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Tasmanian Certificate of Education

BIOLOGY

Senior Secondary 5C

Subject Code: BIO5C

External Assessment

2006

Part 1

Time: 35 minutes

On the basis of your performance in this examination, the examiners will provide a result on the following criterion taken from the syllabus statement:

Criterion 4 Develop and evaluate experiments.

Section Total

/34

Pages: 11
Questions: 4

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CANDIDATE INSTRUCTIONS

Candidates **MUST** ensure that they have addressed the externally assessed criterion on this examination paper.

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The 2006 Biology Information Sheet can be used throughout the examination.

Question 1

A student used beetroot tissue to investigate the properties of cell membranes. Beetroot cells contain a strongly coloured red pigment. Beetroot pieces were placed in water at different temperatures and changes in the colour of the water were recorded as follows:

Table of Results

Tube	Temperature (°C)	Intensity of colour of water (0-10)
A	18	0
B	30	1
C	40	5
D	60	10

- (a) State one hypothesis that this experiment may have been designed to test. (3 marks)

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- (b) (i) State the dependent variable in your hypothesis. (1 mark)

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- (ii) State the independent variable in your hypothesis. (1 mark)

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- (c) Describe the control you would use in this experiment, explaining carefully what its purpose would be. (3 marks)

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Question 1 continues opposite.

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Question 1 (continued)

- (d) What additional information would you need to be confident about the accuracy and reliability of these results? (3 marks)

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The research department of a forestry company has been asked to compare the photosynthetic rate of leaf tissue from five species of *Eucalyptus* trees. The researchers chose to use the leaf disc method for their investigation:

When leaf discs are cut from fresh leaves and kept in water containing CO_2 they remain alive and are able to photosynthesise. Normally such leaf discs would float in water, but if air is removed from the spongy mesophyll air spaces by creating a low pressure, they will become less buoyant and sink. When the leaf discs photosynthesise they produce oxygen, become buoyant and float to the surface of water. The faster the discs rise, the faster the rate of photosynthesis.

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Question 3**For
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The average age at which puberty starts for young women has been getting lower over the past 20 years. Scientists believe that this trend could be linked to female hormones that are being used in food production.

- (a) Outline two significant problems that are likely to occur when investigating the link between the onset of puberty in girls and the exposure to these hormones. (4 marks)

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- (b) Suggest a way of investigating this link without directly experimenting on humans. Evidence collected would still need to be reliable and meaningful. (3 marks)

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Question 4

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A pulp and paper mill has started processing timber on the north coast of Tasmania. To protect the beaches and inter-tidal zone this mill pumps its waste material four kilometres out into Bass Strait. The pipeline containing the waste material lies on the sea-bed. The mill has published details of the make-up of the waste material, stating that it contains no toxins and will have no impact on marine life.

As part of an independent environmental impact group you are asked to collect samples of water and marine life in order to test the claims of the pulp mill. Outline where you would collect samples from and what types of materials you would collect. (6 marks)

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BIOLOGY

Senior Secondary 5C

Subject Code: BIO5C

External Assessment

2006

Part 2

Time: 35 minutes

On the basis of your performance in this examination, the examiners will provide a result on the following criterion taken from the syllabus statement:

Criterion 7 Demonstrate knowledge and understanding of the chemical basis of life.

Section Total

/33

Pages: 11
Questions: 5

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CANDIDATE INSTRUCTIONS

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Question 5

Complete the table below by filling in the missing information:

(3 marks)

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Class of Biological Compound	Sub-unit (Building block)	Function (List one only)
1.		Enzymes
2. Carbohydrates		
3.	Fatty acids and Glycerol	

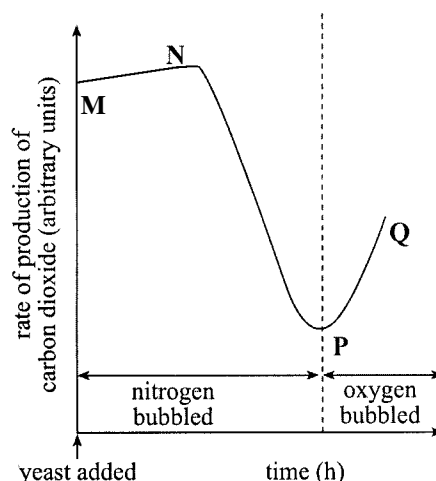
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Question 6**For
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An experiment was carried out to investigate the rate of production of carbon dioxide by yeast cells.

Nitrogen gas was bubbled through a glucose solution overnight to remove any dissolved oxygen. A deoxygenated suspension of yeast cells was then added to the glucose solution. Nitrogen continued to be bubbled through the glucose and yeast mixture. The nitrogen supply was then ceased and oxygen was bubbled through the mixture.

Throughout the experiment, the rate of production of carbon dioxide was measured. The results obtained are shown in the following graph:



(a) Name the biochemical processes that are occurring: (2 marks)

(i) Between points M and N:

(ii) Between points P and Q:

(b) Explain why the yeast cells released energy more efficiently between points P and Q than between points M and N. (4 marks)

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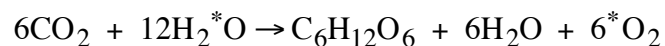
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Question 7**For
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- (a) The following equation describes the formation of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) by a green alga living in freshwater. The oxygen atoms in the water have been radioactively labelled.



* denotes radioactive atoms.

- (i) What process is this equation summarising? (1 mark)

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- (ii) What important information about this process is gained by the use of radioactive labelling? Explain your answer. (2 marks)

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Question 7 continues over the page.

Question 7 continued**For
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- (b) A biologist was examining a single-celled organism found on the bottom of a shallow sea. The biologist carried out a number of tests when studying the organism and found that it:

- reproduced by splitting into two equal halves;
- contained no chlorophyll;
- could survive in water without oxygen but reproduced much more rapidly when oxygen was present;
- could not survive in water without carbon dioxide unless glucose was present.

The biologist observed that when the organism was subjected to greater light intensity its rate of reproduction increased. The biologist concluded that this organism was able to photosynthesise but used a chemical other than chlorophyll to capture light energy.

- (i) Explain the evidence that supports the conclusion that this organism was able to photosynthesise. (4 marks)

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- (ii) Further study of the organism enabled the biologist to identify a chemical that was thought to have the same function as chlorophyll. The biologist carried out an experiment in which cells with different concentrations of this chemical were exposed to identical conditions.

State the results that would indicate that this chemical was involved in photosynthesis. (2 marks)

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Question 8**For
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- (a) During their work in establishing the structure of DNA, Watson and Crick were interested in the proportion of nucleotides in skin cells from a particular organism. They considered the results from three different laboratories. The result of each of the laboratories was as follows.

	Laboratory 1					Laboratory 2					Laboratory 3			
Nucleotides in DNA	A	T	C	G		A	T	C	G		A	T	C	G
percentage	29	19	21	31		30	29	20	21		29	32	19	20

If Watson and Crick had only considered the results from Laboratory 1, how might their model of DNA have been different from the one we know today? (2 marks)

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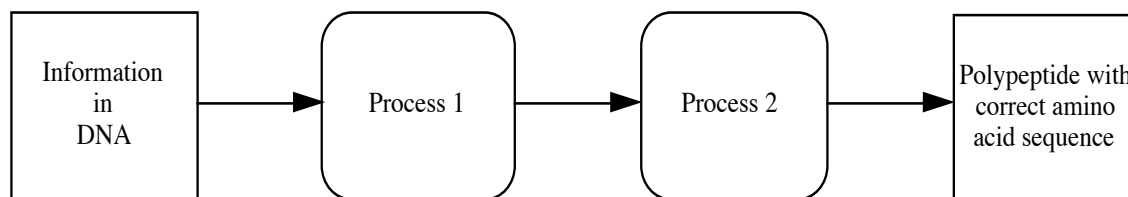
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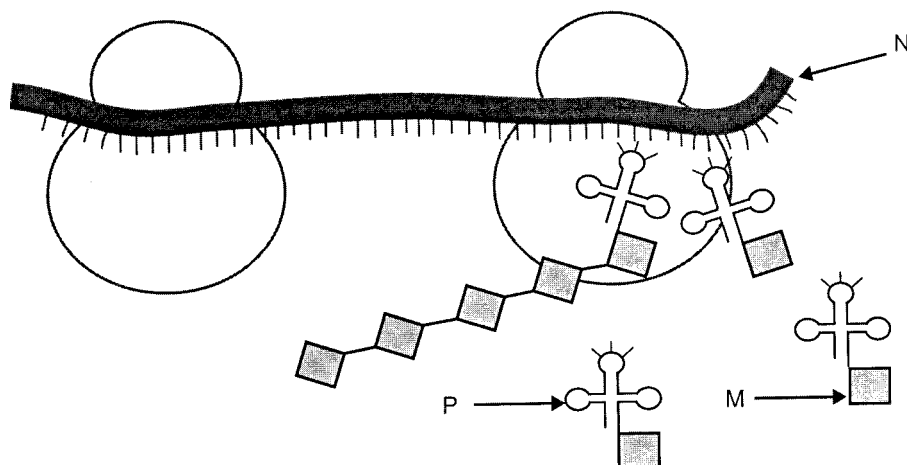
Question 8 continues over the page.

Question 8 (continued)

(b) Consider this flowchart showing protein synthesis:



(i) This diagram represents one of the processes in the above flowchart.



(i) Which process is it (1 or 2)?

Name the process: (1 mark)

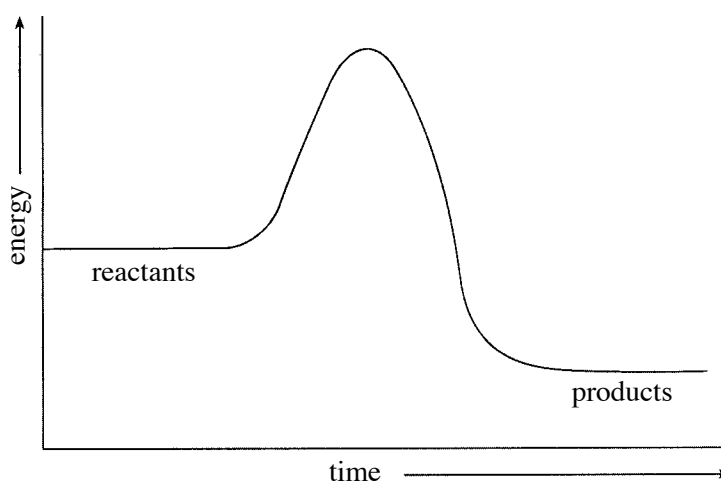
(ii) Two of the labelled structures in the above diagram are different forms of the same molecule. Identify and name these two structures and by describing their functions, demonstrate your understanding of the process that you have named in (i). (6 marks)

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Question 9

(a)

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The graph above shows the change in energy during a biological reaction that has **not** been catalysed by an enzyme.

- (i) Draw a line on the graph (in a different colour) to show the change in energy that would occur if an enzyme was present. (1 mark)
- (ii) Why do chemical pathways in living systems involve many, small steps? (2 marks)

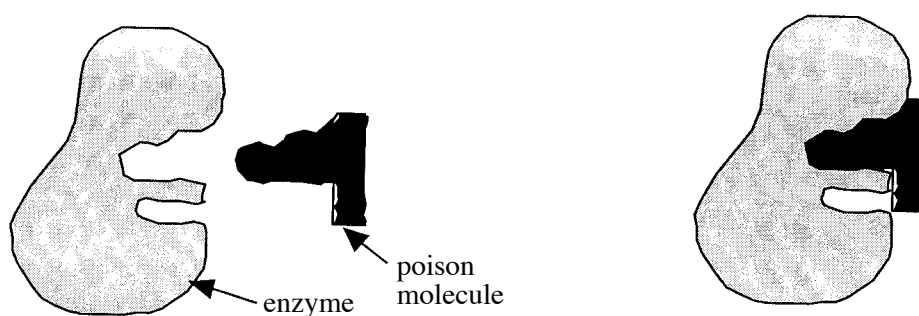
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- (b) Some of the most feared weapons of modern warfare involve nerve gases that inhibit enzyme activity. Using the diagram to assist you, explain how these gases may impact on cellular respiration. (3 marks)



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Tasmanian Certificate of Education

BIOLOGY
Senior Secondary 5C

Subject Code: BIO5C

External Assessment

2006

Part 3

Time: 35 minutes

On the basis of your performance in this examination, the examiners will provide a result on the following criterion taken from the syllabus statement:

Criterion 8 Demonstrate knowledge and understanding of cells.

Section Total
/33

Pages: 11
 Questions: 5

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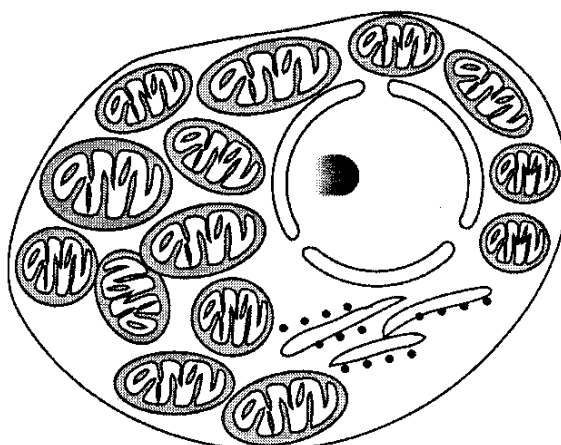
Answer **ALL** questions. Answers must be written in the spaces provided on the examination paper.

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The 2006 Biology Information Sheet can be used throughout the examination.

Question 10

Consider this diagram of a section through a cell.



- (a) Give a piece of evidence that indicates this is an animal cell. (1 mark)

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- (b) Suggest a human tissue that this cell might be found in and explain why you have chosen this location. (3 marks)

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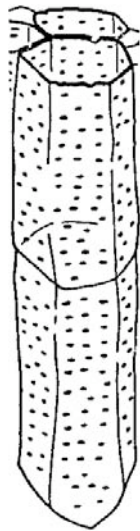
- (c) This cell diagram was drawn from an electron micrograph. Give one piece of evidence that supports this. (1 mark)

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Question 11

(a) These cells are involved in plant transport:

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II

Name these cells and contrast them in terms of their structure and function. (5 marks)

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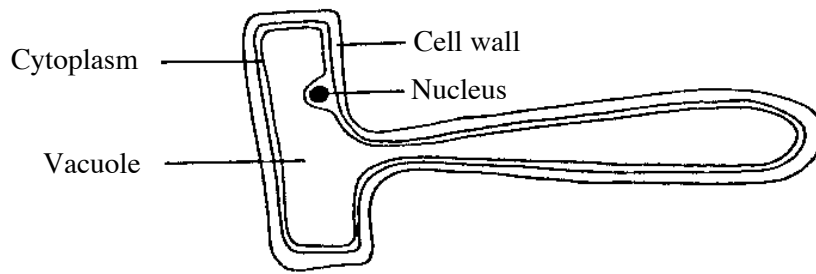
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Question 11 continues over the page.

Question 11 (continued)

(b) This cell comes from the root of a plant:



Describe **exactly** how this cell's unique structure facilitates its specialist function. (3 marks)

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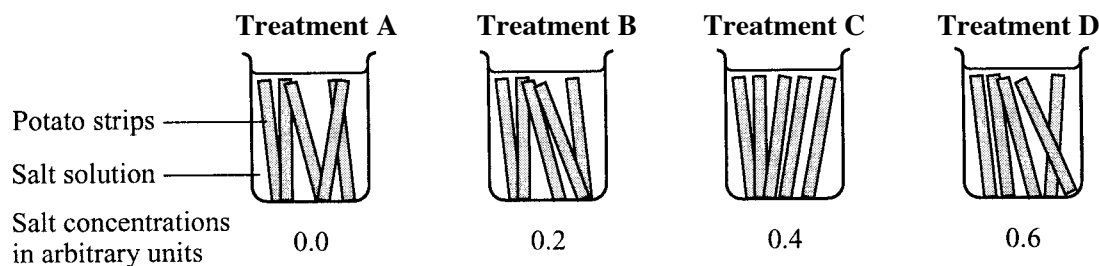
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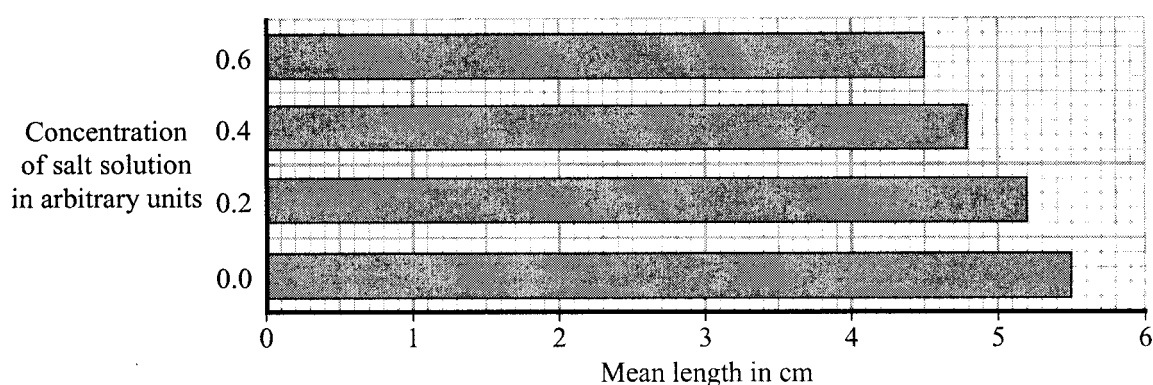
Question 12

Thin strips of potato tissue were cut. They were all the same width and exactly 5cm long. They were placed in a series of salt solutions of different concentrations.



After two hours, the strips were removed and their length was measured.

The mean length of the strips of potato was recorded and is shown on the chart.



- (a) Explain **all** the results observed in this experiment in terms of the physiological processes occurring in the potato tissue. (5 marks)

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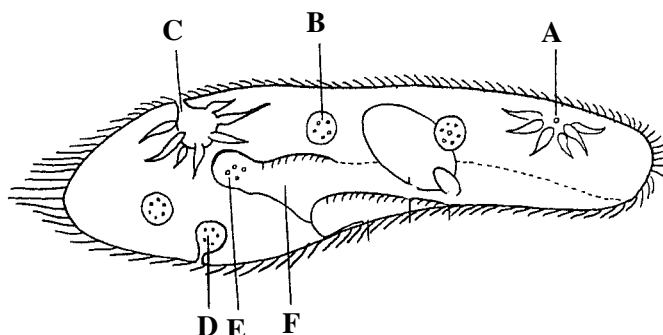
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- (b) Estimate the natural salt concentration that is found in potato cells. (1 mark)

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Question 13

Consider this diagram of a unicellular protozoan:



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(a) Structures **B**, **D** and **E** all contain food particles which enter the cell via structure **F**.

(i) Name structure **B** and describe what is happening inside it. (2 marks)

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(ii) If structure **D** is an older version of structure **B** then what process is occurring in it. Describe this process. (2 marks)

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(b) Structures **A** and **C** are the same organelle. Name this organelle and describe how it enables this protozoan to live in fresh water. (4 marks)

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Question 14

- Mitosis occurs throughout the bodies of multicellular animals.
- Mitosis occurs in specialised regions of multicellular plants.
- Meiosis occurs in specialised regions of both multicellular animals and plants.

With reference to the above information demonstrate that you understand the significance of both types of cell division in terms of the growth, maintenance and reproduction of multicellular animals and plants. (6 marks)

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Tasmanian Certificate of Education

BIOLOGY

Senior Secondary 5C

Subject Code: BIO5C

External Assessment

2006

Part 4

Time: 35 minutes

On the basis of your performance in this examination, the examiners will provide a result on the following criterion taken from the syllabus statement:

Criterion 9 Demonstrate knowledge and understanding of organisms.

Section Total

/32

Pages: 11
Questions: 5

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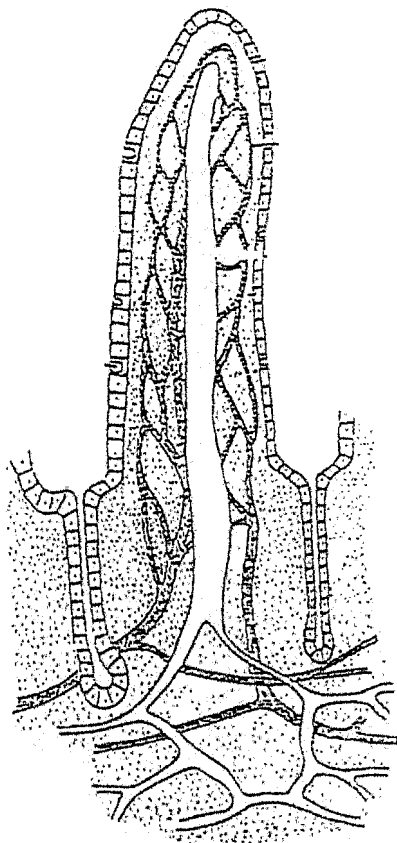
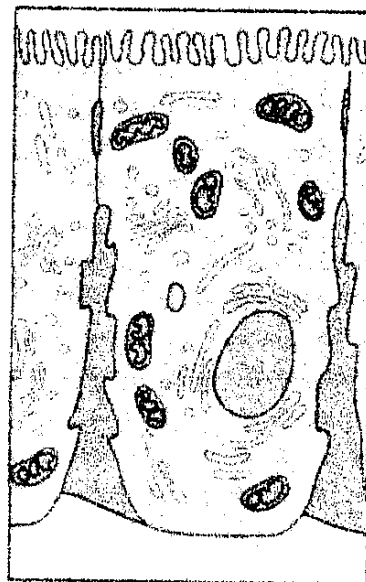
You should make sure you answer all parts within each question so that the criterion can be assessed.

The 2006 Biology Information Sheet can be used throughout the examination.

Question 15

Consider these diagrams of structures which are found within the human digestive system.

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**A****B**

- (a) Describe how structure **B** is part of structure **A**. (2 marks)

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Question 15 continues over the page.

Question 15 (continued)

- (b) With reference to both diagrams **A** and **B**, relate visible structures to the efficiency of food absorption in humans. (6 marks)

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Question 16

This table shows the results of the analysis of urine samples of three organisms.

Organism	Terrestrial mammal	Freshwater fish	Marine fish
<i>Urine concentration</i>	concentrated	dilute	concentrated
<i>Form of nitrogen waste</i>	urea	ammonia	urea

Using information from the table, explain the differences in urine concentration of these three organisms. (6 marks)

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Question 17

One way of determining the metabolic rate of a mammal is to measure the amount of oxygen it uses over time. Larger mammals use more oxygen than smaller mammals use, and so the metabolic rate is usually expressed as the volume of oxygen consumed per unit of body mass.

The table below shows the metabolic rates of some mammals.

Mammal	Body mass (kg)	Metabolic rate measured as oxygen consumption per unit of body mass (mL/Kg)
mouse	0.025	1600
rat	0.23	870
rabbit	2.20	470
dog	12	320
human being	70	200
horse	700	110
elephant	3800	67

Explain why heat loss can account for the fact that the mouse has the highest metabolic rate of the mammals listed in the table. (4 marks)

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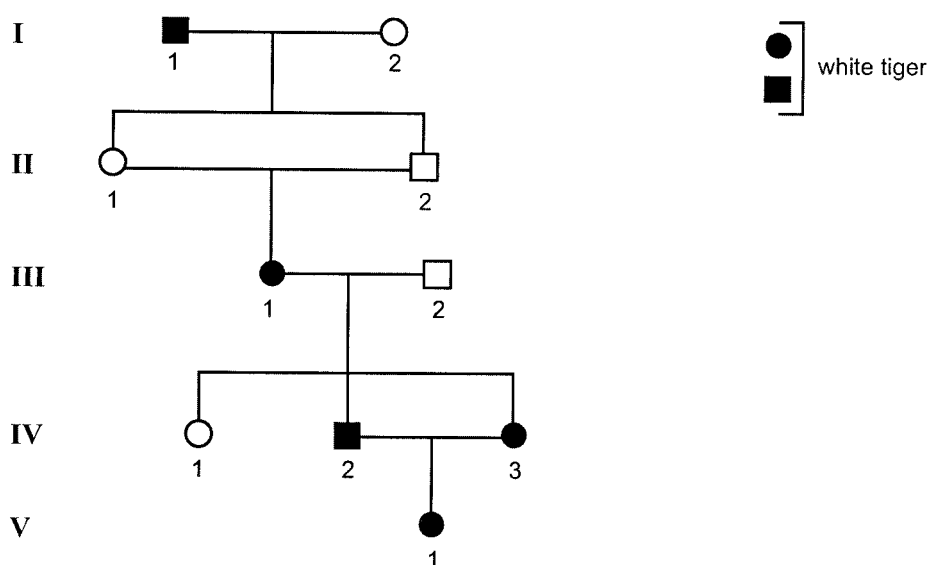
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Question 18**For
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The pedigree below represents the ancestry of a white female tiger, V-1, bred in a zoo. As with domestic animals inbreeding is quite common. For example on this pedigree II-1 is mated to her brother, II-2, and IV-2 mated with his sister, IV-3.



In tigers the combination of sex chromosomes is similar to that in humans. Refer to the pedigree when answering the following questions.

- (a) With reference to the individual III-1 explain why the allele for white coat colour cannot be X-linked recessive. (3 marks)

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- (b) Explain why the allele for white coat colour cannot be X-linked dominant. (3 marks)

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Question 18 continues over the page.

Question 18 (continued)**For
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- (c) Explain whether there is enough information on the pedigree to distinguish between autosomal dominant and autosomal recessive inheritance for white coat colour. (2 marks)

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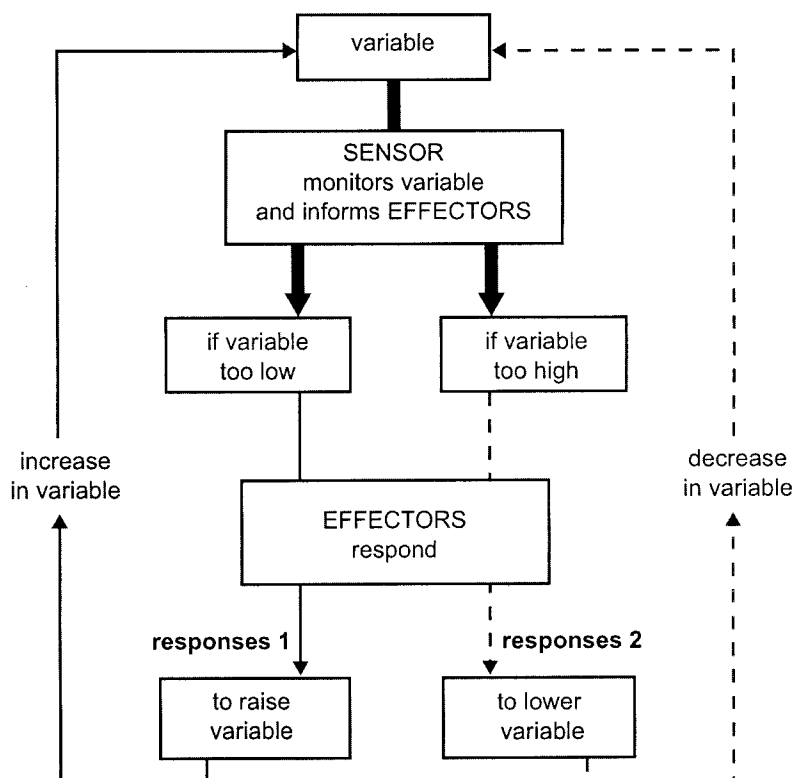
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Question 19

One way in which the general principle of homeostasis can be outlined is given in the following diagram.

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Explain how the regulation of blood glucose in humans fits this model. Your answer should include reference to the term 'negative feedback'.

(6 marks)

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Tasmanian Certificate of Education

BIOLOGY

Senior Secondary 5C

Subject Code: BIO5C

External Assessment

2006

Part 5

Time: 35 minutes

On the basis of your performance in this examination, the examiners will provide a result on the following criterion taken from the syllabus statement:

Criterion 10 Demonstrate knowledge and understanding of the interaction of organisms in their environment.

Section Total

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Pages: 15
Questions: 4

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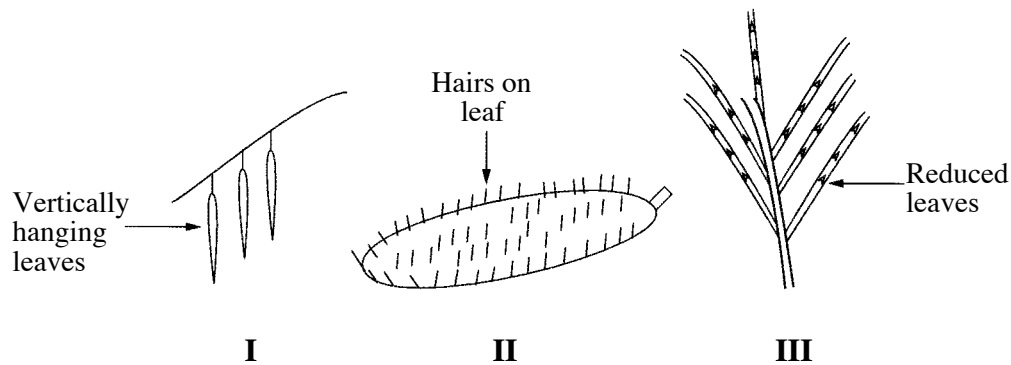
You should make sure you answer all parts within each question so that the criterion can be assessed.

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Question 20

- (a) The features shown in the diagram are adaptations found in some Australian plants.

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- (i) What do these adaptations help to achieve? (1 mark)

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- (ii) Explain how each adaptation achieves this purpose. (3 marks)

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II:

III:

Question 20 continues opposite.

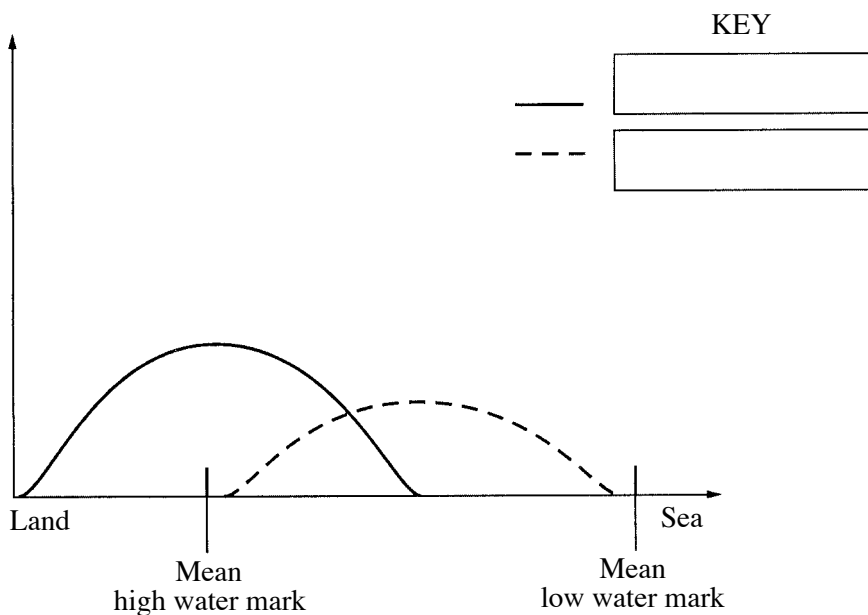
Question 20 (continued)

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- (b) The graph illustrates the relative distribution of two species of mangrove growing on the margin of an estuary.

The main characteristics of the leaves of these mangrove plants are:

<i>Mangrove</i>	<i>Characteristics</i>
Species A	Leaves covered with salt crystals
Species B	Leaves with thick waxy cuticles



Complete the KEY in the boxes provided above, to identify which line represents Species A and which line represents Species B. Justify your answer below: (4 marks)

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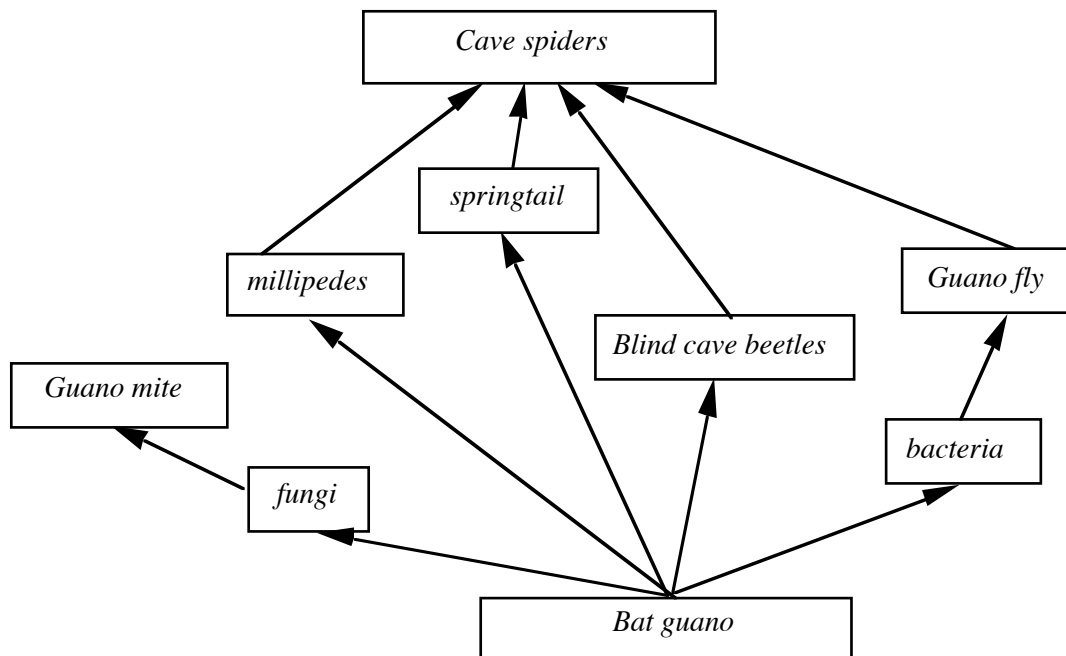
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Question 21

There are many caves in Australia. Even though the cave is a dark, barren environment, many organisms inhabit caves and show special adaptations to that environment. Bats, however, do not live permanently in caves, but roost there during resting times and breeding times. The bats leave the cave to feed on insects in the outside community. The following is a food web from a cave on the Nullarbor Plain in South Australia:



- (a) All ecosystems ultimately rely on autotrophic organisms. Explain what their role is and identify their location in the ecosystem described above. (3 marks)

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- (b) Discuss the niche of the bacteria and fungi in this ecosystem and compare this to the niche that these organisms usually occupy. (2 marks)

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Question 21 continues opposite.

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Question 21 (continued)

- (c) A biologist collected the animals living in and on a sample of bat guano:

Cave Organism	Population count in Guano sample
Cave Spiders	10
Millipedes	87
Springtails	126
Blind Cave Beetles	113
Guano Mite	36
Guano Fly	42

Explain the data in terms of your understanding of energy flow through an ecosystem:
(3 marks)

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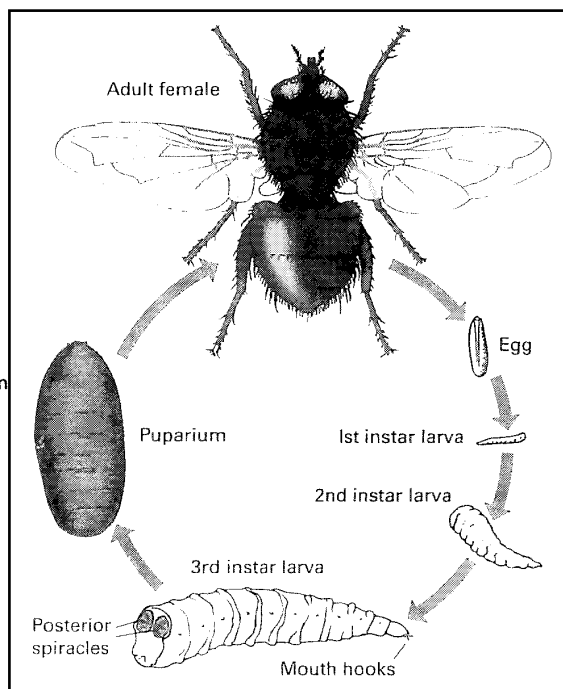
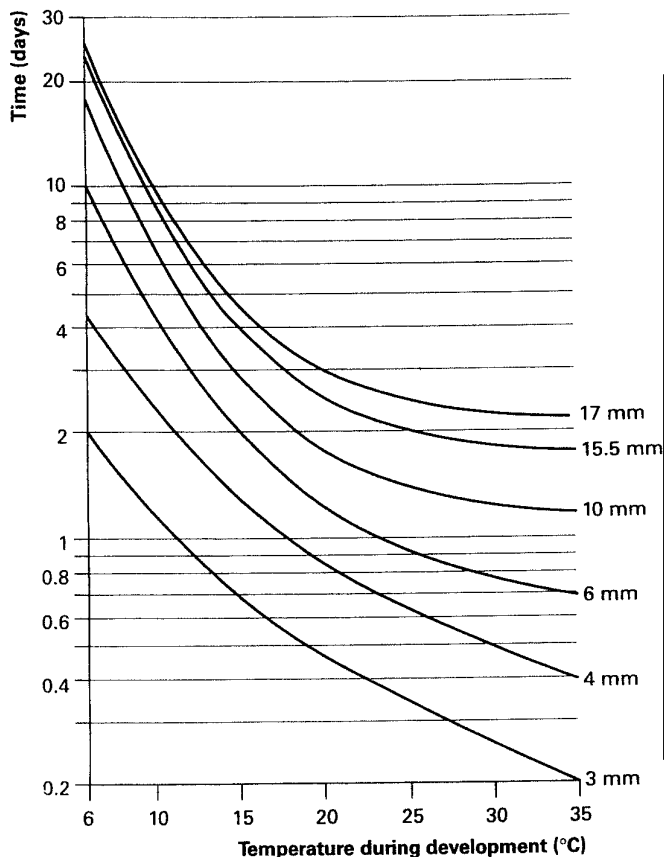
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Question 22**For
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The strong correlation between maggot development and temperature in the environment allows forensic scientists to use maggot size to predict (within hours) how long a corpse has been dead. The data provided here is for the common blue bottle blowfly (*Calliphora vicina*).

Graph showing how temperature and time affect the length of bluebottle larvae.



- (a) Estimate how long ago a 6mm long bluebottle larva hatched from the egg, if the temperature was: (2 marks)

(i) 10°C:

(ii) 30°C:

- (b) What is the range of times it can take for a bluebottle larva to reach full size? (1 mark)

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Question 22 continues opposite.

Question 22 (continued)**For
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- (c) A dead rabbit was found by the side of the road. A number of maggots were found feeding on it. The largest maggot was 8mm long. The temperature was 17°C. A group of students decided to use the graph to estimate how long the rabbit had been dead.

- (i) Explain why they would need to know the species of maggot on the body of the rabbit before using the graph. (2 marks)

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- (ii) Give two reasons why the estimate they made might have been unreliable. (2 marks)

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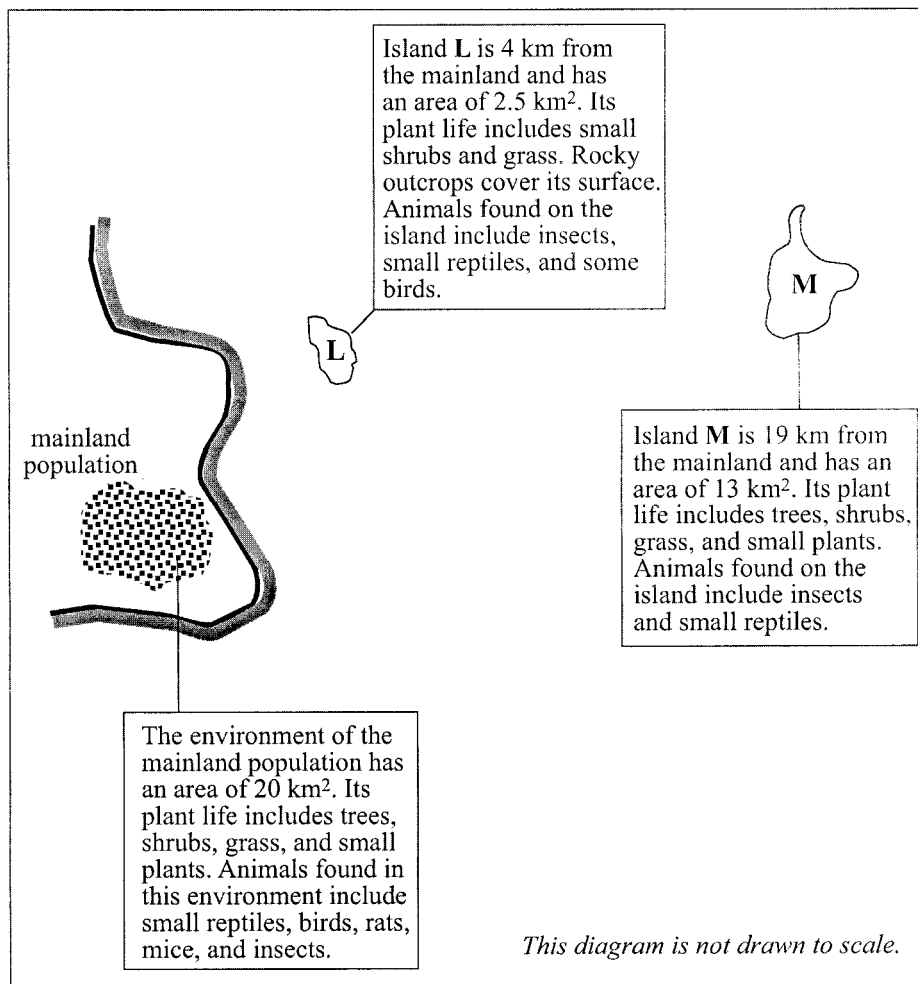
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Question 23

- (a) One method of conserving endangered bird species involves capturing mainland birds and establishing small populations of them on isolated offshore islands. These islands are chosen because they are free from introduced species that are found on the mainland.

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Refer to the following diagram, which shows data about the environment of a mainland population of an endangered bird species, and data about the environment on two nearby offshore islands, **L** and **M**.



The birds in the mainland population are known to nest among the long grass and low shrubs in the shelter of the trees. They feed on seeds, insects, and small reptiles.

Scientists decide to move a number of endangered birds from the mainland population to one of the nearby offshore islands. They establish the new population on island **M** rather than on island **L** to minimise the risk of speciation.

Question 23 (a) continues opposite.

Question 23 (a) (continued)

Explain why a population on island **M** is less likely than a population on island **L** to undergo significant change which may ultimately lead to speciation. (6 marks)

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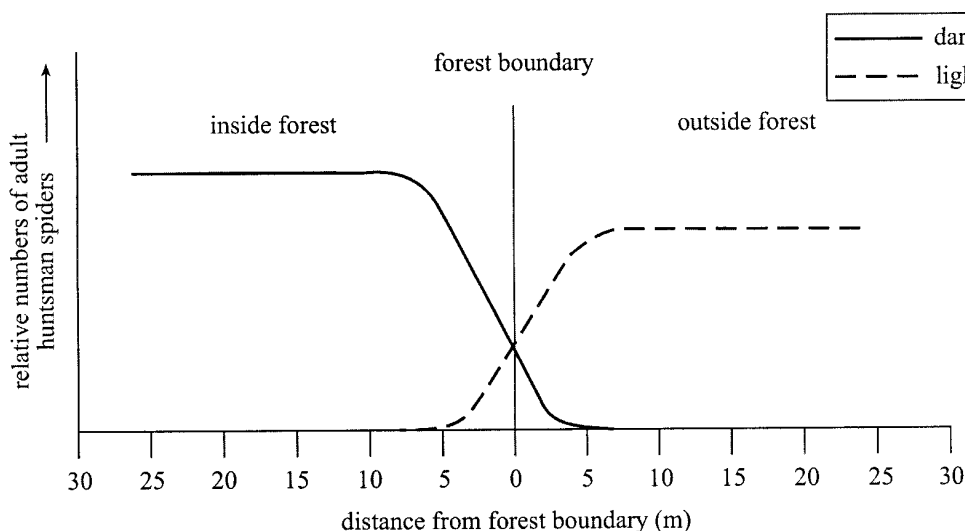
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Question 23 continues over the page.

Question 23 (continued)**For
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- (b) One species of huntsman spider (*Isopeda isopedella*) varies in body colour from dark brown to light grey. In one community at the forest boundary, two populations of this species were found. Some were found living in the leaf litter inside the forest and others were found living in the grass just outside the forest. The relative numbers of dark brown adult spiders and light grey adult spiders found at certain distances from the forest boundary are shown in the graph below.

Distribution of Huntsman spiders at a forest boundary:



Explain the distribution of these two populations in terms of 'selective advantage'.

(3 marks)

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