Highworth Warneford School

Science Department

Year 8 End of Year Exam Revision

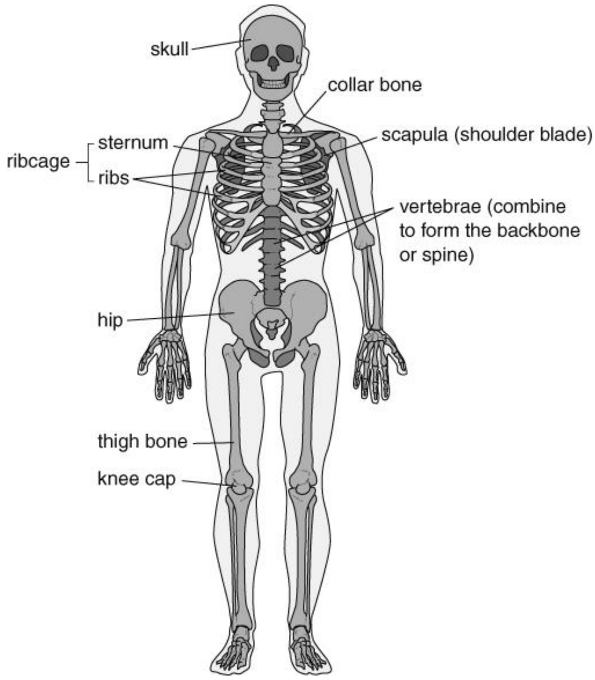
Locomotor system

The **locomotor system** consists of bones and muscles and lets you move.

Bones are organs that form the **skeleton**, which:

- protects some organs (e.g. the **ribs** and **sternum** protect the lungs; the **skull** protects the brain)
- supports your body (e.g. the **vertebrae** in your '**backbone'** hold you up straight)
- allows you to move (using muscles at your **joints**).

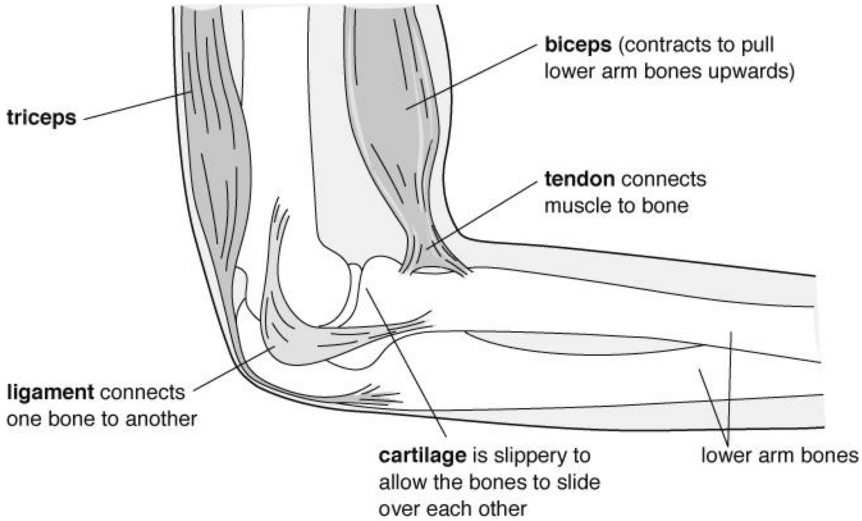
Bones are hard (to withstand knocks and pressure) and light (so they are easy to move). Many have a hollow centre containing **bone marrow**, where **blood cells** are made.



The human skeleton.

Muscle action

Muscles cannot push and so bones need pairs of muscles (**antagonistic pairs**) to pull them in opposite directions. One muscle **contracts** (gets shorter and fatter) to pull a bone. At the same time, the other muscle in the pair **relaxes**.



The elbow joint is a flexible joint (whereas the bones in the skull meet at fixed joints).

Muscles are controlled by the **nervous system**. Impulses from the brain travel down the **spinal cord** and along **nerves** to muscles.

Muscle cells are adapted to their function by containing strands that can shorten to produce a pulling force. This requires energy from **respiration**.

The oxygen and nutrients (from food) required for respiration are carried to the muscles in the blood. Nutrients are carried in the **plasma**, while oxygen is carried on **red blood cells**. Blood also contains **white blood cells**, which attack micro-organisms.

Breathing

The **gas exchange** or **breathing system** allows air to enter and leave the lungs, so that oxygen can get into the blood and carbon dioxide can leave the blood. Oxygen for respiration leaves the lungs and enters the blood. Carbon dioxide (a waste product from respiration) leaves the blood and enters the air in the lungs. Carbon dioxide is **excreted** when you **exhale**.

Breathing is the movement of the muscles in your **diaphragm** and between the ribs, which cause the changes in the volume of the lungs. **Ventilation** is the movement of air into and out of the lungs as breathing occurs.

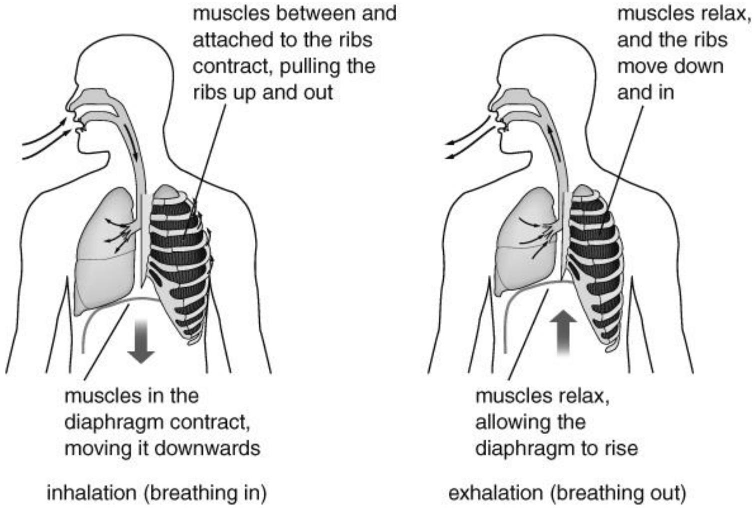
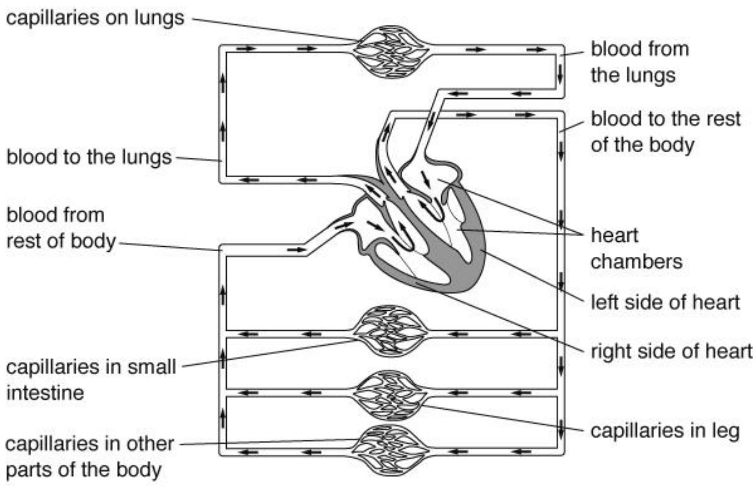


Diagram showing breathing.

Circulation

Blood is carried to the heart by veins, where it enters the chambers of the heart. The blood is then forced back out when the heart muscle tissue contracts. The pumping of the heart can be felt in arteries as a **pulse**.

Arteries are connected to **veins** by **capillaries**, which are **blood vessels** with very thin walls that allow oxygen and nutrients to leave the blood to get to the cells in tissues. Carbon dioxide from the cells can easily get into the capillaries.



Some of the circulatory system.

Drugs

Drugs are chemicals that affect how the body works. Some can damage your organs (e.g. the liver), particularly if they are abused. Some drugs are **addictive**.

Medicines (e.g. **antibiotics**) are drugs that can help people who are suffering from diseases. **Recreational drugs** are drugs that people take because they like the effect that they have on their bodies (e.g. **caffeine** in coffee and **alcohol**, which are both **legal** drugs). Some are **illegal drugs** (e.g. **heroin** and **ecstasy**) because they have very harmful **side-effects**.

Drugs that slow down the **nervous system** are called **depressants**. Alcohol is a depressant. It alters behaviour and slows reaction times. Drugs that speed up the nervous system are called **stimulants** (e.g. caffeine).

Food

We need to eat a wide variety of foods to get all the food substances that we need. When we do this, we are said to have a **balanced diet**. Carbohydrates, proteins, fats and oils (lipids), vitamins and minerals are **nutrients**, which means that they provide the raw materials for making other substances that the body needs.

Substance needed	Examples	Why it is needed	Good sources
carbohydrate	starch, sugars	for energy (in respiration)	pasta, bread, rice, potatoes
protein		for growth and repair (building new substances)	meat, fish, beans
vitamins	vitamin C	for health	fruits and vegetables (e.g. oranges contain lots of vitamin C)
minerals	calcium	for health	fruits, vegetables and dairy products (e.g. milk contains calcium)
fibre		for health (helps to stop constipation)	wholemeal bread, wholegrain rice, celery and other fibrous vegetables
water		for health (water dissolves substances and fills up cells)	

We can do tests to find out which substances are in foods. For example, starch makes iodine solution go a blue-black colour.

Nutrition information labels on foods tell us what the food contains. The labels also tell us how much energy is stored in the substances that make up the food. The amount of energy is measured in **kilojoules (kJ)**. The amount of energy a person needs in a day depends on:

- levels of activity (more active people need more energy)
- age (teenagers need more energy from food than adults do)
- whether the person is a girl or a boy (boys need more energy than girls).

Food labels may also have health claims on them, which use persuasive language.

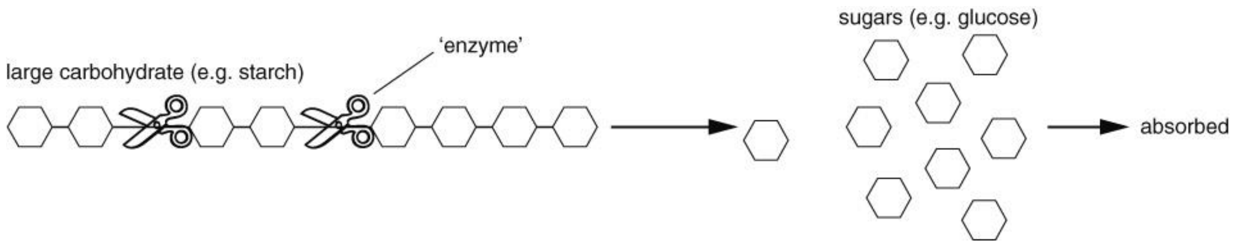
Eating too much or too little can cause problems. Too much fat may cause **heart disease** and can make people overweight. Very overweight people are **obese**.

People starve and become weak if they eat too little. **Starvation** and obesity are both forms of **malnutrition**. Other forms include **deficiency diseases** such as **scurvy**, which is due to a lack of vitamin C.

Digestion

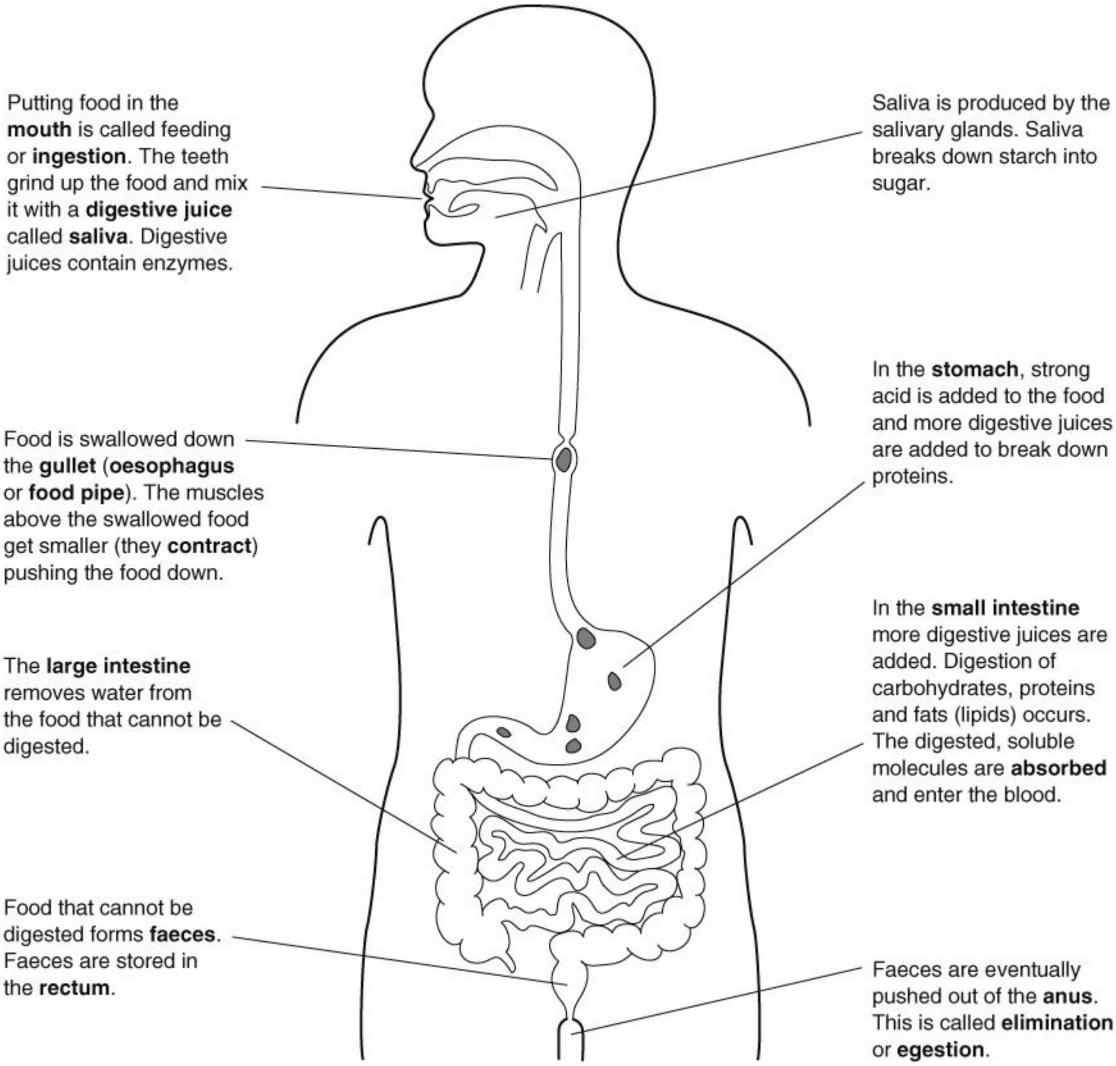
Digestion turns large **insoluble** substances into small **soluble** ones. The organs of the **digestive system** help us digest food. Many of them produce **enzymes** (substances that are **catalysts** and help speed up food digestion).

We can use a **model** to make it easier to think about how enzymes work:



The gut

Food is digested in the **gut**.



To help absorb the digested food, the wall of the small intestine is folded and covered with **villi**. The cells have microvilli. These features all increase the **surface area**. The wall of the small intestine is also only one-cell thick, meaning that it is easy for small molecules to **diffuse** out of the small intestine and into the blood. The digested food molecules are carried in the blood **plasma**.

The surface area is the total area of the faces of a three-dimensional object.

Hazards

- A **hazard** is something that can cause harm.
- Chemicals are labelled with hazard symbols to warn people of potential dangers.
- Some common hazard symbols are:

Risk WS

- A **risk** is the chance that a hazard will actually cause harm.
- Risks can be reduced by taking **precautions**. E.g. wearing eye protection to prevent chemicals splashing in your eyes or tying long hair back to prevent it catching fire in a Bunsen flame.

Acids

- Common substances at home that contain acids include: citric acid, vinegar, fizzy drinks and car battery acid.
- Acids have a sour taste.
- Most concentrated acids are **corrosive**. If they are added to water they become more **dilute**. Dilute acids are less hazardous. Many dilute acids are **irritant**.

Alkalis

- Common substances at home that contain alkalis include: toothpaste, drain cleaner, oven cleaner.
- Many alkalis are metal hydroxide solutions.
- An alkali can be described as a soluble base. A base is any substance, soluble or insoluble, that neutralises an acid forming a salt and water.

Indicators

- Indicators change colour and can be used to detect acids, alkalis and neutral solutions.
- Litmus is a common indicator.

Solution	Colour of litmus
acid	red
neutral	purple
alkali	blue

pH scale

- A numbered scale from 1 to 14.
- Acids have a pH less than 7. The lower the pH, the more acidic the substance is. The lower the pH, the more hazardous the acid is.
- Neutral solutions have pH 7.
- Alkalis have a pH more than 7. The higher the pH, the more alkaline the substance is. The higher the pH, the more hazardous the alkali is.

strong acid			weak acid			neutral	weak alkali			strong alkali			
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
stomach acid		vinegar lemon juice	fizzy drinks		skin milk	pure water	indigestion powder toothpaste			washing powder			oven cleaner

Neutralisation

- This is a reaction between an acid and an alkali.

acid + alkali → salt + water

- It is also a reaction between an acid and a base.

acid + base → salt + water

Word equation

- This summarises a reaction by writing the names of the substances you start with and the names of the new substances that are made.
- **Reactants** are the substances you start with and are written on the left side of the word equation.
- **Products** are the new substances that are made and are written on the right side of the word equation.
- There is an arrow between the reactants and products. The arrow means ‘react to form’. Do not write an equals sign, =.
- For example

hydrochloric acid + sodium hydroxide → sodium chloride + water

Hydrochloric acid and sodium hydroxide are the reactants.

Sodium chloride and water are the products.

Notice the arrow between the reactants and the products.

Salts

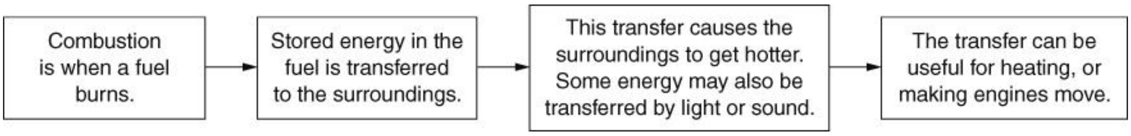
- Salts are made when an acid reacts with an alkali or a base.
- Salts names are made of two words.
- The first part of the name of the salt is the same as the metal in the alkali or base.
- The second part of the name of the salt comes from the acid.

Acid	Second part of the name of the salt	Example
hydrochloric acid	chloride	Zinc chloride is made from zinc oxide and hydrochloric acid
nitric acid	nitrate	Magnesium nitrate is made from magnesium oxide and nitric acid
sulfuric acid	sulfate	Copper sulfate is made from copper oxide and sulfuric acid

Neutralisation in everyday life

- Antacids are indigestion remedies. People take these medicines if they have indigestion caused by too much acid in the stomach. The antacid contains a base that neutralises the extra acid.
- Soil can become too acidic for some crops to grow. Farmers spread lime (a base) on the soil to neutralise the acid.
- Toothpaste contains a mild alkali to neutralise the acid in our mouths.
- Alkalis are used to neutralise the acidic gases coming out of power stations.
- Sulfuric acid reacts with iron oxide in rust and removes it from the surface of an object.

Combustion and oxidation



A **hydrocarbon** is made only of carbon and hydrogen. Many fuels are mainly hydrocarbons.

Hydrocarbon combustion:

hydrocarbon + oxygen → water + carbon dioxide

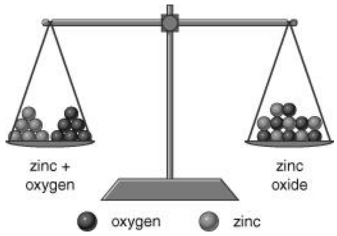
This is a word equation.

Combustion is also an **oxidation reaction** because the substances react with oxygen.

Carbon and hydrogen are **non-metals** but metals can also be oxidised:

metal + oxygen → metal oxide

Conservation of mass in reactions



In a reaction, the mass of the **reactants** is always the same as the mass of the **products**.

Metals can appear to gain mass when heated in air:

zinc + oxygen → zinc oxide

The difference in mass is the mass of oxygen that reacted.

When a hydrocarbon fuel combusts, it appears to lose mass because the products of the reaction (carbon dioxide, water vapour) are lost into the air.

Phlogiston

Before oxygen was discovered, scientists explained combustion by saying that, as a substance burnt, it gave out a substance called phlogiston to the air. For example:

wood → calx (ash) + phlogiston

However, the phlogiston theory could not explain why metals gained mass when they reacted with air.

The fire triangle and putting fires out

The fire triangle shows the three factors needed for a fire to burn. If any factor is removed, the fire will go out.

We use **fire extinguishers** to put out fires. Water extinguishers remove heat. Powder and carbon dioxide extinguishers exclude oxygen. Foam extinguishers can both remove heat and exclude oxygen.

Oil fires should not be treated with water because the water sinks through the oil, which heats up and causes the water to evaporate. This causes the oil to 'spit' and can spread the fire.

Hazard symbols

Hazard symbols explain why a substance must be handled carefully.

Air pollution from burning fossil fuels

Complete combustion – the fuel reacts completely with oxygen, e.g.:

hydrocarbon + oxygen $\rightarrow$ carbon dioxide + water

Incomplete combustion – the fuel only partly reacts with oxygen, e.g.:

hydrocarbon + oxygen $\rightarrow$ carbon dioxide + water + carbon monoxide + carbon (soot)

Impurities in fossil fuels, such as substances that contain sulfur, also react with oxygen when heated:

sulfur + oxygen $\rightarrow$ sulfur dioxide

At the very high temperatures in vehicle engines, nitrogen gas from the air reacts with oxygen:

nitrogen + oxygen $\rightarrow$ nitrogen oxides

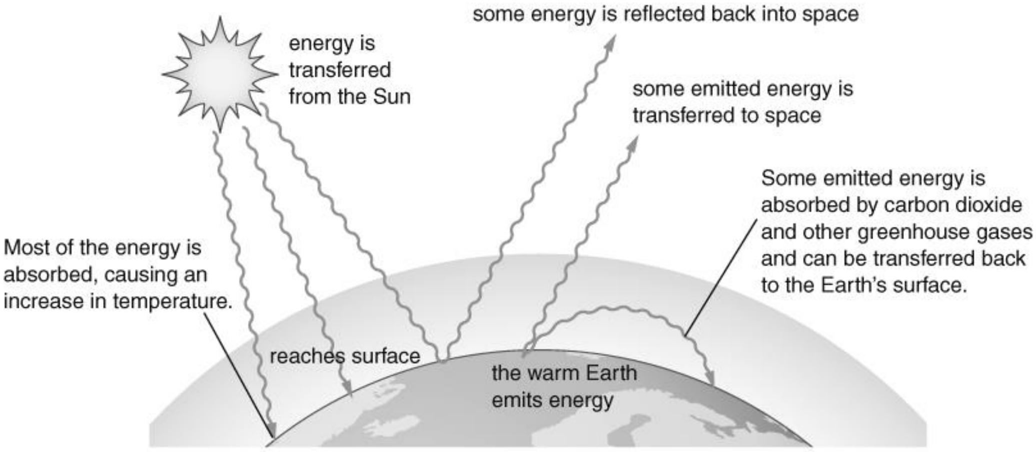
Many products from burning fossil fuels are **pollutants**; they harm the habitats and their organisms.

Acid rain

Acid rain is rain water that is made more acidic by dissolved sulfur dioxide and nitrogen oxides. Some of these gases are removed from power station chimneys by neutralisation, and by using **catalytic converters** on vehicle exhausts. Catalytic converters also remove carbon monoxide (another pollutant).

Greenhouse effect and global warming

Greenhouse gases in the Earth's atmosphere keep the Earth's surface warm. This is the **greenhouse effect**.



Carbon dioxide is a greenhouse gas. Most scientists think that the extra carbon dioxide released from burning fossil fuels has increased the temperature of the Earth's surface (**global warming**).

Scientists predict that global warming will cause **climate change**. The best way to control global warming is probably to reduce the amount of carbon dioxide we release into the air.

Forces

Forces are pushes or pulls. Forces can:

- change the shape or size of an object
- change the speed things are moving (make them move faster or slower)
- change the direction of a moving object.

The unit for measuring force is the **newton** (**N**).

Friction is a force caused by two things rubbing together. **Air resistance** and **water resistance** are kinds of friction.

Solid things, like your chair, push up on you when you sit on them. Upwards forces from water or air are called **upthrust**. Things float in water because of upthrust.

Contact forces only act when two objects or materials are touching. Examples of contact forces are:

- friction
- air resistance
- water resistance
- upthrust.

Some forces can have an effect without objects touching. They are called **non-contact forces**. There are three non-contact forces:

- **magnetism**
- **gravity**
- **static electricity**.

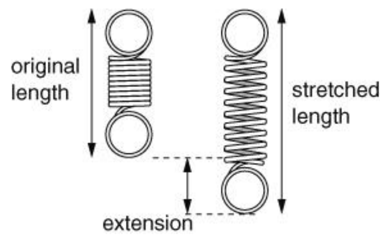
Weight and mass

Your **mass** is the amount of substance in your body. Your mass is measured in **kilograms** (**kg**). Your **weight** is a force caused by gravity pulling on your body. The newton (N) is the scientific unit used to measure forces, and so it is also used as the unit for weight.

Wherever you take an object, its mass will not change but its weight depends on the force of gravity. An object on the Moon would have a smaller weight than on Earth, because the Moon's gravity is not as strong as Earth's.

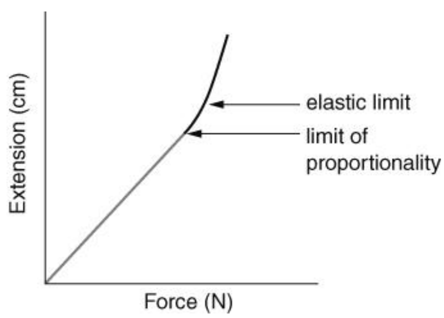
Measuring forces

Elastic materials will stretch with a force and then return to their original shape when the force is taken away. Springs are elastic. The extension of a spring is the difference between its original length and its stretched length.



The extension of a spring is **proportional** to the force on it. This is called **Hooke's Law**.

If the spring is stretched too far, the extension stops being proportional to the force. If it is stretched even further, it goes beyond its **elastic limit**. The spring will no longer return to its original length when the force is removed.



Force meters have springs inside them.

Materials like Plasticine® will stretch with a force but they will not return to their original shape afterwards. Plasticine® is a **plastic** material.

Friction

Friction is a contact force. Friction can:

- slow things down
- wear things away
- produce heat
- cause a noise.

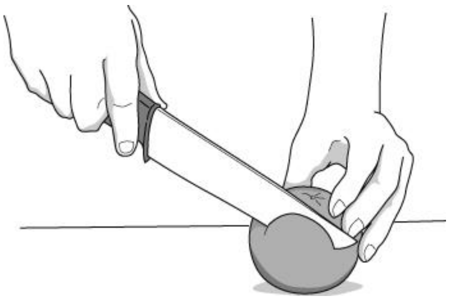
Friction can be increased by using rough surfaces, or by using materials such as rubber that have a lot of friction.

Friction can be reduced by using smooth surfaces, or by lubrication. Oil and grease are examples of lubricants, and help things to move past each other easily.

Pressure

Pressure is the amount of force pushing on a certain area.

For a certain area, the bigger the force, the bigger the pressure. For a certain force, the bigger the area, the smaller the pressure.



Sharp knife – a small area giving a large pressure.

Snow shoes – a large area giving a small pressure.

We can work out the pressure under an object using this formula:

$$\text{pressure} = \text{force} \div \text{area}$$

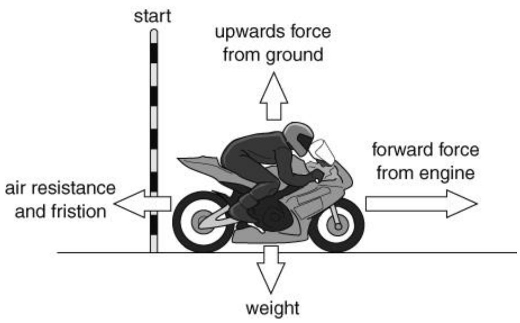
Balanced and unbalanced forces

Balanced forces are forces on an object that are the same size but work in opposite directions. If forces are balanced:

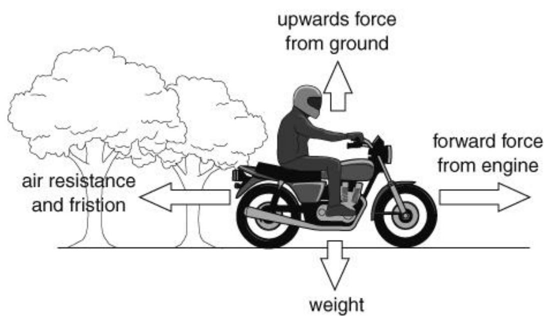
- a stationary object stays stationary
- a moving object continues to move at the same speed and in the same direction.

If there are **unbalanced forces** on an object:

- a stationary object will start to move
- a moving object will change its speed or direction.



Unbalanced forces – the motorbike will speed up.



Balanced forces – the motorbike will continue to move at a steady speed.

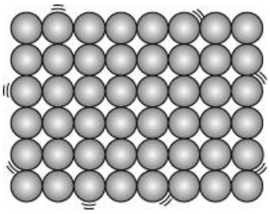
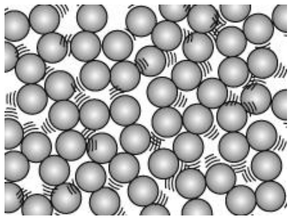
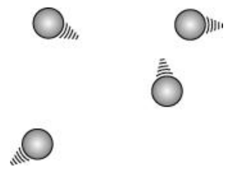
A car or motorbike uses the energy stored in fuel to move at a steady speed because it needs a force from the engine to balance the forces of air resistance and friction.

Fluids

Fluids are liquids or gases.

The particle model

The particle model can explain the properties of solids, liquids and gases.

	Solids	Liquids	Gases
Properties	• fixed volume • fixed shape	• fixed volume • take shape of container	• expand to fill container • take shape of container
Particle diagram			
Particles	• are close together • are held in fixed positions by strong forces	• are close together • are held by fairly strong forces • can move around	• are far apart • are held by very weak forces • can move around

Density

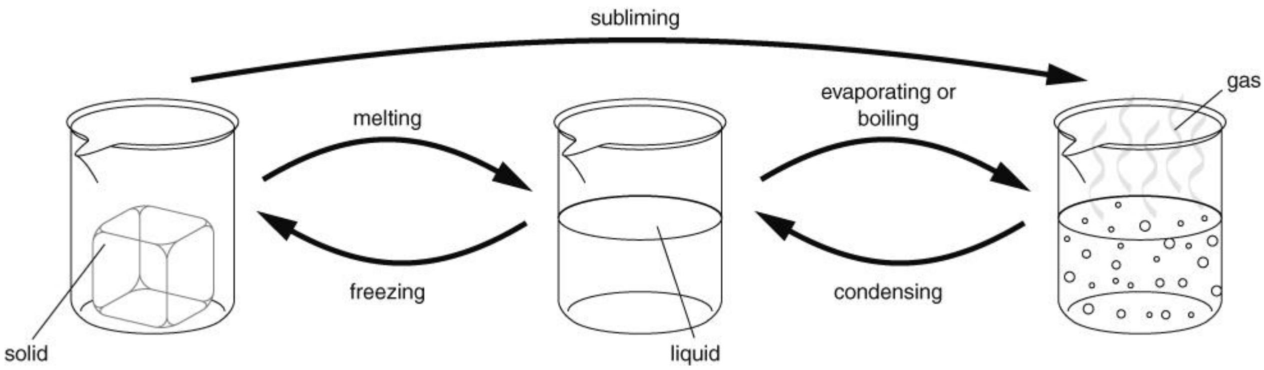
Density is the mass of a certain volume of something, and it can be calculated using this formula:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

The units for density are g/cm^3 or kg/m^3.

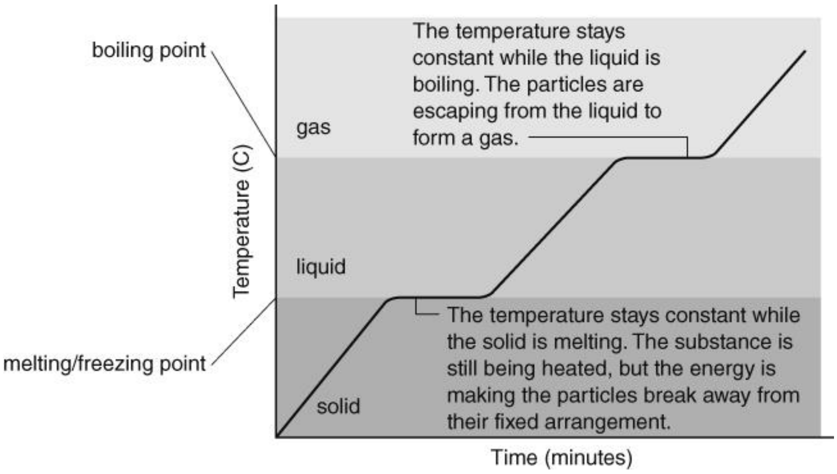
Changes of state

Substances can change state when they are heated or cooled. The three states of matter are solid, liquid and gas.



A liquid evaporates from its surface. When it is boiling, bubbles of gas form within the liquid.

The melting point and the freezing point of a substance are the same temperature. The temperature of a substance does not change while it is melting, even if it is still being heated.



Changing density

Substances expand when they are heated. The particles in a solid vibrate more and take up more space. The particles in liquids and gases move around faster and take up more space. When a material expands its density decreases.

Substances contract when they cool down, as the particles have less energy and do not move as much. This reduces the volume and increases the density. When a liquid freezes and becomes a solid its density increases a lot.

Ice is unusual, because it is *less* dense than liquid water. This is why ice floats on water.

Pressure in fluids

Both gases and liquids are fluids. Fluids can flow. Pressure in fluids acts in all directions. The particles in fluids are moving all the time and hitting the walls of containers and other things they come into contact with. The force of the collisions causes pressure, which acts in all directions.

The pressure of gas in a container can be increased by:

- putting more particles into the container (so there will be more collisions with the container walls each second).
- heating the gas (so the particles move faster, hitting the walls harder and more often).
- reducing the volume of the container (so the particles do not have as far to go between the walls and so collide with the walls more often).

As you go deeper into the sea, pressure increases because there is more water above you pressing down. If you climb a high mountain, the air pressure on you will get less, because there is less air above you pressing down.

Floating and sinking

You can decide if something will float by working out its density, and the density of the fluid. If the density of the object is less than the density of the fluid, it will float.

The density of water is 1 g/cm^3, so objects with densities less than 1 g/cm^3 will float in water.

Drag

Drag is another name for air resistance or water resistance. The amount of drag on something can be reduced by giving it a smooth surface and a streamlined shape. The drag increases as the speed increases, so cars use up more fuel per kilometre when they are travelling fast. Drag is caused by particles in the fluid hitting the moving object, and by the force needed for the object to push the fluid out of the way. The particles transfer energy to the object, which is why objects moving through air can get hot.