



KNOWLEDGE ORGANISER

2021-22

Science HT2

Key Terms

Organisms—Living thing

Organ—collection of tissues which carry out specific functions in organisms

Cell—building block of all organisms

Tissue—collection of cells which make up a part of an organ

Microscope—instrument consisting of an optical part that magnifies the image of an object .

Transplant—an operation in which a bodily organ is transplanted.

Specialised Cell—a cell with a specific role and different features so it can carry out its function.

Functions Of Cells

Part	Function	Found in
Cell membrane	Controls the movement of substances into and out of the cell	Plant and animal cells
Cytoplasm	Jelly-like substance, where chemical reactions happen	Plant and animal cells
Nucleus	Carries genetic information and controls what happens inside the cell	Plant and animal cells
Mitochondria	Where most respiration reactions happen	Plant and animal cells
Vacuole	Contains a liquid called cell sap, which keeps the cell firm	Plant cells only
Cell wall	Made of a tough substance called cellulose, which supports the cell	Plant cells only

Animal and Plant Cells

Humans are **multicellular**. That means we are made of lots of cells, not just one cell. The cells in many multicellular animals and plants are **specialised**, so that they can share out the processes of life. They work together like a team to support the different processes in an organism.

MRS GREN

Living organisms have certain life processes in common. There are seven things that they need to do to count as being alive. The phrase **MRS GREN** is one way to remember them:

- **Movement** - all living things move, even plants
- **Respiration** - getting energy from food
- **Sensitivity** - detecting changes in the surroundings
- **Growth** - all living things grow
- **Reproduction** - making more living things of the same type
- **Excretion** - getting rid of waste
- **Nutrition** - taking in and using food

Light Microscope

A light microscope uses a series of lenses to produce a magnified image of an object:

1. the object is placed on a rectangular glass slide
2. the slide is placed on a stage with a light source below
3. light shines through the object and into the objective lens
4. the light passes through the eyepiece lens and from there into your eye

Cells Under a Microscope



Cells

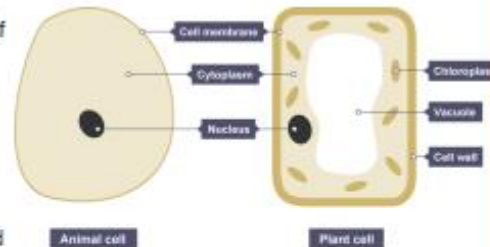
Animal cells usually have an irregular shape, and plant cells usually have a regular shape. Cells are made up of different parts.

Animal cells and plant cells both contain:

- cell membrane
- cytoplasm
- nucleus
- mitochondria

Plant cells also contain these parts, which are not found in animal cells:

- cell wall
- vacuole
- chloroplasts



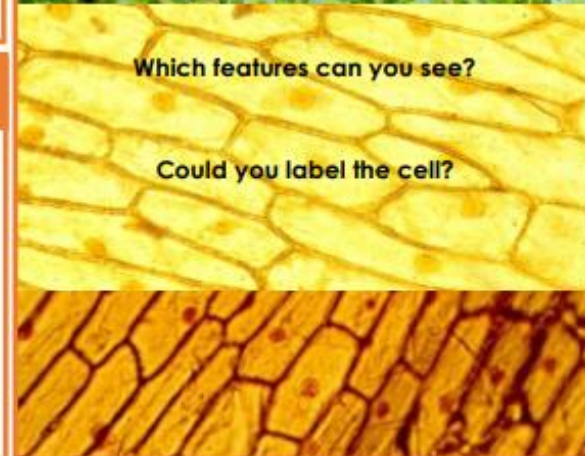
Organ Systems

An **organ system** is made from a group of different organs, which all work together to do a particular job. Here are some examples of organ systems:

- circulatory system
- respiratory system
- digestive system
- nervous system
- reproductive system

Which features can you see?

Could you label the cell?



Key vocabulary

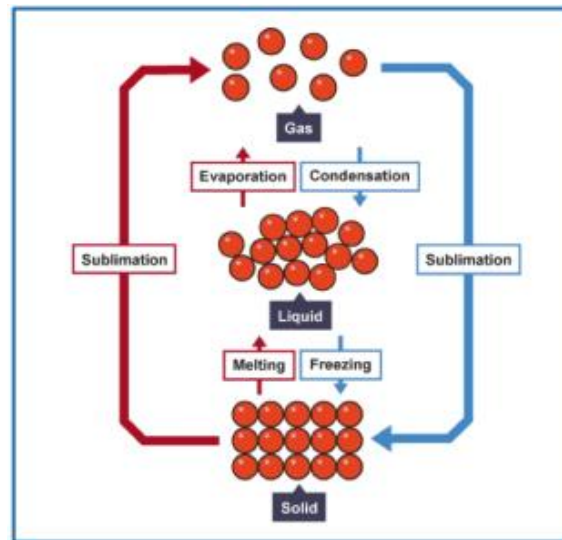
Particle	The general term for a small piece of matter.
State of Matter	The distinct forms in which matter can exist (solid, liquid, gas)
Solid	A substance with a fixed shape and volume.
Liquid	A substance with a fixed volume but not a fixed shape.
Gas	A substance that does not have a fixed shape or volume.
Change of State	The change of a substance from one physical form to another.
Melting	The change of state when a solid changes to a liquid.
Freezing	The change of state when a liquid changes to a solid.
Condensing	The change of state when a gas changes to a liquid.
Evaporation	The change of state when a liquid changes to a gas.
Density	The amount of mass that 1cm ³ of a substance has.
Density (formula)	Density = mass ÷ volume $p = m \div v$
Dense	Something which is heavy for its volume.

Further Reading

<https://www.bbc.com/bitesize/guides/z2wmxnb/revision/1>
<https://www.bbc.com/bitesize/articles/zqp7p3>



States of Matter

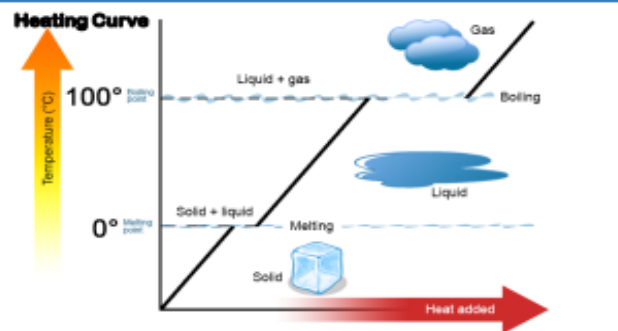


Forces between particles:

Solid: There are strong forces of attraction between the particles in a solid. Therefore, particles can only vibrate in a fixed position.

Liquid: There are weaker forces of attraction between the particles in a liquid. Therefore, the particles are close together, and are able to move around each other.

Gas: The forces of attraction between the particles are overcome. Therefore, the particles are far apart and move quickly in all directions.

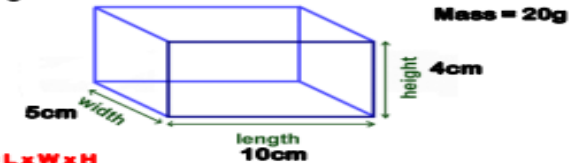


Solid Liquid Gas

Solid	Liquid	Gas
The particles vibrate in a fixed position.	The particles are close together and move around each other.	The particles are far apart and move quickly in all directions.
The particles cannot move from place to place.	The particles are arranged in a random position.	The particles are arranged in a random way.
Particles have a fixed shape and cannot flow.	The particles flow and take the shape of the bottom of their container.	The particles flow and completely fill their container.
The particles cannot be compressed (squashed)	The particles cannot be compressed.	The particles can easily be compressed.

Calculating Volume

Calculating Volume:



Volume = L x W x H
Volume = 10cm x 5cm x 4cm
Volume = 200cm³.

Calculating Density:
Density = Mass ÷ Volume
Density = 20g ÷ 200cm³
Density = 0.1g/cm³

Density:

1kg of a gas has a larger volume than 1kg of a solid. There is empty space between particles in a gas, but in a solid, they're tightly packed together.

Key Vocabulary

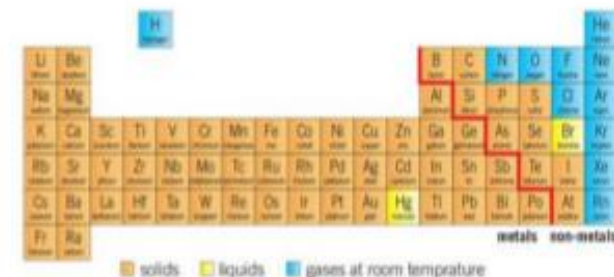
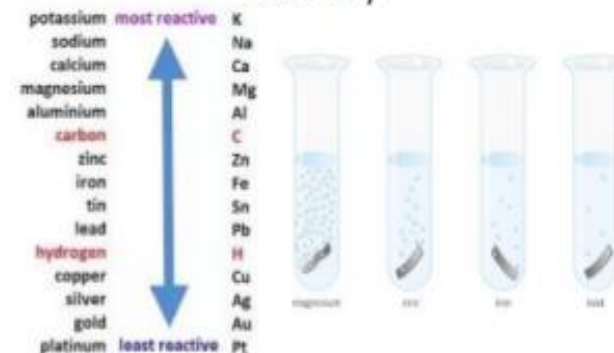
Malleable	Can be bent or hammered into shape without shattering
Ductile	Capable of being stretched into a thin wire without becoming weaker
Sonorous	Produces a ringing sound when struck
Conductor	Allows heat and electricity to travel through it easily
Reactivity	The tendency of a substance to undergo chemical reaction
State Symbol	State symbols give more information about the reactants and products e.g. s, l, g, aq
Displacement	When a more reactive metal replaces a less reactive metal in a compound
Metal	A solid material which is typically hard, shiny, malleable, and ductile, with good electrical and thermal conductivity
Non-metal	An element not having the character of a metal
Lustrous	Shiny
Effervescence	Giving off a gas or bubbles
Brittle	Shatter when bent or hit

Quick Questions

Where on the Periodic table are metals found?	On the left, from aluminium, germanium, antimony and polonium
Do metals have high or low densities?	Typically, they have high densities, though a few can float on water
What do the different state symbols stand for?	(s) = solid (l) = liquid (g) = gas (aq) = aqueous (in solution)
What is the general equation for the reaction between metals and acids?	Meal + Acid → Salt + Hydrogen
How do we name salts?	The first part of the name is from the metal, the second from the acid
What are the salt names for common acids?	Hydrochloric → chlorides Nitric → nitrates Phosphoric → phosphate
What is formed when a metal reacts with oxygen?	A metal oxide e.g. magnesium oxide, calcium oxide
How can you compare the reactivity of metals?	Either compare the vigour of their reactions with acids or water, or through displacement reactions
What happens in a displacement reaction?	The more reactive metal is about to displace the less reactive metal in the compound

Helpful Images

Reactivity series and experiments showing reactivity



- magnesium and sulfuric acid → magnesium sulfate
- aluminium and hydrochloric acid → aluminium sulfate
- zinc and nitric acid → aluminium chloride
- aluminium and sulfuric acid → zinc nitrate
- lead and hydrochloric acid → lead chloride



Gathering The Evidence

Astronomer	A scientist that studies space.
Early Astronomers	Could only use their eyes to make observations.
Ptolemy	Egyptian astronomer (90-168) Proposed a model with the Earth in the centre and the Moon, Sun and planets orbiting the Earth.
Nicolaus Copernicus	Polish astronomer (1473-1543) Suggested the Earth and other planets move in circles around (orbit) the Sun. It was not accepted straight away. However observation made by Galileo using one of the first telescopes provided more evidence to support it.
Reaction to Copernicus' Model	
Johannes Kepler	German astronomer (1571-1630) Proposed the model used today. The Sun is at the centre with the planets moving around in elliptical orbits. Moons orbit planets.

The Model of the Solar System



The Moon appears different shapes at different times due to its position relative to the Earth and Sun.



Phases of the Moon

Allowed scientists to investigate space more by collecting samples and taking readings on other planets.

Spacecraft

Seasons

Summer	Longer days than nights, Sun high in the sky.
Winter	Longer nights than days, Sun not very high in the sky.
Cause of Seasons	Due to the tilt of the Earth's axis by 23.5°.
Causing Summer	When the northern hemisphere is tilted towards the Sun it is summer in the UK.
Causing Winter	When the northern hemisphere is tilted away from the Sun it is winter in the UK.
Causing Seasons Diagram	
Summer Sun	Because the Sun is higher in the sky in summer the heat is more concentrated, making it feel warmer

Beyond the Solar Systems

Constellation	Pattern of stars
Stars	Huge balls of gas that give out large amounts of energy. The Sun is a star.
Stars At Night	Appear less bright than the Sun because they are further away.
Galaxies	Large groups of stars.
Milky Way	The galaxy our Sun is in.
Universe	Made up by all of the millions of galaxies.
Light Year	Measurement of distance- the distance travelled by light in 1 year. Approximately ten million million kilometres.
Proxima Centauri	Nearest star to the Sun, about 4.22 light years away.

Magnetic Earth

Compass	A magnet that points north.
North-Seeking pole	The end of a bar magnet that points north- shortened to north pole.
South-Seeking pole	The end of a bar magnet that points south- shortened to south pole.
Attract	When two magnets are pulled together. Opposite poles will attract each other.
Repel	When two magnets are pushed apart. The same poles will repel each other.
Magnetic Field	The area around a magnet where it has an effect. Can be found using iron filings or a small compass.
Magnetic Field Diagram	
Magnetic Field Strength	Strongest closest to each pole, the field gets weaker as you get further from the magnet.
Magnetic Field Direction	The direction of a magnetic field is always from the north pole towards the south pole.

Gravity In Space

Gravity	Force exerted by all objects with mass trying to pull other objects towards it.
Bigger Mass	The bigger the mass of an object, the stronger the force it exerts.
Weight	The force of gravity pulling on you. Measured in Newtons (N)
Gravitational Field	The space around the Earth where gravity attracts things.
Gravitational Field Strength (g)	At the surface of the Earth it is about 10 newtons per kilogram (N/kg).
Weight Formula	Weight = mass x g
Gravity and Orbits	The force of gravity keeps the Earth in its orbit of the Sun.
Satellite	Anything that orbits a planet.
Natural Satellite	Moons are examples of natural satellites.
Artificial Satellite	Can be put into orbit around Earth for photographing / transmitting TV programs etc

Early Atmosphere Evolving

Volcanoes produced Carbon dioxide, nitrogen (and a bit of methane and ammonia)



Oceans formed

From condensed water. Carbon dioxide dissolved in the oceans. Carbonates precipitated (turned into solid bits) to form sediments.

Green plants and algae

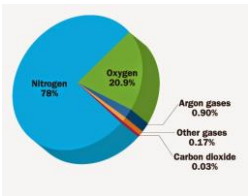
Took in CO₂ and released O₂ in photosynthesis.

$$6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow{\text{Photosynthesis}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$$

carbon dioxide + water → glucose + oxygen

Sedimentary rocks and fossil fuels were formed:

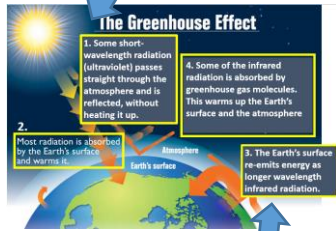
Decreased the CO₂ levels



Respiration

Carbon dioxide
Methane
Water Vapour

Short wavelength doesn't interact with the gases



Longer wavelength emitted does interact with the gases

Human activities increase the levels of CO₂ and CH₄

Human activities increase the levels of CO₂ and CH₄

- CO₂
- burning fossil fuels
 - Deforestation
- Methane
- Cows (and rice paddies)
 - landfill

Effects of Climate Change

- Rising sea levels
- Droughts
- Extreme weather events
- Changes in wildlife distribution

Why do some people deny humans cause climate change????

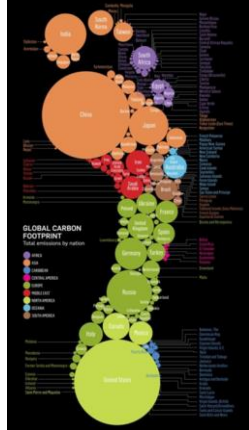
- Difficult to model.
- Models are simplified.
- Media can be biased.
- MUST check the evidence is PEER REVIEWED

Carbon Footprint

Carbon footprint: 'Total amount of CO₂ and other greenhouse gases emitted over the full life cycle of a product, service or event'

Solution: Reduce carbon footprint (emissions of CO₂ and methane)

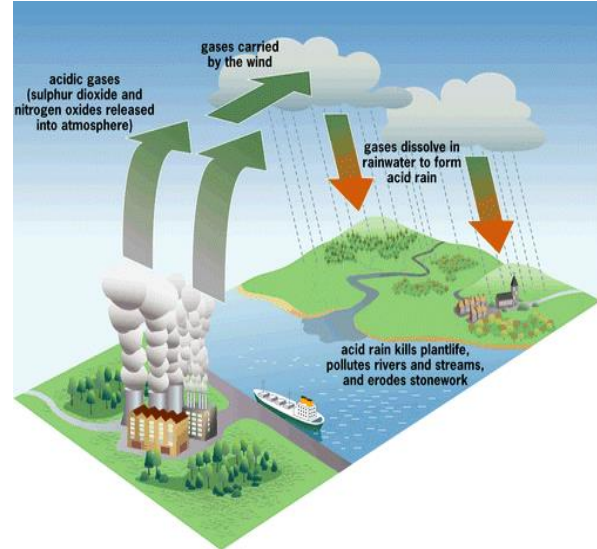
- Use less fossil fuels
- Carbon capture and storage
- Eat less meat
- Send less food waste to landfill



Atmospheric Pollutants

Gases released in combustion of fossil fuels and their effects:

Gases	Released when	Effects caused
Carbon dioxide	All fossil fuels burn	Global warming
Water vapour	All fossil fuels burn	None
Carbon monoxide	Incomplete combustion of fuels (not enough O ₂)	Poisonous gas
Solid particulates	Solid fuels burn incompletely	Global dimming Asthma
Sulphur dioxide	Coal burns (sulphur is an impurity in coal)	Acid rain Respiratory problems
Nitrous oxides	Nitrogen in air reacts with oxygen at high temperatures	Acid rain Respiratory problems



Lesson Sequences

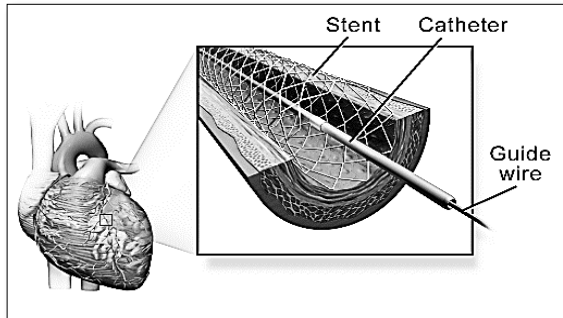
- Health and disease
- Non-communicable disease
- Cardiovascular disease
- Pathogens
- Spreading disease
- Preventing infection
- The immune system
- Antibiotics

Health & Disease

Physical health	Being free from disease, active, fit, sleeping well and no substance abuse.
Mental health	Feeling good about yourself and being free of conditions such as depression and anxiety.
Social health	Having healthy relationships, loving and being loved.
WHO	World Health Organization – part of the UN responsible for monitoring global health.
Disease	Any problem with the body not caused by injury.
Communicable diseases	Diseases caused by pathogens, can be passed on.
Non-communicable diseases	Diseases caused by genes or, lifestyle. Cannot be passed on.
Correlated diseases	Getting one disease increases your chance of another due to diseases weakening organ systems, damaged immune system, weaker defences.

Cardiovascular Disease

Obesity	Being overweight to the extent that your health is at risk.
BMI	Body mass index, over 30 = obese.
BMI calculation	$BMI = \frac{mass (kg)}{height^2 (m^2)}$
Problems with BMI	Someone with a lot of muscle could have high BMI without being obese.
Waist:hip ratio	The ratio of waist width to hip width. Over 0.9 (women) or 1.0 (men) = obese.
Calculating waist:hip ratio	$Waist: hip ratio = \frac{waist width}{hip width}$
Cardiovascular disease	Harmful substances in blood build up in the arteries around the heart. Blockages can form leading to heart attacks.
Stents	Used to treat cardiovascular disease. A tube of metal mesh is fed into the narrowed artery and opened up, holding the artery open.
Treating heart disease with lifestyle	More exercise and a better diet can treat cardiovascular disease, but this takes time.

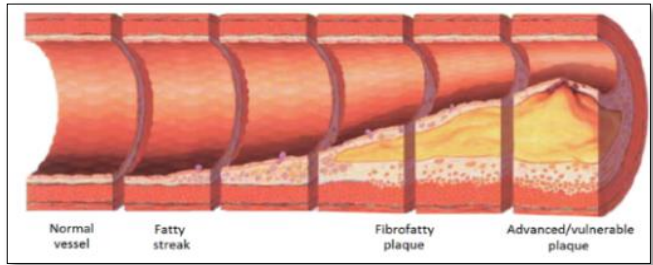


Pathogens

Pathogen	Microorganism that causes disease.
Types of pathogen	Bacteria, virus, protist, fungi.
Tuberculosis	Bacteria. Serious lung damage, bloody cough, fever.
Cholera	Bacteria. Severe life-threatening diarrhoea.
Chalara ash dieback	Fungi. Kills the leaves of ash trees, killing the tree.
Malaria	Protist. Sickness, fever and weakness.
Haemorrhagic fever	Virus, eg Ebola. Liver and kidney damage, internal bleeding.
HIV	Human immunodeficiency virus attacks white blood cells, causing AIDS.
AIDS	Acquired Immunodeficiency Syndrome. Weakened immune system making simple infections deadly. Caused by HIV.
Opportunistic pathogens	Pathogens that live in us causing no harm, but become dangerous when given the opportunity, such as <i>Helicobacter pylori</i> which cause stomach ulcers.

Spreading Disease

Airborne	Spreading through the air, such as colds and flu in infected droplets of saliva, and chalara ash dieback by fungal spores.
Waterborne	Spreading through contaminated water such as cholera.
Oral route	Eating food contaminated with a pathogen.
Vectors	Animals that spread pathogens in their bites, such as malaria that is spread by mosquitoes.
Bodily fluids	Spreading through contact with infected body fluids such as blood or semen, for example, HIV.





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