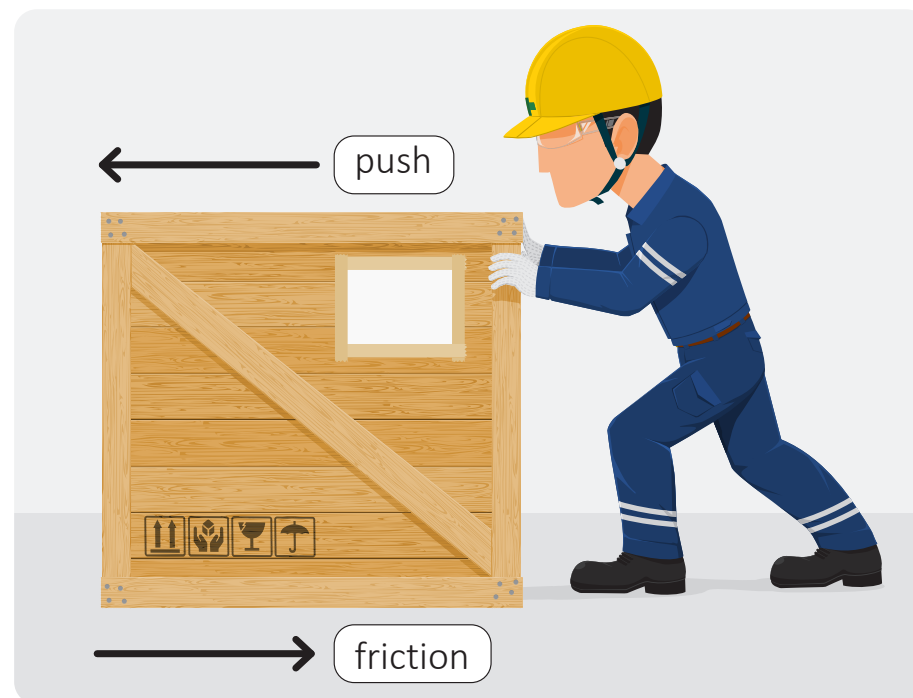
foot pushes ball



hand pulls fishing rod

Frictional forces

Friction is a force between two surfaces as they move across each other. Friction acts in the opposite direction to the movement. Friction always slows down a moving object. It also produces heat.



Sizes of frictional force

The size of a frictional force depends on the materials both surfaces are made from. The rougher the materials, the larger the frictional force. The smoother the materials, the smaller the frictional force.



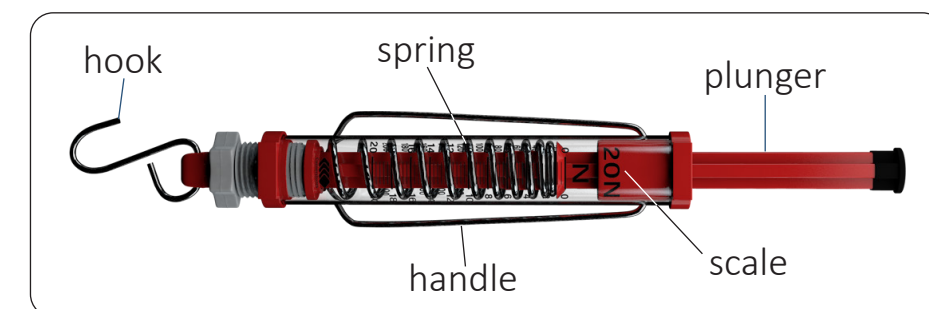
large frictional force



small frictional force

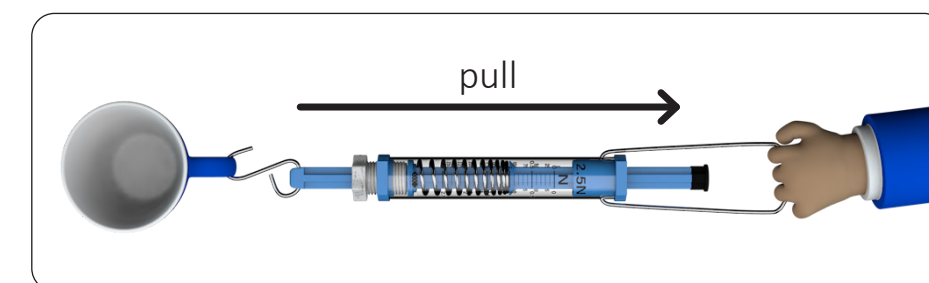
Force meters

A force meter is a piece of scientific equipment that measures force. It can also be called a newton meter or a spring balance. Forces are measured in newtons (N). A force meter has a handle, hook, plunger, spring and scale.



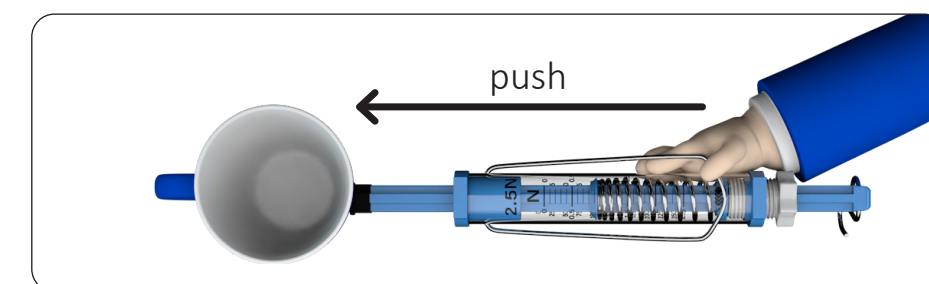
Measuring a pulling force

Attach the object to the force meter's hook. Pull the force meter gently by the handle. When the object starts to move, read the pulling force on the force meter's scale in newtons.



Measuring a pushing force

Place the force meter's plunger on the object. Push the force meter gently against the object until it starts to move. Read the pushing force on the force meter's scale in newtons.

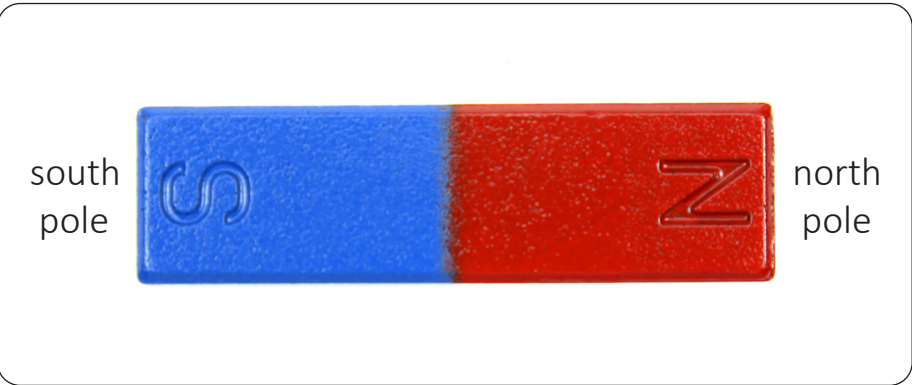


Non-contact forces

Non-contact forces exert a push or a pull but have no direct contact with the objects they affect. We cannot see non-contact forces, but we can feel them. Magnetic forces are a type of non-contact force.

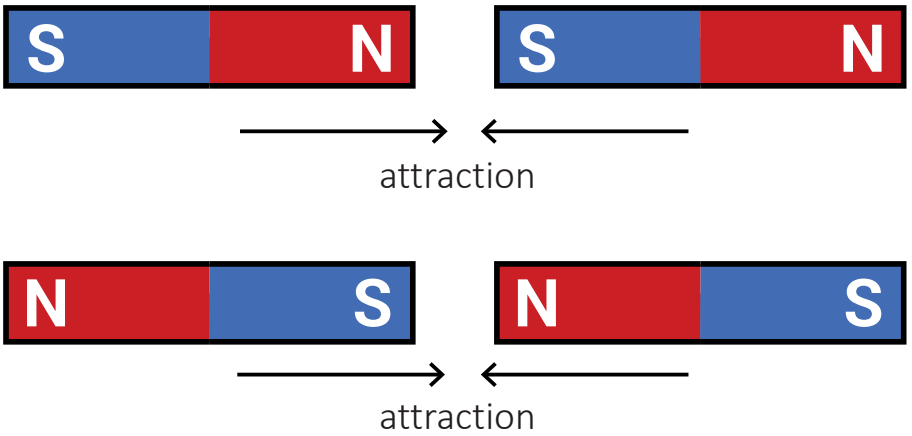
Magnets

Magnets have two ends called poles. The red end is the north pole and the blue end is the south pole.



Magnetic attraction

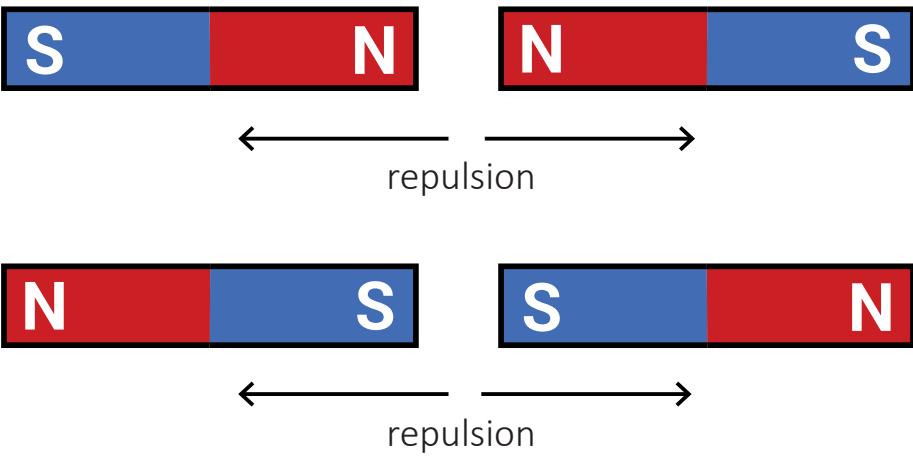
When different, or unlike, poles of two magnets are placed near each other, the magnets pull towards each other. This is called magnetic **attraction**.



Magnets also attract some materials towards them. These materials are known as magnetic. Materials that are not attracted to magnets are called non-magnetic.

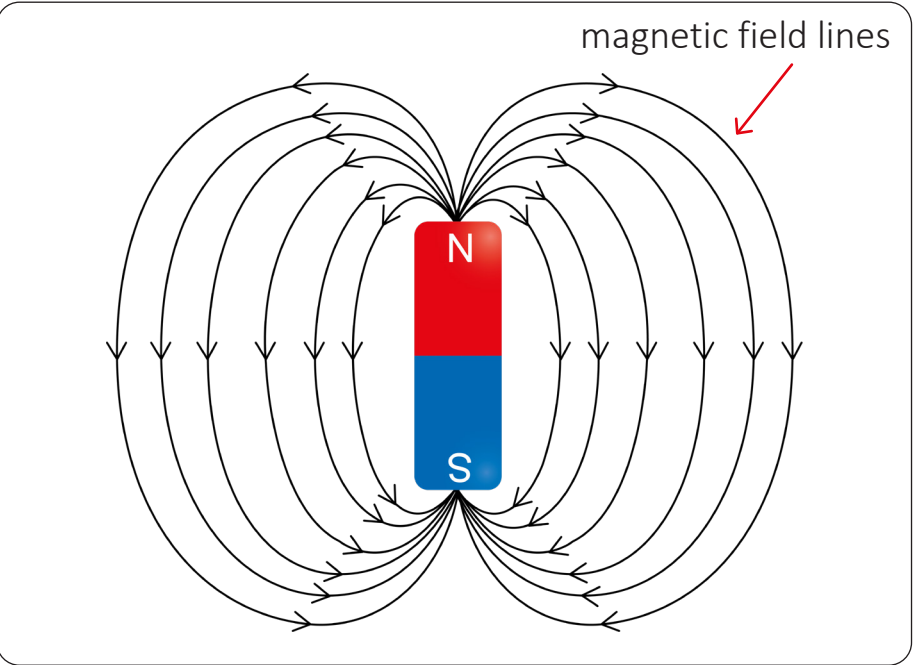
Magnetic repulsion

When the same, or like, poles of two magnets are placed near each other, they push apart. This is called magnetic **repulsion**.



Magnetic fields

The invisible forces we can feel when magnets are close together are caused by their magnetic fields. Magnetic fields are invisible but can be shown as lines on a diagram.



Magnetic Earth

The Earth acts like a huge bar magnet. It is surrounded by an invisible magnetic field called the magnetosphere. Without the magnetosphere, nothing could live on Earth. The magnetosphere is responsible for creating lights in the sky called aurora and also makes navigational compasses work.



aurora

Glossary

attraction	When one object moves towards another object.
aurora	A natural phenomenon characterised by coloured lights in the sky near the North and South Poles.
bar magnet	A rectangular magnet.
magnetic	Attracted to or acting as a magnet.
navigational compass	An instrument used for finding directions.
repulsion	When one object pushes another object away.



Light and Shadows

Light

Light is a form of energy that travels in straight lines. The Sun is the main natural source of light on Earth. Darkness, like at night time, is the absence of light. Light from the Sun is vital for life on Earth. Plants need light to grow and survive. Light from the Sun creates daytime and provides heat that is essential for all living things. Without the Sun’s light, no plants or animals could live on Earth.

Light sources

A light source is something that produces light. Light sources can be natural or artificial. The Sun and a firefly are examples of natural light sources. A light bulb and candle are examples of artificial light sources.

natural light sources



Sun



firefly

artificial light sources



light bulb



candle

Reflectors

A reflector is an object that reflects light from a light source. Light is not produced by a reflector. The light from a light source hits and then bounces off a reflector’s surface. When this happens, the reflector appears to be lit up. Water is an example of a reflector.



Water reflects light.

Reflectors can be natural or artificial. Animals’ eyes and the Moon are examples of natural reflectors. Reflective clothing or a bike reflector are examples of artificial reflectors.

Reflectors are useful in everyday life. For example, reflective clothing is worn for safety so people, such as work workers or cyclists, can be seen in the dark.

natural reflectors



animals’ eyes



Moon

artificial reflectors



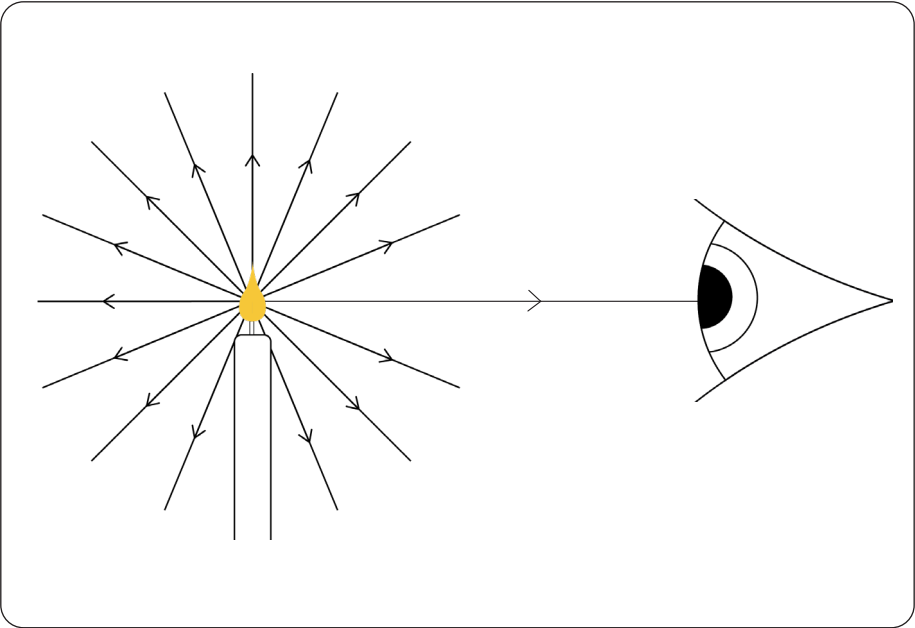
reflective clothing



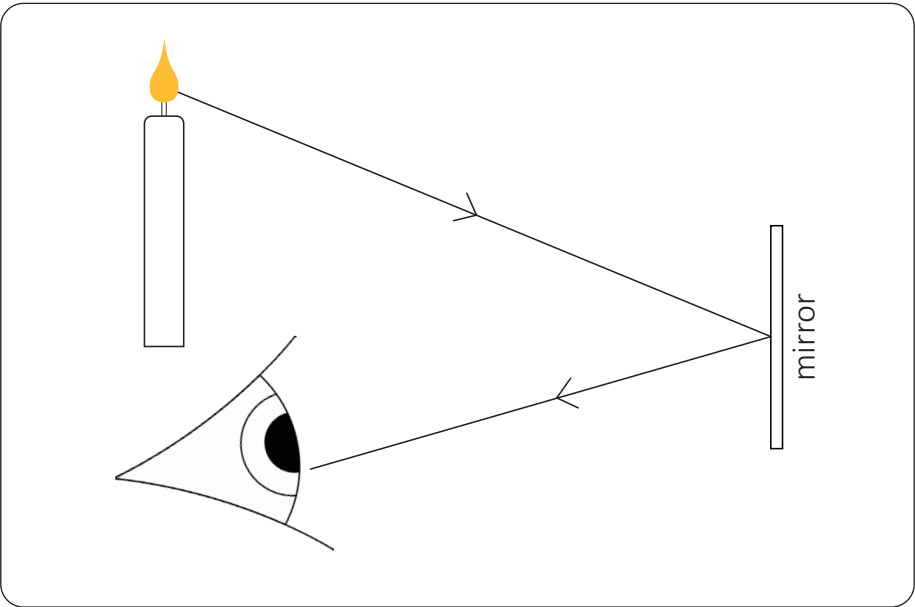
bike reflector

Seeing light

Without light, we cannot see. We can see a light source because light travels from the light source into our eye.

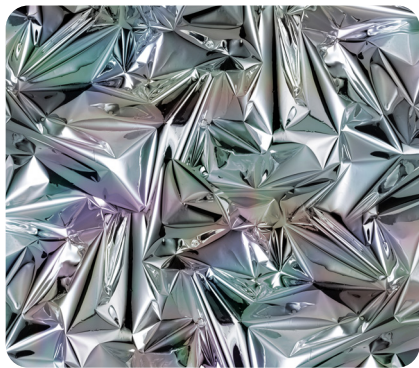


We can see reflectors because light travels from a light source to the reflector. It then bounces off the surface of the reflector and travels to our eyes.



Reflective and non-reflective materials

Some materials are reflective, such as metals or smooth plastics, because they reflect light. Reflective materials are shiny and smooth and are usually light in colour. When they reflect light from a light source, reflective materials can appear lit up or show a reflected image.



Foil is a reflective material.

Some materials are non-reflective, such as rough fabric or stone, because they do not reflect light. Non-reflective materials are rough, dull, and usually dark in colour. They do not appear lit up or show a reflected image.



Stone is a non-reflective material.

Shadows

A shadow is an area of darkness. A shadow is made when an object blocks the passage of light from a light source. An object's shadow always forms on the side opposite the light source. The shape of a shadow is the same as the object that created it because light travels in straight lines.



Sun safety

The Sun gives out harmful light rays called ultraviolet (UV) light that damage our skin and eyes. UV light is invisible. It ages our skin, causes sunburn and increases the risk of skin cancer. There are five ways people can protect themselves from UV light.



apply sun cream



wear loose, close-weave clothing



wear a wide-brimmed hat



wear sunglasses that block UV light



find good quality shade

Shadows and opaque, transparent and translucent objects

Opaque objects, such as wooden or stone blocks, cast dark shadows. Translucent objects, such as frosted glass or tracing paper, cast light, blurry shadows. Transparent objects, such as glass or water, cast very light shadows.



opaque object



translucent object



transparent object

Changes in shadows

Shadows change shape and size when a light source moves. For example, when a light source is high above an object, the shadow is short and when a light source is low down, the shadow is long.



Glossary

artificial	Made by humans.
natural	Existing in nature and not made by humans.
opaque	A material that does not allow light to pass through and cannot be seen through.
ray	A narrow beam of light.
reflect	To bounce off a surface.
translucent	A material that allows some light to pass through and can be seen through, but objects appear blurry.
transparent	A material that allows light to pass through and can be seen through.



Plant Nutrition and Reproduction

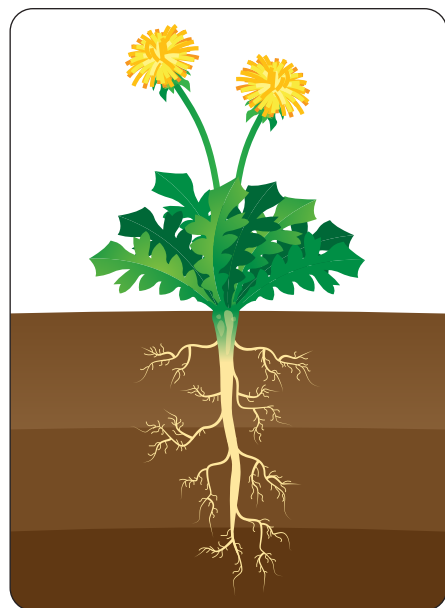
Plant parts

Plant parts have different functions. The flowers, stems, leaves and roots each have an important role.

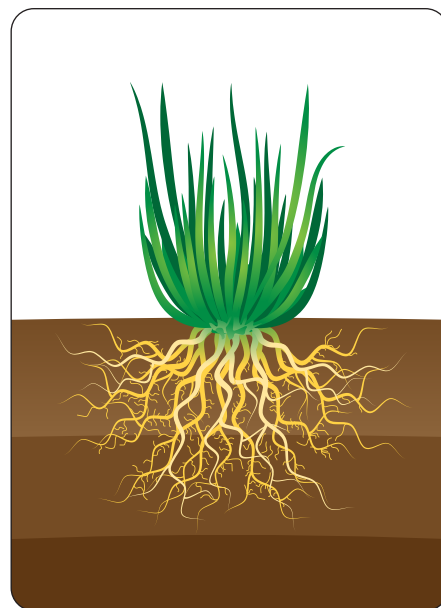
Roots

Roots have two main functions. They anchor the plant securely in the ground and take in water and nutrients from the growing medium, such as soil.

There are two main types of root systems: taproots and fibrous roots.



taproot



fibrous roots

A taproot system has a large primary root that grows deep into the soil to anchor the plant. Smaller lateral roots grow out from the taproot. Lateral roots are covered with small root hairs, which take in water and nutrients. Some taproots are edible, such as carrots and beetroots.

A fibrous root system has many thin roots that grow out from the stem and anchor the plant just under the soil's surface. Fibrous roots spread far from the plant to reach water and nutrients.

Stems

Stems have two main functions. They transport water, nutrients and food around the plant and they support the leaves and flowers.

Stems transport water, nutrients and food around the plant through vessels called xylem and phloem. Xylem transport water and nutrients from the roots to the leaves. Phloem transport food made in the leaves to the rest of the plant.

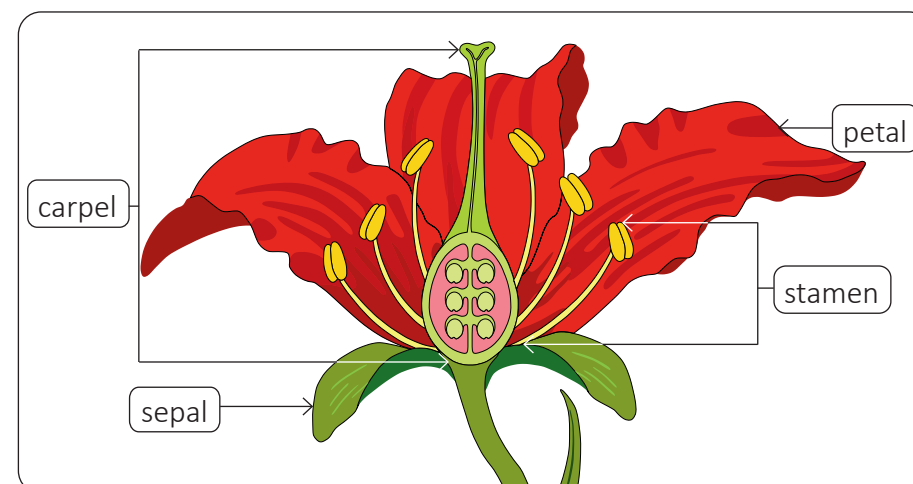
A stem also supports the flowers to attract pollinators and the leaves so they can capture sunlight.



Flowers

Flowers have one main function. Following reproduction, they make seeds that can grow into new plants.

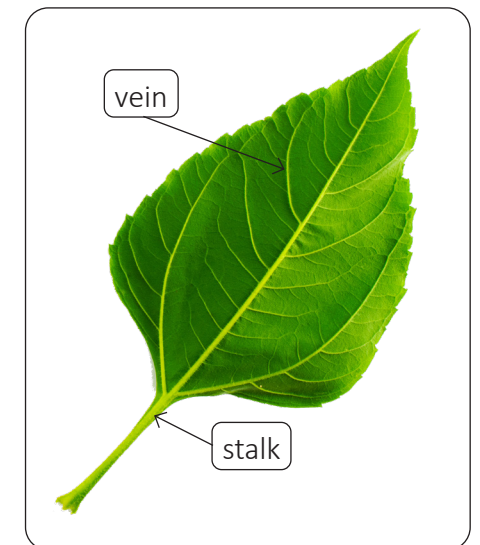
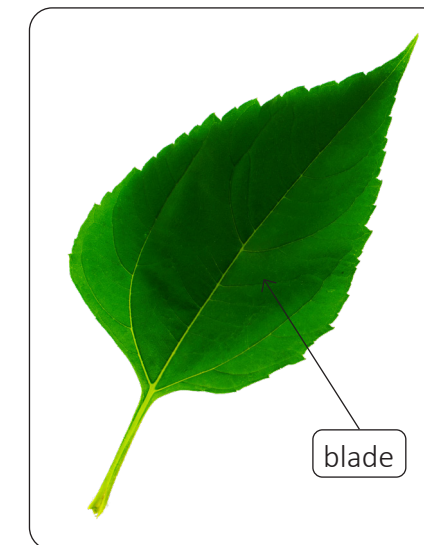
Different parts of a flower have different functions. Sepals protect the flower bud as it grows, bending back when the flower opens. Petals attract pollinators with their bright colours, scent, and a sweet liquid called nectar. The stamen is the male part of the plant. Male pollen grains are produced at the top of the stamen in the anther. The carpel is the female part of the plant. Pollen travels into the carpel to make seeds. The carpel of some plants can swell into a fruit.



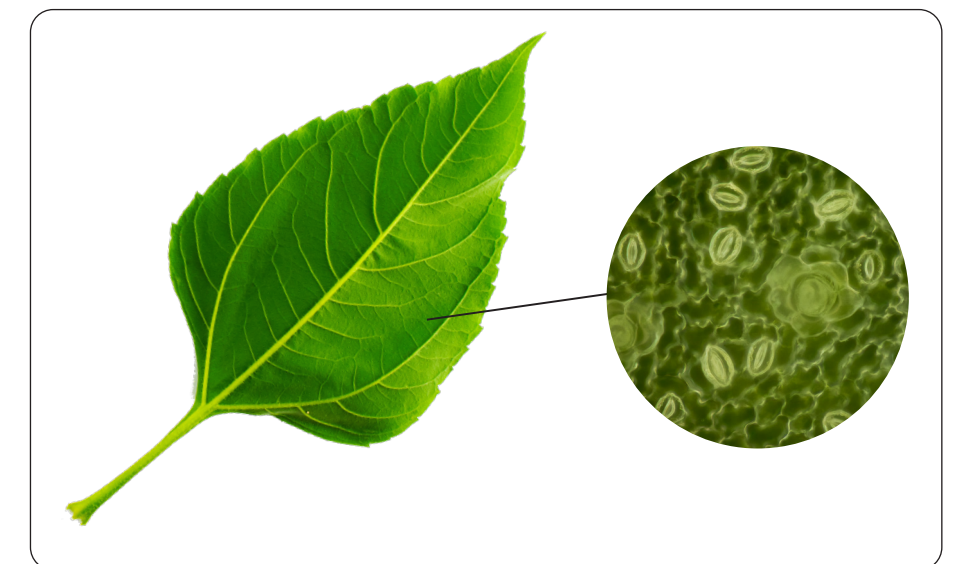
Leaves

Leaves have two main functions. They make food for the plant through a process called photosynthesis. They also lose water from their underside in a process called transpiration.

The structure of leaves allows them to carry out these functions. The blade captures sunlight, and the stalk and veins transport water into and out of the leaf.



Holes called pores are on the underside of leaves. They help gases from the air to enter and leave the leaf. This is also where water leaves the leaf during transpiration.



pores on the underside of a leaf



Life cycle of a plant

There are four stages in the life cycle of a plant.

Seed

A seed contains a tiny new plant and a food store in a protective seed coat. Germination is the process of a plant beginning to grow from a seed.

Seedling

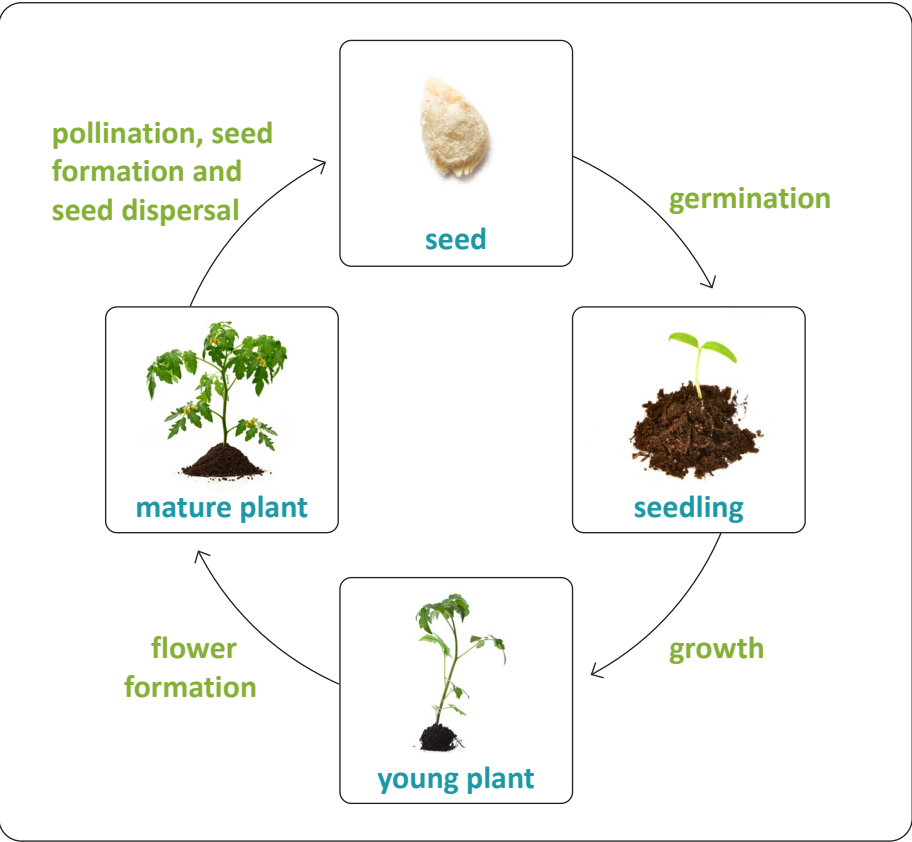
If a seedling has sunlight, nutrients, warmth, water and is protected from strong winds and heavy rain, it goes through a process of growth to form a young plant.

Young plant

As a young plant grows and matures, it begins the process of flower formation and buds form.

Mature plant

When a flowering plant has matured, pollen is moved from the stamens of one flower to the carpel of another during pollination. Seed formation then occurs in the carpel. Seeds are moved away from the parent plant during a process called seed dispersal.



Pollination

Pollination is the process where pollen is transferred from the male anther at the top of the stamen to the female carpel of another flower.

Flowering plants can be pollinated by insects, such as bees. The pollen sticks to an insect as it drinks nectar from a flower. The pollen on the insect then lands on the stigma at the top of the carpel of another flower. It travels down into the carpel to make seeds. Wind can also disperse the pollen of some flowering plants.



Seed dispersal

Seeds are moved away from the parent plant so that new plants do not have to compete for sunlight and water. This process is called seed dispersal. Seeds are dispersed in different ways.

Wind

Seeds dispersed by the wind are usually small and light so they can be carried in the air.



Animals

Seeds formed in fruits are eaten by animals, which are dispersed through their droppings. Some seeds hook onto animals when they brush past a plant. Others are buried by animals.



Explosion

Some seeds are dispersed by explosion. The seeds develop inside a seed pod, which bursts open and fires the seeds into the air.



Water

Seeds dispersed by water can be small and light or contain air so that they float.



Varying needs of plants

Most plants take in water and nutrients from soil. However, **orchids** live high up on rainforest plants. Their roots don't reach the soil, so they take in water and nutrients from the moist, tropical air.



Most plants need a regular supply of water, but **cacti** thrive in dry places with little rainfall. Their stems swell and store water when it is available to use in times of drought.



Many plants need sunny conditions to survive but the **hart's tongue fern** thrives in the shade. Its leaves are broad and thin to capture as much sunlight as possible.



Glossary

anther	A male part of a flower where pollen grains are made.
pollinator	An animal that transfers pollen for the process of pollination.
stamen	A flower's male reproductive organ consisting of an anther and filament.
stigma	A female part of a flower .
vessel	A tube that transports liquids.

