



Western Australian Certificate of Education Examination, 2010

Question/Answer Booklet

BIOLOGICAL SCIENCES

Stage 3

Please place your student identification label in this box

Student Number: In figures

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In words

Time allowed for this paper

Reading time before commencing work: ten minutes
Working time for paper: three hours

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer Booklet
Multiple-choice Answer Sheet

To be provided by the candidate

Standard items: pens, pencils, eraser, correction fluid/tape, ruler, highlighters

Special items: non-programmable calculators satisfying the conditions set by the Curriculum Council for this course

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of exam
Section One: Multiple-choice	20	20	30	20	20
Section Two: Short answer	5	5	90	100	50
Section Three: Extended answer	8	4	60	60	30
Total					100

Instructions to candidates

- The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2010*. Sitting this examination implies that you agree to abide by these rules.

- Answer the questions according to the following instructions.

Section One: Answer all questions on the separate Multiple-choice Answer Sheet provided. For each question shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, do not erase or use correction fluid, and shade your new answer. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Section Two: Write your answers in the spaces provided in this Question/Answer Booklet. Wherever possible, confine your answers to the line spaces provide. Use a blue or black pen (**not** pencil) for this section.

Spare answer pages are provided at the end of this booklet. If you need to use them, indicate in the original answer space where the answer is continued, e.g. write 'continued on page 54'. Fill in the number of the question that you are continuing at the top of that page.

The space provided for each question is an indication of the length of answer required.

Section Three: Write your answers in this Question/Answer Booklet. Use a blue or black pen (**not** pencil) for this section. Tick the box next to the question you are answering; write the number of each question in the margin. Do not copy the questions when answering.

If your answer exceeds the five pages provided for each question, continue writing on the spare pages at the end of the booklet. Indicate at the end of the fifth page that the answer is continued, e.g. write 'continued on page 54'. Fill in the number of the question that you are continuing at the top of that page.

Section One: Multiple-choice

20% (20 Marks)

This section has **20** questions. Answer **all** questions on the separate Multiple-choice Answer Sheet provided. For each question shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, do not erase or use correction fluid, and shade your new answer. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Suggested working time: 30 minutes.

1. Substance A is present inside a cell in a far higher concentration than in the cell's surroundings, yet the cell still manages to take up more of substance A. By what process does it do this?
- (a) exocytosis
 - (b) osmosis
 - (c) passive diffusion
 - (d) active transport

2. Examine the table below.

Insects sampled in a light trap			
Species	Male	Female	Total
A	75%	25%	100%
B	17%	83%	100%
C	50%	50%	100%
D	50%	50%	100%

Which of the following statements describes accurately the 75% which is printed in bold?

- (a) 75% of all male insects caught were from Species A.
 - (b) 75% of the insects caught from Species A were males.
 - (c) 75% of all these insects caught were male Species A.
 - (d) 75% of all males from Species A were caught in the light trap.
3. What will happen when the guard cells surrounding the stomates in a leaf are swollen with water (turgid)?
- (a) respiration by the leaf will increase
 - (b) water evaporation from the leaf will decrease
 - (c) the rate of sugar production in the leaf will decrease
 - (d) carbon dioxide uptake by the leaf will increase

4. Assuming equal body mass, which of these organisms would probably produce the greatest amount of nitrogenous waste?
- (a) an endothermic herbivore
 - (b) an endothermic carnivore
 - (c) an ectothermic carnivore
 - (d) an ectothermic herbivore
5. Homeostasis is the ability of an organism to maintain constant internal conditions in a fluctuating environment. Which of the following statements best illustrates homeostasis?
- (a) When a mammal's blood salt concentration increases, its kidneys excrete more salt.
 - (b) The desert hopping mouse rarely drinks water as it gains enough from other sources.
 - (c) Humans feel dizzy and lose their balance if the oxygen in their blood decreases.
 - (d) The surface area to volume ratio of animals increases as their body size falls.
6. Which of the following is more likely to occur in small populations than in large populations?
- (a) competition for mates
 - (b) natural selection
 - (c) genetic diversity
 - (d) genetic drift
7. Protein synthesis and energy release in a eukaryotic cell involve respectively
- (a) endoplasmic reticulum and ribosomes.
 - (b) mitochondria and contractile vacuoles.
 - (c) ribosomes and mitochondria.
 - (d) Golgi bodies and mitochondria.

Questions 8 and 9 relate to the following information.

Analysis of the complete genome of an amoeba (a small, single-celled eukaryote) shows that it contains 14% thymine.

8. The percentage of adenine in the genome of this amoeba is likely to be
- (a) 14%.
 - (b) 28%.
 - (c) 36%.
 - (d) 72%.
9. The percentage of cytosine in the genome of this amoeba is likely to be
- (a) 14%.
 - (b) 28%.
 - (c) 36%.
 - (d) 72%.

See next page

10. Which of the following actions would require the approval of an animal ethics committee?
- (a) laying rodent baits to eradicate rats in a university biology building
 - (b) fumigating a museum collection to kill insect pests
 - (c) spraying the dormitory at an ecological field station to kill mosquitoes
 - (d) observing migratory birds from a concealed location for a scientific study
11. When preparing biological material for viewing under a monocular microscope it should always be cut very thinly or spread very thinly on the slide. What is the main reason for this?
- (a) Light must be able to pass through the material.
 - (b) The cover slip is a very thin piece of glass.
 - (c) Only a small part of the material can be seen through the microscope.
 - (d) There are usually only small samples of material available for study.
12. An 8.0cm long strand of the filamentous alga *Spirogyra* was examined under the microscope. It was seen to be made of a single chain of long, cylindrical cells joined end to end. The average length of a cell was 400 μ m. The closest estimate of the number of cells in the strand is
- (a) 200.
 - (b) 2 000.
 - (c) 500.
 - (d) 5 000.
13. For a given area and time period the amount of solar energy converted to chemical energy is called primary
- (a) photosynthesis.
 - (b) productivity.
 - (c) succession.
 - (d) fixation.
14. In recent years the Western Australian Government has bought and then closed down several cattle stations in the arid, central parts of the State. The loss of several livestock watering points has resulted in the deaths of many native species, especially birds. A biological argument in favour of this strategy would **not** include
- (a) revegetation is more successful with natural population sizes of native species.
 - (b) feral species would find it harder to live in the area.
 - (c) natural water sources are better for the animals' health.
 - (d) the native animal populations were artificially high.

15. South Africa has a very similar climate to that of the south-west of Western Australia. A garden plant from South Africa is introduced to Western Australia, where it spreads in natural environments and becomes a pest. What would be the best strategy for achieving biological control of this plant?
- (a) Genetically modify a Western Australian plant to compete successfully with the pest.
 - (b) Identify its natural enemies in South Africa for testing for possible introduction to Western Australia.
 - (c) Encourage livestock grazing in areas where the plant is a pest.
 - (d) Pay a bounty to farmers to destroy the plant on their land.
16. Why do marine conservation reserves often need to be larger than conservation reserves on land?
- (a) Most marine animals have external fertilisation, while land animals use internal fertilisation.
 - (b) Far more people catch fish than hunt for land animals.
 - (c) There are no natural boundaries, such as rivers or roads, in the ocean.
 - (d) There are more endangered species in the marine environment than on land.
17. A family has set up an aquarium in a well-lit room. It contains several fish and some aquatic plants growing in soil composed of coarse gravel. There is no filtration system attached. The fish are fed food pellets every day. This input to the aquarium ecosystem could be best balanced by
- (a) removal of debris and fish faeces from the aquarium.
 - (b) the increased mass of the fish as they grow.
 - (c) the decomposers living in the coarse gravel.
 - (d) photosynthesis by the aquatic plants.
18. Which of the following statements about inputs and outputs of ecosystems is correct?
- (a) Urban ecosystems require little input of organic matter.
 - (b) Agricultural ecosystems require much less organic matter input than do natural ecosystems.
 - (c) Urban ecosystems put out large amounts of industrial waste but little heat.
 - (d) Most organic matter in natural ecosystems is recycled within the ecosystems.

19. While designing an experiment for a horticultural class, a student drew up the following table as a planning aid:

Type of variable	Variable
Independent	Butyric acid solution/ concentration of butyric acid
Dependent	Root growth
Controlled	Type of plant Potting medium Amount of light Amount of water

Which of the following hypotheses was the student most likely to be testing?

- (a) Butyric acid helps plant cuttings grow roots.
(b) Plant roots produce butyric acid as they grow.
(c) Different types of plants respond differently to butyric acid.
(d) Butyric acid improves fruit yield in crop plants.
20. Some chemical companies have joined with biotechnologists to produce genetically modified crop varieties that have complete resistance to their particular brand of chemical herbicide. This allows the farmer to spray the crop to kill all the weeds without harming the crop species. This is very efficient and gives large increases in crop yield. From a biological point of view, a major concern would be
- (a) weed species are an important part of the ecosystem and should not be killed.
(b) most farmers would grow the new variety, risking loss of genetic diversity.
(c) it is unnatural to maintain only one species of plant in an area.
(d) some weeds are needed to assist in pollinating the crop.

End of Section One

See next page

Section Two: Short answer

50% (100 Marks)

This section has **five (5)** questions. Answer **all** questions. Write your answers in the spaces provided in this Question/Answer Booklet. Wherever possible, confine your answers to the line spaces provided. Use a blue or black pen (**not** pencil) for this section.

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- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.

Suggested working time: 90 minutes.

Question 21**(20 marks)**

Wildlife tourism, in which people travel to nature reserves to see animals in natural settings, is becoming popular. Some biologists are concerned that such tourism could actually harm wild animals.

- (a) Describe briefly **two (2)** distinct ways in which wildlife tourism may be harmful to the animals.

One (2 marks)

Two (2 marks)

- (b) Describe briefly how **two (2)** management strategies that authorities could implement would minimise the effects of tourists in nature reserves. **Do not repeat the effects you mentioned in part (a).**

Management strategy one (2 marks)

Management strategy two (2 marks)

See next page

- (c) In some national parks in Western Australia, there is concern that climate change is leading to drier conditions and that fires are becoming more frequent and severe.
- (i) List **two (2)** human activities that could contribute to climate change. (2 marks)

- (ii) Describe briefly how more frequent fires could affect plant species in a national park. (2 marks)

- (d) If very few animals of a species remain in the wild, biologists sometimes trap the survivors and try to breed them in zoos. Very detailed records are kept of the relationships between zoo animals and animals may be sent across a country or across the world to breed. Explain why such careful records are necessary. (4 marks)

- (e) While many biologists concentrate on conserving wildlife, others are concerned that particular varieties of domestic farm animals and crop plants may become extinct as new varieties become fashionable. Explain, providing **two (2)** practical reasons related to crop or animal productivity, why it might be useful to conserve as wide a range of farm animals and crop plants as possible.

Reason one (2 marks)

Reason two (2 marks)

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Question 22

(20 marks)

(a) DNA and RNA are important in cellular functioning.

(i) List **two (2)** structural differences between DNA and RNA. (2 marks)

(ii) Name the major function performed by (2 marks)

tRNA _____

mRNA _____

(b) Describe, without molecular detail, the difference between *transcription* and *translation*. (4 marks)

(c) Describe briefly, at the molecular level, the process of protein synthesis. (4 marks)

See next page

DO NOT WRITE IN THIS AREA

(d) Give brief definitions of

(i) restriction enzymes.

(2 marks)

(ii) gel electrophoresis.

(2 marks)

DNA profiling is proving useful in many areas of science.

(e) (i) Define 'DNA profiling'.

(2 marks)

(ii) Describe an example of the application of DNA profiling in environmental conservation.

(2 marks)

Question 23

(20 marks)

The group of plants known as mistletoes are mainly parasitic, photosynthetic plants that grow on the stems and branches of trees. They grow root-like structures that penetrate the vascular tissue of the host tree to draw water and other nutrients for the mistletoe's use. Many species of mistletoe are native to Australia, with each species growing on a very narrow selection of host trees, often only a single species. A biological study was conducted in arid central Australia where one particular mistletoe species was commonly found growing on a species of wattle tree, *Acacia acuminata*. The scientists measured the amount of carbon dioxide the two plants exchanged with the atmosphere at various times of the day. Their results are summarised in the table below.

CO₂ exchange by wattle and parasitic mistletoe (measured as CO₂ units) during the day

Time	4 am	6 am	8 am	2 pm	5 pm	6 pm	8 pm
Wattle	-3	22	49	60	64	25	-8
Mistletoe	-1	18	24	15	10	16	-6

- (a) On the grid provided, graph both of these sets of data.

If you wish to have a second attempt at this item, the grid is repeated on page 55 of this examination booklet. Indicate clearly on this page if you have used the second grid and cancel the working on the grid on this page. (4 marks)



See next page

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- (b) (i) Describe the similarities shown by the data for these two plants. (2 marks)

- (ii) Describe any differences shown by the two sets of data. (2 marks)

- (c) The researchers had no readings for noon or midnight. They attempted to estimate these values from the graph.

- (i) What would your estimates be? (2 marks)

Time	CO ₂ exchange (measured as CO ₂ units)	
	Wattle	Mistletoe
Noon		
Midnight		

- (ii) In which estimate (noon or midnight) do you have the greatest confidence? Explain why. (2 marks)

- (d) (i) Predict which of these plants would be growing at the faster rate. Explain the reason for your choice. (2 marks)

See next page

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(ii) Explain the negative values recorded for 4 am and 8 pm. (2 marks)

(e) Wattle plants that have been affected by mistletoe have a shorter life span than unaffected plants. Use evidence from the table and/or graph and your knowledge of stomata function to give a possible explanation of why this is the case. (4 marks)

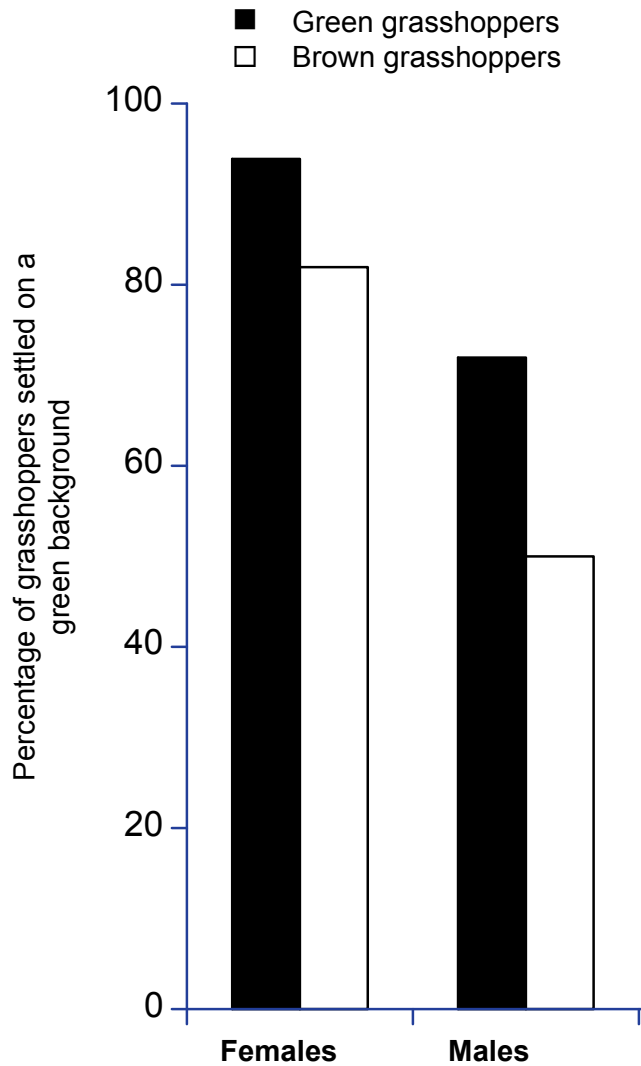
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Question 24

(20 marks)

Biologists studying the grasshopper *Acrida conica* noticed that some specimens were green and some were brown. Green grasshoppers were found mainly in green (live) grass and brown ones in brown (dead) grass. They hypothesised that, given a choice, a grasshopper will settle on a colour of grass that matches its own body colour.

To test this hypothesis, the biologists prepared an arena measuring 4 m x 4 m, divided equally into a brown half covered with dead grass and a green half covered with live, green grass. They released 100 green grasshoppers into the arena and, after 30 minutes, recorded the percentage of grasshoppers settled on the green grass. They then repeated the experiment with 100 brown grasshoppers. The results are shown in the graph below.



Graph 1

See next page

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(a) (i) For the experiment described, name the following: (2 marks)

The dependent variable.

The independent variable.

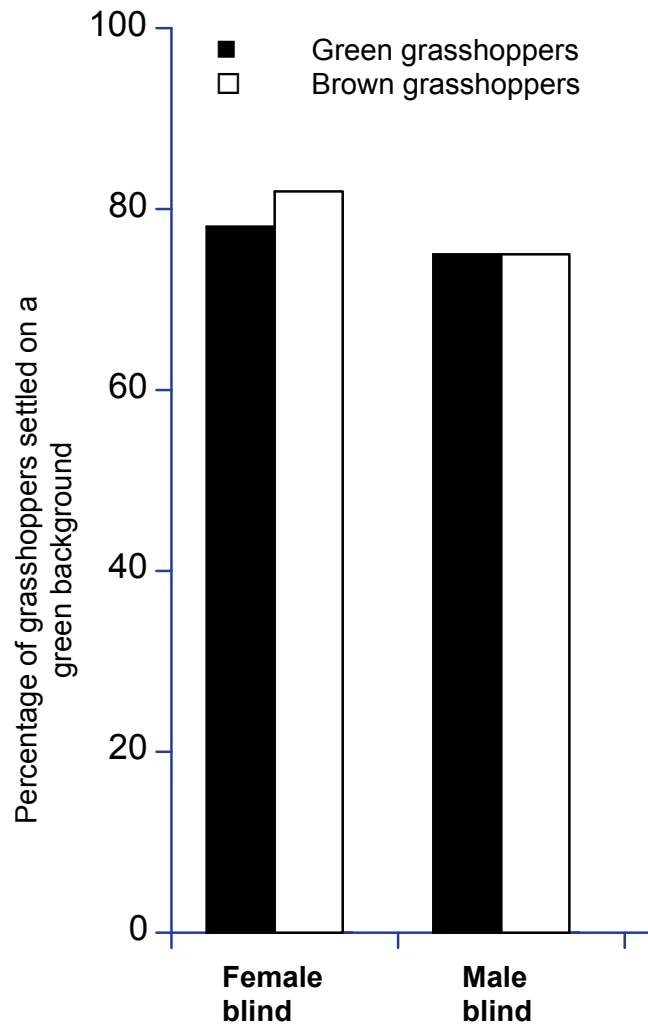
(ii) Why did the biologists use 100 grasshoppers in each group tested? (2 marks)

(b) (i) Describe, with reference to the graph, any differences in the colour of grass selected by green and brown grasshoppers. (2 marks)

(ii) Do the results support the hypothesis? Explain your answer. (2 marks)

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After examining the results, the biologists hypothesised that the grasshoppers used eyesight to choose between the green and brown grass. To test this, they repeated the experiment, but this time they blindfolded the grasshoppers by wrapping small pieces of foil over their eyes. The results are shown in the graph below.



Graph 2

- (c) (i) Describe, with reference to graph 1 and graph 2, any difference being blindfolded made to the colour of grass selected by green and brown grasshoppers. (2 marks)

- (ii) Do the results support the hypothesis that the grasshoppers use eyesight to choose between the green and the brown grass? Explain your answer. (2 marks)

See next page

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- (d) Explain how **two (2)** factors, other than deliberate choice by grasshoppers, could explain why most green grasshoppers are found in green grass and most brown grasshoppers are found in brown grass.

Factor one (2 marks)

Factor two (2 marks)

- (e) Another biologist examined the data and argued that the results could not be accepted unless they occurred again if the experiments were repeated. Explain the biologist's reasoning. (4 marks)

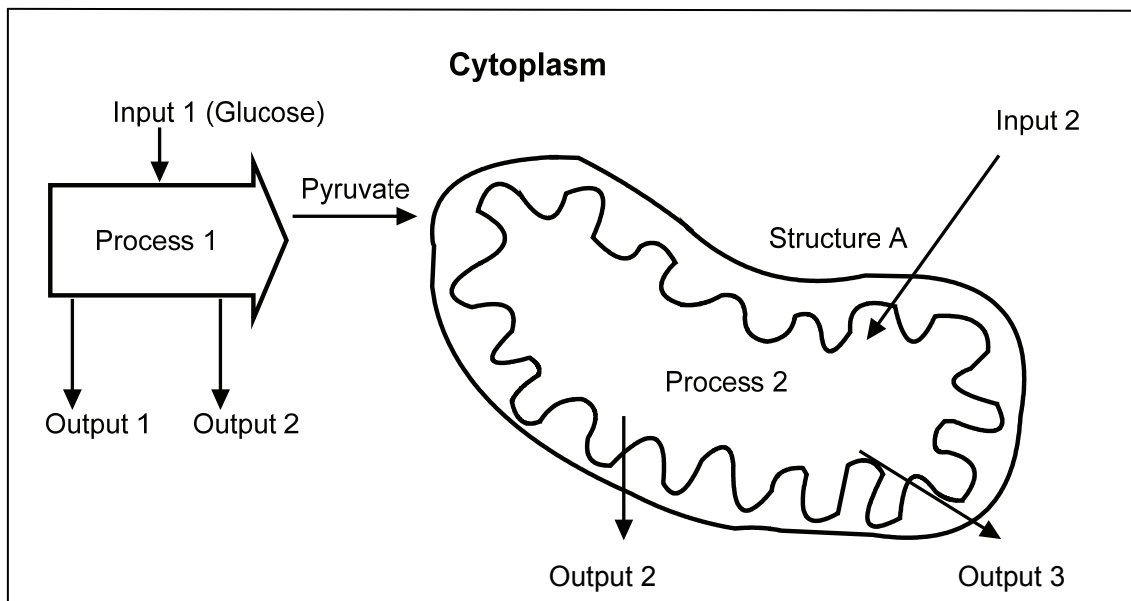
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Question 25

(20 marks)

The following parts of question 25 relate to the diagram below, which shows processes occurring in an animal cell.

Animal Cell



(a) Name:

Output 1 _____ (1 mark)

Output 2 _____ (1 mark)

Output 3 _____ (1 mark)

Input 2 _____ (1 mark)

(b) (i) Under what conditions do cells rely entirely on Process 1? (1 mark)

(ii) List **all** of the outputs of Process 1 in plant cells. (1 mark)

- (iii) Describe **two (2)** disadvantages for cells relying on Process 1 only rather than Process 1 followed by Process 2. (2 marks)

Disadvantage one

Disadvantage two

- (c) For the reactions in Processes 1 and 2 to take place, certain chemicals called enzymes must be present in the cell. Explain how they are affected by

- (i) variations in pH. (2 marks)

- (ii) decreases in temperature. (2 marks)

- (d) Structure A has many closely folded internal membranes.

- (i) Explain what advantage this gives. (2 marks)

- (ii) What substances would you expect to find on the surface of the internal membranes, and why? (2 marks)

- (e) What advantages does the cell gain by carrying out Process 1 in the cytoplasm and Process 2 inside Structure A? (4 marks)

End of Section Two

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Section Three: Extended answer**30% (60 Marks)**

Section Three consists of two parts.

Part A mainly tests your **knowledge** of syllabus content. Answer **two (2)** questions from this part.

Part B mainly tests **how you apply** your understanding of biological principles. Answer **two (2)** questions from this part.

Answers may be presented in different ways, provided that they communicate your ideas effectively. You may choose to:

- present a clearly labelled diagram;
- write notes beside a clear diagram;
- write lists of points, with sentences that link them;
- write concisely worded sentences; or
- use some other appropriate way to present ideas.

Use black or blue pen or ballpoint for written answers and pencil for diagrams. Crossing out of incorrect material is acceptable and preferred to using correction fluid.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- **Planning:** If you use the spare pages for planning, indicate this clearly at the top of the page.
- **Continuing an answer:** If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.

Suggested working time: 60 minutes.

Part A

Answer any two (2) questions from questions 26 to 29. (30 marks)

Indicate the first question from Part A you will answer by ticking the box next to the question. Write your answers on pages 26–30. When you have answered your first question, turn to pages 31 and indicate the second question you will answer on that page.

Question 26**(15 marks)**

Urban and natural ecosystems have similarities and differences.

- Compare and contrast inputs and outputs of urban and natural ecosystems. (5 marks)
- Compare and contrast the role of recycling in urban and natural ecosystems. (5 marks)
- Over long periods of time, would an urban or a natural ecosystem be the more stable? Explain your answer. (5 marks)

See next page

**Question 27****(15 marks)**

It is important for animals to maintain the levels of water and salts in their internal environment within narrow limits.

- (i) Explain why these substances must be kept within narrow limits. (5 marks)
- (ii) Explain briefly how **five (5)** named animals you have studied maintain water and salt levels in the internal environment within narrow limits. (10 marks)

Question 28**(15 marks)**

Outline **five (5)** types of evidence showing that species have evolved over time. Use examples to support your answer.

Question 29**(15 marks)**

Describe an experiment you carried out in this course that used cytological or biochemical testing to determine the function of an enzyme, cell organelle or cell membrane. In your answer, indicate clearly:

- (i) the specific cell function involved and the hypothesis you tested. (3 marks)
- (ii) the equipment or reagents required. (3 marks)
- (iii) the dependent variable(s) you measured, the independent variable(s) and the variables you controlled. (3 marks)
- (iv) the results you obtained. (3 marks)
- (v) what the results indicated about the function of the enzyme, organelle or membrane. (3 marks)



Part A

Indicate the second question from Part A you will answer by ticking the box next to the question. Write your answers on pages provided.

Question 26**(15 marks)**

Urban and natural ecosystems have similarities and differences.

- (i) Compare and contrast inputs and outputs of urban and natural ecosystems. (5 marks)
- (ii) Compare and contrast the role of recycling in urban and natural ecosystems. (5 marks)
- (iii) Over long periods of time, would an urban or a natural ecosystem be the more stable? Explain your answer. (5 marks)

Question 27**(15 marks)**

It is important for animals to maintain the levels of water and salts in their internal environment within narrow limits.

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- (iii) the dependent variable(s) you measured, the independent variable(s) and the variables you controlled. (3 marks)
- (iv) the results you obtained. (3 marks)
- (v) what the results indicated about the function of the enzyme, organelle or membrane. (3 marks)

Part B

(30 marks)

Answer any two (2) questions from questions 30 to 33.

Indicate the first question from Part B you will answer by ticking the box next to the question. Write your answer on pages 40–45. When you have answered your first question, turn to pages 46–48 and indicate the second question you will answer on those pages.

Question 30

(15 marks)

The antelope jackrabbit, *Lepus alleni*, is found in deserts in Arizona, USA. The arctic hare, *Lepus arcticus*, occurs in the snow-covered Arctic. From what you can see in the photographs below and what you predict is the likely body structure, physiology and behaviour of these animals, given their environments, explain how they are adapted to their specific environments.



Lepus alleni



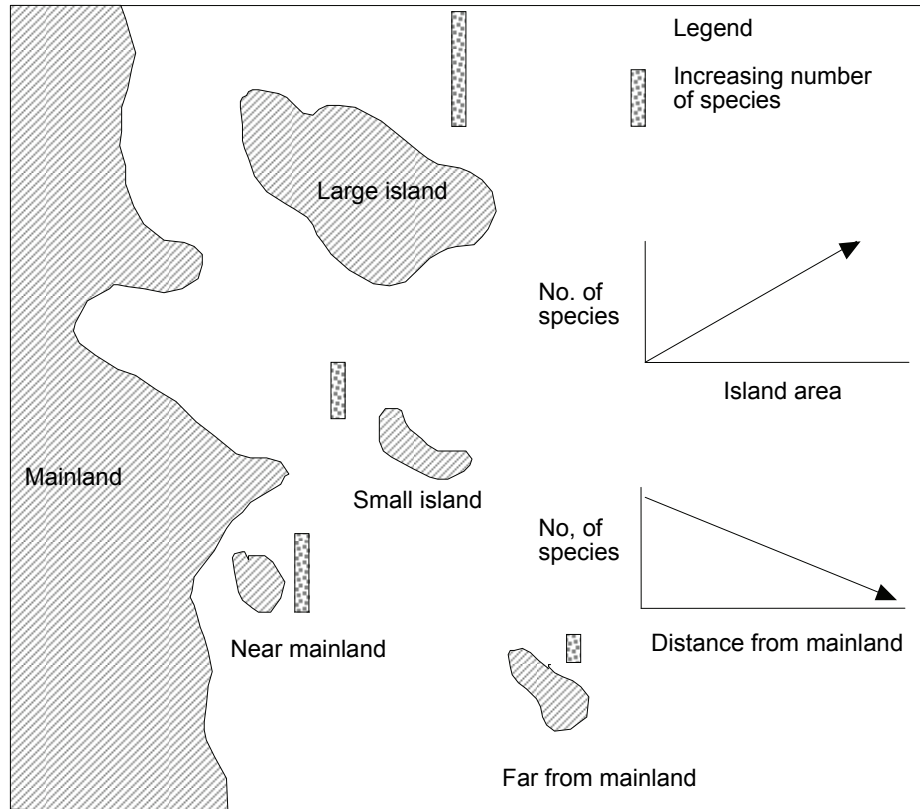
Lepus arcticus



Question 31

(15 marks)

Biologists studying the number of species on islands off the coasts of continents have concluded that, in general, larger islands have more species than smaller islands and the closer an island is to the mainland the more species it is likely to have. These conclusions are shown in the figure below.



Other biologists wondered if these conclusions might also apply to fragments of natural habitat remaining in areas modified by humans. Using your knowledge of the impacts of humans on natural ecosystems, explain

- (i) what human activities might break large landscapes into fragments of natural habitat. (5 marks)
- (ii) how the conclusions from island biogeography could be helpful in planning the location and size of nature reserves or protected areas for the conservation of endangered species in large landscapes. (5 marks)
- (iii) how three other strategies, apart from establishing nature reserves, can be used to conserve endangered species. (5 marks)

Question 32**(15 marks)**

Biologists now believe that the ancestors of domestic cats wandered from forests into human settlements in search of food, which they found in the form of rodents eating stores of grain.

- (i) Explain how the process of natural selection in this situation could have led to the physical and behavioural characteristics of modern domestic cats. (5 marks)
- (ii) A major problem in Australia is that of domestic cats escaping, or being dumped, and surviving in the wild by hunting local animals. One suggested control measure is to genetically modify the cat influenza virus to produce a highly virulent (deadly) form that could be released amongst feral cat populations. Using your knowledge of evolutionary theory, explain what you would expect to happen to both the feral cat population **and** the genetically modified influenza virus over a period of 20 years. (5 marks)
- (iii) What ethical and biosafety issues would have to be considered before such a control measure could be implemented? (5 marks)

Question 33**(15 marks)**

Animal ethics committees evaluating proposed experiments on animals are meant to operate according to the three principles of reduction (using as few animals as possible while maintaining experimental validity), refinement (using procedures that cause as little pain or suffering as possible, or choosing animal species to study that are least likely to suffer) and replacement (finding an alternative to using animals at all).

A team of veterinarians wished to evaluate a new treatment for healing skin lacerations (cuts) in pet mammals. They planned to use 20 horses. Each horse would be given a local anaesthetic on its right foreleg and then a cut 10 cm long and 1 cm deep would be made through the skin into the muscle, ensuring that the skin was cut all the way through. A random group of ten horses would then be treated with the old treatment and the other ten horses would be treated with the new treatment. The veterinarians intended to monitor the rate at which the wounds healed.

You are on an animal ethics committee evaluating this application. What questions would you ask the investigators and what suggestions would you make according to the principles of reduction, refinement and replacement?

Part B

(30 marks)

Indicate the second question from Part B you will answer by ticking the box next to the question. Write your answer on the pages provided.

Question 30

(15 marks)

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Lepus alleni



Lepus arcticus

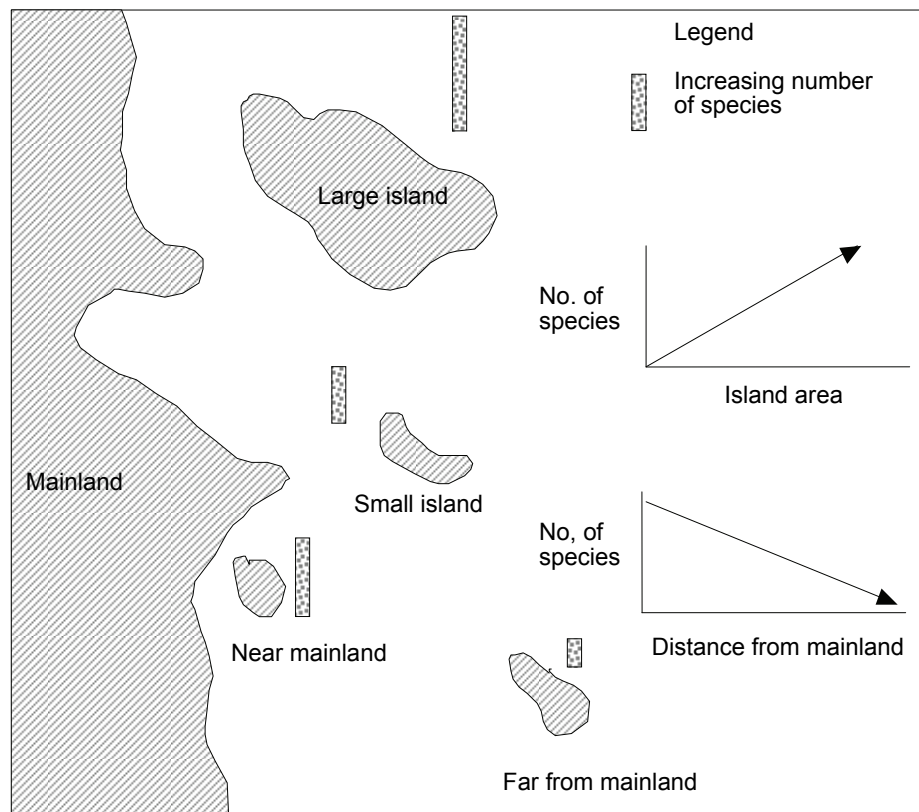
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Question 31

(15 marks)

Biologists studying the number of species on islands off the coasts of continents have concluded that, in general, larger islands have more species than smaller islands and the closer an island is to the mainland the more species it is likely to have. These conclusions are shown in the figure below.



Other biologists wondered if these conclusions might also apply to fragments of natural habitat remaining in areas modified by humans. Using your knowledge of the impacts of humans on natural ecosystems, explain

- (i) what human activities might break large landscapes into fragments of natural habitat. (5 marks)
- (ii) how the conclusions from island biogeography could be helpful in planning the location and size of nature reserves or protected areas for the conservation of endangered species in large landscapes. (5 marks)
- (iii) how three other strategies, apart from establishing nature reserves, can be used to conserve endangered species. (5 marks)

Question 32**(15 marks)**

Biologists now believe that the ancestors of domestic cats wandered from forests into human settlements in search of food, which they found in the form of rodents eating stores of grain.

- (i) Explain how the process of natural selection in this situation could have led to the physical and behavioural characteristics of modern domestic cats. (5 marks)
- (ii) A major problem in Australia that of is domestic cats escaping, or being dumped, and surviving in the wild by hunting local animals. One suggested control measure is to genetically modify the cat influenza virus to produce a highly virulent (deadly) form that could be released amongst feral cat populations. Using your knowledge of evolutionary theory, explain what you would expect to happen to both the feral cat population **and** the genetically modified influenza virus over a period of 20 years. (5 marks)
- (iii) What ethical and biosafety issues would have to be considered before such a control measure could be implemented? (5 marks)

Question 33**(15 marks)**

Animal ethics committees evaluating proposed experiments on animals are meant to operate according to the three principles of reduction (using as few animals as possible while maintaining experimental validity), refinement (using procedures that cause as little pain or suffering as possible, or choosing animal species to study that are least likely to suffer) and replacement (finding an alternative to using animals at all).

A team of veterinarians wished to evaluate a new treatment for healing skin lacerations (cuts) in pet mammals. They planned to use 20 horses. Each horse would be given a local anaesthetic on its right foreleg and then a cut 10 cm long and 1 cm deep would be made through the skin into the muscle, ensuring that the skin was cut all the way through. A random group of ten horses would then be treated with the old treatment and the other ten horses would be treated with the new treatment. The veterinarians intended to monitor the rate at which the wounds healed.

You are on an animal ethics committee evaluating this application. What questions would you ask the investigators and what suggestions would you make according to the principles of reduction, refinement and replacement?

End of questions

ACKNOWLEDGEMENTS

Section Three

Question 30

Adapted photograph of *Lepus alleni*:
Retrieved June, 2010, from Desert Ecology of Tucson, AZ website:
http://wc.pima.edu/Bfiero/tucsonecology/animals/mamm_anja.htm

Photograph of *Lepus arcticus*:
Adapted from Nicklen, P. (n.d.). *Arctic Hare Lepus arcticus*. Retrieved June, 2010, from National Geographic Society website:
<http://animals.nationalgeographic.com/animals/printable/arctic-hare.html>

Question 31

Diagram adapted from:
Environment Canada. (2005). *Figure 16: Island biogeography*. Retrieved June, 2010, from www.on.ec.gc.ca/wildlife/ecogifts/biog-e.html

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