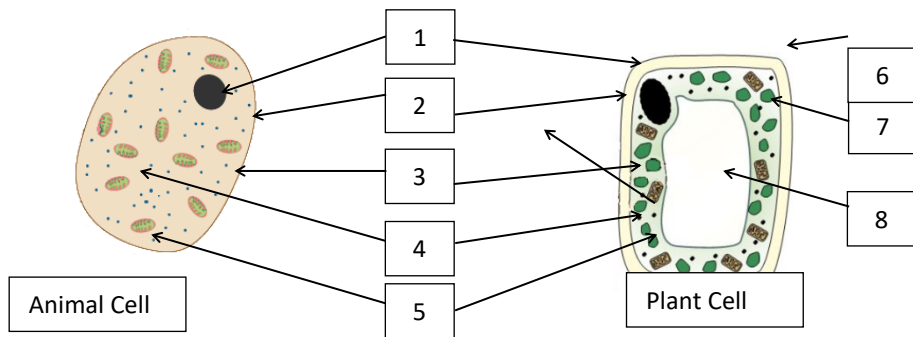


Science: Cell Biology

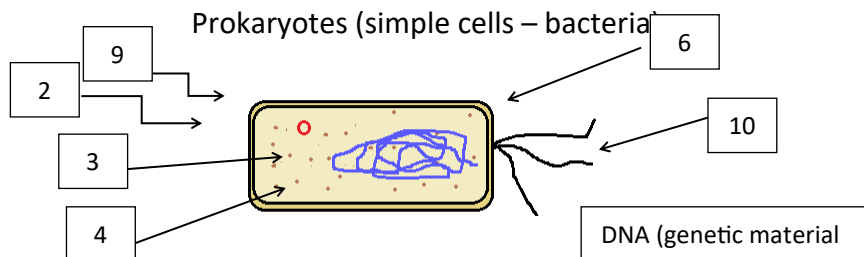
Key Words

	Organelle	Function
1	Nucleus	Controls the cell Contains genetic material
2	Cell membrane	Controls the exchange of substances in and out of the cell
3	Ribosomes	Protein synthesis
4	Cytoplasm	Where chemical reactions occur
5	Mitochondria	Releases energy from aerobic respiration
6	Cell wall	Supports the cell
7	Chloroplasts	Where photosynthesis occurs
8	Vacuole	Contains cell sap
9	Plasmid	Circular ring of DNA
10	flagella	Provides movement for single celled organisms

Eukaryotes (complex cells)



Prokaryotes (simple cells – bacteria)



Specialised Cells

Cell	Function	Adaptation
Sperm cell	Fertilised the egg cell	Tail to swim to egg Many mitochondria to release energy
Nerve cell	Carry electrical impulses around the body	Long to reduce the number of synapses Lots of branches to connect to many cells
Muscle cell	Contracts and relaxes to cause movement	Many mitochondria to release energy Contains protein fibres that can contract
Root hair cell	Absorbs water and minerals from the soil	Large surface area to increase absorption No chloroplasts to allow a larger vacuole
Palisade cell	Where most photosynthesis occurs	Many chloroplasts, so more photosynthesis Rectangular shape to fit more cells along the upper surface of the leaf
Phloem cell	Transports sugars, ions and other minerals around the plant	Many mitochondria to release energy for active transport Perforated ends so cytoplasm of adjacent cells connect speeding up exchange
Xylem cell	Transports water from the root to the leaves.	Contains lignin to prevent water loss Hollow so water and minerals can travel through

Comparing microscopes

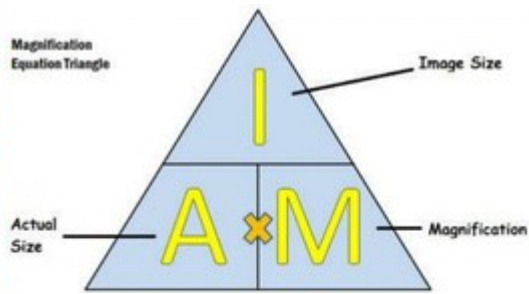
Type	Advantages	Disadvantages
Light Microscope	Can see colours Cheaper Can see live specimens	Lower magnification Lower resolution
Electron Microscope	Higher resolution Higher magnification	Cannot see colour Only see dead specimens

Conversions:



Science: Cell Biology

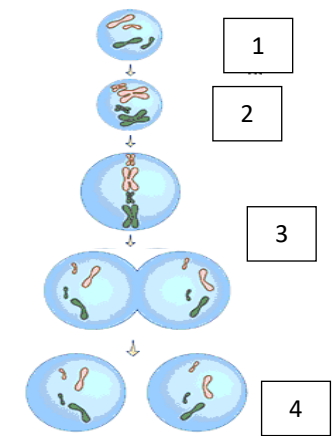
Calculating magnification



1. Magnification = image size ÷ actual size.
2. Actual size = image size ÷ magnification.
3. Image size = actual size x magnification.

Stages of the cell cycle (mitosis in lilac)

1	Organelles are copied and DNA condenses into chromosomes
2	Chromosome number doubles and nuclear membrane dissolves
3	Chromosomes line up along the centre and duplicate chromosomes are pulled apart
4	Cell membrane closes around each set of chromosomes (cytokinesis) and 2 identical cells are formed



Cell differentiation and stem cells

Differentiation	When a stem cell changes into a specialised cell
Stem cells	Cells that have not differentiated yet
Adult stem cells	Stem cells found in body tissues such as skin and bone marrow
Embryonic stem cells	Stem cells from the embryo that have the potential to turn in to any type of specialised cells
Meristems	Tips of the roots and shoot where the plant stem cells are found
Chromosomes	Condensed strand of DNA containing the genes for characteristics (23 pairs in humans)
Cell cycle	The process where the cell divides
Mitosis	A type of cell division that produced 2 identical diploid daughter cells
Therapeutic cloning	Creating a cloned embryo to have the same genetics as the patient to treat genetic diseases.

Types of exchange

Key Word	Definition	Example
Diffusion	Movement of solutes from a high to a low concentration across a semi-permeable membrane	Oxygen and carbon dioxide exchanged in the lungs
Osmosis	Movement of water from a low to high concentration across a semi-permeable membrane	Water moving into the blood in the large intestine or into the roots of a plant
Active transport	Movement of solutes from a low to a high concentration against a concentration, requiring energy	Minerals moving into the root hair cells and sugars moving in to the blood in the small intestines

Challenge Questions

1	Why do prokaryotes not contain mitochondria?
2	Compare and contrast plant, animal and prokaryotic cells.
3	Using a Venn diagram, compare and contrast diffusion, osmosis and active transport.
4	Evaluate the use of adult stem cells and embryonic stem cells to treat patients

Science: Chemistry of the Atmosphere

Composition of the atmosphere

Modern atmosphere (Today)		Early Atmosphere (4 billion years ago)	
78%	Nitrogen	95%	Carbon dioxide
21%	Oxygen	4%	Water vapour
0.04%	Carbon dioxide	1%	Trace amounts of CO ₂ , CH ₄ and ammonia (NH ₃)
0.96%	Trace amounts of Ar, He, CH ₄ , NH ₃ , water vapour and other gases		

Why carbon dioxide levels decreased

Dissolved in oceans	As water vapour cooled and condensed the carbon dioxide in the air dissolved in the water becoming trapped in the ocean
Photosynthesis	<p>Approximately 2.7 billion years ago algae formed and absorbed carbon dioxide from the atmosphere to produce glucose, plants evolved over the next billion years</p> <p>Carbon + water → Glucose + oxygen dioxide $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$</p>
Trapped in sediments	Plants and animals died and became covered in mud that formed the layers in sedimentary rocks or became fossil fuels. This trapped the carbon dioxide from early life in the rocks

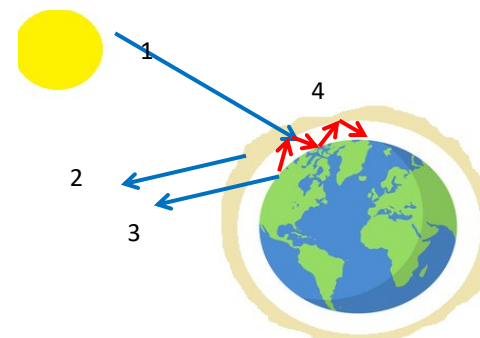
How the Earth and Atmosphere changed

Formation of oceans	As the Earth cooled the water vapour released from volcanic eruptions condensed and fell as rain. This pooled in valleys and crevices and formed the oceans
Increase in oxygen	As plants and algae began photosynthesising they released oxygen into the air.
Increase in nitrogen	The oxygen in the air reacted with ammonia to form nitrogen and water.

Greenhouse Effect

The greenhouse effect is an essential process that maintains the warm temperatures on Earth.

1	Radiation from the sun	The sun emits waves of energy with different wave lengths. These can travel through space to the Earth
2	Reflection of shortwave radiation	Short wavelength radiation such as x-ray and some UV is reflected back into space as it cannot pass through the atmosphere
3	Reflection of light from the Earth's surface	Visible light, UV radiation and other short wavelength radiation is reflected off the Earth's surface and passes through the atmosphere back into space
4	Trapping infra-red radiation	Radiation from the sun that is absorbed by the Earth is then radiated as a longer wavelength infra-red radiation back towards the atmosphere. This is then reflected it back to the Earth.



Science: Chemistry of the Atmosphere

Human Activities that increase the levels of greenhouse gases		
Greenhouse gases		
Carbon dioxide	Water vapour	Methane
What	How	Why
Deforestation	Large areas of forest are cut down to make way for farmland, houses, building materials and other resources	This reduces the amount of carbon dioxide absorbed by plants.
Burning fossil fuels	Fossil fuels are burned to generate electricity and power transport such as cars, trains and planes	When the fuels are burned they release carbon dioxide into the air
Farming of cattle	An increased demand for beef and milk has led to an increase in the number of cows being farmed	Cows release methane during the digestion of plant based foods. More cows, means more methane
Farming of rice	Increasing amounts of rice are being grown to feed the growing population	Rice paddies, release methane as the plants grow
An increase in greenhouse gases can amplify the effects of the Greenhouse Effect, increasing the amount of IR radiation trapped in the Earth's atmosphere. This increases the average temperature of the Earth.		

Challenge Questions

1	How could a person reduce their carbon footprint?
2	How do new theories about the evolution of the atmosphere and climate change become accepted?
3	Explain how global dimming could increase the effects of global warming.
4	Evaluate why it is difficult to reduce the global carbon footprint.

Climate change

Global warming	The gradual increase of average global temperatures due to an increase in greenhouse gases.
Global dimming	A decrease in the levels of light reaching the Earth's surface due to an increase in particulates in the atmosphere.
Carbon footprint	The total amount of carbon dioxide released over the lifetime of a process, product or event.
Acid rain	Acidic gases dissolved in rain water that can cause damage to buildings, statues, lakes and trees.

Consequences of Climate Change

Flooding, rising sea levels and melting polar ice caps	More frequent and intense storms	Drought and difficulty producing foods with changing weather patterns	Changes in distribution of species when habitats change or extinction
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Human Activities that increase the levels of greenhouse gases

Pollutant	Source	Effect
Carbon dioxide	All combustion	Global warming
Carbon monoxide	Incomplete combustion	Toxic, breathing problems
Soot (particulate)	Incomplete combustion	Global dimming
Sulphur dioxide	Burning sulphur impurities in fossil fuels	Acid rain
Oxides of nitrogen	Vehicle engines	Acid rain