Surname	Centre Number	Candidate Number
Other Names		0

New GCSE

4461/02

SCIENCE A
HIGHER TIER
BIOLOGY 1

A.M. WEDNESDAY, 9 January 2013

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1	**6**	
2	**6**	
3	**3**	
4	**3**	
5	**6**	
6	**6**	
7	**7**	
8	**7**	
9	**10**	
10	**6**	
Total	**60**	

4461
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

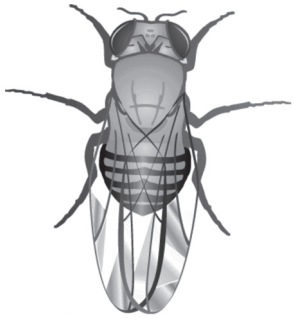
The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication used in your answer to questions **5** and **10**.

Examiner only

Answer **all** *questions.*

1. A grey-bodied fruit fly was mated with a black-bodied fruit fly. All the F1 offspring were grey-bodied.



Grey-bodied fly

×

Black-bodied fly

All the F1 offspring are grey-bodied

(a) Using the letters **A** and **a** to represent the alleles for the two different body colours, complete the Punnett square below to show the offspring produced from the mating between the grey-bodied and black-bodied fruit flies. [2]

	Gametes		
F1			

Examiner only

(b) (i) Complete the Punnett square below to show the offspring produced when two of the F1 offspring are selfed (bred together). [2]

	Gametes		
F2			

(ii) What is the ratio of the different phenotypes in the F2 offspring? [1]

..... : .....

(c) Name the 19th Century scientist whose work on garden pea plants led to the understanding of the mechanism of inheritance. [1]

.....

4461 020003

6

Turn over.

Examiner only

2. A scientist investigated the range of heights of a flowering plant species at two different locations; in the middle of a woodland and in a hedgerow. He measured the heights of 20 plants in each location.

Heights of plants from **woodland** (mm)			
125	134	139	126
135	149	144	135
130	137	128	136
136	141	143	133
131	129	133	138

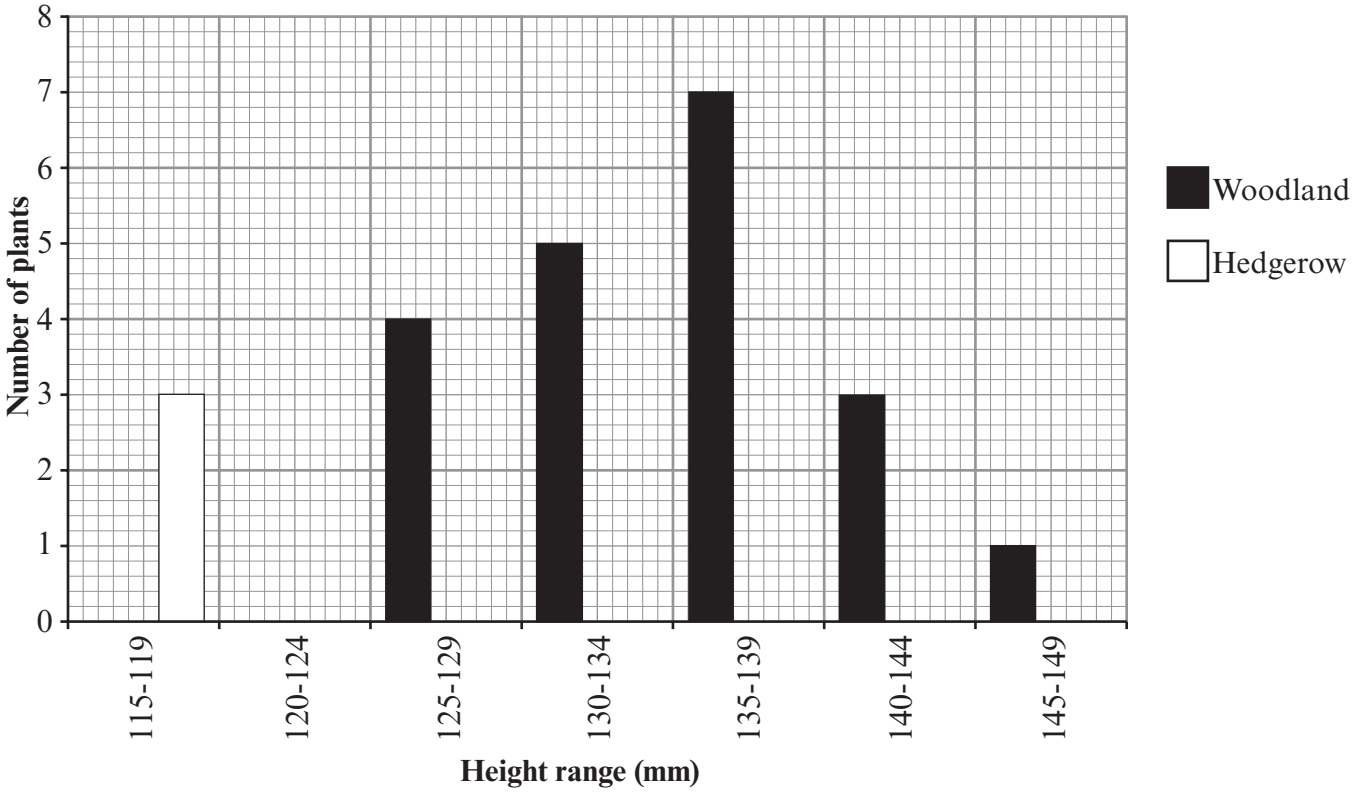
Heights of plants from **hedgerow** (mm)			
115	134	127	117
127	123	131	122
132	126	118	123
121	125	124	128
134	137	129	138

(a) (i) Complete the tally chart below by scoring the height ranges of the **hedgerow** plants. Some have been done for you. [1]

	Tally of plants at each location	
Range (mm)	Woodland	Hedgerow
115-119	0	|||
120-124	0	
125-129	||||	
130-134	𝍸	
135-139	𝍸 ||	
140-144	|||	
145-149	|	

Examiner only

(ii) The woodland data have been plotted below. Complete the bar chart by plotting the data for hedgerow plants. One bar has been done for you. Use a ruler to carefully draw the bars. [2]



4461 020005

(iii) Using the data and graph only what conclusion can you make about the plants growing in the hedgerow? [1]

.....

(b) Suggest a way in which the scientist could find out whether the difference in height of the flowering plant species found at the two locations is due to environmental or genetic causes. [2]

.....

.....

.....

6

Turn over.

Examiner only

3. *(a)* Explain what is meant by the term *genetic profiling.* [1]

.....

.....

(b) State **two** uses of genetic profiling. [2]

(i) .....

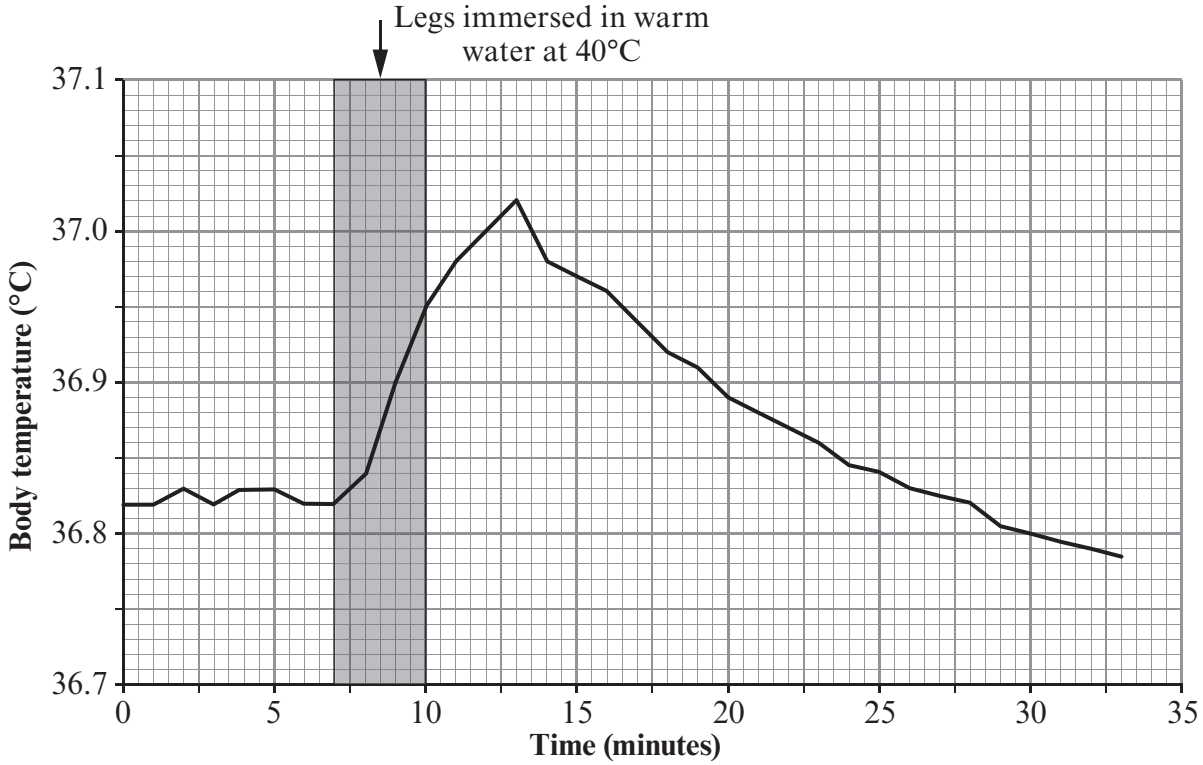
.....

(ii) .....

.....

3

4. A scientist carried out an investigation into the body temperature of a man. The changes in the man's body temperature were measured by a clinical thermometer in his mouth. The graph below shows his body temperature over a 35 minute period. Between 7 and 10 minutes he immersed his legs, from the knees downwards, in a bath of warm water at 40°C. He then stepped out of the bath and dried his legs.



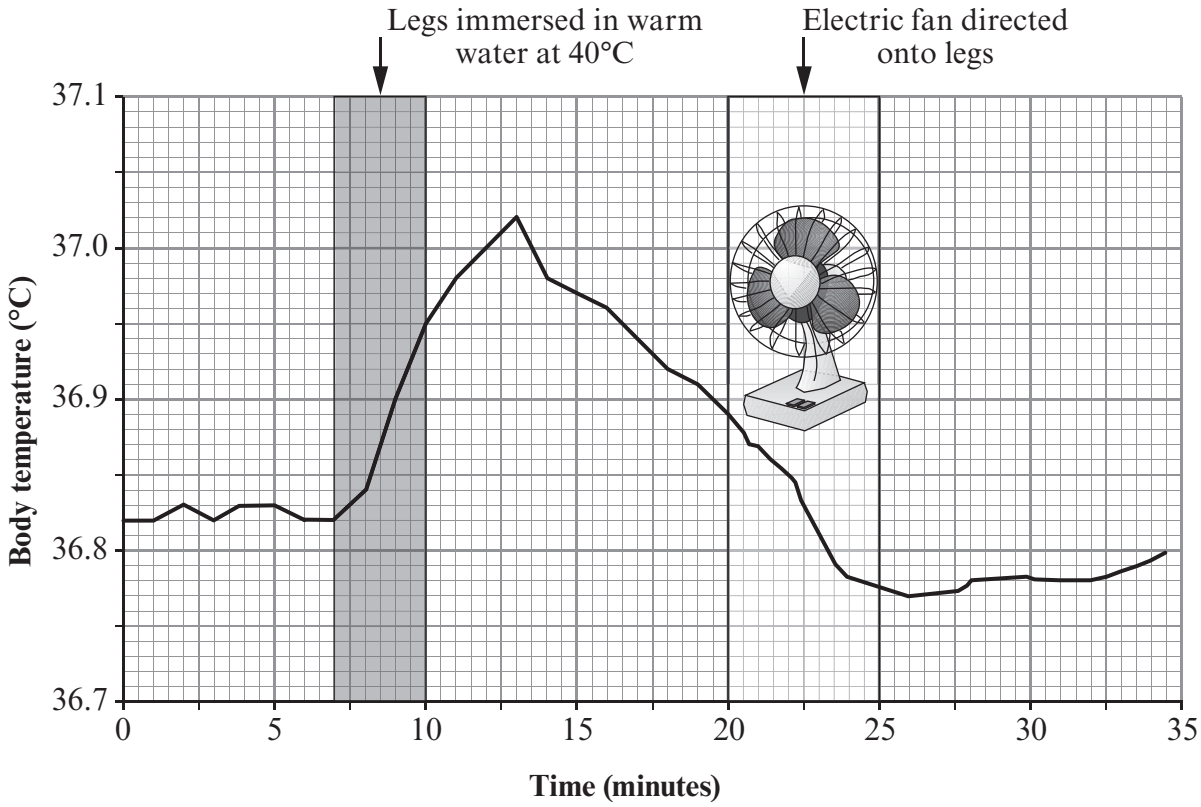
(a) Explain why the body temperature increased even though it was only the legs which were immersed in the warm water. [1]

.....

.....

Examiner only

(b) The experiment was repeated. After 20 minutes an electric fan was directed onto the man's legs. The results are shown in the graph below.



Explain why the body temperature of the man dropped more quickly between 20 and 25 minutes when the fan was used. [2]

.....

.....

.....

.....

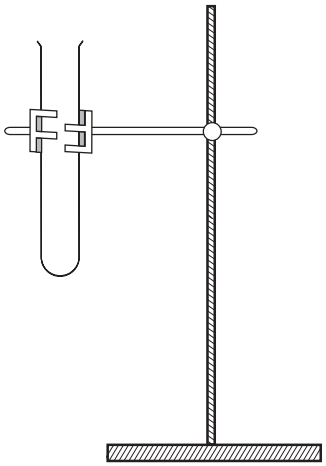
3

4461 020007

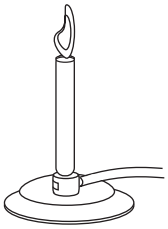
Examiner only

5. Describe how the following apparatus and materials could be used to compare the energy content of two different food samples A and B. [6 QWC]

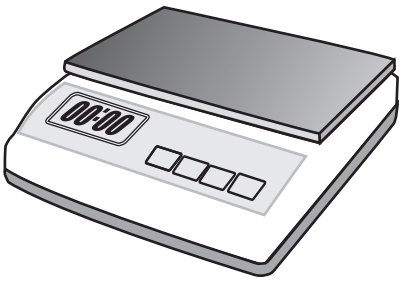
stand and boiling tube



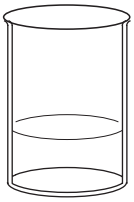
lit Bunsen burner



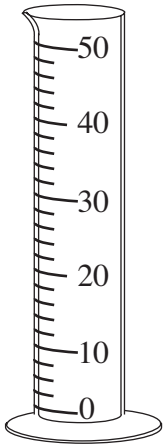
digital balance



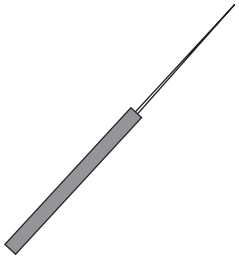
beaker of water



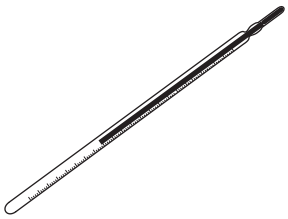
50 cm^3 measuring cylinder



mounted needle with wooden handle



thermometer



.....

.....

.....

.....

.....

.....

.....

Examiner only

.....

.....

.....

.....

.....

.....

.....

.....

6

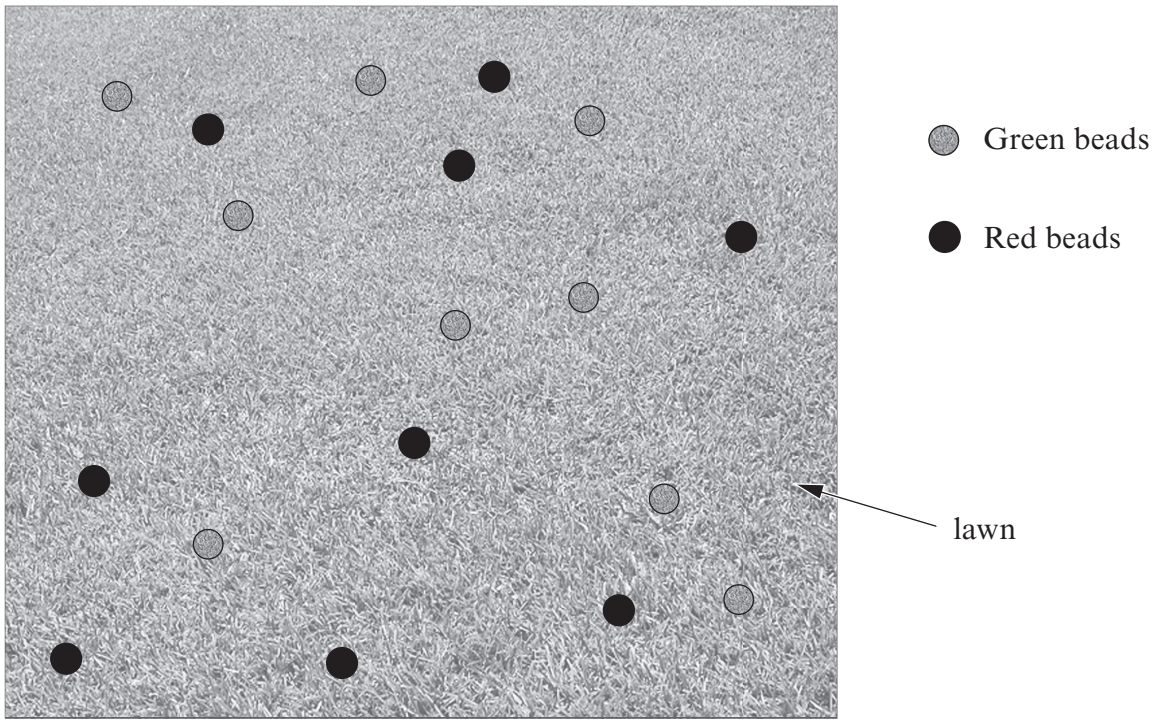
Turn over.

6. John designed a model to represent a predator-prey relationship.

This is part of his design:

- He marked out a $1\,m^2$ area of well mown lawn.
- In a beaker he mixed together 50 green coloured beads and 50 red coloured beads.
- He shook the beaker and scattered the beads randomly over the $1\,m^2$ of lawn.

The diagram below shows part of the marked out area of the lawn.



- John asked another student Susan to pick out as many beads as possible from the $1\,m^2$ of lawn in one minute.
- John then calculated the number of green and red beads that were left in the $1\,m^2$ of lawn.
- John added more beads to the $1\,m^2$ of lawn to make the total up to 100 again. An equal number of each coloured bead was added to make up the 100.
- Susan then repeated the exercise another two times.

Examiner only

The results are shown in the table below:

	Number of beads remaining in $1m^2$ of lawn		Number of beads added to $1m^2$ of lawn	
	Green	Red	Green	Red
At start			50	50
After 1 pick	46	26	14	14
After 2 picks	52	22	13	13
After 3 picks	54	16	15	15

(a) In this predator-prey relationship model what do the following represent:

(i) the coloured beads; ..... [1]

(ii) Susan; ..... [1]

(iii) the process of adding beads to the $1m^2$ of lawn? [1]

.....

(b) After 10 picks the number of red beads had fallen to zero. [1]

Use the term that would best describe this process in nature.

.....

(c) Why are fewer green beads removed from $1m^2$ of lawn at each pick than red? [1]

.....

(d) Suggest **one** way in which this model is not a true representation of what happens in nature. [1]

.....

.....

6

Turn over.

Examiner only

7. In 2011 a contact lens was invented with a sensor that can measure the concentration of glucose in tears. It can be used to detect diabetes.

(a) Name **two** body fluids, other than tears, which can be tested to detect diabetes. [2]

.....

(b) State **three** methods which are used to treat diabetes. [3]

(i) .....

(ii) .....

(iii) .....

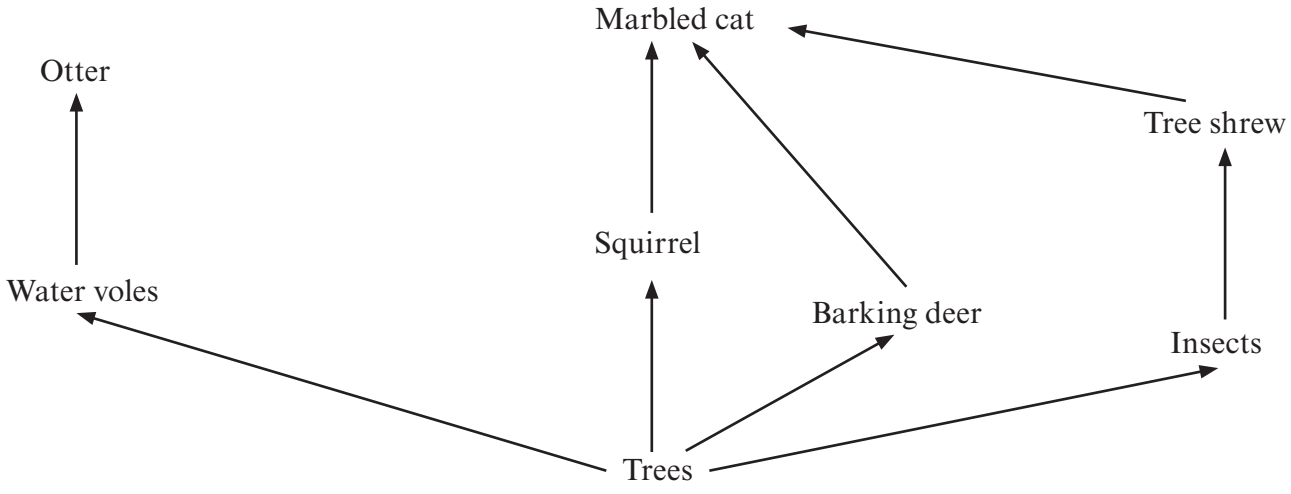
(c) A poor diet in pregnant women increases the risk of their children developing diabetes. These children show abnormal development of cells in the pancreas. State **two** reasons why this could prevent the control of glucose concentration. [2]

(i) .....

(ii) .....

7

8. The diagram below shows a food web in a rainforest in Sarawak in South East Asia.



Examiner only

The removal of trees by logging has been allowed in the forest in a part of Sarawak. A study was carried out to investigate the effect of logging on the animals living in the forest. Numbers of six different mammals per km^2 were estimated before logging and regularly for four years after logging. The table below shows the results.

Mammal	Mean number of animals per km^2			
	Before logging	1 year after logging	2 years after logging	4 years after logging
Marbled cat	1	0	0	0
Otter	1	0	0	0
Water vole	5	0	0	0
Squirrel	16	24	104	19
Tree shrew	10	5	10	38
Barking deer	3	1	10	1

(a) Use the food web opposite and the data in the table above to give reasons for the results for

(i) the otter; [1]

.....

(ii) the squirrel. [3]

.....

.....

.....

.....

(b) Some insects feed on healthy living trees. Others feed on decaying remains of trees. Use all the given information to explain the data for tree shrews over the four years. [3]

.....

.....

.....

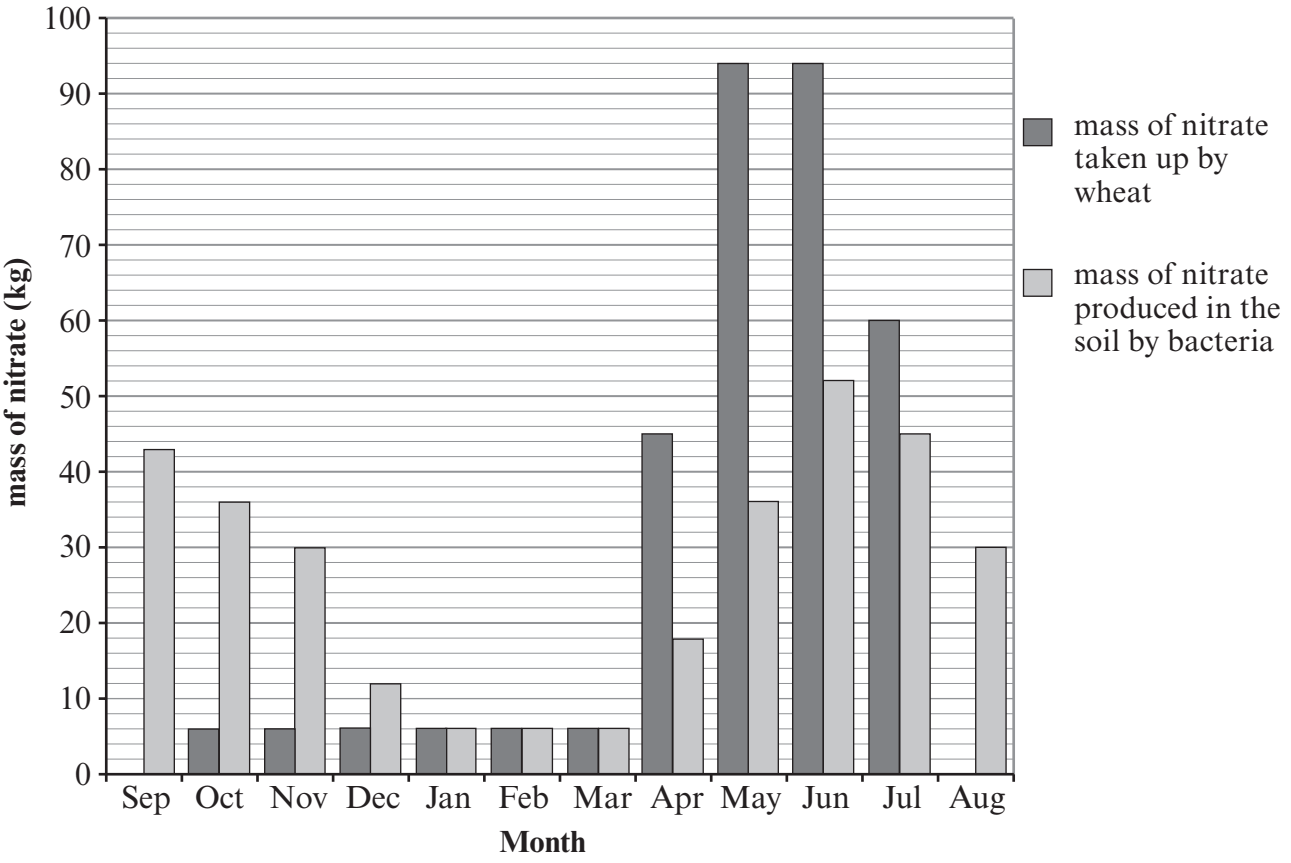
.....

7

Turn over.

Examiner only

9. Computer modelling was used to predict the effects of environmental factors on nitrate production by bacteria and the mass of nitrate taken up by wheat. The results are shown as a bar chart below.



The wheat is planted in September and harvested in August of the following year.

(a) Suggest reasons for the following observations.

(i) The mass of nitrate taken up by the wheat is greater in May than in March. [1]

.....

.....

(ii) The mass of nitrate produced in the soil by bacteria is much greater in September than in January. [1]

.....

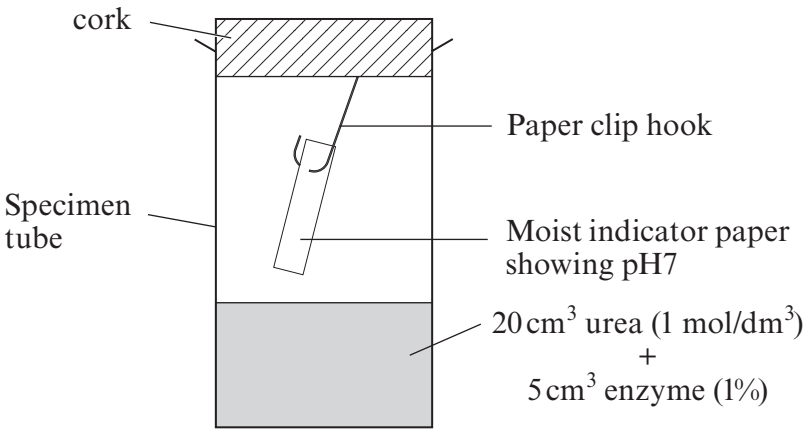
.....

(b) Some bacteria use an enzyme to break down the urea in natural fertilizer which may be added to the soil. Name this enzyme. [1]

.....

Examiner only

(c) (i) An investigation was carried out to determine how bacteria in soil break down urea.
The following apparatus was used and left for one hour at 20°C.

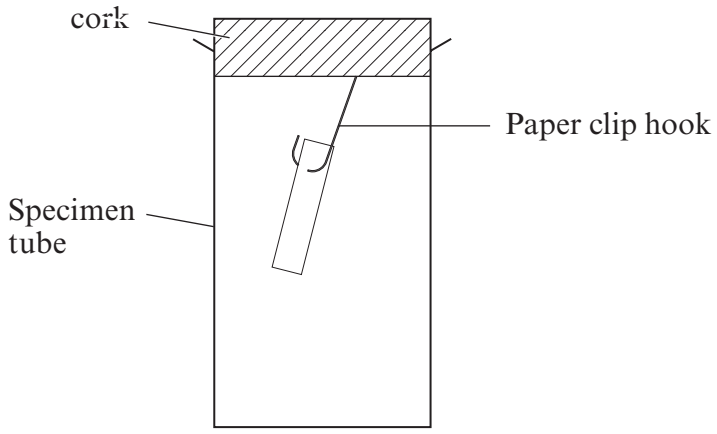


After one hour the indicator paper showed that the pH had changed to 9. Explain this observation. [2]

.....

.....

(ii) Complete the diagram below and **label** it to show the contents of the specimen tube in a control that you would set up to show that the change in pH was due to the enzyme. [3]



(iii) State **two** *other* factors that would be necessary for the control. [2]

.....

.....

PLEASE TURN OVER FOR QUESTION 10

10

Examiner only

10. *Anopheles gambiae* is a species of mosquito which is responsible for the spread of a disease, malaria, in West Africa.
In the 1990s a pesticide, dieldrin, was used to kill mosquitoes.
In areas which were sprayed with dieldrin for the first time, only 10% of mosquitoes were resistant to it.
After spraying areas with dieldrin, for 2 months, 99% of mosquitoes were resistant to it.
Explain these results. [6 QWC]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

6

END OF PAPER