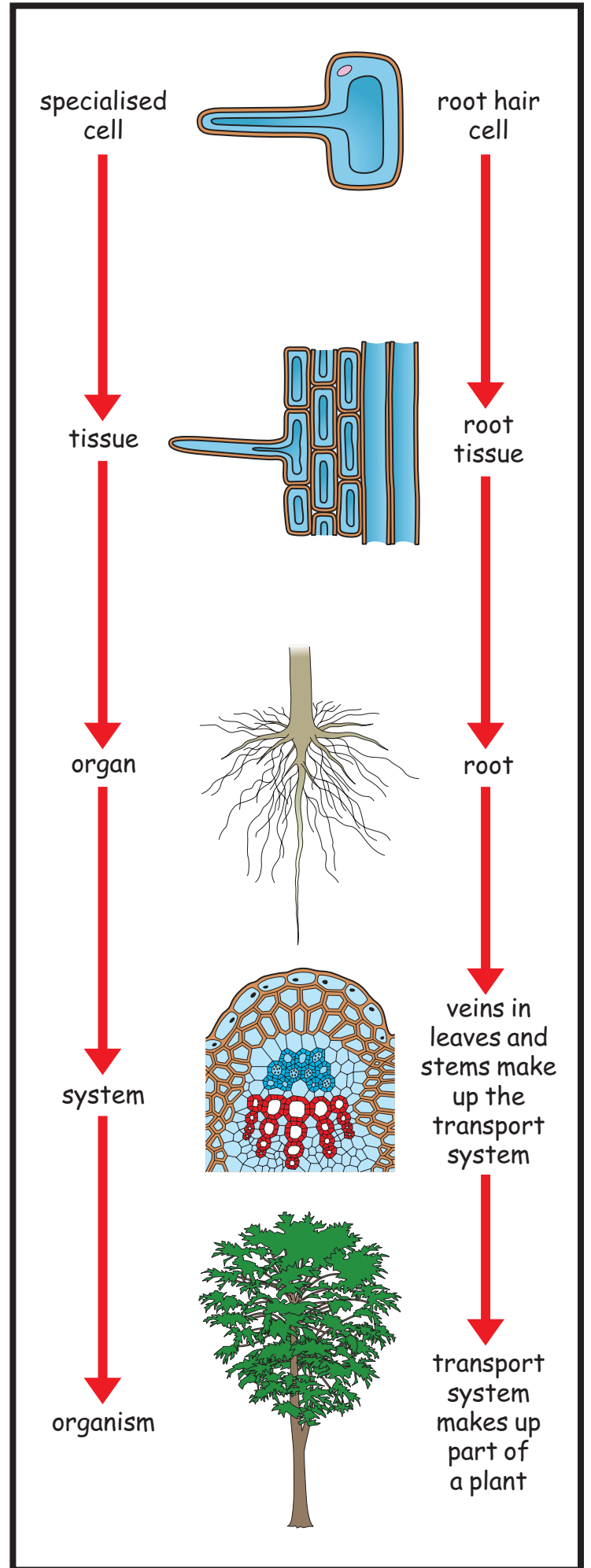
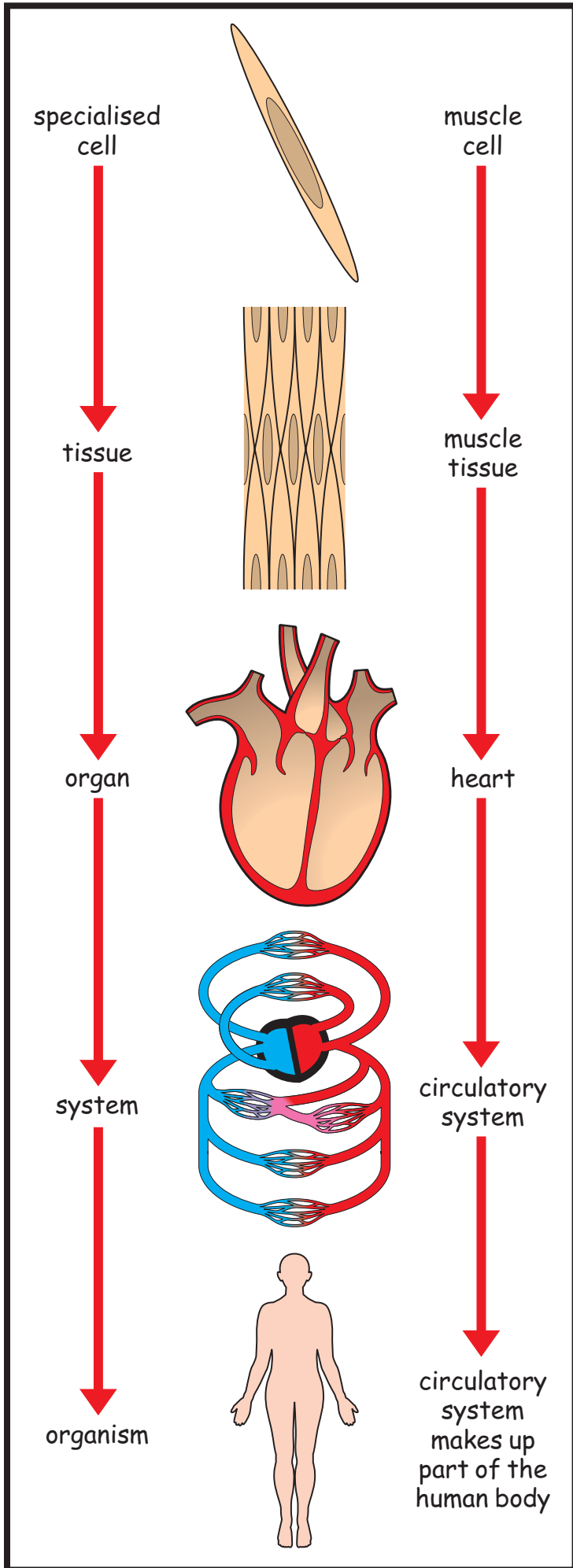
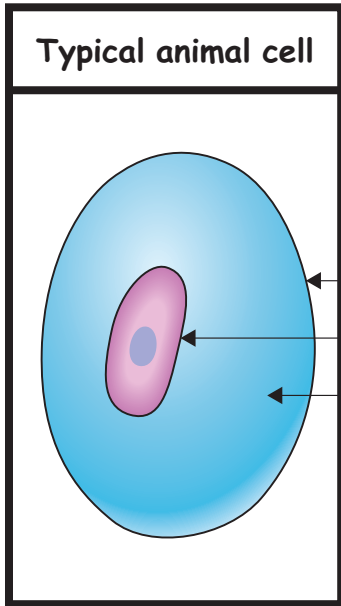
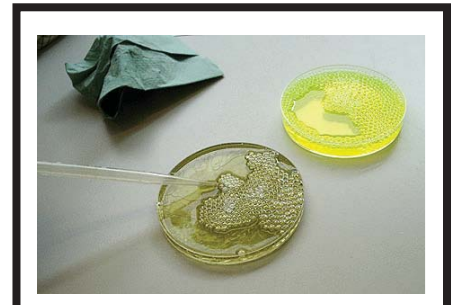
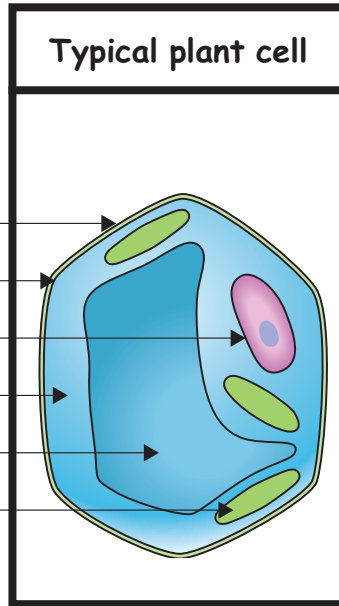


Key scientific ideas - Cells 1





Cell wall
Cell membrane
Nucleus
Cytoplasm
Vacuole
Chloroplast

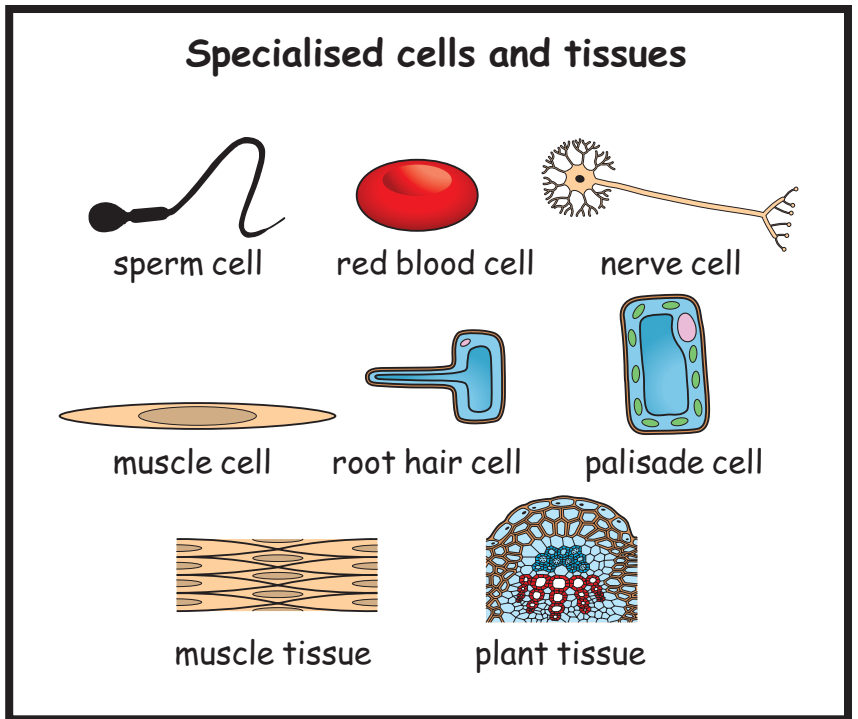


This 3-D model shows how an organism grows because of cell division and not because the individual cells get bigger.

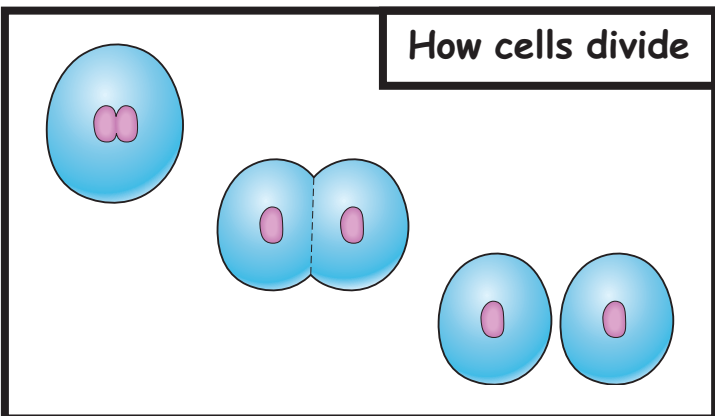
Movement **R**espiration **S**ensitivity **G**rowth **R**eproduction **E**xcretion **N**utrition

Cells, tissues, organs

- Similar specialised cells can be grouped together and form tissues.
- Tissues group together to form organs.
- Organs grouped together form systems and the whole thing is called an organism.



Organisms with specialised cells can function more efficiently and effectively.



Useful vocabulary

Cell	Tissue
Cytoplasm	Organ
Chloroplast	Cell division
Cell wall	Fertilisation
Cell membrane	Sperm cell
Nucleus	Egg cell
Vacuole	Organism

Key scientific ideas - Cells 2

Cells use the nutrients from food to help an organism work properly.

Some food substances are made up of very large molecules. Enzymes break these down quickly for the organism to use.

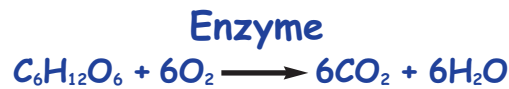
The circulatory system transports useful substances like nutrients and oxygen to all cells in the body. It also transports waste products away from the cells.

The digestive system uses enzymes produced by the cells to break-down food substances into smaller, more useful molecules.

Cells transfer energy through respiration, which often needs oxygen. This helps to keep the organism alive.

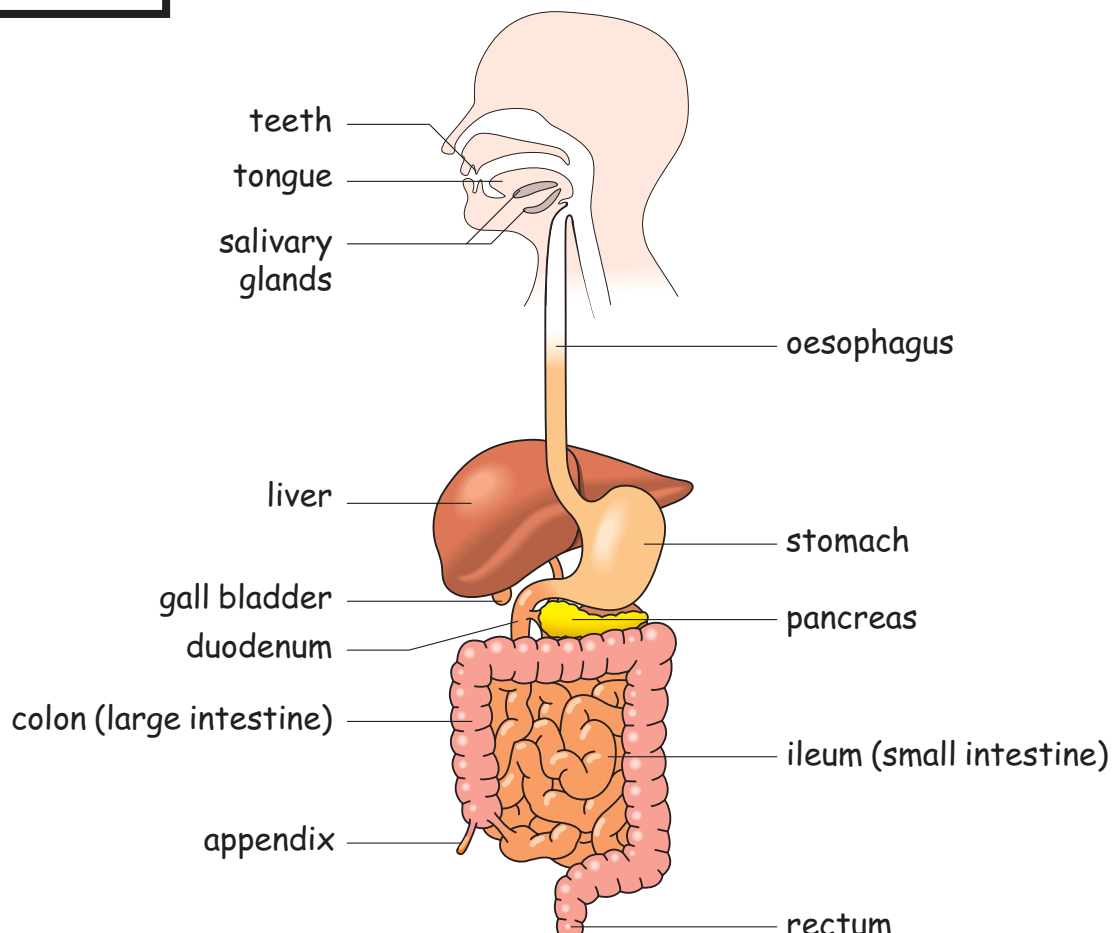


ENERGY



ENERGY

Digestive system



Many diseases are caused by micro-organisms.

Antibiotics are drugs that can cure some diseases caused by bacteria.

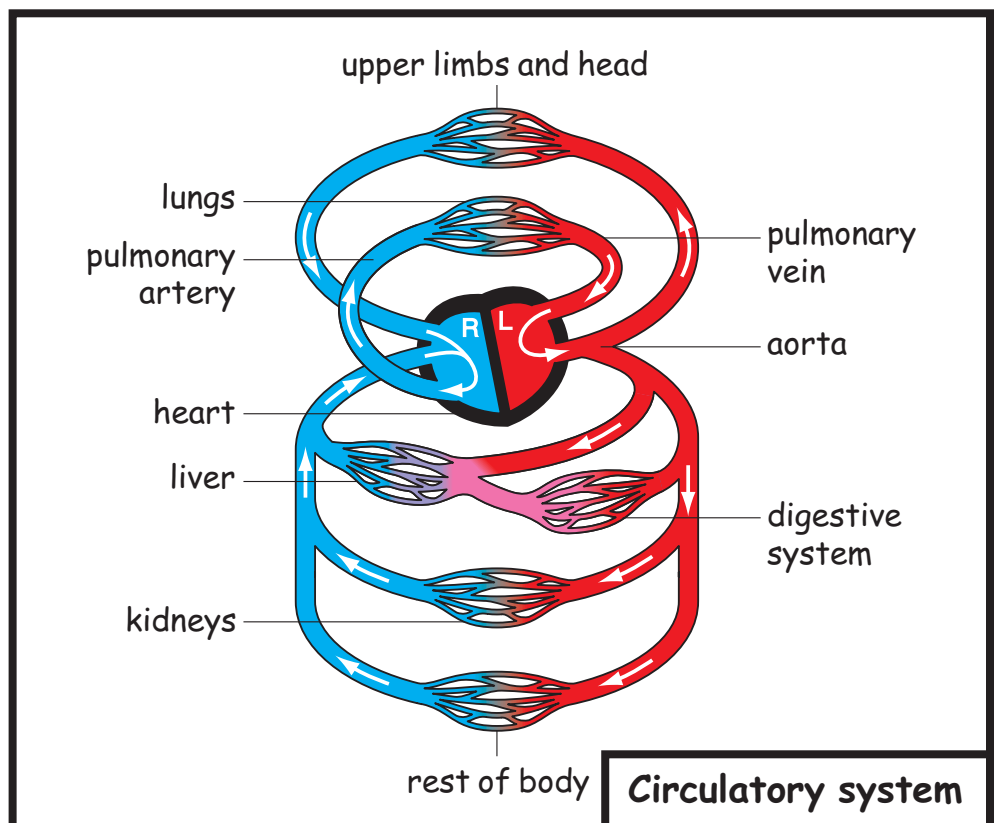
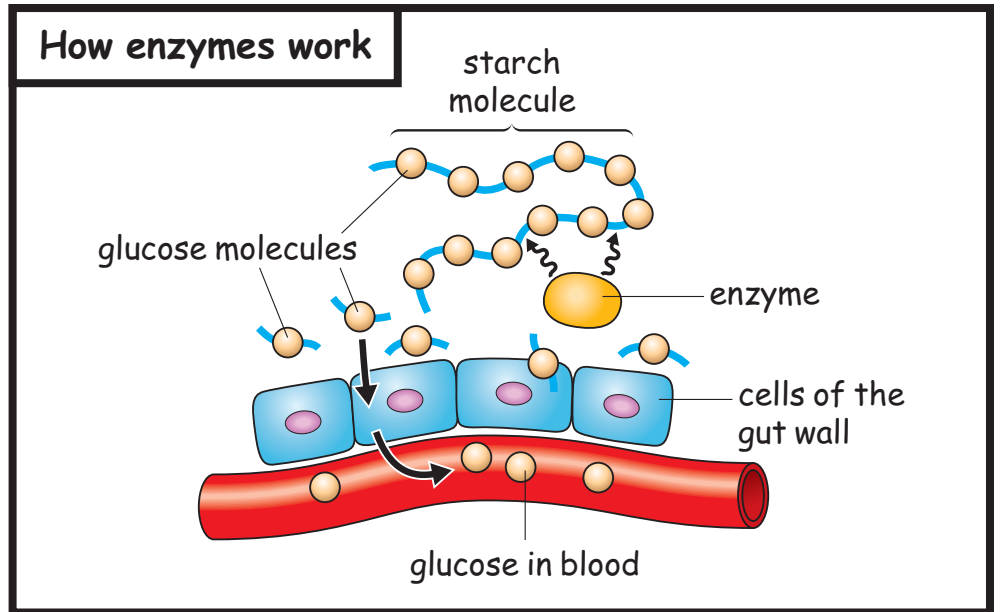
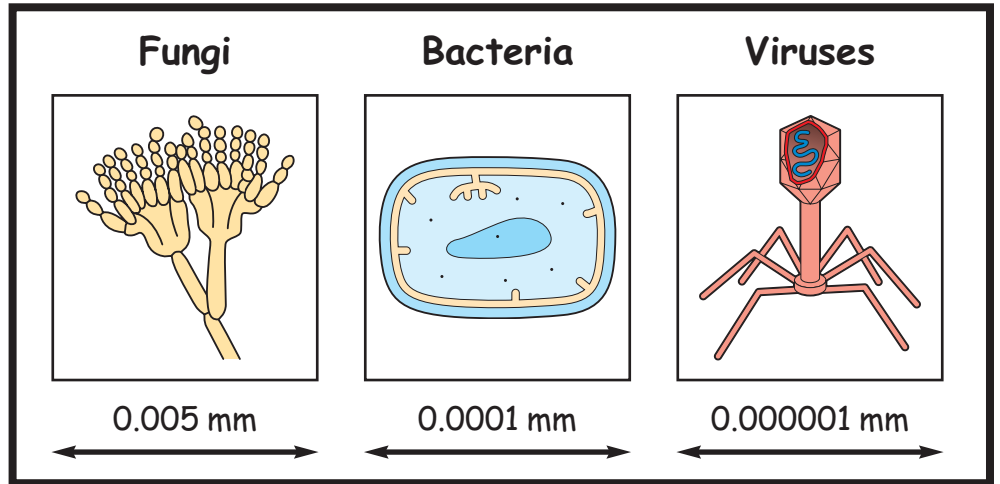
Bacteria and fungi are single-celled organisms.

Vaccination can protect against some illnesses caused by viruses and bacteria.

The body's own defence system protects us against infection by many micro-organisms.

Useful vocabulary

Cell
Organ
Cell membrane
Micro-organism
Bacteria
Immunisation
Vaccine
Antibodies
Digestion
Cell wall
Enzyme
Virus
Fungi
Antibiotics
Disinfectant



Key scientific ideas - Cells 3

Respiration...



.... is a bit like burning a fuel.

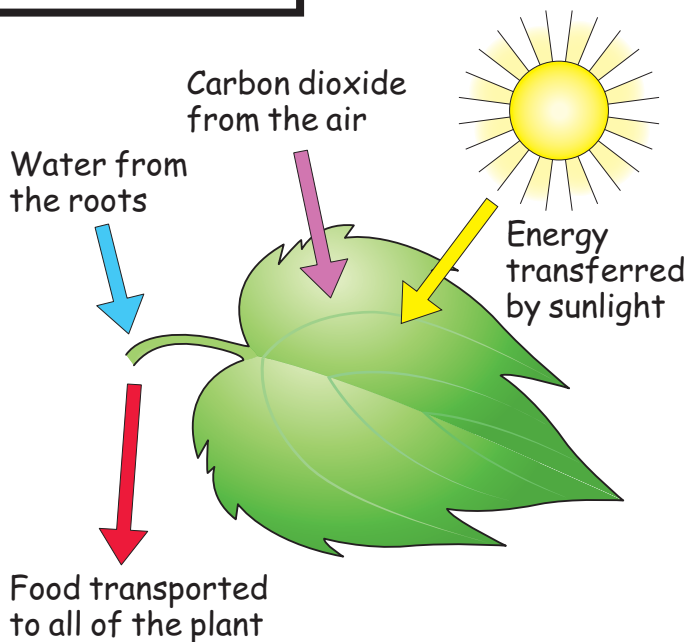


Like burning, respiration transfers **energy** to the surroundings by heating.

The nucleus in a cell contains all the genes that control all the characteristics of an organism.

Selective breeding, either by nature or by humans, can increase the chance of certain genes passing from one parent to the offspring.

Photosynthesis



When fertilisation occurs half the chromosomes from one parent join with half the chromosomes from the other parent to produce a new individual.

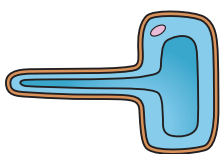
Photosynthesis requires chlorophyll in plant cells, light, carbon dioxide and water in order for the plant to make food. The leaves and roots of a plant are adapted so that photosynthesis can take place efficiently.

Chemicals from smoking, alcohol and drugs can affect how well different parts of the human body work.

Chromosomes are made up of genes and genes are made of DNA.

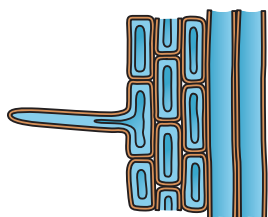
Exercise helps to keep the body's organs and systems working properly.

Cell



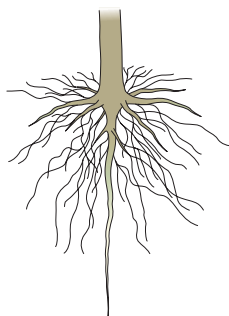
Root hair cell

Tissue



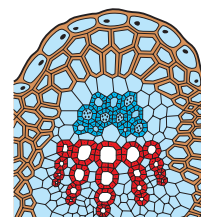
Root hair tissue

Organ



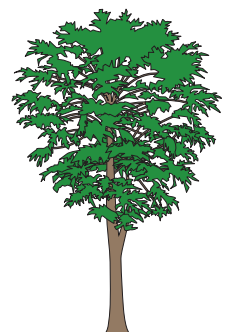
Root

System



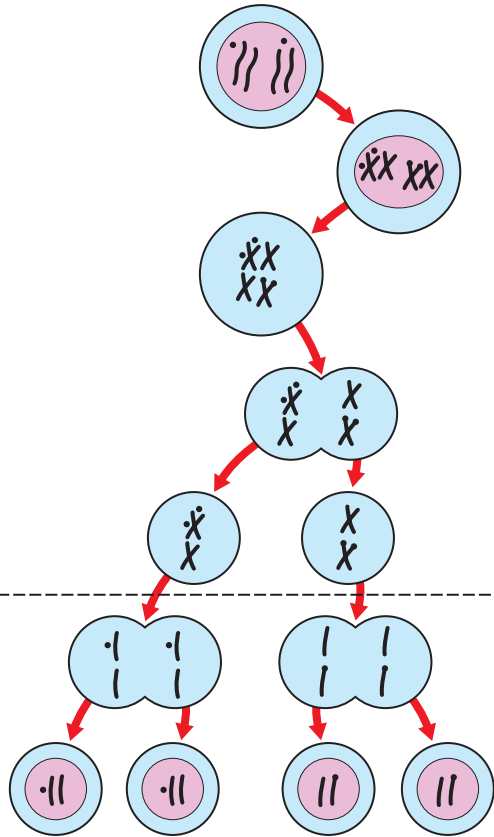
Veins in leaves and stems

Organism



Tree

The formation of sex cells



Parent cell with 4 chromosomes.

Chromosomes replicate forming pairs of chromatids.

Pairs of chromosomes arrange themselves in the centre of the cell.

The chromosomes separate and move to opposite ends of the cell.

The first cell division occurs.

The chromosomes now separates from each other and move to opposite ends of the cells.

The second cell division occurs.

It's all about Respiration, Photosynthesis and Reproduction

Photosynthesis enzyme
 carbon dioxide + water \longrightarrow glucose + oxygen

ENERGY -
 transferred by sunlight

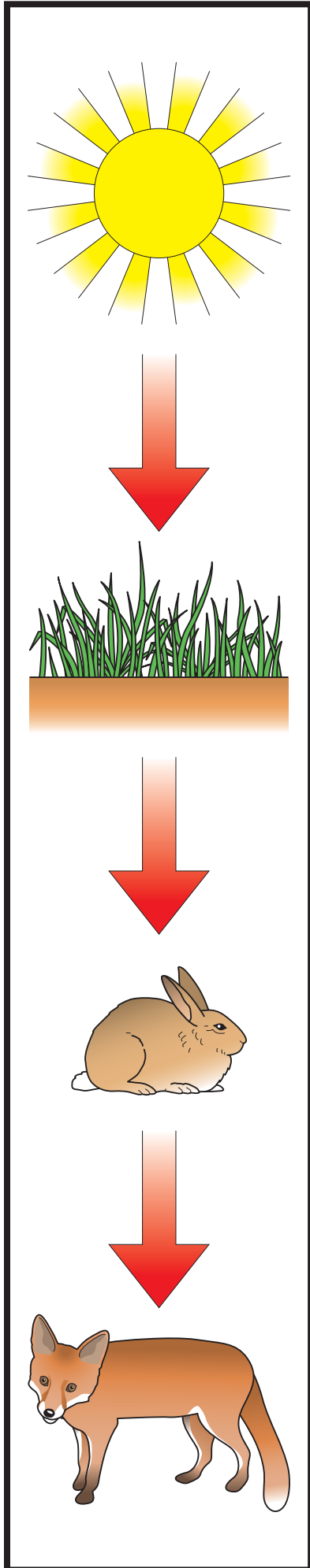
Respiration enzyme
 glucose + oxygen \longrightarrow carbon dioxide + water

ENERGY

Useful vocabulary

Cell
 Digestion
 Organ
 Cell wall
 Cell membrane
 Chlorophyll
 Photosynthesis
 Respiration
 Chloroplasts
 Genes
 Fertilisation
 Characteristics
 Inherited
 Selective breeding
 Fertilisers

Key scientific ideas - Energy 1



Plants get their energy from the sun.

In a circuit, energy is transferred from the cell to the bulb by an electric current.

The sun is the ultimate source of nearly all the energy on the earth.

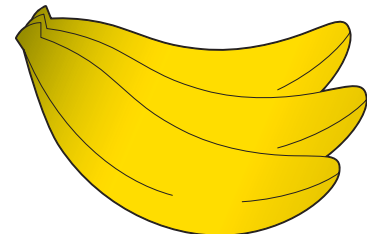
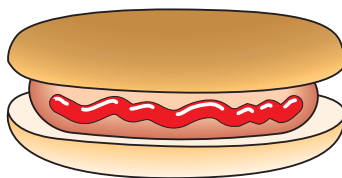
Fossil fuels are convenient concentrated stores of energy.



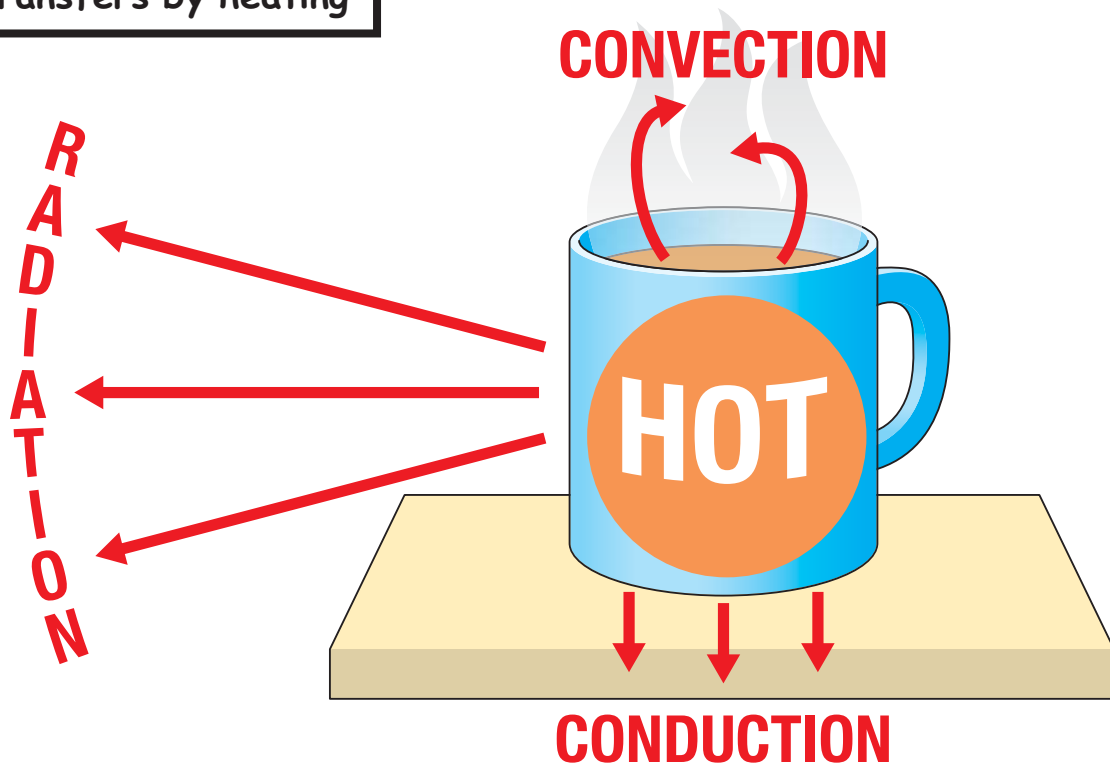
Energy can be stored:

- in food and fuels (chemical energy)
- in stretched elastic bands and springs (elastic potential energy)
- in moving objects (kinetic energy)
- inside atoms (nuclear energy)

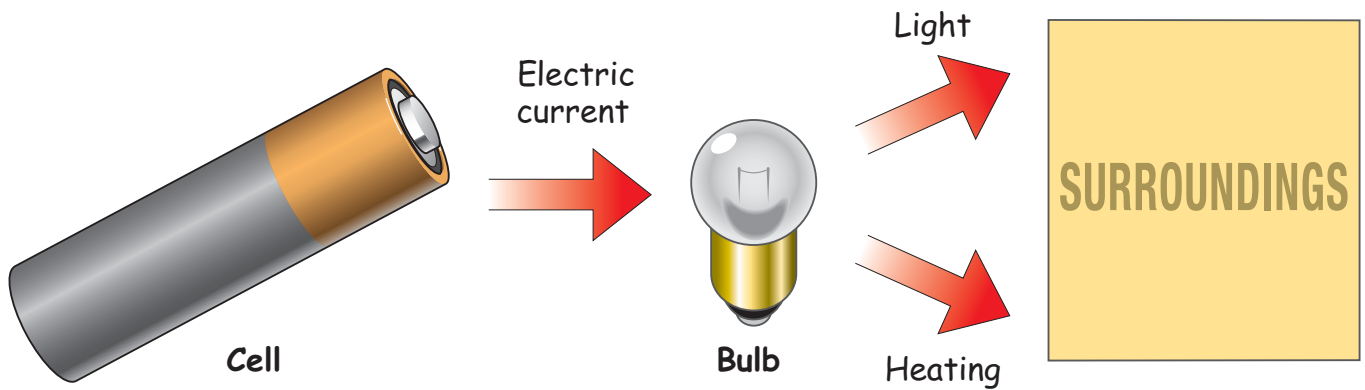
The amount of energy stored in food is measured in joules.



Energy transfers by heating



The energy transfers in a torch



Energy is transferred by heating by:

- conduction
- convection
- radiation

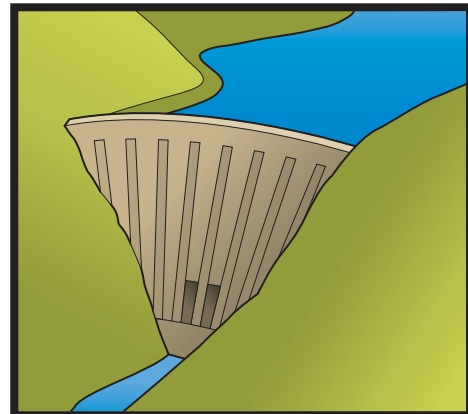
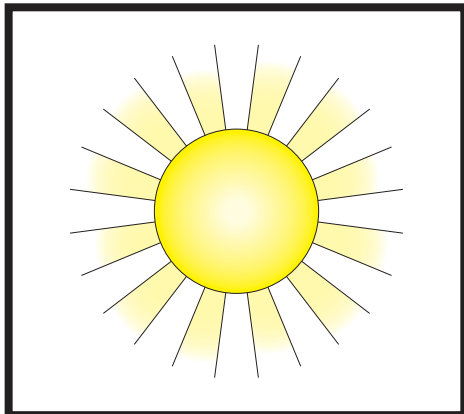
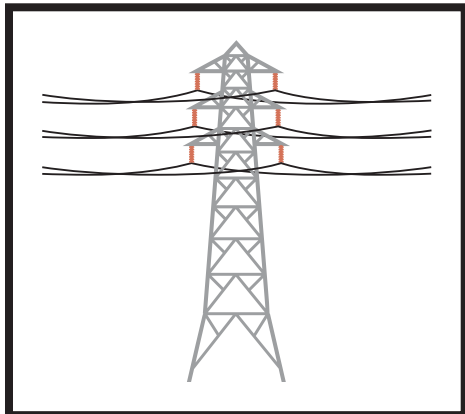
Useful vocabulary

Energy transfer
Food chain
Heating
Light
Sound
Joule

Kinetic
Potential
Chemical
Stored
Producer
Consumer
Fossil fuel

Renewable
Electric current
Surroundings
Convection
Conduction
Radiation

Key scientific ideas - Energy 2



Ordinary electric light bulbs are not very efficient.

In a circuit, energy is transferred from the cell to the bulb by an electric current.

Fossil fuels are convenient concentrated stores of energy.

Energy is transferred by heating by:

- conduction
- convection
- radiation

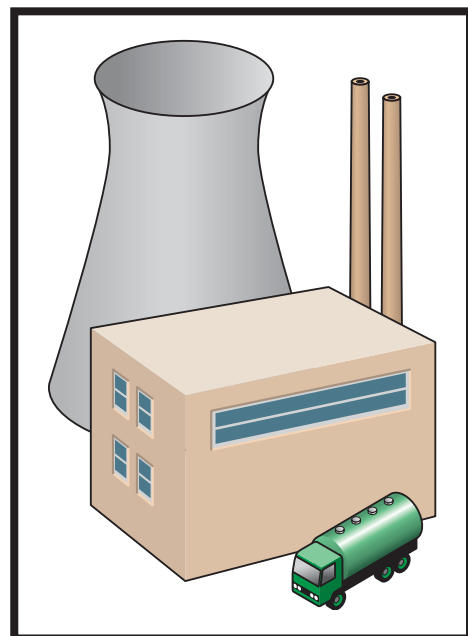
Plants get their energy from the sun.

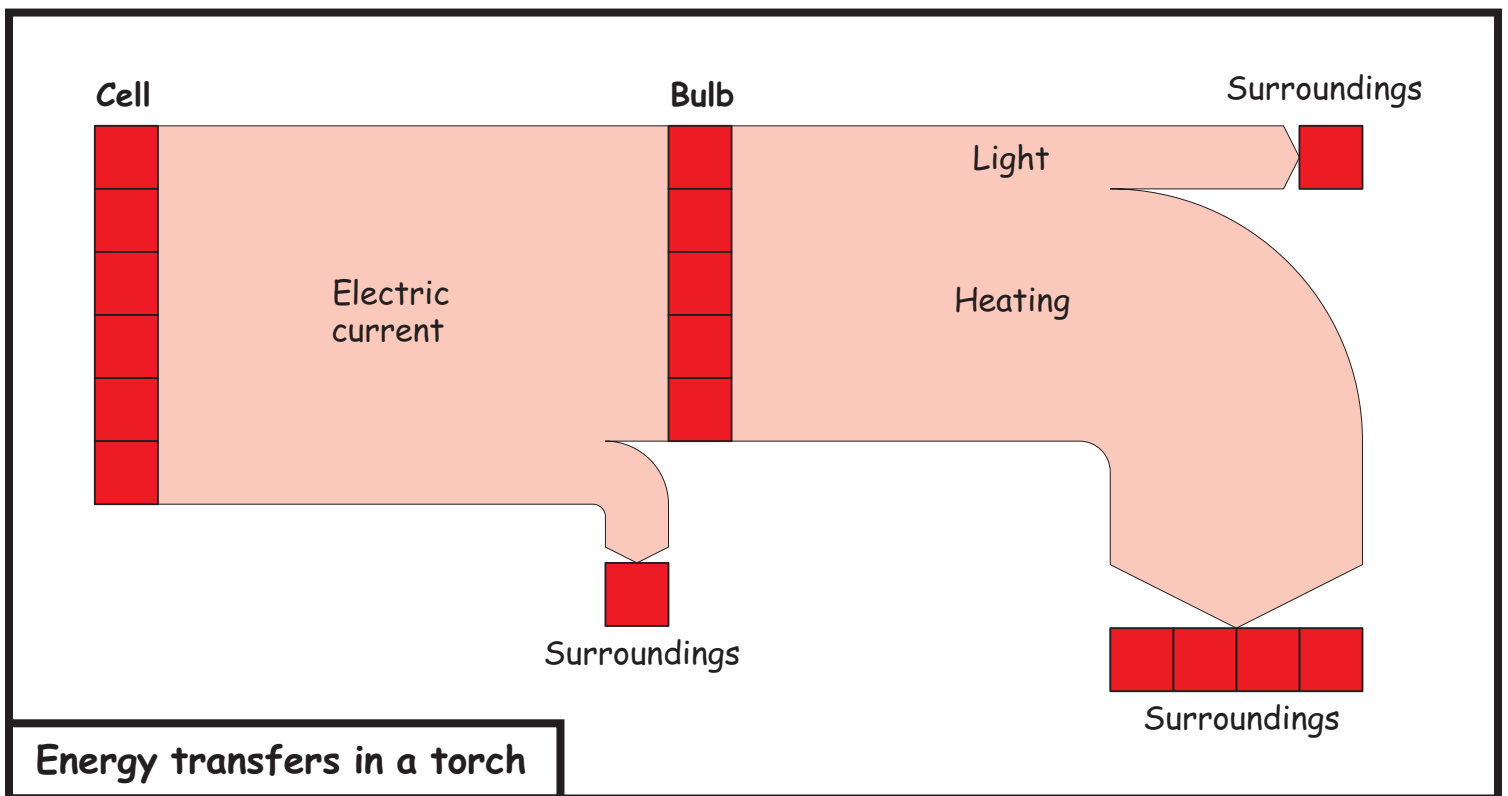
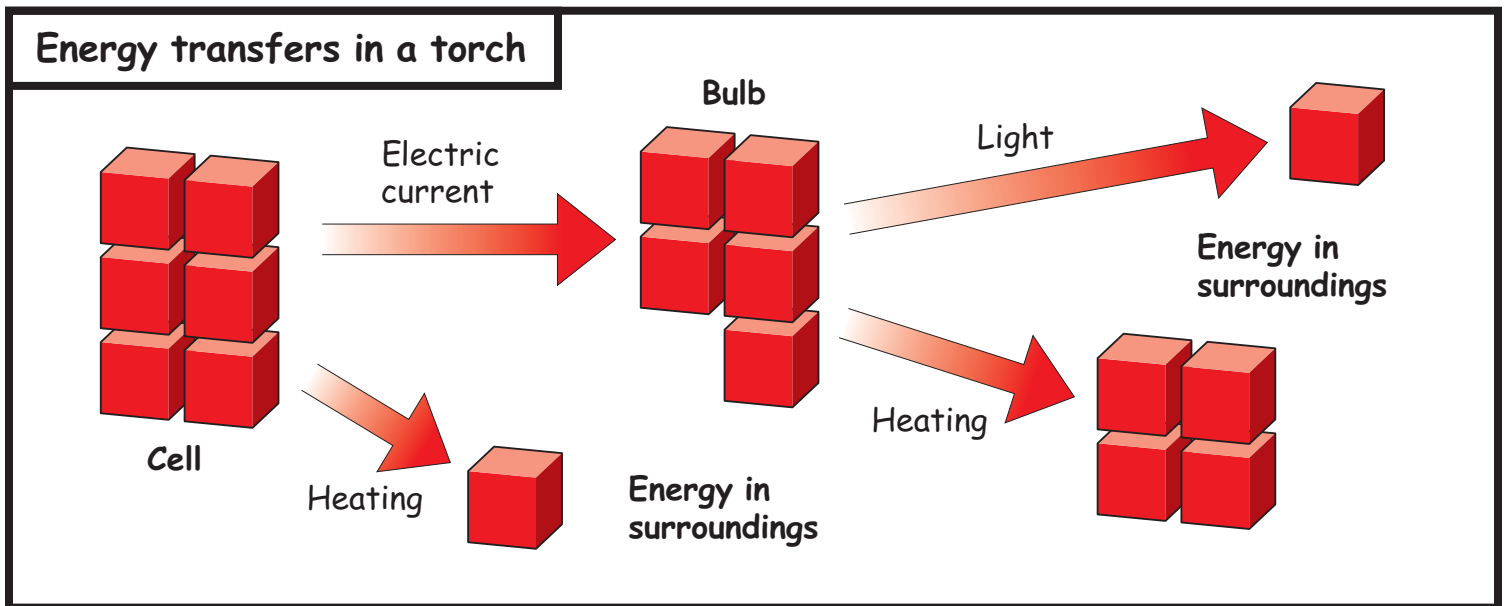
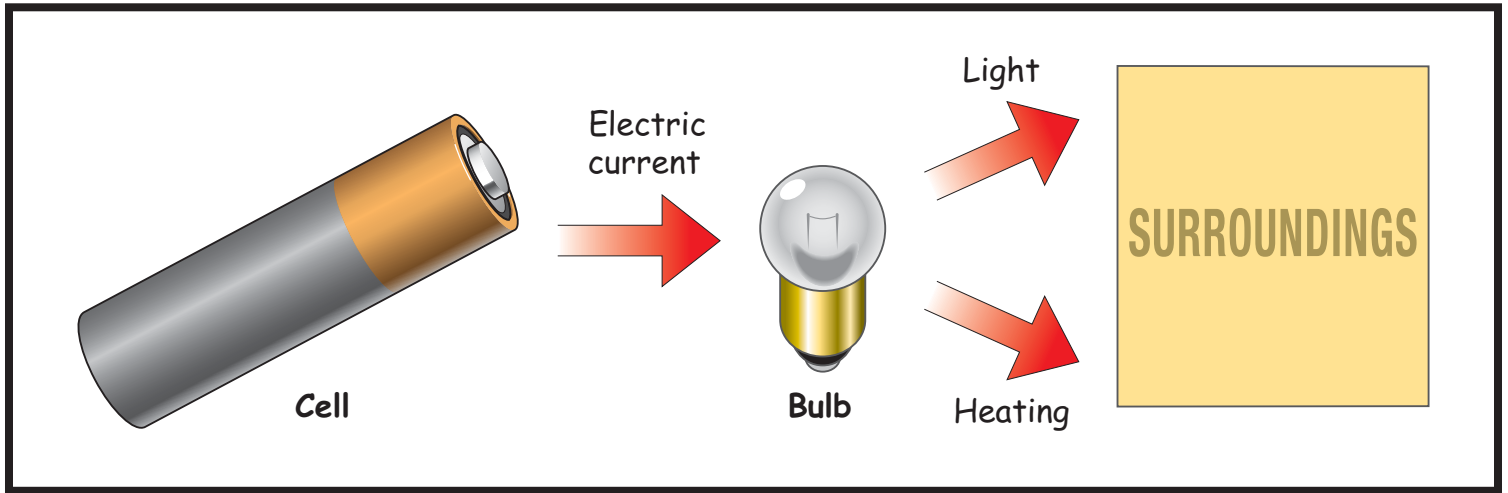
The amount of energy transferred is measured in joules.



Useful vocabulary

Energy transfer	Stored	Renewable
Heating	Conservation	Electric current
Light	Efficiency	Surroundings
Sound	Sankey diagram	Potential
Chemical	Dissipation	
Kinetic	Fossil fuel	





Key scientific ideas - Forces

Forces come in **pairs**.

Contact forces

One object exerts a force on another as long as they are **touching**.

Contact forces exist for as long as the objects are touching. Once the objects are apart, the forces no longer exist and the interaction has ended.

Non-contact forces

Some forces affect an object without touching it. The forces of **gravity**, **magnetism** and **electrostatics** are all examples of non-contact or **field forces**.

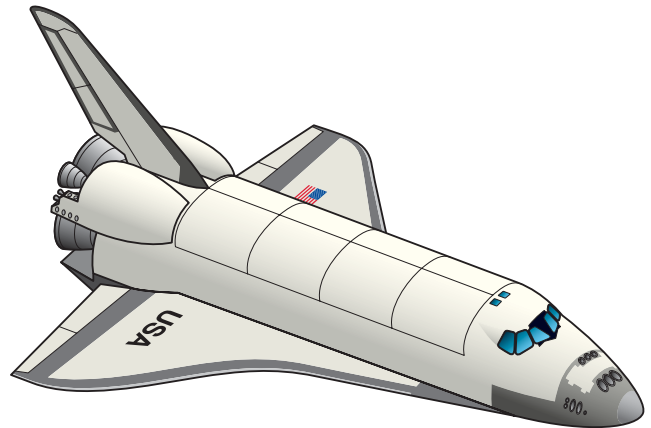
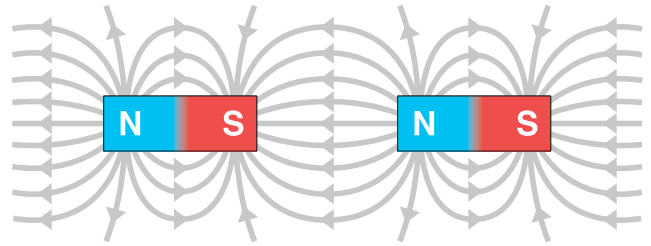
When there are several forces acting, the overall force is called the **resultant** force.

If an object is moving at a **steady speed** in a **straight line**, the overall (resultant) force acting on it is zero.

If an object is **not moving**, the resultant force acting on it is zero.

Friction arises when two surfaces move over one another. Air resistance and water resistance are friction forces caused by the movement of something through air or water.

In the '**perfect**' world... scientists often find it easier to think of what would happen if we lived in a world without friction.



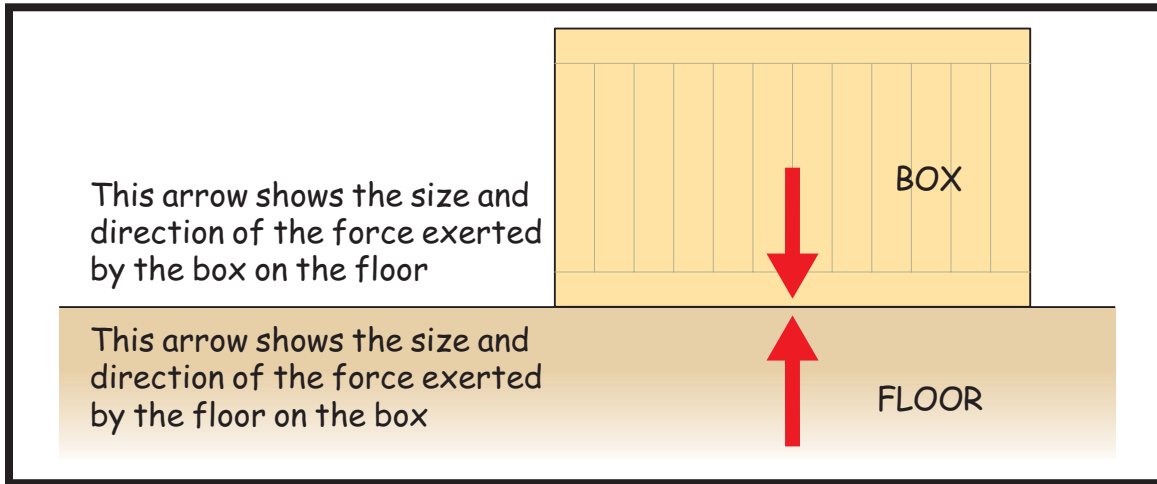
Predicting and explaining motion

1. Identify the size and direction of all the forces acting on the object you are interested in.
2. Add the forces acting on the object together to find the overall 'resultant' force on it.
3. Use the following rules:
 - if there is a total (resultant) force acting on the object, this will change the motion of the object, in the direction of the force;
 - if the resultant force is zero, the motion of the object will not change.

Identifying forces

- Which forces are acting?
- Where are the forces acting?
- What are the size and direction of the forces?

A force cannot be 'put into' or 'stored in' an object.



- ### Useful vocabulary
- Contact force
 - Exerted by
 - Constant
 - Tension
 - Opposing
 - Unbalanced
 - Weight
 - Balanced
 - Mass
 - Acting on
 - Stationary
 - Friction
 - Attraction
 - Newton
 - Reaction
 - Moving
 - Gravity
 - Surface
 - Pair

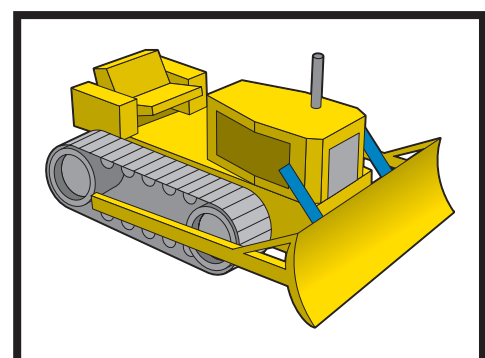
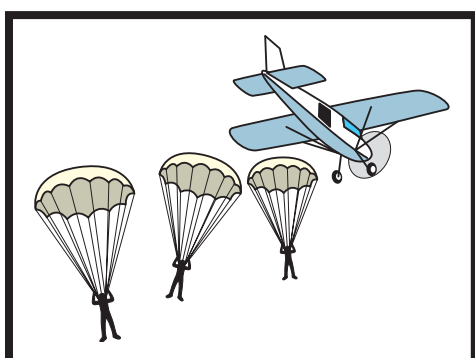
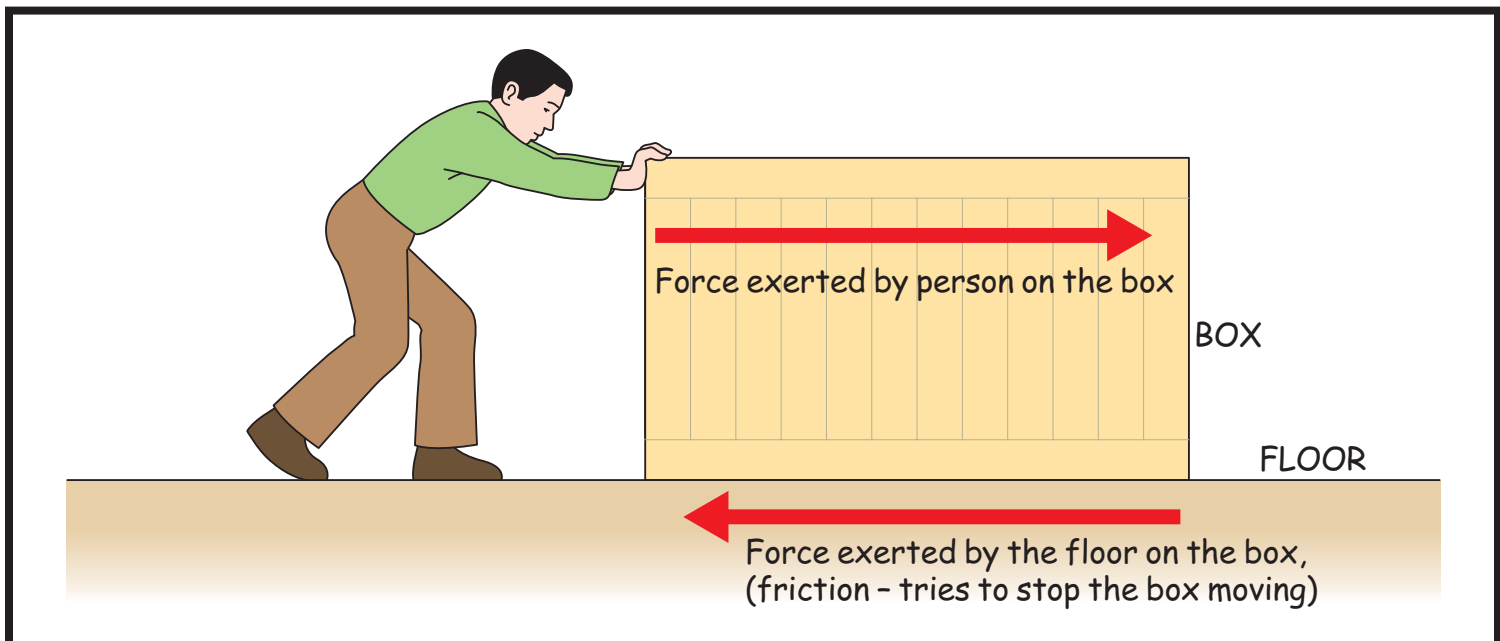
'Force arrows' help to show the forces acting in a particular situation.

The **length** of a 'force arrow' can be used to indicate the size of the force. The **direction** of a 'force arrow' is often more important than the precise point at which it acts.

Pressure

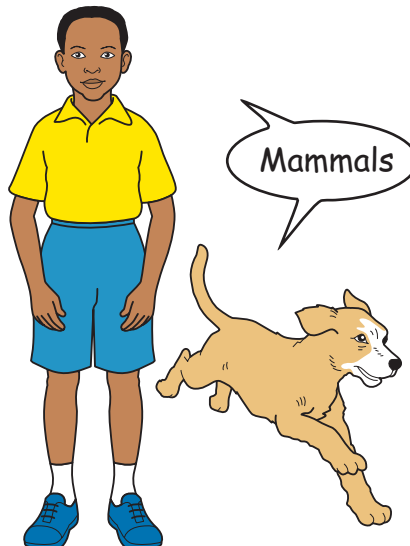
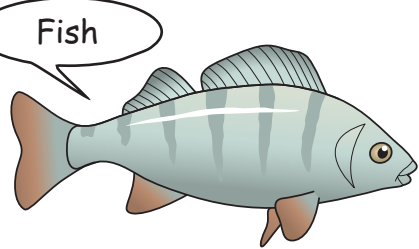
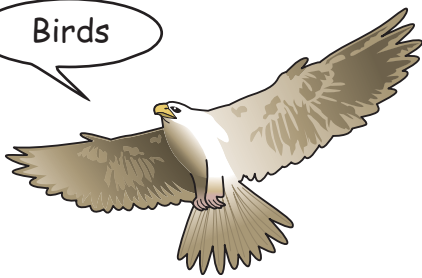
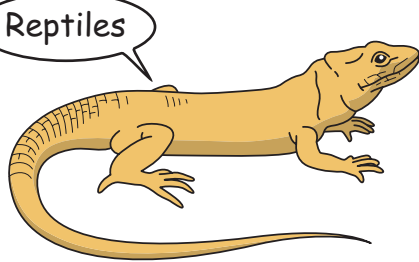
Forces can be spread out over a larger area to reduce the **pressure** on the surface.

When forces are concentrated on a small area the **pressure** is bigger.



Key scientific ideas - Interdependence

5 Vertebrate groups



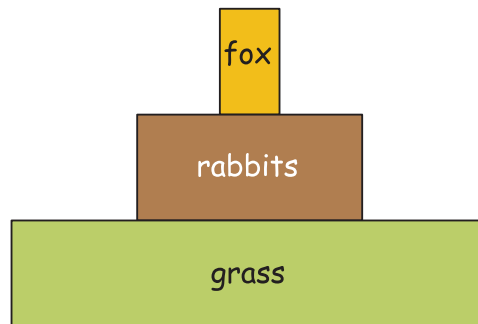
The sun is the ultimate source of nearly all the energy on the earth.

Plants get their energy from the sun.

Energy is transferred through a food chain by feeding.

Only 10% of the energy stored in the organisms at one level in a food chain is transferred by feeding and digestion to the organisms at the next level.

A pyramid of numbers



Plants

With flowers
Daisy; dandelion; rose;
strawberry; potato;
trees; grass

Without flowers
Mosses; ferns; seaweeds

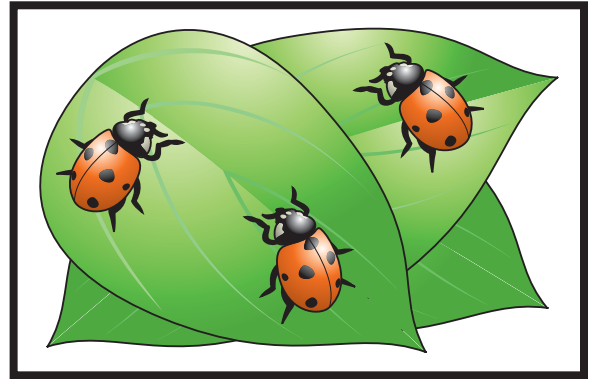


Animals

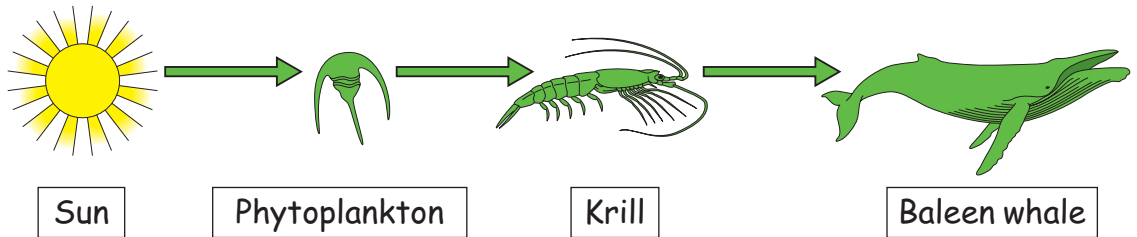
Vertebrates	Invertebrates
Amphibians	Insects
Reptiles	Snails
Birds	Worms
Fish	Jellyfish
Mammals	Squid

Living things interact with each other and their physical environment. Changes that occur in their environment can affect them, for example:

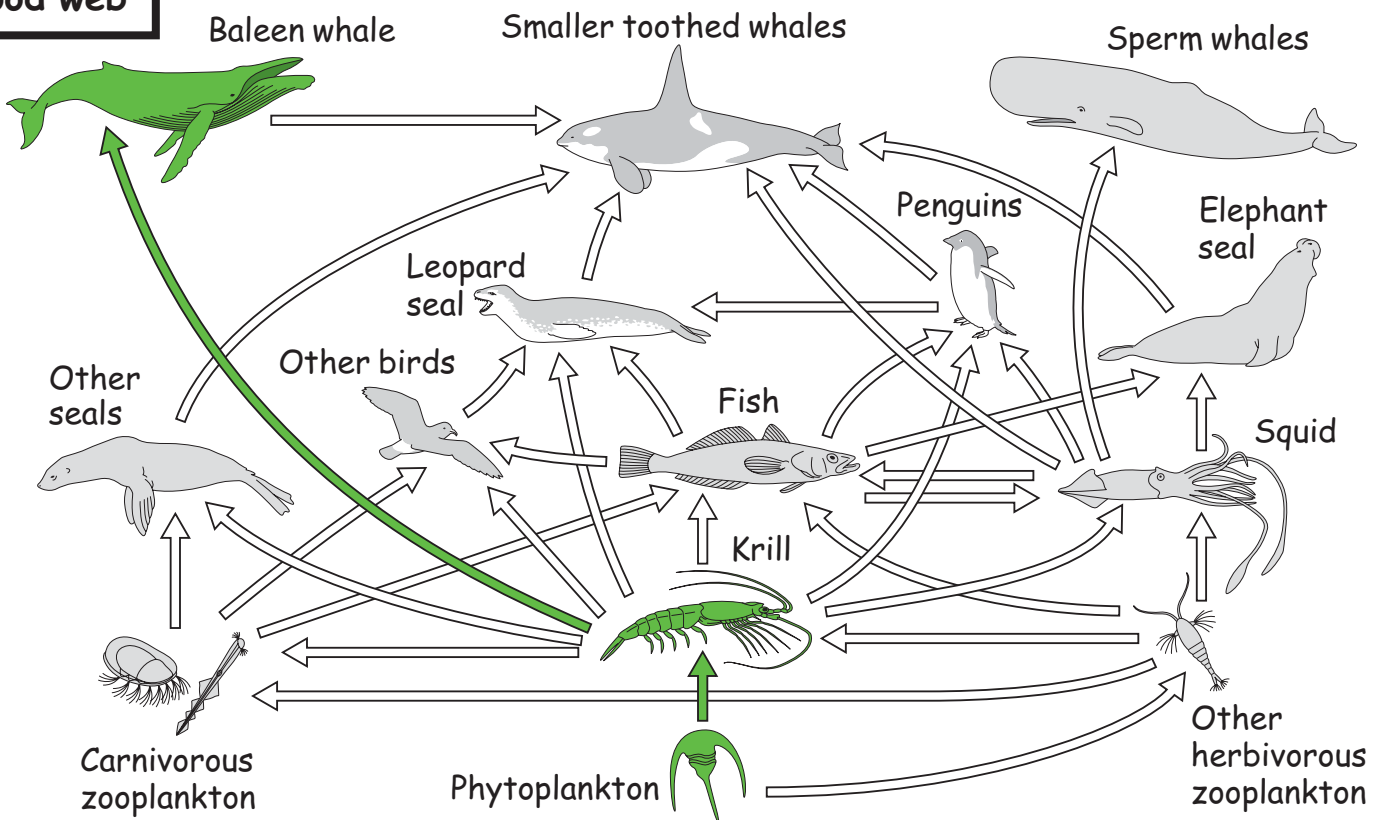
- Global warming
- Acid rain
- Pollution
- Insecticides, herbicides and pesticides



Food chain



Food web



Useful vocabulary

Energy transfer
Food chain
Adaptation
Variation
Habitat

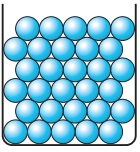
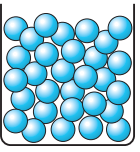
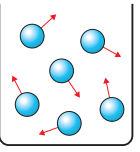
Predation
Competition
Food web
Diversity
Population size

Producer
Environmental factors
Carnivore
Prey
Identification

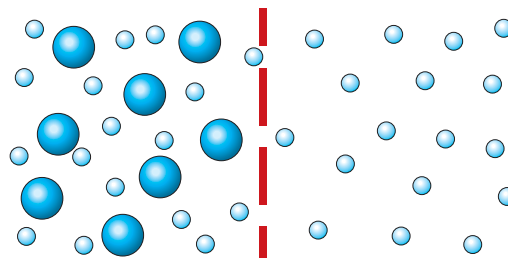
Keys
Ecosystem
Classification
Consumer
Species

Key scientific ideas - Particles

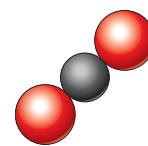
This is one model

	Solid	Liquid	Gas
Diagram			
How are the particles arranged?	Fixed pattern	Random	Random
How are the particles moving?	Vibrating on the spot	Moving over each other	Fast moving
How close are the particles?	Close	Close	Far apart

Particles can be of different sizes. This could explain how some chemicals can pass through membranes and others can't.

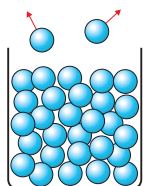


Molecules are made of atoms joined together (bonded), for example, carbon dioxide.



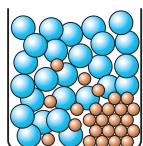
This model can explain...

...evaporation



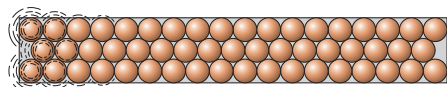
The fastest-moving particles escape from the surface of the liquid.

...dissolving



Particles from the solid break off and spread out amongst the particles of the liquid.

... conduction



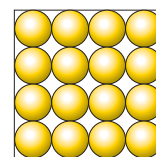
The particles nearest the flame begin to vibrate more.



Gradually energy is transferred from particle to particle along the bar by vibration.

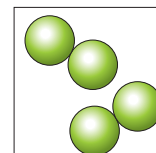
...and lots more!

Elements contain only one type of atom.



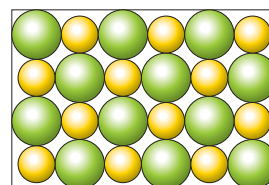
Sodium (Na)

There are just over 100 different elements.



Chlorine (Cl₂)

Compounds have a fixed combination of different types of atoms.

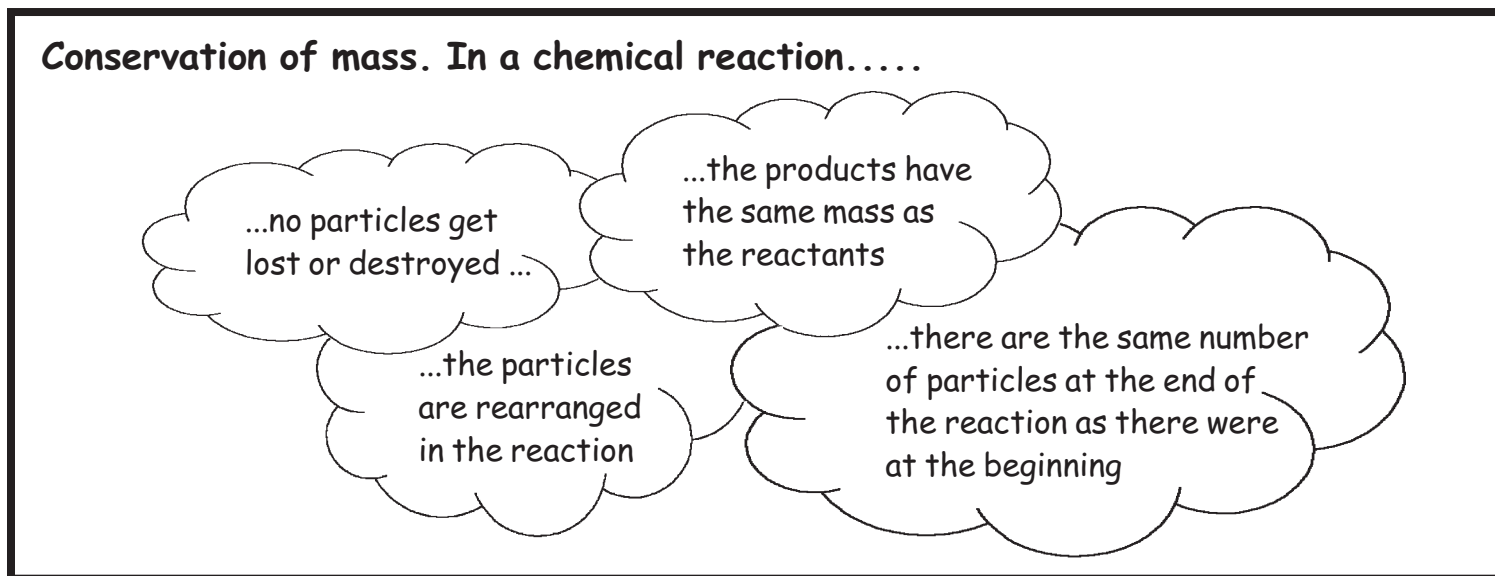
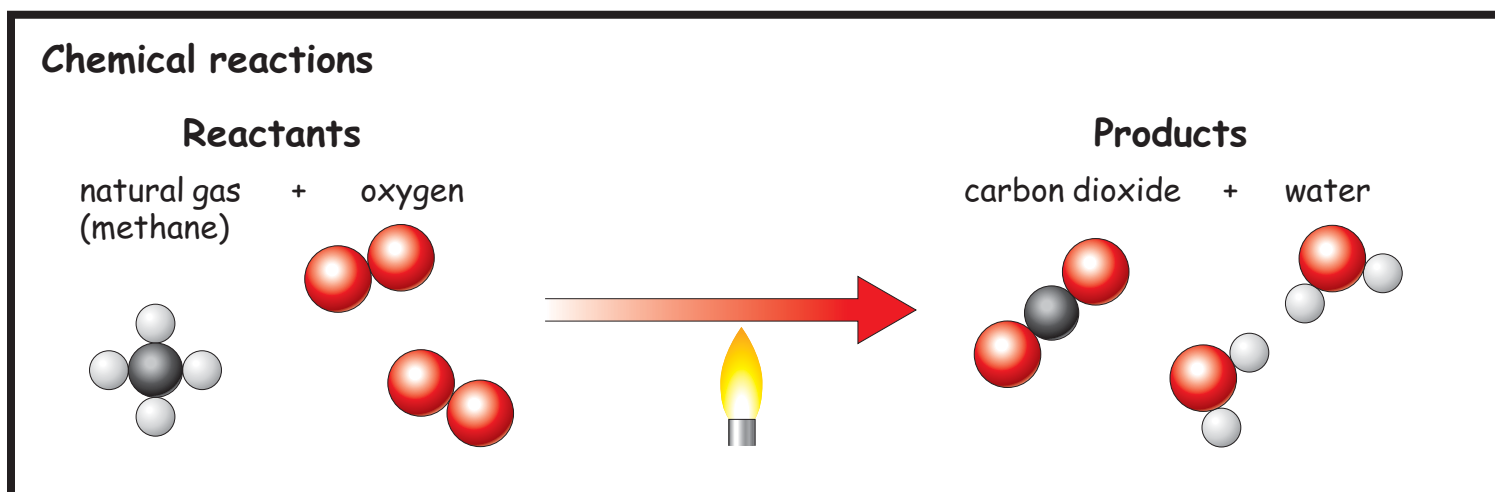
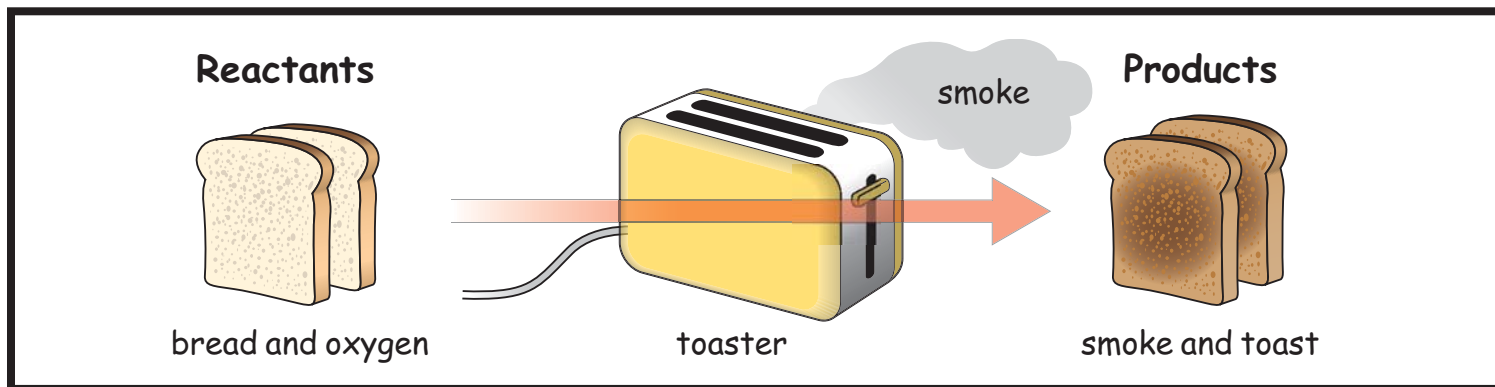


Sodium chloride (NaCl)

Compounds can't easily be separated.

The names of some compounds can tell you what elements are in them, for example compounds ending in:

- ...ate contain lots of oxygen
- ...ite contain some oxygen
- ...ide contain no oxygen (except for oxides and hydroxides)



Word equation

Methane + oxygen → carbon dioxide + water

Symbol equation

$$\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$$

Useful vocabulary

Particle	Atom	Displacement
Compressible	Compound	Equation
Diffusion	Decompose	Neutralisation
Expansion	Element	Product
Gas pressure	Formula	Reactant
Symbol	Molecule	Reactivity
	Mixture	Salt

Science problem solver

The problem:

.....

Brainwaves – *Important ideas and vocabulary that may be useful*

See – *Diagrams and pictures that may help with an explanation*

Science problem solver

Think/Sequence – *Organising the best ideas into a sensible order*



Paragraph – *A full explanation of the problem*