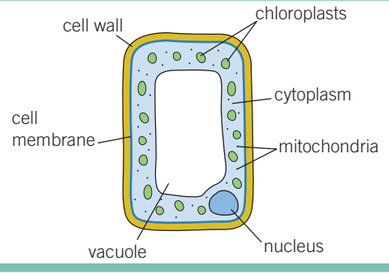
B1 Chapter 1: Cells

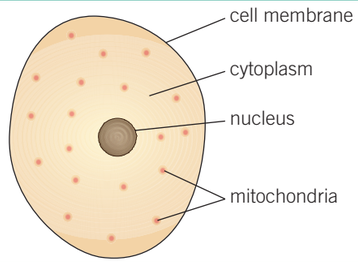
Knowledge organiser

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

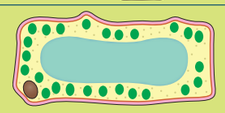
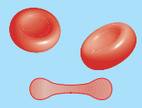
Cells have smaller structures inside them, called components, that each have an important function.





Specialised cells

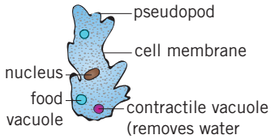
Specialised cells have special features that allow them to do a specific job or function:

	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

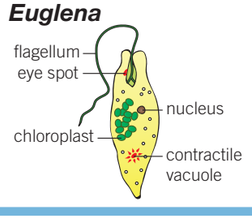
A **unicellular** organism only consists of one cell. They have no fixed shape and are adapted to carry out many different functions.

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



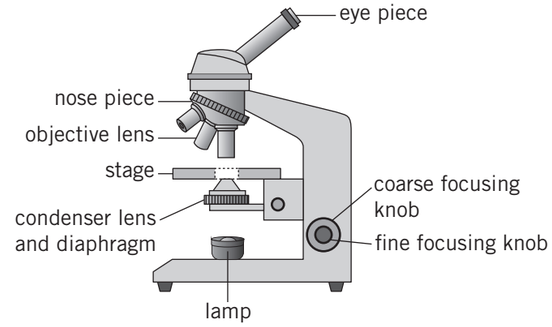
- microscopic organism found in fresh water
- contain chloroplasts and make their own food by photosynthesis
- eye spot that detects light
- flagellum allows the *Euglena* to move towards the light to make more food

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.

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

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

Key words

Make sure you can write a definition for these key terms.

amoeba ***binary fission*** ***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

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

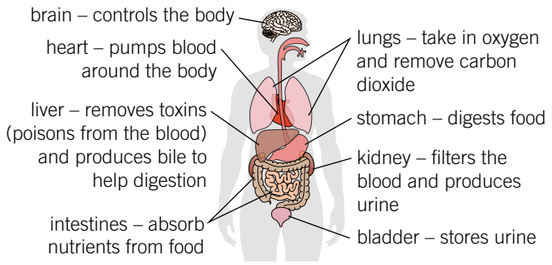
organ – a group of tissues working together

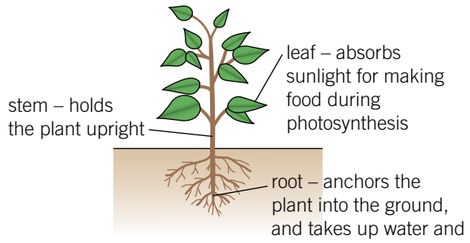
organ system – a group of organs working together

multicellular organism – a group of systems working together

increasing complexity

Plant and animal organs

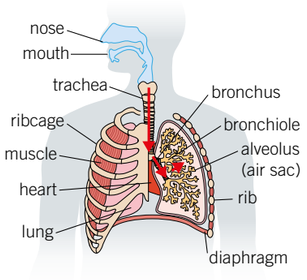


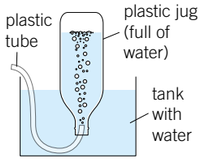


Respiratory system

The respiratory system is involved in:

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





Measuring lung volume

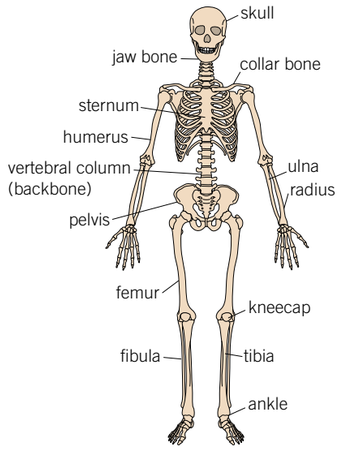
When you breathe out fully into the plastic tube, air from your lungs pushes water out of the bottle.

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.

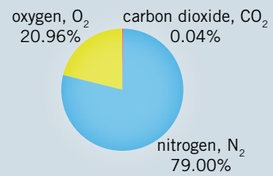
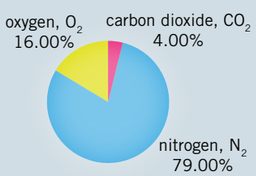
Three types of joint are:

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.

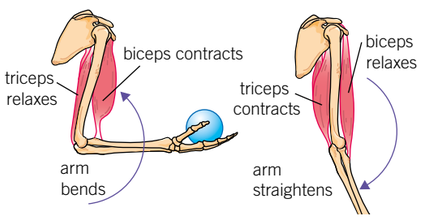
Types of muscle include:

- **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 words

Make sure you can write a definition for these key terms.

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

C1

Chapter 1: Particles and their behaviour

Knowledge organiser

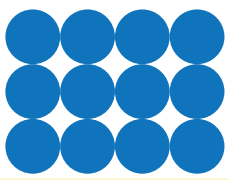
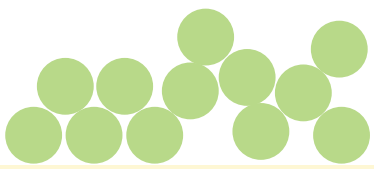
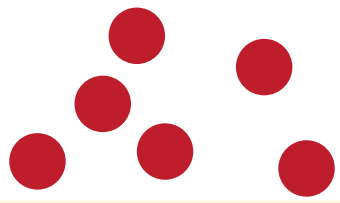
changes of state

particles gain energy from the surroundings → particles vibrate faster → particles lose their place in the pattern

melting

particles gain more energy from the surroundings → particles move faster → particles pull completely away from each other

boiling / evaporation

state of matter	solid	liquid	gas
how do the particles move?	particles do not move around, but vibrate on the spot	particles are touching but can slide over each other	particles are spread out far away from each other
arrangement of particles			
can it be compressed?	no, because there 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 slide over each other and move around	yes, because the particles can move around

freezing

particles take a fixed place in a pattern ← particles move even slower ← particles lose more energy to the surroundings

condensation

particles come close together ← particles move slower ← particles lose energy to the surroundings

changes of state

Sublimation

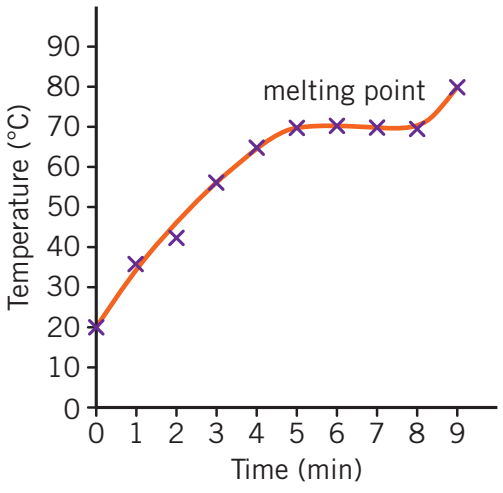
Some substances do not exist as liquids, but instead directly change state from solid to gas in a process called sublimation.

Melting and boiling points

Melting point — the temperature at which a **substance** melts

Boiling point — the temperature at which a substance boils

If you heat a **solid** and plot a graph of temperature against time the melting point will appear as a flat line if the substance is **pure** (has only one type of particle).



Diffusion

Particles move about randomly in liquids and gases and spread out through **mixtures**. This process is called diffusion. How quickly diffusion happens depends upon three variables:

Variable	Effect on diffusion
temperature	diffusion is faster at higher temperatures *because* particles move faster when hotter
particle size	diffusion is slower with larger, heavier particles
state of matter	diffusion is: • fast in gases • slow in liquids • doesn't happen in solids

Gas pressure

Density

Density tells us how heavy something is for its size. You can calculate density using the formula: density = mass / volume

Mass is the amount of 'stuff' an object is made of, measured in grams or kilograms.

Volume is the amount of space an object takes up, measured in cm^3.

Density of a substance depends on:

- the mass of the particles
- how closely together the particles are arranged.

A substance is most dense as a solid, as the particles are closely packed together, and least dense as a gas, as the particles are spread far apart.

Particle model and properties

The properties of a substance depend on:

1 the shape and size of its particles
2 the arrangement of its particles
3 how its particles move
4 how strong the forces between its particles are.

Key words

Make sure you can write a definition for these key terms.

boiling *boiling point* *change of state* *condensation* *diffusion* *evaporation* *freezing* *gas* *liquid* *melting* *mixture* *particle* *solid* *state of matter* *sublimation* *substance*

P1 Chapter 1: Forces

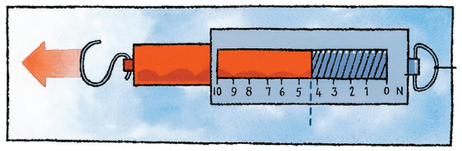
Knowledge organiser

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:

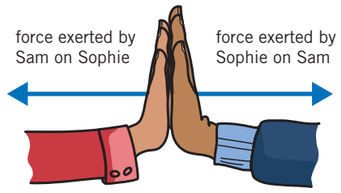
- **friction**
- **drag forces** (**air resistance** and **water resistance**)
- support forces (e.g., **reaction forces**)

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.

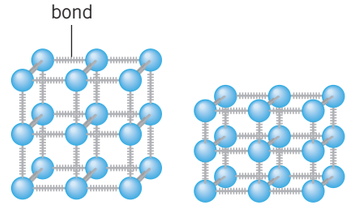
Making an object more **streamlined** will reduce the drag forces on it.

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 or the normal 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.

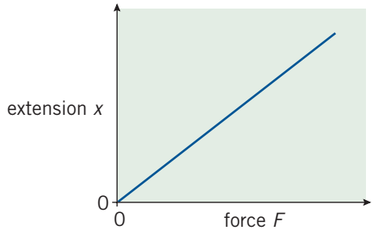
Your weight depends on the gravitational field strength but your mass is the same everywhere.

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 words

Make sure you can write a definition 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*