FOR OFFICIAL USE

N5

National Qualifications 2016

Mark

X707/75/01

Biology
Section 1—Answer Grid and Section 2

MONDAY, 9 MAY
1:00 PM – 3:00 PM

X7077501

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day		Month		Year	

Scottish candidate number

Total marks—80

SECTION 1—20 marks

Attempt ALL questions.

Instructions for the completion of Section 1 are given on *Page 02*.

SECTION 2—60 marks

Attempt ALL questions.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers and rough work is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting. Any rough work must be written in this booklet. You should score through your rough work when you have written your final copy.

Use **blue** or **black** ink.

Before leaving the examination room you must give this booklet to the Invigilator; if you do not, you may lose all the marks for this paper.

SQA ©

SECTION 1—20 marks

The questions for Section 1 are contained in the question paper X707/75/02.

Read these and record your answers on the answer grid on *Page 03* opposite.

Use **blue** or **black** ink. Do NOT use gel pens or pencil.

1. The answer to each question is **either** A, B, C or D. Decide what your answer is, then fill in the appropriate bubble (see sample question below).

2. There is **only one correct** answer to each question.

3. Any rough working should be done on the additional space for answers and rough work at the end of this booklet.

Sample Question

The thigh bone is called the

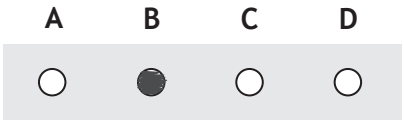
A humerus

B femur

C tibia

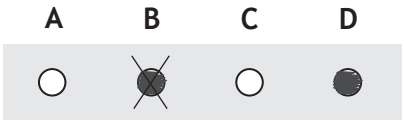
D fibula.

The correct answer is **B** — femur. The answer **B** bubble has been clearly filled in (see below).

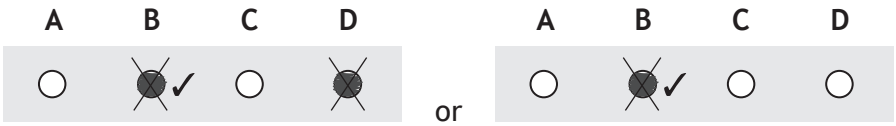


Changing an answer

If you decide to change your answer, cancel your first answer by putting a cross through it (see below) and fill in the answer you want. The answer below has been changed to **D**.



If you then decide to change back to an answer you have already scored out, put a tick (✓) to the **right** of the answer you want, as shown below:



SECTION 1—Answer Grid

OBJ20AD1

	A	B	C	D
1	○	○	○	○
2	○	○	○	○
3	○	○	○	○
4	○	○	○	○
5	○	○	○	○
6	○	○	○	○
7	○	○	○	○
8	○	○	○	○
9	○	○	○	○
10	○	○	○	○
11	○	○	○	○
12	○	○	○	○
13	○	○	○	○
14	○	○	○	○
15	○	○	○	○
16	○	○	○	○
17	○	○	○	○
18	○	○	○	○
19	○	○	○	○
20	○	○	○	○

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DO NOT WRITE ON THIS PAGE

SECTION 2—60 marks

Attempt ALL questions

1. (a) State a feature of the cell membrane which allows the movement of only some substances into the cell. **1**

_____

(b) Osmosis is a process which can occur across the cell membrane.

(i) Choose either the leaf cell or red blood cell by ticking (✓) one of the boxes below.

Describe the effect of osmosis on this type of cell if it was placed in pure water. **1**

Leaf cell ☐ Red blood cell ☐

Effect on the cell _____

_____

(ii) 1 Name a process, other than osmosis, which allows molecules to pass through the cell membrane. **1**

_____

2 Give a definition of the process chosen. **1**

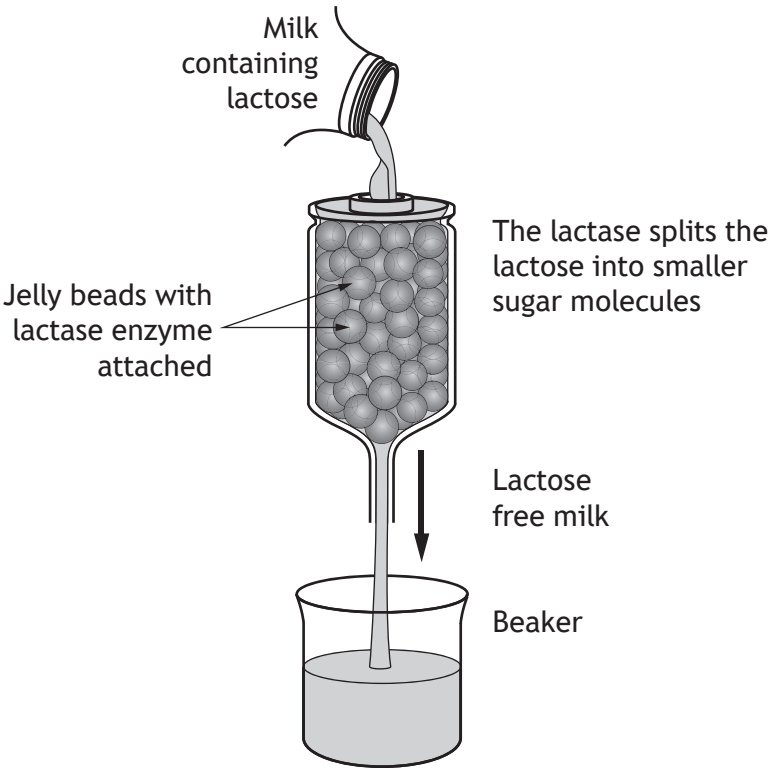
_____

_____

_____

[Turn over

2. The diagram below shows how the enzyme lactase is used in the production of lactose-free milk.



(a) (i) Underline **one** option in each of the brackets to make the following sentences correct. **2**

This process is an example of a {degradation / synthesis} reaction.

In this reaction, lactose is the {product / substrate} of lactase.

2. (a) (continued)

(ii) A fault in the production resulted in boiling water running over the lactase enzyme.

Using your knowledge of enzymes, predict how the milk produced would differ from the expected product.

Explain your answer. **2**

Prediction _____

_____

Explanation _____

_____

(b) Enzymes such as lactase are biological catalysts.

Explain the role of enzymes in living cells. **1**

_____

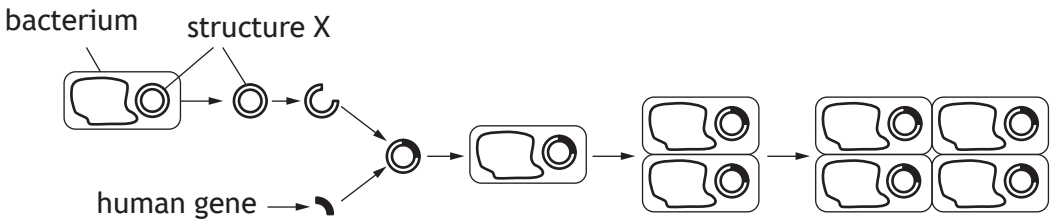
_____

(c) Name the substance of which enzymes are made. **1**

_____

[Turn over

3. The diagram below represents part of the process of genetic engineering.



(a) (i) Structure X is removed from the bacterium and modified during this process.

Name structure X. **1**

_____

(ii) The bacteria have an initial concentration of 1000 cells/cm^3.

Each cell divides once every 30 minutes.

Calculate how long it will take for the concentration to become greater than 15 000 cells/cm^3. **1**

Space for calculation

_____ hours

(b) The genetically modified bacteria are grown in a fermenter.

(i) Explain why the fermenter must be sterilised using aseptic techniques before it is used. **1**

_____

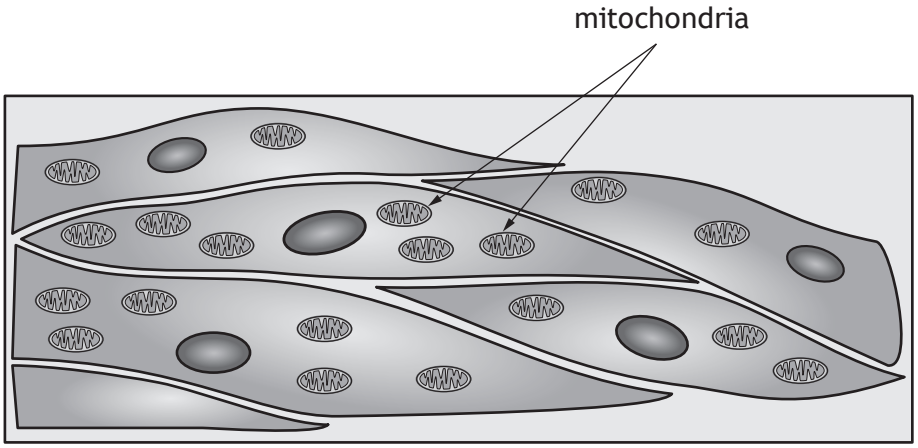
_____

(ii) The fermenter is controlled to provide optimum conditions.

Name one factor which can be controlled. **1**

_____

4. The diagram below shows muscle cells.



(a) (i) Explain why muscle cells require many mitochondria. **1**

(ii) Name **one** substance produced by a cell carrying out aerobic respiration. **1**

(b) A muscle cell will carry out fermentation when oxygen is not available.

Describe the fermentation pathway in muscle cells. **3**

5. The table below gives information about features of three different types of blood vessel.

(a) (i) Complete the table by writing the name of the missing types of blood vessels in the empty boxes. **2**

Type of blood vessel	*Diameter of central channel* (mm)	*Thickness of vessel wall* (mm)
	30·0	1·5
Capillary	0·006	0·001
	25·0	2·0

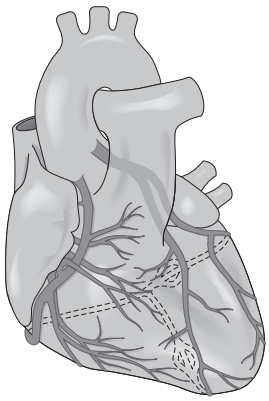
(ii) Of all the blood vessels, capillaries are best adapted for gas exchange.

Using the information in the table, give a reason for this. **1**

_____

_____

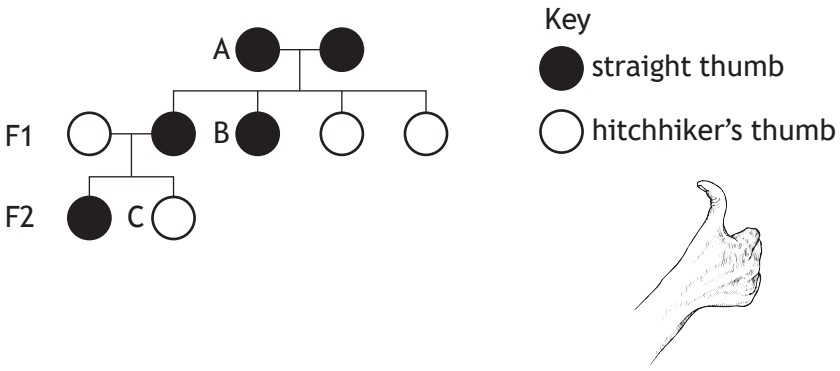
(b) The heart is a muscle which pumps blood around the body and requires its own blood supply.



Name the blood vessel which supplies the heart muscle with blood. **1**

_____

6. The following diagram represents part of a family tree showing the inheritance of hitchhiker's thumb, where the thumb can bend back as shown below.



(a) Complete the table below for individuals A and C. **2**

Individual	*Possible Genotype(s)*	*Phenotype*
A		straight thumb
B	TT or Tt	straight thumb
C	tt	

(b) In a survey of 90 students it was found that 25 of them had hitchhiker's thumb.

(i) Calculate the number of students with straight thumb to hitchhiker's thumb as a simple, whole number ratio. **1**

Space for calculation

_____ : _____

straight thumb | hitchhiker's thumb

(ii) The predicted ratio was 3 straight thumb : 1 hitchhiker's thumb.

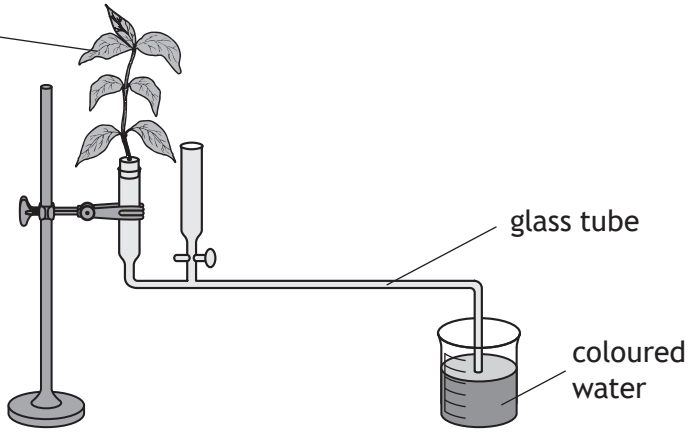
Explain why the predicted ratio was different to the actual ratio. **1**

_____

_____

7. (a) The rate of transpiration in plants can be measured using the apparatus shown below.

As the plant transpires, coloured water is drawn up the glass tube and its volume measured, over a set period of time, to give the rate of transpiration.



Changes in the surrounding environment can have an effect on the rate of transpiration.

(i) Select **one** of the environmental changes listed below by circling it.

increase in humidity	increase in temperature	increase in wind speed

State the effect of this change on the rate of transpiration. **1**

_____

(ii) Choose any of the environmental changes listed above and describe an addition to the apparatus shown, which would allow an investigation into its effect. **1**

Environmental change _____

Description of addition _____

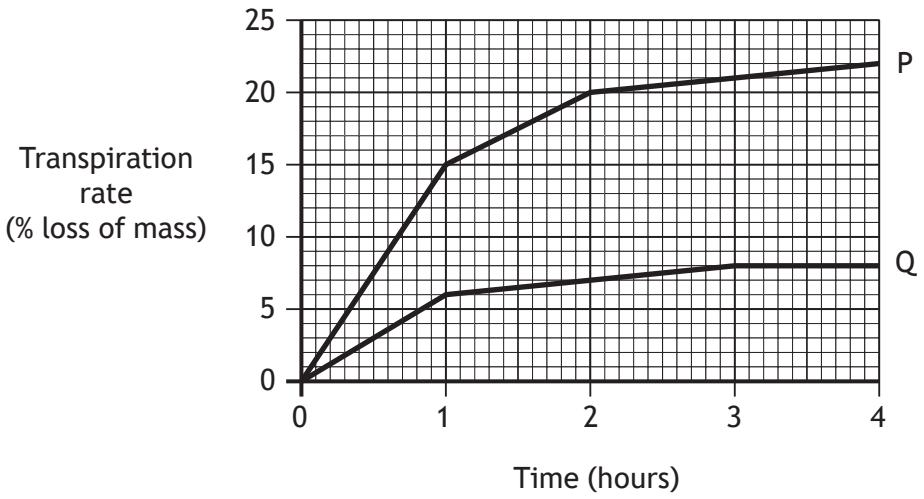
_____

_____

_____

7. (continued)

(b) The graph below shows transpiration rates of two plants, P and Q.



(i) With reference to the number of stomata, suggest a reason for the different transpiration rates of plants P and Q. **1**

(ii) Name the type of cells which control the opening and closing of stomata. **1**

[Turn over

8. Nutritional information helps people make an informed choice about the food they eat.

Table 1 – Label from a bar of chocolate

Nutritional information	*per* 100 g	*per bar*	*% RI**
Energy (kJ)	2251	630	7·5
Sugar	65 g	18 g	15·6
Protein	10 g	2·8 g	3
Total fat	25 g	7 g	10
Saturated fat	20 g	5·6 g	28
Salt	0·4g	0·1 g	1·7

*RI = Reference Intake (formerly "guideline daily amount")

Table 2 – Guidelines on salt content

Salt category	*Salt content* (g/100 g)
High	More than 1·5
Medium	0·3 to 1·5
Low	Less than 0·3

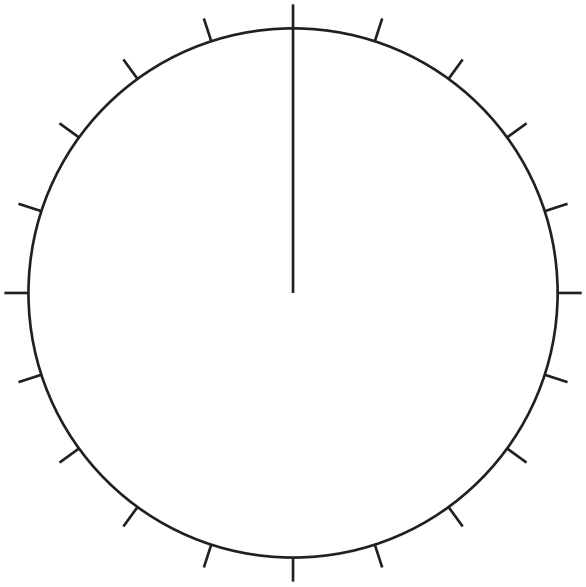
(a) Using information from **Table 1 and Table 2**, identify the salt category to which this chocolate bar belongs. **1**

_____

8. (continued)

(b) Use the information in **Table 1** to complete the pie chart below to show the composition of protein, sugar and total fat in 100 g of the chocolate. **2**

(An additional pie chart, if required, can be found on *Page 26*)



(c) (i) As shown in Table 1, saturated fat makes up part of the total fat in this chocolate bar.

Calculate the percentage of total fat which is saturated. **1**

Space for calculation

_____ %

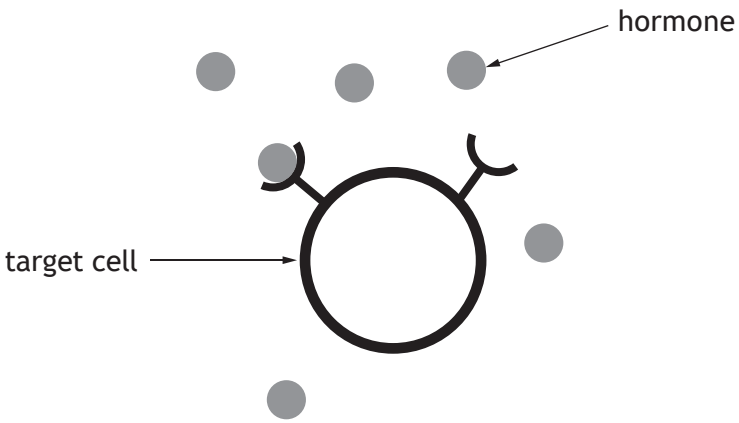
(ii) One bar of this chocolate contains 630 kilojoules which is 7·5% of the reference intake (RI).

Calculate the total number of kilojoules which should be consumed daily. **1**

Space for calculation

_____ kilojoules

9. (a) The diagram below represents a hormone binding to a cell within its target tissue.



Explain why only the target cells are affected by this hormone. **1**

_____

_____

(b) Name the type of gland that releases hormones into the bloodstream. **1**

_____

(c) Blood glucose levels are controlled by two hormones.

Underline one option in the bracket to make the following sentence correct. **1**

A decrease in blood glucose levels is detected by the pancreas

and this causes an increase in the release of { glycogen / insulin / glucagon }

into the blood stream.

10. A food chain from a river is shown below.

algae ⟶ water flea ⟶ stickleback ⟶ perch

Using the information in the food chain, answer the following questions.

(a) (i) Identify an organism which is **both** predator and prey. **1**

_____

(ii) Pesticides are known to run off from the land into rivers and enter the food chains.

Name the organism which would accumulate the greatest concentration of pesticides in its body over a period of time. **1**

_____

(b) State **one** way in which energy may be lost between stages in a food chain. **1**

_____

[Turn over

11. (a) In an investigation, students estimated the population and biomass of some organisms found on part of a rocky shore.

The table below shows the results.

Organism	*Population*	*Average mass of one organism* (g)	*Biomass of population* (g)
Seaweed	220	500	110 000
Limpet	1 100		33 000
Crab	100	90	9 000
Gull	5	700	3 500

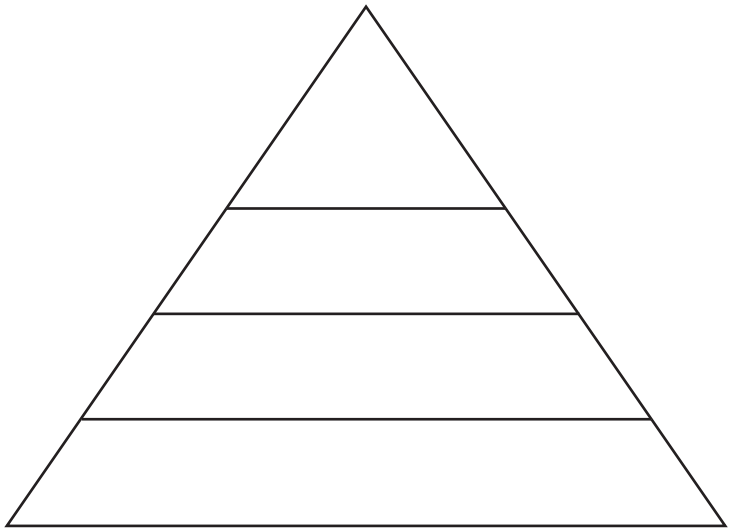
(i) Complete the table to show the average mass of one limpet. **1**

Space for calculation

(ii) The total mass of living material decreases at each level in the food chain. This can be shown as a pyramid of biomass.

Complete the diagram below by entering the names of the organisms from the table into the appropriate section. **1**

(An additional diagram, if required, can be found on *page 26*)



11. (continued)

(b) During the investigation the students found four different species of periwinkles at different positions on the rocky shore.

The highest position that the sea water reaches on the shore is called the high tide level.

The bars in the table below represent the positions on the shore where each species of periwinkle was found.

	Species of periwinkle			
Position on shore	*Small*	*Edible*	*Rough*	*Flat*
High tide level ↓ Low tide level				

(i) State which species of periwinkle is least likely to compete with the small periwinkle.

Explain your answer. **1**

Species _____

Explanation _____

_____

(ii) Using the information given, explain why the competition between these periwinkles is described as interspecific. **1**

_____

_____

12. A group of students carried out a five year investigation into plant growth in an area of abandoned farmland.

They sampled the area using quadrats.

The results are shown in the table below.

	Average abundance of each plant		
Year	*Meadow grass*	*Ragwort*	*Pink campion*
2011	8	15	9
2012	16	14	7
2013	24	12	4
2014	25	8	2
2015	25	5	1

(a) (i) Calculate the average decrease per year in the abundance of ragwort over the five-year period. **1**

Space for calculation

(ii) **Use information from the table** to suggest why the ragwort abundance decreased over the five-year period. **1**

(b) The students also sampled invertebrates such as beetles and spiders.

Name a sampling technique they could have used and describe a possible source of error with this technique. **2**

Sampling technique _____

Source of error _____

_____

12. (continued)

(c) The following table gives information about some of the flowering plants found in the area.

Plant	*Height range* (cm)	*Flower colour*	*Flowering period* (months)
Pink Campion	30–90	pink	6
Ragwort	30–200	yellow	6
Meadow Grass	30–70	green	3
Buttercup	5–90	yellow	5

Using the information in the table, complete the three boxes in the paired statement key below. **3**

1. Flower colour is yellow — go to 2

   Flower colour is not yellow — [ ]

2. Height of plant can be over 100 cm — Ragwort

   Height of plant is under 100 cm — [ ]

3. Flowering period lasts only 3 months — Meadow Grass

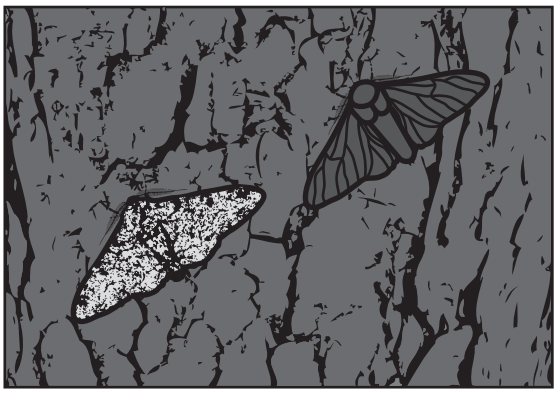
   Flowering period is longer than 3 months — [ ]

[Turn over

13. The diagrams below show the light and dark varieties of a moth which can be found in woodland areas. These moths rest on the bark of trees during the day and can be eaten by birds. Normally the bark of trees in the woodland is light coloured. However in industrial areas, pollutants cause the tree bark to darken.

Woodland area

Industrial area



(a) The dark variety of the moth is the result of a random change in the genetic information.

State the term used to describe this change. **1**

_____

(b) An investigation into the population of these moths in a woodland was carried out. The moths were captured, marked and released. 24 hours later the moths were recaptured.

The results are shown in the following table.

Variety of moth	*Number of moths marked and released*	*Number of marked moths recaptured*	*Marked moths recaptured* (%)
Light	480	264	55
Dark	520	208	40

(i) Suggest a reason why the number of the marked moths recaptured was worked out as a percentage. **1**

_____

_____

13. (b) (continued)

(ii) The woodland was in a non-industrial area.

Explain why the percentage of light moths recaptured was higher than dark moths. **1**

_____

_____

(iii) Name the process which results in the better adapted variety of moth being more likely to survive and reproduce. **1**

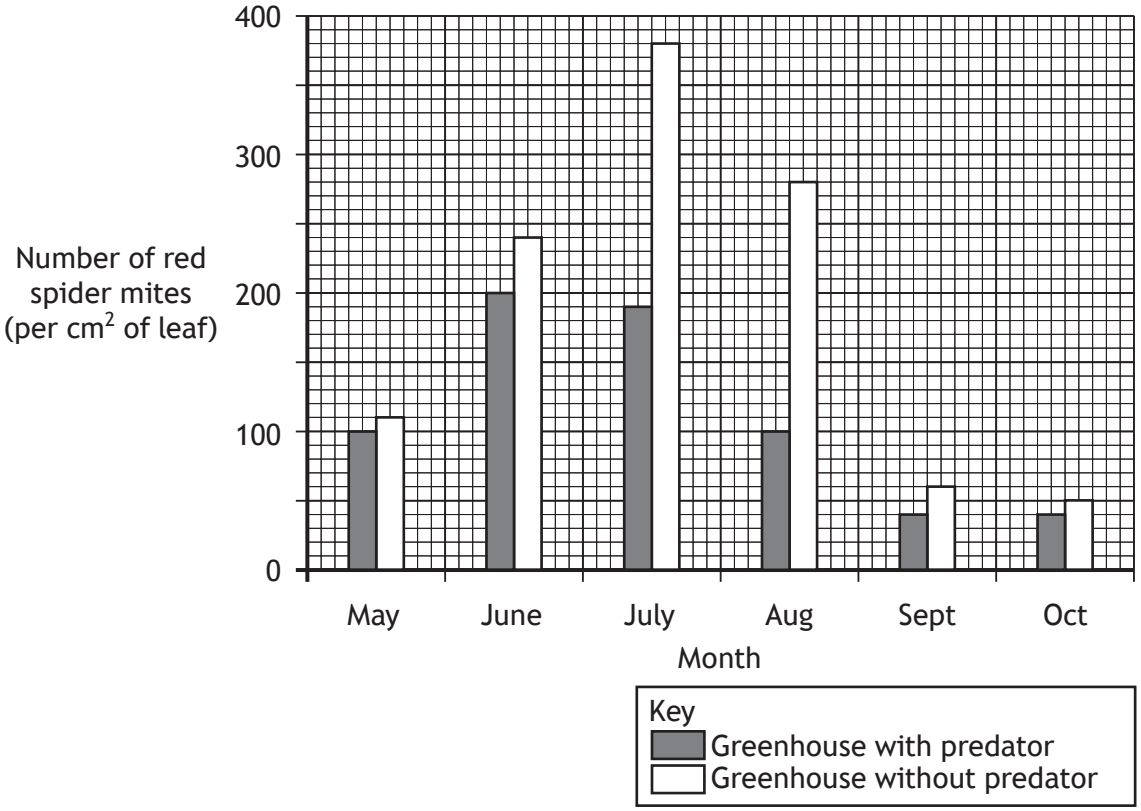
_____

[Turn over

14. Red spider mites are a common pest which destroy tomato plants. Some of the mites are resistant to chemical pesticides.

Tomato growers aimed to investigate whether a predator would reduce the spider mite numbers in their greenhouses. Two identical greenhouses were used and the predator was released into only one greenhouse.

The results are shown in the graph below.



(a) (i) With reference to the aim of this investigation, give the conclusion that the tomato growers would have drawn from these results. **1**

_____

_____

14. (a) (continued)

(ii) The greenhouse containing tomato plants without predators was included as a control experiment.

State the purpose of the control in this investigation. **1**

_____

_____

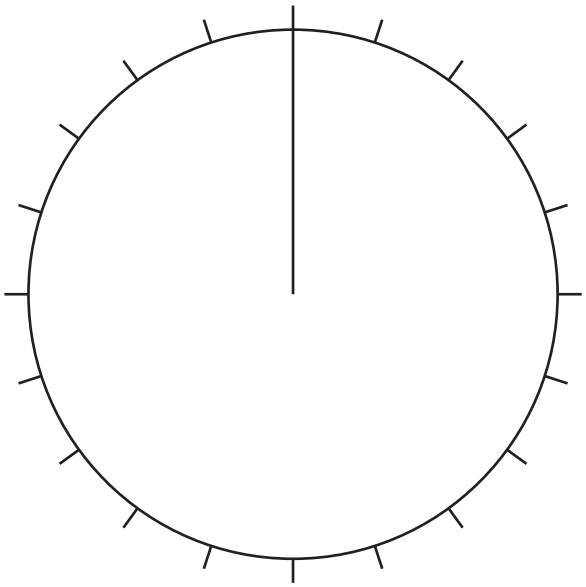
(b) State the term which describes the use of a predator as an alternative to pesticides. **1**

_____

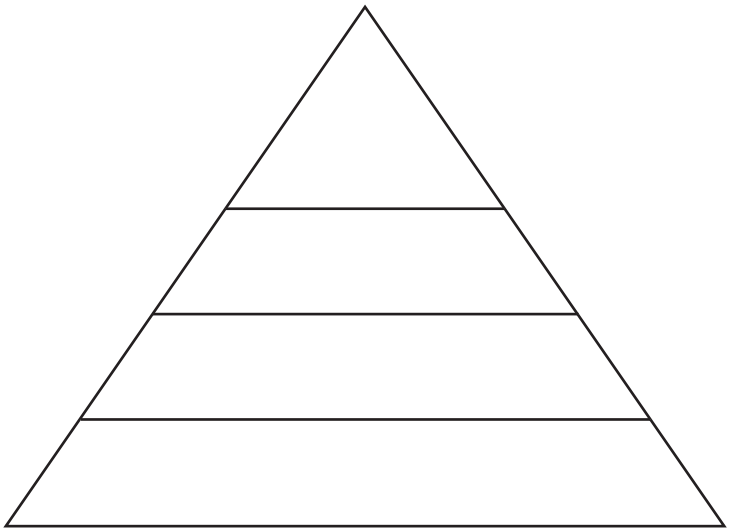
[END OF QUESTION PAPER]

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

ADDITIONAL PIE CHART FOR QUESTION 8(b)



ADDITIONAL DIAGRAM FOR QUESTION 11(a) (ii)



MARKS | DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

MARKS | DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

ACKNOWLEDGEMENTS

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