B1 Chapter 1: Cells
Knowledge organiser

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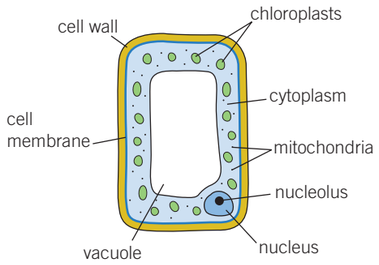
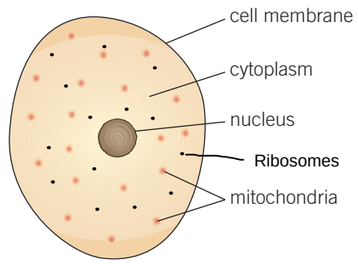
All living things (organisms), are made of **cells**. Some are only made of a single cell, for example, bacteria. A person is made up of millions of cells joined together.

Plant and animal cells

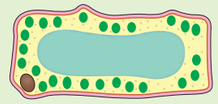
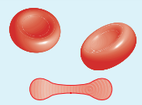
Cells have smaller structures inside them, called components, that each have an important function.





Specialised cells

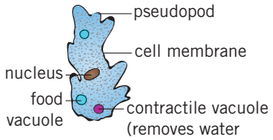
Specialised cells have special features that allow them to do a specific job or function:

	Cell type	Function	Special features	Diagram
plant cells	root hair cell	absorb water and nutrients from soil	• root hair creates a large surface area • no chloroplasts as no light underground	
	leaf cell (palisade cell)	carry out photosynthesis	• found at the top surface of leaves • packed with chloroplasts • thin with a large surface area to absorb more light	
animal cells	red blood cell	transport oxygen around the body	• contain haemoglobin which joins to oxygen • no nucleus • disc shaped to increase surface area	
	nerve cell (neurone)	carry electrical impulses around the body	• long and thin with connections at each end	
	sperm cell	carry male genetic material	• streamlined head and a long tail • lots of mitochondria to transfer energy	

Unicellular organisms

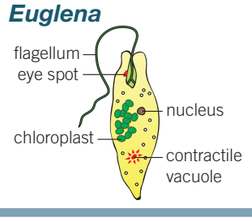
A **unicellular** organism only consists of one cell. They have no fixed shape and are adapted to carry out many different functions.

Amoeba



- nucleus controls growth and reproduction
- move by moving part of their body and the rest follows slowly in the same direction
- eat bacteria, algae, and plant cells by engulfing them
- reproduce by splitting in half (binary fission)

Euglena



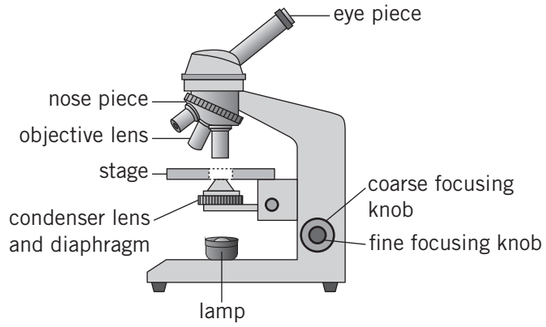
- microscopic organism found in fresh water
- contain chloroplasts and make their own food by photosynthesis
- eye spot that detects light
- flagellum allows the *Euglena* to move towards the light to make more food

Microscopes

Cells can only be seen under a microscope. A microscope magnifies an object using lenses.

Remember that:

- the specimen needs to be thin so light can pass through
- a dye can be added to make the object easier to see.



Using a microscope

1. Move the stage to its lowest position.
2. Place the slide/object on the stage.
3. Choose the objective lens with the lowest magnification.
4. Look through the eyepiece and turn the coarse-focus knob slowly until you see the object.
5. Turn the fine focus knob until it comes into focus.
6. Repeat steps 1–5 using a higher magnification lens.

Movement in and out of cells

Particles move in and out of cells by **diffusion**.

During diffusion, particles spread out from where they are in *high* **concentration** to where they are in *low* concentration.

Diffusion in water is called **osmosis**.

Glucose and oxygen move from the blood **into** cells by diffusion.

Carbon dioxide moves **out of** cells to the blood by diffusion.

Key terms Make sure you can write definitions for these key terms.

amoeba *cell* *cell membrane* *cell wall* *chloroplast* *concentration* *cytoplasm* *diffusion* *Euglena* *flagellum* *leaf cell* *microscope* *mitochondria* *nerve cell* *nucleus* *red blood cell* *root hair cell* *specialised cell* *sperm cell* *unicellular* *vacuole*

B1 Chapter 2: Structure and function of body systems

Knowledge organiser

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Multicellular organisms are made up of many cells and have five levels of organisation:

cell – the smallest building block of an organism

tissue – a group of specialised cells working together

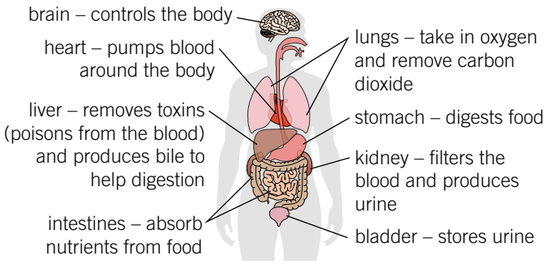
organ – a group of tissues working together

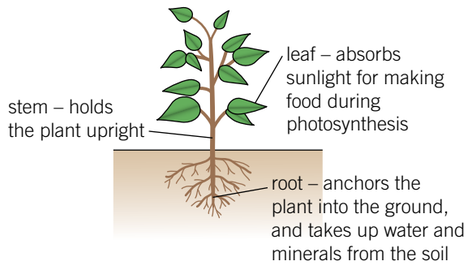
organ system – a group of organs working together

multicellular organism – a group of systems working together

increasing complexity

Plant and animal organs

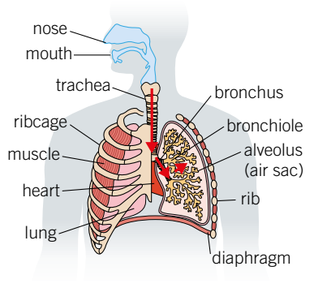




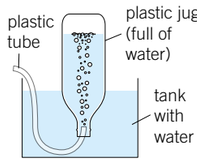
Respiratory system

The respiratory system is involved in:

- breathing in oxygen (for **respiration**)
- breathing out waste carbon dioxide.



Measuring lung volume



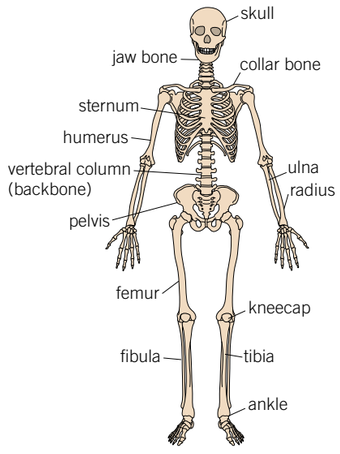
When you breathe out fully into the plastic tube, air from your lungs pushes water out of the bottle.

volume of air in the plastic bottle

=

lung volume

Skeleton



All the bones in your body make up your skeleton.

The four main functions of the **skeleton** are to:

- support the body
- protect vital organs
- help the body move
- make blood cells (in the **bone marrow**).

Joints occur between two or more bones. They allow the skeleton to bend.

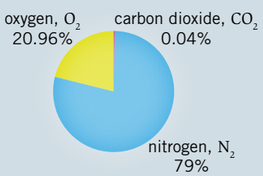
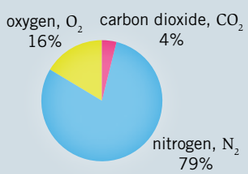
Three types of joint are:

1. **Hinge joints**
   forwards/backwards movements only, e.g., knees
2. **Ball-and-socket joints**
   movement in all directions, e.g., shoulders
3. **Fixed joints**
   no movement allowed, e.g., the skull

In a joint:

- your bone is protected with **cartilage**
- the two bones are held together by **ligaments**.

What happens when we breathe?

When you breathe in (inhale)	• muscles between ribs contract • ribs are pulled up and out • diaphragm contracts and flattens • volume of the chest increases • pressure inside the chest decreases • air rushes into the lungs	composition of inhaled air: 
When you breathe out (exhale)	• muscles between ribs relax • ribs are pulled in and down • diaphragm relaxes and moves up • volume in the chest decreases • pressure inside the chest increases • air is forced out of the lungs	composition of exhaled air: 

Muscles

Muscles are a type of tissue – lots of muscle cells work together to cause movement.

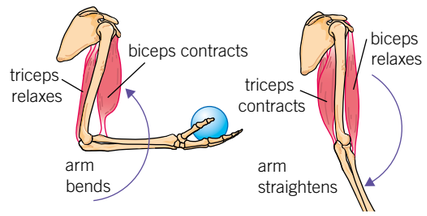
Types of muscle include:

- **cardiac (heart) muscle**
- **smooth muscle**
- **skeletal muscle**

Muscles are attached to bones by **tendons**.

Muscles produce movement by **contracting** (getting shorter).

If a muscle contracts it pulls the bone, causing it to move.



Antagonistic muscles

Pairs of muscles that work together are called **antagonistic** muscles.

When one contracts the other relaxes.

For example, biceps and triceps work together to bend and straighten the forearm.

Key terms

Make sure you can write definitions for these key terms.

alveolus · antagonistic · bone · bone marrow · contract · cartilage · diaphragm · exhale · inhale · joint · ligament · lung · multicellular · organ · organ system · respiration · respiratory system · ribcage · skeleton · tendon · tissue · trachea · volume

B2 Chapter 1: Health and lifestyle
Knowledge organiser

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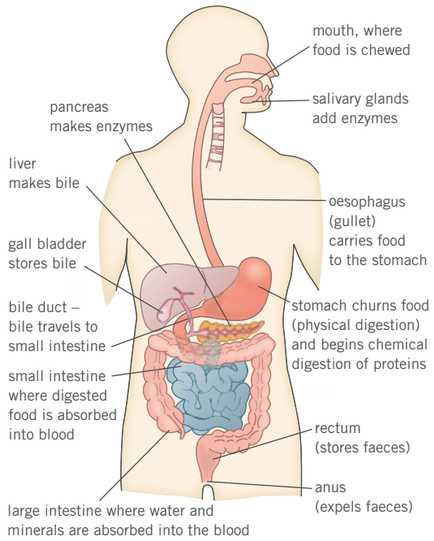
Diet

The digestive system

Bacteria live on fibre in your diet in the large intestine and make important vitamins (e.g., vitamin K).



Enzymes

Enzymes are special proteins that can break large molecules of nutrients down into small molecules.

Enzymes are known as biological **catalysts** – they speed up **digestion** without being used up.

There are three main types of enzyme involved in digestion:

	Type of enzyme		
	carbohydrase	protease	lipase
digests	carbohydrates (e.g., starch) ↓ sugars	protein ↓ amino acids	lipids ↓ fatty acids and glycerol

Nutrients

Nutrient	Role in your body
carbohydrates	main source of energy
lipids	fats and oils provide energy
proteins	growth and repair of cells and tissues
vitamins and minerals	essential in small amounts to keep you healthy
water	needed in all cells and body fluids
fibre	provides bulk to food to keep it moving through the gut (not actually a nutrient)

Food tests

Starch

Add a few drops of iodine solution to the food solution.

Result: If the solution turns blue-black, the food contains starch.

Lipids

Add a few drops of ethanol to the food solution, shake it, and leave for one minute. Then pour the ethanol into a test tube of water.

Result: If the solution turns cloudy, the food contains lipids.

Sugar

Add a few drops of Benedict's solution and heat the solution in a water bath.

Result: If the solution turns orange-red, the food contains sugar.

Protein

Add a few drops of copper sulfate solution and sodium hydroxide solution.

Result: If the solution turns purple, the food contains protein.

Effects of an unhealthy diet

A **balanced diet** is when you have the right proportions of the food groups to keep you healthy.

Eating an unbalanced diet can lead you to be:

underweight

Increased risk of:
- poor immune system
- lack of energy
- lack of vitamins and minerals.

overweight

Increased risk of:
- heart disease
- stroke
- diabetes
- some cancers.

vitamin and mineral deficient

Vitamin A deficiency can lead to night blindness.

Vitamin D deficiency can lead to rickets.

Effects of lifestyle on health

Drugs

Drugs are any chemicals that affect the way your brain and body work.

Medical drugs	Recreational drugs
• used in medicine • benefit your health if used correctly • used to treat symptoms or cure illness • some have side effects	• taken for enjoyment/to relax/stay awake • normally have no health benefits • many can be harmful • many are illegal
examples include: painkillers, antibiotics, and cough mixture	examples include: alcohol, caffeine, heroine, cocaine, tobacco

Alcohol

Alcohol is a depressant because it slows down your body's reactions.

Drinking large amounts of alcohol over a long time can cause:
- stomach ulcers
- heart disease
- reduced fertility
- brain damage
- liver damage (cirrhosis)

Drinking during pregnancy increases the risk of:
- miscarriage
- stillbirth
- premature birth
- low birth weight babies
- Fetal Alcohol Syndrome (FAS)

Smoking

Cigarette smoke is full of harmful chemicals including:

tar – clogs the lining of the lungs and alveoli, contains cancer-causing chemicals

nicotine – an addictive stimulant

carbon monoxide – stops blood from carrying oxygen.

Smoking can cause many different diseases, including:
- heart disease
- emphysema
- respiratory infections
- strokes
- lung cancer

Smoking during pregnancy increases the risk of miscarriage and low birth weight babies, and can also affect the fetus' development.

Addiction – When your body becomes used to the chemical changes caused by a drug and you need to take the drug to feel normal.

When a person who is addicted to a drug tries to stop taking it, they may suffer from sickness, nausea, stomach cramps, headaches, anxiety, and sweating. These are called **withdrawal symptoms**.

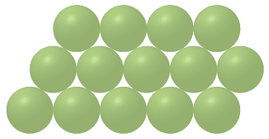
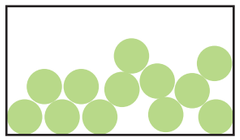
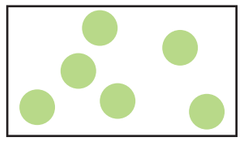
Key terms Make sure you can write definitions for these key terms.

addiction anus balanced diet carbohydrase carbohydrate carbon monoxide catalyst deficiency digestion digestive system drug enzyme fibre food test large intestine lipid lipase mineral nicotine nutrient oesophagus protease protein rectum small intestine stimulant stomach tar vitamin withdrawal symptom

C1 Chapter 5: Matter
Knowledge organiser

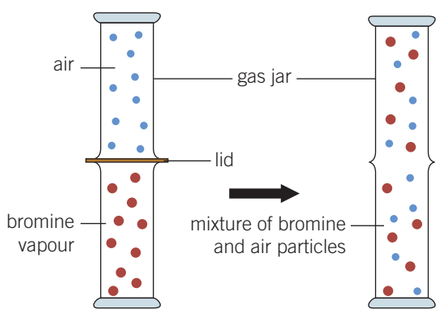
Activate
Question • Progress • Succeed

Changes of state

changes of state		melting	boiling/evaporation
state of matter	solid	liquid	gas
how do the particles move?	Particles donot move around	Particles touching but can slide over each other	particles are spread out far away from each other
arrangement of particles			
can it be compressed?	No, becausethere is no space between the particles	No, because the particles are touching their neighbours	Yes, because there is space between the particles
can it flow?	No, because the particles can't move around	Yes, because the particles can move around	Yes, because the particles can move around
changes of state	freezing		condensation

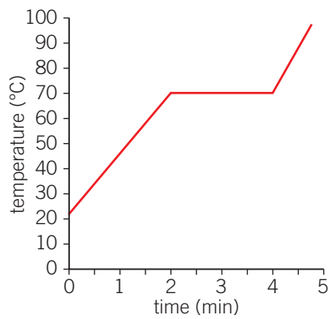
Diffusion

- **Diffusion** is the movement of particles from an area of high concentration (lots of the same particle) to an area of low concentration (not a lot of the same particle)
- It is a random process which does not need energy
- The speed of diffusion can be increased by:
  - A higher temperature
  - Smaller particles diffusing
  - A gas rather than a liquid
- Diffusion does not happen in a solid as the particles can't flow

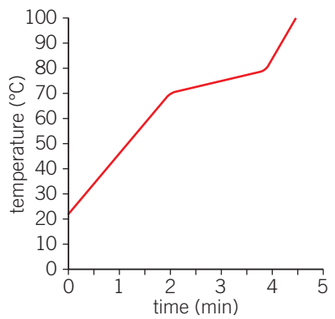


Melting and boiling points

- The **melting point** of a substance is the temperature at which it turns from a solid to a liquid, or a liquid to a solid
- The **boiling point** of a substance is the temperature at which it turns from a liquid to a gas or a gas to a liquid
- **Pure substances** have a fixed (sharp) boiling or melting point, whereas **impure substances** have a range which appears as a diagonal line on a graph



Pure substance (fixed boiling point)



Impure substance (not fixed boiling point)

Mixtures

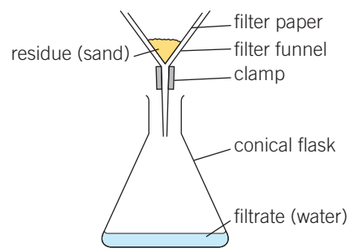
- **Mixtures** are different **substances** which are together, they are not chemically bonded and so are easy to separate
- The substances which make up a mixture keep their own **properties** unlike those in a compound
- A mixture is an **impure** substance as it does not have a fixed melting point, instead it has a range

- A **solution** is a type of mixture which is made up of two parts
- A **solute** is the part which has dissolved in the solution
- A **solvent** is the liquid part which the solute has dissolved into

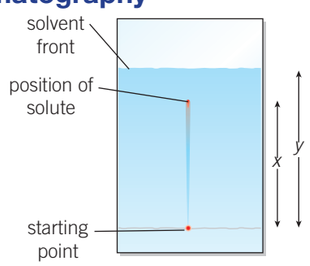
- The **solubility** of a substance is a measure of how much of it will **dissolve**
- Not all solutes will dissolve in all solvents
- Solutes which do not dissolve are known as **insoluble**
- Substances which do dissolve are known as **soluble**
- The **solubility** of a substance can be increased by increasing the temperature of the solution or by stirring the solution
- A **saturated solution** is one where the maximum amount of solute has dissolved in it, no more solute will be able to dissolve

Separating Mixtures

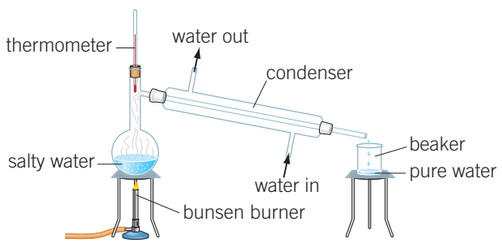
Filtration



Chromatography



Distillation



Evaporation

Key terms Make sure you can write definitions for these key terms.

boiling point · chromatography · condensation · diffusion · dissolve · distillation · evaporation · filtration · freezing · impure substance · melting point · mixture · property · properties · pure substance · saturated solution · substance · soluble · solubility · solute · solution · solvent

C2 Chapter 2: Separation techniques
Knowledge organiser

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What are mixtures?

Mixtures are different substances found together, but not chemically bonded. This means the different substances can be **separated** from each other.

In a **compound**, different substances are chemically bonded together, while in a mixture they are not.

The substances that make up a mixture keep their own properties and are easy to separate.

You can change the amounts of the substances in a mixture.

You can tell the difference between a **pure substance** and an **impure substance** – a pure substance has a single, sharp melting point, while an impure substance (a mixture) has a range of temperatures for its melting point.

Solutions

Solutions are a type of mixture made of two parts:

1 **Solvent**: the liquid that makes up most of the solution.

2 **Solute**: the substance that is added to the solvent and **dissolves** into it.

The solute usually starts as a solid, and its particles break away from each other and move into the solvent.

Solubility

The **solubility** of a solute means how much solute can dissolve in a certain volume of solvent.

- Different solutes have different solubilities in different solvents.
- Increasing the temperature often increases the solubility.
- Soluble substances can dissolve, **insoluble** substances cannot.

Saturated: when so much solute has been added to the solvent that no more can dissolve, we say the mixture is saturated.

How can we separate mixtures?

Filtration

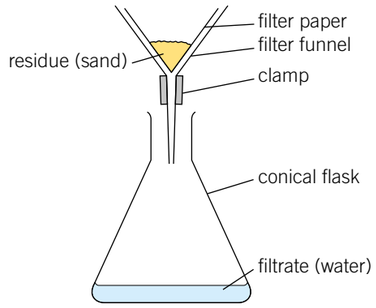
A method to separate a mixture of an undissolved solid and a liquid.

1 **Filter paper** has extremely small holes in it.

2 Particles in a liquid or solution are so tiny that they can fit through the holes.

3 Larger particles of the solid are too big to fit through the holes and are held back by the paper.

- **Residue**: solids left behind in the filter paper.
- **Filtrate**: the liquid that passes through the filter paper.

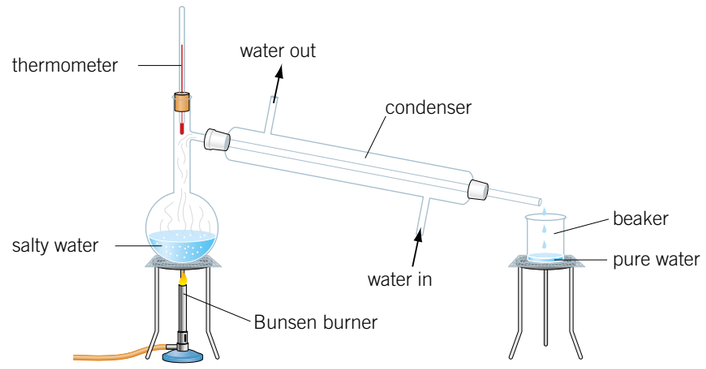


Distillation

A method that separates a solute and a solvent while keeping the solvent.

1 The solution is boiled so the solvent turns in to a gas.

2 The gas is then cooled down in a **condenser**, where it turns back into a liquid and can be collected.

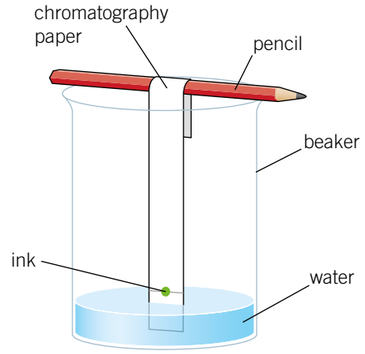


Chromatography

A method used to separate mixtures that are soluble in the same solvent.

1 A mixture like ink is placed on a piece of paper, which is placed in a solvent.

2 As the solvent moves up the paper it separates all the different constituents (parts) of the ink, producing a **chromatogram**.

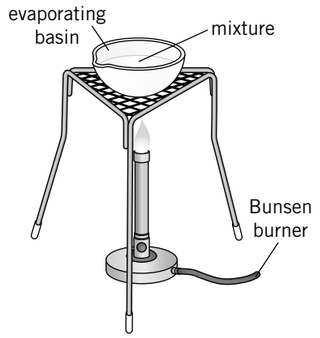


Evaporation

A method to separate a solute and a solvent, keeping the solute.

1 The solution is heated then left in an evaporating basin until all the solvent evaporates.

2 The solute is left behind as a solid.



Key terms Make sure you can write definitions for these key terms.

chromatography chromatogram compound condenser dissolve distillation evaporation filtrate filtration filter paper impure substance insoluble mixture pure substance residue saturated separate solvent solute soluble solubility solution

C2 Chapter 4: The Earth
Knowledge organiser

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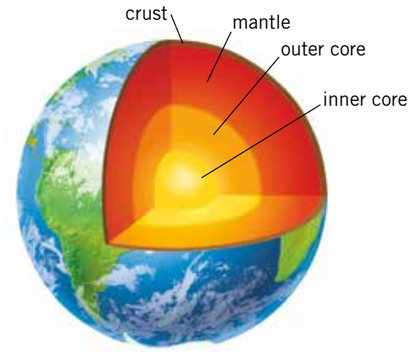
The Earth

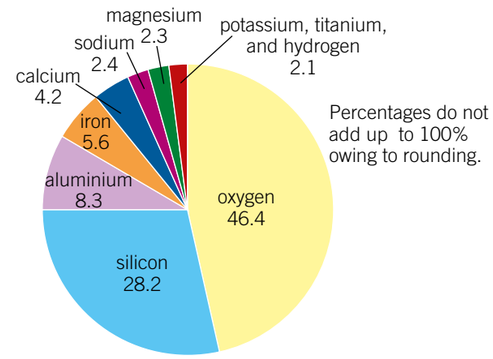


The Earth is made of several layers:

- The **crust** is rocky and solid.
- The **mantle** is solid rock but can flow.
- The **outer core** is liquid metal and the **inner core** is solid metal.

The crust

The Earth's crust contains many naturally-occurring elements in different proportions.

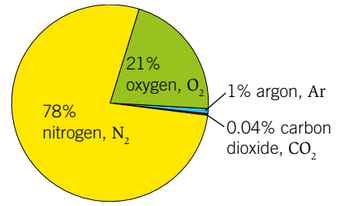


Types of rock

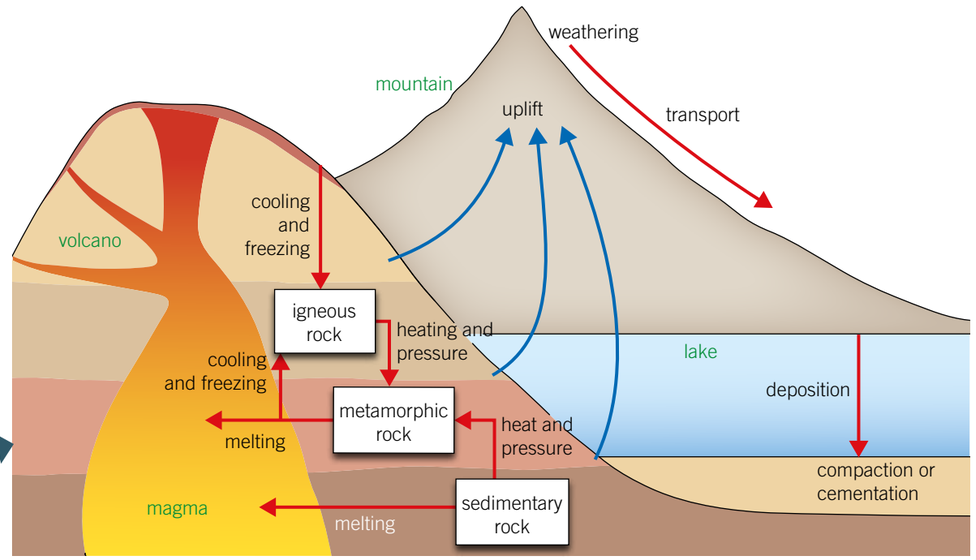
There are three types of rock that make up the Earth's crust. These are formed by different processes in the **rock cycle**, and have different properties.

The atmosphere

The **atmosphere** is a layer of gas surrounding the Earth. It is mainly comprised of nitrogen and oxygen.



Type of rock	How it is formed	Properties	Uses
sedimentary rock	• **sediment** piles up in one place and over many years stick together by **compaction** or **cementation** • **compaction**: weight of sediments above squeeze them into rocks • **cementation**: another substance sticks the sediments together	• porous: made of small grains stuck together so there are holes that water can pass through • soft: easy to break apart the sediments	building materials (*e.g., sandstone and limestone*)
igneous rock	• when liquid rock cools it turns into igneous rocks these are made of **crystals** locked tightly together • **Magma**: liquid rock underground – cools slowly and forms large crystals. • **Lava**: liquid rock above the ground – cools quickly and forms small crystals.	• Durable and hard (difficult to damage): the crystals are locked tightly together • Not porous: there is no space between crystals	pavement rail tracks
metamorphic rock	• other rocks under the Earth are heated and put under pressure • over time, these rocks become metamorphic	• Not porous: there is no space between crystals	marble used for kitchens slate used for roofing tiles



The rock cycle

Because the different rocks can turn into each other, we say that there is a rock cycle.

Key terms Make sure you can write definitions for these key terms.

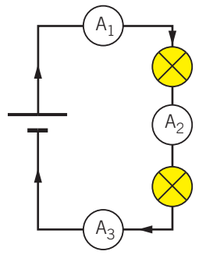
atmosphere *crust* *cementation* *compaction* *Earth* *igneous rock* *inner core* *lava* *magma* *mantle* *metamorphic rock* *outer core* *porous* *rock cycle* *sedimentary rock*

P1 Chapter 2: Electricity
Knowledge organiser

Activate
Question • Progress • Succeed

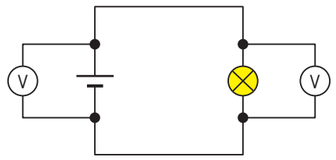
Current

- **Current** is the amount of **charge** flowing per second
- The charges that flow in a circuit are **electrons**, they are negatively charged
- **Electrons** leave the negative end of the **cell** and travel around the circuit to the positive end of the cell
- Current has the unit of Amps (A) and is measured with an **ammeter** (which is placed in series or in the main circuit)



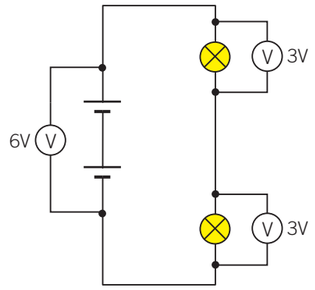
Potential difference

- **Potential difference** is the amount of energy transferred by the cell or **battery** to the charges
- The value of potential difference tells us about the force applied to each charge and then the energy transferred by each charge to the component which it passes through
- Potential difference has the unit of volts (V) and is measured with a **voltmeter** (which is placed in parallel to the circuit)



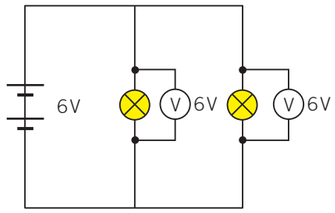
Series circuits

- **Series** circuits only have one loop
- If one component breaks, the whole circuit stops working
- Current is the same everywhere in a series circuit
- The total potential difference from the battery is shared between the components in a series circuit
- Adding more bulbs decreases the brightness of the bulbs



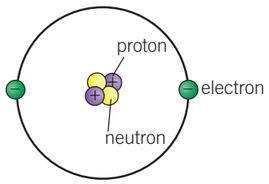
Parallel circuits

- **Parallel** circuits have more than one loop
- If one component breaks, the rest of the circuit will still work
- Current is shared between the different loops in the circuit
- The potential difference is the same everywhere in the circuit
- Adding more bulbs does not affect the brightness of the bulbs



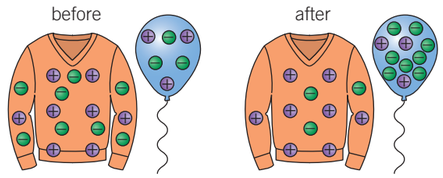
The atom

- The **atom** consists of a central nucleus with electrons orbiting around the outside in shells
- **Electrons** have a negative charged
- **Protons** are inside the nucleus and have a positive charge
- **Neutrons** are inside the nucleus and have a neutral charge



Static electricity

- Static electricity is the caused by the rubbing together of two **insulators**
- This causes electrons to be transferred, leaving one object with a positive charge, and one object with a negative charge



- Like charges will **repel**, opposite charges will **attract**

Resistance

- **Resistance** is a measure of how easy or how hard it is for charges to pass through a component in a circuit
- Resistance has the unit of ohms (Ω)
- Resistance is calculate by measuring potential difference and current and using the following equation:

$$\text{resistance } (\Omega) = \frac{\text{potential difference (V)}}{\text{current (A)}}$$

- Materials with a high resistance are said to be **insulators**
- Materials with a low resistance are said to be **conductors**

Key terms

Make sure you can write definitions for these key terms.

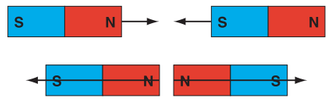
ammeter *atom* *attract* *battery* *cell* *conductors* *current* *electrons* *electric charge* *insulator* *neutral* *neutrons* *parallel* *potential difference* *protons* *repel* *resistance* *series* *voltmeter*

P2 Chapter 2: Electromagnets
Knowledge organiser

Activate
Question • Progress • Succeed

Magnets

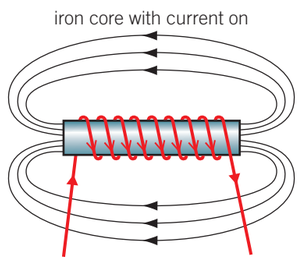
- A **magnet** has two poles, a north and a south pole
  - North poles **attract** south poles
  - South poles **attract** north poles
  - South poles **repel** south poles
  - North poles **repel** north poles



- **Magnetic materials** will experience a magnetic force when placed near a magnet, this is a type of non-contact force as the materials do not have to touch for the force to be apparent
- The three magnetic metals are iron, nickel and cobalt

Electromagnets

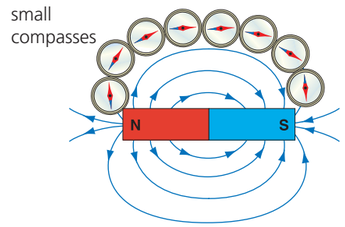
- **Electromagnets** are made by wrapping a coil of wire around a magnetic **core**
- Electromagnets only work when electricity is flowing through the coil, which means that they can be turned on and off
- Electromagnets are also stronger than **permanent** magnets
- The electromagnet will produce the same magnetic field shape as a bar magnet

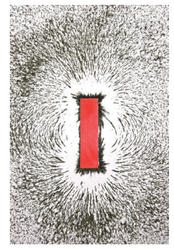


- You can increase the strength of an electromagnet by:
  - Increasing the number of turns on the coil around the core of the electromagnet
  - Increasing the current which is flowing through the coil of wire
  - Using a more magnetic material for the core, e.g. iron rather than aluminium

Magnetic fields

- A **magnetic field** is an area where a magnetic material will experience a force
- A **permanent magnet** will have it's own magnetic field
- **Magnetic field lines** represent the field, these always travel out of the north pole of the magnet, and into the south pole
- The closer together the magnetic field lines are, the stronger the magnetic field will be
- We can find out the shape of a magnetic field in two ways:
  - Using plotting compasses
  - Using iron filings





- The Earth has its own magnetic field, which acts like a giant bar magnet inside the centre of the Earth
- This magnetic field allows compasses to work when navigating around the Earth

Using electromagnets

Electric Bells

The electromagnet attracts the iron armature

↓

When it moves, it breaks the circuit, no longer allowing current to flow

↓

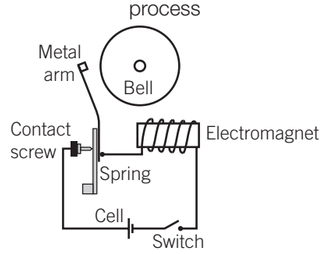
The coil and core are no longer magnetic meaning the spring is no longer attracted and returns to its original position

↓

The bell is rung once

↓

The circuit is complete again, restarting the process

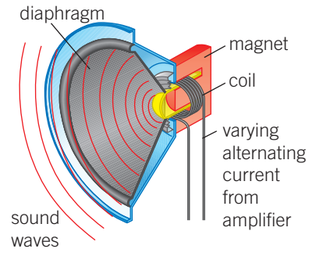


Circuit breakers

- Circuit breakers detect large changes in current in a house, and will break a circuit
- When a large current flows, the electromagnet becomes strong enough to attract an iron catch which will break a circuit
- They can then be reset and used again
- This makes them suitable as an electrical safety device in a home

Loudspeakers

- Loudspeakers use an electromagnet in order to generate sound
- A current passes through the coil and creates an electromagnet, this repels another permanent magnet which moves the cone in and out creating sound



Key terms Make sure you can write definitions for these key terms.

attract *core* *circuit breaker* *electromagnet* *electric bell* *loudspeaker* *magnet* *magnetic pole* *magnetic field lines* *magnetic material* *permanent magnet* *repel*

P1 Chapter 1: Forces
Knowledge organiser

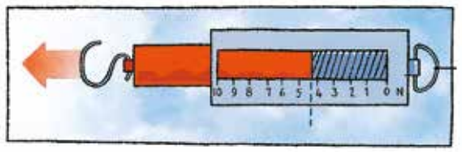
Activate
Question • Progress • Succeed

What are forces?

A **force** can be a *push* or a *pull*.

Forces can be measured using a **newtonmeter**.

Forces are measured in **newtons** (N).



Contact forces occur when objects are touching, for example:

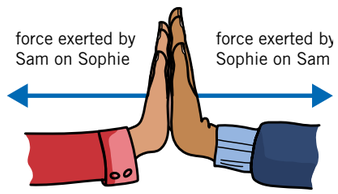
- **friction**
- **drag forces** (**air resistance** and **water resistance**)
- support forces (e.g., **reaction forces**)

Non-contact forces work at a distance, for example:

- **gravity**
- **magnetic force**
- **electrostatic force**

Forces always occur in pairs.

The pairs are called **interaction pairs**.



Balanced and unbalanced forces

When the forces acting on an object are the same size, but act in opposite directions, we say that they are **balanced**.

The balanced forces cancel out, and the object is in **equilibrium**.

If the forces are not the same size, and do not cancel each other out, we say they are **unbalanced**.

The larger the difference between unbalanced forces, the quicker the object will change speed.

Drag forces and friction

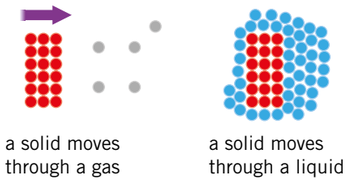
Friction is a contact force that occurs when two objects move against each other. It happens because all surfaces have some roughness – even ones that look smooth.

Friction can be reduced by adding **lubrication** (e.g., oil or grease).

Friction is often useful, for example:

- you need friction to walk across surfaces
- the brakes on a bike need friction to work.

A solid moving through a liquid or a gas has to push the liquid or gas particles out of the way. This produces a drag force on the solid object.



Water resistance and air resistance are drag forces.

Drag forces can be useful if we need to slow something down, for example, by using parachutes.

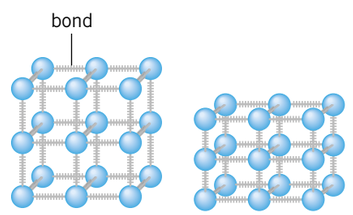
Making an object more **streamlined** will reduce the drag forces on it.

Reaction forces

When you stand on the floor:

- your weight pushes the particles in the floor together
- the bonds between the particles are **compressed**
- the compressed particles push back and support you.

A support force that balances the weight of an object is called the reaction force. **Upthrust** is another example of a support force.



Fields and non-contact forces

In physics, a **field** is a special region where certain objects experience a non-contact force. For example, when

- a mass experiences a force in a gravitational field
- a magnetic material (like iron) experiences a force in a magnetic field
- a charged object experiences a force in an electrostatic field.

As you get further away from a mass, a magnet, or a charged object, the field gets weaker.

Weight and mass

Mass is the amount of 'stuff' something is made of – it is measured in kilograms (kg).

Weight is a force so it is measured in newtons.

$$\text{weight (N)} = \text{mass (kg)} \times \text{gravitational field strength (N/kg)}$$

The **gravitational field strength** on Earth is about 10 N/kg.

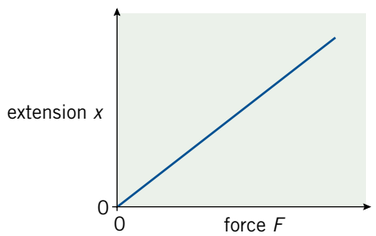
Your weight depends on the gravitational field strength but your mass is the same everywhere.

Hooke's law

Some objects – like springs – can be **stretched** when pulled. The amount they stretch by is called the **extension**.

A force called **tension** makes a spring return to its original length (unless it has gone beyond its **elastic limit**).

Hooke's law states that the extension of a spring doubles when you double the force. This means there is a **linear** relationship between force and extension.



Key terms

Make sure you can write definitions for these key terms.

air resistance, balanced, compress, contact force, drag force, elastic limit, electrostatic force, equilibrium, extension, field, friction, gravitational field strength, gravity, Hooke's law, interaction pair, linear, lubrication, magnetic force, mass, newton, newtonmeter, non-contact force, reaction force, stretch, streamlined, tension, unbalanced, upthrust, water resistance, weight

P1

Chapter 4: Waves
Knowledge organiser

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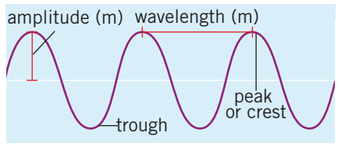
Question • Progress • Succeed

Properties of waves

- A **wave** is an **oscillation** or **vibration** which transfers energy from one place to another
- **Amplitude** – the distance from the middle to the top of bottom of the wave
- **Wavelength** – the distance between a point on the wave to the same point on the next wave
- **Trough** – The bottom of the wave
- **Peak** – The top of the wave
- **Frequency** – How many waves pass a fixed point per second, measured in Hertz (Hz)



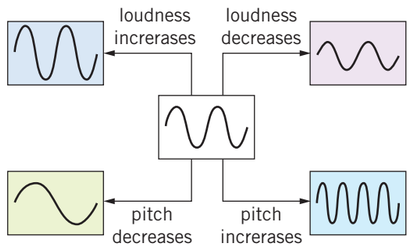
There are two main types of waves:

Transverse waves, e.g. light
- Travel at 90°direction of energy transfer
- Do not need a medium to travel through

Longitudinal waves, e.g. sound
- Travel in the direction of energy transfer
- Need a medium to travel through

Sound waves

- Sound waves are caused by the vibration of particles, sound travels quicker in a solid than a gas as the particles are closer together
- **Oscilloscopes** display sound waves on a screen
- Humans can hear between 20–20 000 **hertz** (Hz), but other animals have different ranges of hearing
- Sound waves above 20 000 Hz are known as **ultrasound**, thesesound waves are too high pitched for humans to hear

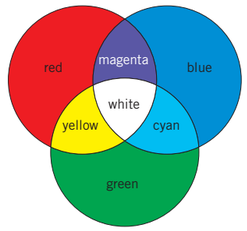


Hearing

- The **pinna** directs sound along the **auditory canal** to the **eardrum** which will vibrate
- The vibration from the ear drum moves onto the ossicles which amplifies the sound
- This passes the sound to the cochlea where tiny hairs detect the vibrations and passes this along to the **auditory nerve** as electrical signals for our brain

Colour

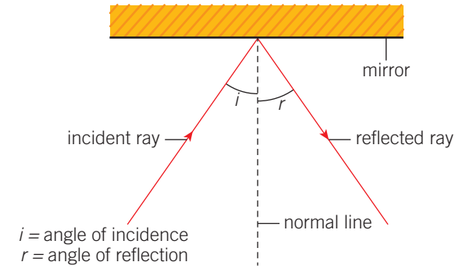
- Light can be split using a prism and is made up from different colours of light
- **Primary colours** can be mixed in order to form **secondary colours**



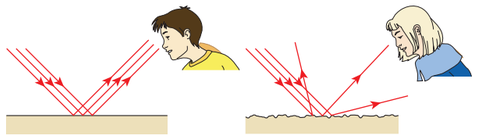
- Objects appear a certain colour as they absorb all other colours of light, but reflect the colour of light which they appear.

Reflection

- The **law of reflection** states that the **angle of incidence** will be equal to the **angle of reflection**

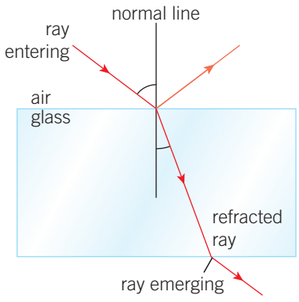


- For light reflecting off a smooth surface will form an image is called **specular reflection**
- Reflection off of a rough surface will not form an image and is know as **diffuse scattering**



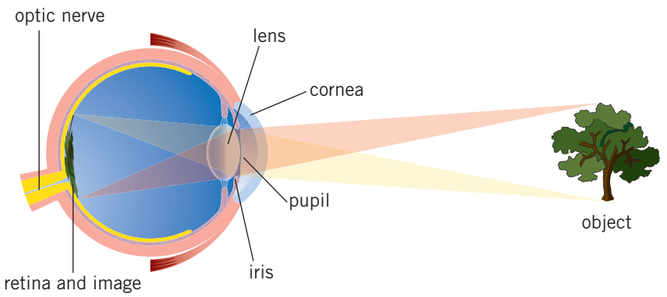
Refraction

- **Refraction** occurs when a wave passes between two different substances
- This happens as the wave will travel at different speeds in the different materials
- When the wave passes into a more dense material from a less dense material it will bend towards the **normal**, e.g. air into glass
- When the wave passes into a less dense material from a more dense material it bends away from the normal e.g. glass to air



Light and the eye

- Light entering your eye is refracted by the **lens**, focusing it on the retina and creating an inverted image
- **Photoreceptors** detect the light hitting your retina and send an electrical impulse to your brain
- If the light is not focussed on the retina or the eye, people cannot see properly



- Long sighted people have the light focus behind the eye, short sighted people have the light focus in front of the retina.
- Lenses can be used to refract the light in a way in which it will focus on the retina.

Key terms Make sure you can write definitions for these key terms.

amplitude angle of incidence angle of reflection auditory canal auditory nerve diffuse scattering eardrum frequency hertz law of reflection lens longitudinal normal oscillation oscilloscope peak photoreceptors primary colour refraction secondary colour specular reflection transverse trough ultrasound wave wavelength

P1

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Knowledge organiser

Activate
Question • Progress • Succeed

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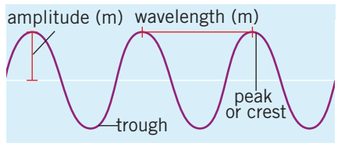

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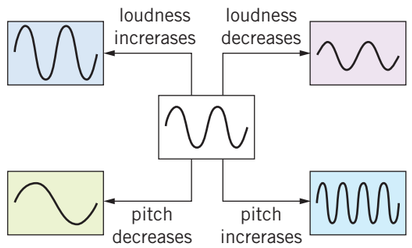

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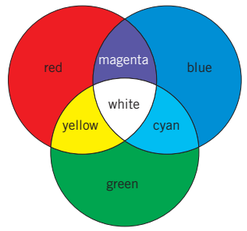

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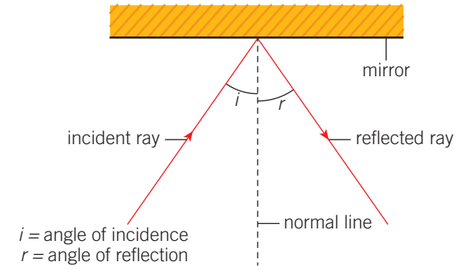
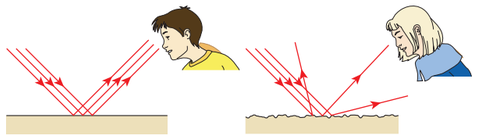
Reflection

- The **law of reflection** states that the **angle of incidence** will be equal to the **angle of reflection**

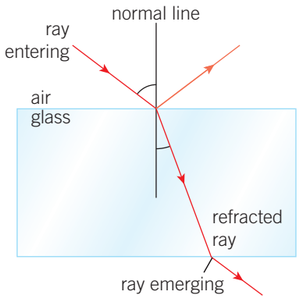


- For light reflecting off a smooth surface will form an image is called **specular reflection**
- Reflection off of a rough surface will not form an image and is know as **diffuse scattering**



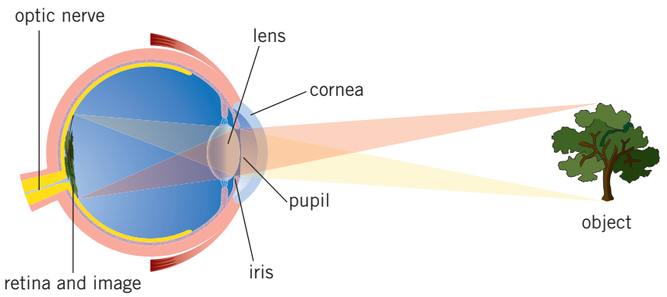
Refraction

- **Refraction** occurs when a wave passes between two different substances
- This happens as the wave will travel at different speeds in the different materials
- When the wave passes into a more dense material from a less dense material it will bend towards the **normal**, e.g. air into glass
- When the wave passes into a less dense material from a more dense material it bends away from the normal e.g. glass to air



Light and the eye

- Light entering your eye is refracted by the **lens**, focusing it on the retina and creating an inverted image
- **Photoreceptors** detect the light hitting your retina and send an electrical impulse to your brain
- If the light is not focussed on the retina or the eye, people cannot see properly



- Long sighted people have the light focus behind the eye, short sighted people have the light focus in front of the retina.
- Lenses can be used to refract the light in a way in which it will focus on the retina.

Key terms Make sure you can write definitions for these key terms.

amplitude angle of incidence angle of reflection auditory canal auditory nerve diffuse scattering eardrum frequency hertz law of reflection lens longitudinal normal oscillation oscilloscope peak photoreceptors primary colour refraction secondary colour specular reflection transverse trough ultrasound wave wavelength