Work Book 1

An **Organelle** is a specific part within a living cell that serves a function e.g. nucleus.

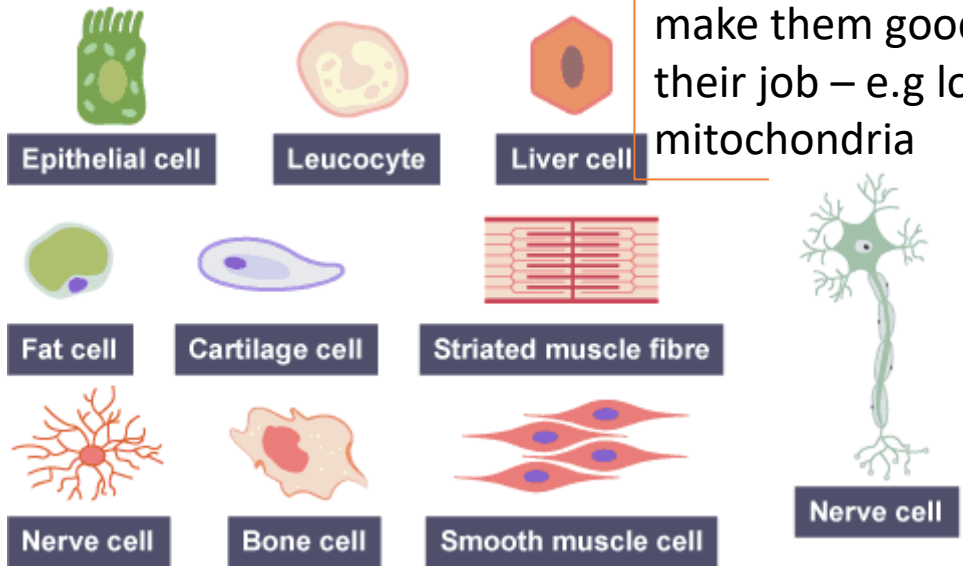
Cells, tissues and organs.

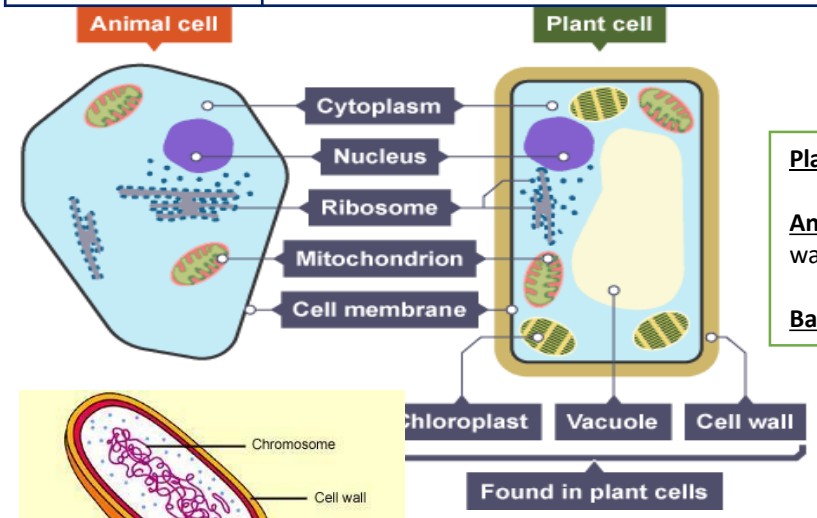
Specialised cells have special features that make them good at their job – e.g lots of mitochondria

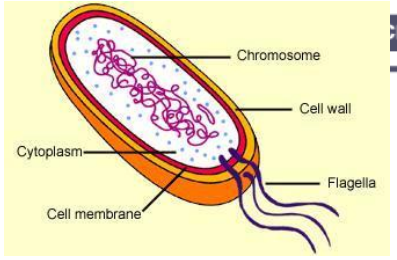
Organelle	Function
Nucleus	*Contains genetic material which controls the cell's activities*
Cell Membrane	*Controls the movement of substances in and out of the cell*
Cytoplasm	*Where most of the chemical reactions happen*
Mitochondria	*Where most energy is released in respiration*
Ribosome	*Where protein synthesis happens*
Cell Wall	*Strengthens the cell and supports the plant*
Chloroplast	*Absorb light energy for photosynthesis (contains **chlorophyll**)*
Vacuole	*Filled with cell sap to help keep the cell turgid to provide support.*

Movement
Respiration
Sensitivity

Growth
Reproduction
Excretion
Nutrition







Bacterial cell

Cell → Tissue → Organ → Organ system → Organism

Plant cells contain **all** of the above organelles.

Animal cells contain all of them **apart from** cell wall, chloroplasts and large, permanent vacuole.

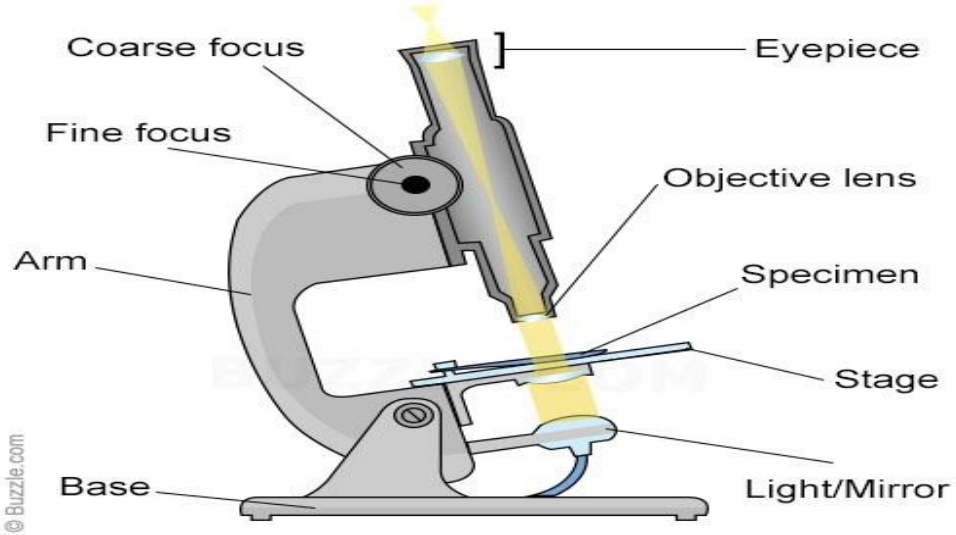
Bacterial cells don't have a nucleus

Unicellular organisms are made of one cell (e.g. amoeba)

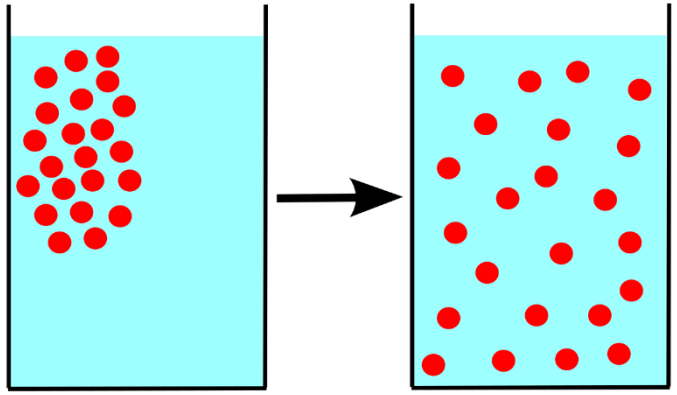
Multicellular organisms are made of many cells (e.g. human)

Cell	The building blocks of life, all living things are made up of cells.
Tissue	A group of the **same type of cell** working together to do a particular job. E.g.. Lots of muscle cells make up a muscle tissue!
Organ	Made from a group of **different types** of tissue, which all work together to do a particular job. E.g.. The heart
Organ System	Made from a group of different organs, which all work together to do a particular job within the organism. Eg circulatory system.
Organism	A living thing – this can be plants, animals or microorganisms!

How can we take a closer look inside cells?



How do cells get what they need?



Diffusion is the spreading out of particles from a high concentration to a low concentration

Magnification

Using a microscope:

1. Stain the sample to make objects easier to see
2. Put the slide on the stage
3. Start with the LOWEST magnification
4. Use the coarse focus to find cells
5. Increase the magnification
6. Use the fine focus to see them clearly

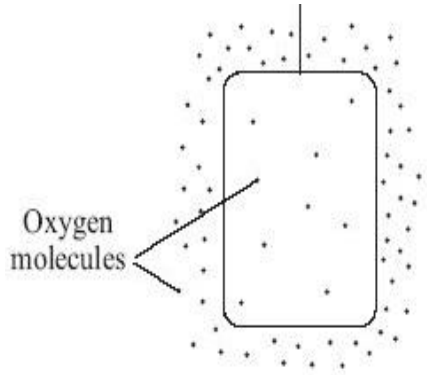
$$\text{Actual size} = \frac{\text{Image size}}{\text{Magnification}}$$

$$\text{Magnification} = \frac{\text{Image size}}{\text{Actual size}}$$

Example :
An image of a cell is 3mm long, but it's actual size is 0.012mm. Calculate the magnification

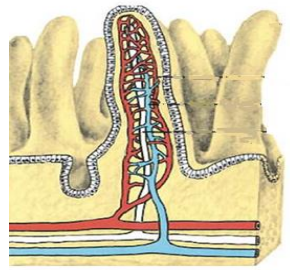
$$\text{Magnification} = \frac{3}{0.012}$$

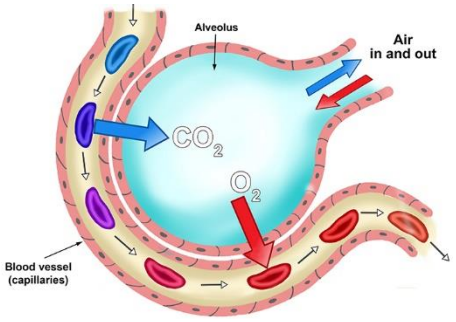
Magnification = 250 x



Diffusion takes place across the cell membrane to allow substances like oxygen in

Internal surfaces





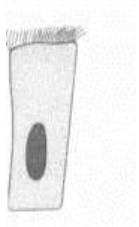
The intestines and lungs are highly folded to make diffusion as fast and easy as possible. The membranes are thin

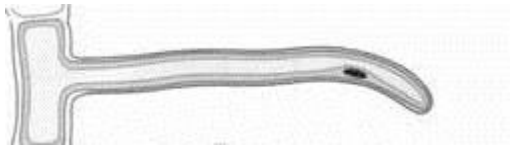
1. What are the functions of the cell membrane?
2. What is the role of mitochondria?
3. What is the function of ribosomes in a cell?
4. This controls the activities of the cell.
5. What do plant cells have that animal cells do not have?
6. Groups of cells are known as……
7. Tissues are organised into……
8. What is the job of the digestive system?
9. These are found in the nucleus and code for different characteristics.
10. These substances pass into living animal cells.
11. Which magnification should you start with on a microscope?
12. Where is chlorophyll found in plant cells?
13. Which feature do bacterial cells NOT have
14. Name 2 types of cell that have a cell wall
15. The stomach, small intestine and large intestine are part of which system?
16. Name the process by which substances move into and out of cells
17. How do folded surfaces inside the body speed up diffusion?

Longer questions:

1. Describe how use a microscope to view cells:

2. Describe how the following cells are specialised for their jobs:





3. An image of a cell is 5mm, the real size is 0.015mm. Calculate the magnification

Explaining the properties of solids

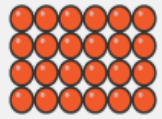
Property	Reason
Fixed shape & cannot flow	Particles cannot move from place to place
Cannot be compressed (squashed)	Particles are close together and have no space to move into

Explaining the properties of liquids

Property	Reason
They flow and take the shape of their container	The particles can move around each other
They cannot be compressed (squashed)	The particles are close together and have no space to move into

Explaining the properties gases

Property	Reason
They flow and completely fill their container	The particles can move quickly in all directions
They can be compressed (squashed)	The particles are far apart and have space to move into

State	Solid	Liquid	Gas
Diagram			
Arrangement of particles	Regular arrangement	Randomly arranged	Randomly arranged
Movement of particles	Vibrate about a fixed position	Move around each other	Move quickly in all directions
Closeness of particles	Very close	Close	Far apart

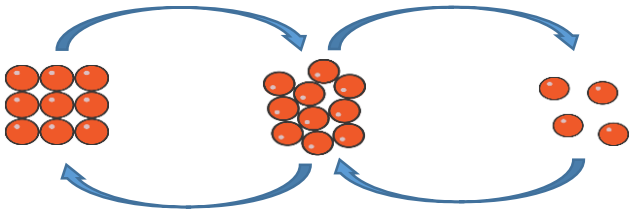
Decreasing Kinetic energy

Particles

Increasing kinetic energy

melting

Boiling (or evaporating)



Freezing

Condensing

Decreasing Kinetic energy

Conservation of mass

The particles stay the same when a substance changes state - only their **closeness**, **arrangement** or **motion** change.

This means that the **mass of the substance stays the same**.

For example, 10 g of water boils to form 10 g of steam, or freezes to form 10 g of ice.

This is called **conservation of mass**.

Increasing Kinetic energy

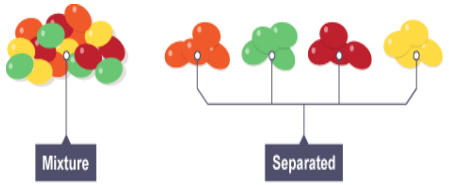
	Condensing	Freezing
Description	Gas to liquid	Liquid to solid
Closeness of particles	Become much closer together	Stay close together
Arrangement of particles	Stay random	Random to regular
Motion of particles	Stop moving quickly in all directions, and can only move around each other	Stop moving around each other, and only vibrate on the spot

	Melting	Evaporating or boiling
Description	Solid to liquid	Liquid to gas
Closeness of particles	Stay close together	Become much further apart
Arrangement of particles	Regular to random	Stay random
Motion of particles	Start to move around each other	Start to move quickly in all directions

Particles

A pure substance contains only one type of particle.
For example:
- Pure iron contains only iron particles (called iron atoms);
- Pure water contains only water particles (called water molecules);
- Pure oxygen only contains oxygen particles (called oxygen molecules).

A mixture contains more than one type of particle that are <u>not</u> chemically joined together.
For example:
- Steel contains iron particles and small amounts of carbon particles (called carbon atoms);
- Tap water contains water particles and small amounts of other particles (called ions);
- Air contains 21% oxygen, 78% nitrogen and 1% of other gases (eg argon and carbon dioxide).



We can separate mixtures in different ways depending on their properties:
- Filtration
- Evaporation
- Chromatography
- Distillation

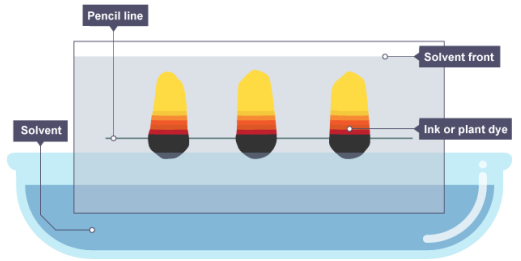
Dissolving is one way to make a mixture. For example, when salt is stirred into water, the salt **dissolves** in the water to make salt **solution**.

In a solution:
- the substance that dissolves is called the **solute**;
- the substance that the solute dissolves in is called the **solvent**.

In salt solution, salt is the solute and water is the solvent.

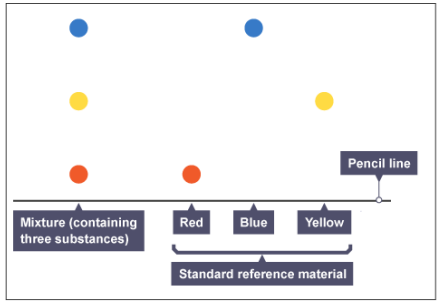
Chromatography is a method for separating dissolved substances from one another.

It works because some of the coloured substances dissolve better than others, so they travel further up the paper.



A pencil line is drawn, and spots of ink or dye are placed on it. There is a container of solvent (eg water or ethanol). Pencil is used because that is insoluble in water or ethanol and so will not run.

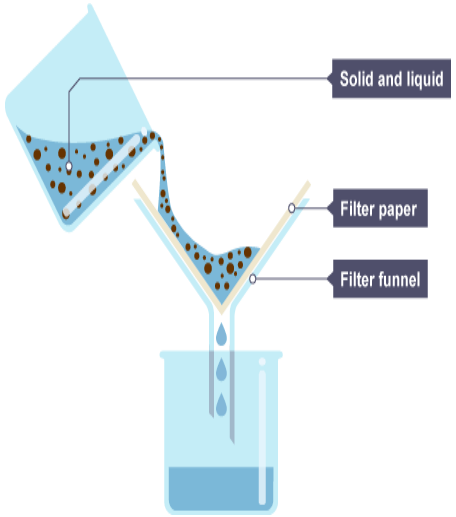
As the solvent continues to travel up the paper, the different coloured substances spread apart.



A **chromatogram**, the results of chromatography experiment.

Filtration is a method for separating an **insoluble** solid from a liquid.

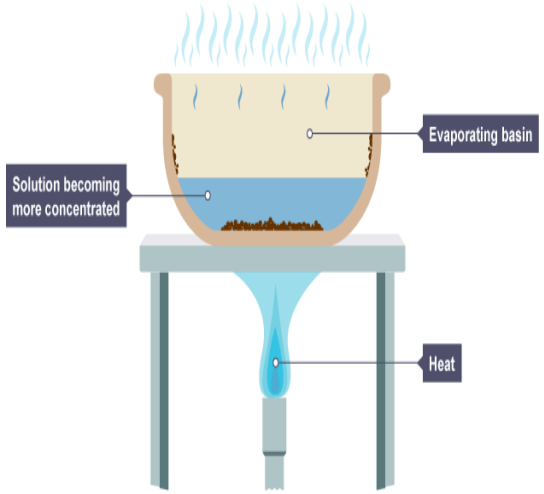
When a mixture of sand and water is filtered:
- the sand stays behind in the filter paper (it becomes the **residue**);
- the water passes through the filter paper (it becomes the **filtrate**).



Evaporation is used to separate a **soluble** solid from a liquid.

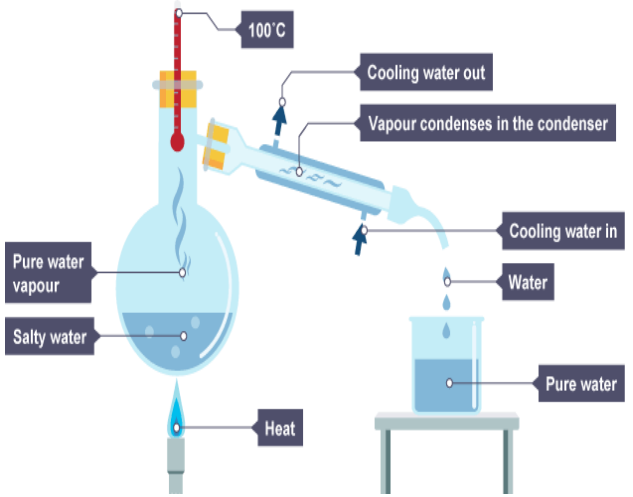
For example, copper sulphate is soluble in water – its crystals dissolve in water to form copper sulphate solution.

During evaporation, the water **evaporates** away leaving solid copper sulphate crystals behind.

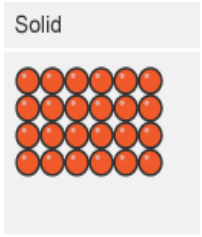


Distillation is a method for separating the solvent from a solution.

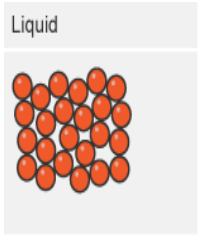
For example, water can be separated from salt solution because water has a much lower boiling point than salt. When the solution is heated, the water **evaporates**. It is then cooled and **condensed** into a separate container. The salt does not evaporate and so it stays behind.



1. Describe the arrangement and movement of the particles :



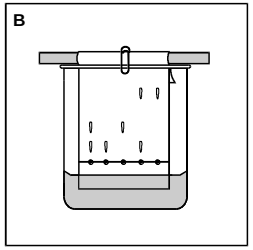
Arrangement
……
Movement
……

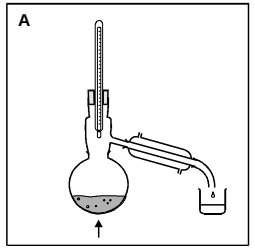


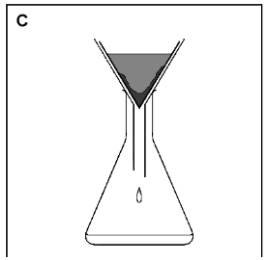
Arrangement
……
Movement
……

Arrangement
……
Movement
……

match the technique shown with the correct name. Draw only 3 lines.







chromatography

distillation

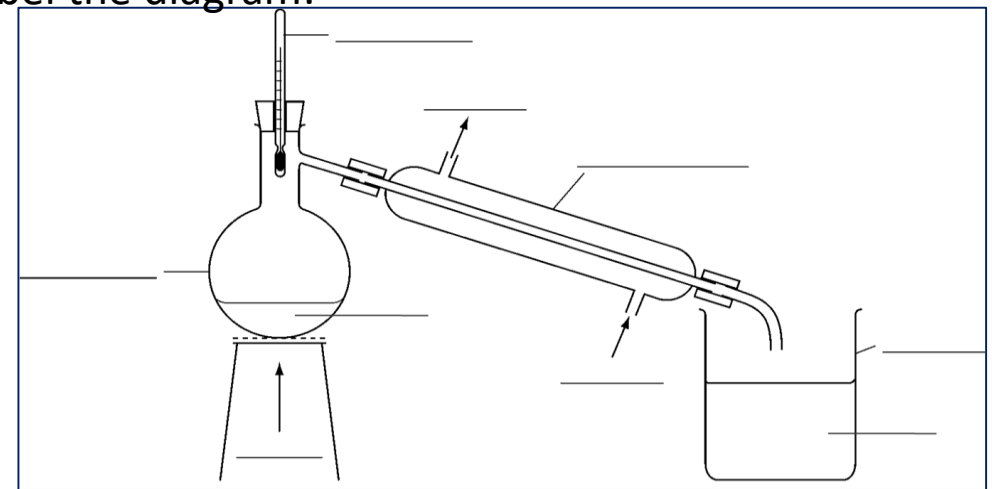
filtration

crystallisation

Describe how to separate a mixture of dissolved solids using chromatography. Draw a diagram to help

……
……
……
……
……
……
……

Label the diagram:



Explain why solids cannot be compressed

……
……

Describe what happens when solids melt

……
……

Energy

Different energy stores:

- **Chemical**;
- **Kinetic**;
- **Gravitational potential**;
- **Elastic potential**;
- **Magnetic**;
- **Electrostatic**;
- **Internal (or thermal)**;

We can measure the amount of energy in a store

Units of energy:
joules (J);
kilojoules (kJ);
kilowatt-hours (kWh).

Note that **electrical**, **light** and **sound** are not included on this list, they are not energy stores, but are ways of transferring energy from one store to another.

Power is a measure of how fast energy is being transferred.

Units of power:
watts (W);
kilowatts (kW).

Power
Power is calculated by dividing energy transferred by time taken

$$P = E/t$$

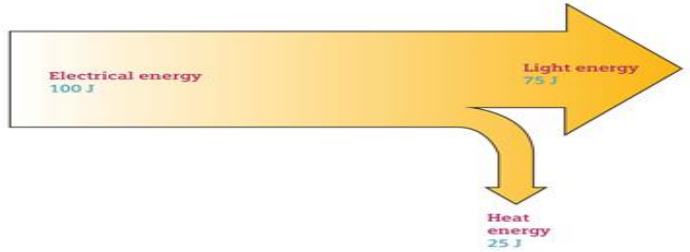
P= :Power (W); E = energy (J); t = time (s).

Heat transfer
Conduction – heat transfer in a solid;
Particles *gain energy and* ***vibrate****; they pass vibrations (and therefore energy) to adjacent particles. In* ***metals****, this happens because* ***free electrons*** *gain energy and* ***move*** *through the metal, colliding with particles and transferring energy to them.*

Convection – heat transfer in fluids (liquids and gases);
Particles *in a fluid gain* ***energy*** *and* ***move further apart****. This makes the fluid* ***less dense****, causing it to* ***rise****.*

Radiation – heat transfer via **infra-red (thermal) radiation** – can travel through a vacuum.

The energy laws:
1) Energy can not be destroyed or created, only transferred - this is called **conservation of energy**;
2) Energy tends to spread out and become less useful (eg hot objects always eventually cool down).



Transferring energy
The following are ways that energy can be transferred:
- by **mechanical** work (a force causing an object to move);
- by **electrical** work (when charges move due to a potential difference);
- By **heating** (due to a difference in temperature);
- By **radiation** (due to electromagnetic waves, eg light or to mechanical waves, eg sound).

Energy costs money.
To work out how much it costs you need to know:

- the amount of **units** of energy used (in **kWh** not **joules**);
- the **cost per unit** (1 unit is 1 kWh) – you will be told this

total cost (p) = number of kilowatt-hours (kWh) × cost per kilowatt-hour (p)

You can work out how many units something uses if you know its power (in kW) and how long you have used it for (in hours):

number of units of energy used (kWh) = power (kW) x time (s)

Renewable and non-renewable resources:

1) Non-renewable energy resources cannot be replaced once they are all used up;

- ***Fossil fuels (coal, oil, gas)***
  - releases carbon dioxide (a greenhouse gas and increases global warming). - releases sulphur dioxide and nitrogen oxides, which cause acid rain
- ***Nuclear***
  + nuclear fuels do not produce carbon dioxide or sulphur dioxide;
  - non-renewable energy resources. They will run out one day;
  - risk of radioactive material being released into the environment

2) Renewable energy resources can be replaced, and will not run out;

- ***Wind***
  + no release of carbon dioxide or sulphur dioxide
  - if there is no wind, there is no electricity.
- ***Water (wave, tidal*** *or* ***hydroelectric)***
  + noif there is no wind, there is no electricity.
  release of carbon dioxide or sulphur dioxide
  - difficult for wave machines to produce large amounts of electricity.
  - tidal barrages destroy the habitats;
  - hydroelectric floods farmland and push people from their homes.
- ***Geothermal***
  + no release of carbon dioxide or sulphur dioxide
  - most parts of the world do not have suitable areas for geothermal
- ***Solar***
  + no release of carbon dioxide or sulphur dioxide
  - if there is no sunlight, there is no electricity.

1 What is the unit for energy?

2 What are the 8 energy stores?

3 Which store fills when energy is ‘wasted’?

4 What is a fuel?

5 Why does the Bunsen burner flame release more energy when the hole in the Bunsen is open?

6 Which method of heat transfer occurs when particles collide with each other?

7 Why do regions of hot liquids and gases rise?

8 Which colour absorbs and emits the most Infrared radiation?

9 Why are hot food takeaway containers silver or white?

10 What is the equation to calculate power?

11 Which unit is used for power?

12 What is 1 watt equal to in terms of joules?

13 What is a fossil fuel?

14 What does the term ‘renewable’ mean?

For each of the pictures below, name the energy store that will be the most full.

Rollercoaster at the top of the track

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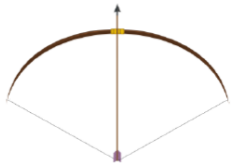

The string of the bow

……

……

Describe which stores empty and which fill up during the following scenarios:

1. After a rollercoaster goes over the top of the track and accelerates down the hill

……

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2. As wood is burned in fire

……

……

……

3. When an arrow is released straight **up** in the air.

……

……

……