

Your Name:

1

Your School:

Mark:

(leave blank)

Mill Hill School

13+ Entrance Examination – Science

January 2014

Time: 1 hour

Materials required for examination

Information for candidates

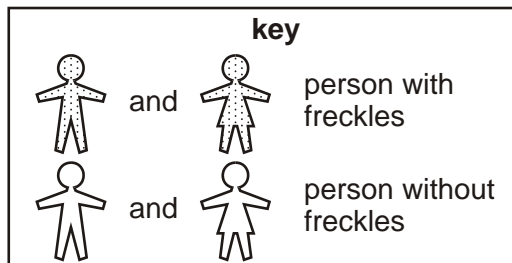
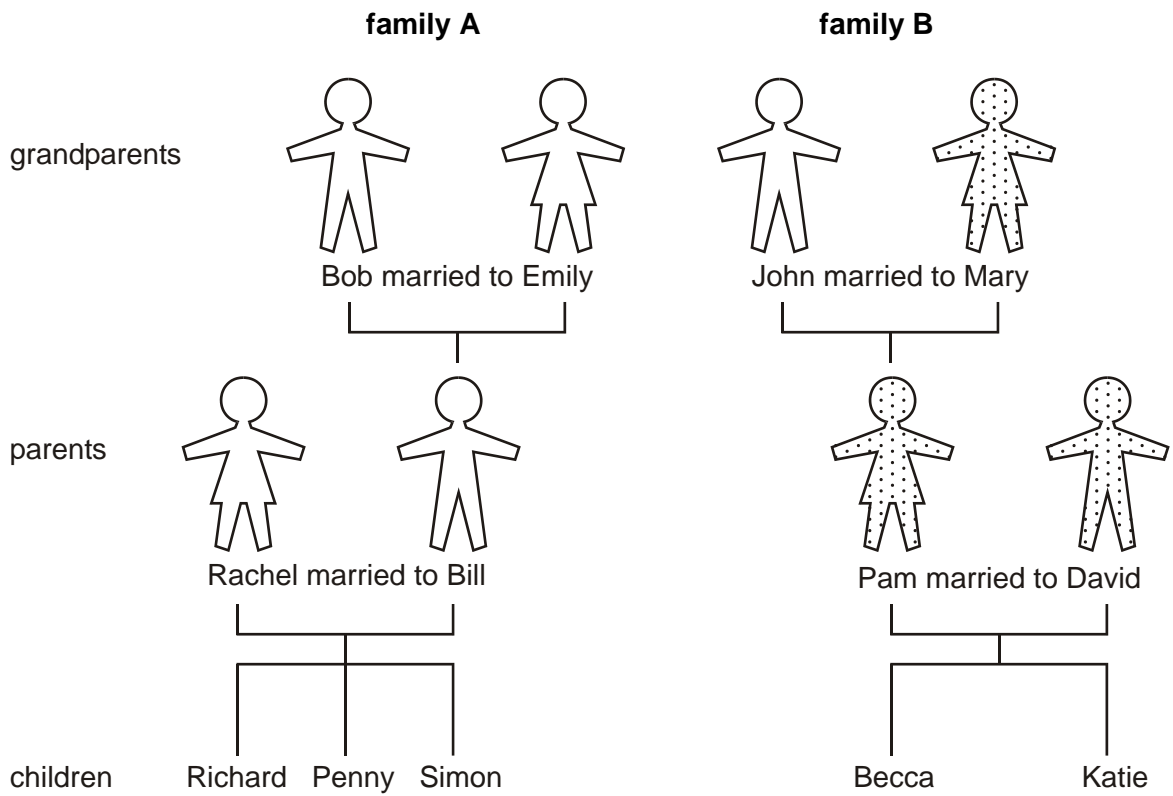
The paper consists of three sections, A, B and C. You should answer all of the questions in each section. The marks for individual questions and the parts of questions are shown in brackets.

Please ensure your name is written at the top of each section.

Section A – Biology

Name:.....

1. The diagram shows two families. Some of the people in the diagram have freckles.



(a) (i) Which children are most likely to have freckles?
Tick the correct boxes.

Richard	Simon	Katie	Penny	Becca
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

1 mark

(ii) How did you decide?

.....

.....

1 mark

(iii) Suggest why Bill does **not** have freckles.

.....
.....

1 mark

(b) (i) Which **two** cells pass on information from parents to their children?
Tick the **two** correct boxes.

bone cell	<input type="checkbox"/>	cheek cell	<input type="checkbox"/>
egg cell	<input type="checkbox"/>	muscle cell	<input type="checkbox"/>
red blood cell	<input type="checkbox"/>	sperm cell	<input type="checkbox"/>

1 mark

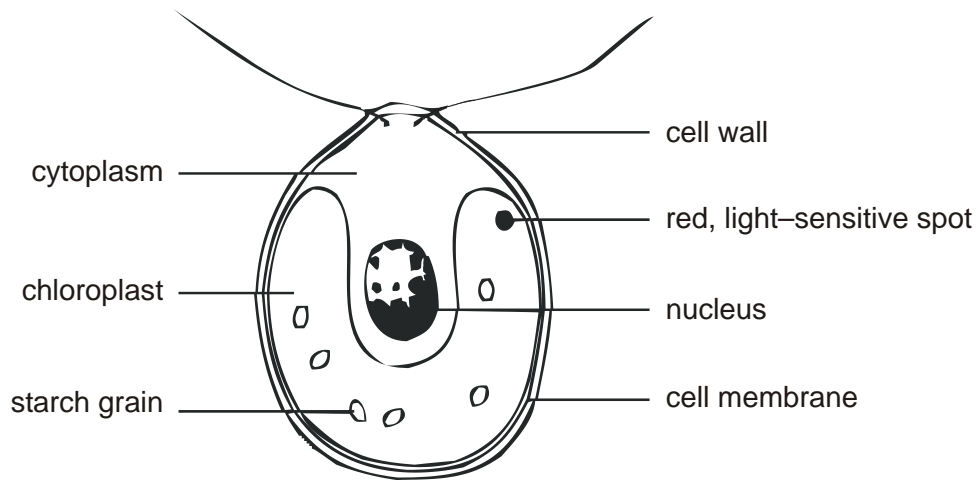
(ii) Which organ system produces these two cells?
Tick the correct box.

circulatory system	<input type="checkbox"/>
digestive system	<input type="checkbox"/>
reproductive system	<input type="checkbox"/>
respiratory system	<input type="checkbox"/>

1 mark

maximum 5 marks

2. The diagram below shows a single-cell organism called Chlamydomonas. It lives in pond water.



Use the information in the diagram to help you answer the questions below.

(a) Give **two** features of Chlamydomonas which show that it is more like a plant cell than an animal cell.

1.
2.

2 marks

(b) Chlamydomonas makes a sugar called glucose.

(i) Give the name of the process in which Chlamydomonas makes glucose.

.....

1 mark

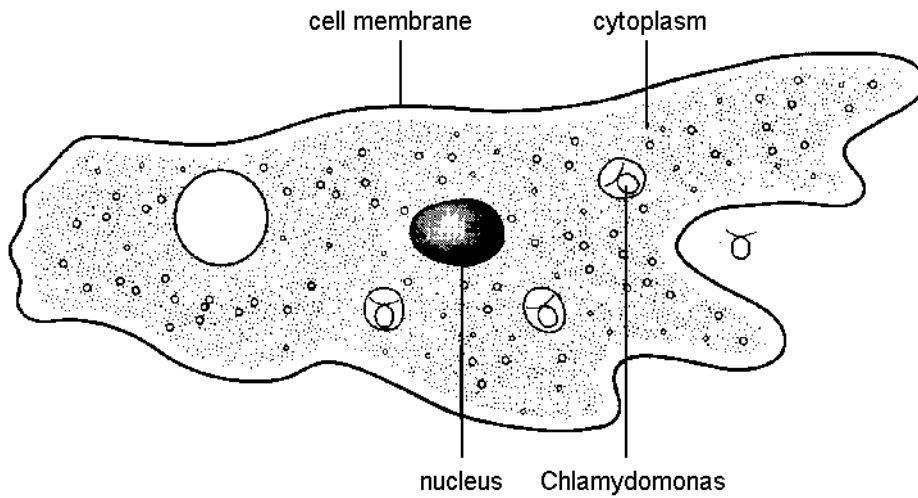
(ii) Chlamydomonas produces starch grains from glucose.

Suggest what will happen to the number of starch grains in the cell if Chlamydomonas is kept in the dark.

.....

1 mark

- (c) The diagram below shows another single-cell organism called Amoeba. It also lives in pond water. Amoeba traps a Chlamydomonas and digests it.



not to scale

Starch is a carbohydrate. Amoeba's digestive enzymes break down the starch in the Chlamydomonas.

Suggest what substance is produced from the starch and what it is used for.

.....

.....

.....

2 marks
Maximum 6 marks

3. The drawings show Sofia taking part in four different sports.



bowling



football



running



tennis

The table below shows the average energy needed for each sport for one hour.

sport	average energy need for one hour (kJ)
bowling	1030
tennis	1760
football	2260
running	3700

- (a) (i) Sofia plays football for two hours each week. She also goes bowling for two hours each week. Explain why Sofia uses up her food reserves more quickly when playing football than when bowling.

.....
.....

1 mark

(ii) Athletes should **not** drink alcohol before taking part in sport.
Give **two** effects of alcohol which would affect an athlete's performance.

1.

.....

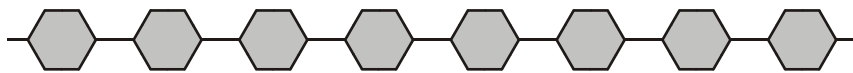
1 mark

2.

.....

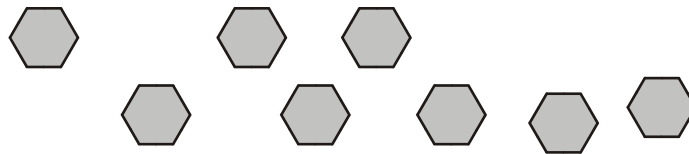
1 mark

(b) Some athletes take glucose tablets before a 100 metre race.
They can also obtain glucose from starch in their diet.
A starch molecule is made up of many glucose molecules joined together
as shown below.



part of a molecule of starch

In the digestive system, starch is broken down into glucose:



molecules of glucose

An athlete can obtain energy more quickly by eating glucose rather than starch.

Explain why.

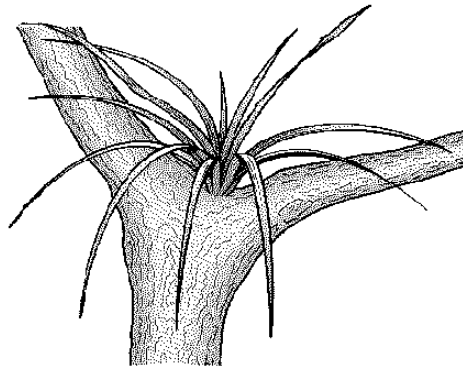
.....

.....

1 mark

maximum 4 marks

4. The drawing shows a plant called Tillandsia.

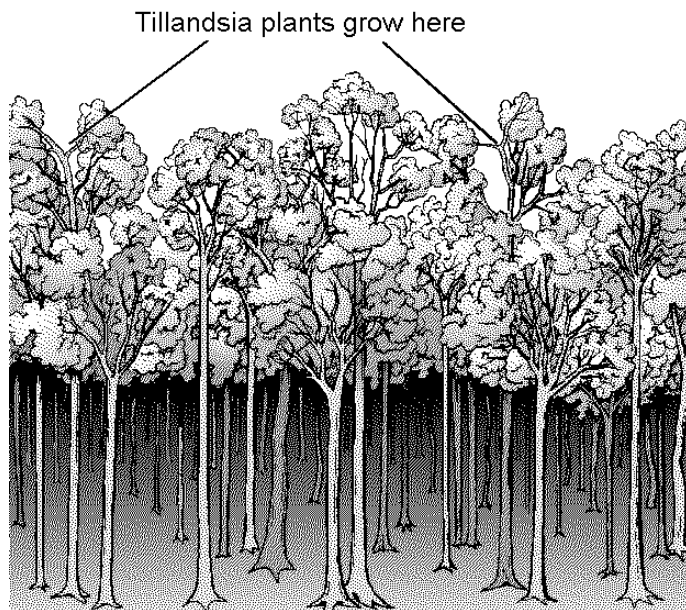


- (a) (i) The leaves of this plant absorb light.
Why do plants need light?

.....

1 mark

- (ii) Tillandsia plants grow on the high branches of trees in rain forests.



not to scale

These plants **cannot** grow well on the lowest branches.
Explain why.

.....

.....

1 mark

(b) Tillandsia plants do **not** have root hairs on their roots.

What **two** substances do most plants absorb through their root hairs?

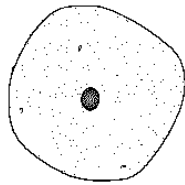
1.

2.

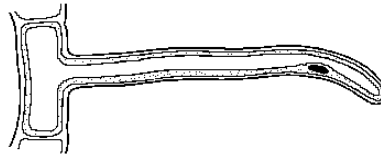
2 marks

(c) Which diagram below shows a root hair?

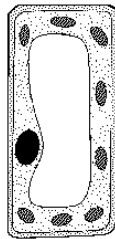
Tick the correct box.



A



B



C



D

not to scale

1 mark

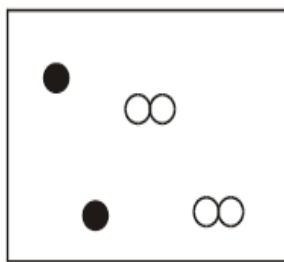
Maximum 5 marks

1.

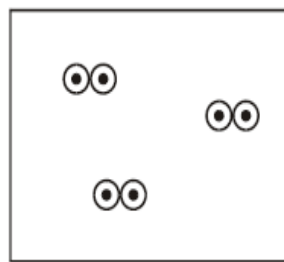
In the 19th Century, a scientist called John Dalton used symbols to represent atoms. The symbols he used for atoms of three different elements are shown below.



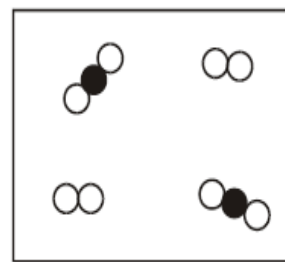
The diagrams below show different combinations of these atoms.



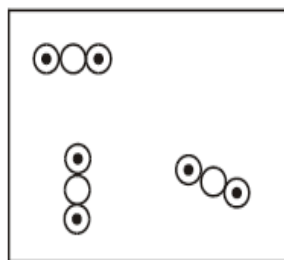
A



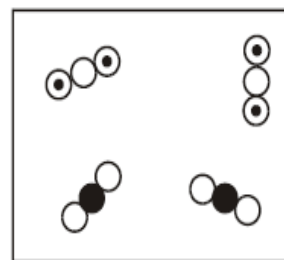
B



C



D



E

Which diagram or diagrams show a mixture of **two** elements?

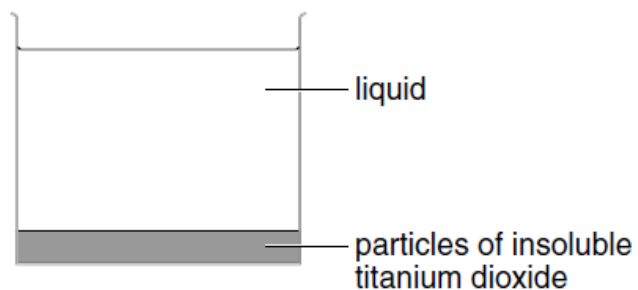
A B and D

B A and E

C A

D C

- 2 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]

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

a compound an element a mixture [1]

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

[1]

3 The drawing shows a gold mask from a tomb in Egypt. The gold is still shiny after thousands of years.



(a) What is pure gold? Tick the correct box.

a compound

a mixture

an element

a solution

[1]

(b) The list shows some of the properties of gold.

A. It conducts electricity.

B. It melts at 1064°C.

C. It is yellow.

D. It is easily scratched.

E. It stays shiny.

F. It conducts heat.

(i) Which **one** of these properties shows that gold does **not** react with oxygen in the air?

.....

[1]

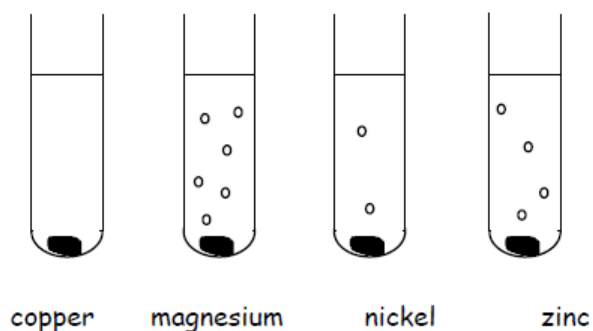
(ii) Which **two** of the properties above are properties of **all** metals?

1.

2.

[2]

4. Small pieces of the metals copper, magnesium, nickel and zinc were placed in test tubes containing small quantities of hydrochloric acid. The following results were observed.



(a) Use the observations from above to complete the following reactivity series.

1.most reactive
 2.
 3.
 4.least reactive
- [2]

(b) (i) What is the name of the gas produced in the above reactions?

..... [1]

(ii) Describe the test and result you would use to identify this gas.

.....
..... [2]

5. (a) The table below shows the melting points and boiling points of four elements.

element	melting point (°C)	boiling point (°C)
aluminium	660	2520
iron	1540	2760
magnesium	650	1100
mercury	-39	357

When answering the questions below, you may give the name of an element more than once.

Which element in the table is:

- (i) a liquid at 0°C?

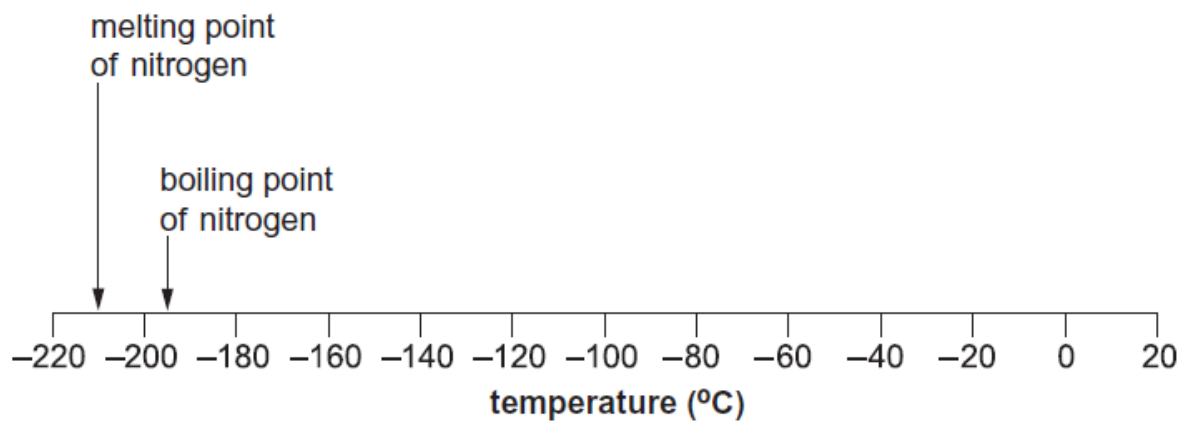
- (ii) a solid at 1500°C?

- (iii) a gas at 500°C?

- (iv) a liquid over the biggest temperature range?

[4]

(b) The melting point and boiling point of nitrogen are marked on the scale below



(i) Draw an arrow on the scale above to show the temperature at which water freezes.

(ii) When water is a liquid, what is the physical state of nitrogen?
Tick the correct box.

solid liquid gas

(iii) What is the physical state of nitrogen at -200°C ?
Tick the correct box.

solid liquid gas

Section C – Physics

Name:.....

1. 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.

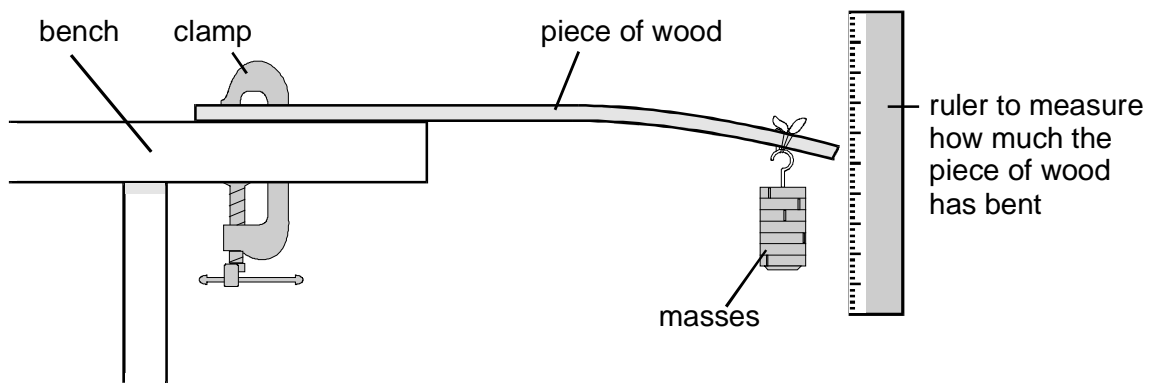
Sugar cane will **not** run out. Explain why.

.....
.....

1 mark

Maximum 5 marks

2. Ruth is investigating how much a piece of wood can bend. She hangs some masses on the end of the piece of wood and measures how far the wood has bent.

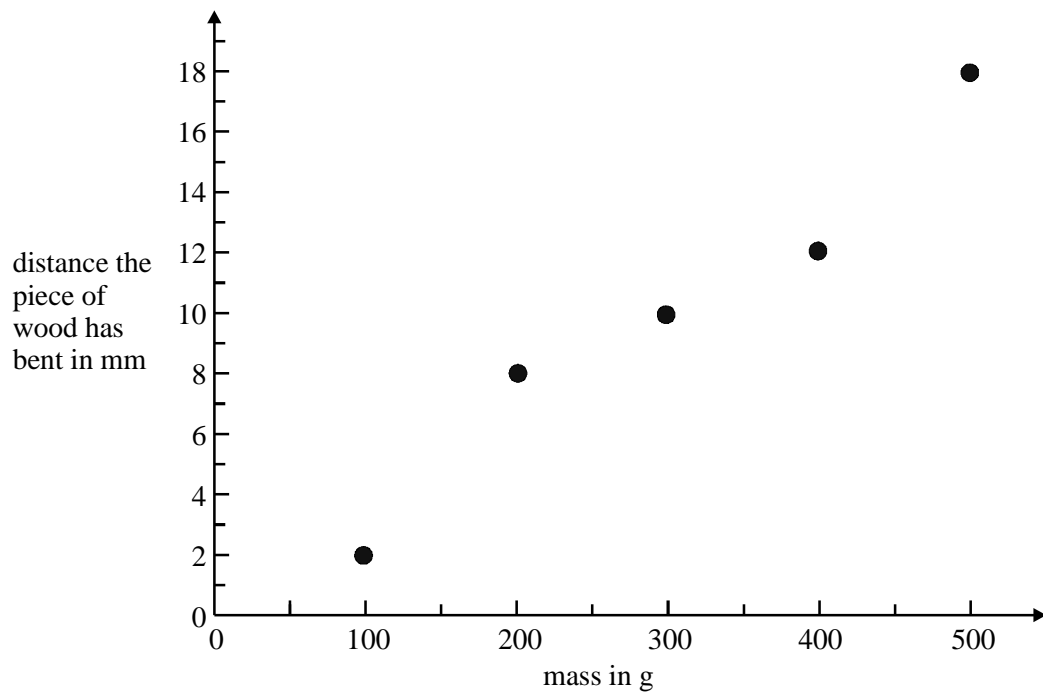


- (a) Give the name of the force which pulls the masses downwards.

.....

1 mark

(b) The graph below shows Ruth's results.



(i) Complete the graph by drawing a straight line of best fit.

1 mark

(ii) A mass of 350 g is hung on the piece of wood. How much does the wood bend?

..... mm

1 mark

Maximum 3 marks

3. (a) Debbie put a paper cup into a glass beaker. She glued a magnet in the bottom of the paper cup. She glued another magnet in the bottom of the beaker. The magnets repelled.

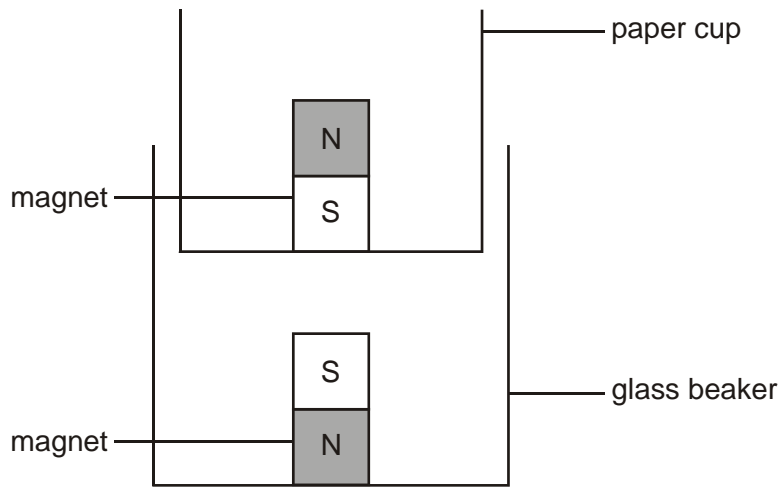


diagram A

not to scale

What **two** forces act on the paper cup and its contents to keep it in this position?

1.

1 mark

2.

1 mark

- (b) Debbie put 5 g of aluminium rivets into the paper cup. It moved down a little as shown in diagram B.

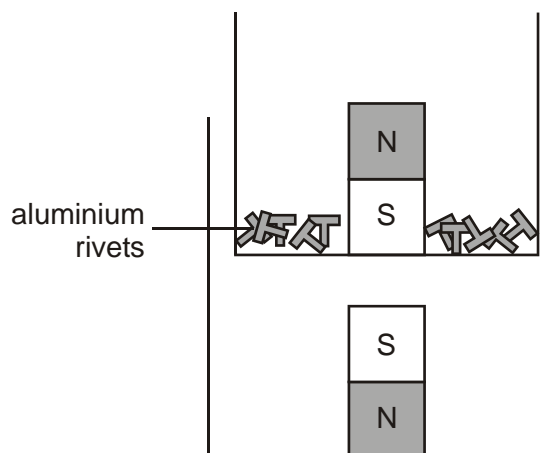
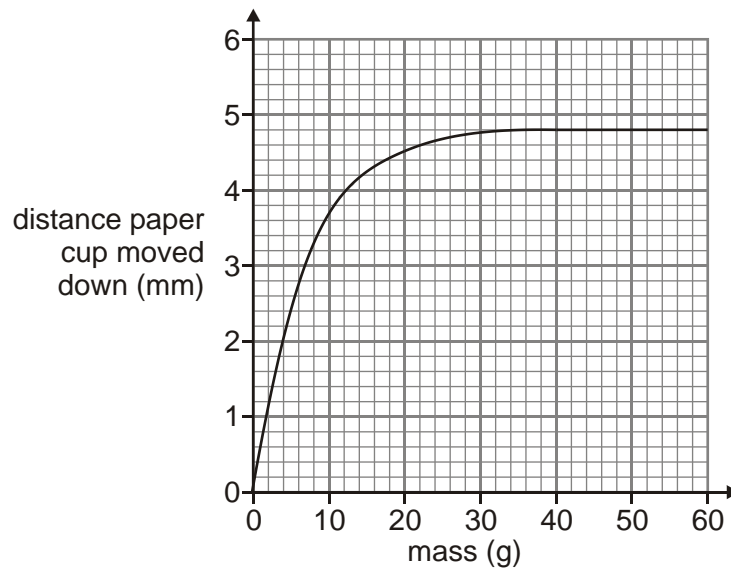


diagram B

not to scale

Debbie plotted a graph to show how the mass of aluminium rivets affected the distance the cup moved down.



(i) Use the graph to find the mass that made the cup move down 4 mm.

..... g

1 mark

(ii) Why did the graph stay flat with masses greater than 40 g?

.....

1 mark

(c) Debbie removed the 5 g of aluminium rivets and put 5 g of iron nails into the cup.

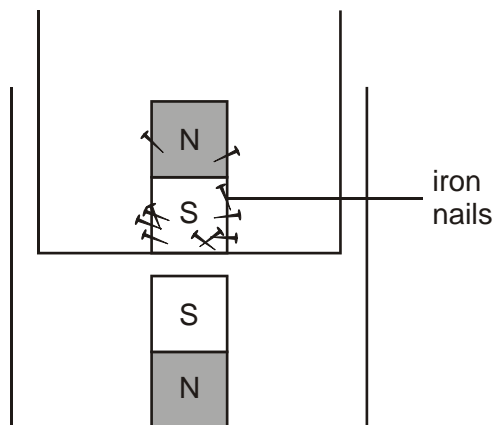


diagram C

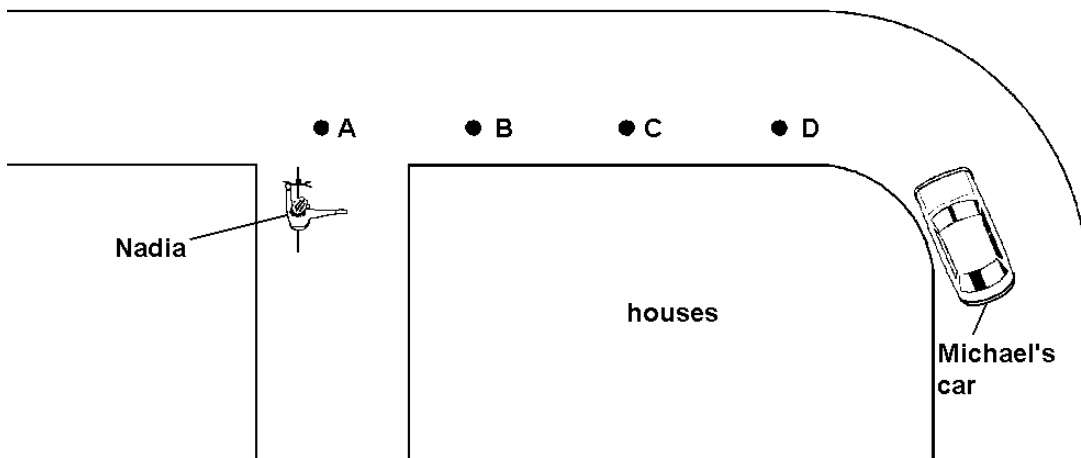
not to scale

The paper cup moved down more with 5 g of iron nails than with 5 g of aluminium rivets as shown in diagram C.
Give the reason for this.

.....
.....

1 mark
maximum 5 marks

4. Nadia is on her bicycle, waiting to pull out from a road junction. Michael is driving his car round the bend. A row of houses stops Nadia from seeing Michael's car.



not to scale

- (a) At what position will Michael's car be when Nadia first sees it?
Tick the correct box.

A

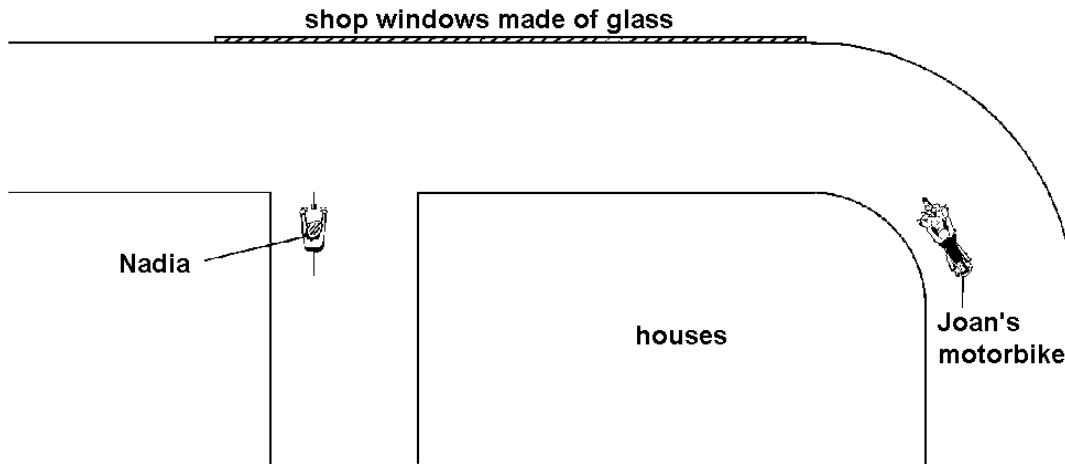
B

C

D

1 mark

- (b) A row of shops was built opposite the junction. The shops have glass windows which act as a mirror.



not to scale

Nadia could see Joan's motorbike reflected in the glass window.

- (i) **On the diagram above**, draw a ray of light to show how Nadia can see Joan's motorbike reflected in the glass window. Add arrows to the ray. Use a ruler.

3 marks

- (ii) How does the glass window help to reduce the number of accidents?

.....
.....

1 mark

Maximum 5 marks