BIOLOGICAL SCIENCES DRAFT SAMPLE EXAMINATION
STAGE 3

Section 7 of the *WACE Manual: 2008 Revised Edition* outlines the policy on WACE examinations.

Further information about the WACE Examinations policy can be accessed from the Curriculum Council website at http://www.curriculum.wa.edu.au

The purpose for providing a sample examination is to provide teachers with an example of how the course will be examined. Further finetuning will be made to this sample in 2008 by the examination panel following consultation with teachers, measurement specialists and advice from the Assessment, Review and Moderation (ARM) panel.

TRIM 2008/24215

Western Australian Certificate of Education, Sample External Examination
Question/Answer Booklet

BIOLOGICAL SCIENCES

WRITTEN PAPER
STAGE 3

Please place your student identification label in this box

Student Number: In figures

In words

Time allowed for this paper

Reading/planning time before commencing work: Ten minutes
Working time for paper: Three hours

Material required/recommended for this paper

To be provided by the supervisor
Question/Answer Booklet
Multiple Choice Answer Sheet

To be provided by the candidate
Standard items: Pens, pencils, eraser, correction fluid, highlighter and ruler.

Special items: 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.

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Structure of this paper

Section	Suggested working time	Number of questions available	Number of questions to be attempted	Marks
SECTION ONE: Multiple-choice	30 minutes	20	All	40 (20%)
SECTION TWO: Short answers	90 minutes	8	All	120 (60%)
SECTION THREE: Extended answers	60 minutes	2	2 parts from each question	40 (20%)
			[Total marks]	200 (100%)

Instructions to candidates

1. The rules for the conduct of Curriculum Council examinations are detailed in the *Student Information Handbook*. Sitting this examination implies that you agree to abide by these rules.

2. Answer the questions according to the following instructions:

   Read every question carefully before you answer.

   Section One
   Answer **all** questions, using a 2B, B or HB pencil, on the separate Multiple Choice Answer Sheet. Do not use a ball point or ink pen.

   Section Two
   Answer in the spaces provided in this Question/Answer Booklet. Do not answer this section in the Standard Answer Book. A blue or black ball point or ink pen should be used for written answers and pencil for diagrams.

   Section Three
   Write your answers in the Standard Answers Book. Your writing or printing must be **LEGIBLE**. Use a blue or black ball point or ink pen for this section.

3. Answers may be presented in a combination of different ways provided they communicate your ideas effectively. You may choose to:
   - present a clearly labelled diagram or flow chart;
   - write notes besides a clear diagram;
   - write lists of points, with sentences which link them;
   - write concisely worded sentences;
   - use some other appropriate way to present ideas.

4. At the end of the examination your Question/Answer Booklet should be attached to the front of the Standard Answer Book(s) with the paper binder provided.

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SECTION ONE—MULTIPLE-CHOICE [40 marks]

A multiple-choice answer sheet is provided for you to answer questions in this section. Use a 2B, B or HB pencil for all entries. For each question, shade the box which indicates your answer.

If you want to change an answer, erase your first answer and mark the new choice. The answer sheet for Section One will be collected separately by the supervisor.

This section has **TWENTY (20)** questions. Each question is worth **TWO (2)** marks. Marks are not deducted for wrong answers. Attempt **ALL** questions.

Suggested working time: 30 minutes

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1. Complete the following sentence.
Horticulturists and home gardeners grow plants from cuttings, bulbs or runners. The new plants produced this way

a. show very little genetic diversity.
b. exhibit a range of phenotypes.
c. are already adapted to the environment.
d. are able to survive in a greater range of habitats.

2. Substance A, which is a large molecule, is present in low concentrations in the environment surrounding the cell. Substance A is required in high concentrations inside the cell for normal cell functioning. If energy is required to move the molecule across the cell membrane into the cell, which of the following is likely to provide the immediate supply of energy for this transfer to occur?

a. a lipid molecule
b. an ATP molecule
c. a carbohydrate molecules
d. a molecule of DNA

3. One result of the activities of humans in industrial societies has been the release of chemical pollutants into the environment. One group of pollutants resemble oestrogen in their biological effect. Consequently, some scientists describe organisms as now inhabiting a ‘sea of oestrogen’. The effect which is most likely to be observed is:

a. an increase in the growth rate of green plants
b. an increase in fruit setting in citrus orchards
c. an increase in the retention of salt in marine fish
d. disruption to the reproductive abilities of male animals

4. A large proportion of the rice grown around the world is descended from just a few original parent plants which had a high growth rate. Which of the following statements is most likely to be true?

a. The descendents of the original rice plants will quickly adapt to different conditions in different localities.
b. A low level of genetic diversity could make all of the descendents susceptible to the same disease.
c. High levels of rice production can be expected wherever these strains of rice are grown.
d. Isolated populations will develop into new species within a short period of time.

5. The table below lists mercury concentrations in some aquatic animals from Australia.

Animal	Area	Mercury Concentration (ppm)
Whiting and bream (fish)	Botany Bay	up to 8
Oysters	Botany Bay	up to 2.8
Garfish, crabs and others	Brisbane and Pine Rivers and Moreton Bay	up to 0.0125
Flathead and other fish	Off Altona, Melbourne	up to 0.06
Jewfish, flounder and leatherjacket (fish)	Quibray Bay	up to 0.05
Oysters and mussels	Quibray Bay	up to 0.1
24 mixed species of fish	Botany Bay	Average 0.2
One specimen of tailor	Off La Perouse, NSW	1.11
Flathead and trevally	Cook's river, NSW	0.68 - 0.96
Oysters	Georges, Manning, Hawkberry Rivers	up to 0.017
School sharks longer than 71 cm	Victoria and South Australia coastal areas	up to 2.9 average 0.9

Which of the following is probably a true statement about mercury poisoning in different localities?

a. Botany Bay is the most polluted because organisms near the bottom of the food pyramid (oysters and mixed fish) have high levels of mercury.
b. Quibray Bay is the most polluted because the organisms found there have a consistently low mercury concentration in their tissues.
c. Victorian and South Australian coastal areas are more polluted because the organisms at the top of the food pyramid (eg. sharks) have a low average mercury concentration.
d. Brisbane and Pine Rivers and Moreton Bay are the most polluted because the scavenger species contain very low concentrations of mercury.

SEE NEXT PAGE

6. Populations of many species of amphibian, including frogs, are declining. The phenomenon is world wide, and is causing concern to scientists studying amphibians and reptiles. Scientists from Oregon State University in the USA have hypothesised that the phenomenon is caused by increasing levels of UV radiation, particularly of UV B, hindering the ability of amphibians to reproduce. If the hypothesis is correct, the phenomenon is a consequence of:

a. the greenhouse effect.
b. thinning of the ozone layer.
c. water pollution.
d. eutrophication of water ways.

7. The table below lists the thermal death points of a variety of fish.

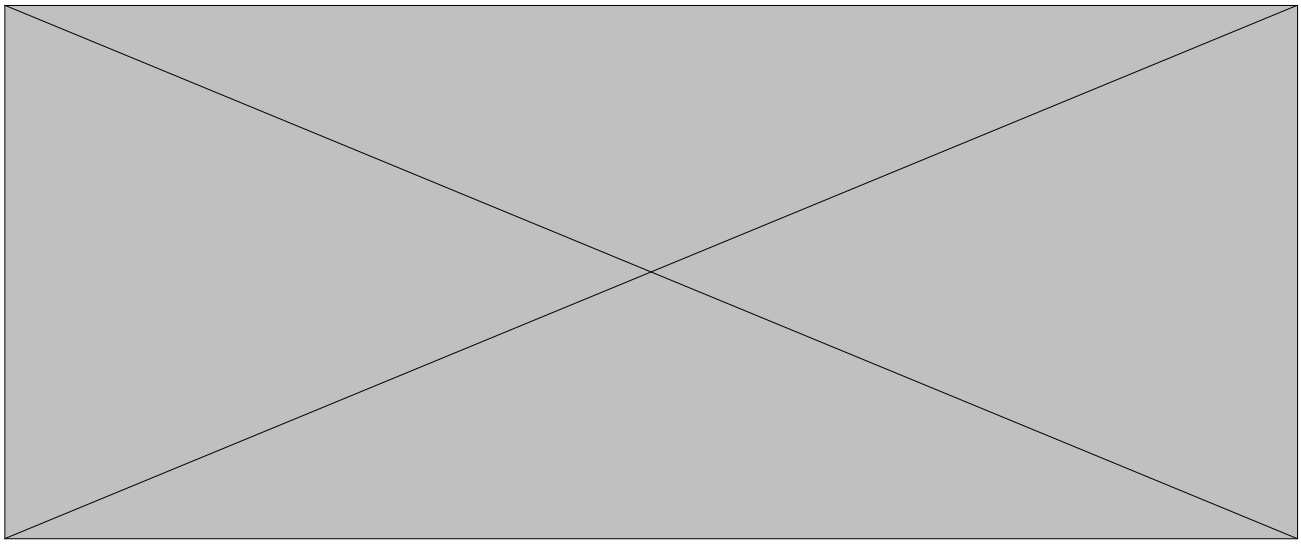
	For copyright reasons the contents of this table cannot be reproduced in the online version of this document.	

[Table from: Jones, 1964]

Which of the following is the best explanation for the death of the fish at the temperatures indicated above?

a. The thermal death point is not affected by the acclimatisation temperature.
b. The enzyme systems of the fish cannot function at these temperatures.
c. The increase in temperature causes disruption to the cell membranes affecting cellular functioning.
d. Changing the temperature reduces the ability of the fish to deal with pollution resulting in the death of the fish.

Use the following information to answer questions 8 and 9.



The equipment was arranged in a laboratory as shown in the diagram above. The mass of the outlet tubes was recorded using a balance and then a small mammal of known body mass was placed in the chamber for two hours. After two hours the mass of the outlet tubes was again recorded. Records were kept as follows:

Date: *14 Sept 2007*		Temperature in Chamber *22*°C			
Type of animal	Animal mass (g)	Initial mass of outlet tubes (g)	Final mass of outlet tubes (g)	Increase in mass of outlet tubes (g)	Duration (hours)
Mouse	*4*	*29.82*	*30.02*	*0.2*	*2*

8. Which of the following aspects of the physiology of the mouse could not be measured with the equipment shown above?

a. the metabolic rate of the mouse
b. the rate of water loss from the mouse
c. the rate of urine production from the mouse
d. the rate of water loss from the skin and lungs of the mouse

9. Data recorded on the data sheet can be summarised by calculating a single number. Which of the following is the most complete correct summary of the data? Evaporative water loss was:

a. 0.1 g/hour.
b. 0.2 g/g of animal/hour.
c. 0.025 g/animal/hour.
d. 0.025 g/g of animal/hour.

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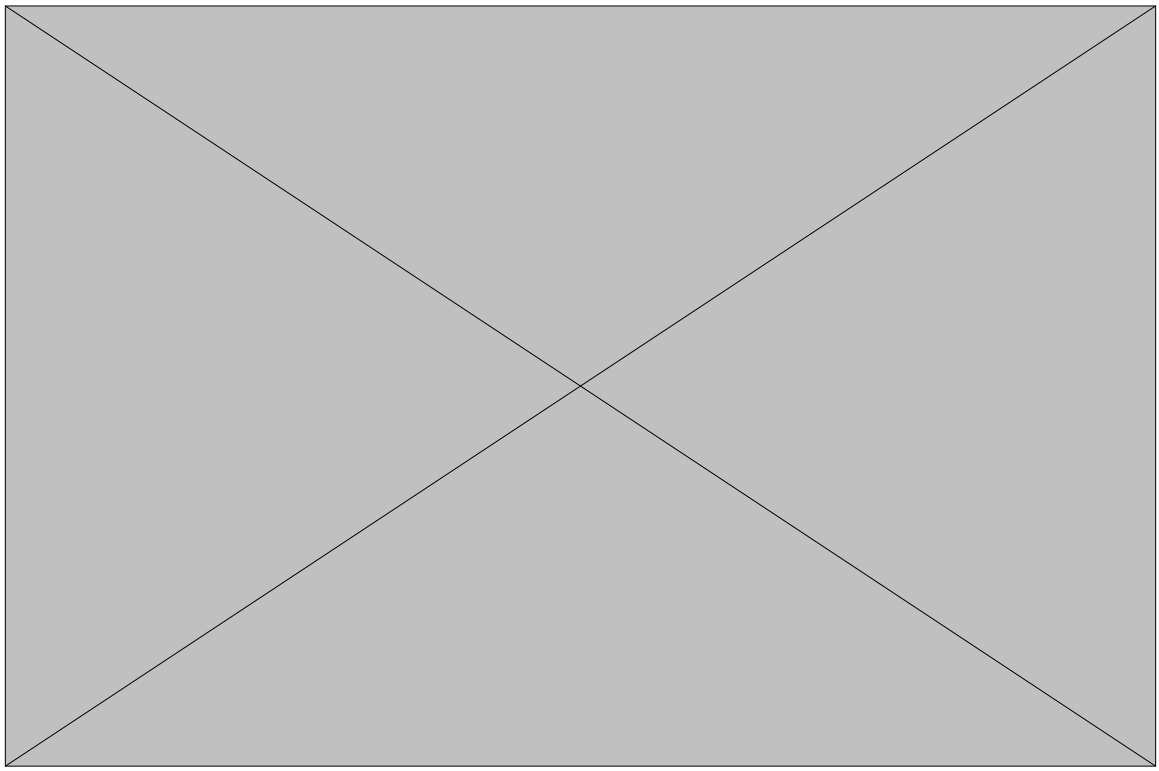
10. Chironomids are insects. Their juvenile stages live in swamps and lakes. Adult chironomids fly and are considered undesirable by people because large numbers of them swarm at dusk around houses built near swamps and lakes, and may inflict painful 'bites' on humans.



You have been given the task of controlling the chironomid problem affecting many townships and cities in Western Australia. You decide, for sound ecological reasons, that chemical control is not a good method to use, and instead you decide to develop some form of biological control. The most likely effect of your biological agent is that it will:

a. have harmful effects on a wide range of non-target species.
b. be able to attack only a very particular life stage in the target species.
c. carry a large variety of parasites in its body.
d. kill most target specimens in an affected area.

Use the following information to answer questions 11 and 12.
Waste digesters are used in some piggeries to recycle animal food scraps, urine and faeces. The digesters produce the gases methane, ammonia and carbon dioxide as end products. The ammonia and carbon dioxide are waste products. The methane is conducted away and burned to heat the enclosures for the pigs.

Decomposition in the waste digester is summarised below:

Bacteria break down raw organic wastes
↓
Other bacteria produce intermediate compounds
↓
Still other bacteria complete the conversion to methane and carbon dioxide

11. How would the total amount of chemical energy present in the original food scraps and animal wastes compare with the amount of chemical energy contained in the final products of the waste digester?

a. There would be more chemical energy in the end products.
b. There would be more chemical energy in the starting materials.
c. Chemical energy contents of all the materials would be the same.
d. All chemical energy is released during the processes in the digester.

12. The piggery ecosystem differs from natural ecosystems in that in the piggery ecosystem

a. gases are produced during decomposition at several metabolic steps.
b. decomposition is a gradual process requiring numerous small steps within the ecosystem.
c. some of the energy released from the wastes is reused within the ecosystem.
d. a variety of different micro-organisms is involved in the decomposition.

13. Vertebrate limbs have a pentadactyly structure. The diagram below shows the fore limbs of seven different vertebrates.

For copyright reasons this diagram cannot be reproduced in the online version of this document, but may be viewed at http://www.pbs.org/wgbh/evolution/library/04/2/image_pop/l_042_01.html.

[Diagram from: Strickberger, 2000]

Differences in the structure of the pentadactyl limbs demonstrate

a. genetic drift.
b. variations which have evolved from a common ancestor.
c. that similar structures can evolve from different ancestors.
d. inheritance of acquired characteristics.

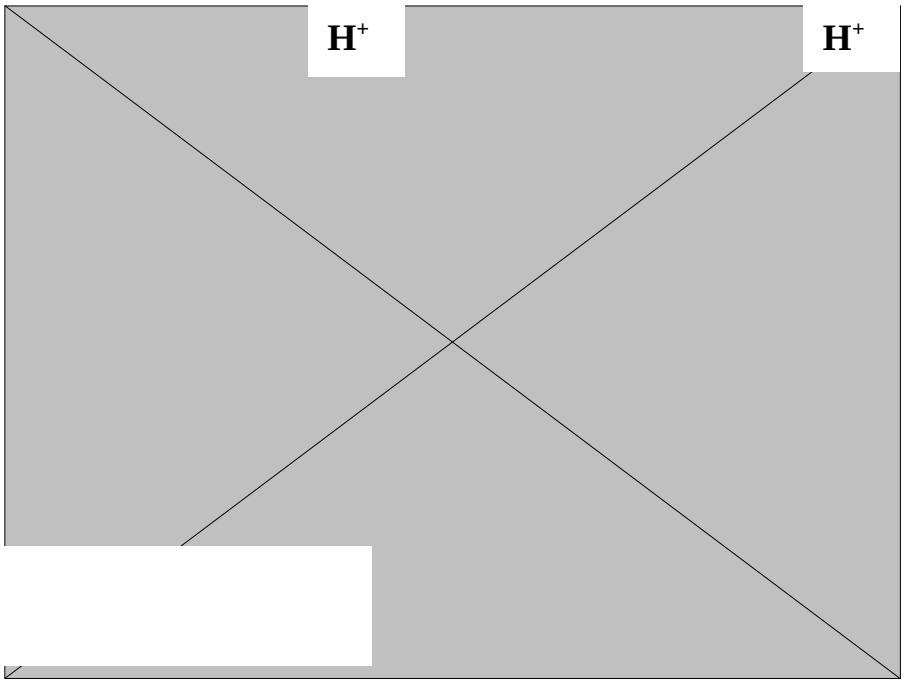
14. The introduced European blackberry is not eaten by many Australian animals. It has taken over large areas of bushland with the result that not only have the native plants disappeared but also the animals which depend on them for food have been much reduced in numbers. The removal of the blackberry and its replacement with indigenous species needs to be done in stages so that

a. food is always available for the native animals.
b. shelter is available for wildlife.
c. the biodiversity of the community will be maintained.
d. salinity problems will not develop.

15. The numbat (Myrmecobius fasciatus) is one of the wildlife emblems of Western Australia. The size of the numbat population has decreased over a period of several decades, and consequently a considerable effort is being expended now to increase their numbers and save numbats from extinction. To be effective, the program must also involve

a. preservation of genetic diversity.
b. monitoring of the number of predators.
c. reduction in environmental pollution.
d. restoration of the numbat habitat.

16. The purple coloured proteins in the cell membranes of certain halophilic (salt-loving) bacteria are involved in the transport of protons (H+) to the outside of the cell using light. The protons diffuse back into the cell through the enzyme ATPase which is embedded in the cell membrane. This is shown in the diagram below.



Which of the following is the **best** statement to complete the sentence about the movement of protons across the cell membrane of the bacterium?

The movement of a proton
a. from inside to outside on the purple protein probably releases energy.
b. from inside to outside on the purple protein probably uses energy.
c. from outside to inside through the ATPase probably uses energy.
d. from outside to inside through the ATPase probably releases energy.

17. The diagram below is a model of the action of an enzyme molecule in the formation of a product.

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[Diagram from: Fung & Hambur, 1992]

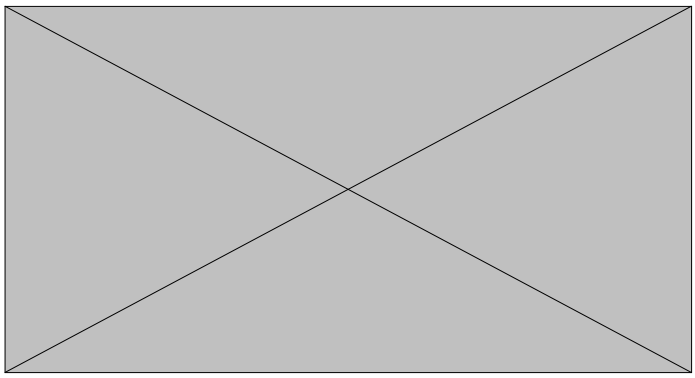
The model is referred to as the 'Lock and Key' model because
a. the shapes of the substrate molecules match the surface of the enzyme like a key matches a lock.
b. the enzyme molecule is the key to making the reaction occur.
c. the substrate molecules must match each other like a lock matches the key.
d. the substrate molecules are said to lock into the enzyme molecule.

18.

For copyright reasons question 18 cannot be reproduced in the online version of this document.

[From: Chan, 1982]

Questions 19 and 20 refer to the following information.



Some shrimps, like the one shown in the diagram above, are common in estuaries in Western Australia. They have organs of balance called statocysts near their tails which contain sensory hairs. These help the animal stay the right way up in the water.

19. Which of the following is the most likely explanation for the processes involved as a shrimp controls its body position?

a. The statocysts receive nerve stimulation from the nerve co-ordination centre signalling them to adjust the body position.
b. Nerves connect the statocysts to a nerve co-ordination centre which then sends signals to the muscles of the swimming organs.
c. The statocysts have nerve connections with the muscles of the swimming appendages signalling them to adjust the body position.
d. Eyes detect the direction of the light from the surface enabling the animal to adjust the orientation of the body.

20. If the body positioning mechanism of the shrimp is thought of as an example of a stimulus - response - negative feedback system, which of the following represents the response?

a. signals from the statocysts as the body changes position in the water.
b. the new position of the body after the swimming appendages cause movement.
c. activity of the swimming muscles causing the body to change position.
d. signals from the eye to the statocysts indicating the normal body position is achieved.

END OF SECTION ONE

SECTION TWO—SHORT ANSWERS [120 marks]

Attempt **ALL** questions in this section. Write answers in the spaces provided. Diagrams may be used in your answer. Use a blue or black ballpoint or ink pen for written answers and pencil for diagrams. Make sure diagrams are clear and labelled.

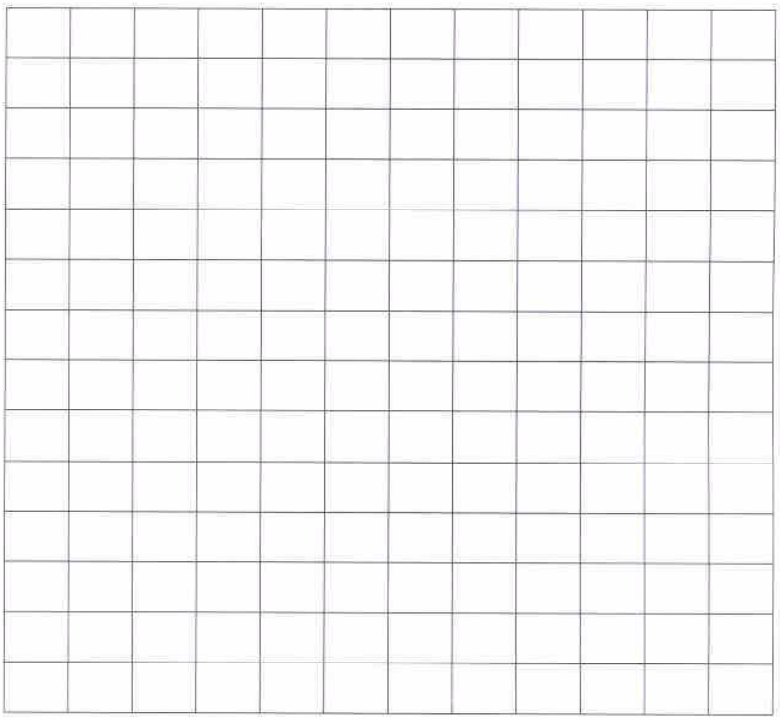
Suggested working time: 90 minutes

Question 1 ***[20 marks]***

While collecting aquatic animals in a stream, biology students observed fish that were eating insects living amongst the rocks on the stream bed. They hypothesised that predation by the fish was decreasing the population of the insects. To test this hypothesis, the students placed 10 wire mesh cages each covering $1m^2$ of the stream bed. The mesh on the cages allowed the insects to enter and leave, but excluded fish from the inside of the cage. They also placed 10 wire frames of equal dimensions next to the wire mesh cages but without any mesh. These frames allowed both fish and insects to enter and leave without restriction. Each week for six weeks, the students counted the number of insects in each of the cages and in each of the wire frames. They calculated the average number of insects in the cages and the average number of insects in the frames. The results are shown below.

	Average number of insects collected/m^2	
Time in weeks	**Cages (fish excluded)**	**Frames (fish can enter)**
1	65	70
2	70	75
3	Data lost	65
4	90	75
5	110	70

(a) On the grid provided, draw a line graph of these data for both cages and the wire frames. *[4 marks]*



(b) Use your graph to predict likely values for these readings had it been possible to measure them.

[4 marks]

(i) Frames Week 6

Cages Week 3

(ii) In which prediction do you have greatest confidence? Explain why.

(c) The students' original hypothesis was that predation by the fish decreased the numbers of insects on the stream bed. Do the experimental results support the hypothesis? Explain your answer by referring to the data collected and to the design of the experiment.

[4 marks]

(d) **(i)** What is the control for this experiment?

[2 mark]

(ii) Why is the control needed?

[2 mark]

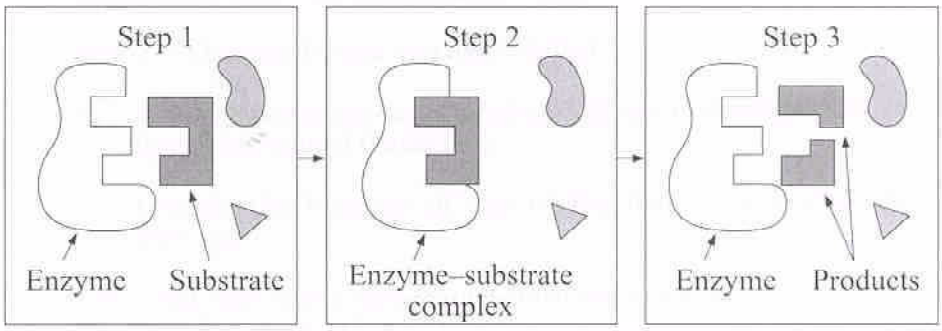
(e) A student complained that the experiment was flawed because there was at least one uncontrolled variable. Name one uncontrolled variable and explain why it is important.

[4 marks]

Question 2 ***[20 marks]***

[2(a) from: Board of Studies New South Wales, 1997; 2(b) adapted from: Tasmanian Secondary Assessment Board, 1997]

(a) The diagrams below represent a chemical reaction catalysed by an enzyme.



(i) How does this model explain the idea of enzyme specificity?

[2 marks]

(ii) Some drugs are effective in killing parasites because they block enzymes involved in biochemical pathways critical for the growth of the organism. Explain how these drug molecules could block the enzyme involved.

[4 marks]

(iii) The enzyme amylase, which is found in saliva, promotes the breakdown of

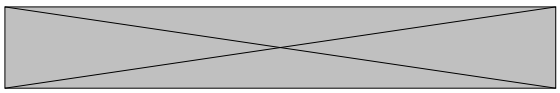
starch to maltose. If saliva is mixed with starch, eventually all the starch will be broken down regardless of the amount of saliva added. Explain why this occurs.
[2 marks]

(b) Plants are sometimes referred to as 'energy converters'.

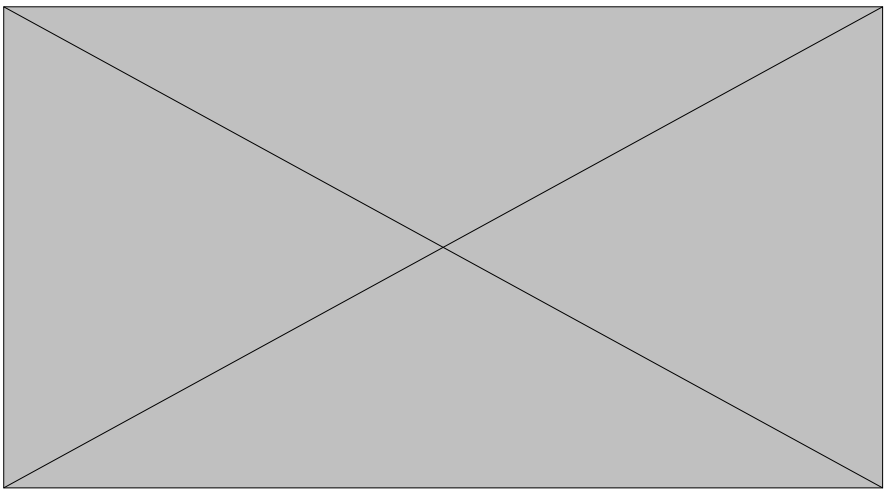
(i) Briefly describe the energy flow within a green plant cell, highlighting the key processes involved.

[6 marks]

(ii) The enzyme amylase catalyses the breakdown of starch to maltose as follows:



Experiment 1 was conducted to investigate how varying the concentration of starch affected the rate of the reaction. The concentration of the enzyme, pH and temperature were kept constant throughout the experiment. The results are shown in the graph below.



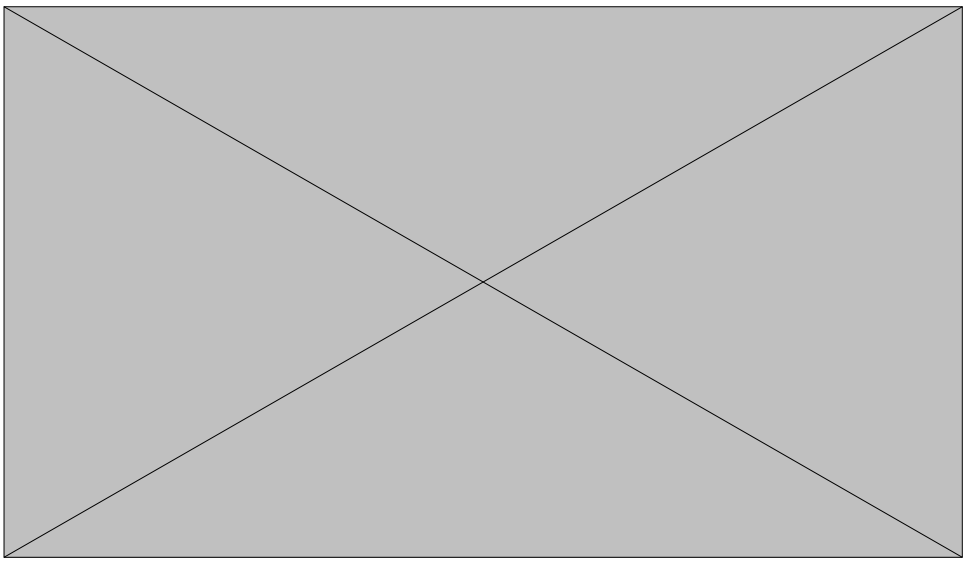
Explain why the reaction rate increases until starch concentration reaches point X.

[2 marks]

Explain why the reaction rate is constant between X and Y.

[2 marks]

(iii) Experiment 2 was conducted with an increased amount of enzyme and the results plotted on the same graph as those of Experiment 1. The graph is as follows:



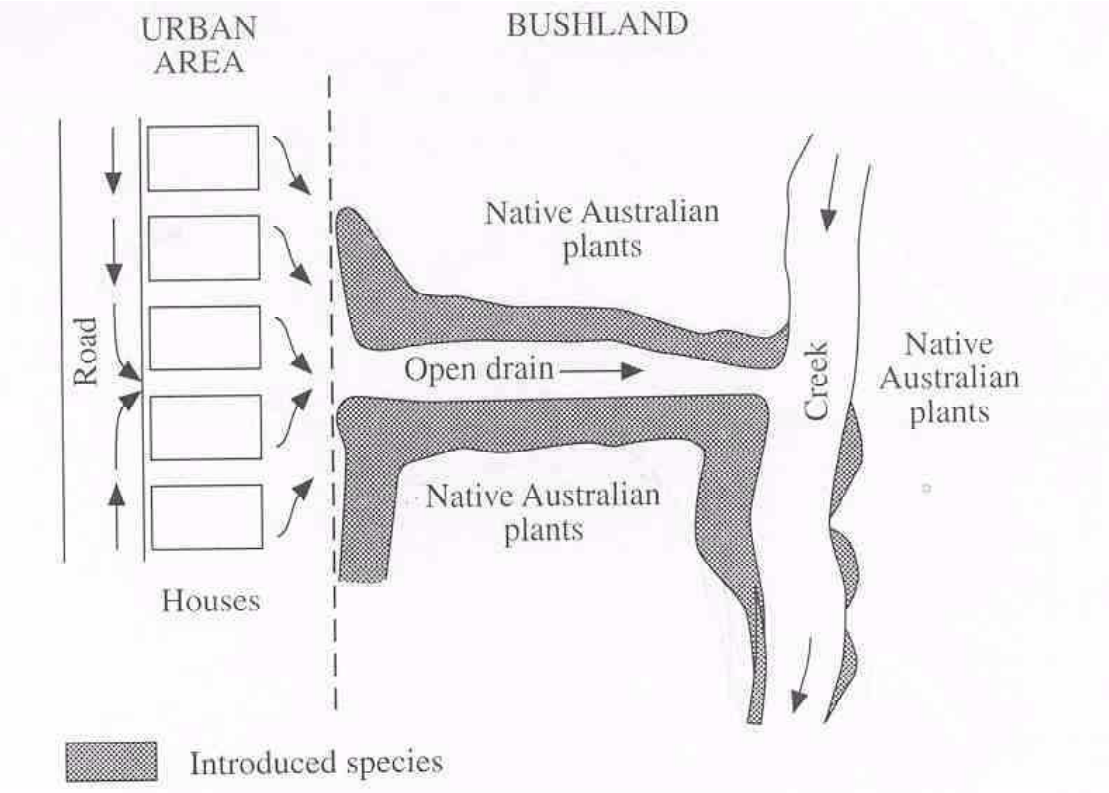
Explain which graph, Graph A or Graph B represents the results of Experiment 2.

[2 marks]

Question 3 ***[15 marks]***

The diagram shows a section of native Australian bushland that lies adjacent to an urban area. A drain takes stormwater from the road and nearby houses to a creek.

The arrows indicate the direction in which water flows after a period of rain.



[Introduction and diagram from: Board of Studies New South Wales, 2000]

(a) What is the main environmental condition that controls the distribution of the introduced species of plants in this area? Use evidence from the diagram to support your answer.

[4 marks]

(b) Suggest three possible methods for managing the introduced species and indicate the impact on native plant species in the area.

[3 marks]

(c) Briefly describe the likely changes over time and possible impacts on the fauna and flora if no steps were taken to control or manage the introduced species.

[4 marks]

(d) Describe two management strategies used by conservationists to maintain biodiversity.

[4 marks]

Question 4 *[13 marks]*

[4(a–d) adapted from: Senior Secondary Assessment Board of South Australia, 2004]

For copyright reasons questions 4a to 4d cannot be reproduced in the online version of this document, but may be viewed in their original form at http://www.ssabsa.sa.edu.au/docs/ex-2004/2bio-ex-2004.pdf (p. 18).

(a)

[2 marks]

(b)

[2 marks]

(c)

[2 marks]

[4 marks]

(d) Outline an experiment a student could set up to determine the rate of photosynthesis.

[3 marks]

Question 5 *[10 marks]*

[5(a & b) adapted from: Senior Secondary Assessment Board of South Australia, 2004]

For copyright reasons questions 5a and 5b cannot be reproduced in the online version of this document, but may be viewed in their original form at http://www.ssabsa.sa.edu.au/docs/ex-2004/2bio-ex-2004.pdf (p. 19, q. 32a, b(ii)).

(a)

[2 marks]

(b)

[4 marks]

(c) How would the removal of the tortoises to the research station and their subsequent return to the natural environment affect the variability of the gene pool?

[4 marks]

SEE NEXT PAGE

Question 6 [20 marks]

[6(a)(I & ii) from: Senior Secondary Assessment Board of South Australia, 2004; 6(b) adapted from: Senior Secondary Assessment Board of South Australia, 2005]

(a)

For copyright reasons questions 6a(i) and 6a(ii) cannot be reproduced in the online version of this document, but may be viewed at http://www.ssabsa.sa.edu.au/docs/ex-2004/2bio-ex-2004.pdf (p. 14).

(i)

[2 marks]

(ii)

[4 marks]

(iii) How could the red fluorescent protein gene be transferred into the fertilised eggs of the zebra fish?

[4 marks]

(iv) In one batch of offspring produced by GloFish, one fish glowed green rather than red. Explain how this could have happened.

[4 marks]

For copyright reasons question 6b cannot be reproduced in the online version of this document, but may be viewed in its original form at http://www.ssabsa.sa.edu.au/docs/ex-2005/2bio-ex-2005-bk12.pdf (p. 18, q. 27a).

(i)

[4 marks]

(ii)

[2 marks]

Question 7 *[10 marks]*

[Introduction and 7(a & c) adapted from: Senior Secondary Assessment Board of South Australia, 2007]

For copyright reasons questions 7a and 7b cannot be reproduced in the online version of this document, but may be viewed in their original form at http://www.ssabsa.sa.edu.au/docs/ex-2007/2bio-ex-2007-bk12.pdf (section B, part 2, pp. 8–9, q. 35b, d)

(a)

[2 marks]

(b) How could researchers determine which beetle species was closest to the ancestral species?

[4 marks]

(c)

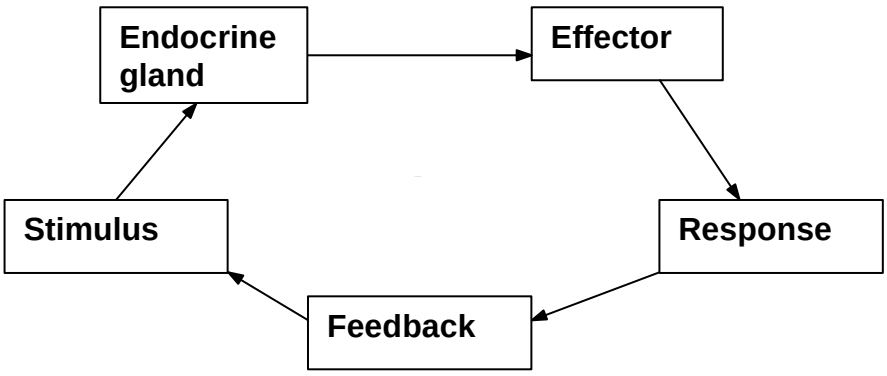
[4 marks]

Question 8 ***[12 marks]***

(a) Freshwater animal cells need to osmoregulate, but freshwater plant cells do not. Explain why this difference occurs.

[4 marks]

(b) Use the following model to explain osmoregulation in freshwater fish.



[4 marks]

(c) Explain the role of the cell membrane in controlling the movement of materials into and out of the cell.

[4 marks]

SECTION THREE—EXTENDED RESPONSE [40 marks]

Answer Section Three in the Standard Answer Book.

There are **FOUR (4)** parts to each question. You must answer two parts from question 1 and two parts from question 2. Each part carries ten marks.

Answers may be presented in a combination of different ways provided they communicate your ideas effectively. You may choose to:

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

Suggested working time: 60 minutes

Question 1

Answer any two parts of this question from 1(a) to 1(d).

(a) Explain three (3) different types of problems caused by the absence or reduced activity of enzymes, using named examples to illustrate your answer.

[10 marks]

(b) Introduced rats, *Rattus rattus*, on an isolated island in the Dampier Archipelago in the north west of Western Australia have blue eyes. Blue-eyed rats are very rare in populations found on the mainland.

Explain how it is possible for the whole population of rats on this island to have blue eyes.

[10 marks]

(c) Recent discoveries in the Central American rainforest have shown that huge urban and agricultural areas once flourished there. Today the ruins are overgrown with rainforest vegetation.

Using the factors affecting the stability of ecosystems, explain why the forest took over the abandoned urban areas.

[10 marks]

(d) The desert hopping mouse, *Notomys alexis*, does not drink water. It lives in central Australia where the ground surface temperatures range from -10^{o}C to 70^{o}C.

Explain how the mice can maintain a constant body temperature in such conditions.

[10 marks]

Question 2

Answer any two parts of this question from 2(a) to 2(c).

(a) Climate change predictions for Australia indicate that for every 1^{o}C rise in temperature, organisms will need to migrate 100m uphill or 125 km south to stay in the same ecological conditions. During the previous ice ages, species ranges moved south and then eventually moved north when the environmental conditions changed. The current impact of human activity on ecosystems has fragmented populations which could signal that the impact of climate change will be greater than previously thought.

Explain how the combination of climate change and habitat fragmentation will affect genetic diversity and possible species loss in Australia.

[10 marks]

(b) Cell membranes are often represented by a dashed line (-------), indicating gaps, in simple explanations of osmosis and diffusion. In reality cell membranes are much more complex.

(i) Explain why the dashed-line model is adequate for osmosis and diffusion but not for facilitated diffusion and active transport.

(ii) Describe the molecular/chemical structure of the cell membrane and explain how the structure is able to carry out the different mechanisms of active transport.

[10 marks]

(c) Describe the processes and explain the interactions of these processes in desert plants that allow them to survive hot dry conditions.

[10 marks]

(d) The diagram on the following page shows the distribution of some fish which inhabit coastal waters of southern Australia. A single population of Little Rock Whiting extends from the east coast to the west. Two separate species of salmon, the Western and the Eastern Salmon, overlap near Tasmania. The other fish shown on the diagram vary in the extent of separation of populations.

Use the example of the distribution of other species of fish to explain how two separate species of Salmon might have evolved from a single ancestral species.

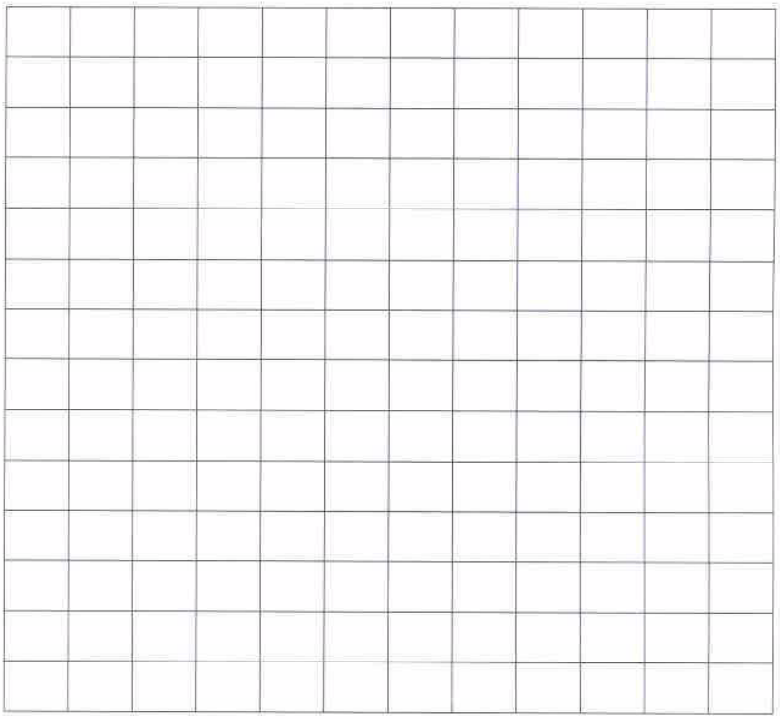
[10 marks]

For copyright reasons this diagram cannot be reproduced in the online version of this document, but may be viewed at http://www.environment.gov.au/biodiversity/publications/series/paper2/biod_5.html (fig. 5).

[Diagram adapted from: Huxley, 1985]

SEE NEXT PAGE

Use the grid below to answer Section Two, Question 1(a) if you have cancelled your first attempt.



END OF EXAM

ACKNOWLEDGEMENTS

SECTION ONE

Question 7 Table from: Jones, J.R.E. (1964). *Fish and river pollution*. Washington, DC: Butterworth's, p. 160.

Question 13 Diagram from: Strickberger, M.W. (2000). *Evolution* (3rd ed.). Sudbury, MA: Jones & Bartlett. Retrieved April, 2008, from Public Broadcasting Service website: http://www.pbs.org/wgbh/evolution/library/04/2/image_pop/l_042_01.html.

Question 17 Diagram from: Fung, S., & Hambur, S. (1992). Continuity and change: Facing challenges and patterns of life. Melbourne: Longman Cheshire, p. 71.

Question 18 Chan, Y.H. (1982). *Comprehensive exercises in biology*. Hong Kong: Hung Fung Book Company, p. 32.

SECTION TWO

Question 2(a): Adapted from: Board of Studies New South Wales. (1997). *1997 Biology 2 Unit: Higher School Certificate Examination* (p. 17). Retrieved April, 2008, from http://www.boardofstudies.nsw.edu.au/hsc_exams/hsc2000exams/hsc00_biology/97BIOLGY.PDF.

Question 2(b) Adapted from: Tasmanian Secondary Assessment Board. (1997). *Tasmanian Certificate of Education: External assessment 1997: BY826 Biology* (pp. 5-6). Retrieved April, 2008, from Tasmanian Qualifications Authority website: http://www.tqa.tas.gov.au/4DCGI/_WWW_doc/003393/RND01/BY826_paper97.pdf.

Question 3: Introduction and diagram from: Board of Studies New South Wales. (2000). *2000 Biology 2 Unit: Higher School Certificate Examination* (p. 43). Retrieved April, 2008, from http://www.boardofstudies.nsw.edu.au/hsc_exams/hsc2000exams/hsc00_biology/00biology.pdf.

Question 4(a–d) Adapted from: Senior Secondary Assessment Board of South Australia. (2004). *2004 Biology: Public examination 2004* (p. 18). Retrieved April, 2008, from http://www.ssabsa.sa.edu.au/docs/ex-2004/2bio-ex-2004.pdf.

Question 5(a & b) Adapted from: Senior Secondary Assessment Board of South Australia. (2004). *2004 Biology: Public examination 2004* (p. 19). Retrieved April, 2008, from http://www.ssabsa.sa.edu.au/docs/ex-2004/2bio-ex-2004.pdf.

Question 6(a)(i & ii) Senior Secondary Assessment Board of South Australia. (2004). *2004 Biology: Public examination 2004* (p. 14). Retrieved April, 2008, from http://www.ssabsa.sa.edu.au/docs/ex-2004/2bio-ex-2004.pdf.

Question 6(b) Adapted from: Senior Secondary Assessment Board of South Australia. (2005). *2005 Biology: External examination 2005* (p. 18). Retrieved April, 2008, from http://www.ssabsa.sa.edu.au/docs/ex-2005/2bio-ex-2005-bk12.pdf.

Question 7(a & c) Adapted from: Senior Secondary Assessment Board of South Australia. (2007). *2007 Biology: External examination 2007* (pp. 8–9). Retrieved April, 2008, from http://www.ssabsa.sa.edu.au/docs/ex-2007/2bio-ex-2007-bk12.pdf.

SECTION THREE

Question 2(d) Diagram adapted from: Huxley, D. (1985). Speciation in eastern and western fish populations. In R. Hughes (Ed.). (1985). *Australia's underwater wilderness*. McMahon's Point, NSW: Weldon. Retrieved April, 2008, from Department of the Environment, Water, Heritage and the Arts website: http://www.environment.gov.au/biodiversity/publications/series/paper2/biod_5.html.

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