

Your FIRST name:		Your SURNAME:	
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Your School:

Mark:

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Mill Hill School

14+ (Remove) Entrance Examination

January 2014

Science

Time: 1 hour

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.

You should spend around 20 minutes on each section.

Each section will be collected in separately.

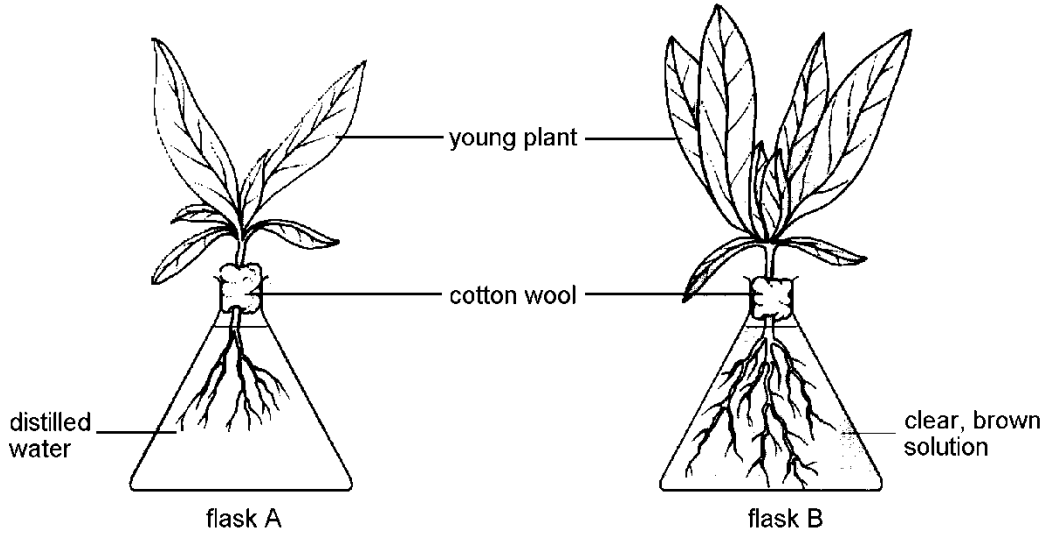
Ensure your name is written at the top of each section

Section A – Biology

Name:.....

1. Plants take in water from the soil. Lisa did an experiment to find out if there is anything else in soil that plants need for growth.

The diagrams below show the results of Lisa's experiment.



Lisa made the clear, brown solution in flask B by shaking a mixture of soil and water and then separating the solution from the soil particles.

(a) How could Lisa separate the brown solution from the soil particles?

.....

1 mark

(b) Explain why Lisa grew one plant in distilled water.

.....
.....

1 mark

(c) (i) What type of substance, dissolved in the water in flask B, is used by the plant for growth?

.....

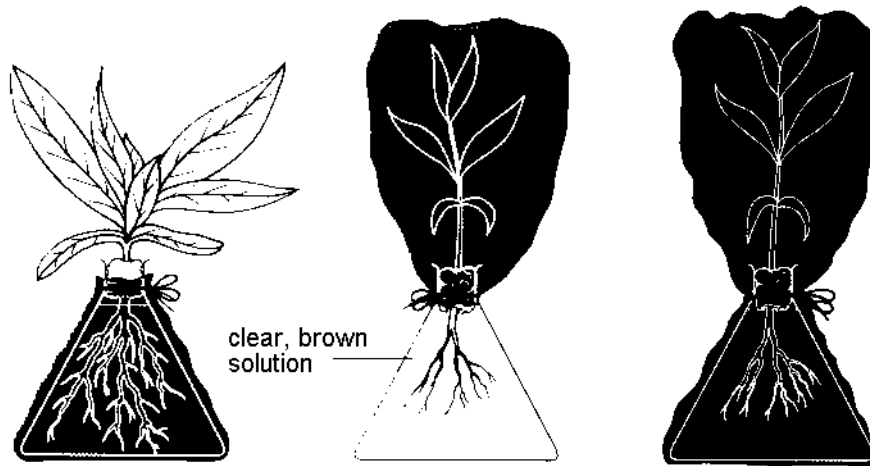
1 mark

(ii) How are roots adapted for taking in water?

.....
.....

1 mark

- (d) Lisa set up a second experiment using three similar plants. The solution in flasks C, D and E was the same. She put all three flasks in a sunny position. The diagrams below show the results of Lisa's second experiment.



flask C

the flask containing the clear, brown solution is wrapped in black paper

flask D

stem and leaves are wrapped in black paper

flask E

stem and leaves and the flask containing the clear, brown solution are wrapped in black paper

The plant in flask C was the only one which grew well in this experiment. Explain why.

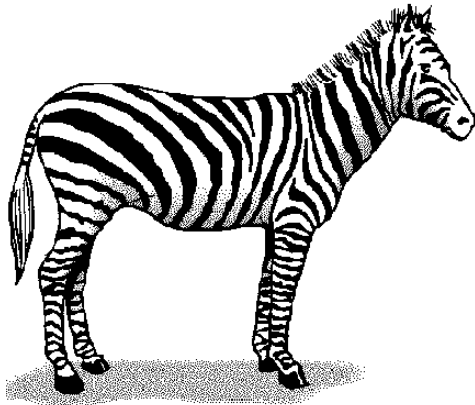
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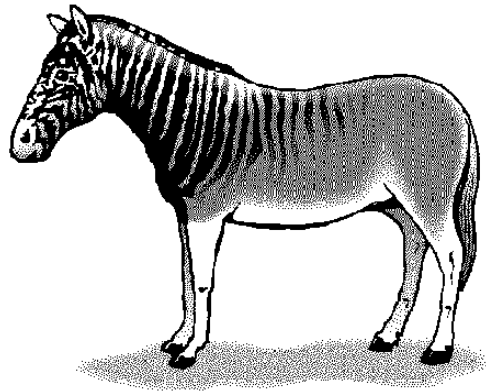
1 mark

Maximum 5 marks

2. The quagga is an extinct animal that lived in Africa. Quaggas belonged to the same group as zebras.
The drawings below show a zebra and a quagga.



Zebra



Quagga

- (a) Zebras and quaggas used to breed with each other. The offspring contained a combination of both zebra and quagga genes (genetic information).
How were zebra **and** quagga genes passed on from the parents to their offspring?

.....
.....

1 mark

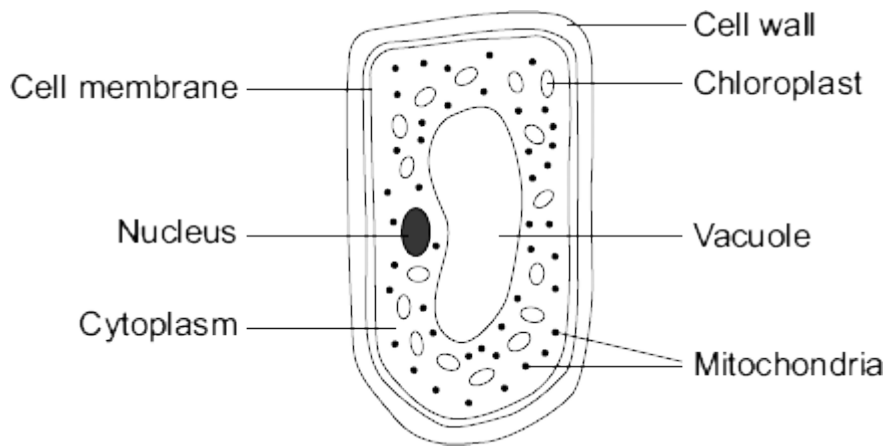
- (b) These days there are some zebras that still show some quagga features. Scientists are using zebras to try to produce quaggas by selective breeding. Describe the steps in this selective breeding process.

.....
.....
.....
.....

3 marks

Maximum 4 marks

3. The diagram shows a cell from a plant leaf.



(a) Name the part of this cell that:

(i) controls the passage of substances in and out of the cell

.....
)

(ii) is filled with cell sap.

.....
)

(b) Give the names of **two** parts of the leaf cell that would **not** be found in a human liver cell.

..... and
)

(c) The chloroplasts produce oxygen.

Draw a ring around the correct answer to complete the sentence.

The oxygen produced by the chloroplasts passes out of the cell by

- | |
|--------------|
| diffusion. |
| digestion. |
| respiration. |

(1)
 (Total 5 marks)

4. (a) The air you breathe in and the air you breathe out are different.

Use the names of gases from this box to complete the **three** spaces.

argon carbon dioxide nitrogen oxygen water vapour
--

Compared to the air you breathe in, the air you breathe out contains:

• **more**

• **more**

• **less**

(3)

(b) The process of aerobic respiration takes place in your cells.

(i) Complete the space in the word equation for this process.

..... + oxygen → carbon dioxide + water

(1)

(ii) Complete the space to give the main energy transfer which takes place in this process.

chemical energy → energy

(1)

(iii) What is the name of the organ where oxygen from the air passes to your blood?

.....

(1)

(c) The athlete is taking part in vigorous exercise.



Complete the **two** spaces in the passage.

The cells in our muscles respire anaerobically during vigorous exercise.

This results indebt and the production of
..... acid.

(2)
(Total 8 marks)

Section B – Chemistry

Name:.....

1. (a) The table below shows the melting points of four metals.

metal	melting point, in °C
gold	1064
mercury	-37
sodium	98
iron	1540

(i) Which metal in the table has the highest melting point?

.....

1 mark

(ii) Which metal in the table has the lowest melting point?

.....

1 mark

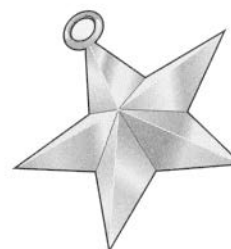
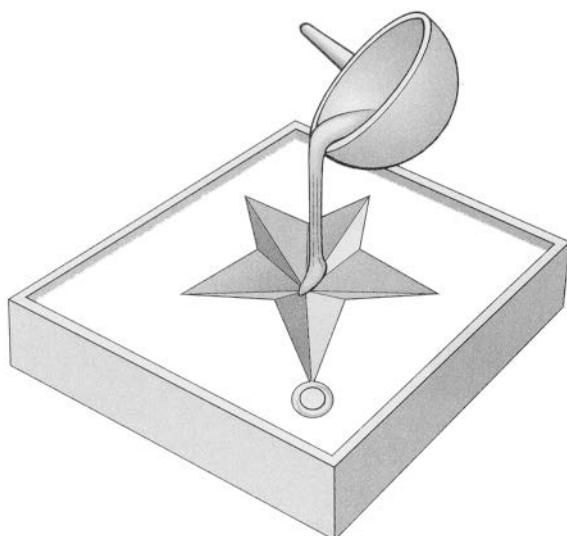
(b) Gold can be a **gas** or a **liquid** or a **solid**.

Choose from these words to fill the gaps below.

When gold is heated from room temperature to 1070°C, the gold changes from a to a

1 mark

- (c) 5 g of gold is melted and **all** of it is poured into a mould to make a pendant as shown below.



gold pendant

melted gold is poured into a mould

What is the mass of the gold pendant?

..... g

1 mark

- (d) The table below shows how the four metals react with oxygen when heated in air.

metal	reaction when heated in air
gold	no change
mercury	slowly forms a red powder
sodium	bursts into flames straight away
iron	very slowly turns black

- (i) Which is the **most** reactive metal in the table?

.....

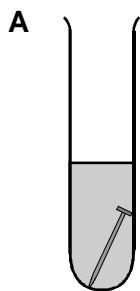
1 mark

- (ii) Which is the **least** reactive metal in the table?

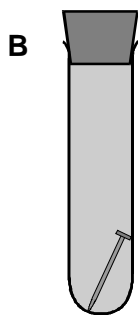
.....

1 mark

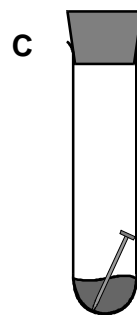
2. Jessica was investigating the rusting of iron. She set up five experiments as shown below, and left the test-tubes for three days.



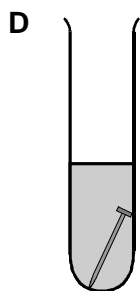
iron nail in distilled water



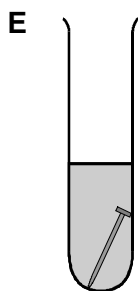
iron nail in tap water which has been boiled to remove dissolved gases



iron nail and a chemical to absorb water vapour



iron nail in sea water



iron nail in vinegar

Jessica wrote the following results in her book.

Test-tube	observation
A	nail slightly rusty
B	nail still shiny
C	nail still shiny
D	nail very rusty
E	nail slightly rusty, bubbles of gas seen

(a) Explain why the nails had **not** rusted in test-tubes B and C.

in test-tube B

.....
.....

in test-tube C

.....
.....

2 marks

(b) In test-tube E the iron nail reacted with the vinegar.

(i) Is vinegar **acidic**, **alkaline** or **neutral**?

.....

1 mark

(ii) When the iron reacted with the vinegar, bubbles of gas were formed. What gas was formed?

.....

1 mark

(c) Before putting the iron nail in test-tube D, Jessica weighed the nail. After three days she dried and weighed the nail **and** the rust which had formed.

(i) How did the total mass of the nail and rust compare to the mass of the nail at the beginning?

.....

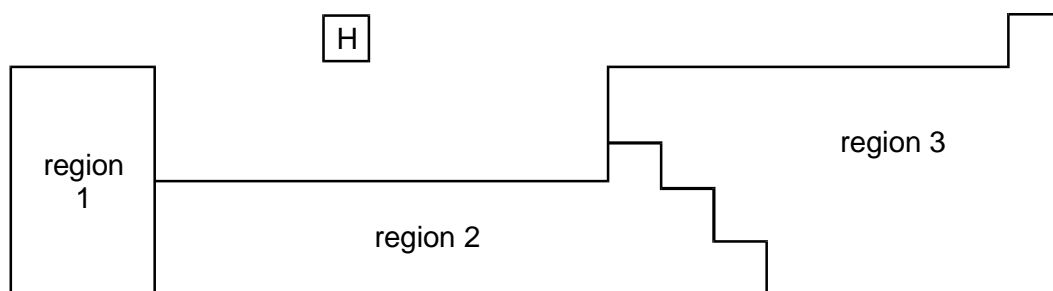
1 mark

(ii) Give the reason for your answer.

.....
.....

1 mark

3. The diagram shows an outline of part of the Periodic Table of Elements.



(a) In which regions of the Periodic Table are the following types of element found?

(i) non-metals (such as oxygen and chlorine);

region

1 mark

(ii) very reactive metals (such as sodium and potassium);

region

1 mark

(iii) less reactive metals (such as copper and zinc).

Region

1 mark

(b) Why is copper sulphate **not** found in the Periodic Table?

.....
.....

1 mark

4. (a) The list shows the names and symbols of five metals in order of their reactivity.

name	symbol
sodium	Na
calcium	Ca
magnesium	Mg
zinc	Zn
silver	Ag

- (i) What, if anything, would be the result of heating zinc powder with calcium oxide?

.....

1 mark

- (ii) Write down the **name** of a metal in the list that will **not** react with a solution of magnesium sulphate.

.....

1 mark

- (d) The powdered metal with the symbol Zn burns in air. Write the **word equation** for the reaction.

.....

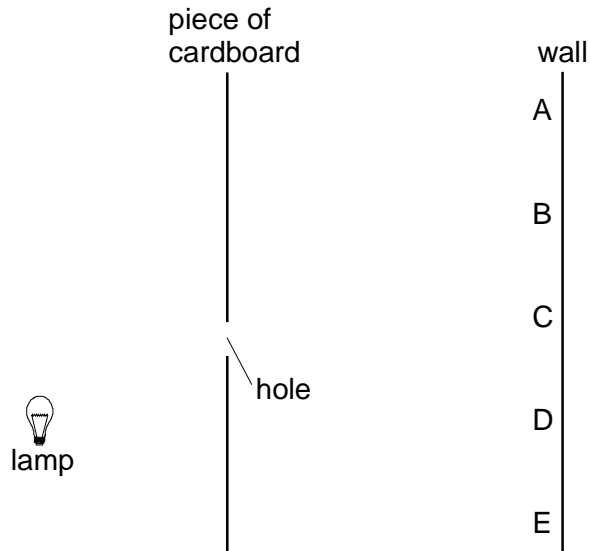
2 marks

20 marks

Section C – Physics

Name:.....

1. The diagram shows a lamp and a piece of cardboard. The piece of cardboard has a hole in it. Light from the lamp passes through the hole and forms a bright spot on a wall.



- (a) (i) Which point on the wall, A B, C, D or E, is lit up by the lamp?

.....

1 mark

- (ii) Explain why the **other** points on the wall are **not** lit up by the lamp.

.....
.....

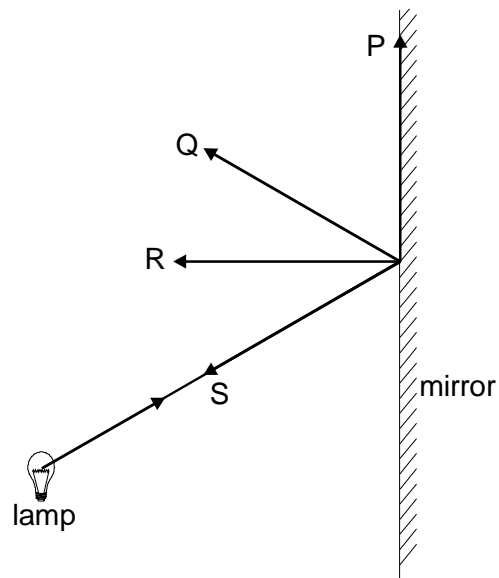
1 mark

- (b) A piece of clear green plastic is placed over the hole.
What is the colour of the light which shines on the wall?

.....

1 mark

(c) The diagram shows a ray of light from a lamp hitting a mirror.



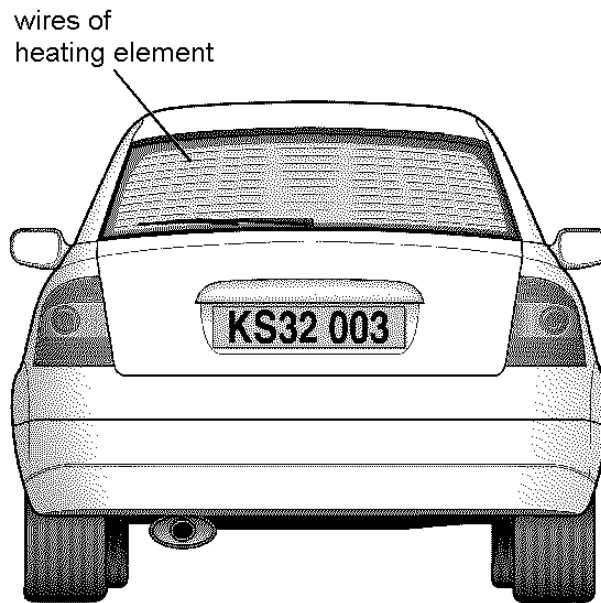
Which arrow, P, Q, R or S, shows the reflected ray?

.....

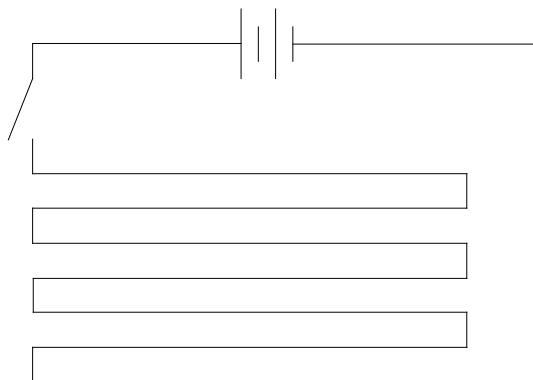
1 mark
Maximum 4 marks

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

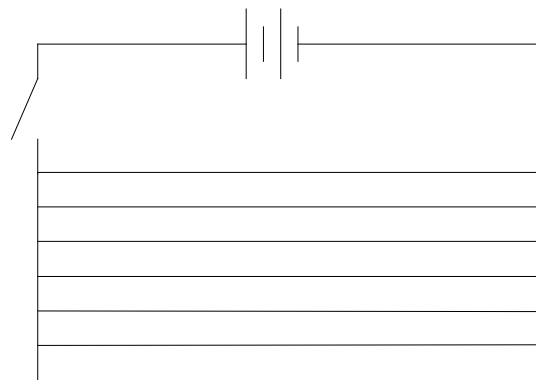
The heating element is part of an electrical circuit connected to the battery of the car.



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



circuit A



circuit B

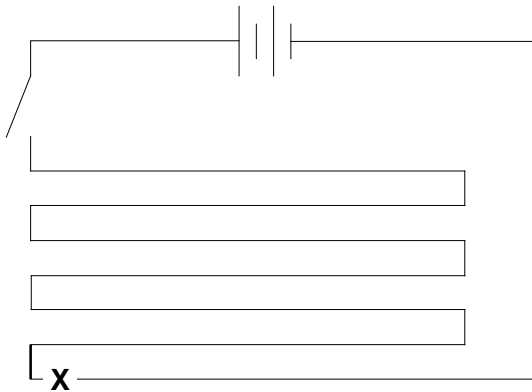
(a) Give the name of each type of circuit:

circuit A

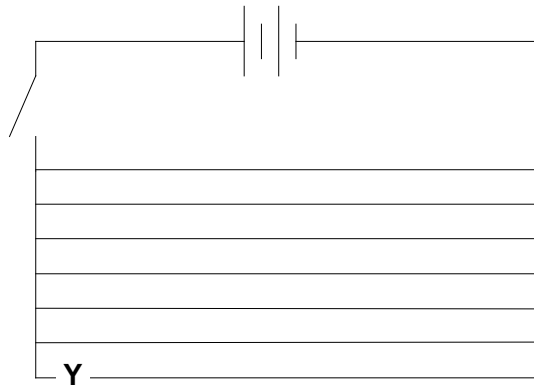
circuit B

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.

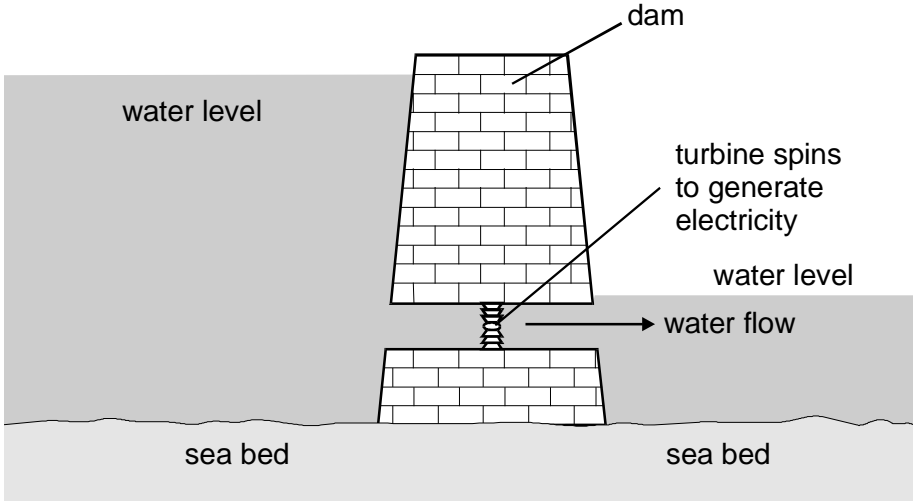
1 mark

(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 toto

1 mark

3. 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

4. Tom tries on four types of footwear in a sports shop.



ski boot



trainer



ice skate



walking boot

- (a) (i) When Tom tries on the footwear, which one sinks into the carpet the most?

.....

1 mark

(ii) When Tom tries on the footwear, what is the same for each type of footwear? Tick the correct box.

the area of the footwear

Tom's weight on the footwear

the material of the footwear

the weight of the footwear

1 mark

(b) The drawing below shows a snowshoe.



How do snowshoes help people to walk in deep snow?

.....

.....

1 mark

(c) Choose the correct word from the list to complete the sentence below.

air resistance **friction** **gravity** **magnetism**

When Tom is ice skating the force of
between the skate and the ice is less than when he is walking on a carpet.

1 mark

Maximum 4 marks