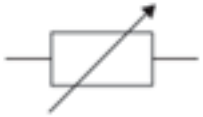
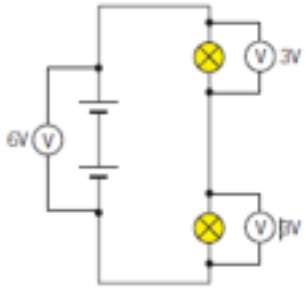
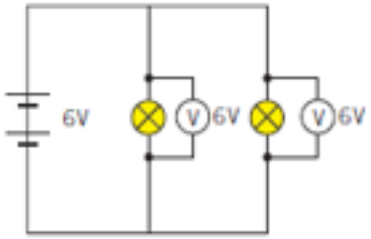
Science: Electricity and Magnetism

1. Circuit symbols / components

Cell		Battery	
Bulb		Motor	
Switch		Closed switch	
Ammeter		Voltmeter	
Resistor		Variable resistor	

2. Series and parallel circuits

Series circuit	Parallel circuit
Only one loop	More than one loop
If a component breaks, circuit will not work	If component breaks, rest of the circuit will work
Current is the same everywhere in the circuit	Current is shared between the different loops
Potential difference is shared between components in the circuit	Potential difference is the same across all components
	

3. Power

Power	How much energy is transferred per second, measured in watts (W)
Current	Is the flow of electrons around a circuit, measured in amps (A)
Potential difference	The force that pushes the current around a circuit, measured in volts (V)
Power rating	States how quickly an appliance uses energy

Power can be calculated using these equations

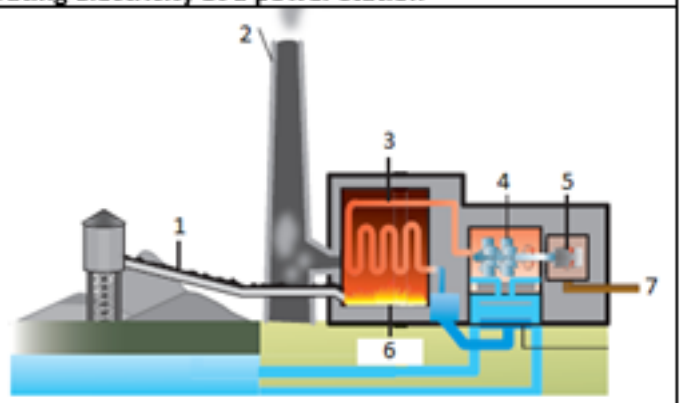
Power (W) = Energy (j) / Time (s)	**Power (W) = potential difference (V) x current (A)**

4. Generating electricity

Non-renewable energy	Renewable energy
Cannot be replaced in our lifetime	Can be replaced in our lifetime
Examples: fossil fuels (coal, gas, oil) & nuclear resources	Examples: wind, tidal wave, biomass, solar, hydroelectric and geothermal

Generating electricity at a power station

1	Coal
2	Chimney
3	Steam
4	Turbine
5	Generator
6	Boiler
7	Electricity out



Fuel is burnt underneath water in the boiler → Water is heated and turns into steam → The seam turns a turbine which turns a generator → Electricity is generated

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5. Magnets

A magnet has two poles, a north and a south pole

North poles	**Attracts**	South poles
South poles	**Attracts**	North poles

South poles	**Repel**	South poles
North poles	**Repel**	North poles

Magnets	**Attract**	Magnetic material

Magnets	**Have no effect**	Non-magnetic material

Challenge Questions

1	Describe why we should increase our use of renewable energy sources.
2	You have 3 pieces of metal, aluminium, iron and magnet. How could you work out which metal each one was?
3	Which would be more expensive, using an 1800W hair dryer for 20 minutes or a 2800W iron for 10minutes? Use calculations to justify your answer
4	Sarah sets up a circuit and it does not work, only one part of the circuit is faulty. How can she, problem solve to work out which piece of equipment of faulty.

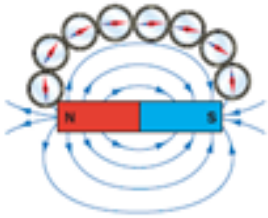
6. Magnetic fields

A **magnetic field** is an area where a magnetic material will experience a force

Magnetic field lines **travel** from the north pole to the south pole

The **closer** the field lines, the **stronger** the magnetic field

Two ways to plot a magnetic field

Using compasses	Iron filings
	
Using a compass: The Earth has it's own magnetic field due to its iron core, this means that a compass can be used to navigate. The compass will point towards the magnetic north of the Earth unless it is near a magnets or magnetic material	

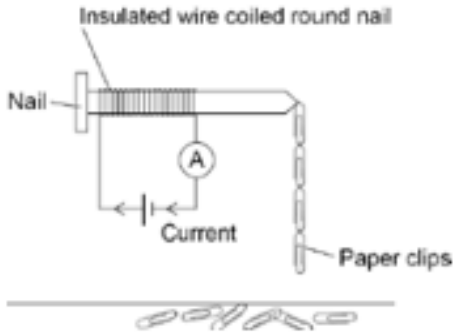
7. Electromagnets

Electromagnets are magnets that can be turned on and off. They are used in everyday items such as door locks, alarm bells and loud speakers

The factors affecting the strength of an electromagnet can be investigated using a simple experiment with an iron nail, a coil of wire, a power source and steel paperclips.

The more paper clips that the electromagnet picks up, the stronger it is.

The number of coils or current in the wire can be changed to see how these changes affect its strength

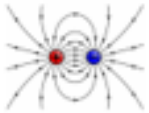


Science: Energy

1. Energy stores

Energy is in different energy stores and is measured in Joules (J).

Energy is needed to do 'work'.

Chemical	Stored in food, fuel and batteries	
Electrostatic	Stored when particles have charge	
Magnetic	Stored when magnetic poles come together	
Elastic potential	Stored when a material is stretched or squashed	
Nuclear	Stored in the nucleus of an atom, and the Sun	
Thermal	Stored in objects that are warm	
Kinetic	Stored in objects that are moving	
Gravitational potential	Stored in objects that have height	

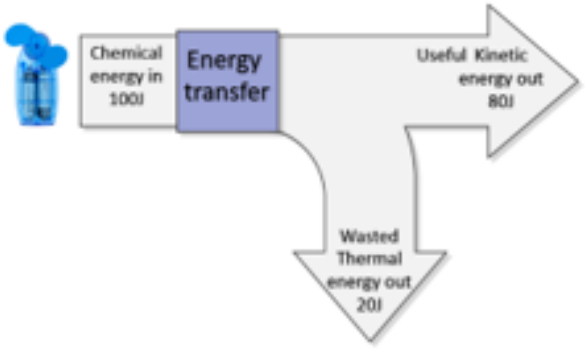
Energy can be transferred between stores in different ways	• By heating • Mechanically • Electrically • By radiation

2. Conservation of energy

*Energy **cannot be created or destroyed**, only transferred from one store to another.*

Total energy in = Total energy out

Wasted energy is not useful so is lost to the surroundings. It **dissipates**



Efficiency measures how much energy is used in a useful way

The less energy that is wasted, the more efficient the machine

$$\text{efficiency} = \frac{\text{useful energy output}}{\text{total energy input}}$$

3. Heat and temperature

Heat	A store of thermal energy, measured in Joules (J)
Temperature	A measure of how much thermal energy a substance has
Thermometer	Used to measure temperature
Degrees Celsius °C	The units for measuring temperature

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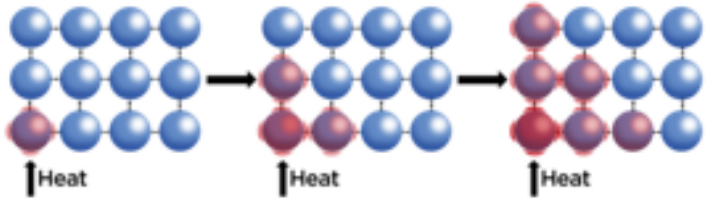
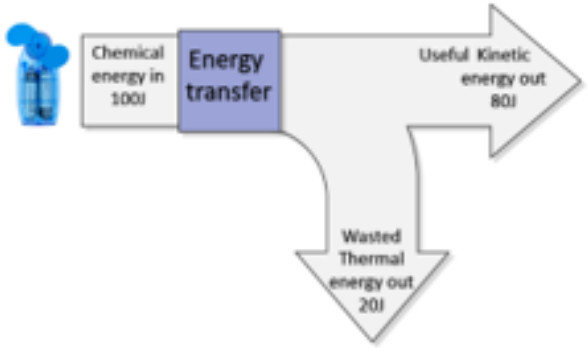
Science: Energy

4. Heat transfer - conduction

Conduction	The transfer of thermal energy by vibration of particles
Conductor	A material that easily transfers thermal energy through vibrating particles
Insulator	A material that does not easily transfer thermal energy through vibrating particles
As energy is added, particles collide, transferring that energy to the surrounding particles	



Challenge Questions	
1	What energy transfer would take place when a hairdryer is switched on?
2	Calculate the efficiency of the fan in the diagram
3	Why do solar panels have a black outer layer?
4	Explain how a radiator warms a room in the winter

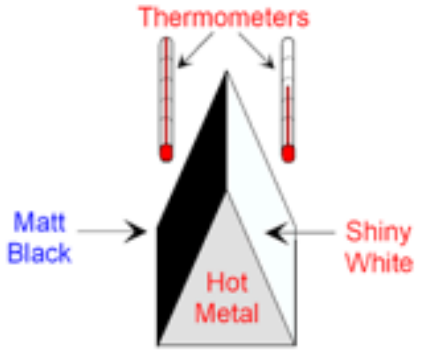
5. Heat transfer - convection

As particles near the heat source are heated, they spread out and become less dense, so they rise.	
Cooler, more dense particles will take their place at the bottom.	
This creates a constant flow of particles.	
This is known as a **convection current**	

6. Heat transfer - radiation

Radiation is method of transferring energy without the need for particles.

Thermal energy is transferred from the Sun to the Earth in this way as there are no particles in space. This is known as **infrared radiation** and it travels as an energy wave. The hotter an object, there more infrared radiation it will **emit**.

The surface of objects effects the amount of infrared radiation it can **emit, absorb and reflect.**	
Matt black is the best surface for **emitting and absorbing** infrared radiation	
Shiny white surfaces are the best at **reflecting** infrared radiation	