International Elementary Science Olympiad e.V.

Time Allowed: 2HRS

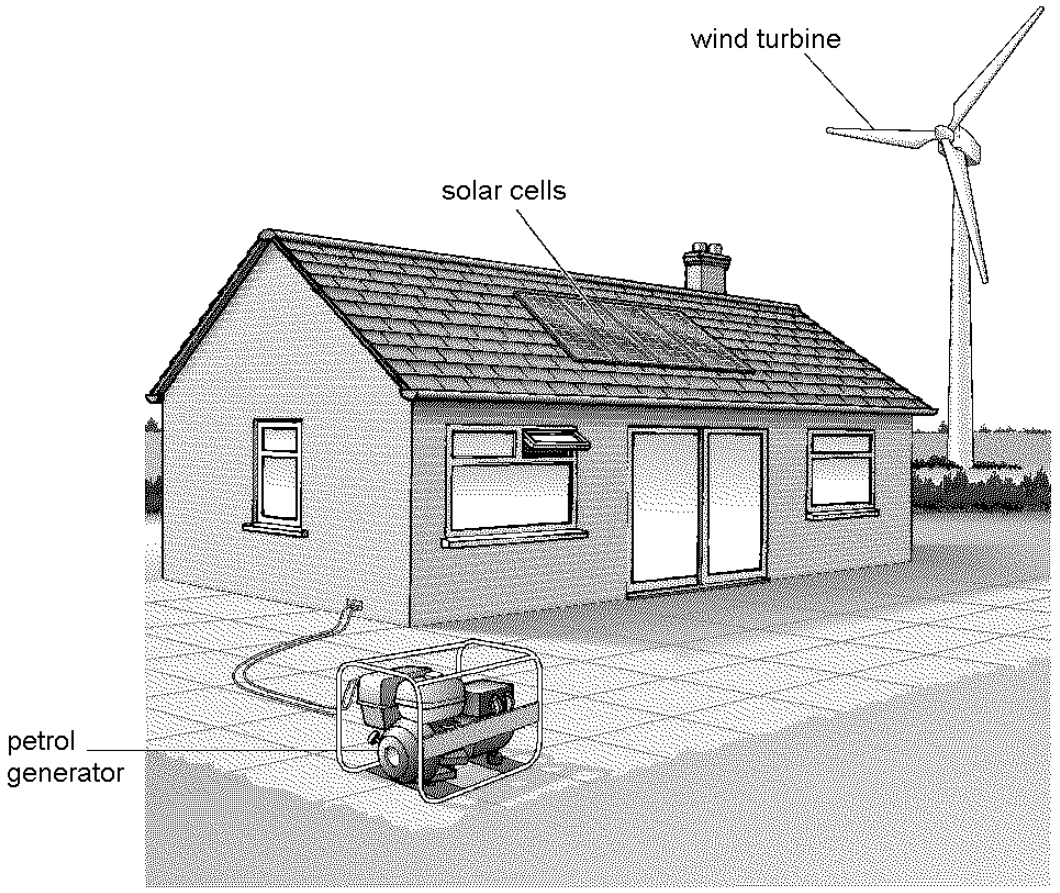
PERSONAL DATA	
First / Given Name *	
Middle Name	
Last/Family Name/ Common Name *	
Preferred Name on badge	
Phone *	
Email *	
Alternate email	
Job description *	
Name of School/Institute/University/Other *	
Gender *	
Date of birth *	
Passport Number	

Energy resources/electrical circuits

7I & 7J

31 min
33 marks
Q1-L3, Q2-L4, Q3-L4, Q4-L5, Q5-L5, Q6-L6

1. The drawing shows Mark's house. He uses three methods to generate electricity.



(a) Draw a straight line from each of the **two** methods below to the main energy resource used to generate electricity.
Draw only **two** lines.

method	**energy resource**
solar cells	air movement
	chemicals
	sunlight
petrol generator	
	heat

2 marks

(b) (i) The solar cells **cannot** work at night.
Give the reason for this.

.....

.....

1 mark

(ii) The wind turbine **cannot** generate electricity all the time.
Give the reason for this.

.....

.....

1 mark

Maximum 4 marks

2. The table below gives information about three fuels that can be used in cars.

✓ shows a substance is produced when the fuel burns.
X shows a substance is **not** produced when the fuel burns.

fuel	physical state	energy released, in kJ/kg	some of the substances produced when the fuel burns		
			carbon monoxide	sulphur dioxide	water
petrol	liquid	48 000	✓	✓	✓
hydrogen	gas	121 000	X	X	✓
ethanol (alcohol)	liquid	30 000	✓	X	✓

(a) Which fuel, in the table, releases the **least** energy per kilogram (kg)?

.....

1 mark

(b) Some scientists say that if hydrogen is burned as a fuel there will be less pollution.
From the information in the table, give **one** reason why there will be less pollution.

.....

.....

1 mark

(c) Which of the three **fuels** in the table can be compressed into a small container?

.....

1 mark

(d) Which gas in the air is needed for fuels to burn?
Tick the correct box.

carbon dioxide ☐

nitrogen ☐

oxygen ☐

water vapour ☐

1 mark

(e) Petrol and ethanol are both fuels. Petrol is made from oil.
Scientists say that oil could run out in 100 years.
In some countries people plant sugar cane and use it to make ethanol.

Sugar cane will **not** run out. Explain why.

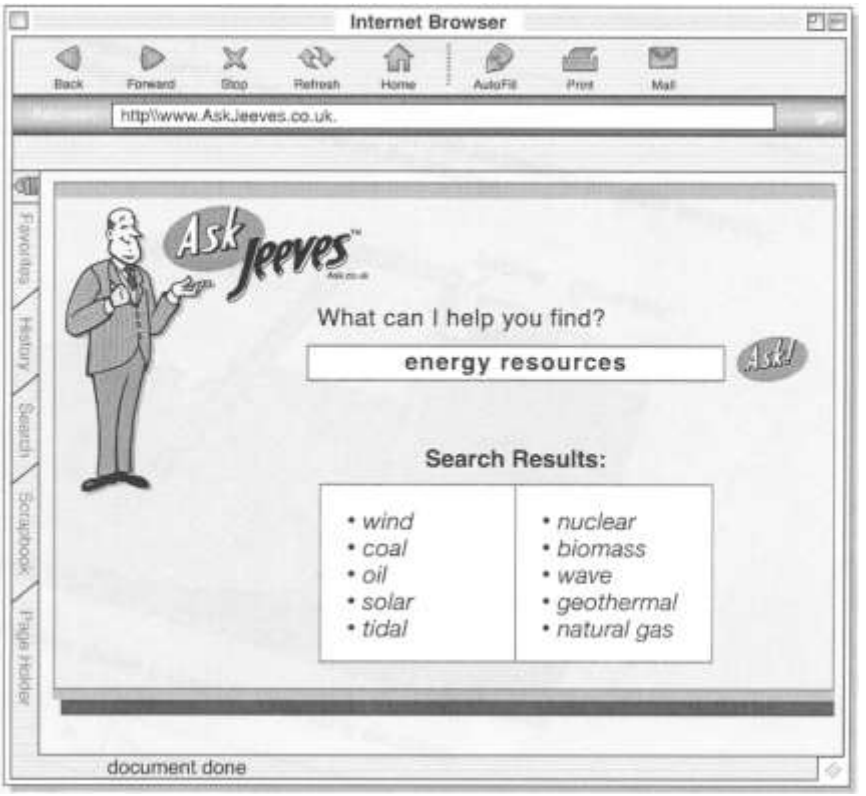
.....

.....

1 mark

Maximum 5 marks

3. Meera used the Internet to find out about energy resources. The drawing below shows what Meera saw on her computer screen.



(a) Coal is a fossil fuel.
Give the names of **two** other fossil fuels in the list on the screen.

……..……..…....and……....……..….

2 marks

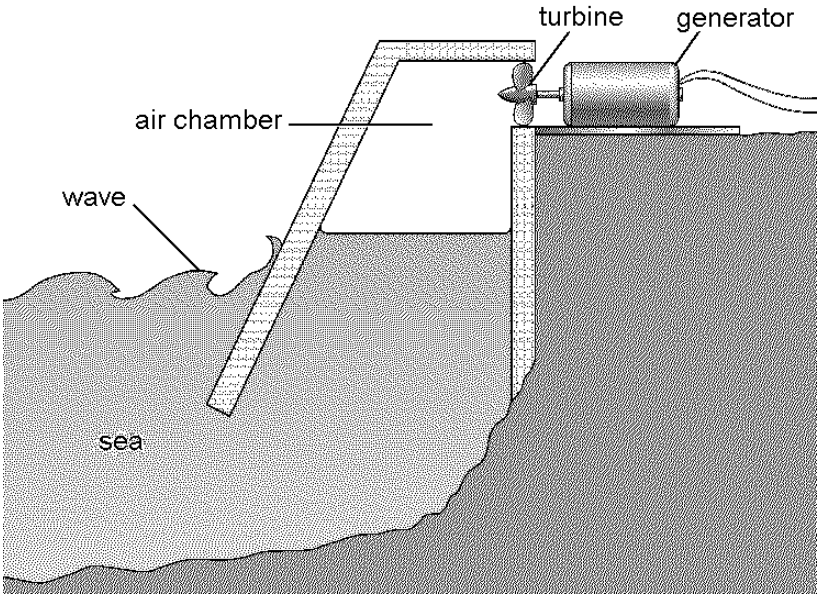
(b) (i) Wave energy is an example of a renewable energy resource.

From the list on the screen above choose **two** other renewable energy resources.

……..……..…..... and ……....……..…

2 marks

(ii) Meera found out how wave energy can be used to generate electricity. She saw the diagram below on the Internet.



Each box below shows a stage in generating electricity.

A	The air turns the turbine.
B	The turbine turns the generator.
C	The waves move up the chamber.
D	The generator produces electricity.
E	The waves push the air up the chamber.

On the lines below write the letters of the stages in the correct order. Two have been done for you.

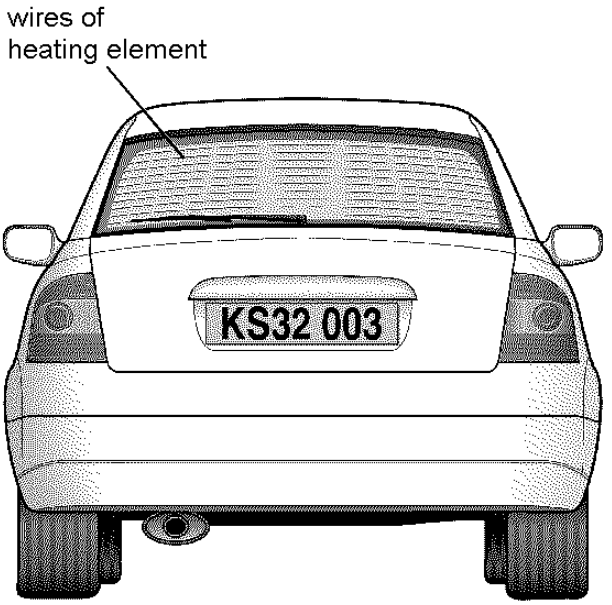
.....C..... ....A..... ....

2 marks

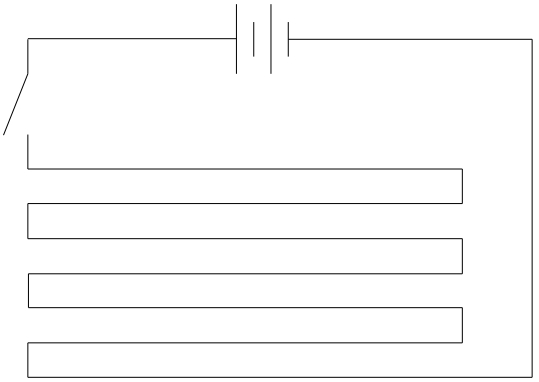
Maximum 6 marks

4. The back window of this car contains a heating element.

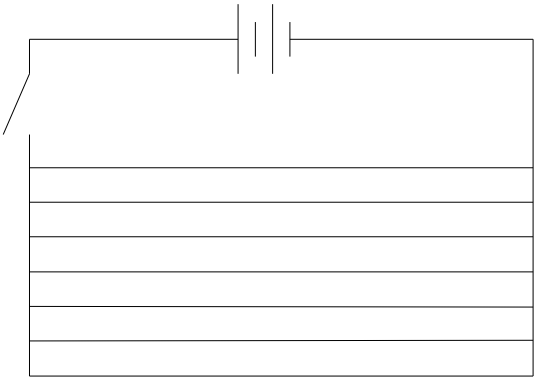
The heating element is part of an electrical circuit connected to the battery of the car.



The diagrams below show **two** ways of connecting the circuit of a heating element.



circuit A



circuit B

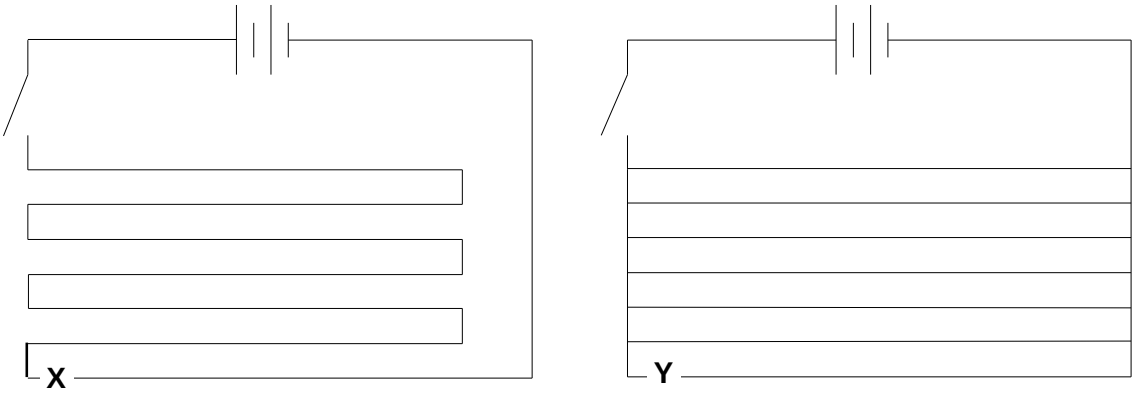
(a) Give the name of each type of circuit:

circuit A .....

circuit B .....

1 mark

(b) A wire gets broken at point X on circuit A and at point Y on circuit B.



circuit A **circuit B**

When the switch is closed, how does the broken wire affect the heating element in:

(i) circuit A? .....

.....

1 mark

(ii) circuit B? .....

.....

1 mark

(c) In very cold weather, ice may form on the back window of the car.
When the heating element is switched on, the ice will disappear and the surface of the window will become clear and dry.

(i) Fill the gap below to show the energy transfer that takes place.

When the heater is switched on, ... energy is transferred from the wires to the ice.

1 mark

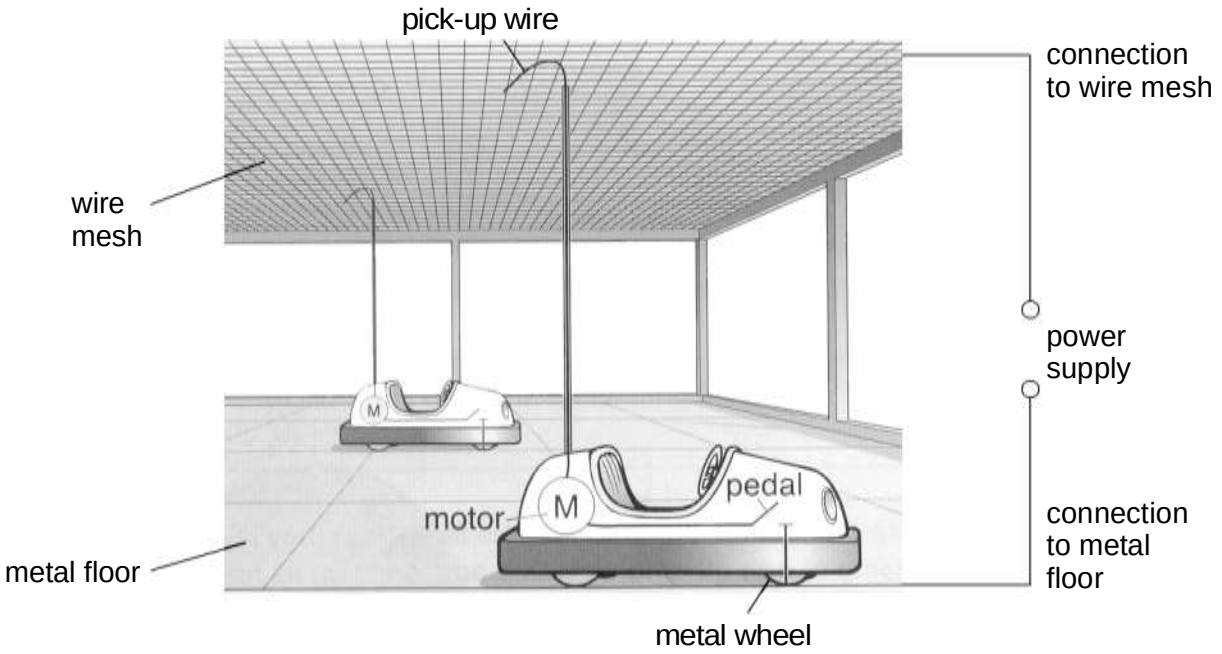
(ii) As the window becomes clear and dry, physical changes take place in the ice.
Fill the gaps below to show the physical changes which take place.

from …… to ……to ……

1 mark

Maximum 5 marks

5. The diagram shows two dodgem cars at a fairground. The circuit symbols for the motor and pedal for each dodgem car are shown on the diagram.



(a) Complete the following sentence.

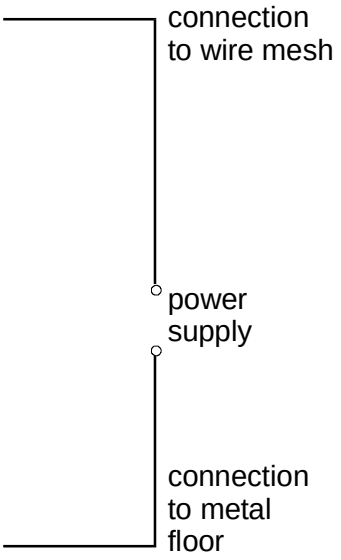
Each dodgem car is connected to the power supply through the ..... which is in contact with the wire mesh, and through the ..... which is in contact with the metal floor.

1 mark

(b) Dodgem cars are connected using parallel circuits.
Complete the circuit diagram below for the **two** dodgem cars.

Use **two** motor symbols, —(M)—, and **two** switch symbols, ⟋ .

The power supply for the circuit has been drawn for you.



2 marks

(c) Even when the power supply is switched on, the dodgem car will **not** move until the pedal is pressed. Give the reason for this.

.....

.....

1 mark

(d) A man looks after the dodgem cars during the rides.
Why does the man **not** get an electric shock as he walks across the metal floor?

.....

.....

1 mark

(e) During one ride, the two dodgem cars are running. The pick-up wire on one car snaps off. Describe how this affects:

(i) the dodgem car with the broken pick-up wire;

.....

1 mark

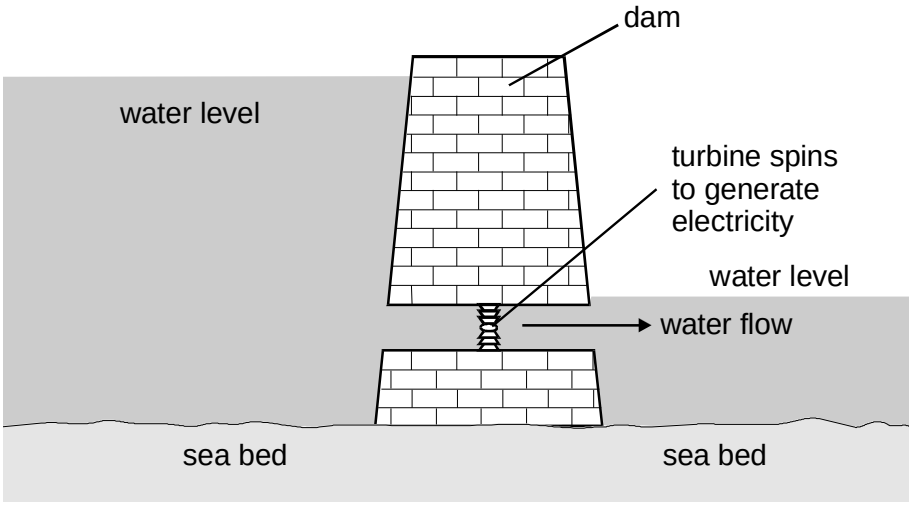
(ii) the other dodgem car.

.....

1 mark

Maximum 7 marks

6. The tides can be used to generate electricity. A dam is built across a river estuary, as shown below.



(a) The water is higher on one side of the dam than on the other. As the water begins to flow through the dam it turns a turbine. The turbine generates electricity. Describe the useful energy changes which take place in this process.

.....

.....

.....

.....

2 marks

(b) Explain why tides are classified as a renewable energy source.

.....

.....

1 mark

(c) Give **one** way, **other** than from the tides, of generating electricity by using the sea.

.....

1 mark

(d) Apart from cost, give **one** advantage and **one** disadvantage of an oil-fired power station compared with a tidal power station.

advantage .....

.....

disadvantage .....

.....

2 marks

Maximum 6 marks

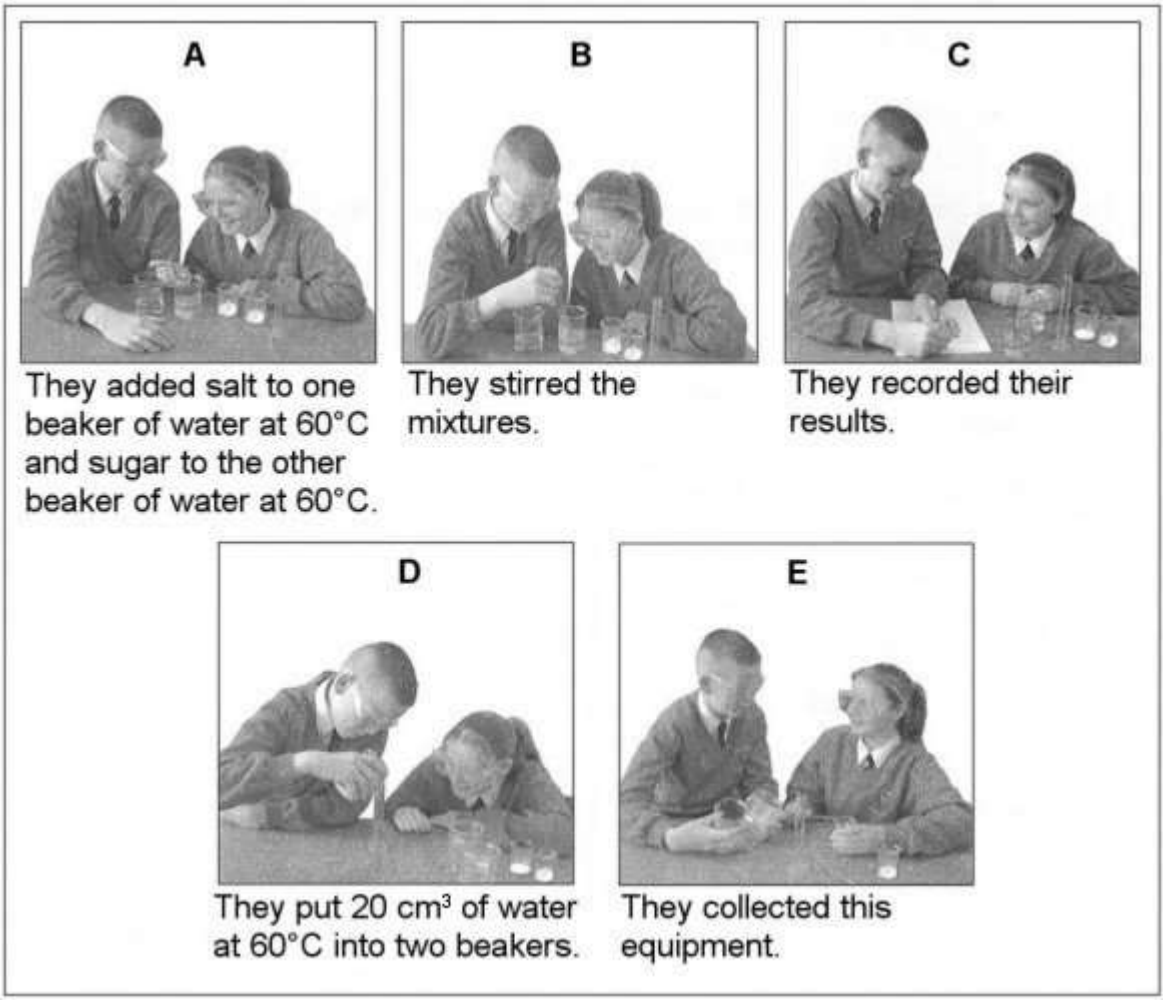
Particle model of solids, liquids and gases/ solutions

7G & 7H

32 min
32 marks
Q1-L3, Q2-L4, Q3-L4, Q4-L5, Q5-L5, Q6-L6

1. Some pupils carried out an investigation to find out whether more sugar or more salt dissolved in water at 60°C.

Here are some of the steps in their investigation.
They are **not** in the correct order.



(a) Put the letters **A**, **B**, **C**, **D** and **E** in the boxes below to show the correct order of the steps in their investigation.

1st ☐ 2nd ☐ 3rd ☐ 4th ☐ 5th ☐

1 mark

(b) Why did they use a measuring cylinder?

.....

1 mark

(c) They used water at 60°C in both beakers.

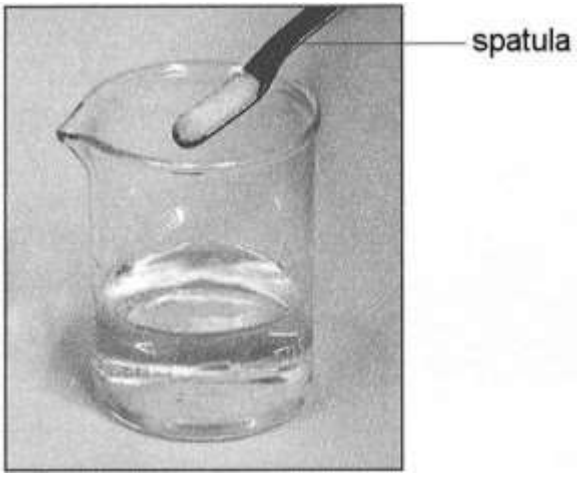
What else did they do to make their investigation fair?

.....

.....

1 mark

(d) They counted the number of spatulas of sugar or salt added to the water until **no** more would dissolve.



(i) Why was this **not** an accurate method of measuring how much sugar or salt they added?

.....

.....

1 mark

(ii) Suggest a more accurate method of measuring how much sugar or salt they added.

.....

.....

1 mark

(e) Jane predicted that more sugar than salt would dissolve.

Complete the table to show a result which would support Jane's prediction.

	sugar	**salt**
number of spatulas	32	

1 mark

maximum 6 marks

2. The list below shows properties that different elements can have.

- magnetic
- can be compressed
- very high melting point
- very low melting point
- good conductor of heat
- poor conductor of heat
- good conductor of electricity
- poor conductor of electricity

(a) Which **two** properties from the list above make aluminium suitable for saucepans?

1. .....

2. .....

2 marks

(b) Which property in the list above explains why:

(i) copper is used in the cable of a television?

.....

1 mark

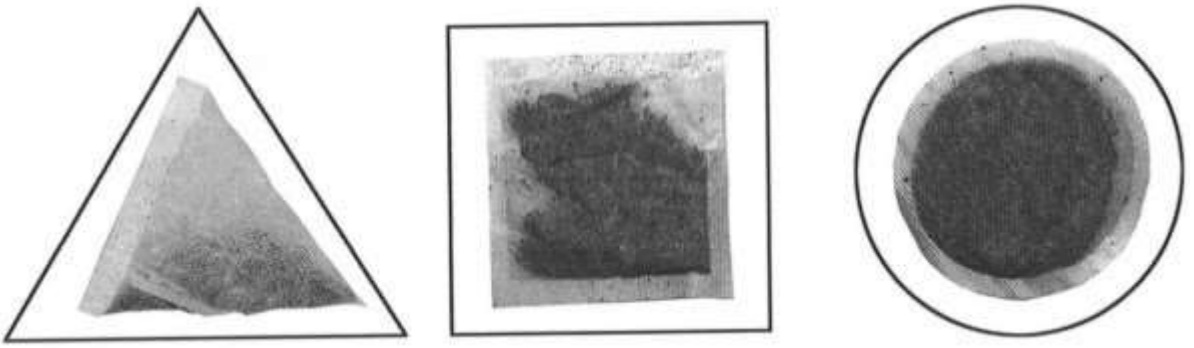
(ii) a lot of oxygen gas can be pumped into a very small container?

.....

1 mark

Maximum 4 marks

3. Tea bags are made in different shapes.



triangle **square** **circle**

Some pupils want to find out which shape of tea bag lets tea dissolve most quickly. They make two plans for their investigation as shown below.

FIRST PLAN
We will use 3 tea bags and 3 beakers

SECOND PLAN
Collect three beakers.
Collect three different tea bags.
Put one tea bag in each beaker.
Add 150 cm³ of water at 65°C.
Keep the temperature of the water the same.
Measure the time taken for the tea to dissolve.
Find out which is the quickest for making tea.

(a) How is the second plan better than the first plan?

.....

.....

1 mark

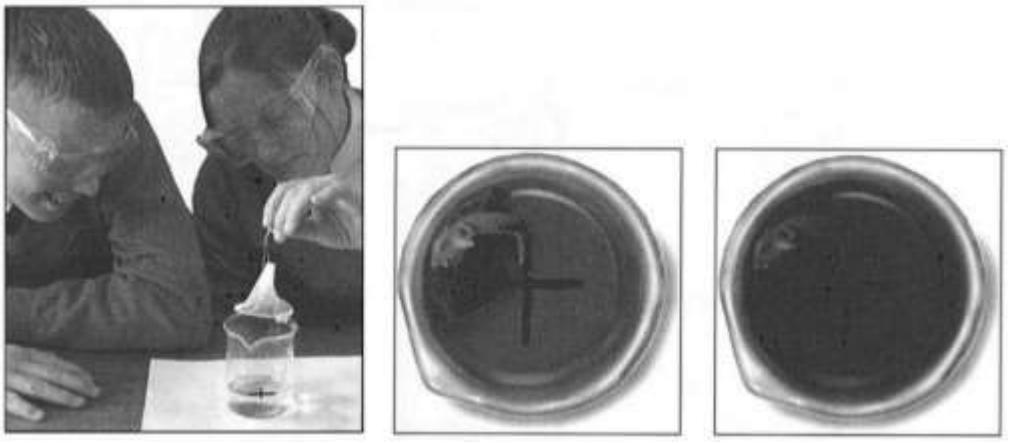
(b) Why should they take care when they add hot water at 65°C to the tea bags?

.....

.....

1 mark

(c) Ben and Vicky drew a cross on some paper. They put each beaker, in turn, over the cross. They poured hot water into the beaker, dropped in the tea bag and watched the water change colour.



To see which shape of tea bag let the tea dissolve the quickest, they measured the time until the liquid was too dark for them to see the cross.

How did the cross help to make their test more accurate?

.....

1 mark

(d) (i) They recorded their measurements in a table as shown below.

shape of tea bag	**time taken untill cross cannot be seen (minutes)**
triangle	8
square	15
circle	10

Which part of their investigation was recorded in the table?
Tick the correct box.

explanations	☐	results	☐
conclusions	☐	plans	☐

1 mark

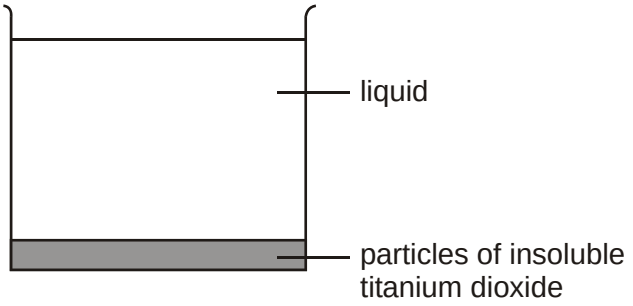
(ii) Give the **three** shapes of tea bags in the order in which the tea dissolved.
Use the table above to help you.

quickest _____ _____ _____ slowest

1 mark

maximum 5 marks

4. (a) Samantha opened a tin of white paint. The paint consisted of a liquid and particles of titanium dioxide that are insoluble in the liquid.
The paint had separated into two layers, as shown below.



(i) What type of substance is the paint?
Tick the correct box.

a compound	☐	an element	☐	a mixture	☐

1 mark

(ii) What type of substance is titanium dioxide?
Tick the correct box.

a compound	☐	an element	☐	a mixture	☐

1 mark

(iii) Why did the particles of insoluble titanium dioxide sink to the bottom?

.....

.....

1 mark

(b) Samantha stirred the paint and used it to paint a window frame.

She got some of the paint on the glass.

Samantha could **not** get the paint off the glass with water.
When she used a different liquid called white spirit the paint came off.

Why could she remove the paint with white spirit but **not** with water?

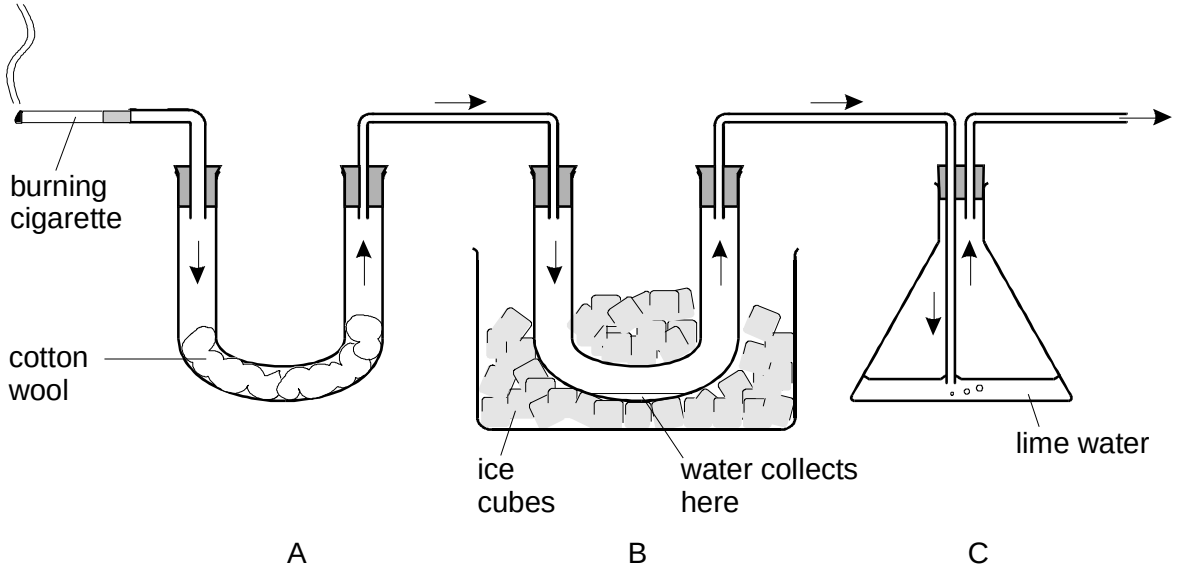
.....

.....

1 mark

maximum 4 marks

5. A teacher set up the following apparatus to separate the chemicals in cigarette smoke.
The chemicals pass through the apparatus in the direction of the arrows.



(a) In A, a brown sticky substance collected on the cotton wool. This substance causes lung cancer. Give the name of the brown substance.

.....

1 mark

(b) As the cigarette burned, water vapour was produced and water collected in B.

(i) Why were ice cubes needed in B?

.....

.....

1 mark

(ii) In the boxes below, draw the arrangement of particles of water vapour and particles of liquid water.
Use a circle, O, to represent each particle.

particles of water vapour

particles of liquid water

2 marks

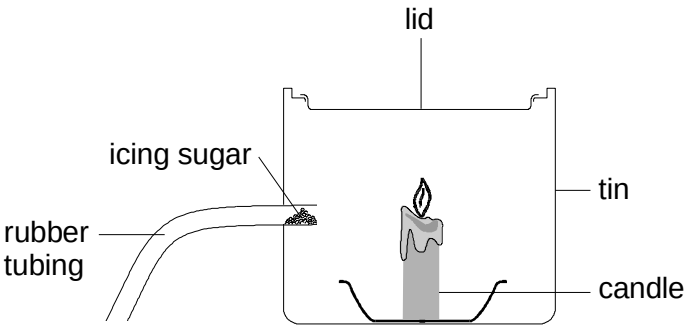
(c) The lime water in C became cloudy. What gas turns lime water cloudy?

.....

1 mark

Maximum 5 marks

6. A teacher set up the following apparatus behind a safety screen.
She placed 1 g of icing sugar in the end of the rubber tubing inside the tin, as shown below.



The teacher blew through the other end of the rubber tubing.
The icing sugar came into contact with the flame.
There was a loud explosion and the lid was blown off the tin.

(a) Complete the following sentence describing the energy changes which took place.

..... energy in the icing sugar changed to

..... energy and ..... energy.

3 marks

(b) As a result of the explosion, the lid of the tin was pushed off.
Explain what had happened to the gas molecules inside the tin to make this happen.

.....

.....

.....

.....

2 marks

(c) When icing sugar is burned in this experiment, the gas **used** and the gas **produced** are the same as when energy is released from sugar in the cells of the body.

(i) Which gas, in the air, is **used** when the icing sugar burns?

.....

1 mark

(ii) Give the name of the gas **produced** when the icing sugar burns.

.....

1 mark

(d) The table below shows the energy values of four food substances.

food substance	energy value, in kJ per 100 g
icing sugar	1680
curry powder	979
flour	1450
custard powder	630

The teacher repeated the experiment with 1 g of custard powder.
What difference would this make to the experiment?

.....

.....

1 mark

Maximum 8 marks