Sc

KEY STAGE 3

TIER 5–7

2004

Science test

Paper 2

Please read this page, but do not open the booklet until your teacher tells you to start. Write your name and the name of your school in the spaces below.

First name _____

Last name _____

School _____

Remember

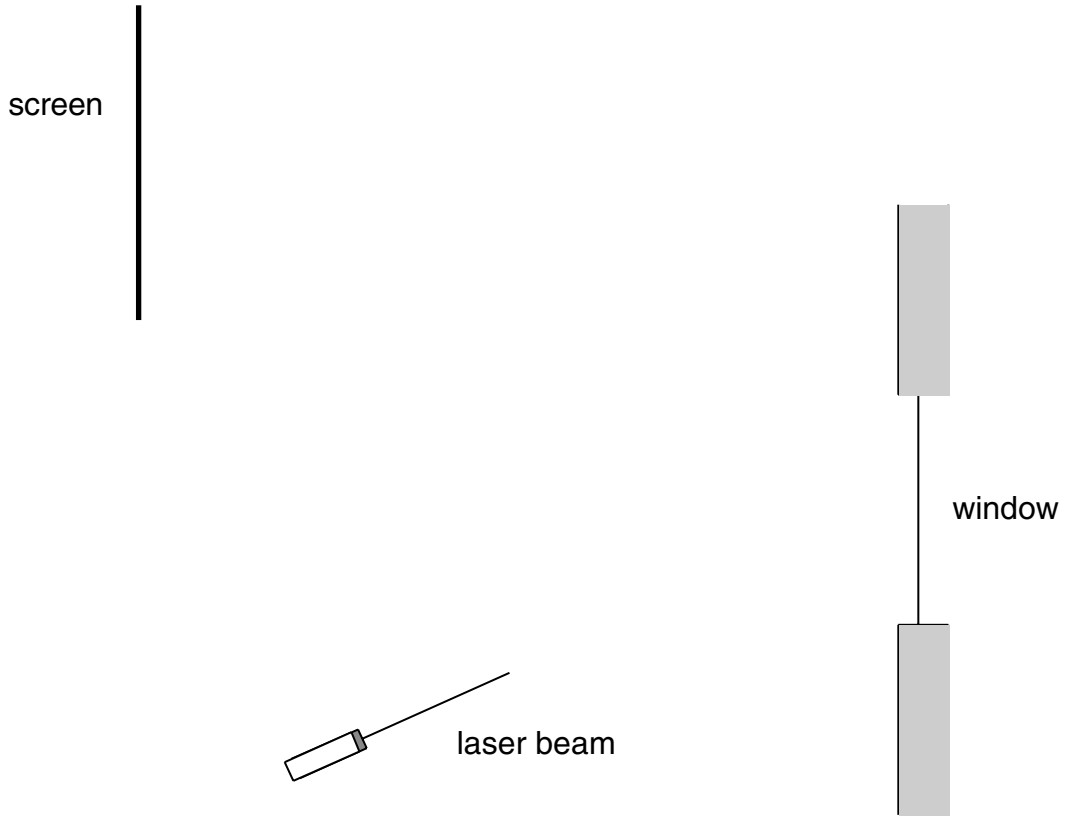
- The test is 1 hour long.
- You will need: pen, pencil, rubber, ruler, protractor and calculator.
- The test starts with easier questions.
- Try to answer all of the questions.
- The number of marks available for each question is given below the mark boxes in the margin. You should not write in this margin.
- Do not use any rough paper.
- Check your work carefully.
- Ask your teacher if you are not sure what to do.

For marker's use only

Total marks	
Borderline check	

QCA/04/1211

1. (a) A teacher shines a laser beam onto a classroom window. It reflects off the window and onto a screen.



1a
1 mark

On the diagram above, continue the laser beam to show its path as it reflects off the window and onto the screen. Use a ruler.
Add arrows to show the direction of the laser beam.

1a
1 mark

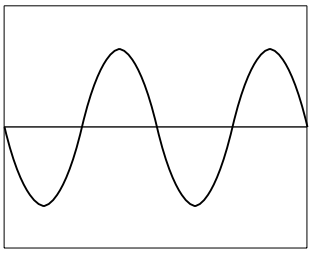
(b) (i) When a pupil plays her flute in the classroom the window vibrates. Give the reason for this.

1bi
1 mark

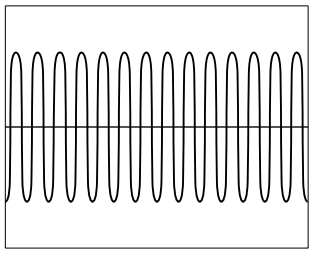
(ii) When the window vibrates, what happens to the laser beam that is reflected off the window?

1bii
1 mark

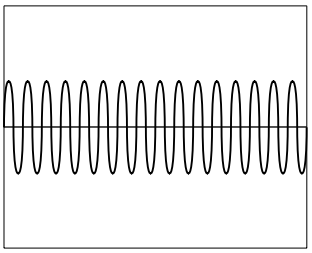
(c) The teacher places a microphone near the pupil as she plays her flute.
The diagram below shows the pattern on an oscilloscope screen.



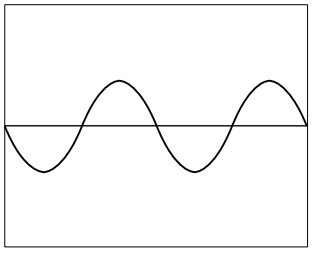
The pupil then plays her flute at a **higher pitch** and **more quietly**.
Which diagram below shows the pattern that would be seen on the oscilloscope?
Tick the correct box.



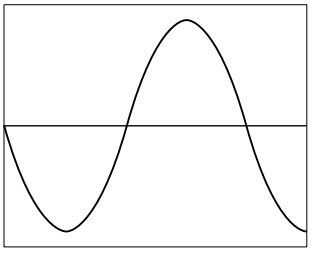
A ☐



B ☐



C ☐



D ☐

☐ 1c
1 mark

maximum 5 marks

Total
☐
5

2. (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 as shown in diagram A.
The magnets repelled.

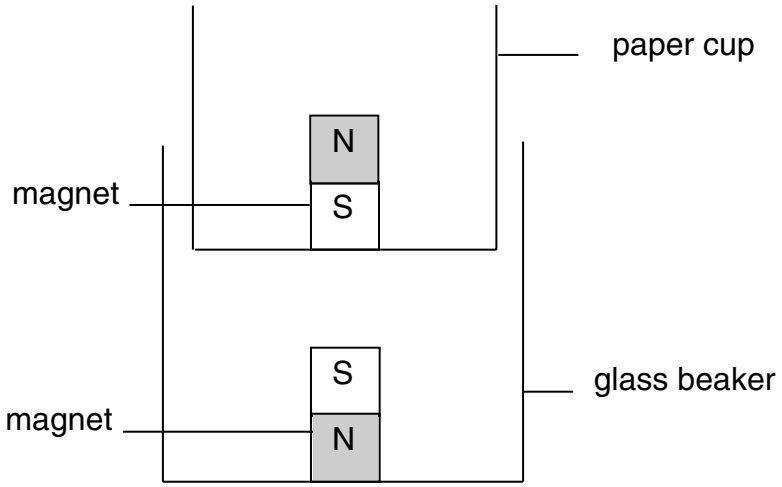


diagram A

not to scale

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

2a
1 mark

1. _____

2a
1 mark

2. _____

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

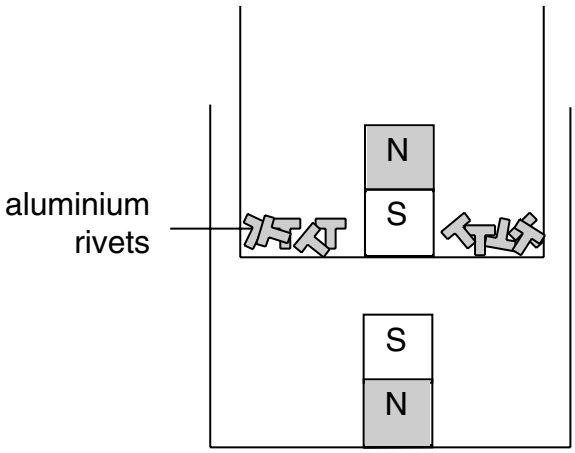
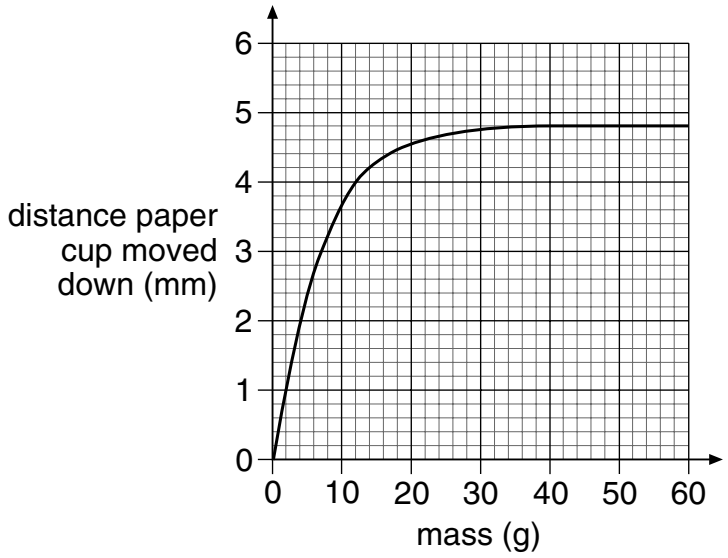


diagram B

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

2bi

1 mark

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

_____

2bii

1 mark

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

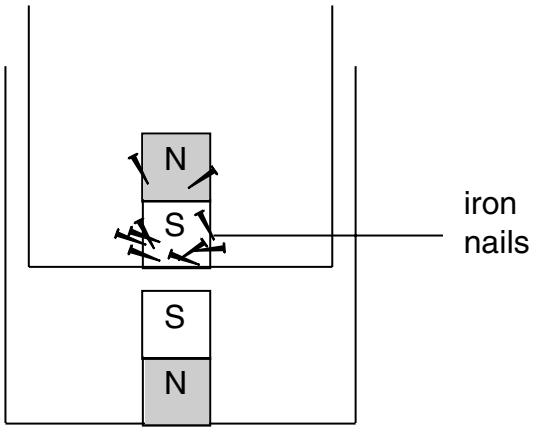


diagram C

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.

_____

_____

2c

1 mark

maximum 5 marks

Total

5

3. Some pupils predicted that water will evaporate faster if the surrounding air temperature is higher.

To investigate their prediction they placed some water in containers in two different rooms.

(a) Give **two** factors they should keep the same to make their investigation fair.

3a
1 mark

1. _____

3a
1 mark

2. _____

(b) They recorded the mass of the water and the container in room 1 and room 2 every day for 5 days.

The table below shows their results.

time (days)	**mass of water and container (g)**	
	room 1	**room 2**
0	100	100
1	92	85
2	80	72
3	72	54
4	60	45
5	46	30

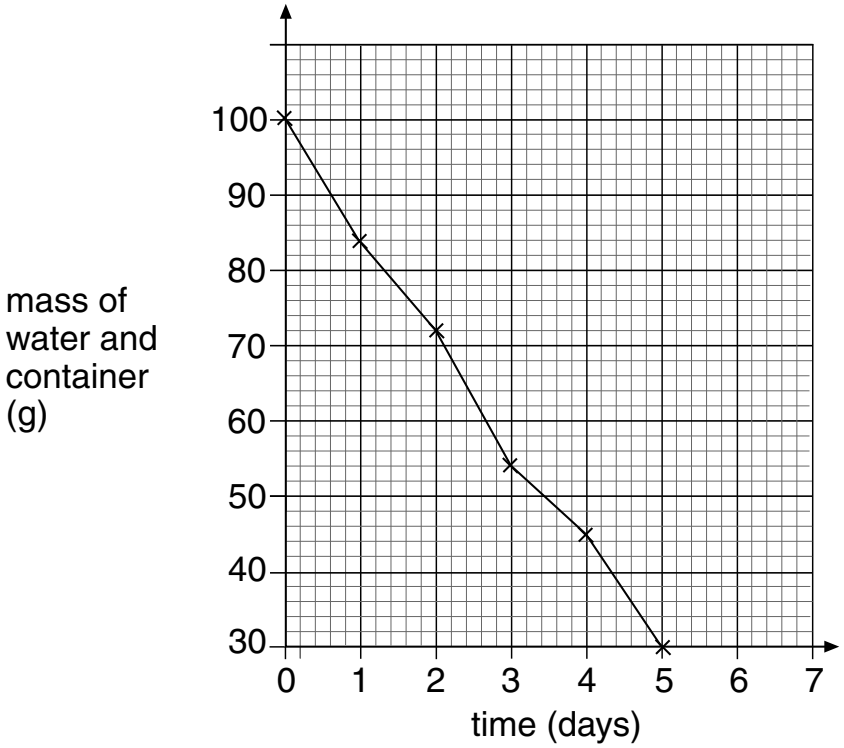
The data shown in their table is **not** sufficient to test their prediction. Explain why.

3b
1 mark

_____

_____

They plotted their data for room 2 and attempted to draw a line of best fit.



(c) Describe the mistake they made in drawing the line of best fit.

_____

_____

3c 1 mark

(d) Using the data in the table plot the points for room 1.

3d 1 mark

(e) Draw a line of best fit of the points you have drawn.

3e 1 mark

(f) In which room did the water evaporate more quickly?
Tick **one** box.

room 1 ☐ room 2 ☐

Use their data to explain your answer.

_____

_____

3f 1 mark

maximum 7 marks

Total 7

4ai

1 mark

4aii

1 mark

4bi

1 mark

4. Hydrochloric acid is a strong acid.

(a) Winston used universal indicator solution to find the pH of some hydrochloric acid.

(i) Suggest the **colour** of the mixture of universal indicator solution and the hydrochloric acid. 4bii

1 mark

_____

(ii) Suggest the **pH** of the hydrochloric acid.

_____

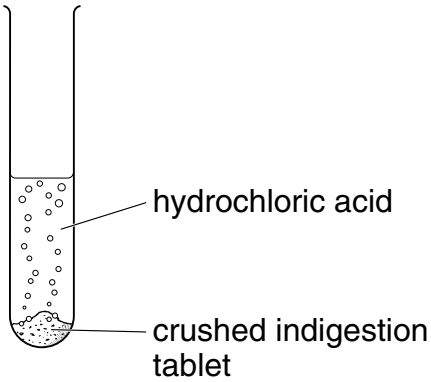
(b) Indigestion can be caused when too much hydrochloric acid is produced in the stomach.
Magnesium carbonate can be used to treat indigestion.

Winston crushed some indigestion tablets containing magnesium carbonate. He added them to hydrochloric acid in a test-tube. The mixture fizzed. 4c

1 mark

4c

1 mark



4d

1 mark

The word equation for the reaction is shown below.

magnesium carbonate + hydrochloric acid → magnesium chloride + carbon dioxide + water

(i) Use the word equation to explain why the mixture fizzed when the reaction took place.

_____

_____

maximum 7 marks

Total

7

(ii) Winston continued to add crushed tablets to the acid until the mixture stopped fizzing.
Why did the fizzing stop?

_____

_____

(c) When magnesium carbonate reacts with hydrochloric acid, magnesium chloride is formed.

Which **two** words describe magnesium chloride?
Tick the **two** correct boxes.

5ai
1 mark

a compound	☐	a mixture	☐
an element	☐	a salt	☐
a metal	☐	a solvent	☐

5aii
1 mark

(d) It is important that the hydrochloric acid in the stomach is **not** completely neutralised by indigestion tablets.

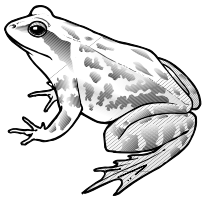
Why is hydrochloric acid needed in the stomach?

_____

_____

5b
1 mark

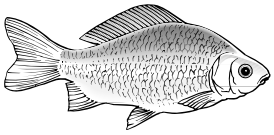
5. (a) The animals drawn below all have backbones.



amphibian

bird

mammal



fish

not to scale

(i) What word describes animals with a backbone?

_____

(ii) There are five groups of animals with a backbone. Only four groups are shown above.
Give the name of the missing group.

_____

5c

1 mark

(b) The drawing below shows the human backbone. It is made up of a number of small bones.

Why is it an advantage that the backbone is made of a number of small bones rather than one long bone?

_____

_____

5d

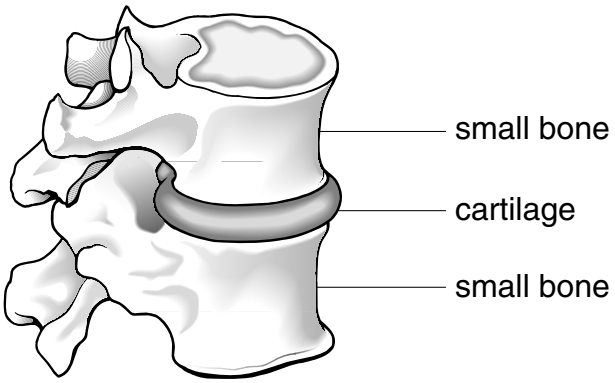
1 mark

maximum 5 marks

Total

5

(c) The drawing below shows two small bones from the backbone.

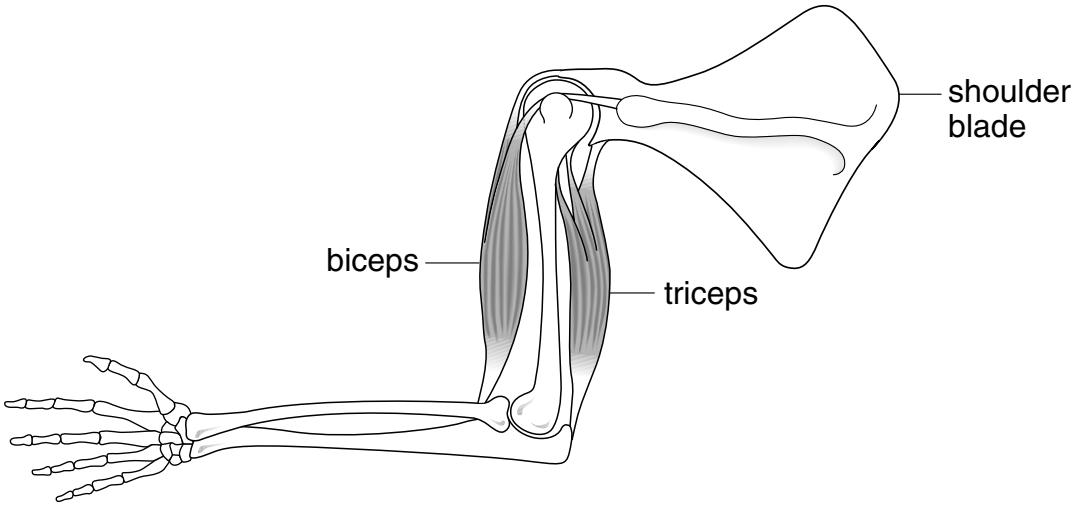


Between the small bones there is a material called cartilage.
Cartilage is softer than bone.
Give **one** advantage of having a softer material between the bones.

_____

_____

(d) The diagram below shows the bones and two muscles of an arm.



The biceps and triceps are muscles which raise and lower the forearm.
What happens to the biceps and triceps to **raise** the forearm?

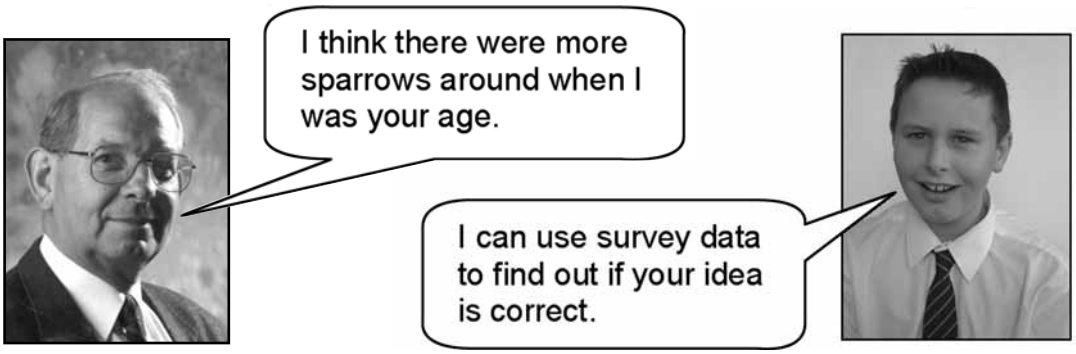
the biceps _____

the triceps _____

6a
1 mark

6b
1 mark

6b
1 mark



6ci
1 mark

6cii
1 mark

maximum 5 marks

Total
5

6. In January 2002, thousands of pupils recorded the numbers of different birds seen in their gardens in one hour. They sent their results to the Royal Society for the Protection of Birds who have kept data for many years.

(a) Why are the results from this survey more reliable than one person's observation?

_____

_____

(b) Pupils observed birds in their gardens for one hour during the last week in January.

Give **two** factors which are being controlled in this survey.

1. _____

2. _____

(c) Jack's grandad says: Jack says:

Jack thinks that the results collected in 2002 **cannot** test his grandad's idea that sparrows are less common than they used to be.

(i) What additional survey data would Jack need to test his grandad's idea?

_____

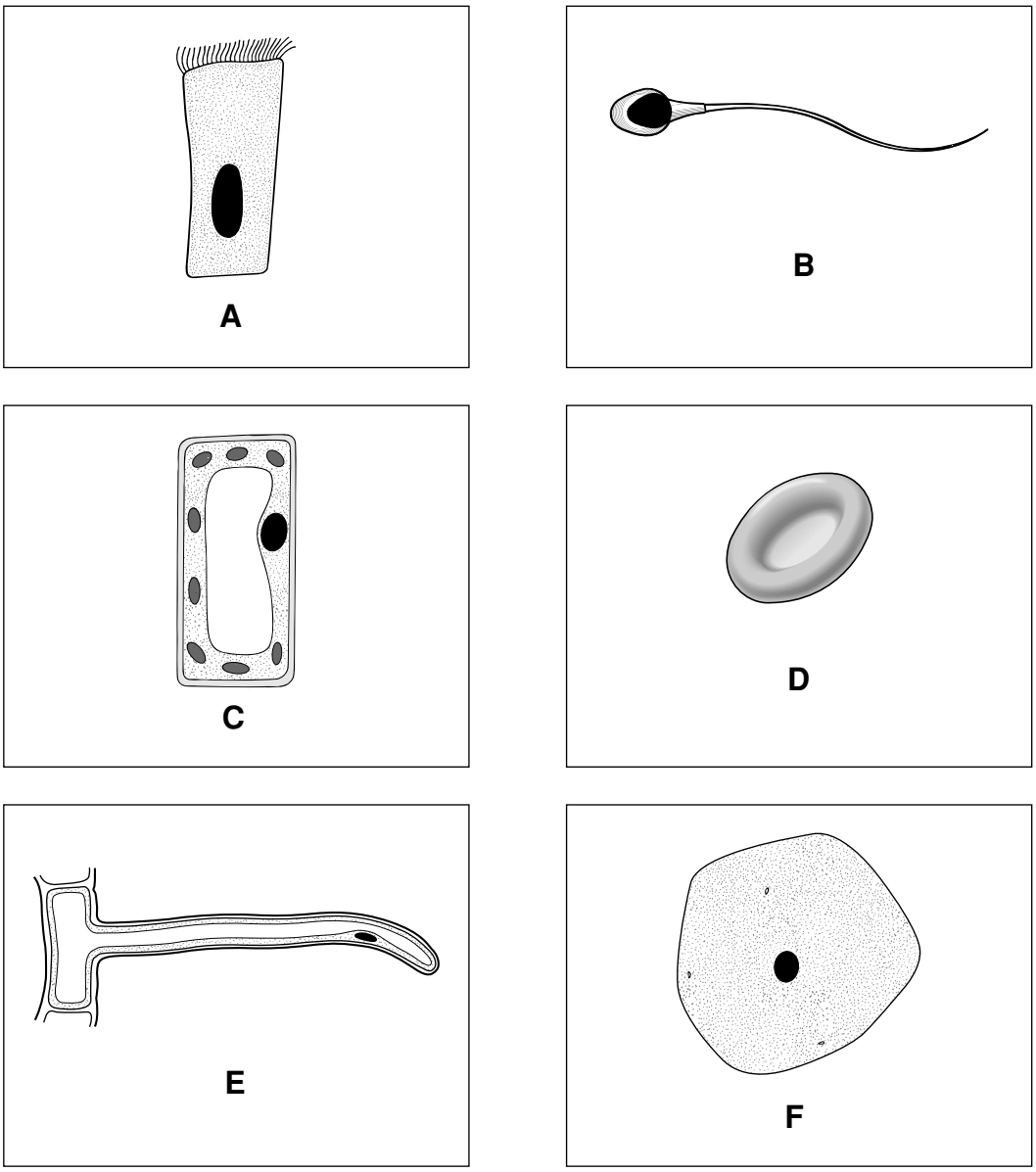
_____

(ii) What pattern in the survey results would give Jack the evidence that his grandad was correct?

_____

_____

7. The diagrams below show six cells.



7ai
1 mark

7aii
1 mark

7aiii
1 mark

7bi
1 mark

7bii
1 mark

7biii
1 mark

7c
1 mark

maximum 7 marks

Total
7

(a) (i) Give the letters of the **two** plant cells in the diagrams opposite.

_____ and _____

(ii) Which **one** of these plant cells contains chloroplasts?
Give the letter.

_____

(iii) Give the function of chloroplasts.

_____

_____

(b) (i) Give the letter of the ciliated cell.

_____

(ii) In which part of the body are ciliated cells found?

_____

(iii) What is the function of ciliated cells in this part of the body?

_____

_____

(c) Give the letter of the cell which transfers genetic information from father to offspring.

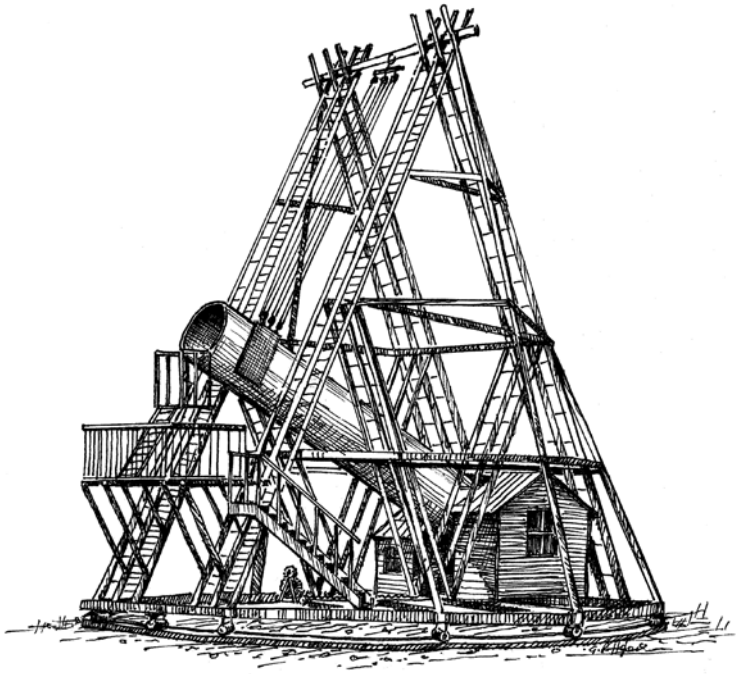
_____

8a

1 mark

8. Until 1781 scientists thought there were only six planets in the solar system. Then a scientist called Herschel looked through a very large telescope that could turn to follow objects in space.
He watched a bright object in the night sky for a few months and made drawings of what he saw. He concluded it was a planet.

Herschel's telescope



(a) What method did Herschel use to discover the new planet?
Tick the correct box.

He carried out practical tests in the laboratory.	☐	He asked scientists' opinions.	☐
He observed the environment.	☐	He gathered data from books.	☐

maximum 4 marks

8b ☐ 1 mark

8c ☐ 1 mark

8d ☐ 1 mark

Total ☐ 4

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9. (a) Megan was doing time-trials on her bike around a 400 metre horizontal track.

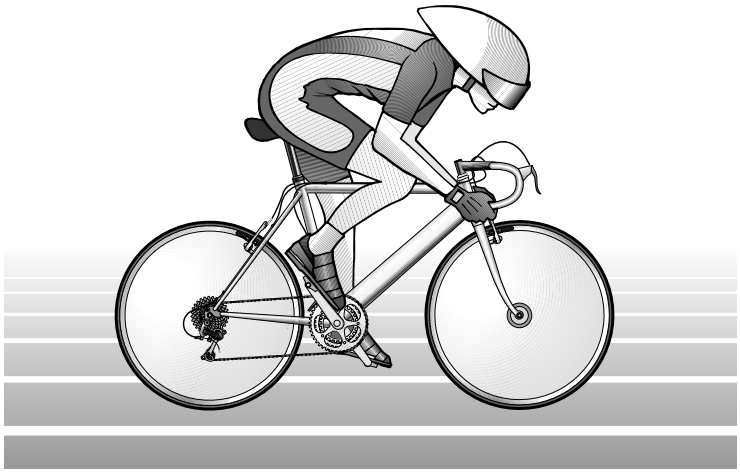
(i) She took 32 seconds to travel 400 m.
What was her average speed? Give the unit.

9ai
1 mark

(ii) Compare the forward force on the bike with the backward force on the bike when Megan was travelling at a constant speed.

9aii
1 mark

(b) Megan then crouched down over the handlebars to make herself more streamlined, as shown below.
She continued to pedal with the same force as before.



Compare the forward and backward forces on Megan and her bike now.

9b
1 mark

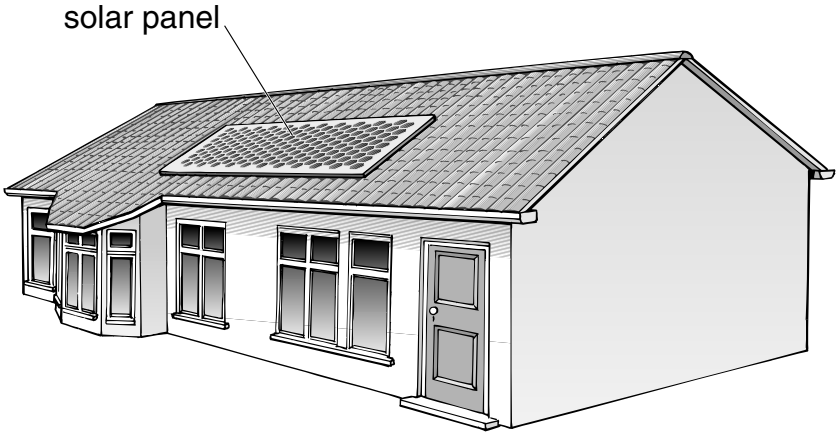
Explain your answer.

9b
1 mark

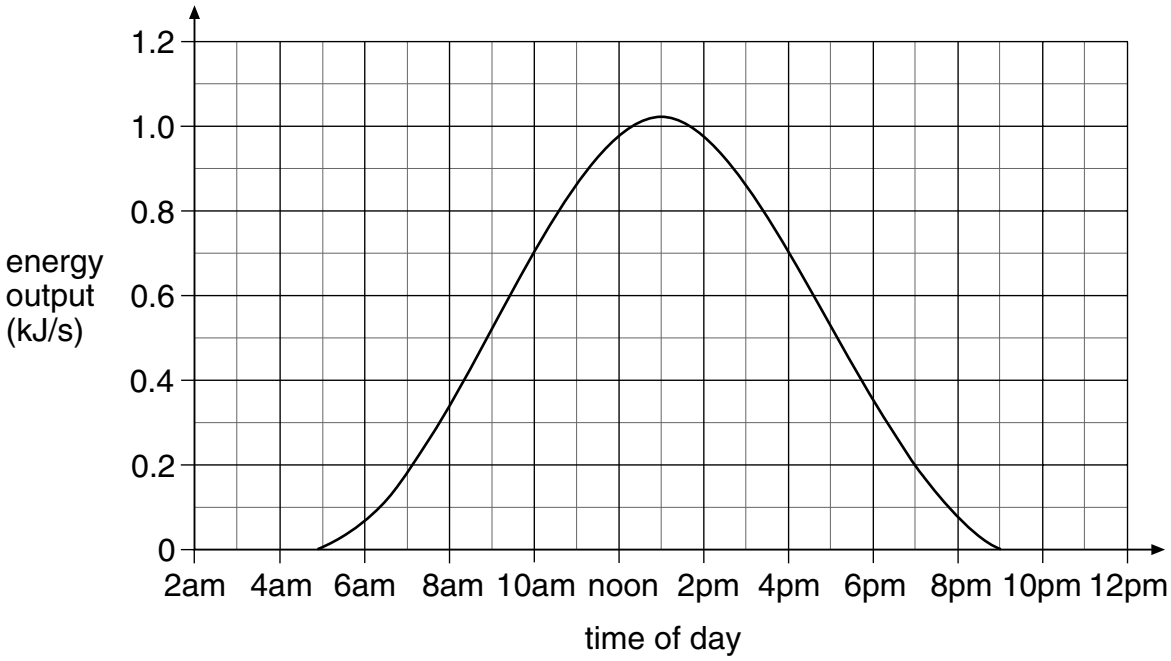
maximum 4 marks

Total
4

10. The drawing below shows a solar panel fixed to the roof of a house in Britain.



(a) Daniel measured the energy output from this solar panel during one day in June. The graph below shows his results.



(i) Why does the energy output from the solar panel vary during the day?

_____

_____

10ai

1 mark

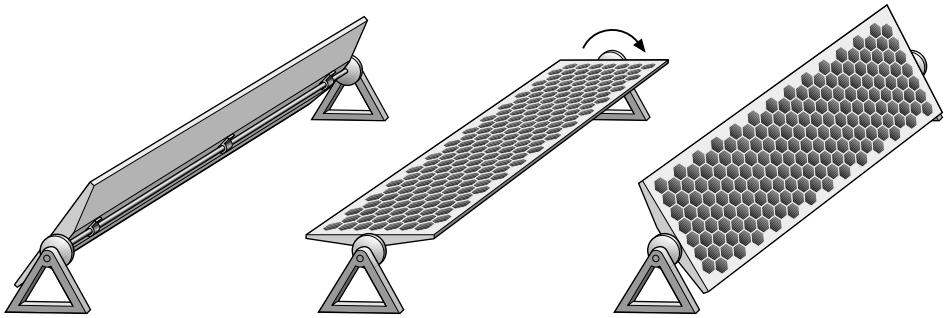
(ii) Daniel used the solar panel to run a motor.
The motor needs 0.7 kJ/s to run at full speed.
Use the graph to find how long Daniel's motor would run at full speed.

_____ hours

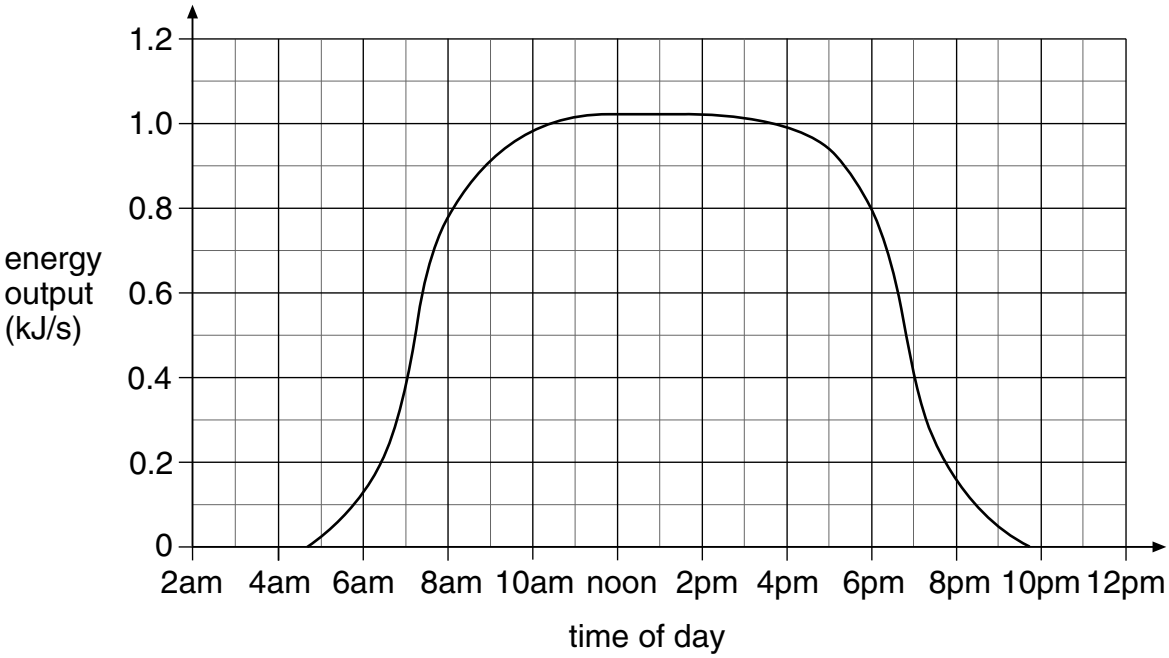
10aii

1 mark

(b) Daniel measured the energy output from a different solar panel.
This type of solar panel turns so that it always faces the Sun.



The graph below shows the energy output for this panel during one day in **mid-summer**.



(i) On the graph above draw another curve to show how the energy output for this solar panel might vary on a day in **mid-winter**. 10bi 1 mark

(ii) Between 7am and 7pm the solar panel turns through an angle of 180°.
Calculate the angle the solar panel turns through each hour. 10bi 1 mark

_____

_____ degrees 10bii 1 mark

maximum 5 marks

Total 5

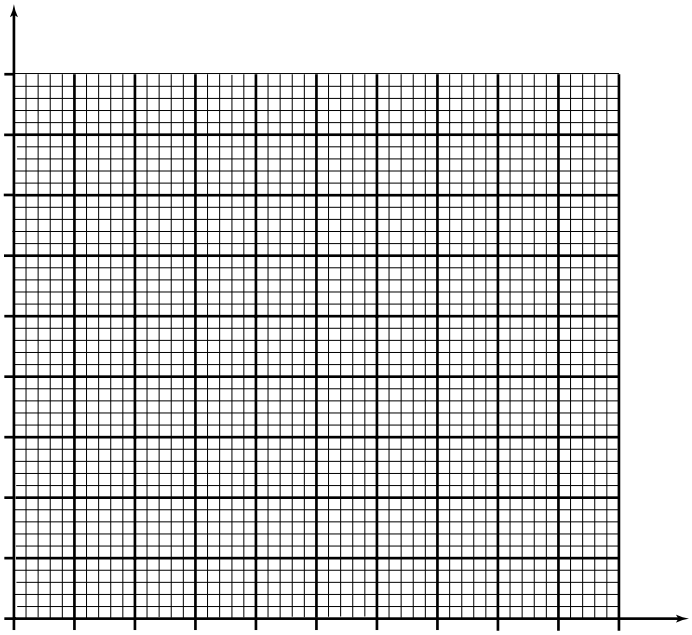
11. A pupil used a sensor to record the change in pH of 10 cm^3 of an acid solution when an alkali solution was added a little at a time. The concentrations of the alkali and acid solutions were fixed.

His results are shown in the table below.

volume of alkali added (cm^3)	pH of resulting mixture
0.0	5.0
2.0	5.0
4.0	5.0
6.0	5.5
8.0	6.0
10.0	7.0
12.0	8.0
14.0	8.5
16.0	9.0
18.0	9.0
20.0	9.0

(a) Use his results to draw a graph on the grid below.

- Label the axes.
- Plot the points.
- Draw a smooth curve.



11a
1 mark

11a
1 mark

11a
1 mark

11a
1 mark

(b) Look at the graph.
What would be the likely pH of the solution if the pupil added a further 2 cm^3 of alkali solution?

_____

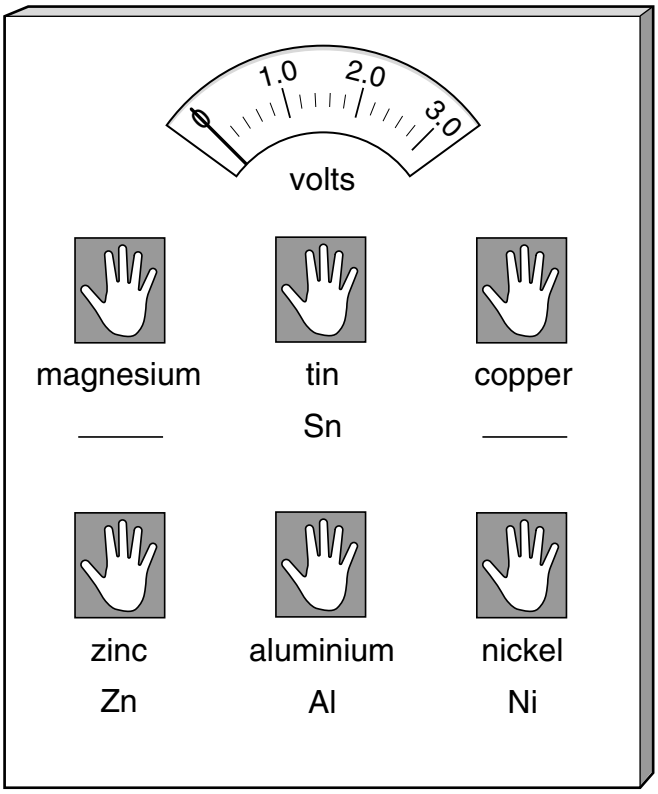
11b
1 mark

maximum 5 marks

Total
5

12. The diagram shows an exhibit at a science museum. It has six blocks of metal connected to a voltmeter.

(a) **On the lines on the diagram**, write the chemical symbols for magnesium and copper.



12a
1 mark

12a
1 mark

(b) When visitors place their hands on two blocks of metal at the same time, there is a reading on the voltmeter.
Some examples are shown in the table.

hands placed on	**reading on voltmeter (volts)**
magnesium + tin	2.1
magnesium + copper	2.5
magnesium + zinc	1.5
magnesium + aluminium	0.6
magnesium + nickel	2.0

The reading on the voltmeter depends on the reactivity of the two metals touched.
The bigger the difference in reactivity, the higher the reading on the voltmeter.

(i) Magnesium is the most reactive of these metals.
Which metal is the least reactive?

_____

12bi
1 mark

(ii) If two blocks of magnesium are used in the experiment, instead of two different metals, what would the voltmeter read?

_____ volts

12bii
1 mark

Explain your answer.

_____

_____

12bii
1 mark

(iii) Look at the voltmeter readings in the table, opposite.
On which **two** metals, other than magnesium, would a person put their hands to give the lowest reading on the voltmeter?

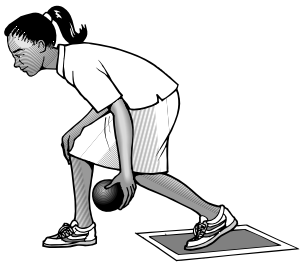
_____ and _____

12biii
1 mark

maximum 6 marks

Total
6

13. 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.

_____

_____

13ai

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. _____

_____

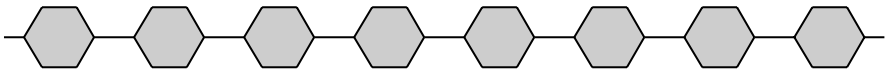
2. _____

_____

13aii
1 mark

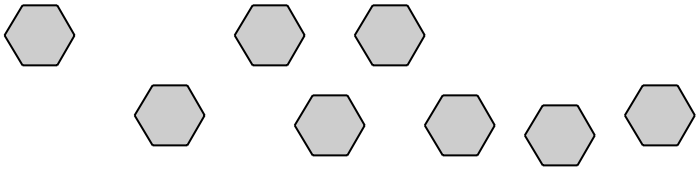
13aii
1 mark

(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.

_____

_____

13b
1 mark

maximum 4 marks

Total
4

14. Almost 200 years ago, an important investigation into plant growth was carried out.

George Sinclair, the Duke of Bedford's head gardener, planted seeds in 242 plots of land, each four feet square.

Charles Darwin concluded from this investigation:

> If a plot of ground is sown with one species of grass and a similar plot is sown with several different species of grass, the second plot will produce a greater number of plants and a greater mass of plant material.

(a) Give **one** feature of the plots that was controlled in Sinclair's investigation.

_____

_____

14a

1 mark

(b) Why did Sinclair use many plots rather than just two?

_____

_____

14b

1 mark

(c) What **two** factors are named in Darwin's conclusion as the measurable outcomes in the investigation?
(These are the dependent variables.)

1. _____

2. _____

14c

1 mark

(d) Which **one** factor was changed in Sinclair's investigation?
(This is called the independent variable.)

_____

14d

1 mark

(e) The soil in each plot was tested.

Suggest **one** reason why these soil tests were helpful to the interpretation of the results of the investigation.

_____

_____

14e

1 mark

(f) Give **one** reason why several different species of grass in a plot produced a greater mass of plant material than a single species in a plot.

_____

_____

_____

14f

1 mark

maximum 6 marks

Total

6

END OF TEST

QCA, Key Stage 3 Team, 83 Piccadilly, London W1J 8QA

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