# *Science KS3* **Cells and organisms**

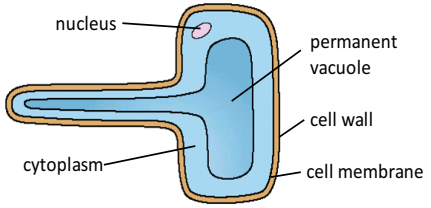
## Glossary:

- **Cell**
  Building blocks of living organisms.
- **Cell membrane**
  Controls movement in and out of cells.
- **Cell wall**
  Strengthens the cell.
- **Chloroplast**
  Where photosynthesis occurs.
- **Cytoplasm**
  Where chemical reactions happen in a cell.
- **Embryo**
  Ball of cells formed from a fertilised egg.
- **Fertilised egg**
  Formed when a sperm and egg fuse together.
- **Function**
  Its job.
- **Microscope**
  Equipment used to see things which are too small to see with the naked eye.
- **Mitochondria**
  Where respiration occurs.
- **Nucleus**
  Controls the cell, contains DNA.
- **Organ**
  Groups of tissues with the same function e.g. a heart.
- **Organ system**
  A group of organs with a specific function.
- **Organism**
  An individual living thing e.g. bacteria or a human.
- **Photosynthesis**
  Chemical reaction which produces glucose.
- **Respiration**
  Chemical reaction which releases energy from glucose.
- **Ribosome**
  For making proteins.
- **Specialised cell**
  A cell which has a specific function.
- **Stem cell**
  An unspecialised cell.
- **Tissue**
  Formed from lots of the same type of cell e.g. muscle.
- **Vacuole**
  Filled with cell sap.

## Activities

- Compare and contrast a plant and animal cell. You should include similarities and differences in your answer.

- The following plant cell is specialised.
  - Explain how it is different to a general plant cell.
  - The cell is a 'root hair cell', how do these differences link to its function?




- Specialised cells enable organs to carry out their functions. For each of the following specialised cells state their function.
  a) Red blood cell
  b) Nerve cell
  c) Leaf cell
  d) Sperm cell.

- If too much water diffuses into a red blood cell it will burst. Explain what stops this happening in a plant cell.

- In terms of cells, explain how a kitten grows into an adult cat.

- Some people are against the use of stem cells because of ethical concerns. Research the advantages and disadvantages of using different types of stem cells in medicine. Produce a summary which:
  a) Explains the difference between adult stem cells and those from an embryo
  b) Explains the benefits and potential issues of stem cell use in medicine.

**QUICK QUESTIONS:**

1. Draw and label a standard plant and animal cell.
2. State 3 differences between plant and animal cells.
3. State the main function of the following body systems:
   a) Breathing system
   b) Circulatory system
   c) Digestive system
   d) Reproductive system
   e) Renal (Kidney) system.

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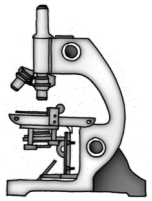
# KS3 Spine

# Cells and organisms

## 1. Cells

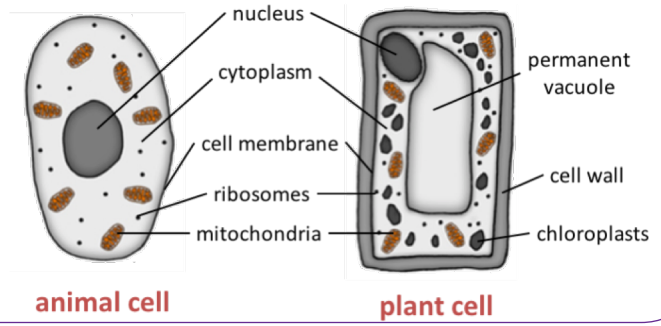
- All living things are made **of** one or more **cells** which can only be seen through a **microscope**.
- All the basic properties of life are the result of what happens inside cells. This includes:
  - **Reproduction**
  - **Respiration**
  - **Photosynthesis**



## 2. Parts of a cell

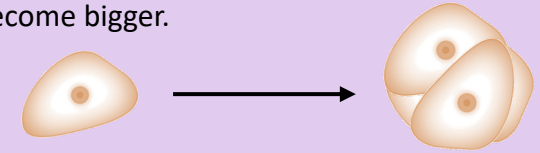
| | |
|---|---|
| **Nucleus** | Controls the cell |
| **Cell membrane** | Controls movement in and out of a cell |
| **Cytoplasm** | Where chemical reactions happen |
| **Mitochondria** | Respiration |
| **Chloroplast** | Photosynthesis |
| **Cell wall** | Strengthens the cell |
| **Vacuole** | Filled with cell sap |

## 3. Plant and animal cells




## 4. Cell division

- Cells divide for **growth** and **repair**.
- For an **organism** to grow the cells need to divide to make more cells. Growth happens because the cells inside the organism divide, not because all the cells become bigger.

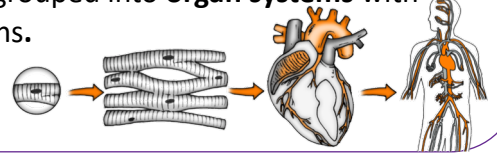


## 5. Specialised cells

- In **multi-cellular organisms** there are many different types of cell.
- These cells are **specialised** and are slightly different to the 'standard' plant and animal cells. These differences help the cell to carry out its **function**.
- For example, muscle, blood and nerve cells carry out specific functions in an organism.

## 6. Tissues and organs

- Cells are often organised into **tissues**.
- Tissues contain lots of the **same type of cell**.
- **Organs** contain **groups of tissues** with the **same function.**
- **Organs** can be grouped into **organ systems** with specific functions**.**



## 7. Organ systems

- In the body, **organ systems** carry out key functions such as **respiration**, **digestion**, **elimination** of waste and **temperature** control.
- The **circulatory system** takes substances to and from cells.
- The **digestive system** breaks down food into smaller pieces which can be absorbed into the body.

## 8. Stem cells

- **Stem cells** are not specialised.
- They can repair cells by being programmed for different functions.
- Stem cells can be found in adults in their **bone marrow** and in **embryos**.
- As they are not specialised, stem cells could be used to **treat** certain health conditions by replacing damaged cells.

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# *Science KS3* **Energy**

## Glossary:

- **Chemical energy store**
  Energy stored because of the chemical composition of an object.
- **Conduction**
  Method of transferring heat in solids.
- **Convection**
  Method of transferring heat in liquids and gases.
- **Dissipation**
  Energy stored in a less useful way.
- **Elastic potential energy store**
  Stored in a compressed or twisted elastic material.
- **Energy transfer**
  Energy moved from one store to another.
- **Gravitational energy store**
  Stored because of the position of the object above ground.
- **Internal energy**
  Energy stored in the system by particles.
- **Joule** Unit of energy
- **Kinetic energy store**
  Stored in a moving object.
- **Non-renewable**
  Energy resources that will run out.
- **Radiation**
  Method of transferring heat which does not need particles.
- **Renewable**
  Energy resources which can be replaced.
- **Temperature**
  A measure of how hot something is.
- **Thermal conductivity**
  A measure of how well an object transfers heat.
- **Thermal energy store**
  Stored because of the object's temperature.
- **Work**
  causes energy to be transferred from one store to another.

## Activities

- These books have been lifted off the ground.

  a) What energy store do these books have?
  b) If these books were to fall what would happen to this stored energy?

- When a torch is switched on, not all of the energy stored in a battery is transferred to useful light in the bulb. What has happened to the remaining energy?

- Look at the following diagram of a rollercoaster.

  a) Describe the energy transfers which take place as the rollercoaster car travels from the top of a hill down to the bottom.
  b) Explain why the second hill on a roller coaster has to be lower than the first.

- If an ice cube were placed on a table it would melt. Explain why in terms of energy transfer.

- Describe how heat is transferred by:
  a) Conduction
  b) Convection
  c) Radiation

- Which of the following would store the most energy and why?
  a) Cup of water at 70ºC
  b) Swimming pool at 30ºC
  c) Bucket of water at 100ºC.

**QUICK QUESTIONS:**

1. Name 3 methods of transferring thermal energy from one substance or place to another.
2. State five reasons why objects might have stored energy.
3. Explain the difference between renewable and non-renewable energy resources.
4. Explain the difference between heat and temperature.
5. Sate the unit for energy.

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# KS3 Spine

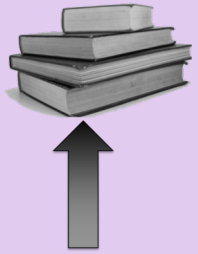
# Energy

## 1. Energy stores

- Objects can have **stored energy** either because of:
  - Their chemical composition – **chemical**
  - Their movement – **kinetic**
  - Their temperature – **thermal**
  - Their position in a field – **gravitational potential, magnetic, electric**
  - Compression or distortion of an elastic material – **elastic potential**

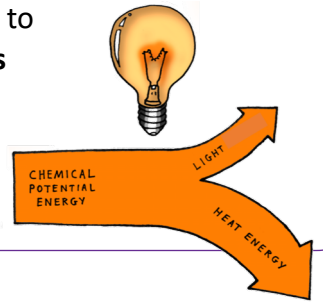
## 2. Work

- When **work** is done by a **force**, it results in an **energy transfer** and leads to energy being **stored** by an object.
- These books have been lifted into the air; work has therefore been done. Energy has been transferred to the books and is now stored in them.



## 3. Energy transfers and dissipation

- The unit for energy is the **joule.**
- Energy **cannot** be created or destroyed.
- Energy can be **transferred** to other useful **energy stores** or **dissipated**.
- We can use diagrams to show these transfers.

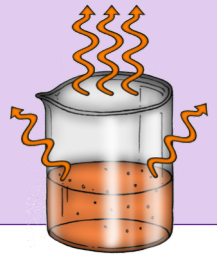



## 4. Lifting objects above the ground

- Energy can be stored by lifting it higher above ground – **gravitational potential**.
- When it is released and falls, this energy is stored in its motion – **kinetic**.
- During this transfer some energy will be **dissipated**.

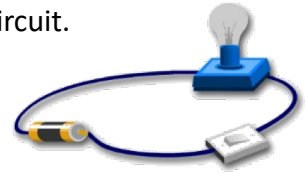
## 5. Heat and temperature

- **Heat** is an **energy store** whereas **temperature** is a measure of how hot something is.
- An object at higher temperature transfers **thermal energy** to the surroundings until they are at the same temperature.
- How quickly this happens depends on the **thermal conductivity** of the materials.



## 6. Batteries and electrical current

- The chemicals in the cells of a battery store energy.
- This energy is **transferred** to charged particles when the battery is connected to a complete circuit.
- This causes the **current** to flow, **transferring** energy to other parts of the circuit.



## 7. Methods of thermal energy transfer

- **Thermal energy** can be transferred by particles, using **conduction** and **convection**. It can also be transferred by **radiation**.
- **Internal energy** is the energy stored in a system by the particles. When heat is added the internal energy of the particles increases.

## 8. Energy resources

- Fuels such as oil, gas, coal and wood are **energy resources**.
- Some energy resources are **renewable**, such as those produced by wind, waves, sunlight and tides.
- Others are **non-renewable** such as those formed by burning fossil fuels with oxygen.

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# *Science KS3* **Evolution and extinction**

## Glossary:

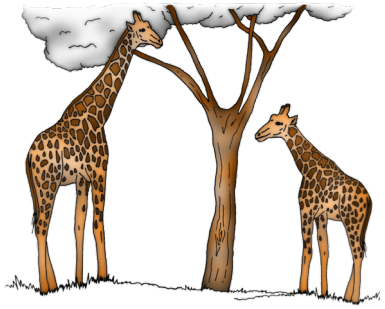
- **Adaptation**
  Characteristic of an organism which makes it suited to an environment.
- **Egg** Female sex cell.
- **Evolution**
  Changes to a species over time. Can involve the production of a new species.
- **Extinct**
  All organisms in a species have died.
- **Fertile**
  able to produce offspring.
- **Fossil**
  The preserved remains or traces of a dead organism.
- **Inherited**
  Passed from one generation to the next.
- **Multi-celled organism**
  An organism made of many cells.
- **Mutation**
  Error when copying a gene during cell division.
- **Natural selection**
  theory of how evolution happens.
- **Offspring**
  Children.
- **Organism**
  Individual in a species.
- **Reproduce**
  produce offspring.
- **Selective advantage**
  Better adapted to the environment.
- **Single-celled organism**
  Organism made of one cell.
- **Species**
  A group of similar organisms which can breed and produce fertile offspring.
- **Sperm**
  Male sex cell.
- **Universal common ancestor**
  A single-celled organism from which all life on Earth evolved.
- **Variation**
  differences between organisms of the same species.

## Activities

- Charles Darwin travelled to the Galapagos Islands and noticed how the beaks of the finches were adapted to suit their food source. Research how his observations led to his theory of evolution by natural selection.

- Explain how the following organisms are adapted to suit their environment:
  a) Cactus plant
  b) Penguin
  c) Camel
  d) Snowshoe rabbit.

- Giraffes have evolved long necks over time. Use the theory of natural selection to explain how this might have occurred. You should include the key words: population, variation, selective advantage and reproduction in your response.



- Look at the following image of the limbs of the two animals.

Human Whale

What evidence is there that these organisms evolved from one common ancestor?

- The fossil record is incomplete. Carry out research to find out what this means and why this is the case.

**QUICK QUESTIONS:**

1. What is the difference between single-celled and multi-celled organisms?
2. What is meant by the term 'extinct'?
3. What does the fossil record tell us?
4. What have all organisms on the planet evolved from?
5. What does the term 'selective advantage' mean?
6. Define the term 'species'.

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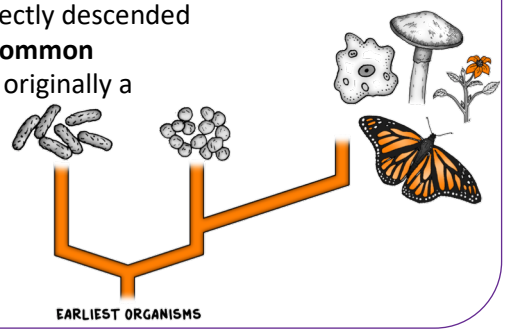
# KS3 Spine

# Evolution and extinction

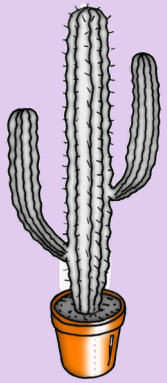
## 1. Universal common ancestor

- All life today is directly descended from a **universal common ancestor** that was originally a **single-celled organism**.



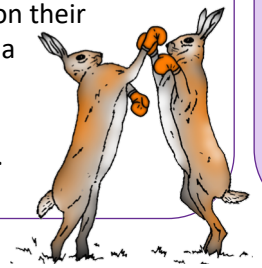

## 2. Adaptation

- Living things are found in certain environments because they have features that enable them to survive there. They have **adapted** to suit the environment.
- This adaptation has happened because of the small differences between individuals in a species; **variation.**



## 3. Competition and survival to reproduce

- Organisms within a **species compete** for the same resources e.g. food or a mate.
- Those who are better **adapted** to the **environment** are more likely to **survive** and may pass on their **adaptation** to their **offspring**. They have a **selective advantage**.
- Those less suited to the environment are more likely to die before they **reproduce**.



## 4. Competition and survival

- Later generations will contain **more** of the **better adapted** individuals.
- This only applies to **mutations** in the reproductive cells e.g. sperm and eggs. Mutations in other cells are not passed on to the offspring.

## 5. Natural selection

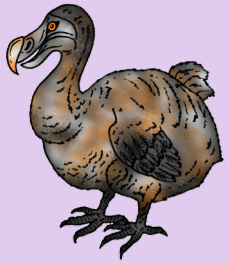
- **Charles Darwin's** theory of **natural selection** explains how **evolution** happens:
  - There is **variation** in a population
  - Some individuals are **better adapted** to changes in the environment, they have a **selective advantage**
  - These individuals are **more likely to survive** and pass on their **genes**.
  - Over **many generations** this leads to **evolution**.

## 6. Natural selection over time

- **Natural selection** has been taking place for billions of years.
- The first form of life appeared on Earth about 3.5 billion years ago.
- Some of these remained as **single-celled species**. Others evolved into **multi-cellular organisms** about 2 billion years ago. These multi-cellular organisms eventually evolved into today's large animals, plants and fungi.

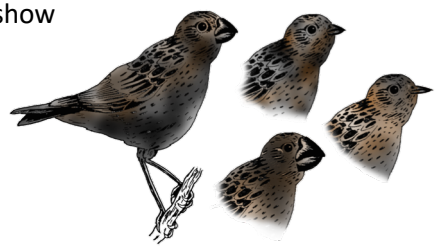
## 7. Extinction

- There are many kinds of animals in the world today and many who once lived, but are now **extinct**.
- A species becomes **extinct** when all the organisms of that species have died.
- We know about many of these extinct animals and plants because of **fossils**.



## 8. Evolution

- Change of species over time is called **evolution**.
- Analysing closely-related species or fossils can show us how species have changed over long periods of time.



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# *Science KS3* **Forces and motion**

## Glossary:

- **Acceleration**
  Speeding up.
- **Deceleration**
  Slowing down.
- **Density**
  A measure of how close the particles are packed together.
- **Displaced**
  Moved from its position and replaced
- **Force**
  Push, pull or twist an object, changing their motion or shape.
- **Gravity**
  The universal attraction between objects.
- **Inertia**
  Object continues its existing state or motion unless the state is changed by a force.
- **Irregular**
  Not regular, object has different sized sides.
- **Magnitude**
  Size
- **Mass**
  Amount of matter something contains, kilograms.
- **Moment**
  Turning effect of a force.
- **Motion**
  movement
- **Newton** Unit of force.
- **Particle**
  Atom or molecule.
- **Pivot**
  Central point where something turns.
- **Speed**
  Energy
- **Stationary**
  Not moving.
- **Weight**
  Force caused by the effect of gravity on a mass, newton.

## Activities

- Describe the forces acting on a stationary object.

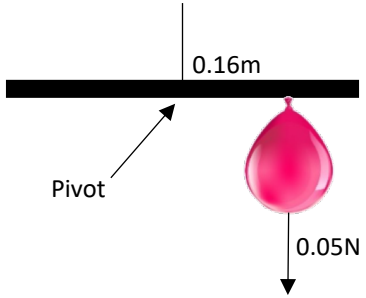
- Look at this diagram of a stationary boat floating on water. The boat is made of metal and is heavy.

  a) Draw and label the forces acting on the boat.
  b) Explain why the boat floats even though it is made of a heavy metal.

- Draw and label the forces acting on this plane as it travels at a steady speed.

- Calculate the density of the following blocks in $g/cm^3$
  a) 1Kg block with a volume of $100cm^3$
  b) 0.5Kg block with a volume of $20cm^3$.

- Calculate the moment the balloon produces about the pivot in the following diagram.




**QUICK QUESTIONS:**

1. State the equation linking distance, time and speed.
2. State the equation linking force, moment and distance.
3. State the equation linking density, volume and mass.
4. What is the unit for force? What is the unit for weight?
5. What is the unit for mass?
6. What is a moment?

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## 1. Speed

- **Speed (m/s) = distance (m) ÷ time (s)**
- The **speed** of a moving object is a measure of how far it will travel in a certain time.
- How quickly an object travels depends on its **mass** and the **force** acting on it.
- The greater the mass of an object the longer it takes to speed up or slow down, a property of mass called **inertia**.

## 2. Gravitational forces

- All objects on Earth are affected by **gravitational forces**. An object which stays at rest on the surface of the Earth has one or more forces acting on it, thus balancing the force of gravity.
- A book lying on a table does not fall because the atoms in the table are pushing upwards on the book with a force **equal** to the force of gravity.

## 3. Force diagrams

- We can show the **forces** acting on an object using **force arrows**.
- These arrows show the **size** (**magnitude**) and **direction** of the force.

## 4. Unbalanced forces

- If the forces acting on an object are **unbalanced** the object will either **speed up (acceleration)**, **slow down (deceleration)** or **change direction**.
- **Unbalanced forces cause change.**

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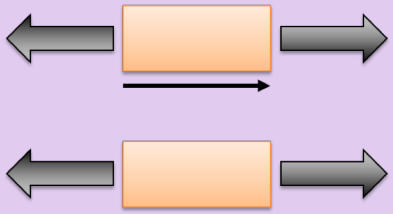
# Forces and motion

## 5. Balanced forces

- **Equal** and **opposite forces** are found **on stationary objects** and those travelling at a **steady speed**.
- An object with equal and opposite forces acting on it will carry on doing what it is already doing.
- **Balanced forces cause no change**.

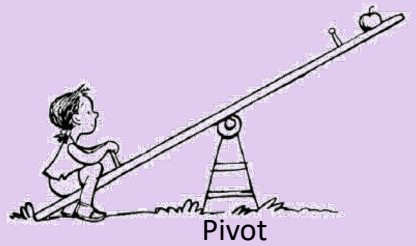


## 6. Floating

- Objects **float** on water because they are **less dense** than the water.
- An object **floating** on a **liquid**, or in **air**, does not move because there is an **upward force balancing** the **downward force of gravity**.
- The **upward force** is **equal** to the **weight** of the fluid **displaced**. So heavy objects can float if they are hollowed out to displace a large weight of water.

## 7. Moments

- **Moment (Nm) = force (N) x distance (m)**
- A **moment** is the **turning effect of a force** around a **pivot**.




## 8. Density

- **Density = mass ÷ volume**
- Density is a measure of how **closely the particles are packed** together in a particular space. The **closer** the particles are packed together, the **heavier** the object feels for its **size**.
- The **volume** of an **irregular shaped object**, like a stone, can be found by measuring the volume of the water **displaced** by the object.

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# *Science KS3* **Inheritance and genetics**

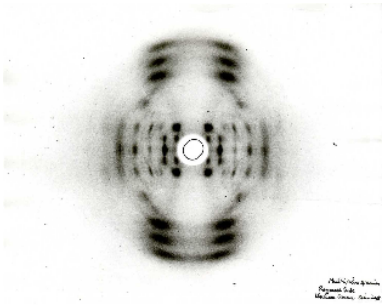
## Glossary:

- **Cell division**
  Cell dividing to produce more cells.
- **Chromosome**
  Molecule of DNA.
- **DNA**
  Carries genetic information.
- **Egg**
  Female sex cell.
- **Fertile**
  Able to produce offspring.
- **Fertilisation**
  Fusing of male and female sex cells.
- **Gene**
  Length of DNA which codes for a protein.
- **Inherited**
  Passed from one generation to the next.
- **Mutation**
  Error when copying a gene during cell division.
- **Nucleus**
  Controls the cell, contains DNA.
- **Offspring**
  Children.
- **Organism**
  Individual in a species
- **Sexual reproduction**
  Producing offspring by fusing sex cells.
- **Specialised cells**
  Cells adapted for a function.
- **Species**
  A group of similar organisms which can breed and produce fertile offspring.
- **Sperm**
  Male sex cell.
- **Variation**
  Differences between organisms of the same species.

## Activities

- Smoking can cause mutations in DNA. Carry out some research to find out what types of chemical are found in cigarette smoke and how they can lead to cancer.

- Explain the difference between continuous and discontinuous variation. Give two examples of each type of variation.
- Watson and Crick used 'Photo 51' to help work out the structure of DNA. This image was created by Rosalind Franklin. Produce a biography of Rosalind Franklin. Your biography should include her work on DNA and how it was used to find its structure.



- DNA is the genetic material of human cells. Describe the structure of DNA and where it is found in a human cell.

**QUICK QUESTIONS:**

1. What are chromosomes and where are they found?
2. What is a gene?
3. Give two reasons cells divide.
4. What is a mutation?
5. Name two causes of variation.
6. State the two types of variation.
7. How many chromosomes in:
   a) A normal human body cell.
   b) A sperm.
   c) An egg?

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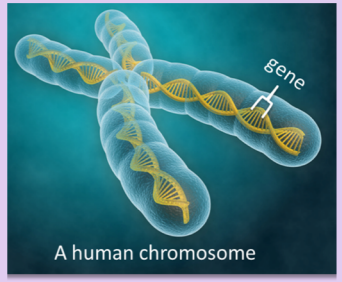
## 1. Chromosomes

- **Chromosomes** are found in the **nucleus** of plant and animal cells.
- Chromosomes contain complex molecules of **DNA**.
- The DNA contains the information needed to make more cells.
- Most cells in humans contain **23 pairs** of chromosomes (**46 chromosomes** in total).

## 2. Genes

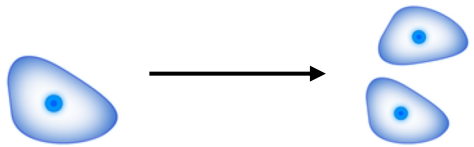
- A **gene** is a length of **DNA**.
- Hundreds and thousands of genes are found on a single **chromosome**.
- Humans have around 20,000 genes.



A human chromosome

## 3. Cell division

- Cells divide for **growth** and **repair**.
- When a cell divides, **genetic information** stored in the genes is copied so that each new cell is a **copy** of the original cell.



## 4. Mutations

- Sometimes an error occurs when genetic information is copied, this causes a **mutation**.
- Not all mutations are harmful.
- Changes in genes can be caused by the **environment.**
- These changes affect the individual, but only affect their **offspring** if they occur in sperm or egg cells.

# KS3 Spine

# Inheritance and genetics

## 5. Sexual reproduction

- A **sperm cell** from a male **fuses** with an **egg cell** from a female. This is called **fertilisation**.
- Sperm and egg cells are **specialised**. They only contain **23 chromosomes**, one copy of each pair.
- Half the genetic material in a **fertilised egg** is from the sperm and half from the egg, making 46 chromosomes in total.

## 6. Variation

- **Sexual reproduction** causes a lot of **variation**; differences between **organisms** in the same **species**.
- This is because the **genetic information** in an offspring is a combination of genetic information from the parents.
- The environment can also cause variation in a species e.g. diet and lifestyle.
- Variation can be **continuous,** e.g. height, or **discontinuous,** e.g. blood type.

## 7. Inheritance

- Inherited variation is due to differences in the **genes**.
- These differences can be **inherited,** passed from one generation to the next.

## 8. Watson, Crick, Wilkins and Franklin

- DNA is made from **two strands bonded together** in a **double helix**. **James Watson** and **Francis Crick** worked out the structure of DNA in the 1950's using an x-ray image, photo 51, produced by **Rosalind Franklin**. **Maurice Wilkins** produced work which supported the model.
- Watson, Crick and Wilkins were awarded the **Nobel Prize.** Unfortunately, Franklin died before the prize was awarded.

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# *Science KS3* **Interdependence and competition**

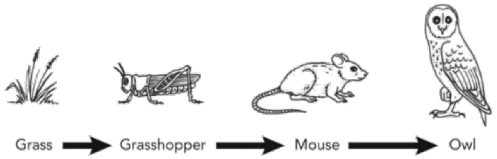
## Glossary:

- **Biomass**
  Living material.
- **Carnivore**
  Animal that only eats animals.
- **Community**
  All the populations of different organisms in a habitat.
- **Competition**
  Plants and animals compete with each other for resources.
- **Consumer**
  Consumes food.
- **Decomposer**
  Breakdown of dead plant and animal matter (bacteria and fungi).
- **Ecosystem**
  A community and its habitat.
- **Fertile**
  Able to produce offspring.
- **Habitat**
  Where the organisms live.
- **Herbivore**
  Animal that only eats plants.
- **Organism**
  An individual living thing.
- **Pollination**
  Transferring pollen from one plant to another.
- **Population**
  All the members of a species living in a habitat.
- **Predator**
  Animal that hunts prey.
- **Prey**
  Animal hunted by a predator.
- **Producer**
  Makes food via photosynthesis (plants).
- **Species**
  A group of similar organisms which can breed and produce fertile offspring.
- **Trophic level**
  Level of a food chain.

## Activities

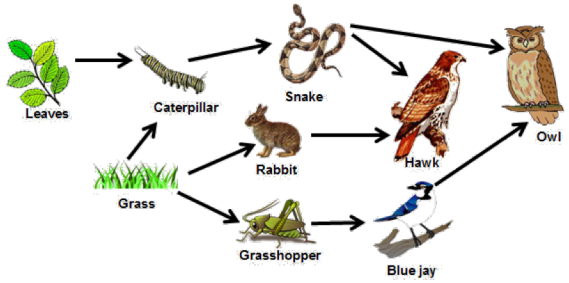
- Explain why decomposers are important in an ecosystem. In your answer you should use and define the terms: habitat, decomposer, ecosystem.

- Look carefully at the following food chain.




  a) Name a predator
  b) Name a prey
  c) Name the producer
  d) Name a consumer
  e) Name the herbivore.

- Look at the following food web. A disease kills the trees on which the caterpillars feed. What impact would a decrease in the number of leaves have on the number of snakes? Why?




- Explain why pollination is important in the production of the following food:
  a) Strawberries
  b) Courgette
  c) Beef
  d) Bread.

- A food chain contains plants, partridges and foxes. Partridges feed on weeds and insects. If a farmer sprayed their crops with chemicals to kill weeds and insects what would happen to the number of foxes? Why?

**QUICK QUESTIONS:**

1. Name two things plants compete for.
2. Name two things animals compete for.
3. List 3 reasons why not all the energy found in plants is transferred up through the food chain to the top carnivore.
4. Name two types of decomposer.
5. What is the difference between a herbivore and a carnivore?
6. What is the difference between a producer and a consumer?
7. What provides the energy in most food chains?

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## 1. Ecosystems

- Individual **organisms** which live together in particular environmental conditions in a **habitat** form an **ecosystem**.
- In a stable ecosystem there are:
  - **Producers** of food (plants)
  - **Consumers** (animals)
  - **Decomposers** (bacteria and fungi).
- All animals depend on plants for their survival.

## 2. Decomposers

- Decomposers are normally bacteria or fungi.
- They **breakdown dead plant and animal matter**, releasing nutrients into the soil for plants to absorb.
- If decomposers were removed from a habitat then organisms would not be broken down when they die.

## 3. Food chains

- Food chains are **feeding relationships** between **organisms** in a **habitat**.
- Food chains start with **producers**, normally plants, which produce food via **photosynthesis**.
- Energy from the sun is used in photosynthesis.

## 4. Energy and biomass in food chains

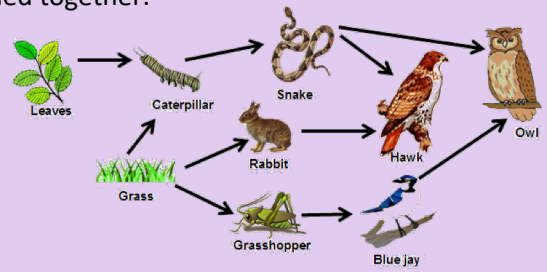
- The arrows in a food chain show the flow of **biomass** or **energy** through the chain.
- Not all the energy found in the biomass of plants at the start of a food chain makes it into the biomass of the **top predator**.
- This is because not all of the organism is eaten (e.g. roots, bones) and some energy is transferred via faeces, urine, respiration, movement or heat.

*KS3 Spine*

# Interdependence and Competition

## 5. Food webs

- A food web shows all the food chains in an ecosystem joined together.




## 6. Competition in plants and animals

- In any ecosystem there is **competition** among species for the energy resources and the materials they need to live.
- **Plants** compete for light, space, water and mineral ions.
- **Animals** compete for food, mates and territory.

## 7. Predator – prey relationships

- **Predators** hunt and eat other organisms.
- **Prey** are the organisms eaten by the predator.
- The **populations** of predators and prey depend on each other.
- If the population of prey decreases then so will the population of predators.

## 8. Pollination and food security

- **Pollinating insects** are not just vital in food webs as a source of food, they are also needed to pollinate flowers to produce seeds and fruit.
- The majority of food we eat comes from food chains which rely on plants which need to be pollinated.

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# *Science KS3* **Non-contact forces**

## Glossary:

- **Attraction**
  When objects are pulled towards each other.
- **Charge**
  Positive or negative, generated by rubbing together two objects.
- **Compass**
  Detects magnetic fields. Can be used to plot a field or navigate.
- **Electric field**
  Area around an electric charge which can affect other objects.
- **Field**
  Area around an object where it can affect other objects.
- **Gravity**
  The universal attraction between objects.
- **Magnetic field**
  Area around a magnet which affects other objects.
- **Mass**
  Amount of matter something contains, kilograms.
- **Newton**
  Unit of force.
- **North-seeking pole**
  Pole of a magnet which is attracted to the north pole of the Earth.
- **Orbit**
  The path of an object around a star, planet or moon.
- **Pole** End of a magnet.
- **Repulsion**
  When objects push away from each other.
- **Solar wind**
  Stream of charged particles released by the Sun.
- **Universal attraction**
  An attraction between all objects.
- **Weight**
  Force caused by the effect of gravity on a mass, newton.

## Activities

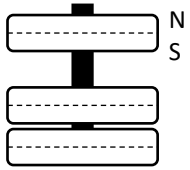
- Why does an astronaut weigh less on the Moon than on the Earth, even though their mass is the same?

- Why does a skydiver weigh slightly less when they jump out of a plane than they do on the ground?

- This balloon has been rubbed on a jumper. Negative charges (electrons) have moved from the jumper to the balloon. The jumper is now positively charged.

  a) Is the balloon positively or negatively charged?
  b) Why?
  c) What will happen when the balloon is placed near the jumper?
  d) Why?

- Some magnets with holes in were placed on a wooden rod. Some of the magnets float. Look at the diagram.




  Explain why some of the magnets are floating. Make sure you label the poles of the magnets in your response.

- Carry out research to explain how the aurora borealis (northern lights) occurs.

- Explain how to plot the field around a bar magnet using a plotting compass. Your response should include a drawing of the field around a bar magnet.

**QUICK QUESTIONS:**

1. What is gravity?
2. What factors affect the size of the gravitational attraction between objects?
3. What is the difference between mass and weight?
4. If two north ends of magnets were brought together what would happen?
5. What is a field?
6. Give three examples of fields.
7. What causes the tides on Earth?

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# KS3 Spine

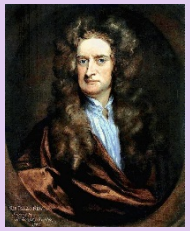
# Non-contact forces

## 1. Gravity

- Gravity is the **universal attraction** between **all** objects, although we only notice it when objects are large – like planets. This gravitational attraction keeps things in **orbit**.
- On the Earth it results in everything being pulled down towards the centre of the Earth. The object pulls the Earth, as the Earth pulls the object. We only notice the movement of the object as its mass is smaller.

## 2. Weight and mass

- The downward attraction of objects towards the Earth is called **weight**. The unit for weight is the **newton (N)**.
- **Mass** is the amount of matter something contains; its unit is the **kilogram (kg)**.

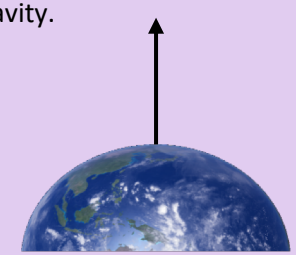



## 3. Gravity on the Moon

- The effect of **gravity** on an object on the Moon is less than that on the Earth because the Moon has less **mass** than the Earth.
- This means a person on the Moon **weighs** less than on Earth even though their **mass** is the same.
- The pull of the Moon on Earth causes the tides.

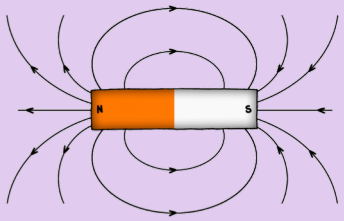
## 4. Gravitational attraction

- Gravitational force **increases with mass,** the larger the mass the larger the force of gravity.
- Gravitational force **decreases with distance**, the further away from the object the smaller the force of gravity.



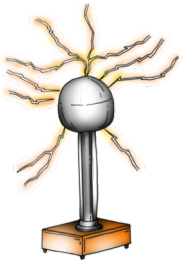
## 5. Magnet field

- Magnets have **north** and **south poles**. When they are brought together they will experience **attraction** or **repulsion**.
- Alike poles **repel** and opposing poles **attract**.
- The **magnetic field**, which is not visible, can be plotted using **compasses**.




## 6. Electric field

- When some insulating materials are rubbed together they can become **charged**. These charged objects create an **electric field**.
- When two charged objects are brought together they will experience **attraction** or **repulsion**.
- Alike charges **repel** and opposing charges **attract**.
- Charged objects will attract small non-charged objects.



## 7. 'Fields'

- A **field** is the area around an object where it can affect other objects. The further away you are from the object, the weaker the field.
- Another object entering this field experiences an effect – **attraction** or **repulsion**.
- **Gravity, electric and magnetic** interactions can be described in terms of '**fields**'.

## 8. Earth's magnetic field

- The **Earth** has a magnetic field which can be detected using a **compass**.
- It is possible to use a compass to navigate as the **north-seeking pole** of the compass needle points towards the **north pole** of the Earth.
- The Earth's magnetic field helps to protect us from charged particles in the **solar wind** and causes the northern lights.

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# *Science KS3* All matter in the universe is made of very small particles

## Glossary:

- **Atom**
  Basic building blocks of all substances.
- **Chromatography**
  Separates mixtures of soluble substances.
- **Compound**
  Substances containing two or more types of atom.
- **Condensation**
  Change in state from gas to liquid.
- **Distillation**
  Separates a liquid from a mixture. Involves evaporation and condensation.
- **Element**
  Substances made of only one type of atom.
- **Evaporation**
  Change in state from liquid to gas.
- **Filtration**
  Separates insoluble substances form a solvent.
- **Freezing**
  Change in state from liquid to solid.
- **Insoluble**
  Describes a substance that will not dissolve in a solvent.
- **Melting**
  Change in state from solid to liquid.
- **Mixture**
  Different substances together which can be easily separated.
- **Soluble**
  Describes a substance that will dissolve in a solvent.
- **Solute**
  The substance that dissolves in a solvent to form a solution.
- **Solution**
  The mixture formed when a solute has dissolved in a solvent.
- **Solvent**
  The liquid in which a solute dissolves.

## Activities

- Explain how a solid melts in terms of **energy** and **forces between particles**.
- Explain why ice and iron have different melting points. Your answer should consider the forces of attraction between the particles.
- Rock salt contains sand and salt. A student mixed rock salt in warm water. Describe how the student would separate out the sand, salt and water from the mixture formed. You will need to consider the question carefully as the water needs to be collected too.
- Look at the diagrams in the table below. For each one answer the following questions:
  a) Name the separating technique.
  b) Name the pieces of equipment included in the diagram.
  c) Describe how the equipment is used to separate mixtures. Make sure you include key scientific terms including changes in state if appropriate.

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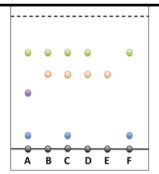
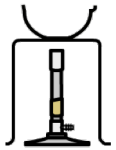
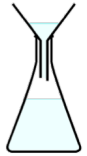
| 1   | 2  |
| 3  | 4  |

Explain the difference between an **atom**, an **element**, a **compound** and a **mixture** using the gases found in air as examples. Substances you could use in your answer include: oxygen, carbon dioxide and argon.

When a volcano erupts liquid rock (magma) is released along with hot gases. The magma cools and turns into solid rock.

a) Describe the changes in the movement of the particles in the magma as it cools.
b) Describe the arrangement of particles in the hot gases and explain how they are different to those in a liquid.

**QUICK QUESTIONS:**

1. Draw diagrams representing the particles in a solid, liquid and gas.
2. Describe how the particles move in a solid, liquid and gas.
3. State the name of the process in each of the following changes:
   a) Solid to liquid
   b) Liquid to solid
   c) Gas to liquid
   d) Liquid to gas.

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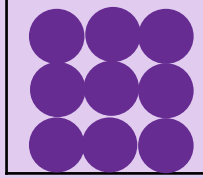
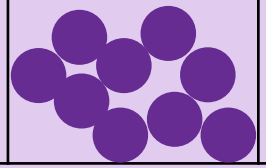
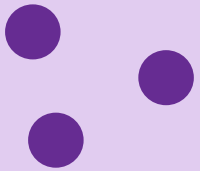
## 1. Particles

- If we could divide any substance down into smaller and smaller pieces we could see it is made of tiny **particles**.
- These particles are so small they could **not** be seen using a microscope.
- We can represent these particles in models using **spheres**.

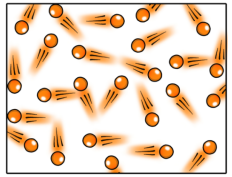
## 2. States of matter

- Three states of matter are **solid**, **liquid** and **gas**.

| Solid | Liquid | Gas |
|---|---|---|
|  |  |  |

## 3. Differences in states of matter

- In solids the particles are **closely spaced** and **vibrating**. In liquids there is **random motion** but the particles are in **contact**.
- In a gas there is **random motion** and the particles are **widely spaced**.
- Liquids and gases **flow** and completely **fill** their container. Gases can be **compressed**.



PiXL Science

*KS3 Spine*

# All matter in the universe is made of small particles

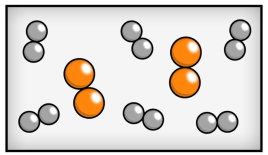
## 4. Changes in states of matter


- A solid melts when it is heated because the particles are **gaining energy**. This energy is used to break the **forces of attraction** between the molecules. The **more energy** a particle has the **faster** it can move.

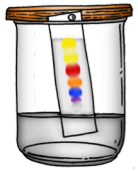
## 5. Atoms and elements

- Atoms are the **basic building blocks** of **all** living and non-living things anywhere in the universe.
- There are just over **100** different types of atom.
- Substances made of only **one kind** of atom are called **elements**.
- All the known elements are listed in the **periodic table** of elements.

## 6. Elements and mixtures

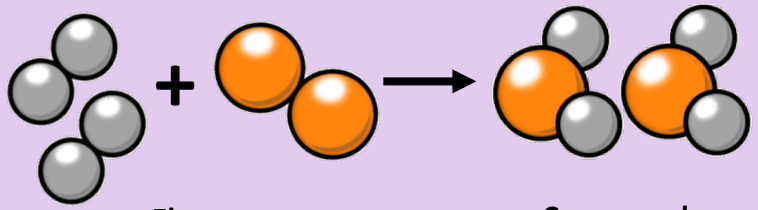


- This diagram shows a mixture of elements.
- **Mixtures** can be easily separated using techniques such as:
  - **Filtration**
  - **Distillation**
  - **Chromatography**



## 7. Compounds

- **Atoms** of different **elements** can combine together to form a very large number of **compounds**.



**Elements** **Compounds**

## 8. Reactions and properties

- A chemical reaction involves the rearrangement of atoms to form new substances, while the total number of atoms **stays the same** (see image above).
- The **properties** of different materials can be explained in terms of the behaviour of the atoms and groups of atoms of which they are made.

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# *Science KS3* **Scientific method**

## Glossary:

- **Accurate**
  Close to the real value.
- **Anomalous**
  Something which does not fit the trend or pattern.
- **Control variable**
  Variable which is kept the same to ensure a 'fair test'.
- **Correlation**
  Relationship between two variables.
- **Decimal places**
  number of digits after the decimal point.
- **Dependent variable**
  Variable which is monitored or measured.
- **Digit** number.
- **Explanation**
  Reason why something happens.
- **Hypothesis**
  An idea or explanation which is tested.
- **Independent variable**
  Variable which is changed.
- **Line of best fit**
  Passes through as many points as possible, roughly equal number of points end up on each side.
- **Mean**
  Add them all together and divide by how many values you have.
- **Median**
  Put the data in numerical order, then choose the middle one.
- **Mode**
  Most frequently occurring value
- **Precise**
  Repeats are close together.
- **Prediction**
  What you think will happen if the independent variable in an experiment is changed.
- **Repeatable**
  Method repeated by the same scientist to produce same results.
- **Reproducible**
  Repeated by a different scientist to get the same results.
- **Trend** Pattern in the data.

## Activities

- Look at the dartboard below. The shots were precise but not accurate. Explain why.

- A student carried out an experiment to investigate the effect of temperature on the speed of a reaction. They put their data into a results table.

| Time seconds | repeat | average | Temperature |
|---|---|---|---|
| 130 | 129 | 129.5 | 15°C |
| 196 | 194 | 195 | 10°C |
| 39 | 37 | 38 | 35°C |
| 21 | 19 | 20 | 45°C |
| 7 | 7 | 7 | 60°C |
| 290 | 289 | 289.5 | 5°C |

  a) What feedback would you give the student to improve their table?
  b) Draw a better version of the results table.
  c) State the trend in the data.
  d) Plot a graph of the data.

- Look at the following data:
  **5, 7, 3, 6, 11, 6, 7, 7**
  a) Find the **mean** of the data
  b) Find the **mode** of the data
  c) Find the **median** of the data.

- A scientist noticed that tomato plants in the sun produced larger tomatoes than tomato plants grown in the shade.
  a) Write a prediction for an experiment to investigate the effect of light on the growth of tomatoes.
  b) Identify the independent and dependent variables.
  c) What control variables might you need to consider?

**QUICK QUESTIONS:**

1. What is the difference between repeatable and reproducible?
2. What is the difference between mean, mode and median?
3. What does the term 'anomalous' mean?
4. State the rules for drawing a results table.
5. State the rules for plotting a graph.
6. State the three types of variable.
7. What is an evaluation?

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## 1. What is science?

- Science is about finding explanations for why things happen or what makes things work.
- An **explanation** is not a guess, there has be some basis for it.
- Careful **observation**, including **measurement** where possible, can suggest what may be happening.
- In some cases it is possible to make a change and observe what happens.

## 2. Hypothesis and prediction

- A **hypothesis** is a possible **explanation** or reason for why something happens.
- A **prediction** is what a scientist thinks will happen if **the independent variable** in an experiment is changed.

## 3. Variables

- The **independent variable** is the variable the scientist changes to observe what happens.
- The **dependent variable** is the one which is measured to see if changing the independent variable had an effect.
- The **control variables** are kept constant so that the result can only be the effect of changing the independent variable.

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# Scientific method

## 4. Repeats, repeatable and reproducible

- **Repeating** an experiment enables us to calculate an **average** and shows the experiment is **repeatable**. A measurement is **repeatable** if the same scientist uses the same method and gets the same result.
- What people expect to happen can influence what they observe. It is good for the same experiment to be **repeated** by a different person. If they get the same result then the measurement is **reproducible**.

## 5. Recording data

- Data should be recorded during any practical work; this is normally in a table. Tables should have:
  - **Clear headings** with **units**
  - **Independent variable** in the first column
  - **No units** in the body of the table
  - Consistent number of **decimal places**

## 6. Graphs

- Data can be displayed in a graph to help identify **trends** or **correlations**.
- Data points should be marked with a **cross.** The plotted points should **fill at least half the paper**.
- **Axes** should be **labelled** with the **variable** and the **unit**.
- The **line of best fit** can ignore **anomalous data** and can form a **curve,** not just a straight line.

## 7. Averages and decimal places

- Calculating an **average** in science usually involves finding the **mean**, but can also include the **mode** or **median** value.
- When calculating a mean, make sure the answer never has more **decimal places** than any of the data values you used.
- When rounding up, use the **deciding digit** to decide whether to round up or down.

## 8. Conclusion and evaluation

- A **conclusion** contains a **description** and **explanation** of any **trends** or **patterns** in the data. It also looks back at the **hypothesis** and related **prediction** to see if they were correct.
- An **evaluation** looks at the data to see how **precise** or **accurate** it is. It identifies any **anomalous** data and identifies sources of **error** in the method.

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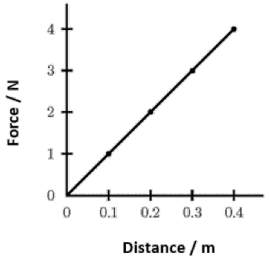
# *Science KS3* **Scientific theories and models**

## Glossary:

- **Conference**
  Meeting of people to discuss a shared interest. Usually has presentations to large numbers of people.
- **Directly proportional**
  When x is doubled y is doubled.
- **Explanation**
  Reason why something happens.
- **Hypothesis**
  An idea or explanation which is tested
- **Inversely proportional**
  When x is doubled y is halved.
- **Journal**
  An official magazine where the articles have been peer reviewed before publishing.
- **Linear relationship**
  Forms a straight line on a graph **y = mx + c**
- **Mathematical Formula**
  Mathematical relationship between variables.
- **Model**
  Method of explaining an idea.
- **Observation**
  Something that is seen or observed.
- **Peer review**
  Evaluation of work by experts.
- **Physical model**
  Model which can be touched.
- **Prediction**
  What you think will happen if the independent variable in an experiment is changed
- **Theoretical model**
  Model which cannot be touched.
- **Theory**
  Explanation based on facts that have been repeatedly confirmed through observation and experiment.
- **Trend**
  Overall pattern in the data e.g. 'As the *independent variable* is increased the *dependent variable* decreases.'

## Activities

- The **model** of the atom has changed over time. The following scientists have contributed science which has caused changes to the model. For each scientist, research **the discovery they made <u>and</u> how the model changed** from John Dalton's **solid sphere model.**
  a) J.J. Thomson
  b) Ernest Rutherford
  c) Neils Bohr
  d) Erwin Scrödinger.
- The particle model is used to help explain the states of matter. The particles are all represented as solid spheres. Evaluate this model.
- The word 'theory' has a different meaning in everyday life.
  a) Explain what is meant by 'a scientific theory'.
  b) Explain how the meaning of the word 'theory' is different in every day life.
  c) Why do you think the two different meanings cause confusion when scientists are talking about their work?
- Why is it important for scientists to discuss and publish their work in journals and at conferences?
- What do you think the term non-linear means? Explain your answer.
- Look at the following graph:




What trend does the data show?
  a) Is the relationship linear or non-linear? Explain your answer.
  b) Is the relationship proportional? Explain your answer.

**QUICK QUESTIONS:**

1. What is a scientific theory?
2. What is a hypothesis?
3. What happens to scientific papers before they are published in a scientific journal?
4. What happens to a model when new evidence emerges?
5. What is the difference between inversely proportional and directly proportional?

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# KS3 Spine

# Scientific theories and models

## 1. Science

- Scientific **theories** and **models** fit the **observations** available at the time and lead to **predictions** that can be tested.
- **Methods** and **theories** develop as earlier **explanations** are **modified** (changed) to take account of new evidence and ideas.
- If new data does not fit the current ideas then the ideas are changed or replaced by alternative ideas.

## 2. Scientific theories

- A scientific **theory** is an **explanation** based on **facts** that have been **repeatedly confirmed** through **observation** and **experiment**.
- For example, scientists have gathered **evidence** and **observations** of the **universe** and how it is expanding away from an initial point. This evidence has led to the **Big Bang Theory**.
- Predications which are repeatedly and reliably confirmed by evidence are regarded as '**facts**'.

## 3. Sharing ideas

- Scientists publish their results which are then **peer reviewed**.
- Scientists will discuss ideas with each other at **conferences** and after reading papers published in **journals**. Different scientists may have different explanations for the same data.
- Other scientists **repeat** their experiments to see if they get the same results.

## 4. Models

- To help in the process of explaining observations and what makes things happen, scientists create **models** to represent what they think may be happening.
- Some models will change as new evidence emerges, others will stay the same as they have an abundance of evidence to support them.
- There may be more than one possible model which fits the evidence.

## 5. Examples of models

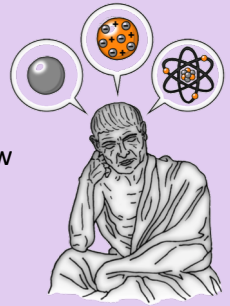
- Sometimes models are **physical models**, e.g. a model of a molecule or the solar system.
- Some models are **theoretical,** e.g. light being a wave motion.

## 6. Mathematics and models

- Some relationships can be represented by a mathematical **formula**.
- Terms such as **linear, inversely proportional and directly proportional** are important terms when looking at relationships in data.

## 7. Theories and models develop over time

- As new evidence is found models and theories will change and adapt.
- A good example of this is the **model of the atom** which changed from a solid sphere model to today's model of the atom as new discoveries were made, e.g. the electron and the positive nucleus.



## 8. Scientific explanations

- A scientific explanation explains an observation using **models** and **theories**.
- **Explanations** do not instantly appear from data. Data provides a **trend** or **pattern.**
- The scientist has to use **intuition**, **imagination** and their **scientific knowledge** to produce a **hypothesis** which can lead to a **prediction** and an **experiment** or **observation.**

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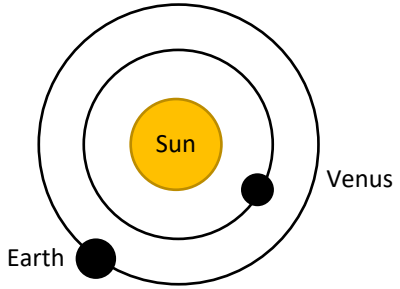
# *Science KS3* **Space**

## Glossary:

- **Asteroid**
  Small rock orbiting a star.
- **Comet**
  Orbits a star, made of ice and dust and may have a tail' of gas when near a star.
- **Earth** Our planet.
- **Earth's Axis**
  Imaginary line between the north and south poles.
- **Galaxy**
  A group of billions of stars.
- **Light year**
  The distance light travels in a year.
- **Milky Way**
  Our galaxy.
- **Moon** Orbits a planet.
- **Orbit**
  The path of an object around a star, planet or moon.
- **Planet**
  Large object which orbits a star.
- **Rotates** Turns.
- **Satellite**
  Orbits a planet. Can be natural – moon or artificial.
- **Seasons**
  Spring, summer, autumn and winter.
- **Star**
  A large ball of gases which generates light and other energy.
- **Sun**
  The star at the centre of our solar system.
- **Tilted**
  At an angle.
- **Universe**
  Everything in existence.
- **Year**
  Time taken for a planet to orbit the Sun once.

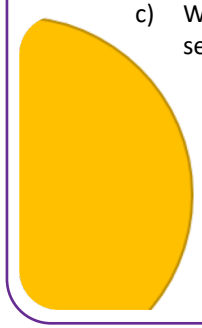
## Activities

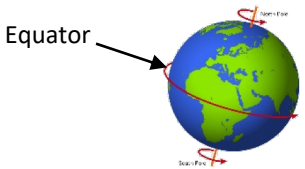
- Look at the diagram below (not to scale). A person standing on the Earth can see Venus even though it does not produce its own light.




a) Name the planet which is between Venus and the Sun.
b) Explain why Venus takes less time than the Earth to orbit the Sun.
c) Explain why Venus can be seen from Earth. You can draw a ray diagram to explain your answer.

- Look at the diagram of the Earth and Sun.
  a) Explain why the Earth has seasons.
  b) Look at the northern hemisphere (the half of the planet above the equator). What season is it in?
  c) What needs to happen for the season to change?






- Place the following in order of size, from the smallest to the largest.
  **Solar system, planet, galaxy, asteroid, universe, Moon, Sun**

- Explain the advantages and disadvantages of sending a robot to explore Mars.

- Neptune is 4.5 billion km from the Sun, 30 times further than the Earth. Calculate how far away the Earth is from the Sun.

**QUICK QUESTIONS:**

1. Name the 8 planets in our solar system, in order from the Sun.
2. Name the Earth's nearest star.
3. What is an asteroid?
4. How long does it take the Earth to orbit the Sun?
5. Why do we have day and night?
6. Why do we have seasons?
7. How have we explored distant parts of our solar system?
8. What is a light year? What is it used for?
9. What is the name of our galaxy?
10. What is the universe?

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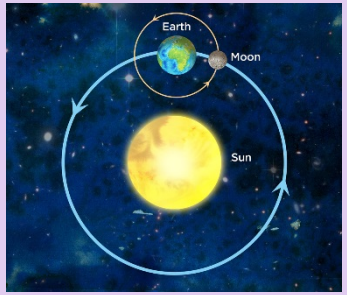
## 1. Our solar system

- The **Sun**, a **star** at the centre of our **solar system**, is its only source of **visible light**.
- Our Solar System contains:
  - 8 planets
  - Dwarf planets
  - Moons
  - Asteroids
  - Comets.

## 2. The Earth's orbit

- The Earth moves around the Sun in an **orbit** which takes a **year (just over 365 days)**.
- Planets orbit the Sun in roughly circular orbits.
- The force of **gravity** keeps planets in orbit.

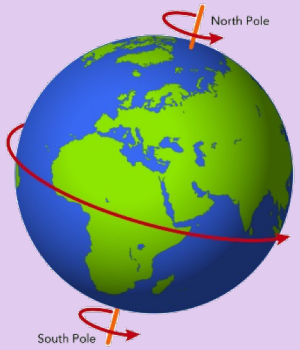



## 3. The Earth's rotation

- The Earth **rotates** about its north to south axis. This makes it appear that the Sun and stars are moving around the Earth.
- This rotation causes **day and night** as different parts of the Earth face towards or away from the Sun.
- It takes about 24 hours for the Earth to spin in its axis.

## 4. A tilted Earth

- The Earth's axis is **tilted** so that the length of the day varies depending on the position the Earth and the time of year.
- This causes the **seasons.**




## 5. The Moon

- The **Moon** is a natural **satellite** which orbits the Earth, taking about 4 weeks to complete an **orbit**.
- The Moon **reflects light** from the Sun as it moves around the Earth. Only the parts lit by the Sun's rays are seen.
- Other planets also have moons.

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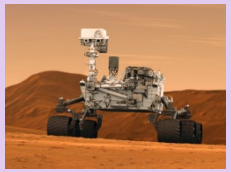
# Space

## 6. The planets

- The Earth is one of eight known planets in the Solar System: **M**ercury, **V**enus, **E**arth, **M**ars, **J**upiter, **S**aturn, **U**ranus and **N**eptune.
- The planets are different distances from the Sun and have **different orbits**; they take different amounts of time to orbit the Sun.
- The distances between planets is huge – Neptune is 4.5 billion km from the Sun, 30 times further than the Earth.

## 7. Exploring the solar system

- Exploring the solar system is possible with **robot missions,** e.g. exploration of the planets by Voyager I and II.
- Exploring shorter distances from the Earth is possible by humans, e.g. the International Space Station (ISS) and the Moon.



## 8. The Universe

- The solar system is part of a **galaxy** of stars, dust and gas, called the **Milky Way**.
- Our galaxy is one of many billions in the **Universe.**
- These galaxies are enormous distances apart so the **light year** is used as a unit of distance. This is the distance light would travel in a year.
- Many other stars appear to have planets, some of which may be able to support life.

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# *Science KS3* **The Earth**

## Glossary:

- **Chlorophyll**
  Green dye found in plants.
- **Climate change**
  Changing the weather and environmental conditions.
- **Combustion**
  Burning in oxygen or air.
- **Core**
  Centre of the Earth.
- **Crust**
  Surface of the Earth, divided into tectonic plates.
- **Deforestation**
  Cutting down forests of trees.
- **Emit** Give out.
- **Fossil fuels**
  Non-renewable fuel including oil, natural gas and coal.
- **Global warming**
  Rise in the average temperature of the Earth's surface.
- **Greenhouse effect**
  Greenhouse gases trapping infra-red radiation keeping the Earth warm.
- **Infra-red radiation**
  Heat energy.
- **Magma**
  Liquid rock in the mantle.
- **Mantle**
  Hot layer beneath the Earth's crust.
- **Organism**
  An individual living thing, e.g. bacteria or a human.
- **Photosynthesis**
  Chemical reaction which produces glucose.
- **Radiation**
  Energy waves emitted by the Sun.
- **Radioactive**
  Dangerous particles or waves emitted by unstable atoms.
- **Respiration**
  Chemical reaction which releases energy from glucose.
- **Tectonic plates**
  Large pieces of the Earth's crust.

## Activities

- Explain the greenhouse effect in terms of radiation.
  a) Where does the original radiation come from?
  b) What happens to it when it reaches the surface of the Earth?
  c) What type of radiation is emitted from the surface of the Earth?
  d) What happens to this radiation?
  e) Why does this cause the green house effect?

- During deforestation, large areas of trees are cut down and burned.

Explain two ways deforestation leads to global warming.

- Carry out research into **Alfred Wegener** who developed the continental drift theory, which led to the modern theory of plate tectonics.

a) What evidence did he have for continental drift?
b) Why was his theory so controversial?

- Green plants produce glucose via photosynthesis.
  a) Describe the process of photosynthesis.
  b) Explain how plants use this glucose to get energy.

**QUICK QUESTIONS:**

1. Draw and label a diagram showing the structure of the Earth.
2. Name three gases found in the atmosphere.
3. Name two gases which contribute to the greenhouse effect.
4. Where does the Earth's external energy come from?
5. Where does the Earth's internal energy come from?
6. Name two processes which release carbon dioxide into the atmosphere.
7. Name a process which removes carbon dioxide from the atmosphere.
8. Why do plants need chlorophyll?

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# KS3 Spine The Earth

## 1. The atmosphere

- There is **air** all around the Earth's surface, but less and less the higher in the sky you go.
- The layer of air at the Earth's surface is **transparent** to most of the **radiation** coming from the Sun.
- The Earth's atmosphere contains approximately 78% Nitrogen, 21% oxygen and 0.04% carbon dioxide.

## 2. Internal source of energy

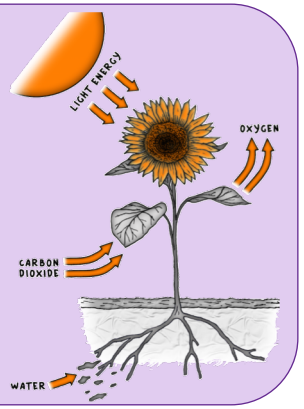
- **Radioactive decay** of materials inside the Earth acts as the Earth's **internal** source of energy.
- It is this energy which causes the **tectonic plates** to move. This leads to earthquakes, as well as the formation of mountains and volcanoes.

## 3. External source of energy

- The radiation from the Sun, which is **absorbed** by the Earth's surface, acts as an **external** source of energy.

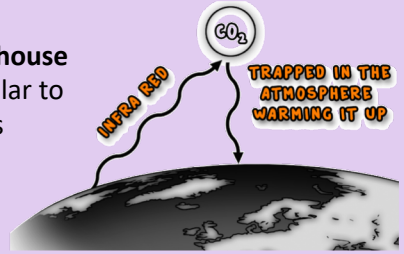

## 4. Photosynthesis

- **Radiation** from the Sun provides the energy for **photosynthesis**.
- **Organisms** which contain **chlorophyll** can absorb this energy to make **glucose** via photosynthesis.




## 5. The greenhouse effect

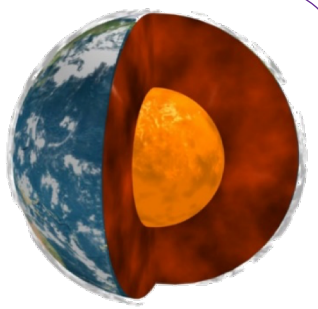
- The radiation absorbed by the surface of the Earth is **emitted** as **infra-red radiation**.
- Infra-red radiation cannot pass through the Earth's atmosphere but is absorbed by it, keeping the Earth warm.
- This is called the '**greenhouse effect**' because it is similar to the way a greenhouse is heated by the sun.




## 6. The structure of the Earth

- The Earth's **crust** is made of large pieces called **tectonic plates**. Beneath the Earth's crust is a hot layer called the **mantle**. When there is less pressure, the mantle melts and forms **magma.**

The centre of the Earth is called the **core**.

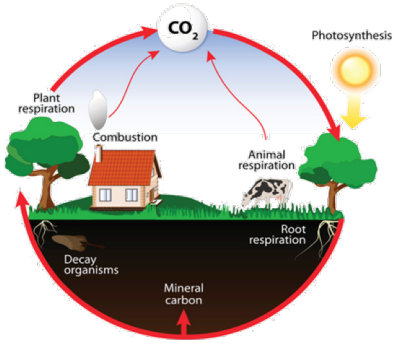


## 7. Human impact on climate

- Human activities produce **carbon dioxide** and **methane**.
- **Burning fossil fuels** and **deforestation** increase the levels of carbon dioxide in the atmosphere. Cattle produce large amounts of methane.
- This increases the **greenhouse effect** and leads to **global warming** and **climate change**.
- Climate change causes: ice caps to melt, oceans to warm and changes to habitats.

## 8. The carbon cycle

- Carbon is needed by all **cells**.
- It is removed from the atmosphere by **photosynthesis** and returned to it by **respiration** and **combustion**.

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