Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4471/02

W16-4471-02

ADDITIONAL SCIENCE/BIOLOGY

BIOLOGY 2
HIGHER TIER

A.M. THURSDAY, 7 January 2016

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**4**	
2.	**7**	
3.	**7**	
4.	**6**	
5.	**6**	
6.	**8**	
7.	**7**	
8.	**9**	
9.	**6**	
Total	**60**	

4471
020001

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

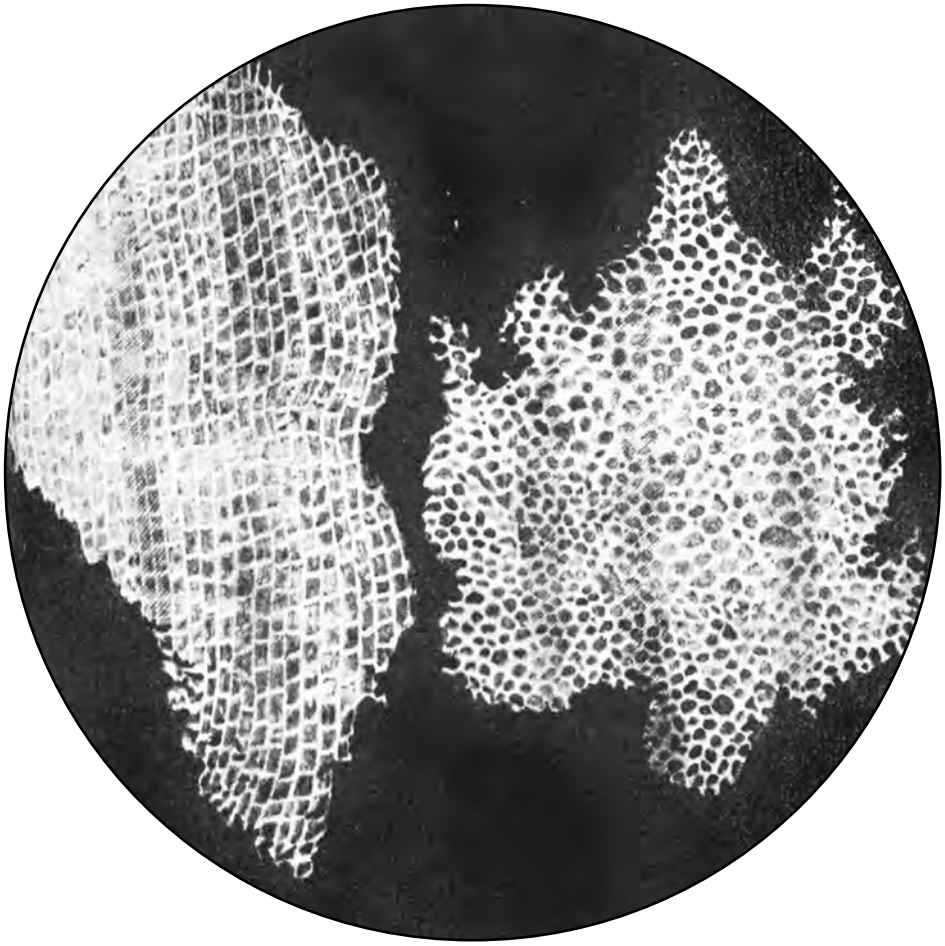
You are reminded that assessment will take into account the quality of written communication (QWC) used in your answer to question **4** and question **9**.

Examiner only

Answer **all** *questions.*

1. Robert Hooke (1635 – 1703) was an English scientist who studied the structure of living organisms using one of the first light microscopes. In 1665 Hooke viewed a thin cutting of cork (tree bark) and discovered empty spaces, surrounded by walls, which he called cells. The work of Hooke and other scientists led to the development of the Cell Theory.

Hooke's drawing of cork as viewed under the light microscope



(a) What does the Cell Theory state? [1]

.....

.....

(b) Viruses were discovered in the 1950s. State **two** reasons why viruses are not thought to be living organisms. [2]

(i) .....

(ii) .....

Examiner only

(c) You are provided with a sample of pond water containing single-celled swimming organisms. Which microscope would you use to observe the swimming action of these organisms? Place a tick (✓) in the box under the microscope you would choose and state the reason for your choice. [1]

Light microscope
(magnification up to x 1 500)

☐

Electron microscope
(magnification up to x 500 000)

☐

Reason .....

.....

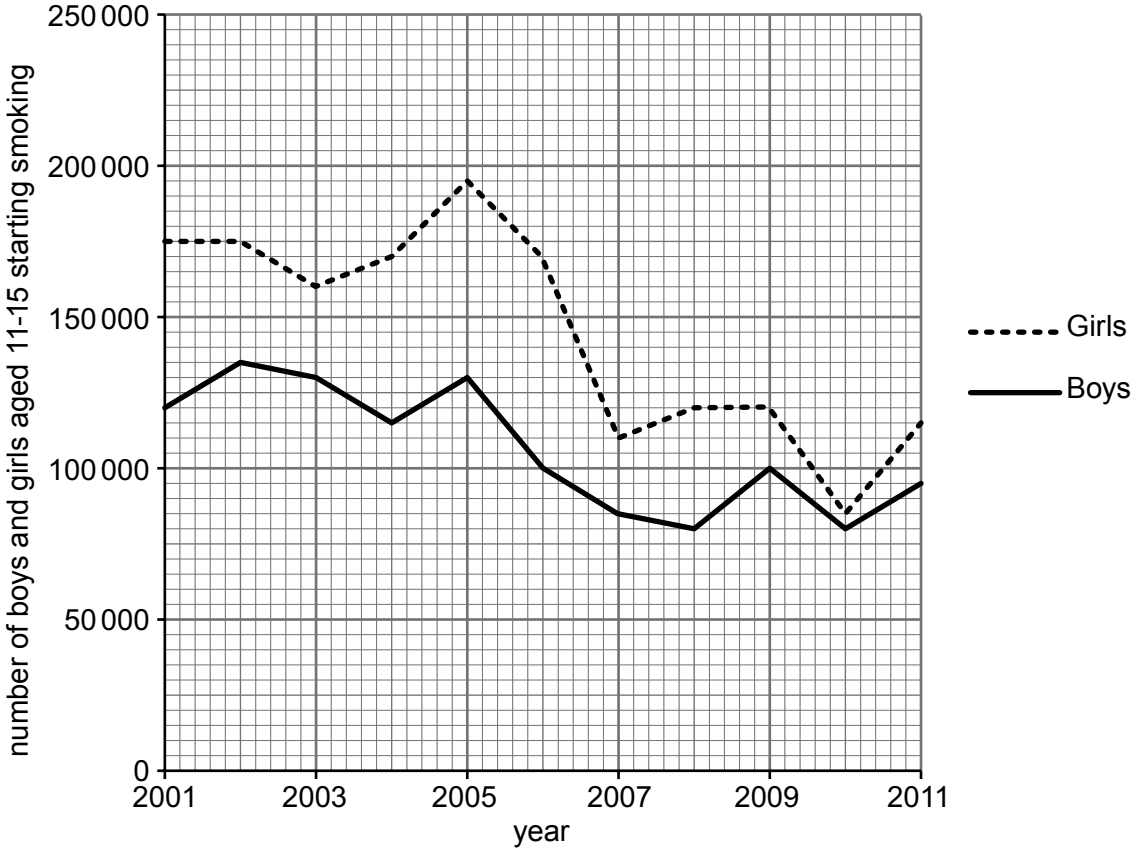
4471 020003

4

Turn over.

Examiner only

2. The graph below shows the number of boys and girls aged 11 – 15 who started smoking each year between 2001 and 2011 in the UK.



Cancer Research UK

(a) (i) Give **two** trends which are shown in the graph. [2]

I. .....

II. .....

(ii) In 2009 the population of the UK was estimated at 62 million. In the same year, 102 000 people died in the UK from tobacco smoking related disease.
Calculate the percentage of the UK population who died from tobacco smoking related disease in 2009. Show your working. [2]

Percentage of population = ... **%**

Examiner only

(b) Cotinine is a chemical found in tobacco smoke. It is found in the saliva and urine of tobacco smokers. Simple test kits are available which can test for the presence of cotinine in saliva and urine.

In 2011 the percentage of 15 year old boys and girls in the UK who admitted smoking tobacco regularly was:

Boys 8% Girls 10%

However, based on cotinine test results of volunteer 15 year old boys and girls, the figures are more likely to be:

Boys 21% Girls 19%

(All data Cancer Research UK)

Suggest why the admitted levels of smoking amongst 15 year old boys and girls is almost 50% less than the results indicated from the cotinine tests. [1]

.....

.....

.....

(c) Explain how the smoking related disease, emphysema, affects the function of the lungs. [2]

.....

.....

.....

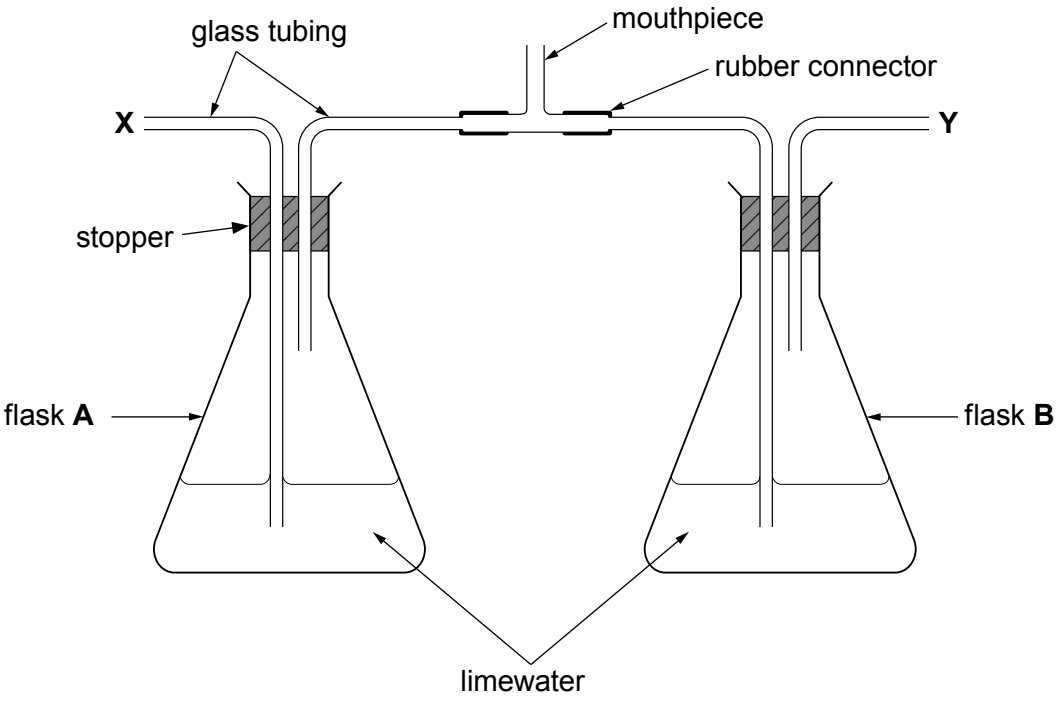
7

4471 020005

Turn over.

Examiner only

3. Mair set up the following apparatus in a school laboratory in order to investigate the difference between inspired and expired air.



(a) Draw an arrow at **X** and another at **Y** to show the direction of air flow through the apparatus when air is gently breathed in and out at the mouth piece. [2]

(b) Mair breathed gently in and out through the mouthpiece for 1 minute.

(i) Complete the table below to show the expected **appearance** of the limewater after 1 minute. [2]

	flask **A**	flask **B**
appearance of limewater after 1 minute	.....	.....

(ii) Explain the **difference** in the appearance of the limewater after 1 minute. [2]

.....

.....

(c) If Mair had breathed gently in and out through the mouthpiece for 5 minutes, how would the results she obtained have been different? [1]

.....

Examiner only

4. A student ate a chicken sandwich made from bread, butter and chicken for lunch. Describe fully what happens to the food in the sandwich from the time it enters the **mouth** to the time it leaves the **stomach**.

[6 QWC]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

6

Turn over.

Examiner only

5. *(a)* What is meant by the term *biological control*? [2]

.....

.....

.....

(b) The following table contains data relating to the development and use of chemical and biological control agents.

	chemical control	biological control
number of agents tested	>3.5 million	3 000
success ratio	1:200 000	1:20
development costs per agent	180 million US dollars	2 million US dollars
development time per agent	10 years	10 years
risk of resistance to agent	large	very small
harmful side effects	many	few
how specific is the agent to the job it has to do?	not very	very

The Royal Society

(i) The development time is the time between the selection of the agent and its use in the field. Suggest what scientists have to do during this 10-year period. [2]

.....

.....

.....

(ii) I. The success ratio of the development of biological control agents is 1:20. State what this means. [1]

.....

.....

II. Select **one** piece of information from the table which helps to explain why the success ratio of chemical control agents is so low. [1]

.....

.....

6

BLANK PAGE

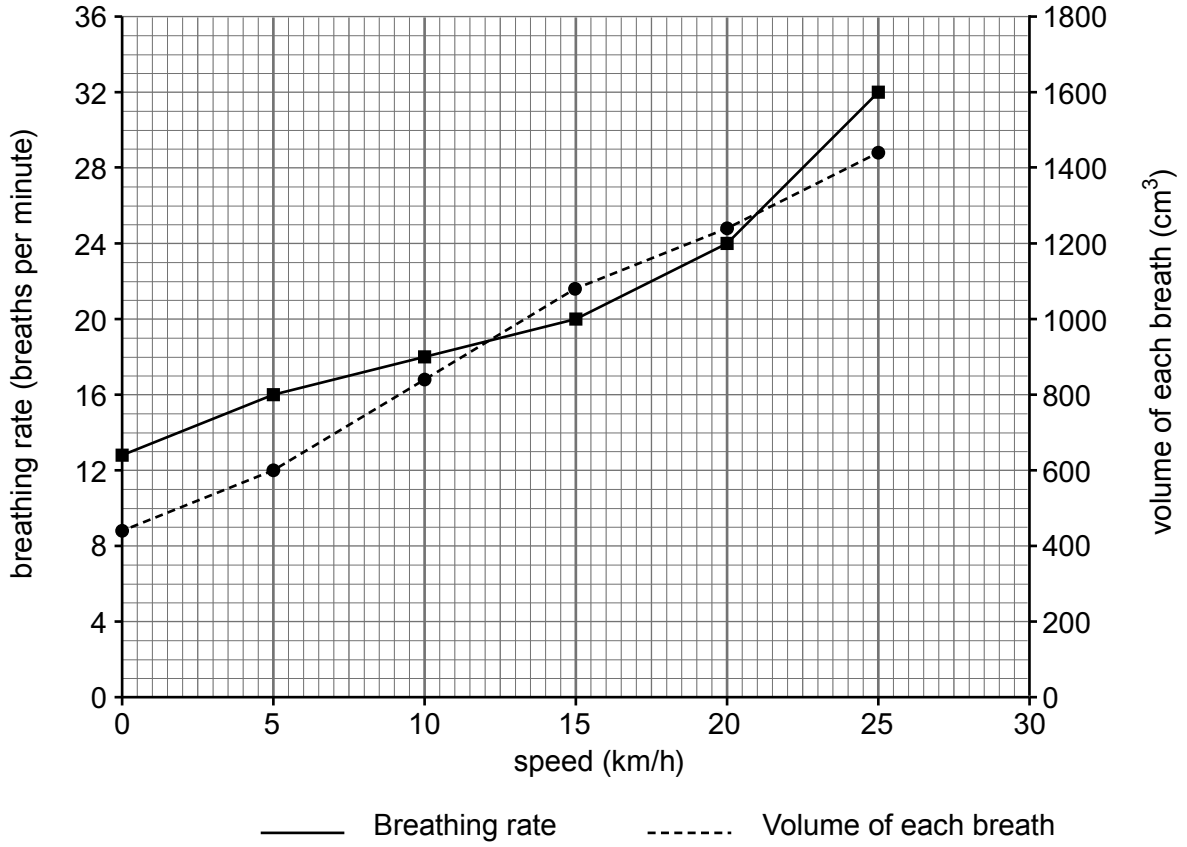
Examiner only

6. *(a)* State **two** ways in which anaerobic respiration and aerobic respiration in humans are similar. [2]

(i) .....

(ii) .....

(b) When athletes run faster, they breathe faster and the volume of each breath increases. The graph shows these changes for an athlete running a race.



(i) How many breaths per minute were taken when the athlete was running at 10 kilometres per hour? [1]

.....

(ii) What was the volume of each breath when the athlete was running at 15 kilometres per hour? [1]

.....

Examiner only

(iii) Calculate the volume of air entering the lungs each minute when the athlete was running at 20 kilometres per hour. Show your working. [2]

Volume = ...

(c) Describe the benefits of increasing the breathing rate and the volume of each breath when the level of activity increases. [2]

.....

.....

.....

8

Turn over.

Examiner only

7. The concentration of glucose in oak leaves was measured and recorded as a percentage of the (dry) mass of the leaves. The concentration was measured at 4 hour intervals throughout 24 hours. The results are shown in the table:

time in hours (24 h clock)	concentration of glucose (% dry mass)
04.00	0.45
08.00	0.60
12.00 noon	1.75
16.00	2.00
20.00	1.40
24.00 midnight	0.50

(a) State **two** environmental factors that would limit the production of glucose between 20.00 h and 24.00 h. [1]

(i) .....

(ii) .....

(b) Explain fully the results for:

(i) 04.00 h [3]

.....

.....

.....

.....

(ii) 16.00 h [3]

.....

.....

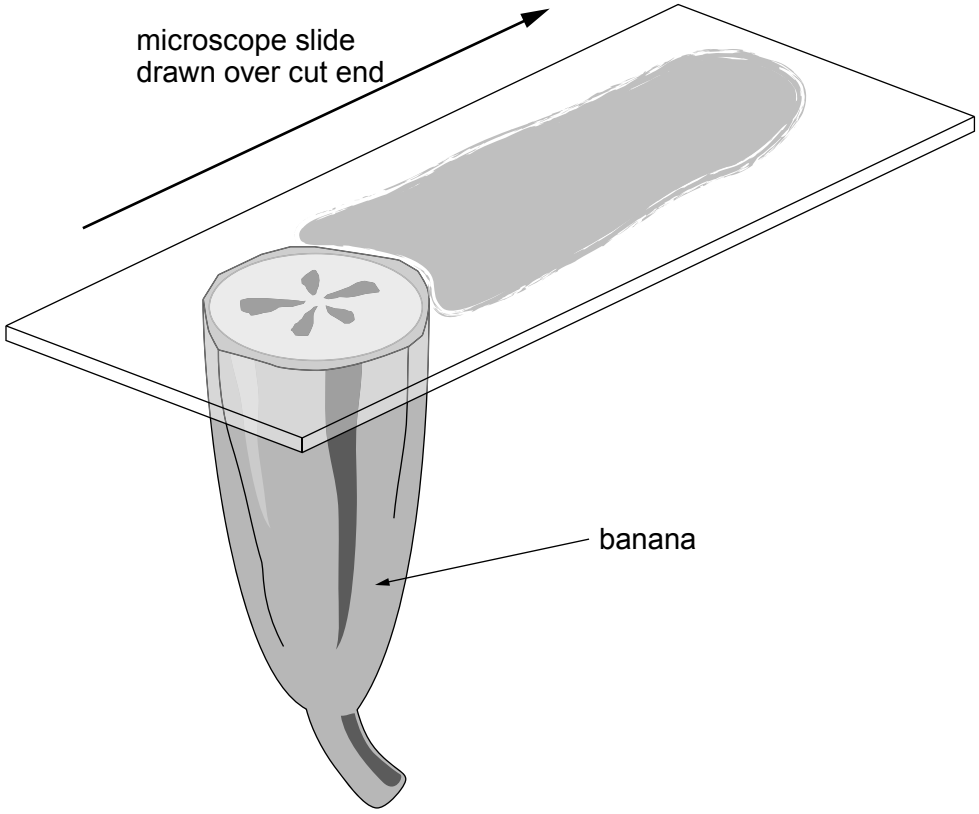
.....

.....

7

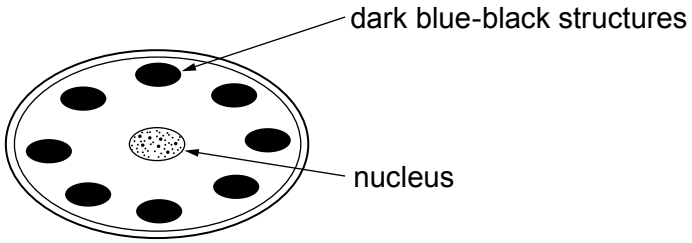
BLANK PAGE

8. An unripe banana was cut across and a microscope slide was drawn over the cut end as shown in the diagram below.



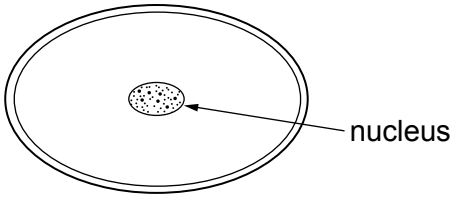
This procedure caused cells from the banana to be smeared onto the microscope slide. A drop of iodine solution was added to the cells on the microscope slide and the cells were then viewed with a microscope at high power magnification. A drawing of one of the cells is shown below.

Diagram **A**



The procedure, described above, was repeated using an over-ripe banana. A drawing of one of its cells is shown below.

Diagram **B**



Examiner only

A sample of the over-ripe banana was liquidised in a food blender. Some of the liquidised banana was placed in a boiling tube and an equal volume of Benedict's solution added. The mixture was then heated to 90 °C. The colour of the mixture changed from light blue to brick red.

(a) Explain the observations in diagrams **A** and **B** opposite and the results in the paragraph above. [3]

.....

.....

.....

.....

(b) A piece of unripe banana was weighed and put into a beaker containing 200 cm^3 of 0.2 M sugar solution. This was repeated for the over-ripe banana using a separate beaker. After 30 minutes both pieces of banana were removed, dried with a paper towel and weighed again. The percentage change in mass was calculated for each piece of banana. This procedure was then carried out three more times and the mean percentage change in mass calculated. The results are shown below.

	unripe banana	over-ripe banana
mean % change in mass	–10	0

Explain the results in terms of osmosis for

(i) the unripe banana; [3]

.....

.....

.....

.....

(ii) the over-ripe banana. [2]

.....

.....

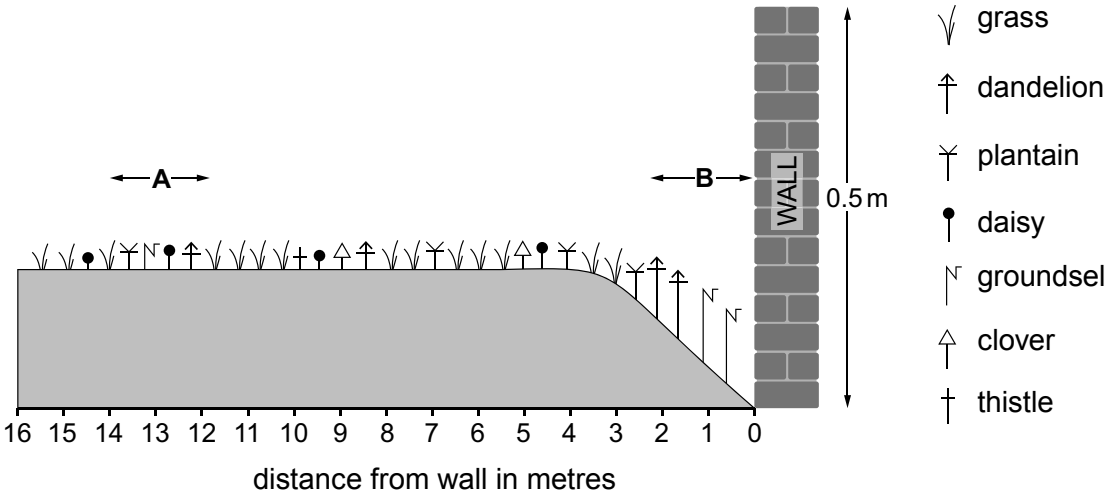
(c) State the reason for carrying out the procedure three more times and calculating the mean. [1]

.....

.....

Examiner only

9. A survey was made to show the heights and distribution of the plants growing on a school playing field. The results are shown in the diagram of the profile. The heights of the plants are shown by the sizes of the symbols used for each plant.



Describe the technique that you would use to obtain the results shown above. Suggest why the plants at point **A** are shorter than those at point **B**. [6 QWC]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

END OF PAPER