Half term 1

Subject:Science

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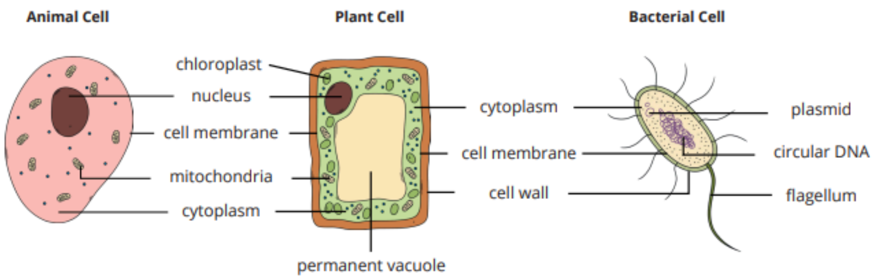
KS3 Cells and Organisation **Knowledge Organiser**



The components of a cell each have different functions.

Sub-Cellular Structure	Function
nucleus	Controls the activities of the cell. It contains genetic material (DNA), which is packaged into structures called chromosomes.
circular DNA	The DNA of bacteria found free in the cytoplasm.
mitochondria	Contain the enzymes needed for aerobic respiration, which releases energy for the cell.
chloroplasts	Contain a pigment called chlorophyll, which absorbs light to provide energy for photosynthesis.
cell wall	Helps to strengthen the cell and provides support for the plant.
cell membrane	Controls the movement of substances into and out of the cell.
cytoplasm	A jelly-like substance that fills the cell, where most chemical reactions occur.
flagellum	A tail-like structure that allows bacteria to move around.
permanent vacuole	Filled with cell sap to keep the cell rigid to support the plant.
plasmids	Plasmids are small rings of DNA that code for specific features, such as antibiotic resistance.

Different cell types contain different sub-cellular structures.

Sub-Cellular Structure	Animal Cell	Plant Cell	Bacterial Cell
nucleus	✓	✓	×
circular DNA	×	×	✓
mitochondria	✓	✓	×
chloroplasts	×	✓	×
cell wall	×	✓	✓
cell membrane	✓	✓	✓
cytoplasm	✓	✓	✓
flagellum	×	×	✓
permanent vacuole	×	✓	×
plasmids	×	×	✓

Levels of Organisation

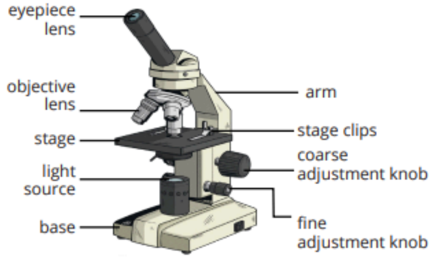
A **cell** is the smallest unit of a living organism. It contains structures needed to carry out life processes.

A **tissue** is a group of cells of the same type.

An **organ** is a group of different tissues working together to carry out a job.

An **organ system** is a group of different organs working together to perform a particular function.

Parts of a Light Microscope



Using a Light Microscope

- Plug in the microscope and turn on the light.
- Place the slide on the stage and hold it in place with the stage clips.
- Turn to the objective lens with the lowest magnification.
- Look down the eyepiece lens and use the adjustment knobs to focus the specimen.
- Increase the magnification by turning to a higher power objective lens, then use the fine adjustment knob to bring the cells back into focus.

Organ System Functions

Organ System	Function
musculoskeletal system	Muscles and bones working together support and move the body.
reproductive system	Produces sperm (males) and eggs (females). In females, this is where the foetus develops.
respiratory system	Takes in oxygen from the air and removes carbon dioxide from blood.
immune system	Protects the body against infections.
digestive system	Breaks down and absorbs food molecules.
circulatory system	Transports substances around the body.

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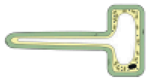
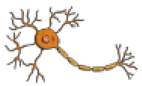
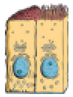
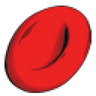
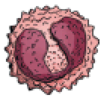
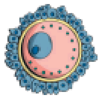
Specialised Cells

Each function carried out by the organism is performed by different cells. Each type of cell has slightly different features.

Name	Diagram	Functions	Adaptions
root hair cell		To absorb water and minerals from the soil.	Long protrusion fits between grains of soil and provides a large surface area for the absorption of water and minerals into the cell.
palisade cell		To carry out photosynthesis and make food for the plant.	Lots of chloroplasts to absorb light energy for photosynthesis. Its tall, long shape gives the cell a large surface area to maximise the absorption of light.
sperm cell		To travel to and fuse with an egg cell for fertilisation.	Long tail for movement to the egg and lots of mitochondria to release energy to allow the sperm to move.
muscle cell		To help the body to move.	Contains bands of protein that change shape to contract and relax the muscle. Lots of mitochondria to provide energy for muscle contraction.
nerve cell		To carry nerve impulses around the body.	Long fibres carry electrical impulses up and down the body and branching dendrites at each end connect to other nerves or muscles.
ciliated epithelial cell		To move mucus away from the lungs.	Tiny hairs called cilia to help waft mucus along the airways. Lots of mitochondria release energy for the cilia to move.
red blood cell		To transport oxygen around the body.	Biconcave shape increases the surface area for the diffusion of oxygen. No nucleus so that there is more room for haemoglobin, which binds oxygen molecules.
white blood cell		To fight pathogens which cause disease.	Some can change shape to squeeze out of blood vessels and engulf pathogens. Some can produce antibodies or antitoxins.
egg cell		To be fertilised by the sperm cell.	The cytoplasm contains nutrients for the developing embryo. The membrane changes after fertilisation to stop any more sperm getting in.

The Skeleton

The skeleton has several functions:

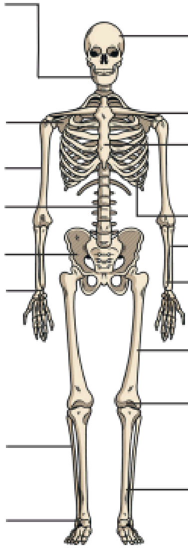
Support – The skeleton provides a frame to hold your body upright and keep your organs in place.

Protection - Bones are hard and strong to protect important organs such as the heart and the brain.

Movement - Your bones and muscles work together to allow your body to move.

Making blood cells – Some bones contain a soft tissue called bone marrow. Red blood cells and white blood cells are made in the bone marrow.

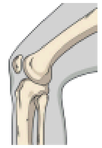
The adult body contains around 206 bones. Some are shown below:



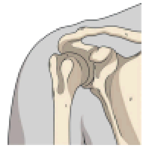
Joints

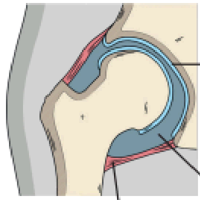
Joints are found where bones meet. Sometimes these joints are fixed but most joints are flexible to allow the body to move.

A **hinge joint** allows backwards and forwards movements. Knees and elbows are hinge joints.



A **ball and socket joint** allows movement in all directions. Shoulders and hips are ball and socket joints.





Cartilage is a strong, smooth tissue that covers the ends of the bones to protect them from damage.

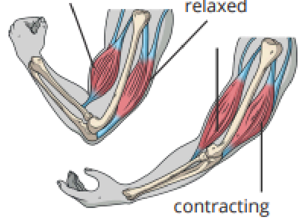
Ligaments hold the bones together.

Fluid in the joints keeps the cartilage slippery to reduce friction.

Muscles

Muscles can't push, they can only pull.

A pair of muscles that work together are called **antagonistic muscles.**



This combination of muscles, bones and joints making our bodies move is called **biomechanics.**

KS3 States of Matter **Knowledge Organiser**

Three States of Matter

There are three main states of matter: **solid**, **liquid** and **gas**.

All matter is made up of tiny parts called particles. How they are arranged determines the state of matter and the properties of the material.

	Solid	Liquid	Gas
particle model diagram			
particle arrangement	regular structure no space between particles	irregular structure very little space between particles	irregular structure large space between particles
volume and shape	fixed volume fixed shape	fixed volume shape changes to fill bottom of container	volume increases to fill capacity shape changes to fill capacity
able to flow	no (forces between particles are very strong and hold them in fixed positions)	yes (forces between particles are weak and particles slide over one another)	yes (forces between particles are very weak and particles move randomly and rapidly)
density	high cannot be compressed (particles are already tightly packed)	high cannot be compressed (particles are already tightly packed)	low can be compressed (particles are forced closer together)
particle energy levels	low (particles vibrate around a fixed point only)	moderate (particles can move and flow but slowly)	high (particles moving rapidly and freely)
examples	wood, metal, stone, plastic	water, milk, bleach, acid	air, oxygen, carbon dioxide

matter - any substance that has mass and takes up space (volume)

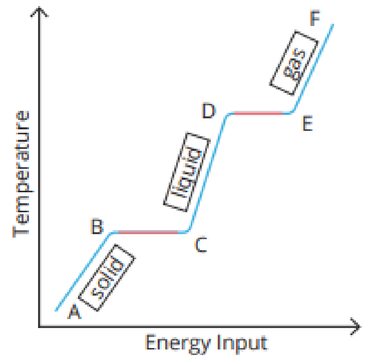
properties – characteristics or features

density - the mass of a substance per volume **(density = mass ÷ volume)**

Melting and Boiling Points

B – C When a solid substance is heated, the particles gain energy and begin to move around more.

When a solid reaches its melting point, the particles begin to break off from the uniform structure and are free to flow. The solid melts into a liquid.



D – E When a liquid substance is heated, the particles gain energy and begin to move around more. When a liquid reaches its boiling point, evaporation occurs and the liquid boils. Liquid particles break free and evaporate into a gas.

Every pure substance has a specific melting and boiling point. The purity of a substance can be checked for using knowledge of these specific melting and boiling points.

For example, pure water boils at 100°C whereas pure ethanol boils at 78°C.

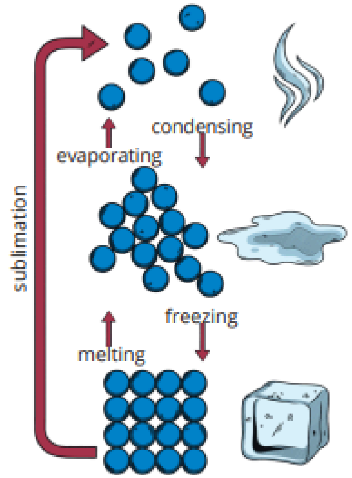
Ice melts at 0°C, and iron has a melting point of 1538 °C.

If a substance contains any impurities (dissolved solids), then its melting and boiling point will extend over a range of temperatures.

Changes of State

The arrangement of particles changes when the substance changes state.

Sublimation is when a solid changes to a gas, without going through the liquid phase.

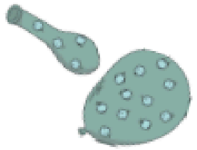


Gas Pressure

Gas pressure is the force exerted by the gas particles on the wall of the container it is in. The more frequently air particles hit the walls, the higher the pressure rises.

Gas pressure is affected by:

- amount of gas;
- volume of container;
- temperature.



High gas pressure can be created by a high volume of particles in a small space, or with a high temperature.

An inflated balloon will shrink if placed in ice water and expand when placed in hot water.

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Dissolving

Dissolving is the process of mixing a **soluble solute** into a solvent until it is fully incorporated to create a **solution**.

Solutes dissolve faster with increased **temperature**, greater **surface area** and **stirring**.

soluble – able to be dissolved

solvent – the substance that something dissolves in

solute – the substance that is dissolved

solution – a liquid containing a dissolved solid or another liquid

Compounds and Mixtures

Compounds contain two or more different **elements chemically bonded** together, for example, carbon dioxide contains carbon and oxygen.

Mixtures contain substances that are **not chemically bonded**. Mixtures can be **separated** easily.

A **pure** element or compound contains only one substance, with no other substances mixed in. Impure materials are mixtures of elements, compounds, or both.

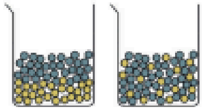
Examples of different types of mixtures:

	gas	liquid	solid
gas	air		
liquid	aerosols and foams	solutions, e.g. beer	
solid	smoke	solutions, e.g. salt water	metal alloys

Diffusion

When a **liquid** or **gas** is mixed into another, the particles will flow and move about until they are **evenly spread** throughout.

The particles move from an area of high concentration to an area of low concentration.



This process is called **diffusion**.

The rate of diffusion is affected by:

- concentration gradient;
- temperature.

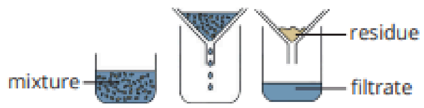
Diffusion will occur at a faster rate when the concentration gradient is steep, or the solution is at a higher temperature.

Separating Rock Salt

Rock salt is a mixture of sand and salt. Sand is **insoluble** and salt is soluble, which means they can be separated easily **using** several separation **techniques**.

1. Create a **solution** of the rock salt with water. Only the salt will **dissolve** into the water.
2. **Filter this solution**. The insoluble sand will collect as **residue** in the filter paper. The salt will pass through, dissolved in the water. The **filtrate** collected is a salt water solution.
3. Heat the salt water solution, **evaporation** or **simple distillation** can be used to collect either the salt crystals or the water.

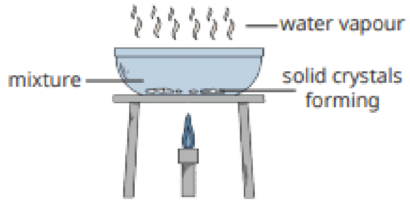
Filtration



This method is used to separate an **insoluble solid** from a **liquid**. The solution is passed through a filter paper and a funnel.

The **residue** remains in the filter paper, and the part which passes through the filter is called the **filtrate**. A mixture of sand and water can be separated by filtration.

Evaporation



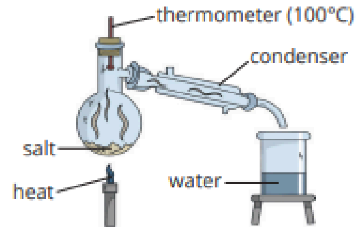
This method is used to separate a **soluble solid** from a **solvent**. The solution is heated, the liquid evaporates and the solid crystallises.

If the **evaporation** and **crystallisation** occur quickly, the crystals formed will grow rapidly and will be small.

If it can occur slowly, such as on a windowsill, then the crystals will have more time to form and be larger in size.

A solution of salt water can be separated using the evaporation method.

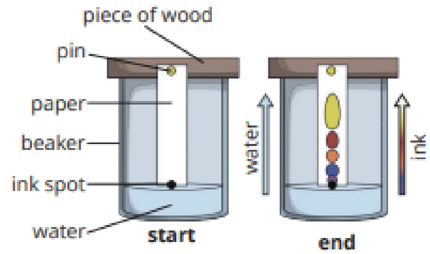
Distillation



This method is used to separate a solvent from a solution. It can separate the same type of solution as in evaporation, e.g. salt water, but retrieving the other component of the mixture.

As the water is **heated** and evaporates from the flask, it flows upwards and into the **condenser**. The condenser is surrounded by cool water which causes the water vapour to **condense** back into a liquid, this flows down the tube and into the beaker. The water collected in the beaker is **distilled water**.

Chromatography



Chromatography can be used to separate, for example, different dyes in ink. The colours are separated because they have varying **solubilities**.

The separate inks are carried different distances up the **stationary phase** (filter paper) by the **mobile phase** (solvent).

Chemical and Physical Changes

When a **chemical reaction** occurs, there is a **chemical change**. New **compounds** or different **elements** are formed in the reaction.

Physical changes do not form any new chemical substances. The substance simply **changes physical state**, for example, from a solid to a liquid, or a liquid to a gas.