We often hear about how important it is to “save energy”. In order to do this we have to know about different kinds of energy.

Moving objects have kinetic energy

Food contains chemical energy

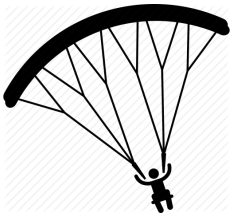
Pianos produce sound energy

Cars use the chemical energy in petrol

Atomic bombs use nuclear energy

Ovens produce heat energy

Bulbs give out light energy



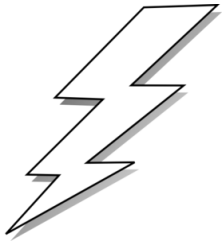
A parachutist high in the sky has potential energy

Lightning contains electrical energy

Batteries contain chemical energy

All moving objects have kinetic energy. The faster the object moves the more kinetic energy the object has. Energy is measured in units called Joules (J). More commonly we use kilojoules (kJ). 1 kilojoule = 1000 Joules.

Potential energy is the energy which objects have when they are high up. The higher the object the more energy it has. When elastic bands are stretched they have potential energy. The more stretched the band, the greater the potential energy.



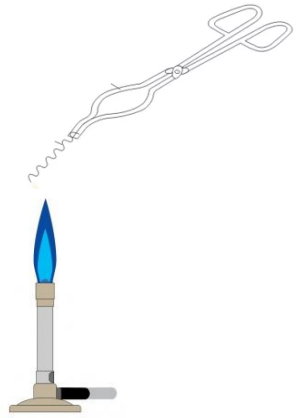
Cars contain lead acid batteries

Conservation of Energy.

There is an important law in Science called the law of conservation of energy. This law states that energy can be neither created or destroyed. It can only be changed from one form of energy into another.

When a car is moving the kinetic energy of the car comes from the chemical energy present in the petrol. All fuels contain chemical energy.

Whenever a fuel is burned the chemical energy does not disappear. It is simply changed into heat and light energy. Batteries contain chemical energy. When a battery is used the chemical energy is changed into electrical energy. When all of the chemical energy is used up we say that the battery is flat.



Magnesium is a metal which burns brightly.

Like all things which burn it contains chemical energy. When the magnesium burns the chemical energy changes into heat and light energy.

We write the energy change as

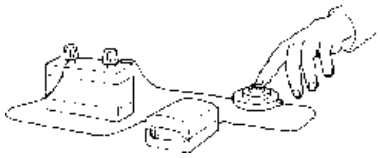
Chemical --> Heat + Light

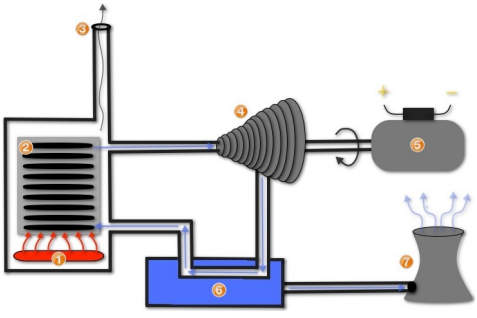
Companies like Tesla produce cars that run on electricity stored in huge batteries.

A battery was used to power a buzzer.

When a battery is used to power a buzzer, the chemical energy in the battery changes into electrical energy, which then changes into sound energy.

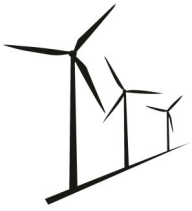
Chemical --> Electrical --> Sound





In a steam engine the chemical energy of the fuel is changed into heat energy. The heat is used to make steam which has potential energy. The steam turns a motor which has kinetic energy. This is connected to a dynamo which makes electrical energy.

Chemical --> Heat --> Kinetic --> Electrical



Fossil Fuels

Fossil fuels are produced from the remains of plants and animals which lived many million years ago. Coal is made from the remains of plants which grew in forests over 50 million years ago. The plants fell and were trapped in mud.

As the plants were buried they changed into coal over millions of years.

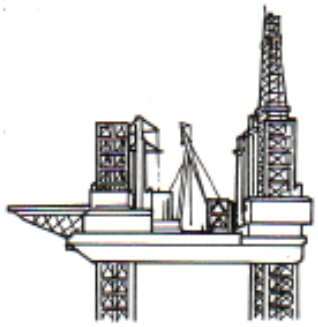
The remains of fossil plants can be found in coal.

Oil and gas came from the bodies of tiny creatures which lived in ancient shallow seas. When the creatures died they sank into the mud at the bottom of the seas. With time the mud turned into rock and the bodies of the sea creatures turned into oil and gas.

The energy in fossil fuels is chemical energy from the bodies of plants and animals.

Coal is packed full of energy from plants and animal that died millions of years ago.

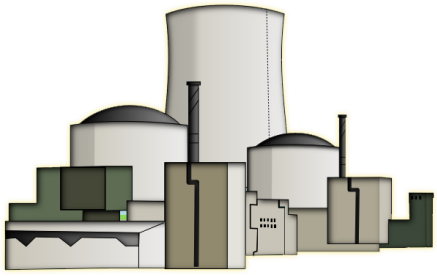
Coal, oil and gas are called fossil fuels. We burn them to give us heat and light energy, and can use them to make electrical energy and kinetic energy. Coal and oil are burned in power stations to produce electricity. Petrol, which comes from oil, is burned inside cars to help the cars move.



Fossil fuels will not last forever and we have to look for other sources of energy.

Mining fossil fuels often damages the landscape and environment.

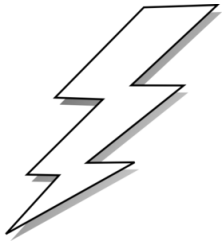
Nuclear



Nuclear power is a valuable form of energy. It uses a substance called uranium which is a very powerful source of energy.

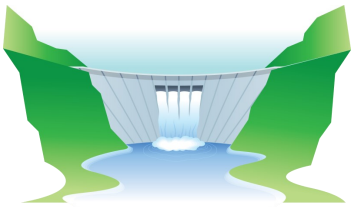
Countries like France have many nuclear power stations.

There is enough Uranium on Earth to last over 200 years but it is not renewable.



The sun gives out vast amounts of energy

Renewable Energy Sources



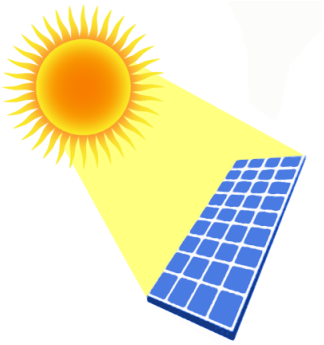
Hydroelectric power uses the potential energy of water stored in dams to turn dynamos and make electricity.

Most places which can be used for hydroelectric power stations in Britain have already been used. Hydroelectric energy is renewable- as long as it rains the dam will refill.

Wind Farms, like Whitelee, use turbines to harness the kinetic energy of the wind and turn it into electrical energy.

Wind turbines can be built almost anywhere, including out at sea, but work best where it is very windy like the top of hills or offshore.

A solar farm



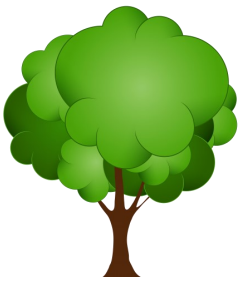
Solar Panels collect Light energy from the sun to turn into Electricity.

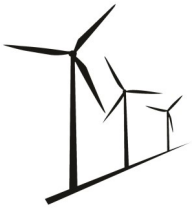
They are relatively cheap so people can put them on their house to generate their own electricity.

In hot countries they can build “solar farms” with hundreds of panels that can produce as much power as a coal power plant.

Solar is renewable but works best in countries with a lot of sun (Not Scotland).

Plants can be grown to produce energy. Wood can be burned, sugar from sugar cane can be changed into alcohol which can be used to power cars. The plants are referred to as biomass. Biomass is a renewable form of energy.



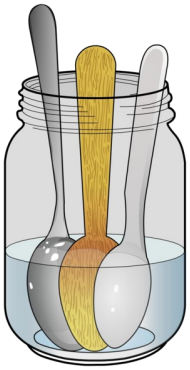


Scientists are working on ways to trap wave energy and turn it into electricity.

Scotland is leading the way in this form of energy.

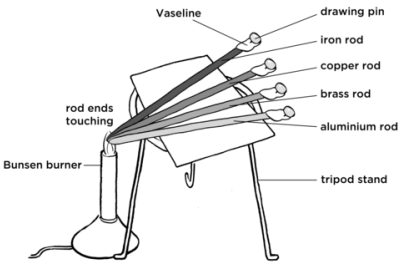
Conductors and Insulators of Heat

Some substances allow heat to flow through them easily, these substances are said to be conductors of heat. When heat flows through a substance we call this conduction. If a plastic spoon, a wooden spoon and a metal spoon are dipped into hot water, the metal spoon soon feels hot whilst the other spoons stays cool.



Substances like plastic and wood which do not let heat flow through them are called insulators.

Copper is used for expensive pots and pans as it is an excellent conductor of heat.



Metals let heat flow through them, metals are good conductors of heat. Some metals are better conductors than others. We can show this using the experiment shown on the left.

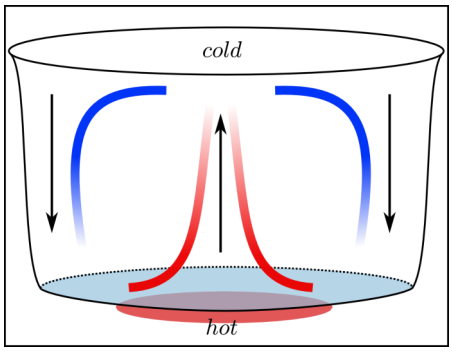
Four metal rods of equal thickness were placed in a Bunsen flame. The copper rod became warm to the touch faster than the other. This is because copper is a better conductor of heat.

Pots and pans are made of metal to ensure that heat flows from the cooker to the food. The handle is made of wood or plastic. These are both good insulators, they stop the heat flowing to our hands.

Conduction happens mostly in solids so gases like air are excellent insulators.

As well as being good conductors of heat, metals are also good conductors of electricity.

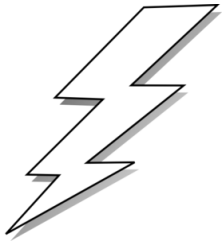
Convection

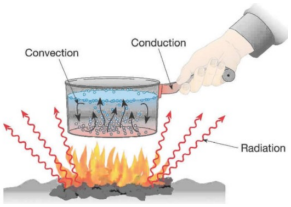


As materials heat up they begin to expand, this happens to liquids and gases too.

This expansion causes them to rise, pushing the colder liquid or gas down to the bottom.

This cycle is called convection, it is responsible for clouds and turbulence and is the reason your oven has a fan in it.



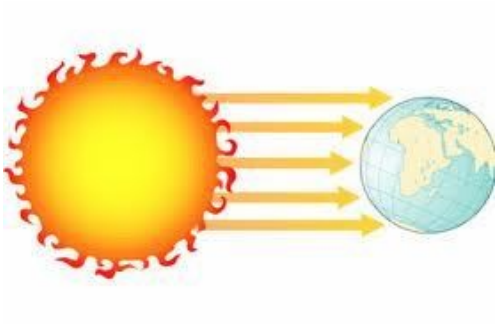


One heat source can transfer energy in all three ways.

Radiation

Any object that produces heat gives out radiation, the hotter the object the more radiation it gives out.

Radiation does not need to move through any material to transfer heat so it is the only type of heat that makes it to us through the vacuum of space from the sun.



Light coloured or shiny objects reflect radiation away and don't heat up, dark materials absorb radiation. That is why you don't wear black clothing in summer.

Tabulating data

Scientists often put data (information) into tables. The passage below contains data on solar panels.

> *A scientist is charging a small electric car for 5 minutes with solar panels. With 0.25m^2 of solar panels the car ran for 30 seconds, with 0.5m^2 it ran for 60 seconds. It ran for 120s with 1m^2 of solar panels and finally with 4m^2 it ran for a full 8 minutes.*

Engineers are trying to make efficient solar cars

The passage tells us two things about the experiment, the area of the solar panels and how long the car was able to run for.

This gives us the two headings for a table. The completed table is:

Solar Panel Area (m^2)	Car running time (s)
0.25	30
0.5	60
1	120
4	480

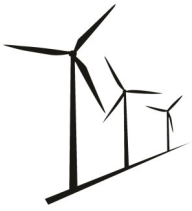
minutes has been converted into seconds to match the other results and the heading of the table.

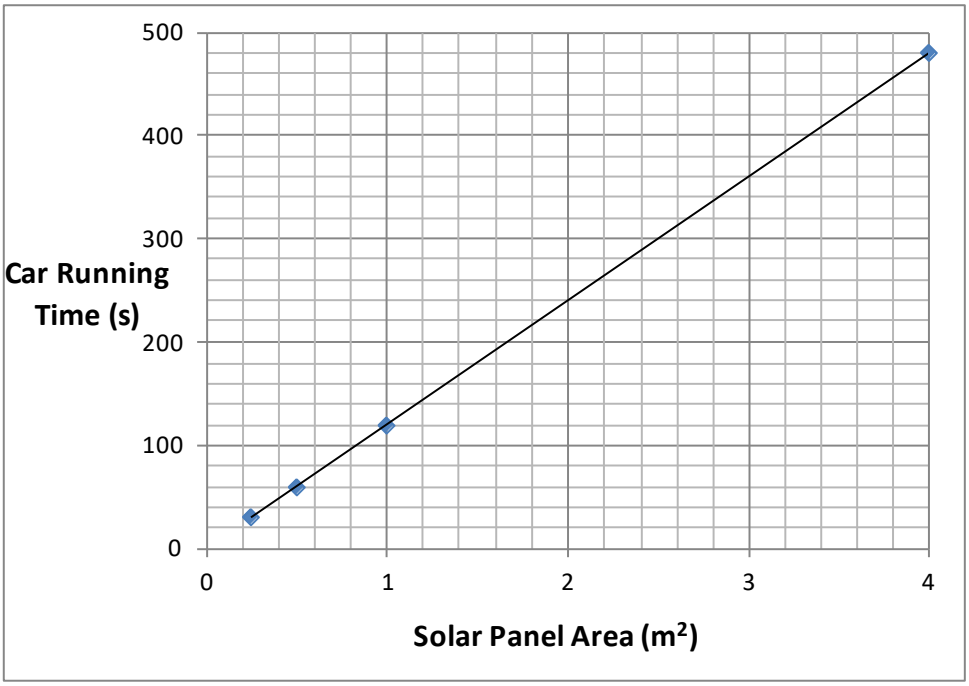
8x60 = 480s

Line graphs

In science we often present data in line graphs.

To show this data on a line graph we first set the axes. Area on the bottom and time on the side. We then add points for each piece of data and join the points.

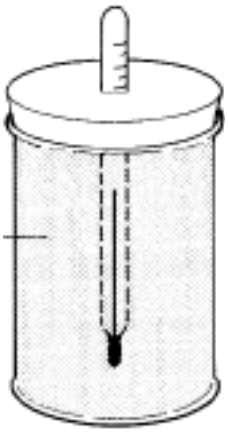




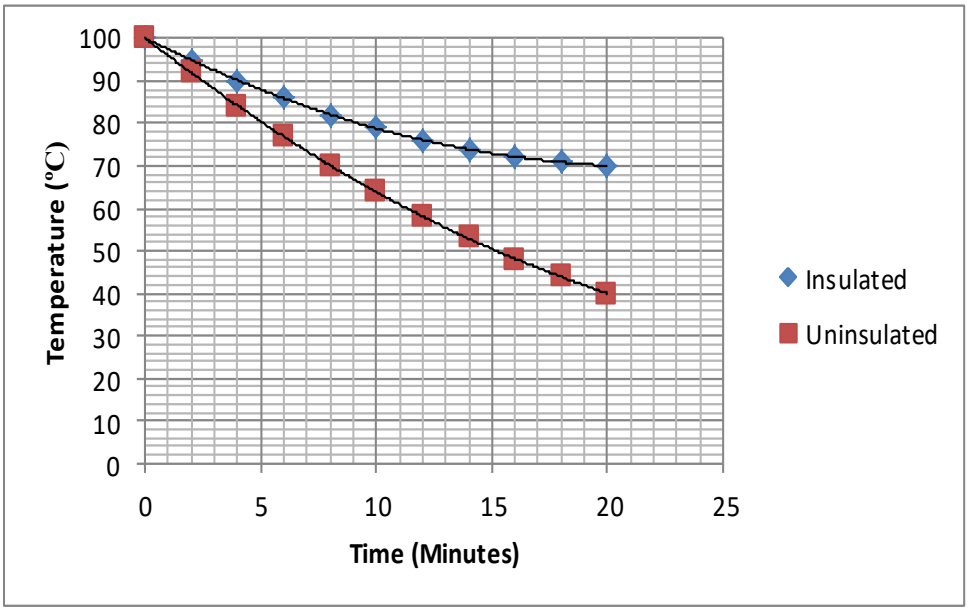
Flasks use a thin pocket of vacuum (space without any air) to keep their contents warm

Fair experiments with insulation

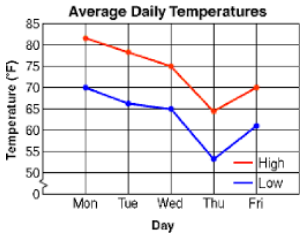
To find out if insulation prevents loss of heat from an object we must carry out a fair experiment. We should have two cans like the one shown on the right. Both should be filled with hot water. One should be insulated and the other uninsulated. We should measure the temperature of each.



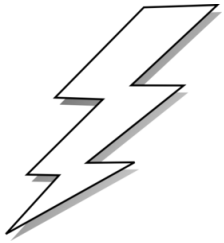
To make the experiment fair we should control the variables-things which could change and make the experiment unfair. The important variables here are the volume of the water and the starting temperature. The results of the experiment are shown in the graph below.



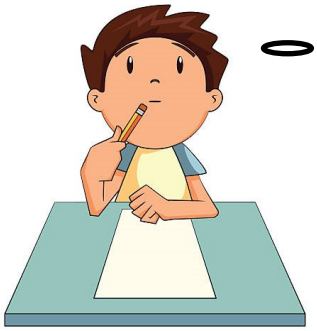
The insulated can loses heat more slowly than the uninsulated can.



Line graphs make data easy to understand at a glance.



What do I need to know?



- Know the following types of energy:

Kinetic	**Light,**
Potential	**Electrical**
Sound	**Chemical**
Heat	**Nuclear**

- Know that a moving object has kinetic energy.
- Know that potential energy is an example of stored energy.
- Know that a “high up” object has potential energy.
- Know that a stretched rubber band has potential energy.
- Know that fuels, food, and batteries contain chemical energy.
- Know that the unit of energy is the Joule (J), and that 1000 Joules equal 1 kilojoule (kJ).
- Know the following Energy Changes:

Bulb	electrical —> heat + light
Falling Object	potential —> kinetic
Battery	chemical —> electrical
Dynamo	Kinetic —> electrical
Radio	electrical —> sound
Burning fuel	chemical —> heat + light
Motor	electrical —> kinetic

- ❑ Know that fossil fuels are formed from plants and animals which died millions of year ago.
- ❑ Know that coal, oil, and gas are fossil fuels.
- ❑ Know that the worlds supply of fossil fuels will soon run out.
- ❑ Know that wind, wave, solar, geothermal, tidal and hydroelectric are renewable so will never run out.
- ❑ Know that materials expand when heated and contract when cooled.
- ❑ Know that heat flows from regions of high temperature to regions of low temperature.
- ❑ Know that materials that let heat flow through them are called conductors.

  e.g. metals (aluminium, steel, copper, iron)
- ❑ Know that materials that do not allow heat to flow through them are called insulators.

  e.g. plastic, wool, feathers, air
- ❑ Know that heat is transferred through gases and liquids through convection.
- ❑ Know that heat can be transferred through radiation and that this is how the sun heats the earth.