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Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | | | | | |

Candidate Number | | | | |

Thursday 4 June 2020

Morning (Time: 1 hour 30 minutes) | Paper Reference **WBI04/01**

Biology

Advanced

Unit 4: The Natural Environment and Species Survival

You must have:
Calculator, HB pencil, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*

Information

- The total mark for this paper is 90.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
  – *you should take particular care with your spelling, punctuation and grammar, as well as the clarity of expression, on these questions.*
- Candidates may use a calculator.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

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Answer ALL questions.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 Cells contain different types of RNA, including messenger RNA (mRNA), transfer RNA (tRNA) and ribosomal RNA (rRNA).

(a) Describe the role of **mRNA** in protein synthesis.

(3)

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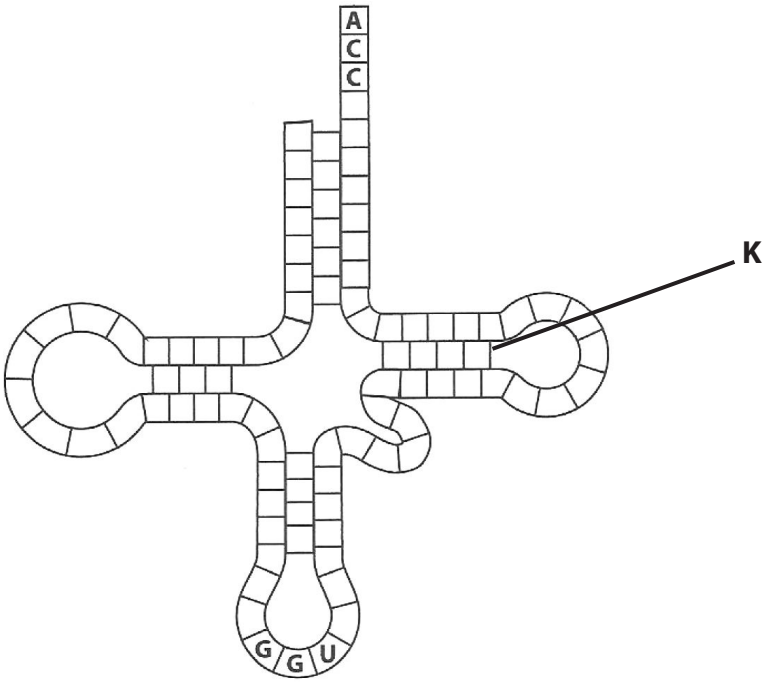
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(b) A tRNA molecule is a single-stranded polynucleotide.

It is folded into a clover-leaf shape, held together by bonds between complementary bases. One of these bonds is labelled **K**.

The diagram below shows a tRNA molecule specific for the amino acid proline.



(i) Put a cross ☒ in the box next to the name of the bond labelled **K**.

(1)

- ☒ **A** ester
- ☒ **B** hydrogen
- ☒ **C** peptide
- ☒ **D** phosphodiester

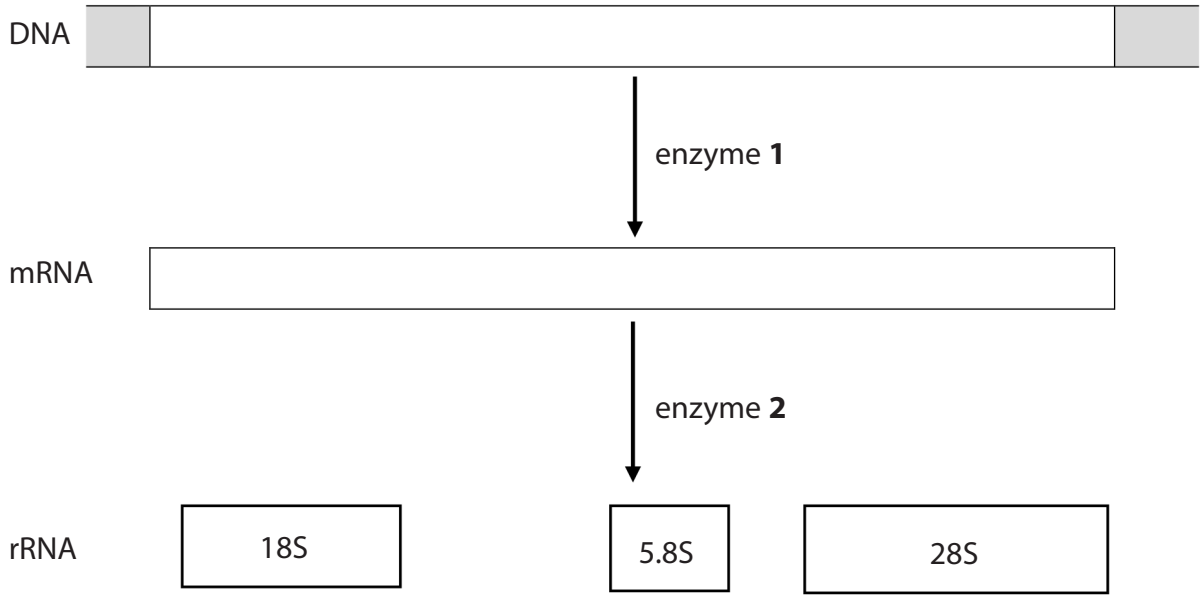
(ii) Put a cross ☒ in the box next to the mRNA codon for this tRNA.

(1)

- ☒ **A** C C A
- ☒ **B** C C T
- ☒ **C** T T G
- ☒ **D** U G G

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(c) The diagram below shows how three different types of rRNA, 18S, 5.8S and 28S, are produced from mRNA.



(i) Name the process shown in this diagram.

(1)

.....

(ii) Put a cross ☒ in the box next to the part of the cell where this process takes place.

(1)

☒ **A** cytoplasm

☒ **B** Golgi apparatus

☒ **C** nucleus

☒ **D** rough endoplasmic reticulum (rER)

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(iii) Put a cross ☒ in the box next to the name of enzyme **1**.

(1)

- ☒ **A** DNA polymerase
- ☒ **B** reverse transcriptase
- ☒ **C** RNA polymerase
- ☒ **D** spliceosome

(iv) Put a cross ☒ in the box next to the name of enzyme **2**.

(1)

- ☒ **A** integrase
- ☒ **B** reverse transcriptase
- ☒ **C** RNA polymerase
- ☒ **D** spliceosome

(v) Name the parts of the mRNA molecule removed by enzyme **2**.

(1)

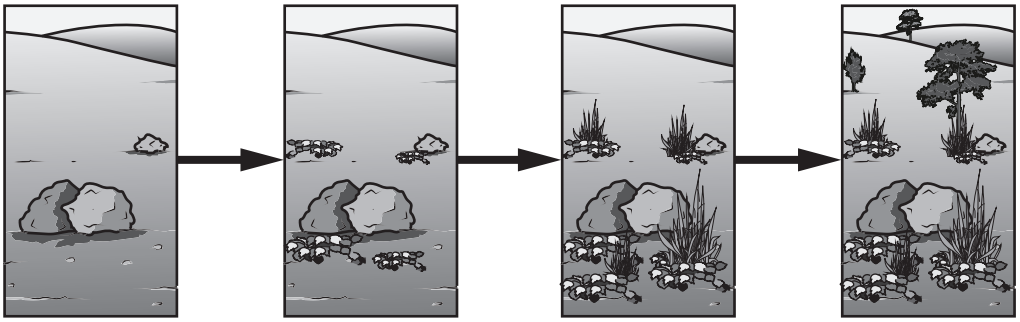
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(Total for Question 1 = 10 marks)

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2 The diagrams below show some stages that take place when bare rock becomes a climax community.



bare rock | stage **1** | stage **2** | stage **3**

(a) Explain the meaning of the term **climax community**.

(2)

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(b) Using the information in the diagrams, explain the changes between stage **1** and stage **3**.

(3)

(c) Explain what would happen if herbivores were introduced into the area at stage **2**.

(4)

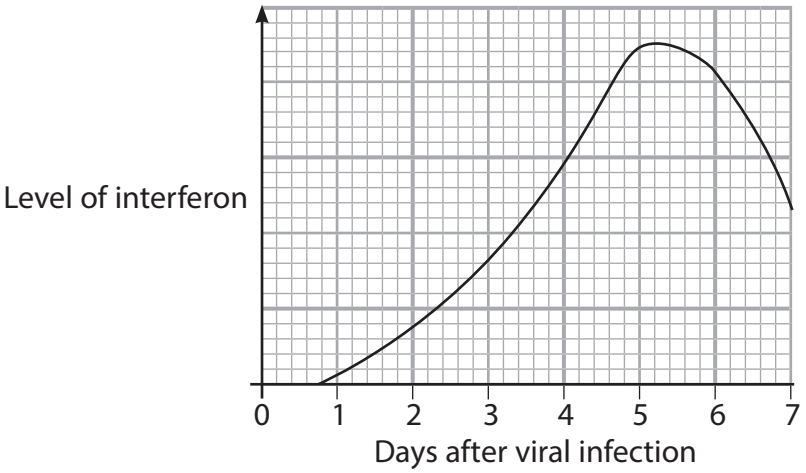
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3 The body responds to viral infections with the non-specific response and the immune response.

(a) State what is meant by the term **viral infection**.

(1)

(b) The graph below shows the levels of interferon in a person during a viral infection.



Explain the changes in the level of interferon from day 0 to day 7.

(3)

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(c) Macrophages are involved in both the non-specific response and the immune response to viral infections.

The table below shows some of the roles of macrophages in the non-specific response and in the immune response.

For each role, put one cross ☒ in the appropriate box in each row to show the role of macrophages in the non-specific response and in the immune response.

(3)

Role	Non-specific response only	Immune response only	Both the non-specific response and the immune response	Not in either type of response
phagocytosis	☒	☒	☒	☒
destruction of pathogen	☒	☒	☒	☒
antigen presentation	☒	☒	☒	☒

(d) The immune response to viral infections also involves T cells.

Distinguish between the roles of T helper cells and T killer cells in the immune response to viral infections.

(3)

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(Total for Question 3 = 10 marks)

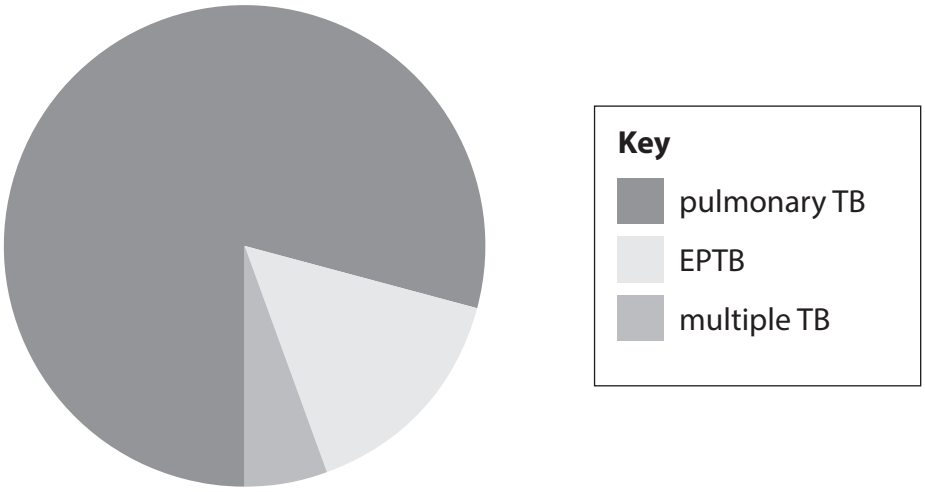
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4 *Mycobacterium tuberculosis* causes the disease tuberculosis (TB).

The table below shows one way of classifying TB.

Type of TB	Description of where the disease affects
pulmonary	lungs only
extra-pulmonary (EPTB)	organs other than the lungs
multiple	lungs and then at least one other organ

(a) The pie chart below shows the incidence of these three types of TB in one population of people.



Using the information in the pie chart, compare the incidence of these three types of TB.

(2)

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(b) (i) Explain the proportion of people with pulmonary TB.

(2)

(ii) Explain the sequence of symptoms that may result in death from pulmonary TB.

(4)

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(c) Suggest how multiple TB occurs and results in death.

(3)

(Total for Question 4 = 11 marks)

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5 Ticks are small animals that feed on the blood of other animals. The tick bites the skin and sucks out blood.

The photograph below shows a tick feeding.



Magnification × 10

(Source: © Zoonar GmbH/Alamy Stock Photo)

When an animal is bitten by a tick, chemicals called chemokines are released by cells in the skin.

Chemokines attract white blood cells into the area of the bite.

The saliva of the tick contains proteins, called evasins, that inhibit chemokines and reduce inflammation. This allows the tick to feed for longer.

(a) Suggest why reducing inflammation allows the tick to feed for longer.

(2)

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(b) Scientists have synthesised two different types of evasin, E1 and E2.

The number of amino acids in E1 is 98. The molecular mass of this evasin is 10.9 kDa.

The number of amino acids in E2 is 80.

(i) Calculate the predicted molecular mass of E2.

(2)

Answer ..... kDa

(ii) The actual molecular mass of E2 was found to be greater than the predicted value.

Explain why the actual molecular mass is different from the predicted value.

(2)

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(iii) The scientists joined these two evasins together to form E3.

Suggest how the scientists joined E1 and E2 together.

(2)

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(c) The scientists showed that evasins inhibit the migration of white blood cells towards chemokines.

Suggest why evasins could be used as a treatment to reduce the risk of cardiovascular disease (CVD).

(5)

(Total for Question 5 =13 marks)

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6 Basking sharks are an endangered species.

These sharks can be seen in the water or identified by their fin sticking out of the water.

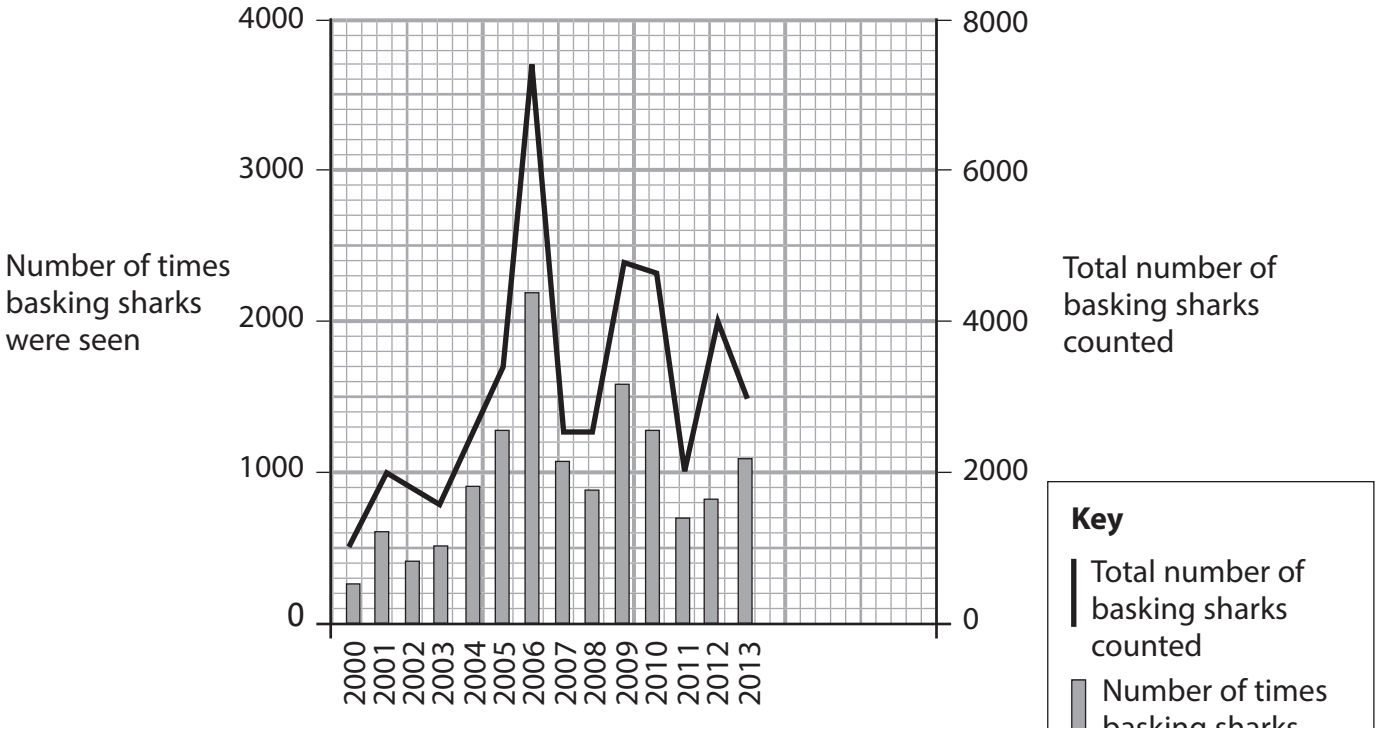
The photograph below shows a basking shark.



Magnification × 0.01

(Source: © Chris Gomersall/Alamy Stock Photo)

(a) The graph below shows the number of times basking sharks were seen and the total number of basking sharks counted around the coast of the UK, from 2000 to 2013.



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(i) State why, in any one year, the number of times basking sharks were seen is not equal to the number of sharks counted.

(1)

(ii) Suggest **two** reasons why the number of times basking sharks were seen fluctuates over the years.

(2)

(iii) Using the information in the graph, state how many basking sharks could be seen in 2015.

Explain how you arrived at this number.

(2)

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(b) Scientists used DNA profiling to determine the genetic diversity of the population of basking sharks.

(i) Describe how DNA profiling could be carried out to determine the genetic diversity of these sharks.

(4)

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(ii) Explain why scientists are concerned about the genetic diversity of these sharks.

(3)

(Total for Question 6 = 12 marks)

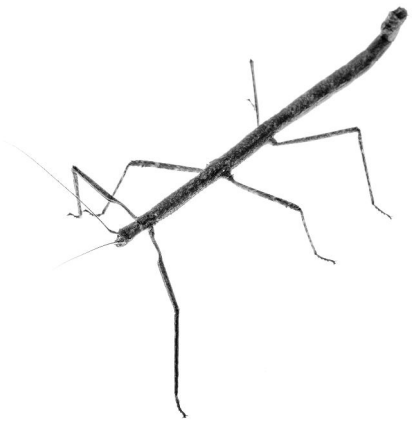
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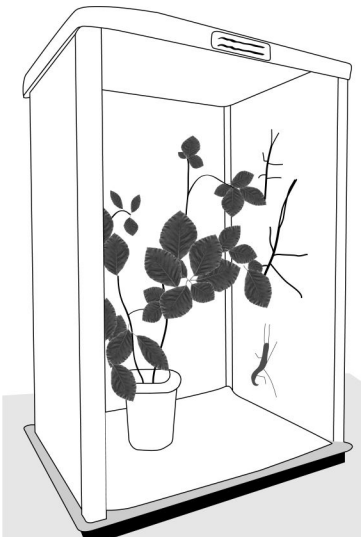
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7 Evidence from ecological field studies can be supported by laboratory investigations.

Stick insects can be kept in a school laboratory in a tank. Most stick insects are females and lay eggs readily in captivity.

The photograph below shows a stick insect. The diagram shows stick insects kept in a laboratory.



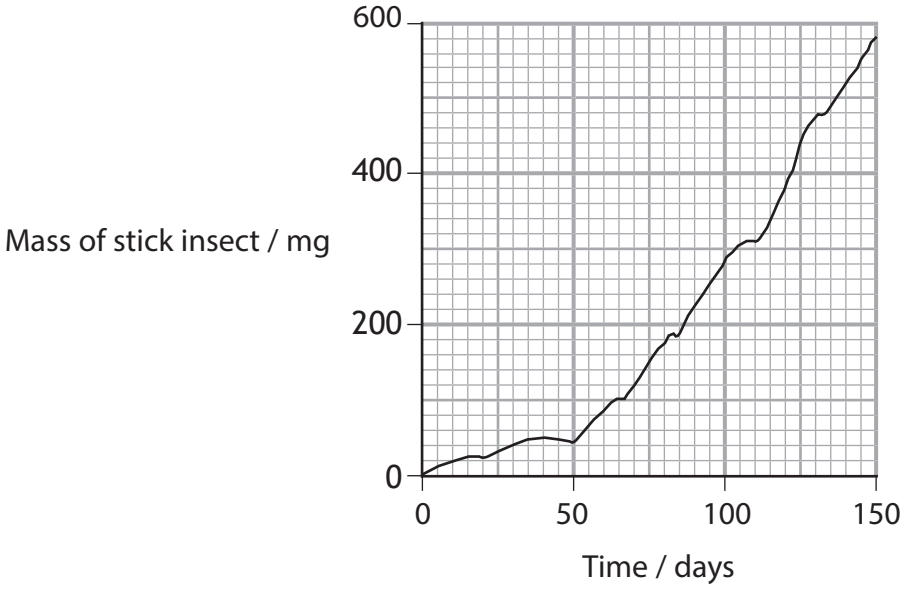


Magnification × 1

(Source: © Nature Picture Library/Alamy Stock Photo)

A student suggested that the increase in mass of a stick insect would be the same as the mass of leaves that it ate.

The graph below shows the mass of a stick insect recorded each day for 150 days.



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(a) Calculate the mean daily increase in mass of this insect from day 10 to day 130.

(2)

Answer ..... mg

(b) From day 10 to day 130, the stick insect ate 5 g of leaves.

Calculate the efficiency of mass transfer between trophic levels 1 and 2.

(2)

Answer ..... %

(c) (i) Suggest **two** reasons why the increase in mass of this stick insect is less than the mass of leaves that it ate.

(2)

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*(ii) Describe an investigation that the student could carry out to produce reliable data on the transfer of mass between leaves and stick insects.

(6)

(Total for Question 7 = 12 marks)

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8 (a) Bamboo is a fast-growing plant. It has a higher carbon fixation and oxygen emission rate than many other plants.

As a result, it has been suggested that growing bamboo could be used to reduce global warming.

*(i) One species of bamboo grows quickly in the monsoon period.

During this period, the temperature and humidity are both high, and the day length is long.

Explain why this bamboo grows quickly in the monsoon period.

(6)

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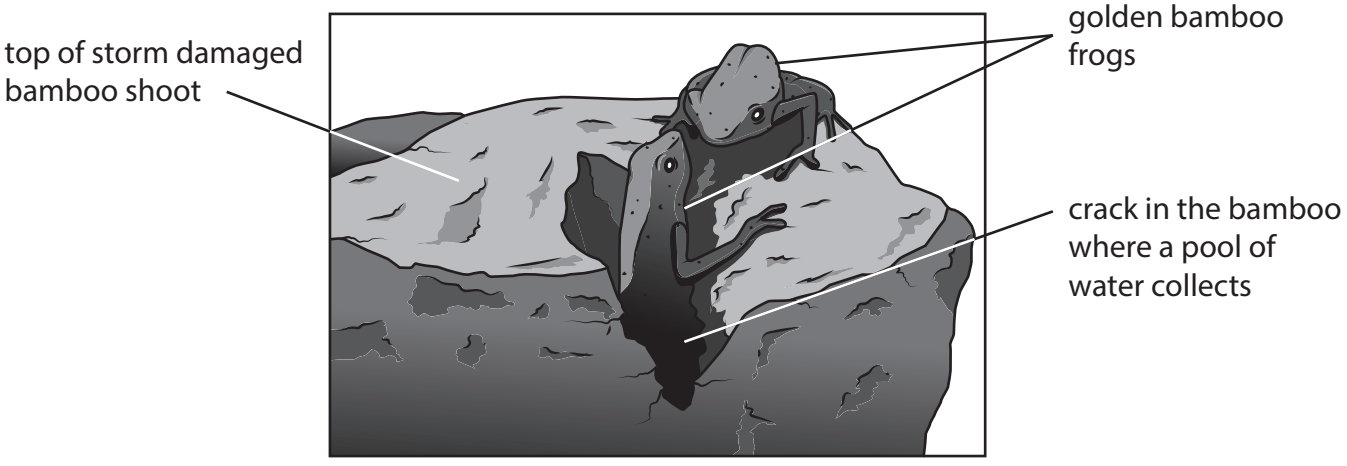
(ii) Explain why growing bamboo could reduce global warming.

(3)

(b) The golden bamboo frog is endemic to a very dry part of Madagascar.

This frog lays its egg in a small pool of water that collects in a storm damaged bamboo shoot.

The diagram below shows two golden bamboo frogs on top of a storm damaged bamboo shoot.



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Below are some facts about golden bamboo frogs and the pools of water that collect in storm damaged bamboo shoots:

- the female will not allow the male to mate with her in a pool where another female has already laid an egg
- the female lays only one fertilised egg
- the female returns to the pool of water and lays unfertilised eggs
- there is very little food in the pool.

Using the diagram and the information above, explain how the golden bamboo frog is adapted to living in this part of Madagascar.

(4)

(Total for Question 8 = 13 marks)

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