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Tasmanian Certificate of Education

BIOLOGY

Senior Secondary 5C

Subject Code: BIO5C

External Assessment

2007

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
/32

Pages: 12
Questions: 5

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CANDIDATE INSTRUCTIONS

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

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

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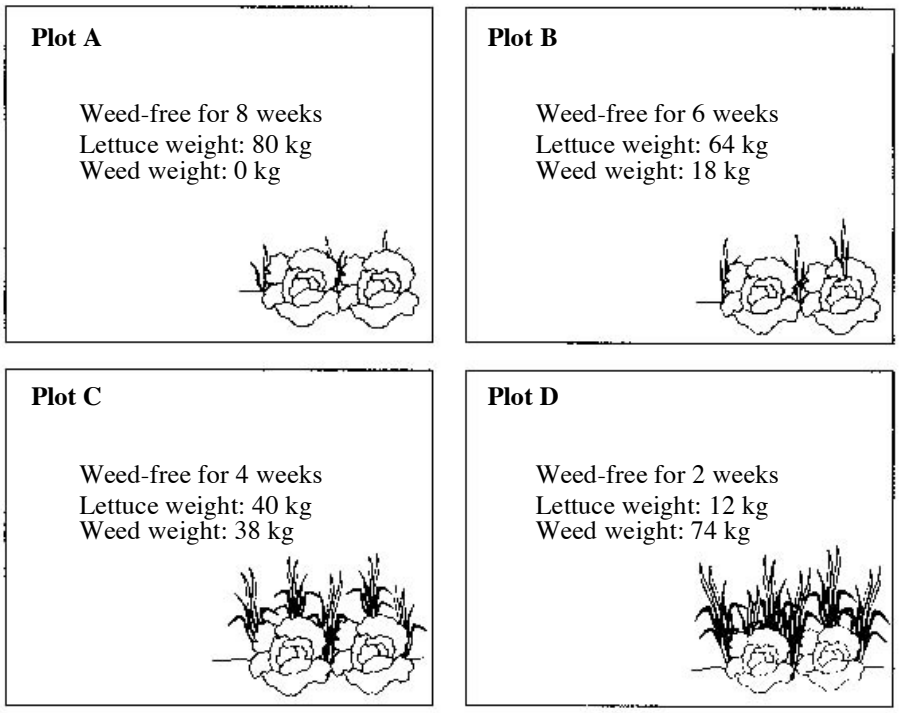
The 2007 Biology Information Sheet can be used throughout the examination.

All written responses must be in English.

For Marker Use Only

Question 1

Refer to the following diagram which shows the sketches and notes for the results of a student's experiment. The student had removed all the weeds from four identical plots of land and had then sown each plot with an identical quantity and type of lettuce seed. After sowing, the plots were kept weed-free for different lengths of time. After eight weeks all the plants were harvested from each plot and weighed:



(a) In the experiment, what was the independent variable? (1 mark)

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(b) In the experiment, what was the dependent variable? (1 mark)

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(c) Which of the plots of land is the control? Why is this plot included in the experiment? (2 marks)

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Question 2

For Marker Use Only

A farmer stocked his farm ponds with fish. He found that in some ponds the fish grew well and produced many young, while in others the fish grew poorly, produced no young and eventually died out. He also noticed that the ponds in which fish grew poorly contained large numbers of tadpoles. There were few if any tadpoles in those ponds in which the fish grew well and reproduced.

(a) To get a better picture of the factors influencing the fish yield a good biologist would want to collect more information than that given above, before beginning to develop and test hypotheses. Suggest **FOUR** factors a biologist would want to measure or otherwise investigate to help establish why the ponds varied in their ability to support fish populations. (2 marks)

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(b) Formulate **ONE** plausible hypothesis to account for the differing fish yields in the various ponds. (4 marks)

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For Marker Use Only

Question 3

An experimenter wished to determine the relationship between light intensity and the rate of photosynthesis in a particular species of plant. She performed an experiment in which she endeavoured to control all factors other than light intensity. None of the raw materials needed for photosynthesis were in short supply. She made measurements of the amount of carbon dioxide absorbed by some leaves at eight different light intensities (Set 1). She repeated her measurements twice (Set 2 and Set 3). The results are summarised in the table below:

Light intensity *(lux)*	**Carbon dioxide absorbed** *(microlitres/minute/unit area)*			
	Set 1	Set 2	Set 3	Average
x	y_1	y_2	y_3	y
1000	14	18	16	16
2000	34	38	36	36
3000	49	56	51	52
4000	67	69	68	68
5000	80	85	84	83
6000	95	104	101	100
7000	122	129	124	125
8000	133	142	136	137

(a) Would you have expected all three results for each light intensity to be identical? Explain your answer. (2 marks)

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(b) Comment on any pattern in the results which suggests that conditions for all three sets of data were not identical. What may have caused this pattern? (3 marks)

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Question 3 continues opposite.

Question 3 (continued)

For Marker Use Only

(c) Based on the results of this experiment **ONLY**, what conclusion would you reach? (1 mark)

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(d) Based on the data collected in this investigation, how confident would you be about the conclusion you have given in part (c)? Explain your answer. (3 marks)

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For Marker Use Only

Question 4

Warfarin is a drug that inhibits blood clotting. A trial was carried out using 508 patients aged 30 or over who were at risk of thrombosis (blood clot). Patients were assigned to two groups. One group received warfarin tablets and the other group received a placebo. The results were as follows:

Treatment	Number in Group	Number developing thrombosis after treatment was started
Warfarin	255	14
Placebo	253	37

(a) What steps should the experimenter have taken when assigning patients to the two groups to ensure the validity of the experiment? (2 marks)

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(b) A student suggested that, for ethical reasons, no patients should have been given a placebo. Comment on the validity of the study if her suggestion had been adopted. (3 marks)

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(c) Explain the ethical issue raised by the use of a placebo in this study. (2 marks)

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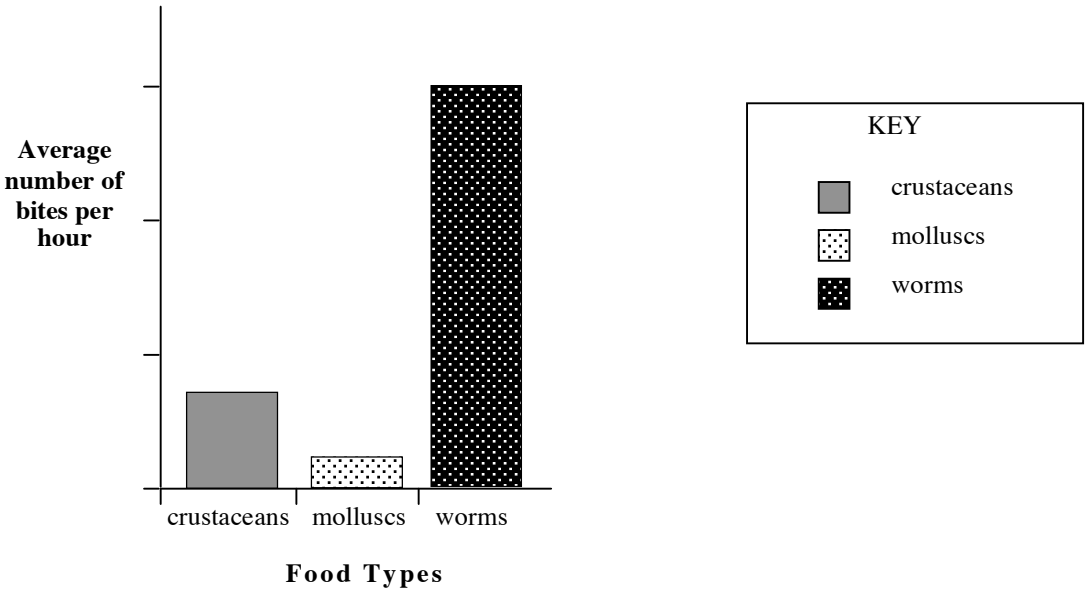
For Marker Use Only

Question 5

A scientist wished to study the food eaten by a fish of the *Nesogobius* genus, which lives in a shallow estuarine seagrass habitat. Initially he conducted a laboratory experiment in which three different food types from the natural environment were offered simultaneously to a fish in an aquarium. He repeated this with a number of fish of the same species and recorded the number of bites at each food type over the course of one hour. Figure 1 summarises these results.

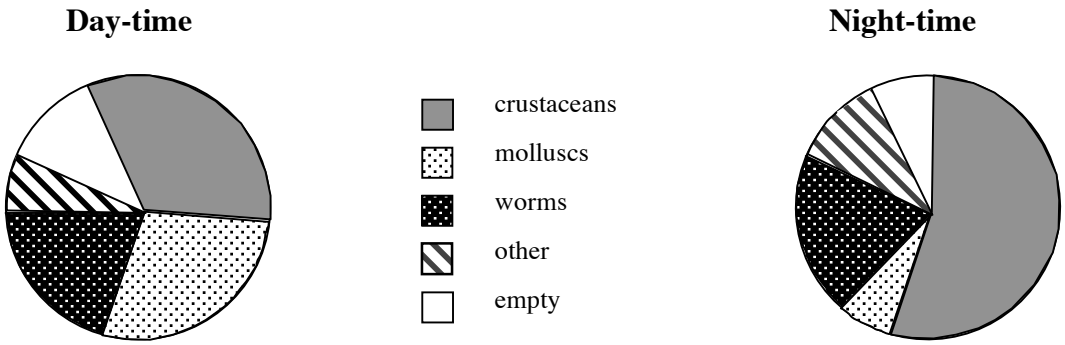
Figure 1



He devised a sampling scheme in which fish in their natural habitat were netted every 3 hours throughout a day and a night. The stomach contents of the fish caught in each period were analysed to establish the type of food the fish had eaten. The results for a total of 313 fish caught during the 24 hour period were summarised in Figure 2.

Figure 2 represents the average stomach contents of daytime catches compared to that of night-time catches of this species of *Nesogobius*.

Figure 2



Question 5 continues opposite.

Question 5 (continued)

For Marker Use Only

By referring to the given information and data, discuss the difficulties in establishing the types of organisms upon which this species of *Nesogobius* depends for its food supply. How could the scientist minimise these difficulties? (6 marks)

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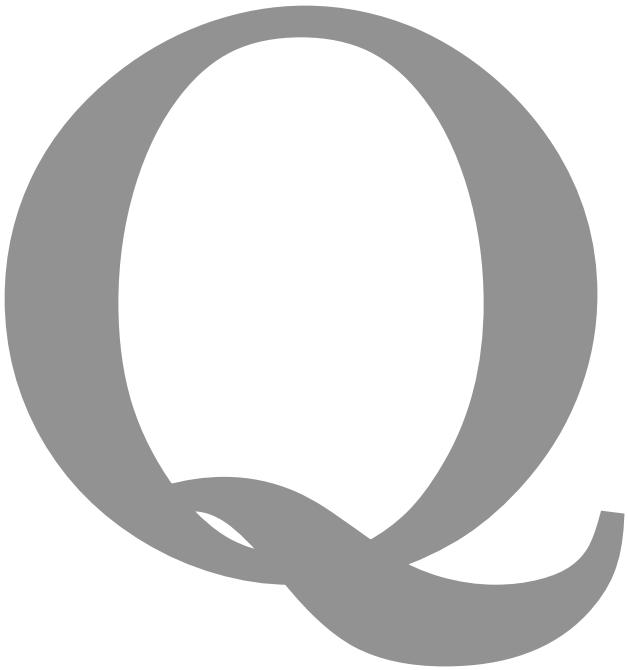

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Tasmanian Certificate of Education

BIOLOGY

Senior Secondary 5C

Subject Code: BIO5C

External Assessment

2007

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: 12
Questions: 4

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CANDIDATE INSTRUCTIONS

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

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

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

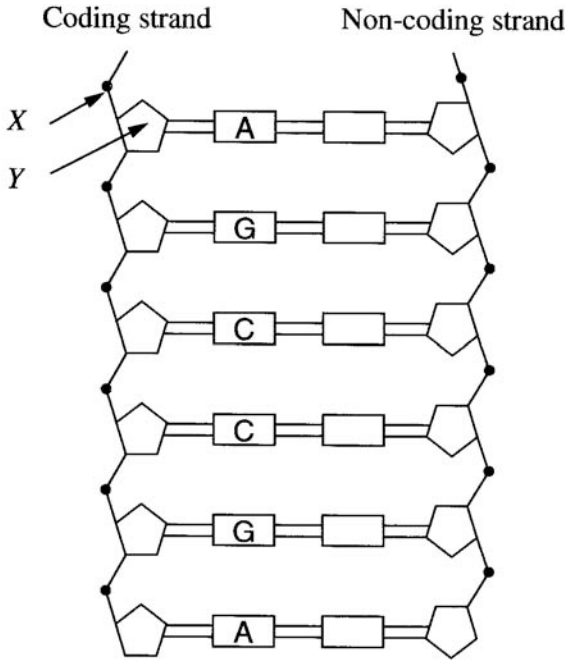
The 2007 Biology Information Sheet can be used throughout the examination.

All written responses must be in English.

For Marker Use Only

Question 6

The diagram below shows a simplified model of a DNA molecule.



(a) Identify structures X and Y. (2 marks)

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(b) What is the base sequence for the non-coding strand (top to bottom)? (2 marks)

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(c) What would be the base sequence for mRNA formed from the coding strand? (2 marks)

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(d) For how many amino acids would this segment code? (1 mark)

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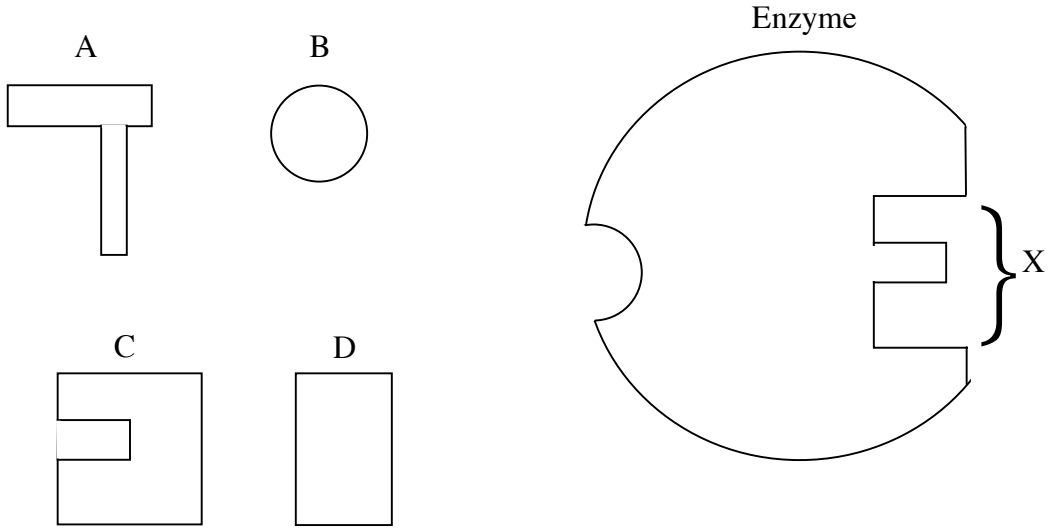
Question 7

For Marker Use Only

(a) The diagram below represents an enzyme and four molecules that could combine with it.



(i) Name the part of the enzyme labelled X. (1 mark)

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(ii) Which of the two molecules, C or D, is more likely to be the substrate for the given enzyme? Explain your answer. (2 marks)

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(iii) Molecules A and B inhibit the enzyme in different ways. Explain how each molecule inhibits the enzyme. (4 marks)

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B: .....

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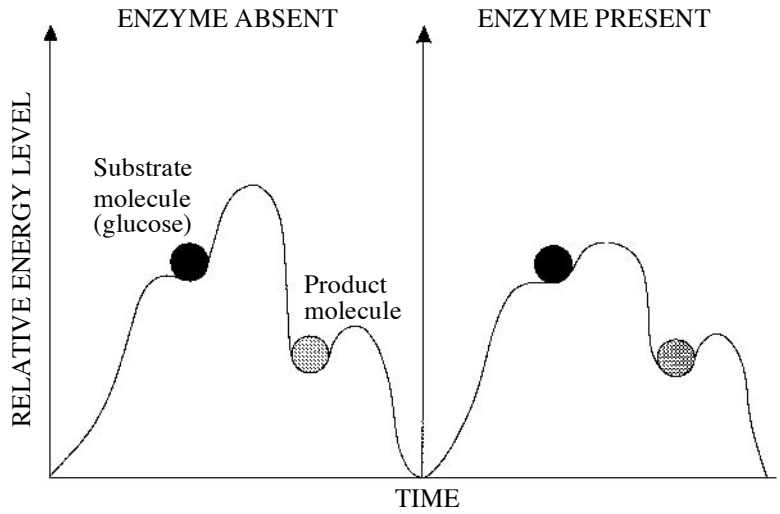
Question 7 continues over the page.

Question 7 (continued)

For Marker Use Only

(b) The graph below shows the effect of adding an enzyme to a chemical reaction involving glucose.



Explain what this graph illustrates about the breakdown of glucose with, and without, the appropriate enzyme being present. (4 marks)

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Question 8

For Marker Use Only

Most muscles contain both fast-twitch muscle cells and slow-twitch muscle cells. The proportion of each cell type in a muscle depends on the function of the muscle.

The following table shows some of the characteristics of slow-twitch muscle cells and fast-twitch muscle cells.

Characteristic	Slow-twitch muscle cells	Fast-twitch muscle cells
Contraction time	Slow	Fast
Mitochondria per cell	Many	Few
Store of glycogen	Low	High
Capillaries near cells	Many	Few

(a) (i) Based on the information in the table, which form of respiration, aerobic or anaerobic, would you expect to normally occur in slow-twitch muscles? (1 mark)

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(ii) Use information from the table to explain your answer. (2 marks)

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(b) Fast-twitch cells fatigue more rapidly than slow-twitch muscle cells. Use evidence from the table above to explain why it would be reasonable to expect the more rapid accumulation of the products of anaerobic respiration in fast-twitch cells than in slow-twitch cells. (3 marks)

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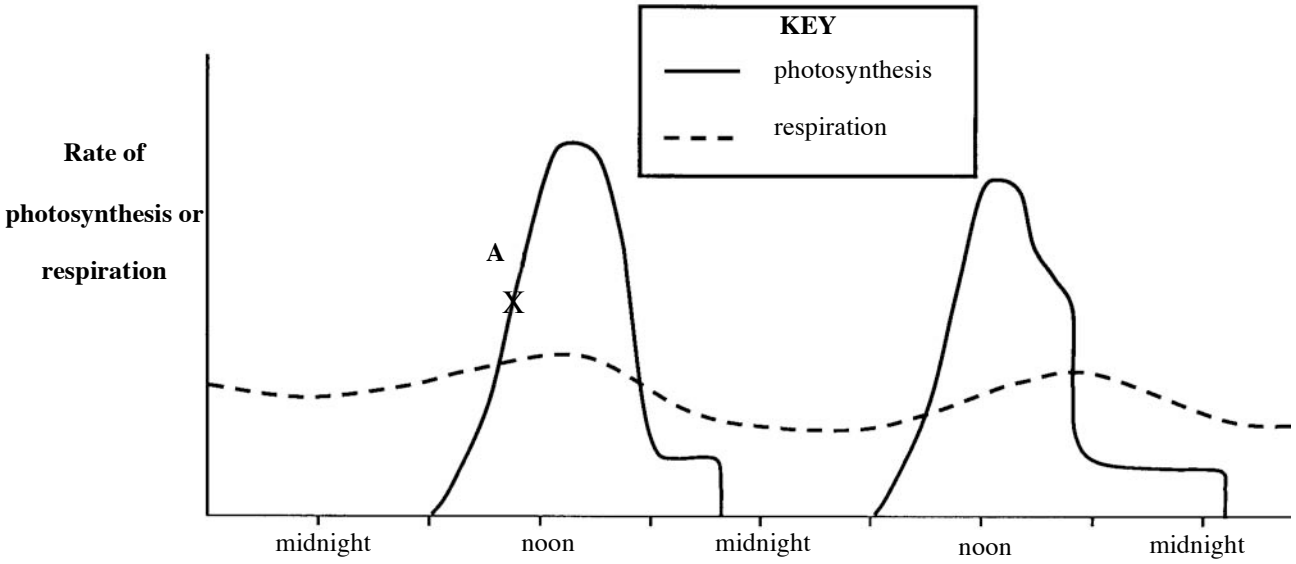
For Marker Use Only

Question 9

This graph shows the rates of photosynthesis and cellular respiration of an indoor plant receiving plenty of natural light through a large window.



(a) Describe the changes that occur in the rate of cellular respiration in a 24 hour period. (1 mark)

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(b) Explain why the changes described in part (a) occur. (2 marks)

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(c) At point A is the plant using or producing oxygen? Explain your answer. (2 marks)

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Question 9 continues opposite.

Question 9 (continued)

For Marker Use Only

(d) Explain what may have caused the changes that occur in the rate of photosynthesis over the 48 hour period. (4 marks)

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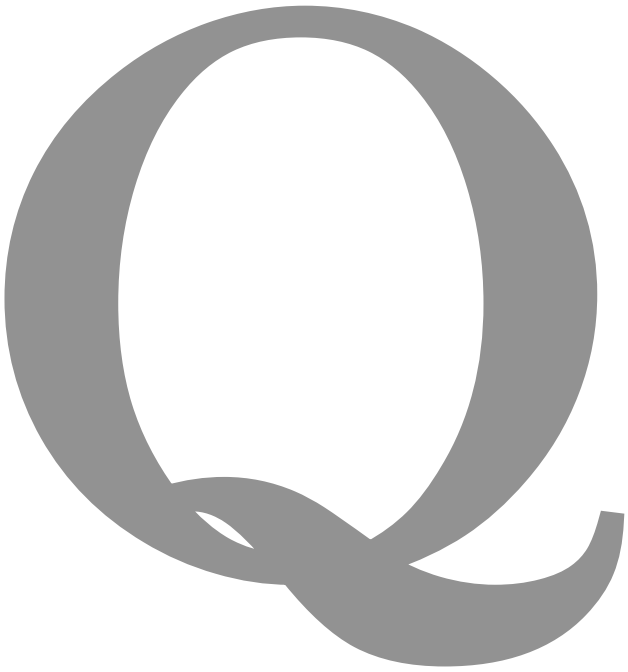

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Tasmanian Certificate of Education

BIOLOGY

Senior Secondary 5C

Subject Code: BIO5C

External Assessment

2007

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
/32

Pages: 12
Questions: 5

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CANDIDATE INSTRUCTIONS

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

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

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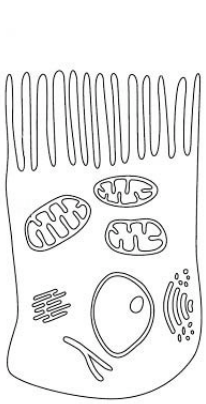
Question 10

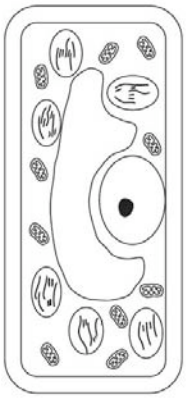
For Marker Use O5ly

The drawings below show three cells. Two of the cells are from multicellular organisms and one is a single-celled organism.



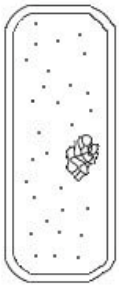
30 µm

Cell A



60 µm

Cell B



1 µm

Cell C

(a) Which of the cells is a prokaryotic cell? Justify your answer with three reasons. (2 marks)

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(b) Which of the cells is a plant cell? Justify your answer with three reasons. (2 marks)

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(c) Name **ONE** organelle you would expect to find in all three cells. (1 mark)

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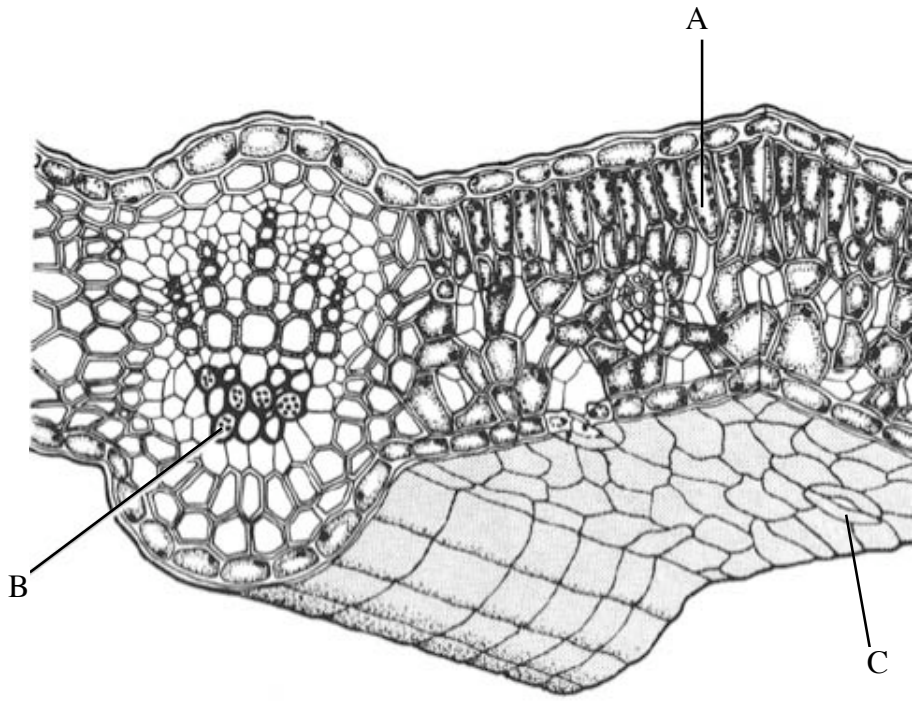
Question 11

For Marker Use Only

This question refers to the leaf section diagram given below.



(a) Name **ONE** of the cell types labelled A, B, or C. (1 mark)

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(b) Use your knowledge of the selected cell type to illustrate the relationship between the structure of this type of cell and its function. (4 marks)

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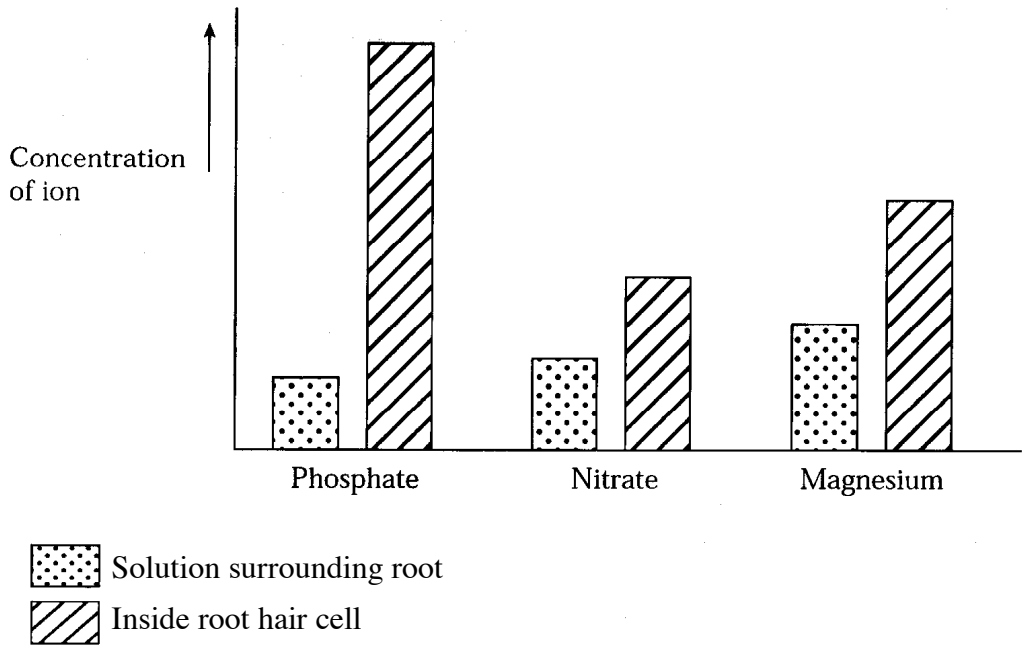
Question 12

For Marker Use Only

(a) An experiment was carried out to study the uptake of ions by root hair cells. Plant roots were washed, and suspended in a solution similar to that found in soil surrounding the roots. The graph below shows the concentrations of various ions inside root hair cells and in the surrounding solution.



(i) Name the process which the cell is using to absorb these ions. Use information in the graph to justify your answer. (2 marks)

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(ii) Explain why it was necessary to ensure that the solution surrounding the root hairs was well aerated during this investigation. (2 marks)

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Question 12 continues opposite.

Question 12 (continued)

For Marker Use Only

(b) (i) As a cell increases in size its ability to exchange materials with its surrounding environment changes. Explain why this is so. (3 marks)

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(ii) What is the impact of mitosis on the ability of cells to exchanges gases with the environment? (2 marks)

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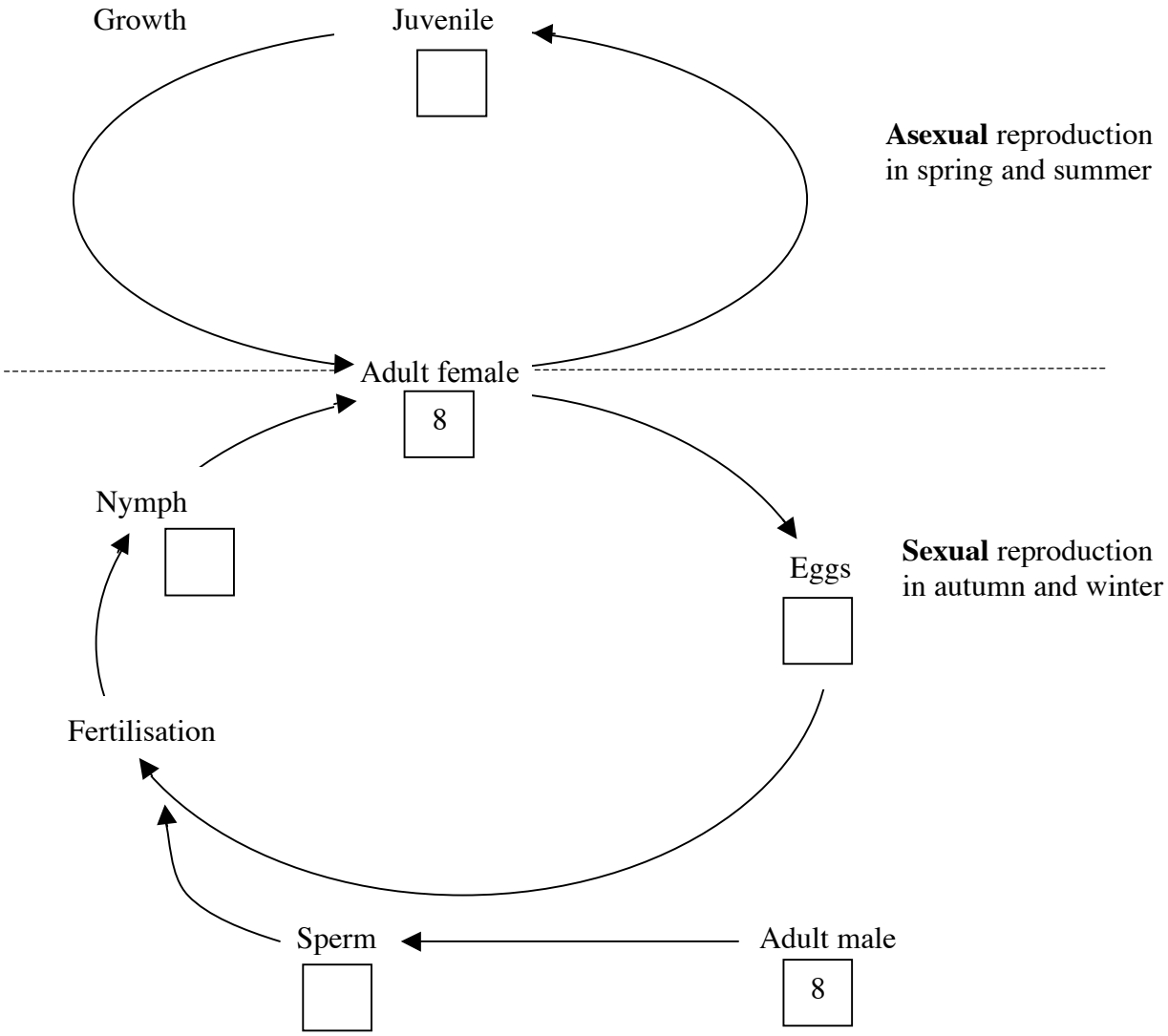
Question 13

For Marker Use Only

Black bean aphids are small insects which feed on broad bean plants. The diagram below shows stages in the life cycle of the black bean aphid. The adult females undergo one of two alternative life cycles depending on the time of the year.

The boxes show the number of chromosomes present in a single cell from the particular stage indicated.



(a) (i) Complete the boxes to show the number of chromosomes present in a single cell at that stage of the life cycle. (2 marks)

(ii) Label **ONE** of the arrows with the letter **Q** to show one stage in the life cycle where meiosis would occur. (1 mark)

Question 13 continues opposite.

Question 13 (continued)

For Marker Use Only

(b) Use your knowledge of cell division to explain why a juvenile aphid produced in spring or summer is genetically identical to its parent. (3 marks)

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Question 14

For Marker Use Only

Students in a Biology class were supplied with pond water containing a mixture of micro-organisms, including *Amoeba* and *Paramecium*. A few drops of the pond water, containing some of the micro-organisms mentioned above, were spilt on a bench and went unnoticed. Over the next few hours, the pond water slowly evaporated. (Pond water is a very dilute solution of dissolved salts. Water evaporates, salts do not.)

Outline the challenges faced by the *Amoeba* (or *Paramecium*) in maintaining internal water balance as the water evaporated. In your answer include discussion of:

- the way in which the named micro-organism osmoregulates at the time the pond water is spilt.
- the way in which the osmoregulatory response changes over time, and why.
- the impact of the changing conditions on the ability of the micro-organisms to remain alive.

(7 marks)

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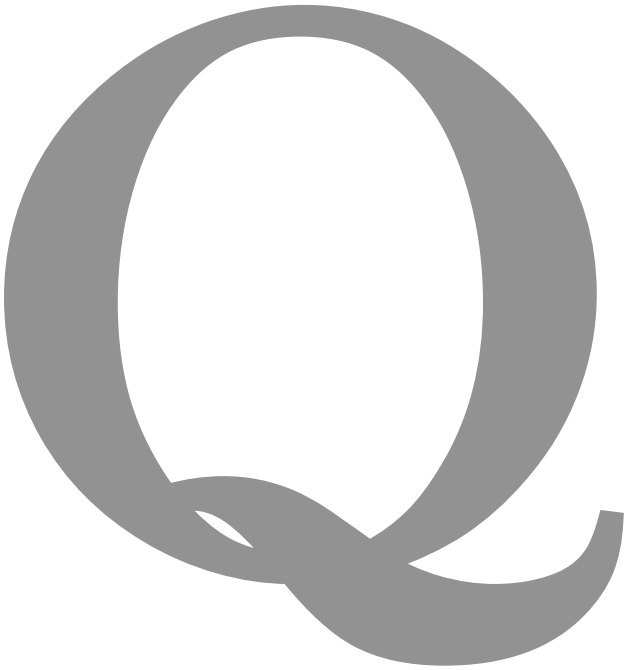

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Tasmanian Certificate of Education

BIOLOGY

Senior Secondary 5C

Subject Code: BIO5C

External Assessment

2007

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
/33

Pages: 12
Questions: 4

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CANDIDATE INSTRUCTIONS

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

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

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The 2007 Biology Information Sheet can be used throughout the examination.

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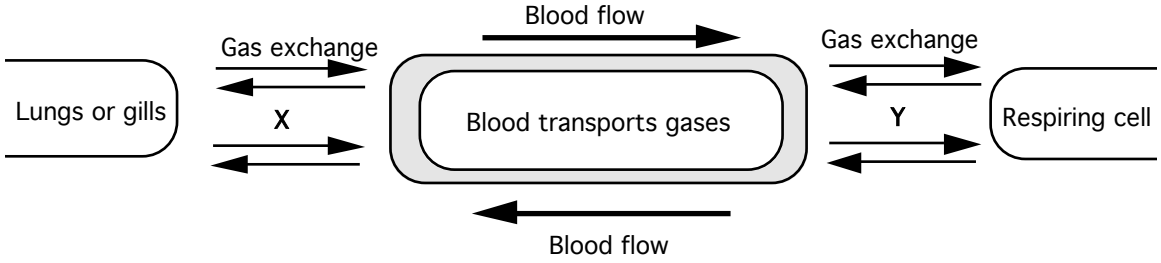
For Marker Use Only

Question 15

(a) The diagram below represents the gas exchange between an organism and its environment.



(i) Name **two** gases exchanged at point X. (1 mark)

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(ii) Name the process by which gases are exchanged at points X and Y. (1 mark)

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(iii) List **two** structural characteristics that make lungs and gills efficient surfaces for gas exchange. (2 marks)

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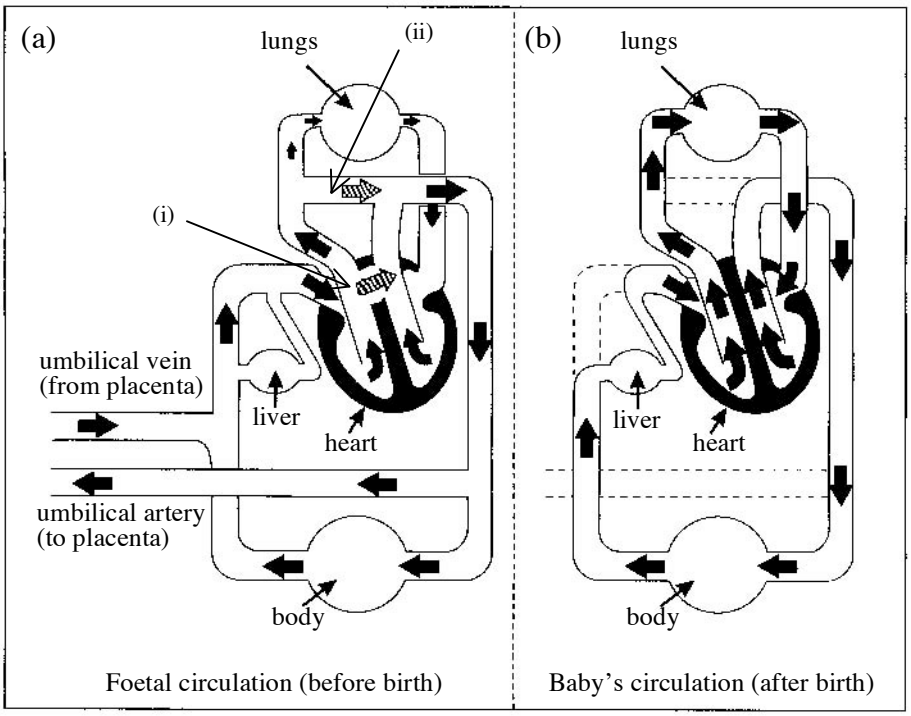
(b) The diagrams opposite show the circulatory systems of a human foetus and a human baby. The major differences between the two systems are:

- In foetal systems about 60% of the blood that enters the right atrium passes through the *foramen ovale* – indicated on the diagram at (i) – to the left atrium.
- Most of the remaining 40% passes via the *ductus arteriosus* – indicated on the diagram at (ii) – into the body circulation.

Question 15 continues opposite.

Question 15 (continued)

For Marker Use Only



(i) In what significant way would the blood entering the right side of the heart of a foetus differ from blood entering the right side of the heart of a baby after birth? Explain your answer. (2 marks)

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(ii) Describe the disadvantages that these bypasses would present for the baby after birth if they remained unchanged. (3 marks)

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For Marker Use Only

Question 16

Claire and Nick have just had twins, a boy, Jack and a girl, Kate. Both of the babies' grandfathers are red-green colour blind, while their grandmothers have normal vision. Nick, who is an only child, has normal vision; Claire and her brother both have normal vision.

(a) Construct a family pedigree to show the inheritance of this recessive sex-linked genetic disorder. (Use circles for females, squares for males; shade those affected by colour blindness.) (2 marks)

(b) Explain what can be deduced about the genotypes of both Claire and Nick with respect to red-green colour blindness from the given information. (3 marks)

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(c) Show how you can use your answers to part (b) to predict the probabilities that Jack and Kate will be colour blind. (3 marks)

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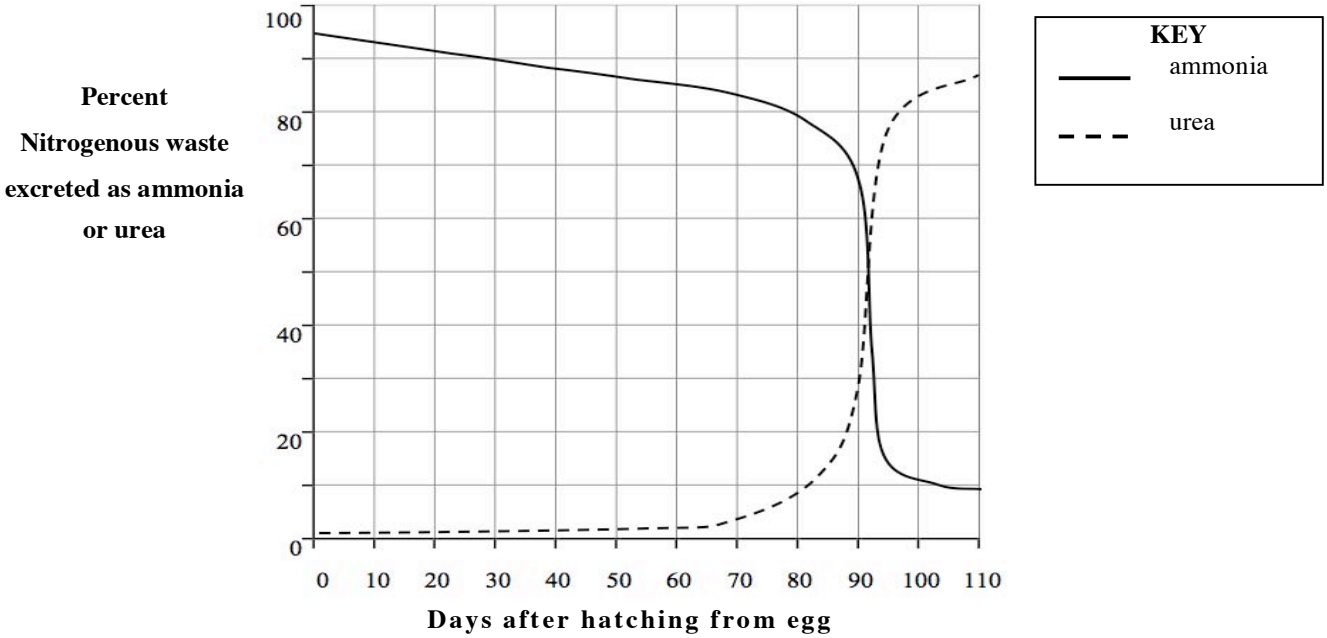
For Marker Use Only

Question 17

Tadpoles of the common frog live in freshwater ponds. Over a period of weeks, they undergo metamorphosis as they develop into adult frogs and move onto land. The graph below shows the percentage of total nitrogenous wastes excreted as ammonia and as urea during the time after the tadpole hatches from the egg.



(a) Describe the changes in proportions of the two excretory products over the period shown. (2 marks)

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(b) Explain the reasons for the changes in the proportions of ammonia and urea excreted as tadpoles mature into adult frogs. (4 marks)

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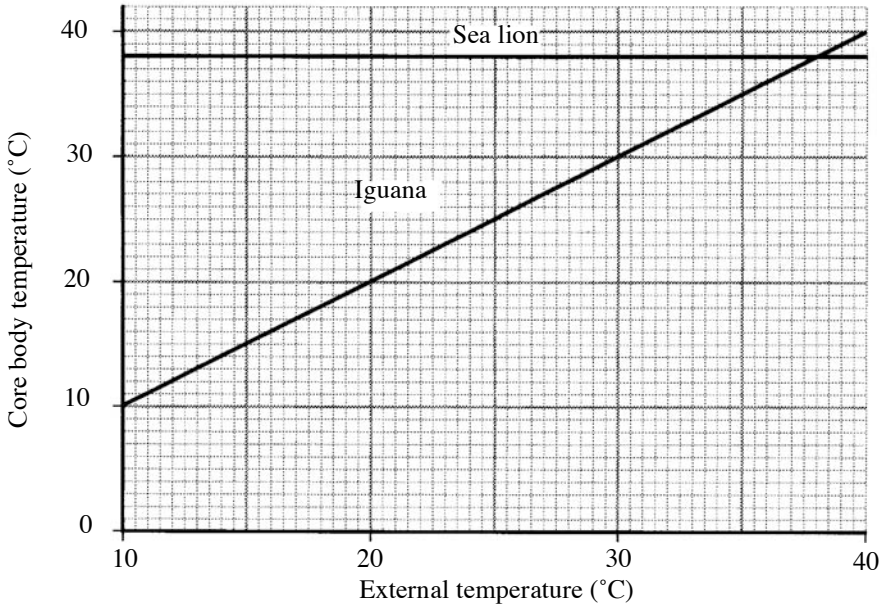
For Marker Use Only

Question 18

Sea lions and marine iguanas feed in the sea around the Galapagos Islands. Sea lions are mammals and iguanas are reptiles. Both species spend some time on land. Graph 1 shows the core temperature of an iguana and a sea lion at different external temperatures.

Use information from Graph 1 to answer the following questions.



Graph 1

(a) Explain why the graphs of core body temperature for the sea lion and the iguana differ. (2 marks)

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(b) The mean temperature of the sea surrounding the Galapagos islands is 21˚C, while the mean maximum air temperature is 5˚C to 10˚C degrees higher than this. Iguanas alternate short periods of time feeding in the sea with time spent sitting on the black rocks on the shore. Explain how this behaviour is of benefit to them. (4 marks)

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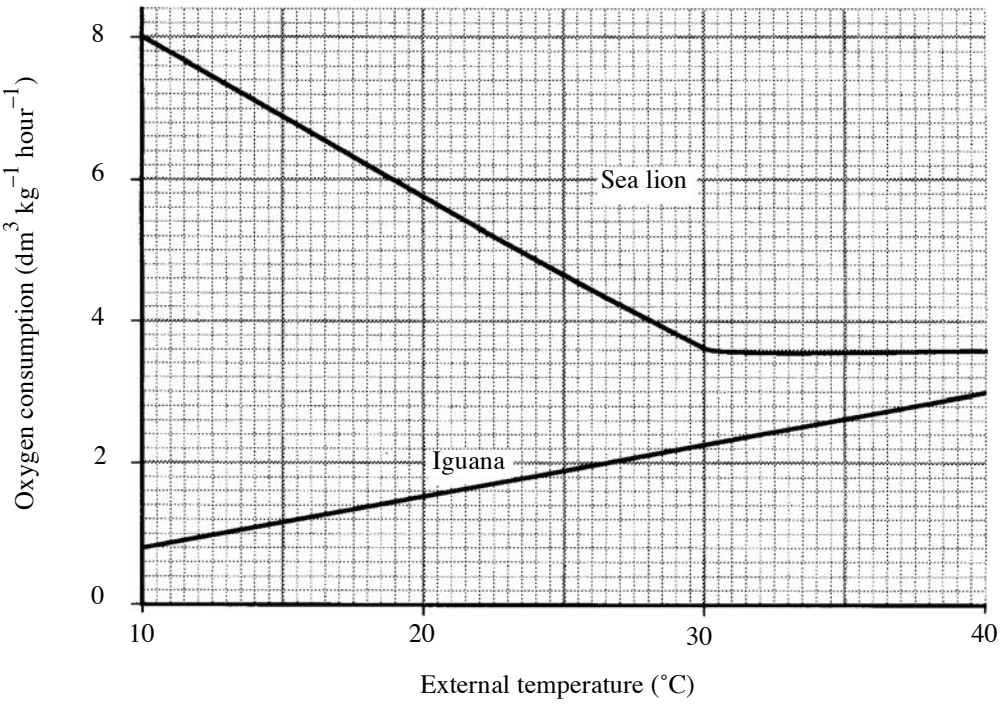
Question 18 continues opposite.

Question 18 (continued)

For Marker Use Only

Graph 2 shows the oxygen consumption of an iguana and a sea lion at different external temperatures.



Graph 2

(c) Use the information from both the graphs to explain the link between core body temperature and rate of oxygen consumption in the **sea lion** between the external temperatures of 10°C and 30°C. (4 marks)

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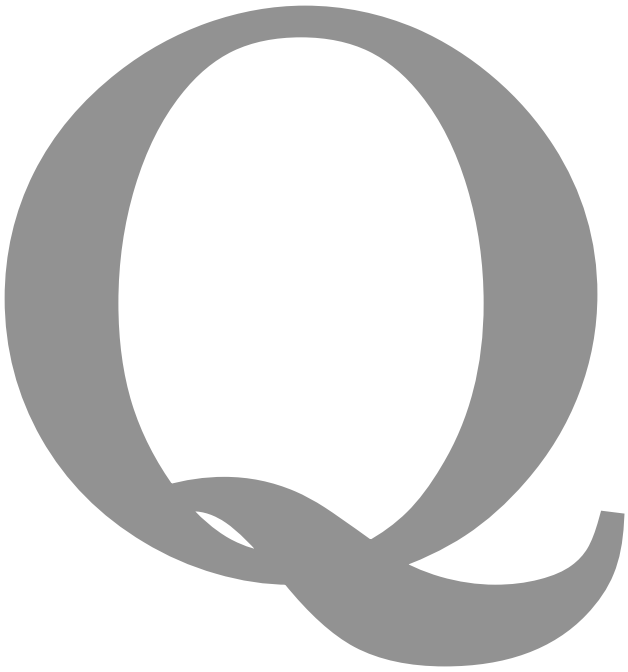


PLACE LABEL HERE

Tasmanian Certificate of Education

BIOLOGY

Senior Secondary 5C

Subject Code: BIO5C

External Assessment

2007

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
/33

Pages: 12
Questions: 5

CANDIDATE INSTRUCTIONS

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

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

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

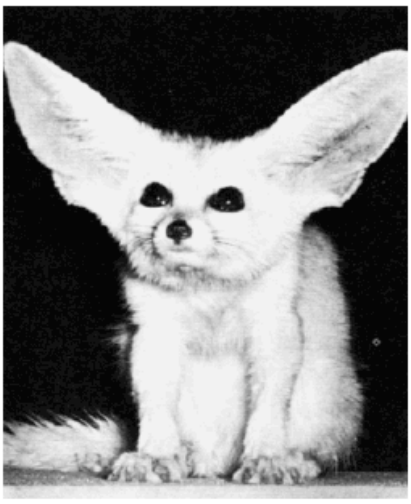
The 2007 Biology Information Sheet can be used throughout the examination.

All written responses must be in English.

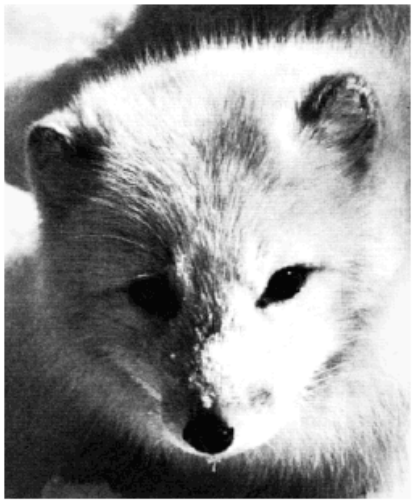
Question 19

For Marker Use Only

(a) As its name suggests the Arctic fox lives in cold, high latitude areas, while its close relative, the Fennec fox lives in the hot North African desert region.



Fox A



Fox B

(i) Based on the differences shown in the photographs above, which of the two foxes, A or B, would be the Arctic fox? Explain your choice. (2 marks)

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(ii) Given the habitat in which they live, which of the two foxes, the Arctic or the Fennec, would you expect to have the smaller average adult body size? Explain your answer. (3 marks)

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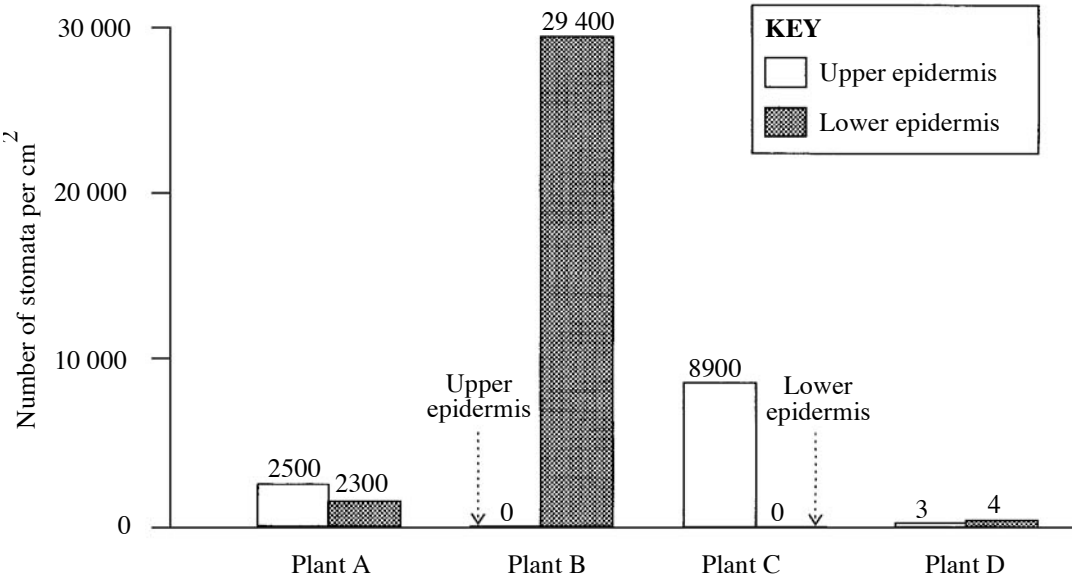
Question 19 continues over the page.

Question 19 (continued)

For Marker Use Only

(b) The graph below shows the distribution of stomata on the upper and lower epidermis of the leaves of four plants from different environments.



Based on the data given, suggest the type of environment in which the following plants would grow naturally. Justify your answer. (4 marks)

(i) **Plant C**

Environment: .....

Justification: .....

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(ii) **Plant D**

Environment: .....

Justification: .....

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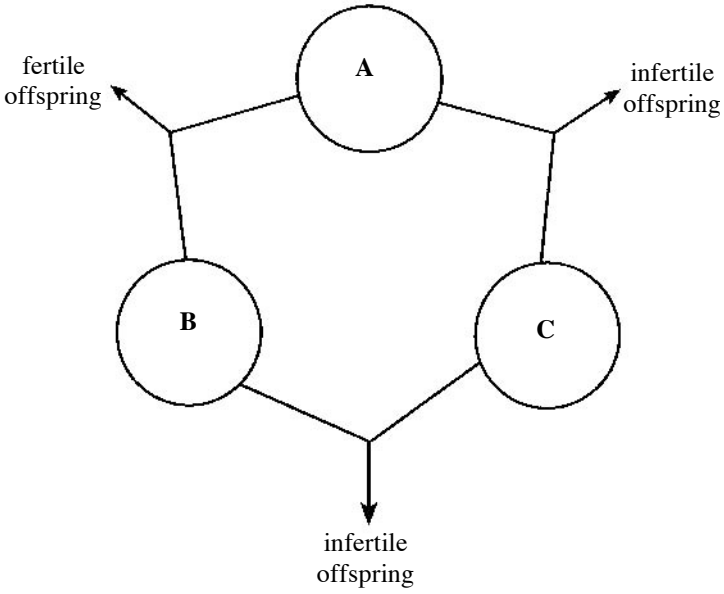
Question 20

For Marker Use Only

The diagram below shows the fertility of the offspring produced when three populations of frogs, A, B and C, interbreed.



How many species of frogs are represented in the diagram? Explain your answer. (2 marks)

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Question 21

For Marker Use Only

The diagram below shows a transect across a sand-dune ecosystem.

The table below shows the result of a soil analysis carried out on samples collected from the locations **A, B** and **C** along the transect.

	Sampling Position along transect		
	A	**B**	**C**
Percentage humus (dead plant material)	0.2	4.5	13.5
Nitrate concentration (parts per million)	23.0	53.2	138.0
Number of soil bacteria $\times 10^3$ per gram of soil	132.0	201.4	653.0

(a) Give two reasons why the percentage of humus at **C** is much higher than at **A**. (2 marks)

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Question 21 continues opposite.

Question 21 (continued)

For Marker Use Only

(b) Use information from the table and your own knowledge to explain why the nitrate concentration is greater at location C than at location A. (2 marks)

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(c) A student predicted that certain hardy legumes would be better adapted than other similar non-legumes to grow at sites A and B. What is the basis for this prediction? (2 marks)

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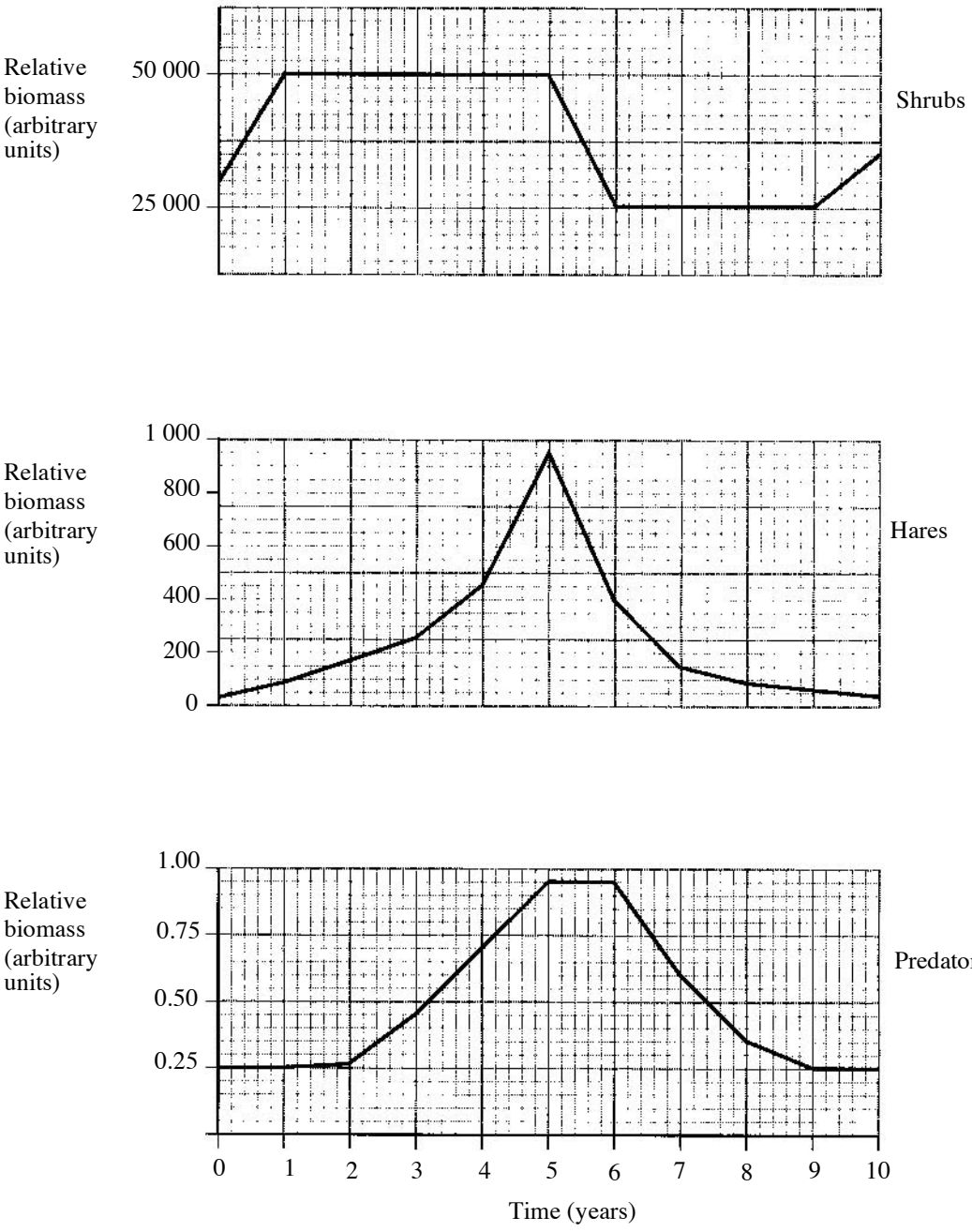
Question 22

For Marker Use Only

Shrubs and small trees cover large areas of northern Canada. In winter there is deep snow for several months. Few species of mammal are adapted to survive in these conditions. The most common consumer is the snowshoe hare, which feeds on the young leaves and shoots of the shrubs and small trees. Several mammalian predators feed on the hares.

The graphs show changes in the relative biomass of the shrubs, hares and predators over a period of 10 years. Measurements of biomass were taken at the beginning of winter each year.



Question 22 continues opposite.

Question 22 (continued)

For Marker Use Only

Account for the differences in

- biomass, and
- population patterns

observed in each of the three components of the ecosystem over the 10 years. (6 marks)

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Question 23

For Marker Use Only

(a) In the 1960s, throughout the world, large amounts of organochlorine pesticides were used to control insect pests. The table below shows the results of an analysis of the concentration of organochlorines in the muscle tissue of some bird species found in England where these insecticides were used on farmland and in domestic situations during this period.

Species	Main Contents of Diet	Concentration of Organochlorines in muscles (parts per million)
Sparrowhawk	Small birds	3.6
Barn owl	Small mammals	2.3
Song thrush	Invertebrates and plant material	0.5
Wood pigeon	Plant material	0.3
Heron	Fish	15.2
Moorhen	Plant material	0.2

(i) Does the data suggest that the organochlorine pesticides being studied were biodegradable or non-biodegradable? Explain your answer. (2 marks)

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(ii) Give a plausible explanation of the high levels of organochlorine pesticide in the muscles of the heron. (3 marks)

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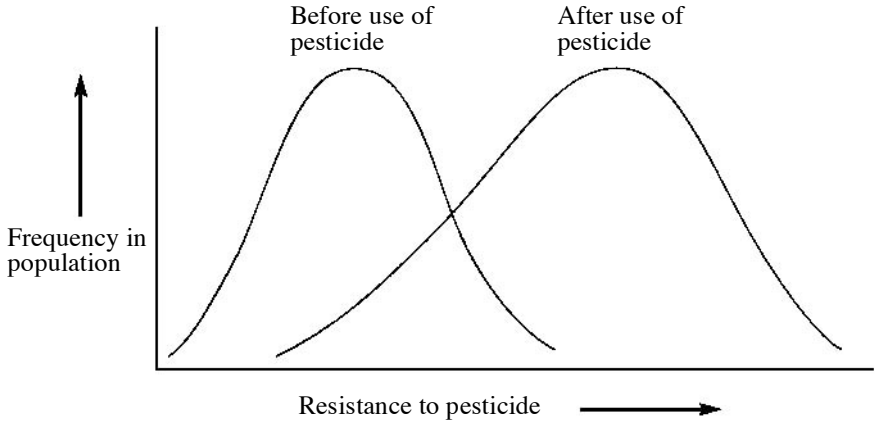
Question 23 continues opposite.

Question 23 (continued)

For Marker Use Only

(b) During the 1960s scientists studied a population of insects and their resistance to one of the organochlorine pesticides being used at the time. The graph below shows the resistance of the population of insects before use of the pesticide and several years after use of the pesticide became common.



Explain how, after exposure to the pesticide for several years, changes in resistance to it in the population came about. (5 marks)

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