



Western Australian Certificate of Education Examination, 2011

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 Part A	4	2	60	60	30
Part B	4	2			
Total					100

Instructions to candidates

- The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2011*. 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 provided. Use a blue or black pen for this section. Only the graph may be drawn in pencil.

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 52'. 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 52'. 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. A species of marine fish has 144 chromosomes in its gametes. How many chromosomes would be found in its body cells?

- (a) 36
- (b) 72
- (c) 144
- (d) 288

2. The diagrams below show the beaks of three closely-related species of herbivorous finch from three different islands within the Galapagos group.

For copyright reasons this image cannot be reproduced in the online version of this document but may be viewed at <http://taggart.glg.msu.edu/isb200/beagle.htm>

Which of the following would have had the **least** effect on the evolution of the beak shape of these birds?

- (a) type of food available on each island
 - (b) distances between the three islands
 - (c) type of predator on each island
 - (d) type of vegetation on each island
3. The greenkeeper at a bowling club sprays the lawn with a non-biodegradable chemical that prevents fungal infections in the grass. He uses a spray concentration of 1 part per million (ppm). It is known that a species of beetle eats the grass and is in turn eaten by rats, which are then eaten by owls. After three months, a number of dead owls are found in the area. Their bodies are tested for levels of the chemical, which is the suspected cause of the deaths.

Which of the following would be the most likely concentration of insecticide in the owls' bodies?

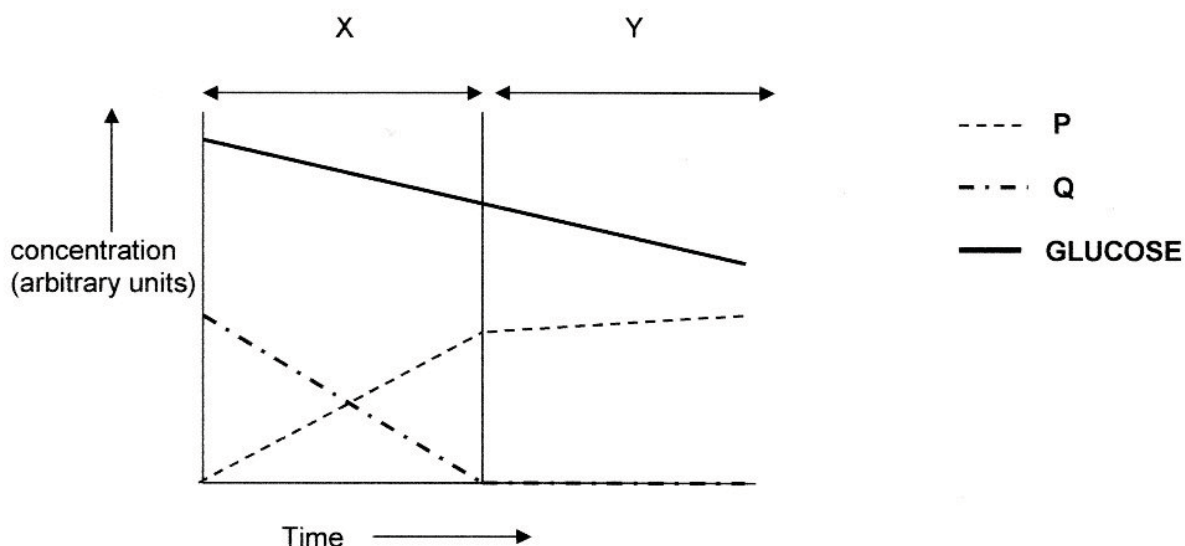
- (a) zero because the chemical only affects insects
- (b) same level as rats but owls are more sensitive than other animals
- (c) less than the levels in the beetles because loss occurs along the food chain
- (d) higher than the levels in the rats because owls are top level consumers

See next page

4. The complementary DNA codon (base triplet) for ATG is
- (a) TAC.
 - (b) GTA.
 - (c) TUC.
 - (d) GCA.
5. The enzyme DNA polymerase
- (a) produces a complementary DNA strand from an RNA template.
 - (b) enables DNA to be repaired and joins DNA fragments together.
 - (c) adds nucleotides to template DNA to produce a complementary strand.
 - (d) cuts DNA at a specific base sequence recognition site.
6. Which one of the following biological field survey techniques would be most useful to estimate the population density of a species of small spider in an area of native bushland?
- (a) trapping
 - (b) quadrats
 - (c) transects
 - (d) tracking
7. Biodiversity
- (a) is increased by selective breeding of agricultural crops.
 - (b) includes extinct species as well as present-day species.
 - (c) includes genes, species and ecosystems.
 - (d) has been decreasing over the history of life on Earth.
8. Many seabirds are able to drink sea water because they have glands near the tops of their beaks that excrete salt solution. If sea water contains 35 grams of salt per litre, the concentration of salt excreted from the glands is
- (a) less than 35 g/L.
 - (b) equal to 35 g/L.
 - (c) more than 35 g/L.
 - (d) dependent on the amount of sea water the bird drinks.

9. Active yeast cells were added to a container of nutrient solution and the container was then sealed. Levels of oxygen, carbon dioxide and glucose were then measured continuously over a period of time.

X and Y represent time intervals when two different types of respiration are occurring.



For the time interval shown in the graph, choose the correct representation of P, Q, X and Y from the alternatives provided in the table.

	P	Q	X	Y
(a)	carbon dioxide	oxygen	anaerobic respiration	aerobic respiration
(b)	oxygen	carbon dioxide	aerobic respiration	anaerobic respiration
(c)	carbon dioxide	oxygen	aerobic respiration	anaerobic respiration
(d)	oxygen	carbon dioxide	anaerobic respiration	aerobic respiration

10. Vertebrates cannot store excess amino acids in their bodies. They are broken down, producing nitrogenous wastes which are excreted.

The table below shows the percentages of different forms of nitrogenous waste excreted by four species of vertebrates.

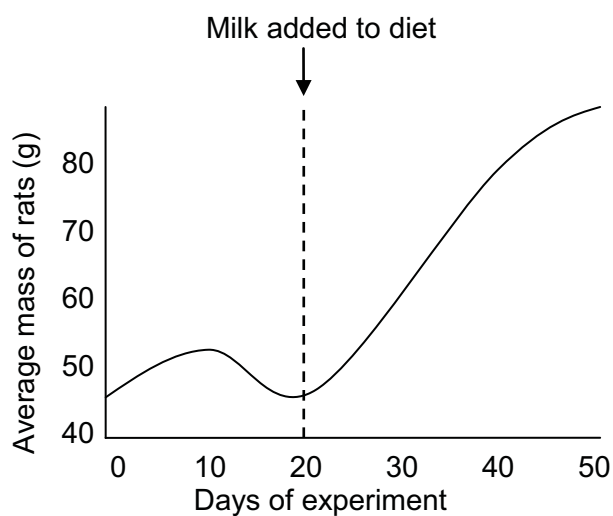
Species	Urea %	Ammonia %	Uric Acid %	Other %
1	84.0	5.2	3.9	6.9
2	0.3	2.6	78.3	18.8
3	8.2	73.9	0.2	17.7
4	3.3	67.4	0.6	28.7

The species most likely to be found in an arid environment is species

- (a) 1.
- (b) 2.
- (c) 3.
- (d) 4.

11. Increases in soil salinity damage plants mainly by
- reducing the oxygen content of soil.
 - increasing the uptake of soil nutrients.
 - killing beneficial soil organisms.
 - reducing the uptake of water.
12. The English biochemist, Sir Frederick Hopkins, identified vitamins as components of milk that were necessary for growth and development in rats. In his experiments he fed young rats on a basic diet that included a purified mixture of lipids, protein, starch, inorganic salts and water. After some time, the animals stopped growing. He then demonstrated what would happen if he added 3mL of milk per day to their diet.

Below is a graph of the results of one of his experiments.



- Which of the following statements, concerning variables in this experiment, is **correct**?
- Growth of the rats is a controlled variable.
 - Presence of milk in the diet is the independent variable.
 - Time over which the experiment was conducted is the dependent variable.
 - The basic diet of the rats is the independent variable.
13. In captive breeding programs, several steps are taken to minimise the amount of inbreeding (mating of animals that are genetically related). The main reason for this is that inbreeding
- increases the probability of mutation.
 - leads to expression of harmful recessive phenotypes.
 - does not allow natural selection to occur.
 - is ethically undesirable.

Questions 14 and 15 refer to the following information.

In the technique of genetic profiling, each DNA profile represents several loci (gene positions) on a pair of homologous chromosomes. If an animal is heterozygous at a particular locus, two bands are seen in the DNA profile. If it is homozygous, only one band is seen.

DNA profiles for three animals are shown below.

Locus	Allele	Animal 1	Animal 2	Animal 3
A	1	-----		
	2		-----	
	3		-----	
	4	-----		-----
	5			-----
B	1			
	2		-----	
	3	-----		
	4	-----	-----	-----
	5			-----
C	1			-----
	2			-----
	3	-----		
	4		-----	
	5			
D	1	-----		
	2		-----	
	3		-----	
	4			-----
	5	-----		
E	1			
	2	-----	-----	
	3			-----
	4		-----	-----
	5			

14. At how many loci is Animal 2 homozygous?
- (a) 1
 (b) 2
 (c) 3
 (d) 4
15. If Animal 1 mated with Animal 3 and produced a single offspring, the offspring
- (a) must be homozygous at locus A.
 (b) may be homozygous at locus D.
 (c) could be either homozygous or heterozygous at locus C.
 (d) must be heterozygous at locus E.

Questions 16–18 refer to the following information.

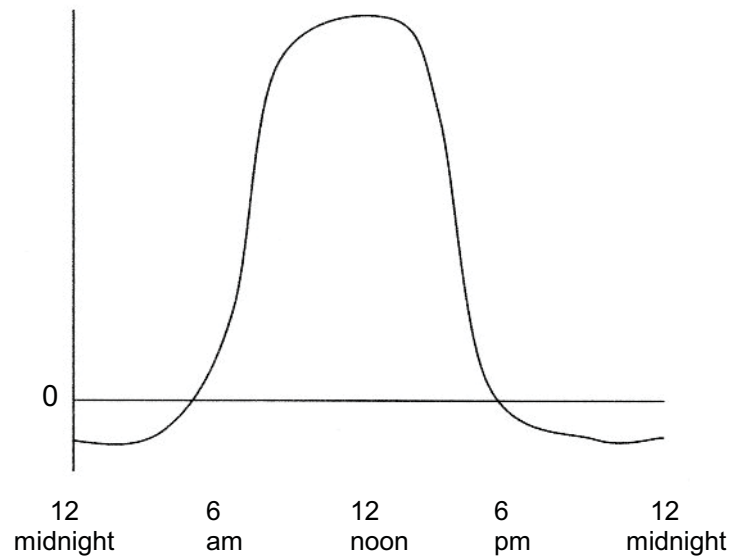
Biologists were particularly interested in why phytoplankton levels were very low in the Southern Ocean, close to Antarctica. They collected marine phytoplankton (single-celled photosynthetic organisms) and grew them in water from the Southern Ocean, adding different combinations of mineral nutrients. They determined the rate of photosynthesis in the cultures by measuring the rate of CO₂ uptake. The results were expressed as a relative amount compared to the rate when no nutrient was added. The results are shown below.

Nutrients added to culture	Uptake of CO ₂ (relative amount)
None (Southern Ocean water only)	1.00
Nitrogen (N) + phosphorus (P)	1.10
N + P + metals (excluding iron)	1.08
N + P + metals (including iron)	12.90
N + P + iron	12.00

16. The dependent variable in the experiment is the
- (a) uptake of CO₂ by cultures.
 - (b) Southern Ocean water.
 - (c) presence or absence of iron.
 - (d) number of cultures used.
17. What is the **best** conclusion that can be drawn from the results of this experiment?
- (a) Southern Ocean phytoplankton has a low rate of photosynthesis.
 - (b) Availability of iron limits photosynthesis in the Southern Ocean water.
 - (c) Single-celled organisms need iron to photosynthesise.
 - (d) Adding metals to the Southern Ocean would be a useful ecological strategy.
18. The validity of the results in the experiment above would be **least** affected by whether all cultures received the same
- (a) amount of light as each other.
 - (b) day length conditions as occur in the Southern Ocean.
 - (c) temperature conditions as each other.
 - (d) amount of phytoplankton added to them.

19. Cactus plants are able to survive in extremely dry environments. One adaptation of the cactus involves chemicals that collect and store CO_2 inside its cells. This allows the plant to photosynthesise, even when its stomata are closed during the hot, dry daytime. The stomata reopen in the cooler, more humid conditions at night to renew their CO_2 store.

Consider the graph below in which the vertical axis has not been labelled.

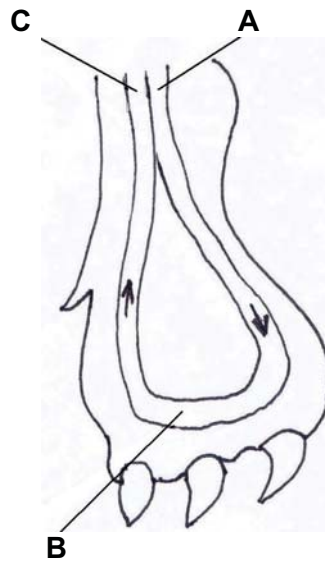


Using the information above, which label should be given to the vertical axis?

- (a) CO_2 levels inside cactus cells
- (b) Stomatal opening
- (c) Rate of O_2 production
- (d) Water uptake by roots

20. Counter-current heat exchangers are found in the limbs of some birds and mammals living in cold environments. Warmer blood pumped to the extremities is cooled by colder blood returning to the heart, thus minimising heat loss from the extremities.

Refer to the diagram below to answer this question.



The blood temperatures ($^{\circ}\text{C}$) at A, B and C respectively, are likely to be

	A	B	C
(a)	34	5	22
(b)	22	5	34
(c)	34	22	5
(d)	22	34	5

End of Section One

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 for this section. Only the graph may be drawn in pencil.

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.

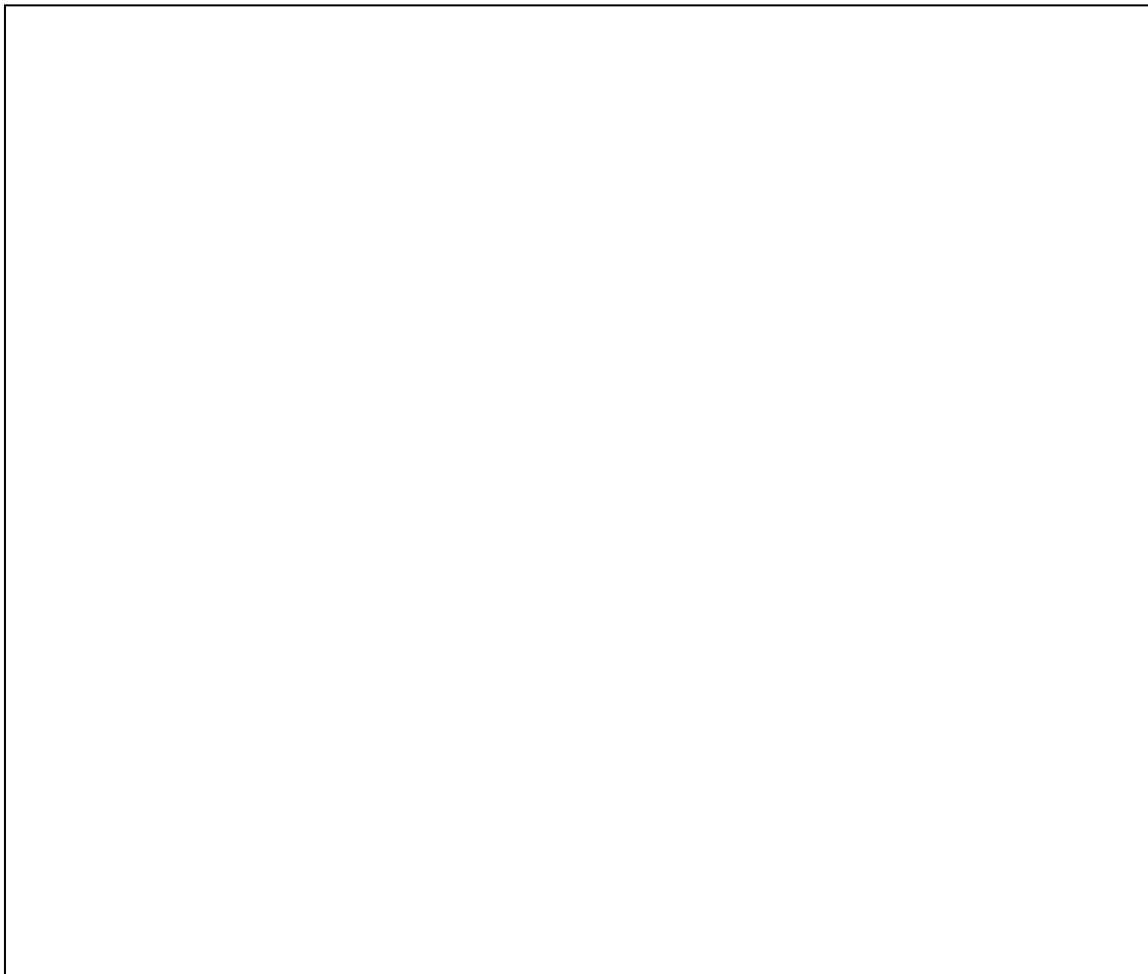
- **Planning:** If you use the spare pages for planning, indicate this clearly at the top of the page.
- **Continuing an answer:** If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of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

Suggested working time: 90 minutes.

Question 21**(20 marks)**

DNA is an information-carrying molecule that is essential to all organisms and has many functions.

- (a) Describe, with the aid of a labelled diagram, the basic structure of DNA. (4 marks)



See next page

- (b) In terms of DNA structure, explain why different alleles of a gene produce different proteins. (4 marks)

- (c) Two techniques that are used in DNA technology are polymerase chain reaction (PCR) and DNA microarrays (chips).

- (i) Explain briefly the purpose of polymerase chain reaction (PCR). (2 marks)

- (ii) State **two (2)** purposes of the DNA microarray technique. (2 marks)

(d) One of the most important uses of recombinant DNA technology in agriculture is pest control in crops.

(i) The main process used in this area is gene cloning. Explain briefly the role of restriction enzymes and plasmids in this process. (2 marks)

(ii) In recent years farmers and biologists have expressed concerns about the ethics of using gene cloning in agricultural pest control. (2 marks)

Discuss **one (1)** concern that has been raised in this area.

(e) Apart from pest management in agriculture, describe **two (2)** other uses of recombinant DNA technology. (4 marks)

Question 22

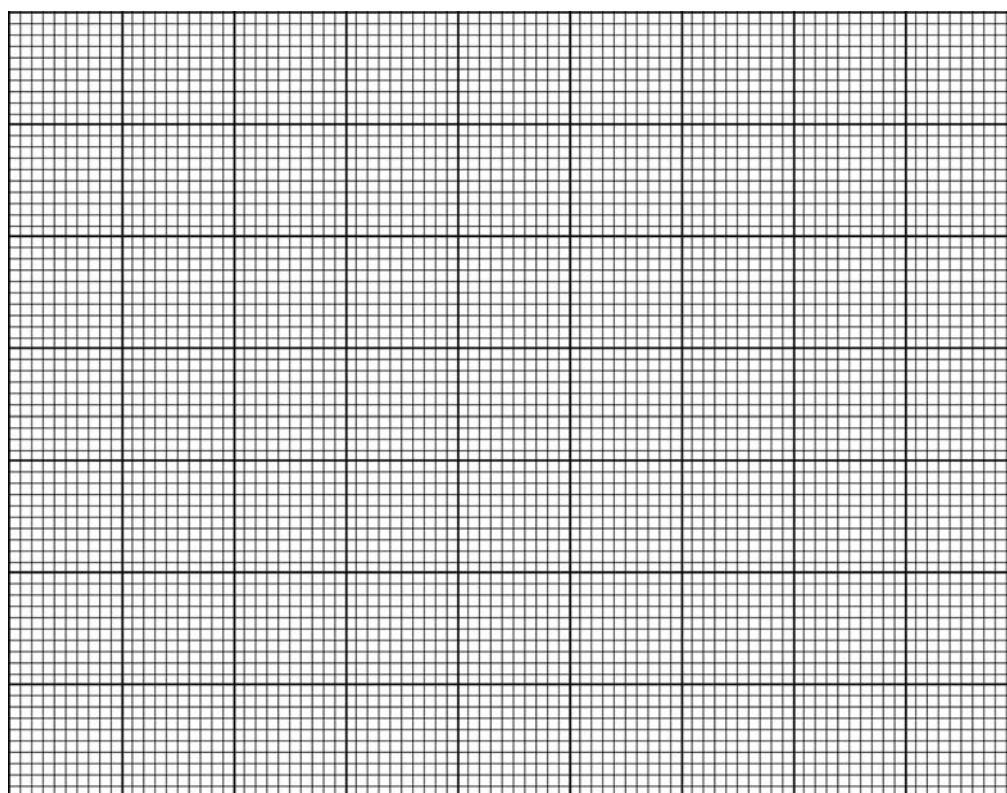
(20 marks)

Biologists can estimate the amount of protein in an unknown solution by using a technique called a standard curve. This technique involves preparing a range of protein solutions of known concentrations. Two drops of an indicator called Coomassie blue is then added to 1 mL of each solution. The protein reacts with the dye to produce a blue colour. The intensity of this blue colour is proportional to the amount of protein present. This colour intensity is measured using an instrument called a spectrophotometer. The results are then graphed and the graph is called a standard curve. Data suitable for constructing a standard curve are shown in Table 1 below.

Table 1: Colour intensity of Coomassie blue at different protein concentrations.

Protein concentration ($\mu\text{g/mL}$)	Coomassie blue intensity (absorbance units)
0	0.00
250	0.35
500	0.50
1000	0.80
1500	1.00
2000	1.10

- (a) On the grid provided, graph these data.
 If you wish to have a second attempt at this item, the grid is repeated at the end of the examination booklet. Indicate clearly on this page if you have used the second grid and cancel the workings on the grid on this page. (6 marks)



- (b) (i) Using your graph, estimate the protein concentrations of solutions having an absorbance of _____ (2 marks)

0.75 absorbance units. _____

1.15 absorbance units. _____

- (ii) In which estimate do you have greater confidence? Explain the reason for your choice. (2 marks)

Two students wished to determine the protein concentration in a sample of plant tissue using this graph. They ground up 1 g of the plant tissue in 5 mL of saline solution, prepared six test tubes as follows and then measured the absorbance (colour intensity) of each solution in the spectrophotometer. Their results are shown in Table 2 below.

Table 2: Results of the students' experiment on the protein concentration in plant tissue

Test tube number	Contents of test tube	Absorbance
1	1 mL of saline solution plus two drops of Coomassie blue	0.00
2	1 mL of saline solution containing ground-up plant tissue plus two drops of Coomassie blue	0.32
3	1 mL of saline solution containing ground-up plant tissue plus two drops of Coomassie blue	0.31
4	1 mL of saline solution containing ground-up plant tissue plus two drops of Coomassie blue	0.35
5	1 mL of saline solution containing ground-up plant tissue plus two drops of Coomassie blue	0.30
6	1 mL of saline solution containing ground-up plant tissue plus two drops of Coomassie blue	0.32

- (c) (i) Why did the students include test tube 1? (2 marks)

- (ii) Why did the students include test tubes 2 to 6, rather than just test tube 2? (2 marks)

- (d) Using the data in your graph and in Table 2, estimate the protein concentration in the plant tissue. Show your workings. (4 marks)

The students' teacher suggested that they should check that their procedure matched that used by the original researchers. To enable them to do this, he supplied them with a protein solution of exactly 1000 µg/mL concentration.

- (e) Describe how the students should check that their procedure is correct **and** predict the expected result using data from Table 1. (2 marks)

Question 23

(20 marks)

Urban ecosystems produce large amounts of solid waste (rubbish), most of which is buried in landfills and not recycled. The table below indicates the relative amounts of solid waste that might be produced annually in a typical large city.

Solid waste sent to landfill		
Categories of rubbish	Weight (thousand tonnes)	Percentage of total waste
Paper/cardboard products	64	32
Garden prunings/wood	40	20
Aluminium	4	2
Other metals	14	7
Glass	11	5.5
Plastics/rubber	21	10.5
Food	22	11
Other	24	12

- (a) Much of this rubbish cannot be broken down by decomposers and remains in the ground, virtually unchanged, for a very long time. However, some of the rubbish is biodegradable (able to be broken down by decomposers).
- (i) From the table name the **three (3)** categories of rubbish that you would most expect to be biodegradable. (1 mark)
- _____
- (ii) What total percentage of rubbish do these three categories make up? (1 mark)
- _____
- (iii) Explain briefly, in biological terms, why these materials are biodegradable and why the others are not. (2 marks)
- _____
- _____
- _____
- _____
- _____

(b) Most local authorities have developed alternative strategies to deal with biodegradable wastes and to reduce the amount buried in the landfill.

Name **two (2)** different, environmentally-friendly methods (other than burial) that households or local authorities could use to recycle biodegradable waste. Explain briefly the benefits of each. (4 marks)

(c) State and explain the effect that increased recycling in an urban ecosystem has on the following:

(i) Stability (sustainability) (2 marks)

(ii) Inputs and outputs (2 marks)

- (d) Name **one (1)** greenhouse gas produced as a result of the decomposition of biodegradable material in landfill sites. Explain how this gas contributes to global warming. (4 marks)

- (e) State **one (1)** cause and **one (1)** biological consequence in natural ecosystems of the following problems that are the result of human activity.

- (i) Eutrophication (2 marks)

- (ii) Excessive harvesting of natural populations to feed humans, for example fishing (2 marks)

Question 24

(20 marks)

Chamaecytisus palmensis (commonly called tree lucerne, or tagasaste) is an evergreen plant that was introduced into Western Australia in the 1980s. It is rich in protein, making it highly nutritious for farm animals, especially cattle.

When tagasaste begins flowering in winter, chemicals called mycotoxins build up in the leaves, causing them to taste bitter to animals. In early summer, the conditions become very dry. At this stage flowering has finished, the seeds are mature, the mycotoxin level has decreased and farm animals begin to feed on the leaves.

(a) The change in mycotoxin levels in tagasaste described above is called an adaptation.

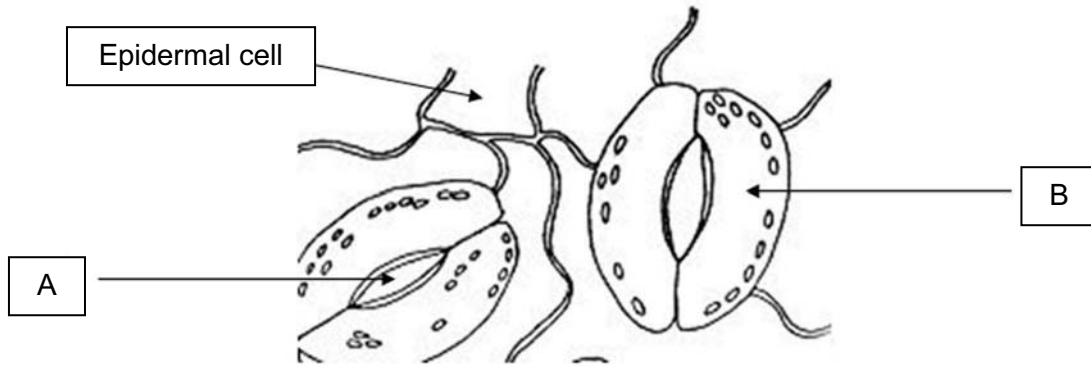
(i) Define adaptation. (1 mark)

(ii) Which of the three categories of adaptation is shown by this characteristic of tagasaste? (1 mark)

(b) Plants like tagasaste that live in hot, dry conditions have adaptations that reduce water loss from their leaves.

Name **two (2)** possible adaptations of plants living in hot and dry conditions and explain how they help to reduce water loss. (4 marks)

(c) Tagasaste is a vascular plant. It therefore contains structures on the epidermal surface of its leaves as shown in the diagram below. These structures are related to water loss.



(i) Name the parts of the diagram labelled as A and B. (2 marks)

A _____

B _____

(ii) During the daytime, the size of A increases. Explain briefly how changes in B cause this. (2 marks)

(d) In some areas, tagasaste has invaded native bushland and become a pest.

(i) State **two (2)** distinctly-different effects the invading tagasaste could have on organisms native to the area that it has invaded. (2 marks)

- (ii) Name **one (1)** other introduced plant that has become a pest in Australia and describe a method used to control it. (2 marks)

- (e) Reafforestation is an important strategy for providing habitat for threatened plant and animal species. When planning reafforestation, there are several things to consider.

For each of the following, give a brief description of how the problem should be approached.

- (i) Describe the kinds of species that should be planted in the program. (2 marks)

- (ii) Identify the most desirable size and shape of an area when planning the reafforestation and explain why. (4 marks)

Question 25

(20 marks)

Many desert mammals survive despite large fluctuations in environmental temperature and water availability from winter to summer and from day to night. These mammals must control both water loss and body temperature extremes.

- (a) Explain briefly how a large surface area to volume ratio can be both an advantage and a disadvantage for mammals living in a hot, dry environment. (4 marks)

- (b) Several factors other than water and temperature levels must be kept constant in the internal environment of mammals.

Name **four (4)** of these factors. (4 marks)

- (c) Homeostasis is mostly maintained by negative feedback.

In the space below draw a labelled diagram that shows the components of a negative feedback model and how they are interrelated. (4 marks)



(d) Many animals are ectotherms. They have different methods of temperature control from endotherms.

(i) Define the term 'ectotherm'. (1 mark)

(ii) Give an example of a terrestrial ectotherm. (1 mark)

(iii) What category of adaptation do ectotherms mainly use to control body temperature? (1 mark)

(iv) Describe **one (1)** way in which an ectotherm can gain heat. (1 mark)

(e) (i) Explain why large endotherms can remain in the sun for long periods during the day but small endotherms generally avoid the heat of the day. (2 marks)

(ii) Many marine mammals rely on blubber (a layer of fat) rather than hair to conserve heat. Explain why. (2 marks)

End of Section Two

See next page

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 your ideas.

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

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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 answer on pages 27–31. When you have answered your first question, turn to page 32 and indicate the second question you will answer on that page.

Question 26**(15 marks)**

Enzymes are molecules that are essential for all organisms to survive. They control the rate of reactions in many biological processes.

- (i) Describe the properties and actions of enzymes and explain the induced fit and lock and key models. **(10 marks)**
- (ii) Explain how changes in temperature and pH can affect the rates of reactions that are controlled by enzymes. **(5 marks)**

See next page

Question 27 **(15 marks)**

For evolutionary change to take place, variation within a species is essential.

- (i) Describe **three (3)** processes that occur during sexual reproduction to produce this variation. (6 marks)

- (ii) Explain how natural selection contributes to the evolution of one species into two separate species. (9 marks)

 Question 28 **(15 marks)**

The key issues when developing conservation strategies are the maintenance of biodiversity of organisms and the prevention of extinction of species. These strategies can be grouped into three categories: genetic, environmental and management strategies.

- (i) Name and describe **three (3)** genetic strategies that can be used to maintain biodiversity and prevent extinction of species. Give an example of each. (9 marks)

- (ii) Describe **three (3)** ways in which management strategies can be used to conserve natural ecosystems. (6 marks)

 Question 29 **(15 marks)**

- (i) Describe the model of the cell membrane and relate this to its function. (5 marks)

- (ii) Explain how active transport enables materials to move through the cell membrane. (5 marks)

- (iii) All cell functions depend on ATP. Describe the ATP cycle and explain why it is important to cell metabolism. (5 marks)

Part A

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

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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 40–44. When you have answered your first question, turn to pages 45–46 and indicate the second question you will answer on those pages.

Question 30**(15 marks)**

In 1883, a volcanic eruption on the island of Krakatoa destroyed all life on the island. Scientists have been studying the area since then and found that the first colonisers were plants whose seeds had been brought in by the wind or sea. The scientists did not notice any animals on the island until plants had become established. The scientists claimed that this showed 'that for an ecosystem to be initially established, autotrophic organisms must appear before heterotrophic organisms'.

- (i) Explain this statement using your knowledge of the chemical processes involved in photosynthesis, respiration and the transfer of energy. (10 marks)
- (ii) In recent times, an enhanced greenhouse effect has occurred due to the increased concentration of several gases in the earth's atmosphere. One of the most significant of these gases is carbon dioxide.

Discuss the effects this increase in carbon dioxide may have on the functioning of living organisms. (5 marks)

Question 31**(15 marks)**

The following statement was made by Professor Richard Dawkins, an evolutionary biologist.

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Discuss **five (5)** distinct types of clues or evidence that may be found and how they help us to draw conclusions about evolution. (15 marks)

Question 32**(15 marks)**

The populations of several native species of animals, mainly birds, have increased to much higher levels than they were when Europeans first arrived in Australia. The main reason for this is believed to be the increase in the number of watering points established by agricultural activities in more arid parts of the country. This has helped these species survive all year in areas in which they could not survive before. Some populations have become so large that they are considered pests.

- (i) Explain, providing **five (5)** reasons, why this situation is harmful for the ecosystem. (5 marks)
- (ii) Describe **three (3)** methods that environmental authorities may use to help control over-populated native species. (6 marks)
- (iii) These problems of over-population do not affect small, ground-dwelling reptiles or mammals to the same extent in these areas.

Explain **two (2)** possible reasons why this is the case. (4 marks)

Question 33**(15 marks)**

During your Biological Sciences course, you will have conducted or read about experiments that investigated how a particular factor affects the rate of photosynthesis or respiration. Examples of these factors include temperature, carbon dioxide, oxygen, enzymes, water, light, minerals or toxins.

Choose either photosynthesis or respiration and give an account of an experiment that tests the effect of one of the factors named above. Construct your answer under the following headings.

- (i) Hypothesis (2 marks)
- (ii) Equipment and procedure (3 marks)
- (iii) Variables involved (4 marks)
- (iv) Reliability (3 marks)
- (v) Results and conclusion (3 marks)

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)**

In 1883, a volcanic eruption on the island of Krakatoa destroyed all life on the island. Scientists have been studying the area since then and found that the first colonisers were plants whose seeds had been brought in by the wind or sea. The scientists did not notice any animals on the island until plants had become established. The scientists claimed that this showed 'that for an ecosystem to be initially established, autotrophic organisms must appear before heterotrophic organisms'.

- (i) Explain this statement using your knowledge of the chemical processes involved in photosynthesis, respiration and the transfer of energy. (10 marks)
- (ii) In recent times, an enhanced greenhouse effect has occurred due to the increased concentration of several gases in the earth's atmosphere. One of the most significant of these gases is carbon dioxide.

Discuss the effects this increase in carbon dioxide may have on the functioning of living organisms. (5 marks)

Question 31**(15 marks)**

The following statement was made by Professor Richard Dawkins, an evolutionary biologist.

'It is not the kind of evidence where you can say that somebody has seen it happen. It is more like a detective coming on the scene of a crime after it has happened and piecing it together, and saying that all the clues point to a certain conclusion. Well, millions and millions of clues point to the truth of evolution'.

Discuss **five (5)** distinct types of clues or evidence that may be found and how they help us to draw conclusions about evolution. (15 marks)

**Question 32****(15 marks)**

The populations of several native species of animals, mainly birds, have increased to much higher levels than they were when Europeans first arrived in Australia. The main reason for this is believed to be the increase in the number of watering points established by agricultural activities in more arid parts of the country. This has helped these species survive all year in areas in which they could not survive before. Some populations have become so large that they are considered pests.

- (i) Explain, providing **five (5)** reasons, why this situation is harmful for the ecosystem. (5 marks)
- (ii) Describe **three (3)** methods that environmental authorities may use to help control over-populated native species. (6 marks)
- (iii) These problems of over-population do not affect small, ground-dwelling reptiles or mammals to the same extent in these areas.
Explain **two (2)** possible reasons why this is the case. (4 marks)

**Question 33****(15 marks)**

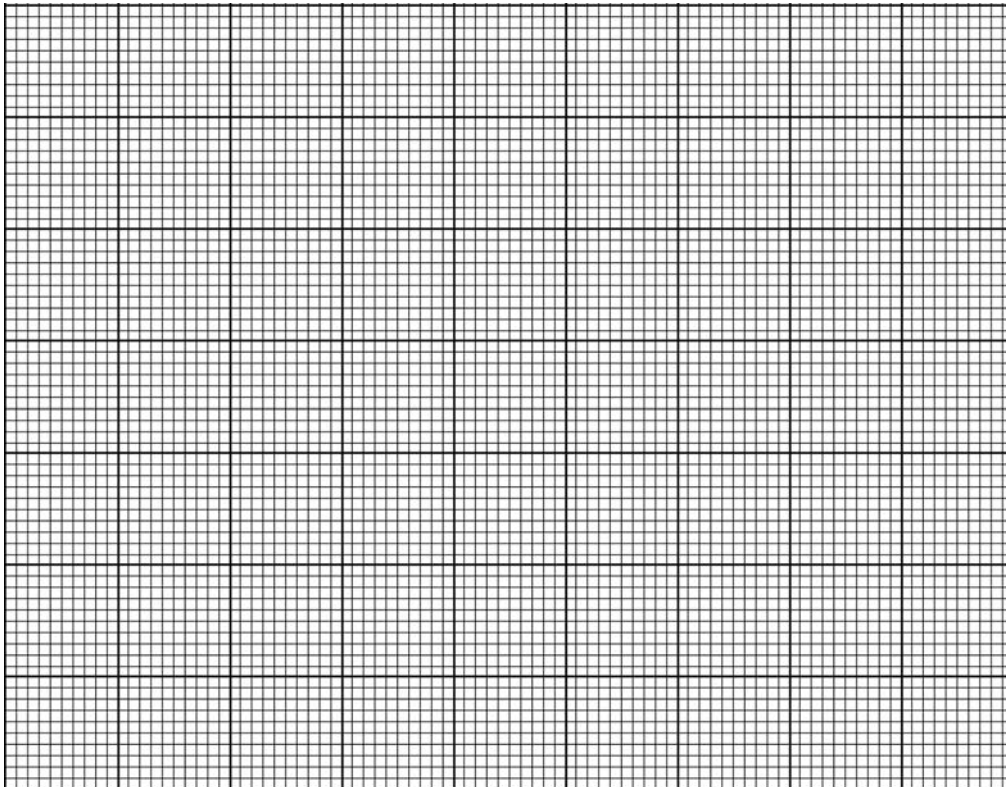
During your Biological Sciences course, you will have conducted or read about experiments that investigated how a particular factor affects the rate of photosynthesis or respiration. Examples of these factors include temperature, carbon dioxide, oxygen, enzymes, water, light, minerals or toxins.

Choose either photosynthesis or respiration and give an account of an experiment that tests the effect of one of the factors named above. Construct your answer under the following headings.

- (i) Hypothesis (2 marks)
- (ii) Equipment and procedure (3 marks)
- (iii) Variables involved (4 marks)
- (iv) Reliability (3 marks)
- (v) Results and conclusion (3 marks)

End of questions

Question 22 (a)



ACKNOWLEDGEMENTS

Section One

Question 2: Diagrams adapted from: Taggart, R.E. Galapagos Island finches. In *The Voyage of the Beagle*. Retrieved December, 2010 from <http://taggart.glg.msu.edu/isb200/beagle.htm>.

Section Three

Question 31: Quotation from: Dawkins, R. In M. Ridley. (2003). *Evolution* (3rd ed.). Retrieved Jan, 2011, from http://www.blackwellpublishing.com/ridley/tutorials/The_evidence_for_evolution3.asp.

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