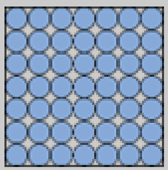
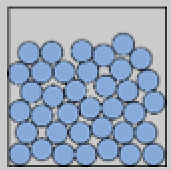
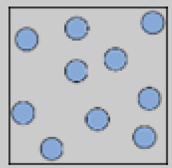
Particles, substances and mixtures

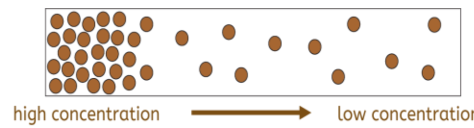
The particle model of matter

[redacted]

Diagram			
Arrangement	ordered and all touching	random and all touching	random and not touching
Movement	vibrate in fixed positions	move and slide over each other	move around quickly in random directions
Attraction between particles	strong	weak	very weak

Diffusion

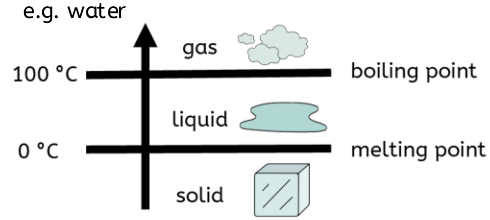
Diffusion is the random movement of particles from an area of high concentration to an area of low concentration. Particles of substances in the liquid and gas states can diffuse because their particles can move freely.



Melting and boiling points

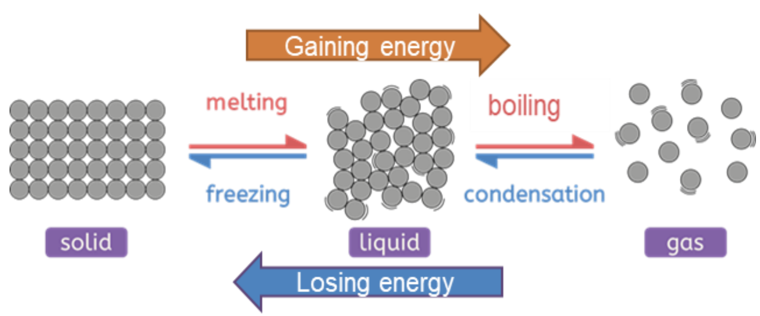
melting point: the temperature at which a substance changes from a solid to a liquid

boiling point: the temperature at which a substance changes from a liquid to a gas, e.g. water



Change of state

A change of state is a physical change because no new substances are made, and the change is reversible. Only the amount of energy the particles have changes, which affects the arrangement and movement of the particles. Temperature stays constant during a change of state.



Explaining the properties of solids

Property	Reason
Fixed shape and cannot flow	Strong forces of attraction between the particles keep them in fixed positions.
Cannot be compressed (squashed)	Particles are all touching and have no space to move into.

Explaining the properties of liquids

Property	Reason
Takes shape of container and can flow	Weak forces of attraction between the particles, so they can move around each other.
Cannot be compressed (squashed)	Particles are all touching and have no space to move into.

Explaining the properties of gases

Property	Reason
Takes shape of container and can flow	Very weak forces of attraction between the particles, allowing them to move and spread out.
Can be compressed (squashed)	Particles are not touching and have space to move into.

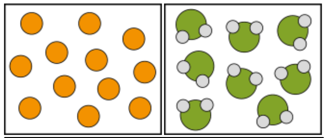
Gas pressure

When gas particles collide with the walls of their container, this creates a constant force on the walls of the container.
This causes pressure. The faster the particles move, the higher the gas pressure. The gas pressure inside containers can be increased by adding more particles or increasing the temperature. The more frequent the collisions, the higher the gas pressure.

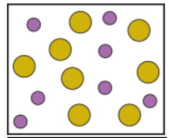
Particles, substances and mixtures

Pure substances and mixtures

A **pure substance** is one that contains only one substance, e.g. pure iron contains only iron particles. A **mixture** contains two or more substances that are not joined together and can be physically separated.



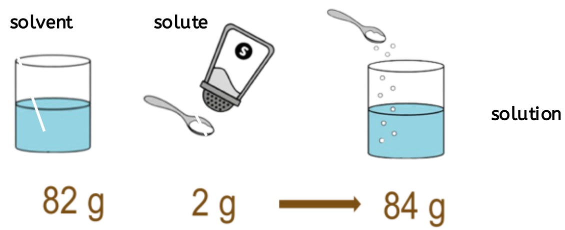
pure substances
(one type of particle)



mixture

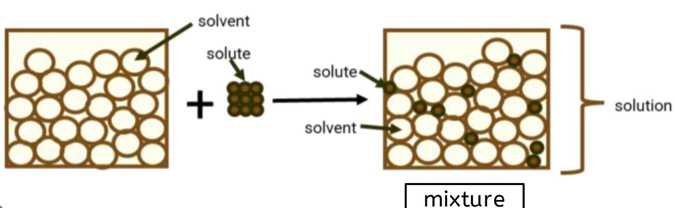
Solutions and solubility

A **solute** can be dissolved in a **solvent**. The mixture created is called a **solution**. When no more solute can dissolve in the solution, it is a **saturated** solution. If a solid dissolves in a solvent, it is **soluble**. If it does not dissolve in a solvent, it is **insoluble**. **Solubility** is a measure of how much solute can dissolve in a solvent. The higher the temperature of the solvent, the greater the mass of the solute that can be dissolved.



Solubility is different for different solutes. The solubility of a solute will change depending on the solvent used.

During **dissolving**, the solute particles are separated and fit between the solvent particles to make a solution.



Conservation of mass

When a solution is formed, **the mass of the solvent + the mass of the solute = the mass of the solution.**

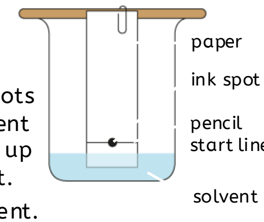
Mass remains constant because the number of particles is the same before dissolving as it is after.

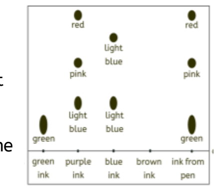
Separating mixtures

We can separate mixtures in different ways depending on their properties:

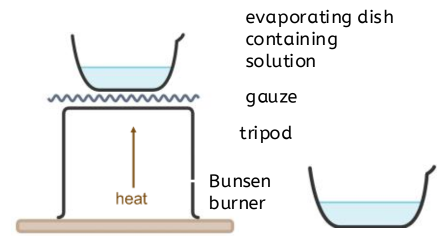
Chromatography is a separation technique that separates mixtures containing more than one solute based on their solubilities in a solvent. It works because some of the coloured substances dissolve better than others, so they travel further up the paper. A pencil line is drawn, and spots of ink or dye are placed on it. There is a container of solvent (e.g. water or ethanol). As the solvent continues to travel up the paper, the different coloured substances spread apart.

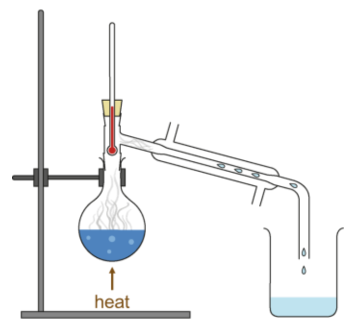
A **chromatogram**, the results of chromatography experiment.





Evaporation and **crystallisation** can be used to separate a soluble solid from a solution. For example, copper sulphate is soluble in water – its crystals dissolve in water to form a copper sulphate solution. During evaporation, the water evaporates away, leaving solid copper sulphate crystals behind. Crystallisation produces larger solid crystals.

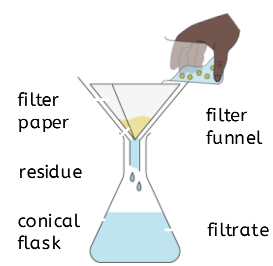




Distillation is a separation technique used to separate a mixture of liquids. The basis for separation in distillation is the difference in the boiling points of the components. For example, water can be separated from an ink and water solution because water has a much lower boiling point than ink. When the solution is heated, water evaporates. It is then cooled and condensed into a separate container. The ink does not evaporate, so it stays behind.

Filtration can be used to separate a liquid from an insoluble solid. The filter paper used in filtration is 'selectively permeable', meaning that it has holes in it that allow the movement of only some substances through whilst preventing the movement of others. The insoluble solid is unable to pass through the small holes of the filter paper. When a mixture of sand and water is filtered:

- The sand stays behind in the filter paper (it becomes the **residue**).
- The water passes through the filter paper (it becomes the **filtrate**).



Particles, substances and mixtures

Glossary

- **aqueous solution:** (noun) a solution in which water is the solvent, e.g. sugar and water solution
- **boiling point:** (noun phrase) the temperature at which a substance changes from a liquid to a gas
- **boiling:** (verb) when matter changes from a liquid state to a gas state, throughout the liquid
- **chromatogram:** (noun) the pattern that forms on chromatography paper after chromatography
- **chromatography:** (noun) a method of separating a mixture containing more than one solute
- **collide:** (verb) to hit or come into contact with something forcefully
- **compress:** (verb) to squash into a smaller space
- **concentration:** (noun) the number of particles present in a certain space
- **condense:** (verb) when gases cool enough to turn back into a liquid
- **condensing:** (verb) when matter changes from a gas state to a liquid state
- **conservation of mass:** (noun phrase) the scientific principle that states mass cannot be created or destroyed in a physical change or chemical reaction
- **crystallisation:** (noun) a method of separating soluble particles from a solution using evaporation
- **diffusion:** (noun) the random spreading out of particles from an area of high concentration to an area of low concentration
- **dissolving:** (verb) the process of solute particles separating and being held between solvent particles to form a solution
- **distillation:** (noun) a method of separation involving boiling followed by condensing
- **evaporate:** (verb) when particles gain enough energy to change from a liquid state to a gas state, at the surface of the liquid
- **filtering:** (verb) a method of separating insoluble particles from a liquid
- **forces of attraction:** (noun phrase) the ability to hold between the particles
- **freezing:** (verb) when matter changes from a liquid state to a solid state
- **gas pressure:** (noun phrase) the force exerted by gas particles when they collide with the walls of a container

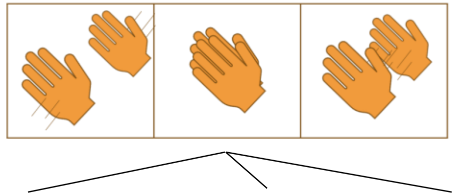
- **insoluble:** (adjective) when a substance cannot dissolve in a solvent
- **mass:** (noun) a measure of how much matter something contains; it is measured in grams or kilograms
- **melting point:** (noun phrase) the temperature at which a substance changes from a solid to a liquid
- **melting:** (verb) when matter changes from a solid state to a liquid state
- **mixture:** (noun) a material that contains two or more different substances that are not joined together and can be separated
- **mobile phase:** (noun phrase) the term given to the solvent because it moves up the chromatography paper
- **molten:** (adjective) the scientific term for a substance that normally exists as a solid at room temperature but has changed state to become a liquid because of heating, e.g. molten iron
- **observation:** (noun) the act of noticing facts about things happening or existing in the world
- **overcome:** (verb) to win against or defeat
- **physical:** (adjective) a property that can be measured without making a permanent change to the substance (e.g. melting point, hardness)
- **properties:** (noun) characteristics that describe what something can do or how it behaves
- **pure substance:** (noun phrase) a material that is made up of only one type of substance; it has only one type of particle
- **purify:** (verb) the act of making a substance pure
- **saturated:** (adjective) when no more solute will dissolve in a solution
- **selectively permeable:** (adjective phrase) something that has holes in it to allow the movement of only some substances through whilst preventing the movement of others
- **solubility:** (noun) a measure of how much solute can dissolve in a solvent
- **soluble:** (adjective) when a substance can dissolve in a solvent
- **solute:** (noun) a substance that has dissolved into a solvent
- **solution:** (noun) when a solvent and solute combine
- **solvent:** (noun) the liquid into which a solute dissolves.
- **stationary phase:** (noun phrase) the term given to the chromatography paper because it does not move
- **temperature:** (noun) a measure of how hot or cold something is; it can be measured using a thermometer; its unit is degrees Celsius, °C
- **volume:** (noun) the amount of space occupied by a substance; it is usually measured in cubic centimetres (cm^3) or millilitres (ml)

7.02: Fundamentals in physics

Forces and their interactions

Interaction:

When two objects influence each other and cause a pair of forces to arise.



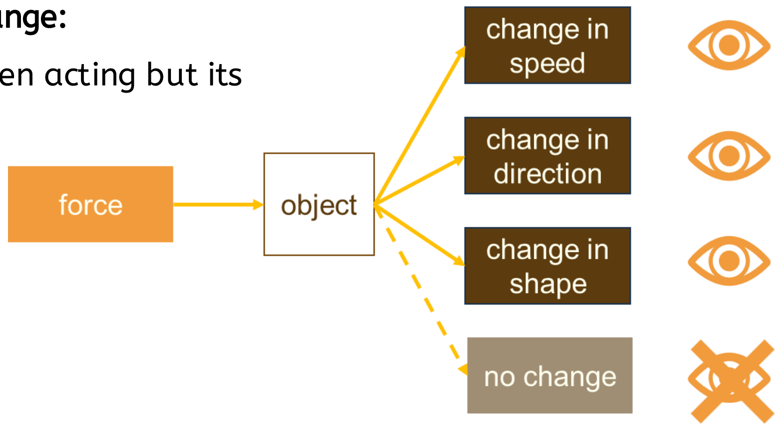
one force on each object

equal in size

opposite in direction

Forces can cause change:

A force cannot be seen acting but its effects often can.



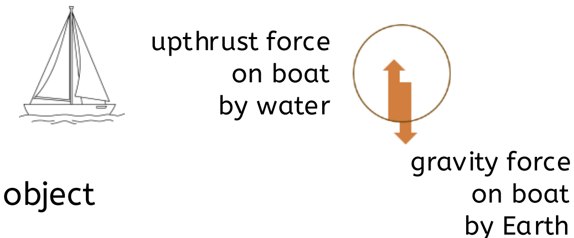
Forces can be contact or non-contact:

Contact forces arise between two touching objects.

Non-contact forces can act between two objects at a distance.

contact	thrust, friction, air resistance, water resistance, normal contact, upthrust
non-contact	gravity force, magnetic force

Free-body force diagrams



One object

Arrows to show size and direction of forces

Labelled forces:

- What kind of force is acting?
- What is the force acting on?
- What exerts the force?

Deforming forces

Two pushing forces cause compression: the object contracts.

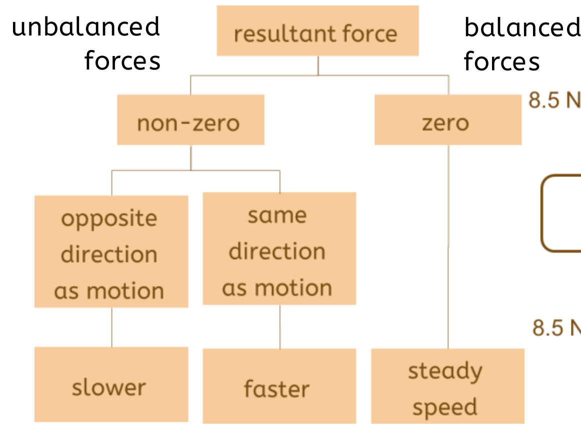
Two pulling forces cause tension: the object extends.

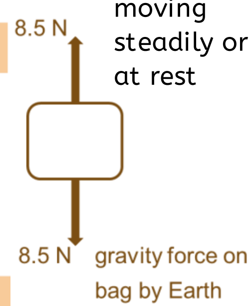
7.02: Fundamentals in physics

Combining forces

More than one force acting:

- Their effects are combined
- As if a single force is acting: the resultant force

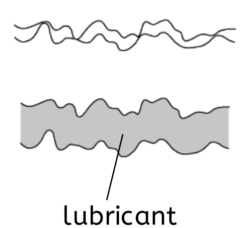




Friction force

- **What?** One of three frictional forces. They act to resist motion.
- **Where?** Acts between solid surfaces, along the surfaces.
- **When?** An object is sliding or trying to. When starting to slide, the applied force must be larger than the limiting friction: so, an unbalanced force acts.
- **How?** Opposite direction to the motion, or the applied force.
- **Why?** Surfaces are uneven, so the 'catching' between them must be overcome.

	Useful	Nuisance
Walking	✓	
Machines		✓
Driving	✓	
Wear and tear		✓

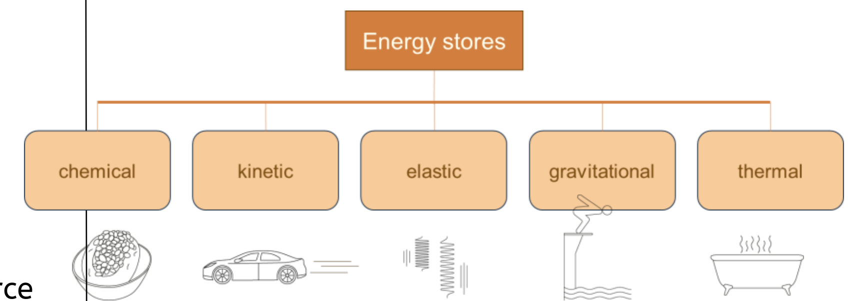


Energy stores and pathways

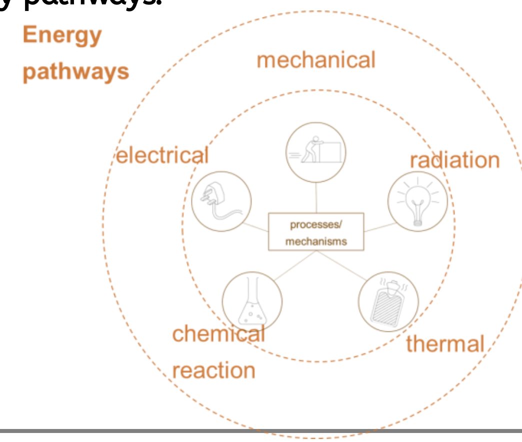
What energy does:

- Flows between objects in a system
- Stays the same when it transfers
- Cannot be used up

Energy is transferred between stores:



Energy is transferred because of processes, by pathways:



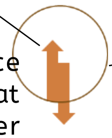
7.02: Fundamentals in physics

Modelling forces

Forces are modelled because:

- forces cannot be seen acting
- there are many forces acting at a time
- their size and direction have important effects on situations, so need to be shown.

Arrows (length represents size, direction of forces)



upthrust force on boat by water

Dot or rectangle shows simplified object

Labels describe type of force, object acted on and objects exerting force on it.

Investigating forces

Scientific methods:

- With or without hypothesis
- Manipulating variables or not

Statement to answer an enquiry question.

Smoother surfaces cause less friction to act on objects sliding over them.

comparative term

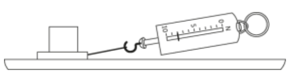
present tense

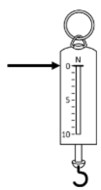
the effect which can be tested

'group' being tested (IV)

Planning to collect high-quality data:

- Measuring with skill
- Preparing the data table
- Repeatable data





Check force-meter is on zero with no force.

headings describe variable

IV

Surface	Force to start sliding (N)		
	1	2	3
Glass	1.4	1.5	1.7
Metal	1.5	1.6	1.7
Polished wood	2.0	2.3	2.2
Plastic	2.9	3.0	2.9
Paper	4.5	3.8	4.0

DV in columns

repeated

Peer review: ★★★

Peers (people of a similar level of knowledge) test the results for quality.

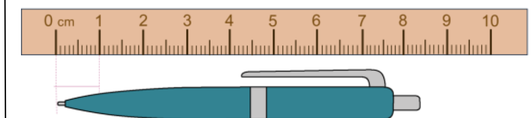
Repeatability:
Same group, same results

Reproducibility:
Different group, same results

Observing by measurement

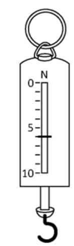
Using a scale

- set of lines at equal increments
- Labelled with numbers and units



Measuring instruments

- Include rulers, balances, clocks and thermometers.
- Force is measured using a force-meter.



Quantities: and their units

Base quantities: length (m), mass (kg), time (s) and temperature (K).

Derived quantities include force (N).

Fundamentals in physics

Glossary

- **air resistance:** (noun phrase) a contact force arising from an interaction between air and a moving object
- **analogy:** (noun) a similarity between two things that can be used as a comparison
- **balanced forces**: (noun phrase) when forces acting on an object have equal size and act in opposite directions
- **chemical reaction pathway:** (noun phrase) the energy pathway that transfers energy during a chemical reaction
- **chemical store:** (noun phrase) the energy store an object has if it possesses chemicals that can react
- **compression:** (noun) the process of forces pushing towards each other on an object
- **conclusion:** (noun) a summary and explanation of what has been found during an investigation
- **conservation of energy:** (noun phrase) a scientific law stating that energy cannot be created or destroyed
- **contact force:** (noun phrase) force that is caused to act on an object because it is touching a surface
- **contract:** (verb) to make smaller or shorter
- **control measure:** (noun phrase) a safety precaution that is put in place to reduce the likelihood of harm
- **deformation:** (noun) a change in shape or size as a result of applied forces
- **dissipate:** (verb) scatter or break up
- **elastic store:** (noun phrase) the energy store that stretched or squashed objects have
- **electrical pathway:** (noun phrase) the energy pathway that transfers energy when an electrical current flows
- **end-point analysis:** (noun phrase) a comparison of the amount of energy in energy stores at the start of an event and the end
- **energy diagram:** (noun phrase) diagram to show energy transfers between objects during an event (bar, box and arrow, Sankey)
- **energy store:** (noun phrase) a representation of where energy is 'kept' in an object
- **energy pathway:** (noun phrase) a description of the path by which energy is transferred
- **energy transfer:** (noun phrase) the relocation of energy from one place to another
- **explanation:** (noun) a statement that gives reasons for an observation to have occurred

- **extend:** (verb) to make longer or bigger
- **force:** (noun) an action that pushes or pulls on an object
- **force arrow:** (noun phrase) an arrow drawn to represent the force acting on an object, whose length and direction equate to that of the force
- **force-meter:** (noun) device used to measure force
- **free-body force diagram**: (noun phrase) drawing to show all forces acting on an object
- **friction force:** (noun phrase) force acting at points of contact between an object and a surface which resists the sliding motion
- **gravitational store:** (noun phrase) the energy store possessed by an object that is high up
- **gravity force:** (noun phrase) a non-contact force arising from an interaction between two objects
- **hazard:** (noun) something that is potentially harmful
- **heating pathway:** (noun phrase) the energy pathway that transfers energy when there is a temperature difference between places
- **hypothesis:** (noun) a statement about a research question, that suggests the result of the investigation
- **interaction:** (noun) when tow objects affect each other at the same time
- **interaction pair:** (noun phrase) the two forces that arise due to an interaction
- **kinetic store:** (noun phrase) the energy store that moving objects have
- **lift force:** (noun phrase) a contact force arising from an interaction between air moving and a curved object
- **limiting friction:** (noun phrase) the maximum friction that can occur between a surface and an object before it starts to slide
- **lubricant:** (noun) substance that helps to reduce friction forces acting between an object and a surface
- **magnetic force:** (noun phrase) a non-contact force arising from an interaction between magnets or a magnet and a magnetic material
- **mass:** (noun) a measure of how much matter something contains; it is measured in grams or kilograms
- **measurement result:** (noun phrase) a value attributed to the quantity being measured, reported at the end of the measurement process
- **mechanical pathway:** (noun phrase) the energy pathway that transfers energy when a force is exerted over a distance
- **newton:** (noun) name of the unit for the quantity ‘force’
- **non-contact force:** (noun phrase) force that can act at a distance between two objects
- **normal contact force:** (noun phrase) force arising from an interaction between two objects in contact and acting perpendicular to the surface
- **observation:** (noun) the act of noticing facts about things happening or existing in the world

- **opposing forces:** (noun phrase) forces that act in opposite directions
- **peer review:** (noun phrase) process where scientific research is checked for quality so that it can be trusted
- **quantity:** (noun) any property that can be given a size by counting or measuring
- **radiation pathway:** (noun phrase) for example, the energy pathway that transfers energy by lighting up an area
- **repeatability**: (noun) a measure of the closeness of experimental results by the same person using the same method
- **reproducibility:** (noun) a measure of the closeness of experimental results by different people or using different methods
- **resultant force:** (noun phrase) the single force that could replace all the forces acting on an object and have the same effect
- **risk:** (noun) likelihood anyone will come to harm if a planned action is carried out, and to what extent
- **stand, clamp and boss:** (noun phrase) apparatus used for support and stability when holding equipment at a desired height and position
- **scientific method:** (noun phrase) the application of an objective approach to collect high-quality data and use the data to explain phenomena
- **scientific model:** (noun phrase) a representation of reality that can be used to explain observations
- **system:** (noun) an object or a group of objects
- **systematic:** (adjective) organised, leaving no gaps, logical
- **temperature:** (noun) a measure of how hot or cold something is; it can be measured using a thermometer; its units are degrees Celsius, °C
- **tension:** (noun) the process of forces pulling away from each other on an object
- **thermal store:** (noun phrase) the energy store that objects that are hot have
- **thrust force:** (noun phrase) a contact force arising from an interaction between two objects which are free to move apart
- **unbalanced forces**: (noun phrase) when one force acting on an object is greater in size than another force and acts in the opposite direction
- **unit:** (noun) standard used to compare measurements
- **upthrust:** (noun) a contact force arising from an interaction between an object and a fluid in which it is or could be immersed
- **value:** (noun) an expression of the size of a quantity; may be a number or a number and a unit
- **variable:** (noun) a quantity or characteristic that can change
- **water resistance:** (noun phrase) a contact force arising from an interaction between a fluid and an object moving through it
- **weight:** (noun) the gravity force acting on an object exerted by a large body

Cells and organisation

The seven common processes of living organisms

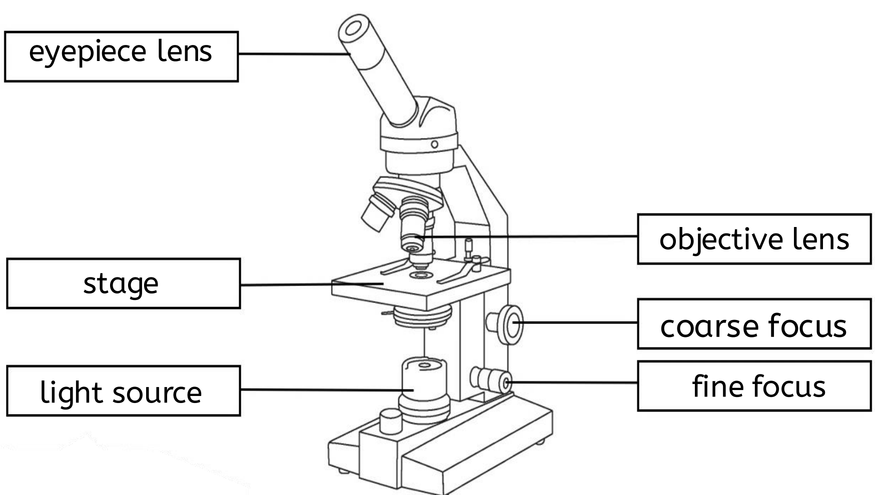
Process	Definition
movement	moving itself or its parts to change position or location
reproduction	producing offspring of the same kind
sensitivity	sensing and responding to changes in their surroundings
growth	increasing in size and repairing parts that are damaged
respiration	using oxygen and glucose (a sugar) to provide energy
excretion	removal of waste substances that are no longer needed
nutrition	using food or other nutrients like water to stay alive

Levels of organisation

cell → tissue → organ → organ system

cell	the smallest living building block of organisms
tissue	a group of similar cells that work together to perform a specific function
organ	a structure made up of different types of tissues that work together to carry out a specific function
organ system	a group of organs that work together to perform a common function

The parts of the microscope

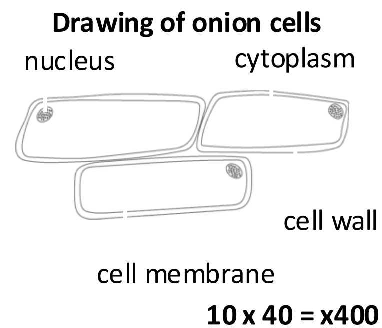


total magnification = eyepiece x objective

Using a microscope

1. Turn the **objective lens** to the **lowest magnification.**
2. Secure the slide on the **stage** using the clips.
3. Move the **stage** up to the **objective lens** by turning the **coarse focus.**
4. Look down the **eyepiece lens,** and move the stage away by turning the **coarse focus.**
5. To make the image sharper and clearer, turn the **fine focus.**
6. Rotate the **objective lens** to get a higher magnification.

Rules for scientific drawings of cells

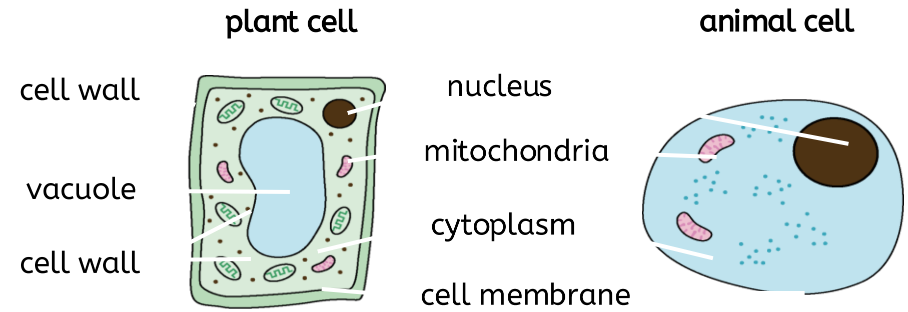


- smooth continuous lines
- large, with the same proportions
- stippling
- a few cells
- title and label
- total magnification

Cells and organisation

Cell organelles and their functions

nucleus	contains the genome that controls the cell's activities
cytoplasm	where the chemical reactions of the cell take place
mitochondria	where energy is released in respiration
cell membrane	controls which substances enter or leave the cell
vacuole	stores a watery sap
cell wall	strengthen and support the cell
chloroplasts	where light is trapped for photosynthesis to happen



Cells are three dimensional (3D).

The rate of diffusion

The rate of diffusion means how fast diffusion happens. Three factors that can affect the rate of diffusion are **temperature**, the **concertation** of particles and **surface area**.

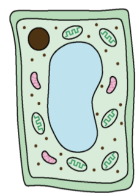
- The higher the temperature, the faster the rate of diffusion.
- The bigger the difference in the concentration of particles, the faster the rate of diffusion.
- The larger the surface area, the faster the rate of diffusion.

Needs of plants and animals for survival

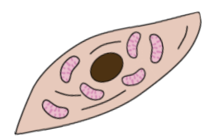
- Plants need, oxygen, water, light, carbon dioxide, minerals, a suitable temperature and space to grow.
- Animals, including humans, need water, oxygen, nutrients and the right temperature to survive.
- Plants and animals need these to keep all the cells that make them up alive and functioning properly.

Oxygen and **glucose** (a sugar) are needed for **respiration** to take place in cells, to provide energy to keep cells alive. These useful substances enter the cell by **diffusion.** Waste products of respiration are carbon dioxide and water. Waste products leave the cell by diffusion and need to be removed from cells to keep them alive.

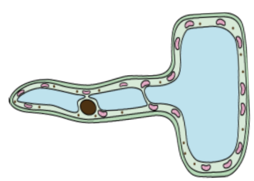
Specialised cells are adapted to carry out a specific function



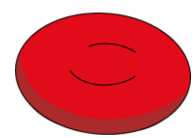
A **palisade cell** has **lots of chloroplasts** that absorb light for photosynthesis and a **column shape** to pack more in the leaf.



A **muscle cell** has **lots of mitochondria** to release energy for contraction.



A **root hair cell** has a **long cell membrane** that provides a large surface area to absorb more water and minerals.



A **red blood cell** has **no nucleus** for extra space to carry more oxygen.

Cells and organisation

Glossary

- **carbon dioxide:** (noun phrase) a gas present in the air, produced during respiration and essential for plant life
- **cell membrane:** (noun phrase) the part of the cell that controls which substances enter or leave the cell
- **cell wall:** (noun) made of fibres to strengthen and support the cell
- **cell:** (noun) the smallest living building block of organisms
- **chloroplasts:** (noun) the part of the cell where light is trapped for the plant to make food by photosynthesis
- **coarse focus:** (noun phrase) the larger focusing wheel on the microscope that moves the stage up and down to bring the object into general focus
- **concentration:** (noun) the number of particles present in a certain volume (space)
- **cytoplasm:** (noun) the part of the cell where the chemical reactions of the cell take place
- **diffusion:** (noun) the random spreading out of particles from an area of high concentration to an area of low concentration
- **excretion:** (noun) a process of living organisms – removal of waste substances that are no longer needed by the organism
- **eyepiece lens:** (noun) the lens at the top of the microscope that we look through for magnification
- **field of view:** (noun phrase) the area of a specimen that is visible through the eyepiece lens of a microscope at any given moment
- **fine focus:** (noun phrase) the smaller focusing wheel on the microscope (used after the coarse focus) to bring the object into sharp focus and clarity and remove any blurriness
- **function:** (noun) a special activity, purpose or job of a person or thing
- **genome:** (noun) a cell's set of instructions for growth, development and life processes. The genome stores genetic information that was inherited from parents
- **glucose:** (noun) a sugar that cells use with oxygen to provide energy through respiration
- **growth:** (noun) a process of living organisms – when an organism increases in size and repairs parts that are damaged

- **hierarchy:** (noun) a system that organises or ranks things in order
- **lens:** (noun) a curved glass that bends light to change the size of an image
- **light source**: (noun phrase) the part that emits light to allow you to see the object being viewed
- **magnify:** (verb) to make something appear larger
- **microscope:** (noun) an instrument used to magnify small objects, usually objects that cannot be seen with the naked eye
- **minerals:** (noun) nutrients from the soil that plants need for survival and growth
- **mitochondria:** (noun) the part of the cell where respiration takes place, providing energy for the cell's activities
- **movement:** (noun) a process of living organisms – when an organism moves itself or its parts to change position or location
- **muscle cells:** (noun phrase) specialised cells in animals that are adapted for contracting to create movement (usually movement of body parts)
- **muscle contraction**: (noun phrase) shortening of muscle cells to generate a pulling force
- **nucleus:** (noun) the part of the cell that contains the genome, which controls activities in the cell
- **nutrition:** (noun) a process of living organisms – when an organism uses food or other nutrients like water to stay alive
- **objective lens:** (noun) the lens located on a rotating wheel, just above the stage, that is used for magnification – there are usually three of them
- **observation:** (noun) the act of noticing facts about things happening or existing in the world
- **organ:** (noun) a structure made up of different types of tissues that work together to carry out a specific function
- **organ system:** (noun phrase) a group of organs that work together to perform a common function
- **organelle:** (noun) cell structures that have specific functions to perform in the cell
- **organism:** (noun) something that is living or used to be alive
- **oxygen:** (noun) a gas that is found in the air and is essential for the survival of most living organisms as it is used in the process of respiration
- **palisade cells:** (noun phrase) specialised cells in plant leaves that are adapted for photosynthesis, which allows the plant to make food
- **photosynthesis**: (noun) the chemical reaction in which plants use carbon dioxide and water to make glucose and oxygen using energy transferred by light
- **qualitative data:** (noun phrase) non-numerical information, such as detailed descriptions

- **quantitative data:** (noun phrase) information that is numerical
- **red blood cells:** (noun phrase) specialised cells in animals that are adapted for transporting oxygen throughout the body
- **reproduction:** (noun) a process of living organisms. when an organism produces offspring of the same kind
- **respiration:** (noun) a process of living organisms – a chemical reaction that takes place in all living cells that releases energy
- **root hair cells:** (noun phrase) specialised cells in plant roots that are adapted for absorbing water and minerals from the soil
- **selectively permeable:** (adjective phrase) something that has holes in it to allow the movement of only some substances through while preventing the movement of others
- **sensitivity:** (noun) a process of living organisms – when an organism senses and responds to changes in its surroundings
- **specialised:** (adjective) adapted to suit a specific purpose; when cells or tissues become adapted to carry out their specific function
- **specimen:** (noun) a sample of an object or organism used for scientific examination or study
- **stage:** (noun) the part of the microscope where we place the object or sample that we want to observe under the microscope
- **surface area:** (noun phrase) the entire outer area of an object or shape
- **temperature:** (noun) a measure of how hot or cold something is; can be measured using a thermometer – its unit is degrees Celsius (°C)
- **tissue:** (noun) a group of similar cells that work together to perform a specific function
- **vacuole:** (noun) where the cell sap is found in plant cells. Sap is a fluid containing water, sugars and other substances