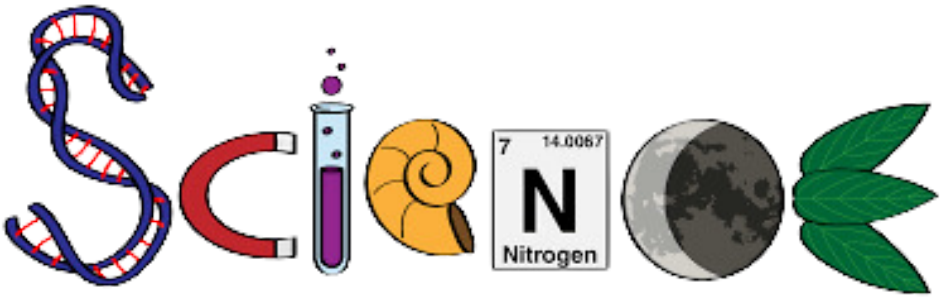
Meopham School



HOMEWORK BOOKLET

Year 8 Term 2

Energy and Electricity

Energy Stores

Homework 1

Write down the name of the energy store that matches each description.

Use the key words in the box to help you.

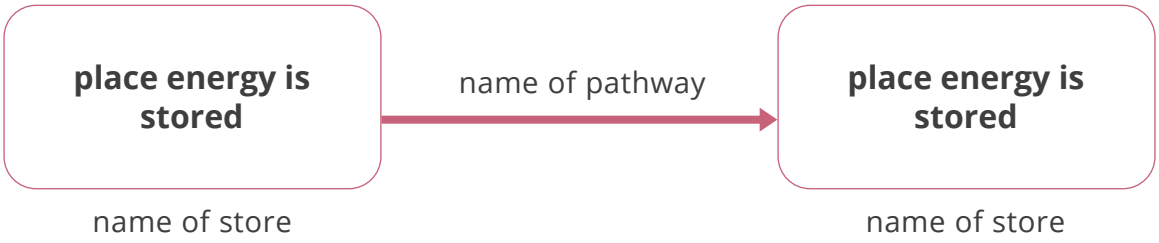
Key Words			
chemical	elastic potential	electrostatic	gravitational potential
kinetic	magnetic	nuclear	thermal

Description of Energy Store	**Name of Energy Store**
The total energy of the particles that make up an object. The more energy there is in this store, the higher the temperature of the object.	
The energy stored in a moving object.	
The energy stored when an object is lifted in a gravitational field.	
The energy stored when an object has been stretched or compressed.	
The energy stored when repelling poles have been pushed closer together or when attracting poles have been pulled further apart.	
The energy stored in the bonds of a substance or group of substances.	
The energy stored when repelling charges have been pushed closer together or when attracting charges have been pulled further apart.	
The energy stored in the nucleus of an atom.	

Energy Transfer Diagrams

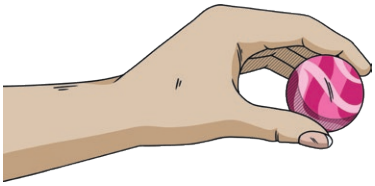
Homework 1

The diagram below shows a template for one type of energy transfer diagram.



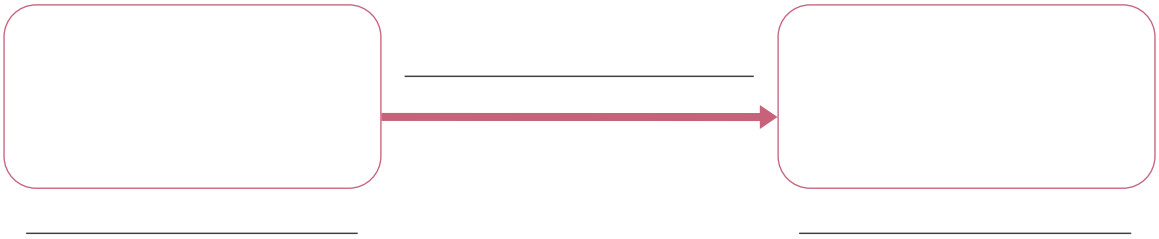
Draw an energy transfer diagram for each of the systems shown below.

System 1: A bouncy ball is dropped from a height.

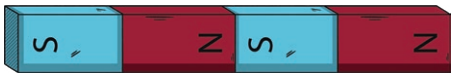


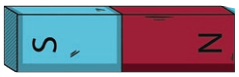
Start Point: The ball is held stationary above the ground.

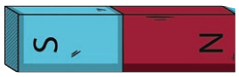
End Point: The ball is compressed as it hits the floor.



System 2: Two magnets are pulled a short distance apart by a person.

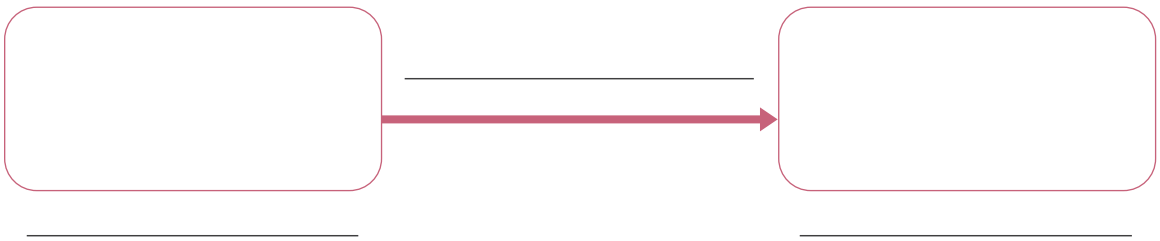






Start Point: The north and south poles of the magnets are in contact.

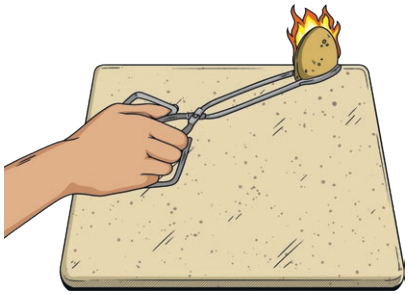
End Point: The north and south poles have been separated.

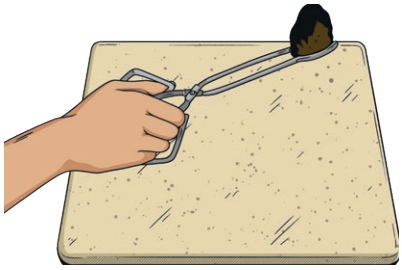


BEYOND SCIENCE

Homework 1

System 3: A crisp is set on fire.

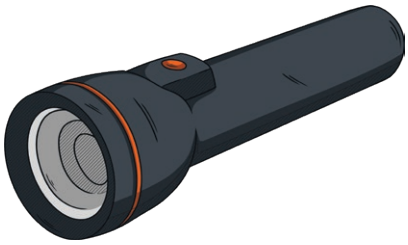


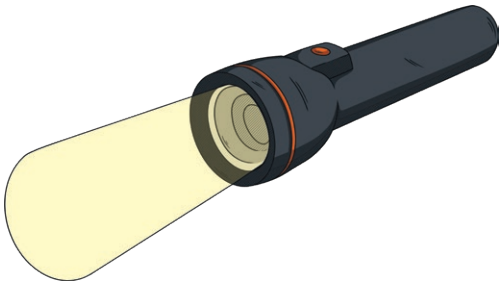


Start Point: The crisp has just been lit.

End Point: The crisp has burnt and the flame has gone out.

System 4: A battery-powered torch is switched on.





Start Point: The torch is off.

End Point: The torch has been on for five minutes.

Energy Efficiency Calculations

Homework 1

The efficiency of a device can be calculated using the equation:

$$\textbf{efficiency} = \frac{\textbf{useful output energy (J)}}{\textbf{total input energy (J)}}$$

1. Calculate the efficiency of the following devices.
   Write each answer as a decimal to 2 decimal places.

   a. A toaster with a total input energy of 800 J and a useful output energy of 520 J.

   efficiency = _____

   b. A washing machine with a total input energy of 1800 J and a useful output energy of 810 J.

   efficiency = _____

The efficiency can also be written as a percentage by multiplying the answer by 100.

$$\textbf{percentage efficiency} = \frac{\textbf{useful output energy (J)}}{\textbf{total input energy (J)}} \times \textbf{100}$$

2. Calculate the efficiency of the following devices.
   Write each answer as a percentage.

   a. A lamp with a total input energy of 1250 J and a useful output energy of 500 J.

   efficiency = _____ %

   b. A microwave with a total input energy of 1200 J and a useful output energy of 600 J.

   efficiency = _____ %

   c. A drill with a total input energy of 2 kJ and a useful output energy of 1400 J.
   1 kilojoule = 1000 joules

   efficiency = _____ %

Renewable Energy

Comprehension Activity

Homework 2

What is renewable energy?

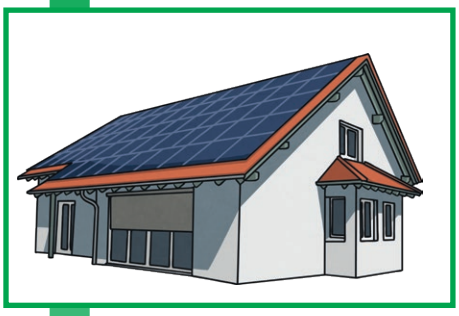
Renewable energy is energy that comes from sources that are easily made or naturally replenished (restored). We can't run out of renewable energy sources. Renewable energy includes solar, geothermal, wind, hydropower and biomass.

Why is using renewable energy sources better for our environment?

Natural gas, coal, petroleum, oil and uranium are all examples of fossil fuels that we burn to create energy. These sources of energy are called non-renewable because once they've been burnt, they're gone and do not naturally restore or fill up again. When we burn fossil fuels, we release harmful chemicals into the air and this is damaging to our environment.

Renewable energy is sometimes called 'clean energy' or 'green power' because it does not release any pollution into the air or waterways. Because renewable energy naturally restores and doesn't pollute our environment, it is better for the planet.

What is solar energy?

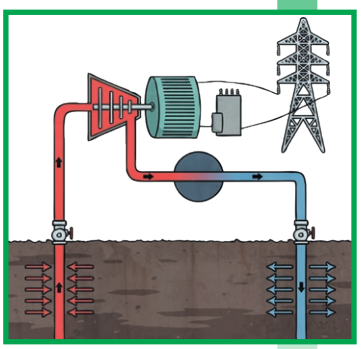


Solar energy is the light and heat that comes from the Sun. Solar energy can be collected and used as electricity to power lights, appliances, electronics and other things that use electricity. Solar energy is collected by solar panels. Solar panels are big, black panels that are fitted to the roofs of houses and buildings to collect energy. They are becoming very popular in sunny places. See if you can spot some next time you're going for a walk.

What is geothermal energy?

Geothermal energy is created from the heat inside the Earth. You can find it anywhere on the Earth's surface but sometimes you need to drill down through rock to find it. Geothermal energy is created as radioactive elements in the Earth's core decay. It can be turned into electricity, used for bathing and used for heating.

What is wind power?

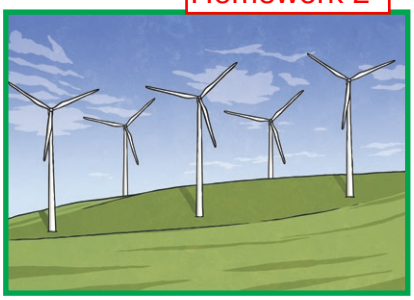


Have you ever seen those huge, white windmills? They are called wind turbines and they harness energy from the wind. Wind farms are lots of those white wind turbines together. The wind turns the blades of the turbine and this powers a generator in the base of the turbine and creates electricity. Wind farms can power entire villages. The bigger the turbine, the more electricity it generates.

Homework 2

What is hydropower?

Hydropower (or hydroelectricity) is also created using a turbine, like wind power. The difference is that, instead of wind, hydropower is generated through running water. The running water makes the turbine blades spin which powers the generator and creates electricity.

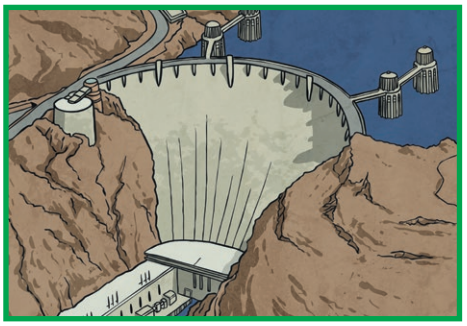


What is biomass energy?

Biomass energy is energy that is created from living or once-living things. The most common biomass material used for energy is plants, wood and waste. Biomass energy can be burnt to create heat, converted into electricity and is the only renewable source that can be made into a liquid form, called biofuel.

Why are non-renewable energy sources still used?

We still use non-renewable energy sources today. The most common non-renewable energy sources used are coal, natural gas and petroleum. Because they generate more energy, can be stored and moved and are cheaper to convert into electricity than renewable sources, non-renewable energy sources are still very valuable and widely used.



Homework 2

Questions

Please answer using complete sentences.

1. Sort the following energy sources into renewable and non-renewable using the table below.

biomass **coal** **natural gas** **water** **sun**

uranium **oil** **wind** **geothermal** **petroleum**

Renewable	Non-renewable

2. What types of renewable energy have you seen before?

_____

_____

_____

3. Why is renewable energy called 'green power' or 'clean energy'?

_____

_____

_____

4. Finish these sentences:
   a) Energy that comes from water is called _____.
   b) Solar power is heat and energy that comes from the _____.
   c) _____ is a source of energy that comes from living or once-living things.
   d) _____ is created as radioactive elements in the Earth's core decay.
   e) Wind that turns a turbine, storing energy in a generator, is called _____.

5. Why do we still use non-renewable energy sources today?

_____

_____

_____

Homework 2

6. How does a wind turbine work?

7. Think about your own home and family. What kinds of energy do you use for day to day living?

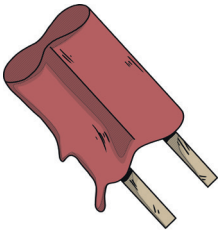
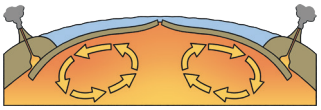
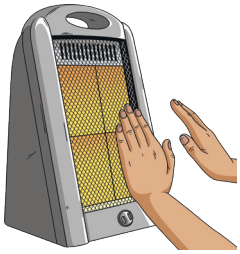
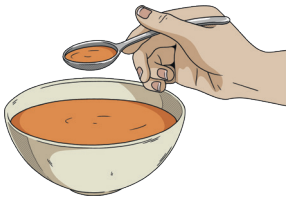
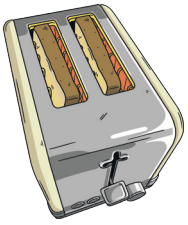
8. Finish the visual dictionary. Draw a picture to match the energy with its source.

Solar	Geothermal	Hydropower	Windpower	Biomass

Homework 3

Conduction, Convection and Radiation

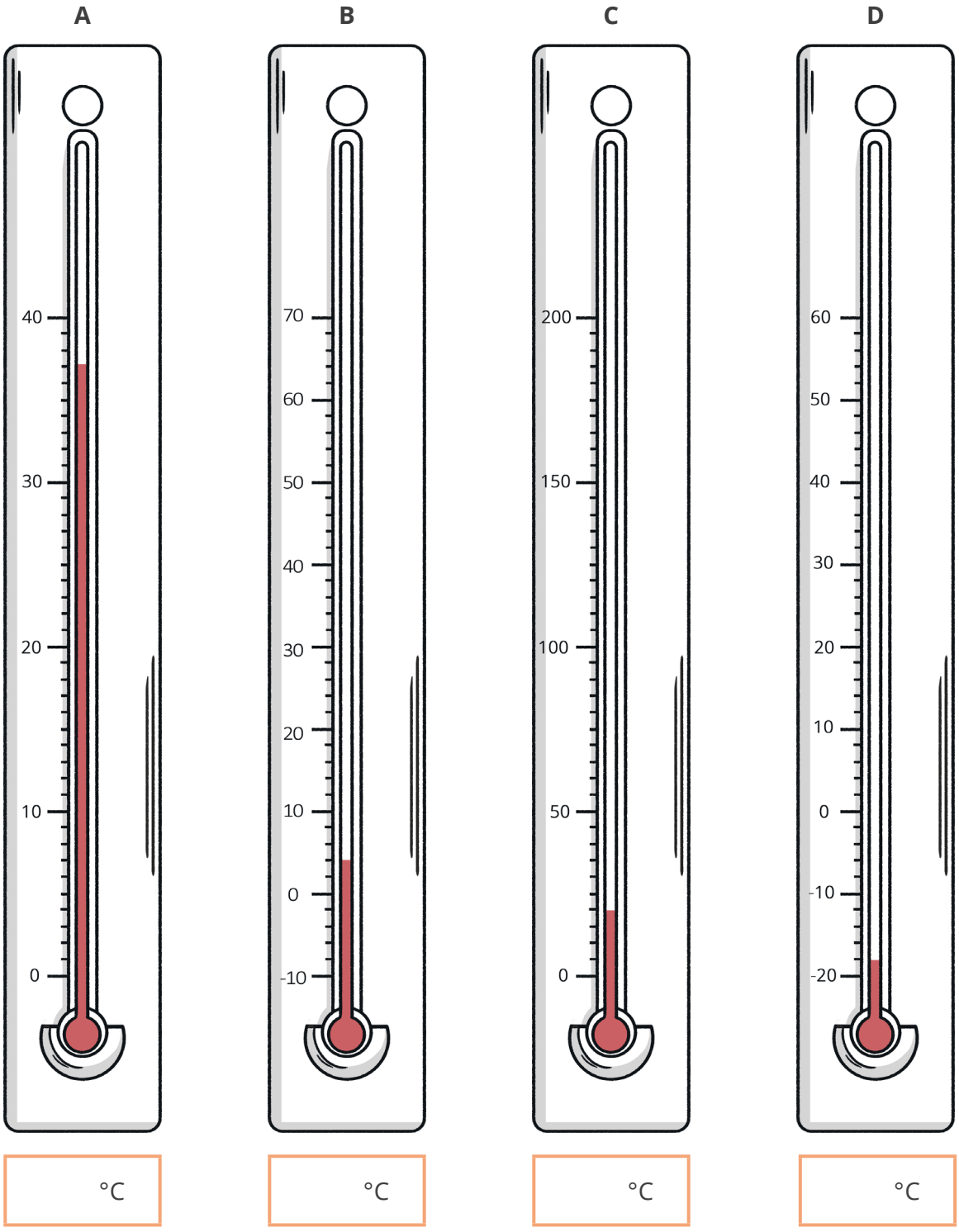
Write down whether the main energy transfer process in each scenario is **conduction**, **convection** or **radiation**.

The transfer of energy through the base of the metal pan.  _____	The transfer of energy from the Sun to the ice lolly.  _____
The transfer of energy through the air in the hot-air balloon.  _____	The transfer of energy from the Earth's core to its surface.  _____
The transfer of energy from the hot-water bottle to the bed.  _____	The transfer of energy through the water in the kettle.  _____
The transfer of energy from the cup to the person's hands.  _____	The transfer of energy from the heater to the person's hands.  _____
The transfer of energy from the flame to the food in the oven.  _____	The transfer of energy from the soup to the metal spoon.  _____
The transfer of energy from the bonfire to the spectators.  _____	The transfer of energy from the heating element to the bread.  _____

Thermometer Scales

Homework 3

1. In the box below each diagram, write down the temperature shown on the thermometer.



°C	°C	°C	°C

2. Write down the letter of the thermometer that is most likely to show:

   a. fridge temperature _____
   b. room temperature _____
   c. freezer temperature _____
   d. body temperature _____

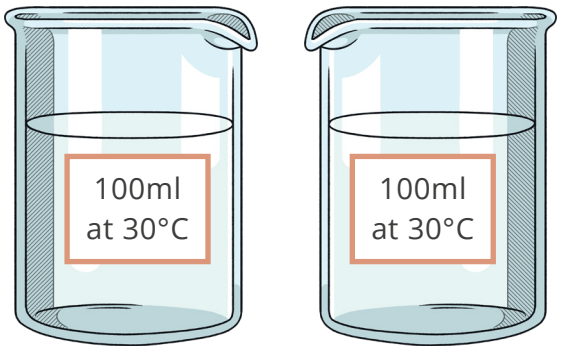
Temperature

Homework 3

Describe the temperature of the water if 50ml of hot water is mixed with 50ml cold water.

_____

The water in each of the following pairs of beakers is mixed. Predict the temperature of the water after mixing each pair and explain how you arrived at your prediction.



temperature = _____ °C

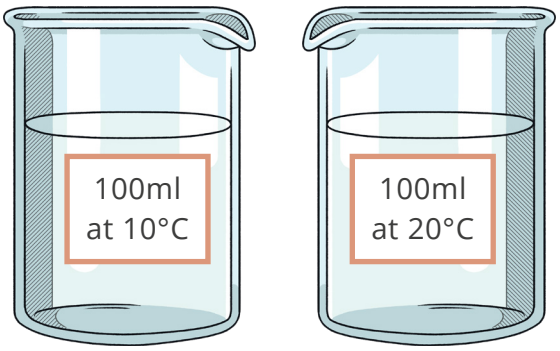
explanation

_____

_____

_____

_____



temperature = _____ °C

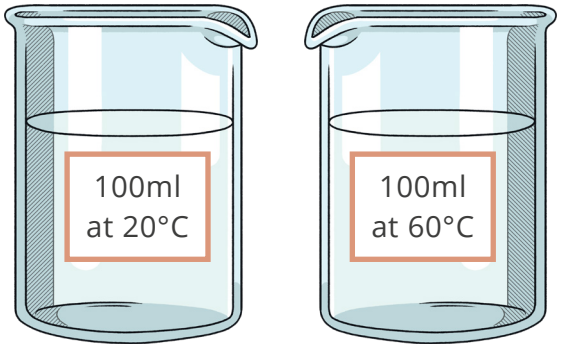
explanation

_____

_____

_____

_____



temperature = _____ °C

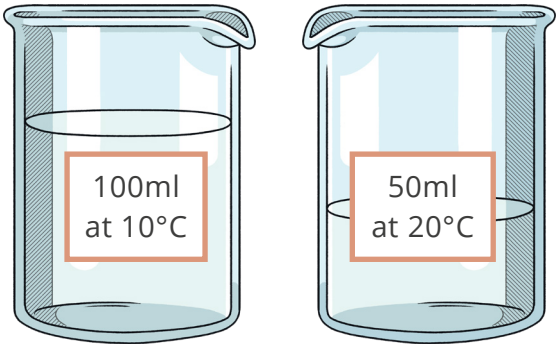
explanation

_____

_____

_____

_____



temperature = _____ °C

explanation

_____

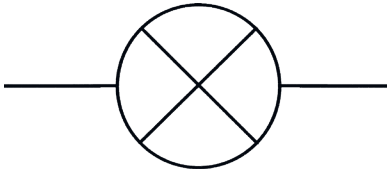
_____

_____

_____

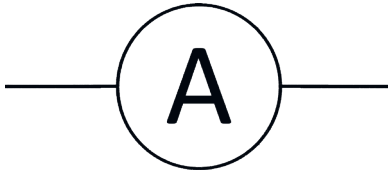
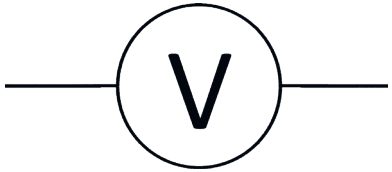
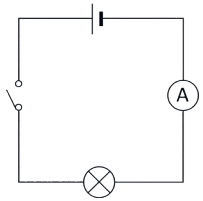
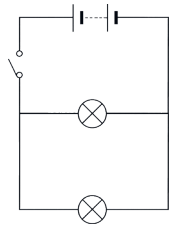
Circuit Components

Write the name of the circuit component shown and then describe its function in the final column.

Circuit Component	Diagram	Description
		
		
		

Homework 4

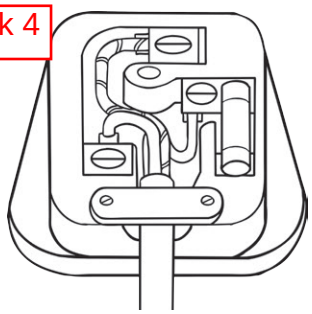
Circuit Components

Homework 4

Homework 4

Introduction to Series Circuits



The rules for drawing circuits are below. You **must** follow these at all times.

1. Always draw circuits using straight lines.
2. Use a pencil and a ruler to draw the lines.

Please complete the following tasks in the spaces below.

1. Draw a series circuit with 1 cell and 2 bulbs.

2. Draw a series circuit with a battery, an open switch, 2 bulbs and an ammeter.

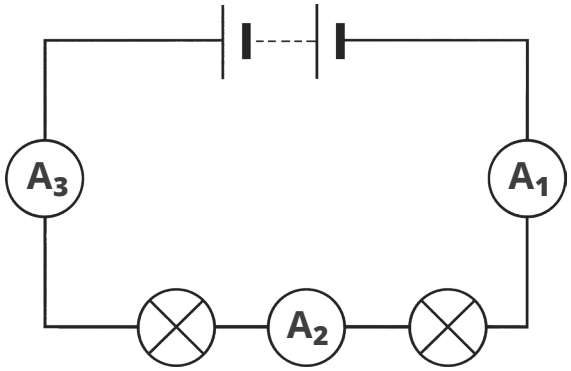
3. Draw a series circuit with 1 cell, 2 bulbs and a closed switch.

Electrical Circuits

Homework 5

The circuit shown in the diagram below contains two identical bulbs connected in series with three ammeters.

The reading on A_3 is 4A.



1. Write down the readings on the other ammeters.

   A_1: _____

   A_2: _____

One of the bulbs is removed from the circuit and the wires are reconnected so the current flows.

2. What happens to the remaining bulb?

   Tick **one** box.

   ☐ The bulb gets brighter.

   ☐ The bulb gets dimmer.

   ☐ The brightness of the bulb does not change.

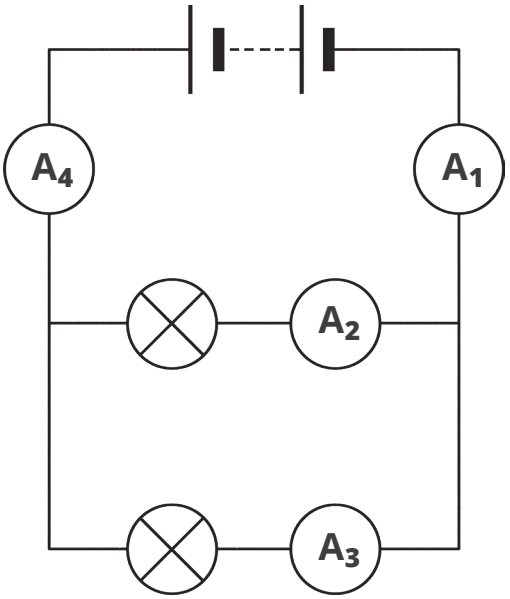
3. Complete the sentence to explain why this happens. Choose the answer from the box below.

current	potential difference	resistance

   This happens because the _____ is no longer shared with another bulb.

The circuit shown in the diagram below contains two identical bulbs connected in parallel. There are also four ammeters in the circuit.

The reading on A_3 is 3A.



4. Write down the readings on the other ammeters.

   A_1: _____

   A_2: _____

   A_4: _____

Homework 5

Current, Resistance and Potential Difference

Potential difference can be calculated using the equation:

potential difference = current × resistance

1. What is the potential difference if a current of 3A flows through a resistance of 20Ω?

potential difference = _____V

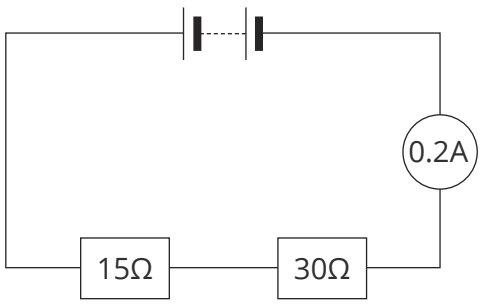
2. A current of 150mA passes through a 10Ω resistor.

   Calculate the potential difference across the resistor.

potential difference = _____V

3. **Figure 1** shows a series circuit.

Figure 1



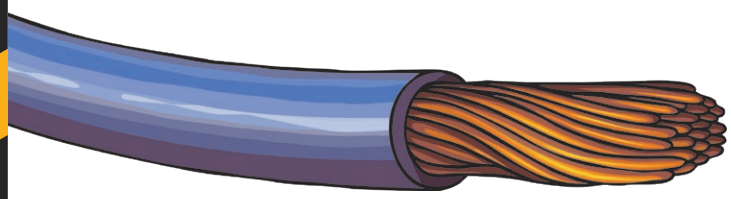
Calculate the potential difference across the battery.

potential difference = _____V

Homework 6

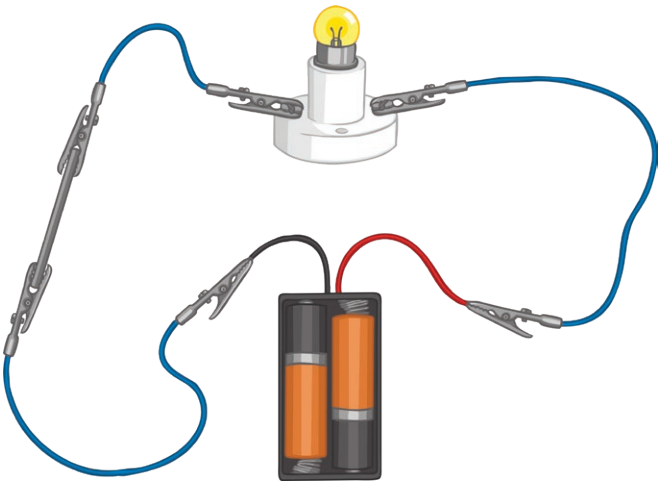
Shocking Science

Electrical Conductors and Insulators



A conductor is a material that allows electrical charges to flow through it easily while an insulator is a material that does not allow charges to flow through it easily. This property is related to the number of free electrons in a material. In conductors, there are many free electrons that can move easily through the material. In contrast, in insulators, the electrons are tightly bound to their respective atoms and cannot move freely.

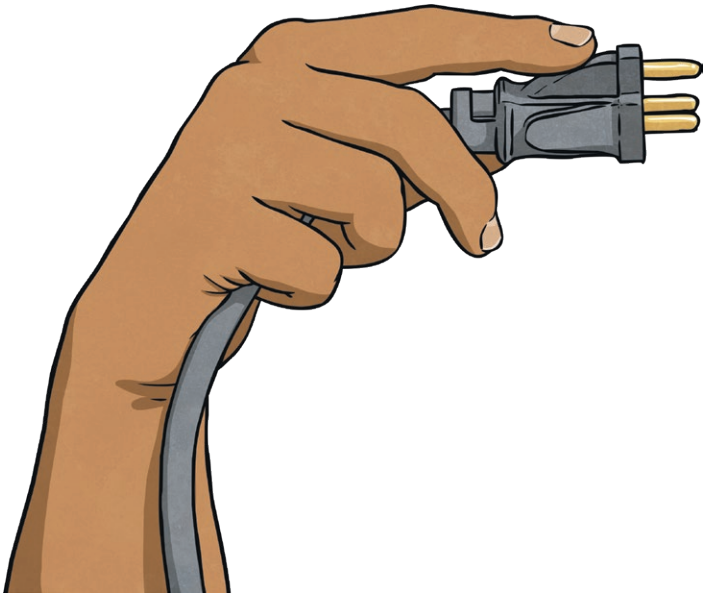
The conductivity of a material is measured in terms of its resistivity, which is the degree to which the material resists the flow of electrical current. Materials with low resistivity are good conductors, while those with high resistivity are good insulators.



Some common examples of good electrical conductors include:

1. **Copper**: Copper is one of the most used electrical conductors because it is highly conductive and relatively inexpensive. It is used in electrical wiring, electrical motors, transformers, and generators.
2. **Aluminium**: Aluminium is another common electrical conductor that is often used in electrical transmission lines and high voltage power cables.
3. **Silver**: Silver is the most conductive metal and is used in applications where high conductivity is required, such as in high-performance electronic components and in some electrical contacts.
4. **Gold**: Gold is also a highly conductive metal that is often used in high-end audio and video equipment as well as in some electrical contacts and connectors.
5. **Iron**: Iron is a good electrical conductor often used in electrical transformers and motors.
6. **Carbon**: Carbon is a good electrical conductor often used in electrodes for batteries and some electronic components.

Homework 6



7. **Brass**: Brass is an alloy of copper and zinc often used in electrical connectors, switches, and terminals.
8. **Bronze**: Bronze is an alloy of copper and tin that is often used in electrical connectors and switches.
9. **Stainless Steel**: Stainless steel is a good electrical conductor that is often used in electrical switches, connectors, and other electrical components.
10. **Graphite**: Graphite is a good electrical conductor often used in batteries, fuel cells, and some electronic components.

These materials are used where electrical conductivity is important.

Some common examples of electrical insulators include rubber, plastic, glass, ceramic, and air. These materials have high resistivity and can prevent the flow of electrical current. Electrical insulators are used in various applications where preventing the flow of electrical current is important.

Some common examples of where electrical insulators are used include:

1. **Electrical Wiring**: Insulating materials cover electrical wires to prevent current flow to unintended locations or objects.
2. **Electrical Equipment**: Insulators isolate different electrical equipment components from each other and from the surroundings to prevent electric shocks and short circuits. Examples of electrical equipment that use insulators include transformers, circuit breakers, and capacitors.
3. **Electronics**: Insulators are used to prevent unwanted electrical coupling between different components of electronic devices. Electronic devices that use insulators include printed circuit boards, integrated circuits, and microchips.
4. **High Voltage Power Lines**: Insulators support and isolate high voltage power lines from their support structures, preventing current flow between the power lines and the earth.

Not all materials are strictly conductors or insulators. Some materials, known as semiconductors, have average conductivity levels and can be used in electronic devices such as transistors and integrated circuits. The conductivity of semiconductors can be controlled by introducing impurities into the material through a process known as doping.

Homework 6

Questions

1. What is the difference between a conductor and an insulator?

2. What property of a material determines whether it is a conductor or an insulator?

3. How is the conductivity of the material measured?

4. What are some common examples of good electrical conductors?

5. What are some common examples of electrical insulators?

6. Where are electrical insulators commonly used?

7. What are semiconductors?

8. How can the conductivity of a semiconductor be controlled for a specific purpose?

Wiring a Plug

Homework 6

Use the information in the text below to label and correctly colour the different parts of a three-pin plug.

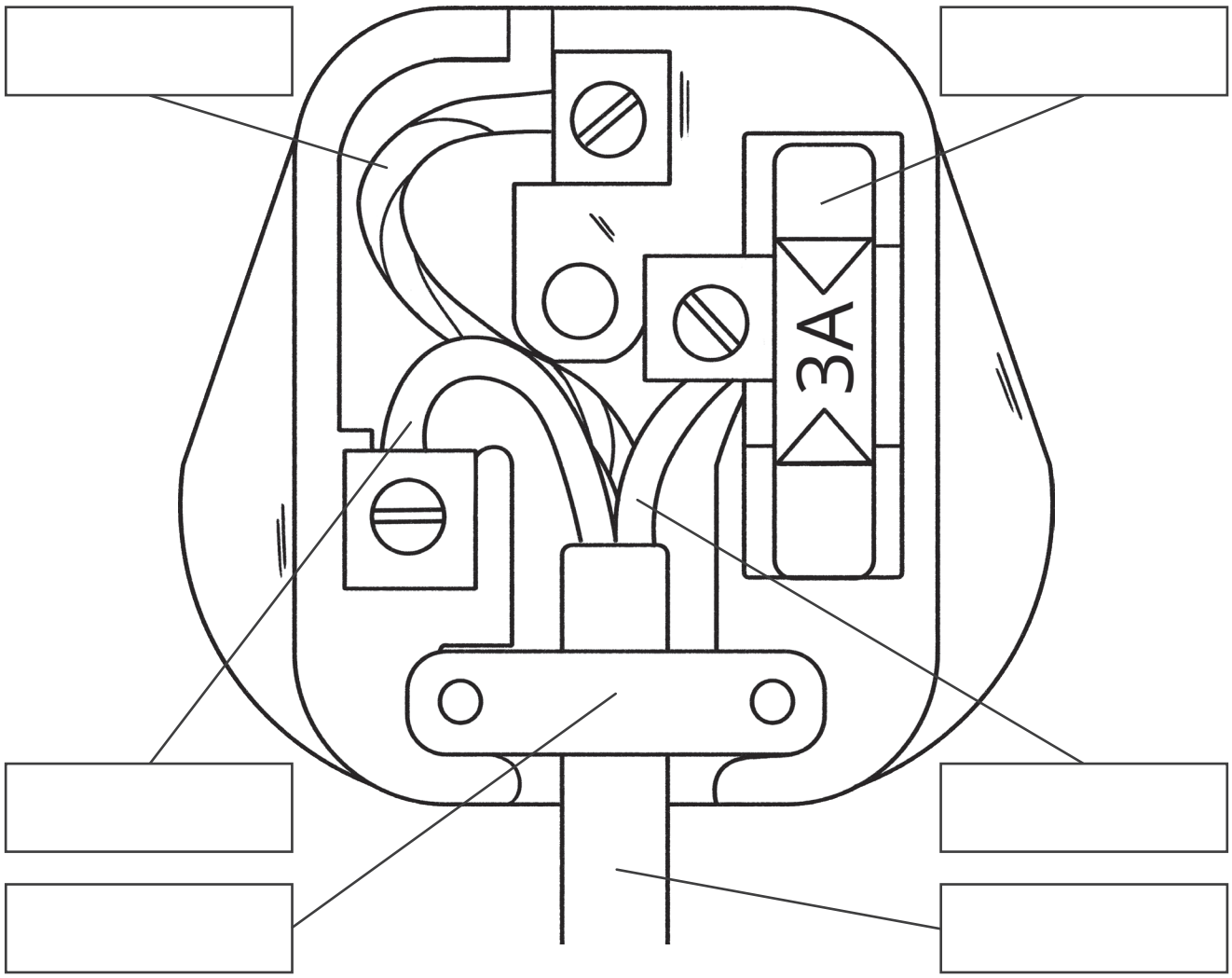
Most electrical appliances are connected to the mains supply using a three-core cable attached to a plug. The three-core cable is held in place inside the plug by a cable grip. It contains three wires surrounded by insulation.

The live wire carries the alternating potential difference of 230V from the supply and is connected to the fuse on the right-hand side of the plug. The fuse is a safety device which is designed to break the circuit if a current exceeding its rating flows through it. The insulation surrounding the live wire is coloured brown.

The neutral wire is at or close to 0V and completes the circuit. It has blue insulation and is found on the left-hand side of the plug.

The final wire is the earth wire. This is connected to the casing of the appliance and only carries a current if there is a fault. It acts as a safety device to protect the user from electric shock. The earth wire is connected to the top pin and has striped insulation which is green and yellow in colour.

The position of each wire can be remembered using the second letter of each colour: the b**R**own live wire is found on the **R**ight-hand side, the b**L**ue neutral wire is found on the **L**eft-hand side and the yellow and green s**T**riped earth wire is found at the **T**op.



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