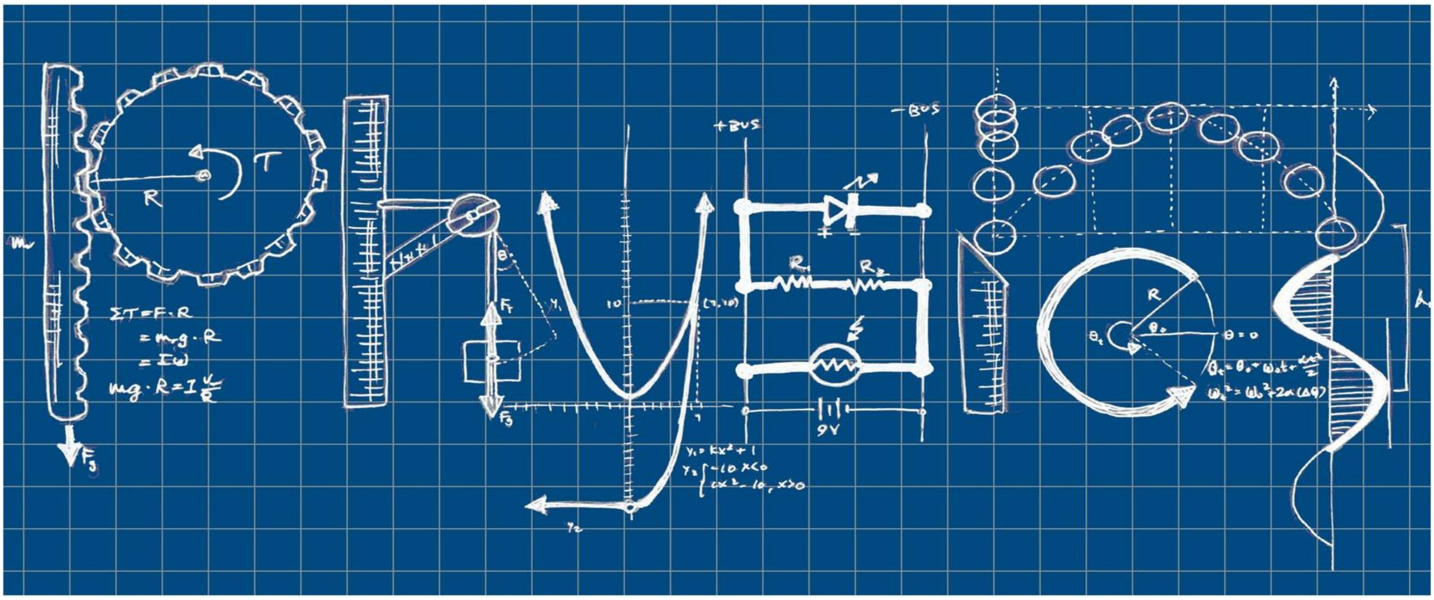


Year 7 Recall Booklet

Name:

Class:

Energy

Kinetic energy

Moving things have kinetic energy. The heavier a thing is and the faster it moves the more kinetic energy it has. All moving things have kinetic energy, even very large things, like planets, and very small ones, like atoms.

Sound energy

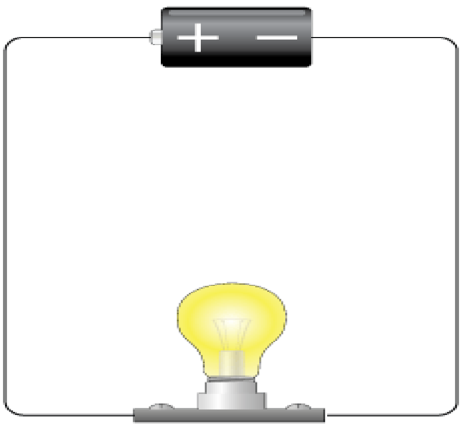
A vibrating drum and a plucked guitar string transfer energy to the air as **sound**. Kinetic energy from the moving air molecules transfers the sound energy to your eardrum.

Thermal energy

Thermal energy is what we call energy that comes from **heat**. A cup of hot tea has thermal energy in the form of kinetic energy from its particles. Some of this energy is transferred to the particles in cold milk, which you pour in to make the tea cooler.

Chemical energy

Some **chemical reactions** release energy. For example, when an explosive goes off, chemical energy stored in it is transferred to the surroundings as **thermal** energy, **sound** energy and **kinetic** energy.



Bulb and battery

Electrical energy

A battery transfers **stored chemical energy** as **electrical** energy in moving charges in wires. For example, electrical energy is transferred to the surroundings by the lamp as **light** energy and **thermal** energy.

South Bubble mountain, USA

Gravitational potential energy

A rock on a mountain has **stored** energy because of its position above the ground and the pull of gravity. This energy is called **gravitational potential energy**. This is the energy it would release if it fell. As the rock falls to the ground, the gravitational potential energy is transferred as kinetic energy.

What are the different type of energy?

Name the energy types, and give 2 different examples of each

Energy Type	Example
K_ _ _ _ _ _	
G _ _ _ _ _ _ _ _ _ _ _ _ P_ _ _ _ _ _ _ _	
E_ _ _ _ _ _	
C_ _ _ _ _ _	
H_ _ _	
S _ _ _ _ _	
E _ _ _ _ _ _ _ _ _ _ _	

<u>Once completed – Look Cover Write Check</u>

Energy Type	Example
K_ _ _ _ _ _	
G _ _ _ _ _ _ _ _ _ _ _ _ P_ _ _ _ _ _ _ _	
E_ _ _ _ _ _	
C_ _ _ _ _ _	
H_ _ _	
S _ _ _ _ _	
E _ _ _ _ _ _ _ _ _ _ _	

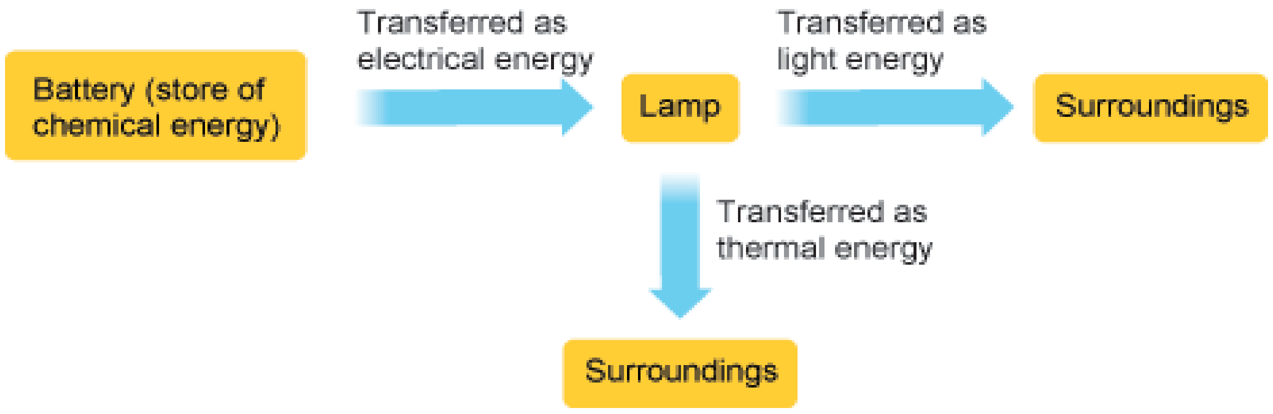
Energy transfer diagrams

Energy transfer diagrams show the locations of **energy stores** and **energy transfers**. For example, consider the energy transfers in the simple electrical circuit below.

We can show the transfers like this:

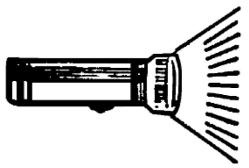
The battery is a **store** of chemical energy. The energy is **transferred** by electricity to the lamp, which **transfers** the energy to the surroundings by light. These are the **useful** energy transfers - we use electric lamps to light up our rooms.

But there are also energy transfers that are not useful to us. In the example above, the lamp also transfers energy to the surroundings by **heating**. If we include this energy transfer, the diagram looks like this:

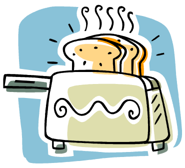
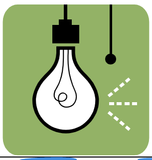
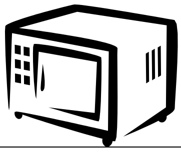
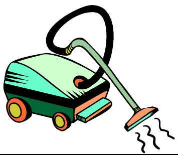


<u>Changes in energy</u>

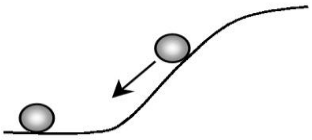
Energy is always <u>changing</u> from one form into another. The Diagram below shows the energy changes in a torch



Chemical ------→ Electrical ------→ Heat + Light

Device	Energy Transfer
	An electric toaster transfers ____________ energy to ______ energy, _______ energy, __________ energy and _________________ ______________ energy.
	A light bulb transfers _____________ energy to ________ energy and __________ energy.
	Speakers transfer ___________ energy to ________ energy.
	A hair dryer transfers ____________ energy to ________ energy, ________ energy and ___________ energy
	A microwave oven transfers ___________ energy to ____________ energy, ________ energy and __________ energy.
	A vacuum cleaner transfers _____________ energy to __________ energy, ________ energy and _________ energy

<u>Exercise</u> - Write down the energy changes for the objects below.

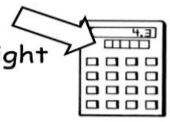


1) GRAVITATIONAL → ....

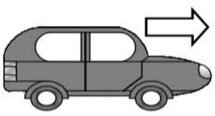
coal

2) .... → HEAT + ...

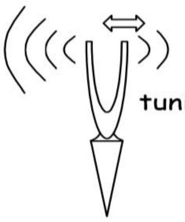
light



3) .... → ELECTRICAL



4) CHEMICAL → HEAT → ....



tuning fork

5) .... → SOUND

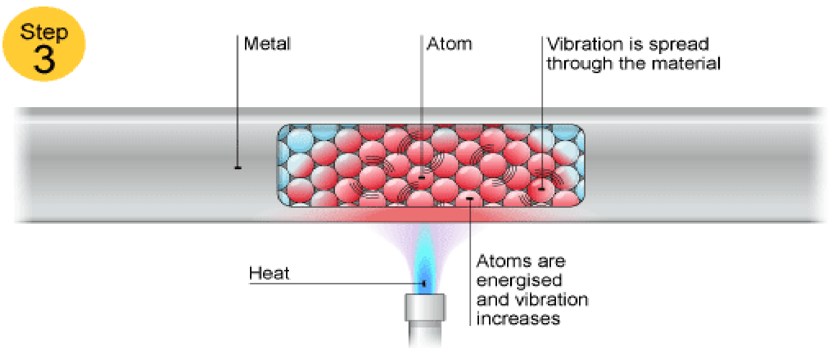
Thermal energy transfer

Thermal energy can be transferred by:

- conduction
- convection
- radiation

Conduction

When a substance is heated, its particles gain energy and vibrate more vigorously. The particles bump into nearby particles and make them vibrate more. This passes the thermal energy through the substance by **conduction**, from the hot end to the cold end.



This is how the handle of a metal spoon soon gets hot when the spoon is put into a hot drink.

- Substances that allow thermal energy to move easily through them are called conductors. Metals are good conductors of thermal energy.
- Substances that **do not** allow thermal energy to move through them easily are called **insulators**. Air and plastics are insulators.

Convection

The particles in liquids and gases can move from place to place. **Convection** happens when particles with a lot of thermal energy in a liquid or gas move, and take the place of particles with less thermal energy. Thermal energy is transferred from hot places to cold places by convection.

Radiation

All objects transfer thermal energy by **infrared radiation**. The hotter an object is, the more infrared radiation it gives off.

No particles are involved in radiation, unlike conduction and convection. This means that thermal energy transfer by radiation can even work in space, but conduction and convection cannot.

- Radiation is how we can feel the heat of the Sun, even though it is millions of kilometres away in space.
- Infrared cameras give images even in the dark, because they are detecting heat, not visible light.

Fill in the gaps

The 3 ways of transferring energy are __________________,
__________________ and radiation.

Conduction-

This is the ________________ of heat energy through a ________________ from a hotter part to a _______________ part. This happens without any movement of the substance.

A substance is a __________ conductor of heat if the _____________ flows through it easily. An example of a good conductor is _____________. A poor heat conductor is called an _________________. An example of a good insulator is _____________.

wood good cooler transfer substance energy metal insulator

Convection-

This is the transfer of __________ energy through the movement of ________________ themselves. ______________ moves from ________________ areas to cooler areas.

Liquids and ______________ can transfer heat by ________________ because the _________________ can move around unlike the particles in a solid.

particles heat gases particles energy hotter convection

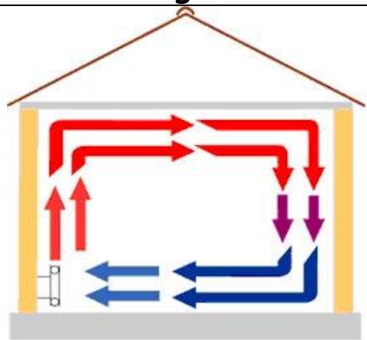
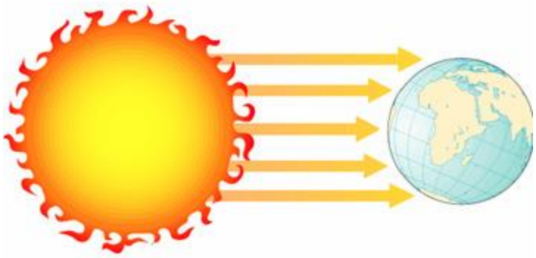
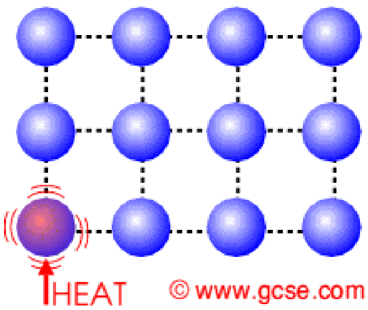
Radiation-

This is the transfer of heat energy by ____________. Radiated heat can travel through a ______________, an empty space with no particles in it.

This is why an ice cream will melt in the sun.

vacuum waves.

Draw lines to match the key word to the definition, the example and the diagram.

Key Word	Definition	Diagram	Example
Convection	The transfer of heat energy by waves from a hot object to a cool one		Touching a hot saucepan and burning your finger
Conduction	The transfer of heat energy by liquid (or fluid) motion from a hot object to a cool one		Warming yourself by a fire
Radiation	The transfer of heat energy by direct contact and the passing of vibration from a hot object to a cool one		A radiator heating a room

Non-renewable resources

We get energy from many different types of energy resources, including fuels, food and stores of energy such as batteries or the wind. We can divide energy resources into two categories: **non-renewable** and **renewable**.

- Non-renewable energy resources cannot be replaced once they are all used up.
- Renewable energy resources can be replaced, and will not run out.

Fossil fuels

- **Coal**, **oil** and **natural gas** are called fossil fuels. They formed millions of years ago from the remains of living things. Coal was formed from plants. Oil and natural gas were formed from sea creatures.
- The energy stored in the fossil fuels originally came from **sunlight**. Plants used light energy from the Sun for **photosynthesis** to make their chemicals. This stored chemical energy was transferred to stored chemical energy in animals that ate the plants. When the living things died, they were gradually buried by layers of rock. The buried remains were put under pressure and chemical reactions heated them up. They gradually changed into the fossil fuels.
- When the remains of the plants and animals became fossil fuels, their chemical energy was stored in the fuels. The energy is transferred to the surroundings as **thermal** energy and **light** energy when the fuels burn.
- Once we have used them all up, they will take millions of years to replace, if they can be replaced at all. For this reason, we call fossil fuels **non-renewable** energy resources

Renewable resources

Renewable energy resources can be replaced, and will not run out. Be careful - it is not true to say that they can be re-used.

Biomass

Biomass fuels come from **living things**. Wood is a biomass fuel. As long as we continue to plant new trees to replace those cut down, we will always have wood to burn. Just as with the fossil fuels, the energy stored in biomass fuels came originally from the Sun.

Wind power

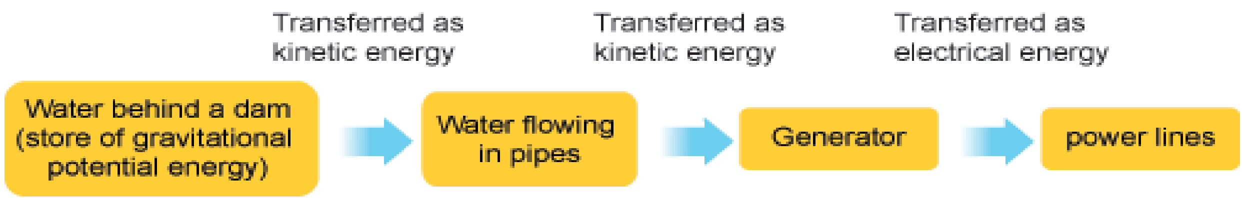
Wind is caused by huge convection currents in the Earth's atmosphere, driven by heat energy from the Sun. The moving air has huge amounts of **kinetic** energy, and this can be transferred into electrical energy using **wind turbines**. Wind turbines cannot work if there is no wind, or if the wind speed is so high it would damage them.

Water power

Moving water has **kinetic** energy. This can be transferred into useful energy in different ways. For example:

- wave machines use the up and down movement of waves to turn electricity generators
- tidal barrages are built across the mouths of rivers. As water moves in or out of the river mouth when the tide turns, the kinetic energy in the water is used to turn electricity generators.
- **Hydroelectric power (HEP)** schemes store water high up in dams. The water has **gravitational potential energy** which is released when it falls. As the water rushes down through pipes, this stored energy is transferred to kinetic energy, which turns electricity generators.

An energy transfer diagram for an HEP scheme:



Geothermal

In some places the rocks underground are hot. Deep wells can be drilled and cold water pumped down. The water runs through fractures in the rocks and is heated up. It returns to the surface as hot water and steam, where its energy can be used to drive turbines and electricity generators

Solar cells

Solar cells are devices that convert **light** energy directly into electrical energy. You may have seen small solar cells on calculators. Larger arrays of solar cells are used to power road signs, and even larger arrays are used to power satellites in orbit around Earth.

Solar panels

Solar panels are different to solar cells. Solar panels **do not** generate electricity. Instead they heat up water directly. A pump pushes cold water from a storage tank through pipes in the solar panel. The water is heated by heat energy from the Sun and returns to the tank. They are often located on the roofs of buildings where they can receive the most sunlight.

Renewable and non-renewable sources

What is meant by a renewable energy source?

____

____

____

What is meant by a non-renewable energy source?

____

____

Renewable	Non- renewable

Put the right resources into the right box

Exercise - Complete the sentences below.

1) Most of the energy we use comes from F _ _ _ _ _ fuels.
2) Fossil fuels are non-renewable because they cannot be R _ _ _ _ _ _ _ _
3) R _ _ _ _ _ _ _ _ _ energy resources do not run out.
4) Biofuels come from P _ _ _ _ _ and animals.
5) Weather conditions must be suitable to use W _ _ _ and solar power.
6) The energy in waves can be used but it is E _ _ _ _ _ _ _ _ _ to set up.

Exercise - Complete the sentences below.

1) Plants absorb the Sun's E _ _ _ _ _ to make food.
2) Fossil fuels are formed from dead P _ _ _ _ _ and A _ _ _ _ _ _
3) S _ _ _ _ panels can be used to absorb heat directly from the Sun.
4) Solar C _ _ _ _ change light energy into electrical energy.
5) Winds are caused by H _ _ _ from the Sun.

Forces

What are forces?

A **force** can be a **push** or a **pull**. For example, when you push open a door you have to apply a force to the door. You also have to apply a force to pull open a drawer.

You cannot see a force but often you can see what it does. When a force is exerted on an object, it can change the object's:

- speed
- direction of movement
- shape (for example, an elastic band gets longer if you pull it)

Forces can be contact forces, where objects must touch each other to exert a force. Other forces are non-contact forces, where objects do not have to touch each other. These include:

- gravity
- magnetism
- forces due to static electricity

A force meter, also called a newton meter, is used to measure forces

Measuring forces

Forces can be measured using a force meter, also called a newton meter. Force meters contain a spring connected to a metal hook. The spring stretches when a force is applied to the hook. The bigger the force applied, the longer the spring stretches and the bigger the reading.

The unit of force is called the **newton**, and it has the symbol N. The greater the force, the bigger the number, so 100 N is a greater force than 5 N.

Forces

FORCE	DESCRIPTION
Gravity	Force that pulls you down to earth
Friction	Force that slows you down
Air resistance	Force that slows you down in the air
Thrust	Forward force e.g from a car engine
Weight	
Magnetism	

Balanced forces

When two forces acting on an object are equal in size but act in opposite directions, we say that they are **balanced forces**.

If the forces on an object are balanced (or if there are no forces acting on it), this is what happens:

- a stationary object stays still
- a moving object continues to move at the same speed and in the same direction

Remember that an object can be moving, even if there are no forces acting on it.

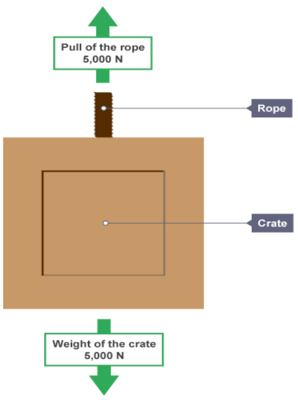
Force diagrams

We can show the forces acting on an object using a force diagram. In a force diagram, an arrow represents each force. The arrow shows:

- the size of the force (the longer the arrow, the bigger the force)
- the direction in which the force acts

The arrow should be labelled with the name of the force and its size in newtons. Here are some examples of situations involving balanced forces.

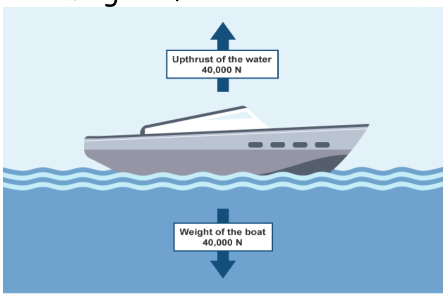
.



Hanging objects

The forces on this hanging crate are equal in size but act in opposite directions. The **weight** pulls down and the **tension** in the rope pulls up

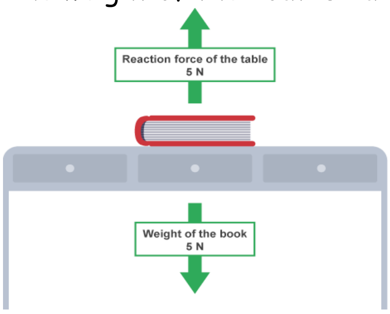
The weight of the crate is balanced by the tension in the rope



Floating in water

Objects float in water when their weight is balanced by the **upthrust** from the water. The object will sink until the weight of the water it pushes out of the way is the same as the weight of the object.

The weight of the boat is balanced by the upthrust from the water



Standing on the ground

When an object rests on a surface such as the ground, the **reaction force** from the ground balances its weight. The ground pushes up against the object. The reaction force is what you feel in your feet as you stand still. Without this balancing force you would sink into the ground.

The weight of the book is balanced by the reaction force from the table

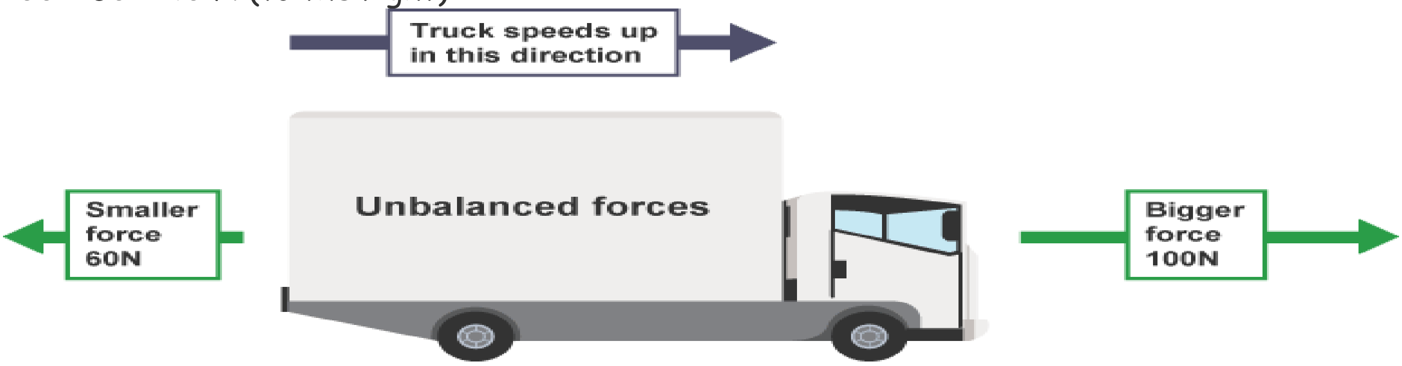
Unbalanced forces

When two forces acting on an object are not equal in size, we say that they are unbalanced forces. The overall force acting on the object is called the **resultant force**. If the forces are balanced, the resultant force is zero.

If the forces on an object are unbalanced, this is what happens:

- a stationary object starts to move in the direction of the resultant force
- a moving object changes speed and/or direction in the direction of the resultant force

In the example below, the resultant force is the difference between the two forces:
100 – 60 = 40 N (to the right)



The truck speeds up in the direction of the resultant force

The change in the motion of an object depends upon:

- the size of the resultant force
- the direction of the resultant force

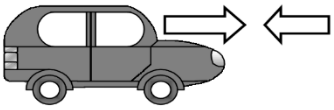
The greater the resultant force, the greater the change in the motion of the object. Whether a moving object speeds up, or slows down, depends on the direction of the resultant force:

- the object speeds up if the resultant force acts in the direction of movement

- the object slows down if the resultant force acts opposite to the direction of movement

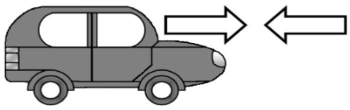
<u>Exercise</u> - Complete the sentences underneath each of the diagrams below.

Force from engine is 500N. Force of air resistance is 300N.



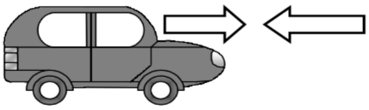
1) The car will ______________________

Force from engine is 500N. Force of air resistance is 500N.

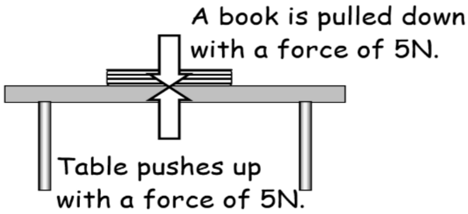


2) The car will ______________________

Force from engine is 500N. Force of air resistance is 700N



3) The car will ______________________

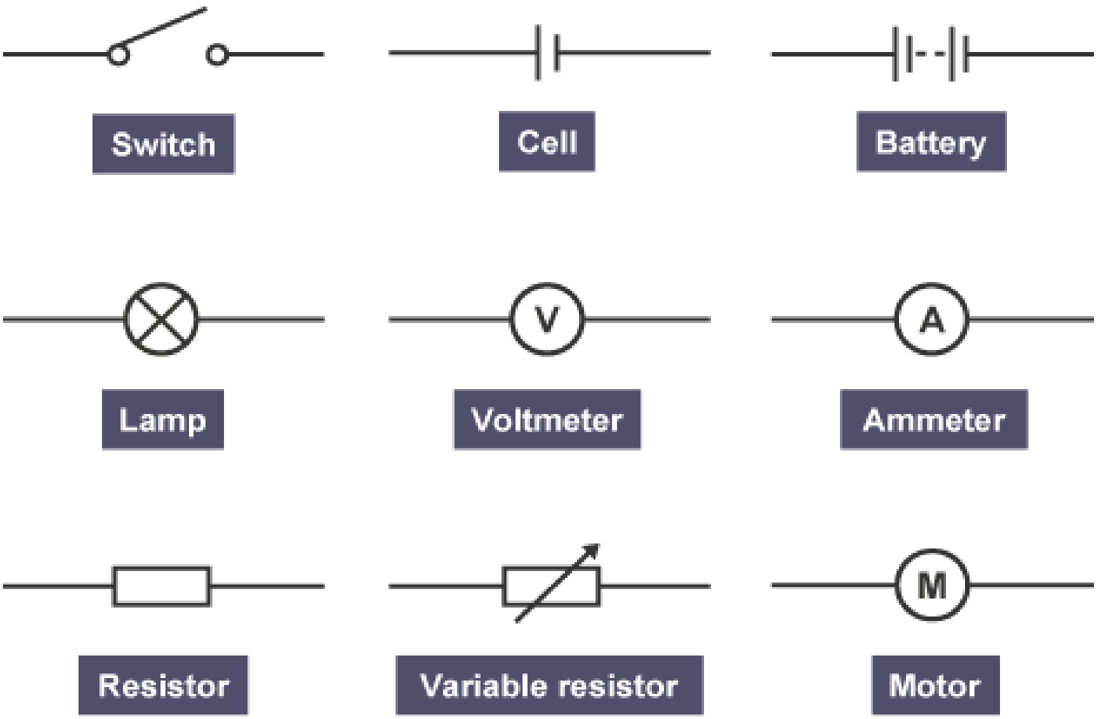


4) The book will not ________________

Electricity

Circuit symbols

We use **circuit symbols** to draw diagrams of electrical circuits, with straight lines to show the wires. The diagram shows some common circuit symbols.



Cells and batteries

The symbol for a **battery** is made by joining two more symbols for a cell together.

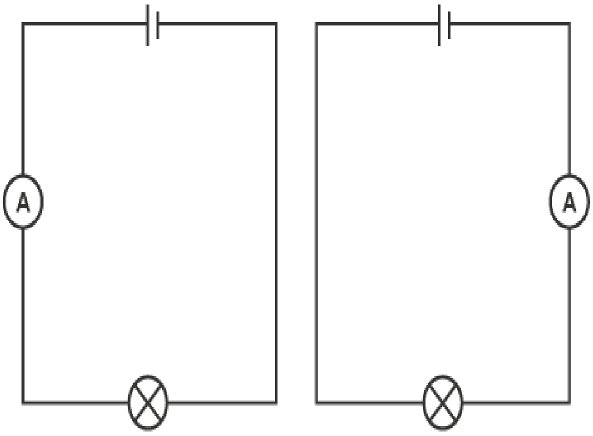
Make sure you know the difference between these two symbols

Circuit Symbols- Look → Cover → Write → Check

1. Try to do as much as you can from memory.
2. In a different colour, add in the pieces of information or diagrams that you could not remember.

Name	Diagram try 1	Diagram try 2	Diagram try 3
Cell			
Battery			
Voltmeter			
Ammeter			
Lamp			
Resistor			
Variable resistor			
Motor			

Measuring current

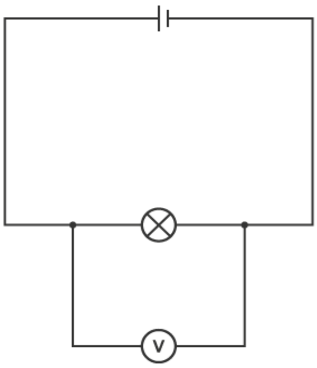


A circuit with an ammeter connected in two different places, both in series with the cell and lamp

A device called an **ammeter** is used to measure current. Some types of ammeter have a pointer on a dial, but most have a digital display. To measure the current flowing through a component in a circuit, you must connect the ammeter **in series** with it.

Measuring potential difference

Potential difference is a measure of the difference in energy between two parts of a circuit. The bigger the difference in energy, the bigger the potential difference
Potential difference is measured using a device called a **voltmeter**. Just like ammeters, some types have a pointer on a dial, but most have a digital display. However, unlike an ammeter, you must connect the voltmeter **in parallel** to measure the potential difference across a component in a circuit.



When two components are connected in parallel, you cannot follow the circuit through both components from one side to the other without lifting your finger or going back over the path you have already taken.

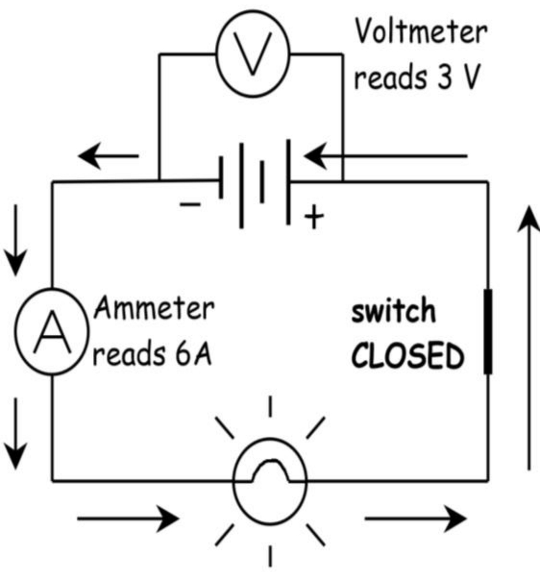
A circuit diagram showing a voltmeter in parallel with a lamp

<u>Exercise 1A</u>

<u>The effect of increasing the voltage.</u>

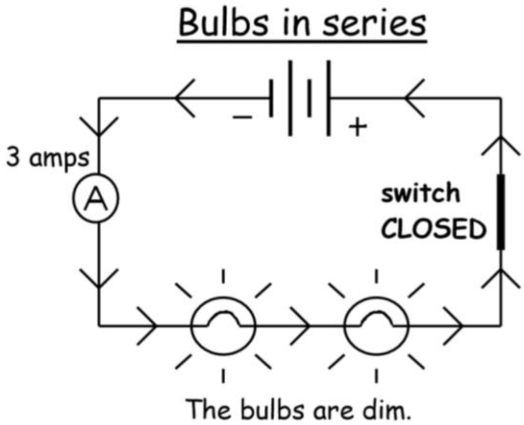
The diagram opposite shows what happens if two batteries are put into the circuit. Carefully compare it to the first diagram at the top of this page and then try to complete the missing words in the passage below.

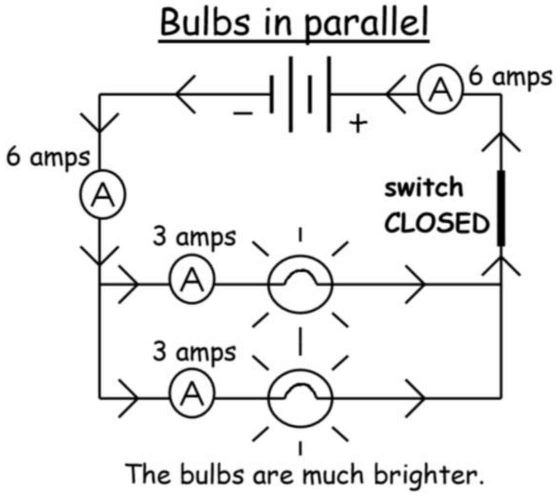
A battery pushes out the C _ _ _ _ _ _ _ The voltage across both batteries can be measured using a V _ _ _ _ _ _ _ _ _ With two batteries there is T _ _ _ _ as much voltage. This produces twice the current and so the bulb is much B _ _ _ _ _ _ _ The negative end of one battery must be connected to the P _ _ _ _ _ _ _ end of the other battery. If they are connected the wrong way round the current will not F _ _ _



The bulb is much brighter.

Exercise 1B



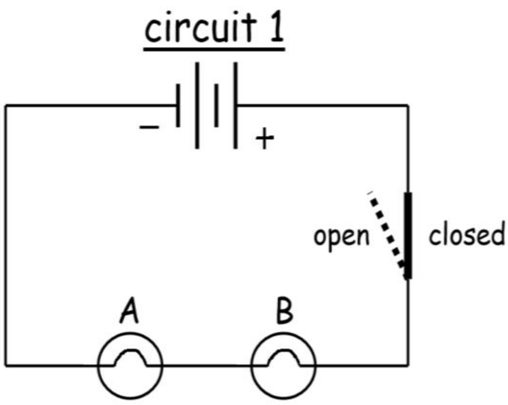


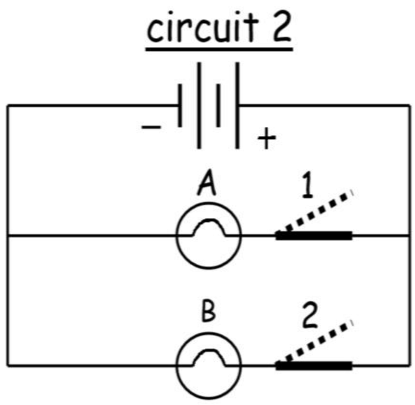
The current is .... because it is harder for it to travel through both bulbs. We say that there is a high .... The current does not get used up as it travels around the circuit. The .... gives the same reading anywhere in the circuit.

Both bulbs are connected directly across the two batteries therefore they are given the full .... The current is .... because it is easier for it to flow around the circuit. If another bulb was connected in parallel they would still be as ....

voltage   small   bright   resistance   larger   ammeter

Exercise 2 - Study the two circuit diagrams below and then try to complete the sentences.





1) If the switch is opened in circuit 1 both bulbs would ______________

2) If bulb A is removed from circuit 1 bulb B would get ______________

3) If switch 1 is opened in circuit 2 only bulb ____ would light up.

Electric charge

Some particles carry an electric charge. In electric wires these particles are electrons. We get an electric current when these charged particles move from place to place.

Electric current

An electric current is a flow of charge, and in a wire this will be a flow of electrons. We need two things for an electric current to flow:

- something to transfer energy to the electrons, such as a battery or power pack
- a complete path for the electrons to flow through (an electric circuit)