



## **BIOLOGICAL SCIENCES STAGE 2 SAMPLE EXAMINATION**

Section 7 of the New WACE Manual: General Information 2006–2009 outlines the policy on WACE examinations.

Further information about the WACE Examinations policy can be accessed from the Curriculum Council website at [http://newwace.curriculum.wa.edu.au/pages/about\\_wace\\_manual.asp](http://newwace.curriculum.wa.edu.au/pages/about_wace_manual.asp).

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.

DRAFT (WEB VERSION ONLY)



Western Australian Certificate of Education, Sample External Examination

Question/Answer Booklet

**BIOLOGICAL SCIENCES**  
**SAMPLE EXAMINATION**  
**STAGE 2**

Please place your student identification label in this box

Student Number: In figures

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In words

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***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 or 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.

**Structure of this paper**

Section	Number of questions available	Number of questions to be attempted	Suggested working time minutes	Marks available
One Multiple choice	20	20	30	40 (20%)
Two Short answers	6	6	90	120 (60%)
Three Extended answers	2	2	60	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 (not pencil) should be used.

**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 (not pencil) 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
- write notes beside 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.

**SEE NEXT PAGE**

**SECTION ONE—MULTIPLE CHOICE****[40 marks]**

Suggested time: 30 minutes

This section has **twenty** questions. Record an answer for Questions 1–20 by marking your choice of alternative on the separate Multiple Choice Answer Sheet using a 2B, B or HB pencil. Each question is worth two marks. Marks are not deducted for wrong answers.

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

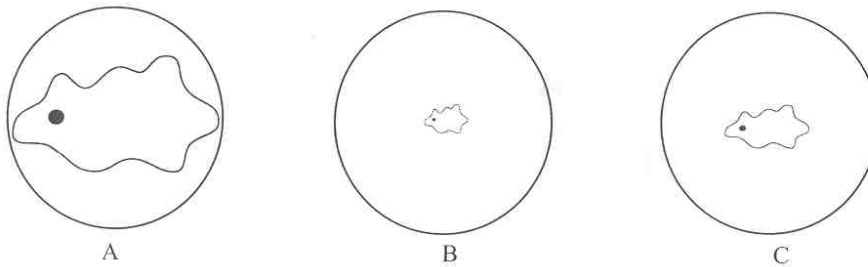
**Question 1**

Which of the following ecological concepts includes both biotic and abiotic components?

- (a) Food web
- (b) Ecosystem
- (c) Population
- (d) Biomass pyramid

**Questions 2 and 3 refer to the diagrams below of an organism viewed under a light microscope at varied magnifications.**

The magnification of A is 600x and the organism is known to be 150 $\mu$ m long.

**Question 2**

What is the magnification of the microscope for diagram C?

- (a) 180x
- (b) 120x
- (c) 240x
- (d) 400x

**Question 3**

What is the field of view (field diameter) of the microscope for diagram B?

- (a) 3.00mm
- (b) 1.75mm
- (c) 1.25mm
- (d) 0.75mm

**SEE NEXT PAGE**

Questions 4, 5 and 6 refer to the following diagram of a plant cell:



[From: Raven, Evert & Eichhorn, 1992]

**Question 4**

Which of the labelled structures would be most likely found in an animal cell?

- (a) A and B
- (b) B and E
- (c) C and G
- (d) D and F

**Question 5**

It is not known whether this cell has been taken from the root or the shoot of the plant. Which structure would be most helpful in deciding this question?

- (a) A
- (b) D
- (c) E
- (d) G

**Question 6**

Which of the following is not an important function of structure F in plants?

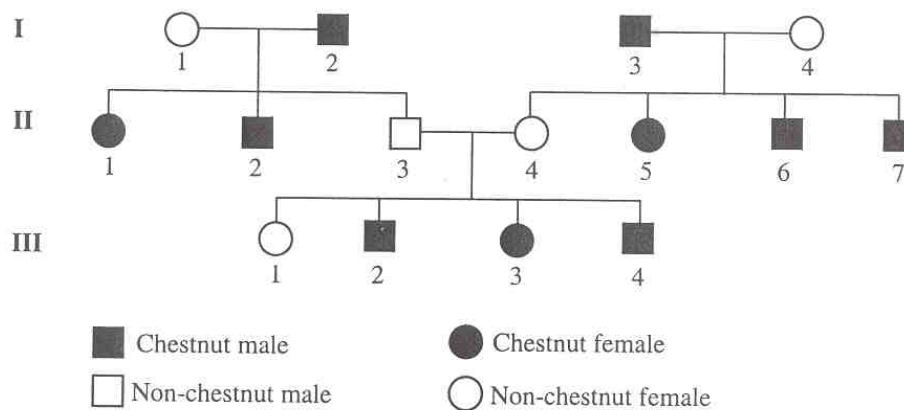
- (a) It controls the movement of substances into and out of the cell
- (b) It prevents the cell from rupturing following the uptake of water
- (c) It provides structural rigidity to the plant as a whole
- (d) It assists in water movement from the roots to the shoot

**Question 7**

A flowering plant has a haploid chromosome number of 8. Which of the following statements about the plant is true?

- (A) Its root cells contain 4 chromosomes
- (B) Its egg cells contain 16 chromosomes
- (C) Its leaf cells contain 32 chromosomes
- (D) Its pollen cells contain 8 chromosomes

Questions 8 and 9 refer to the following pedigree showing the inheritance of chestnut (red/brown) coat colour in horses:

**Question 8**

Sex (male or female) in horses is inherited in the same way as humans. Therefore, which of the following statements is true?

- (a) Individual III 4 must have inherited a Y chromosome from I 2
- (b) Individual III 1 must have inherited an X chromosome from I 4
- (c) Individuals III 1 and III 3 must have identical genes on their X chromosomes
- (d) Individuals III 1 must have different genes on their Y chromosomes

**Question 9**

From the pedigree it can be concluded that chestnut coat colour in horses is inherited as which of the following?

- (a) A dominant autosomal gene
- (b) A recessive sex-linked gene
- (c) A recessive autosomal gene
- (d) A dominant sex-linked gene

**Question 10**

Which is the correct path of water transport in plants, listed from uptake into the plant to exit from the plant?

- (a) Roots, root hair cells, phloem tissue, leaves, stomata
- (b) Root hair cells, roots, phloem tissue, leaves, stomata
- (c) Stomata, leaves, xylem tissue, roots, root hair cells
- (d) Root hair cells, roots, xylem tissue, leaves, stomata

**Question 11**

Which of the following ecological concepts includes both biotic and abiotic components?

- (a) Food web
- (b) Ecosystem
- (c) Population
- (d) Biomass pyramid

**Question 12**

All animals produce nitrogenous waste products that need to be excreted. There are three types of nitrogenous waste products produced by animals:

Ammonia	↓	Decreasing
Urea		solubility
Uric acid		in water

Based on this information, select the correct statement.

- (a) Because of the need to conserve water in a desert environment, reptiles produce uric acid
- (b) Mammals urinate frequently so they produce ammonia
- (c) Birds need to keep their body weight down for flight so they produce ammonia
- (d) Fish need to reduce the amount of water in their bodies so they produce uric acid

**Question 13**

Which of the following statements is true of natural ecosystems?

- (a) Energy recycles through natural ecosystems
- (b) Nutrients flow through natural ecosystems
- (c) Natural ecosystems include living and non-living components
- (d) There is no heat loss from natural ecosystems



**Question 14**

Vascular plants adapted to live by floating on water are most likely to show which of the following adaptations?

- (a) No stomata on the leaves
- (b) Stomata on stems as well as leaves
- (c) Stomata located in pits on the leaves
- (d) Stomata located on the upper surfaces of the leaves

**Question 15**

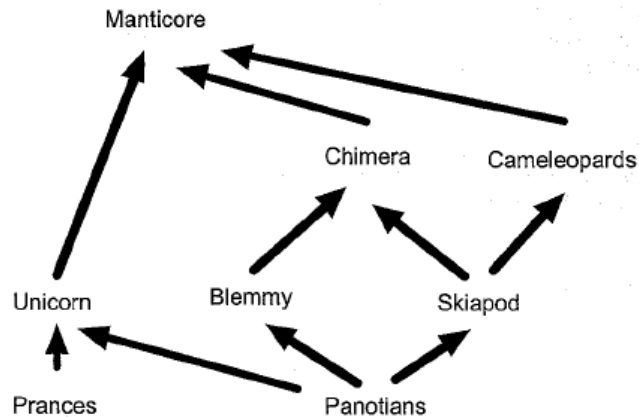
The following table summarises data measured for some soft-bodied aquatic animals collected from a pond.

Animal	Length (cm)	Body weight (g)	Surface area (cm <sup>2</sup> )
A	4	4	12.2
B	2	0.5	0.8
C	1.5	0.4	0.4
D	2	1.5	10.5

Which of these animals has the greatest ratio of surface area to body weight?

- (a) Animal A
- (b) Animal B
- (c) Animal C
- (d) Animal D

Questions 16 to 17 relate to the following diagram of a food web for a fictitious community occurring on a small island.



**Question 16**

Food webs imply information about the biomass of the different organisms and the energy movements between them. Which of the following statements about the food web is correct?

- (a) Some of the biomass in the manticores may eventually be returned to the panotians
- (b) Solar energy recycles through the food web
- (c) Heat energy is gained at each step of the food web
- (d) Total biomass increases at each step of the food web

**Question 17**

Which of the following statements about the biomass of the organisms in this food web is correct?

- (a) The biomasses of the unicorns, the blemmies and the skiapods will be equal
- (b) The biomasses of the skiapods will exceed the biomass of the cameleopards
- (c) The biomass of the manticores will exceed the biomass of the panotians
- (d) The biomass of the prances will equal the biomass of the panotians.

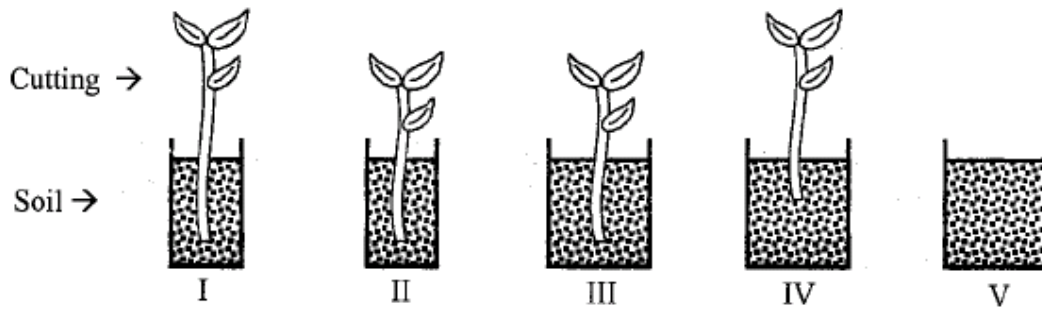
**Question 18**

Which of the following statements about cell division is most correct?

- (a) Mitosis occurs during asexual reproduction
- (b) Meiosis begins immediately after fertilization
- (c) Mitosis explains why members of the same family do not all look alike
- (d) Mitosis involves a change of chromosome number during a life cycle

Questions 19 and 20 refer to the following information:

Five pots were set up with plant cuttings in soil mix. (Note: All diagrams are drawn to the same scale.)



**Question 19**

Which of the following pots would be the most useful to test the hypothesis that 'the deeper a cutting is planted the more likely it is to grow into a new plant'?

- (a) Pots I and II
- (b) Pots III and V
- (c) Pots I and III
- (d) Pots III and IV

**Question 20**

Which of the following changes to the procedure used would be **least** likely to improve the reliability of the above investigation?

- (a) Use the same species of plant in all five set-ups
- (b) Make several of each of the five types of set-up
- (c) Water the pots more often to promote growth
- (d) Repeat the experiment several times

**END OF SECTION ONE**

**SEE NEXT PAGE**

**SECTION TWO—SHORT ANSWERS**

**[120 marks]**

Suggested time: 90 minutes

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

**Question 1**

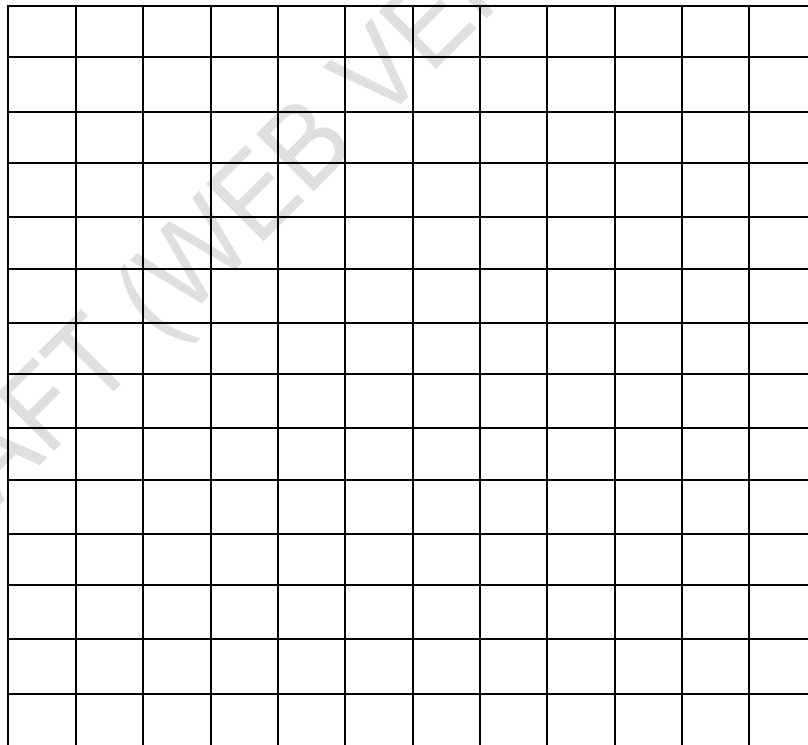
*Chaetoceros* sp. is a single celled alga. In an investigation of the effect of silica on the growth of *Chaetoceros* sp. cultures were set up with and without silica in the culture medium. On day 0 each culture had 400,000 *Chaetoceros* cells per mL. The table below shows the cell numbers in each culture at intervals during the following eight days.

Table X: Number of *Chaetoceros* cells (millions per mL)

	Day 0	Day 1	Day 4	Day 7	Day 8
<i>Chaetoceros</i> with silica	0.4	1.1	3.5	5.2	5.3
<i>Chaetoceros</i> without silica	0.4	1.0	2.0	2.2	2.3

(a) Graph all these data on the single grid provided.

[5 marks]



**(b)** For the investigation on page 10 give the following.

(i) A hypothesis for this investigation.

[2 marks]

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(ii) The dependent variable.

[1 mark]

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(iii) The independent variable

[1 mark]

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**(c)** Name four variables that would have to be controlled for the investigation to be reliable.

[4 marks]

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(d) What do you estimate the population of the *Chaetoceros* with silica to be on

(i) day 5 \_\_\_\_\_ [1 mark]

(ii) day 12 \_\_\_\_\_ [1 mark]

(iii) In which of the above estimations do you have the most confidence? [1 mark]

\_\_\_\_\_

(iv) Why? [2 marks]

\_\_\_\_\_

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(e) Write a valid conclusion from these data on the growth of *Chaetoceros*.

[2 marks]

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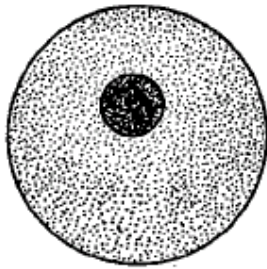
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DRAFT (WEB VERSION ONLY)

**Question 2**

Study the following diagrams showing a human sperm cell and a human ovum. Note that each cell is drawn to a different scale.



100  $\mu\text{m}$



10  $\mu\text{m}$

(a) (i) Write the name of the structure that would contain the cells' DNA.

\_\_\_\_\_

(ii) Name the type of cell division which gives rise to sperm cells.

\_\_\_\_\_

(iii) Sperm cells are haploid. What does this mean?

\_\_\_\_\_

\_\_\_\_\_

[3 marks]

(b) (i) Sperm cells have many mitochondria. What does this suggest about the special needs of sperm cells?

[1 mark]

\_\_\_\_\_

(ii) Name **two** inputs and **two** outputs of sperm cell mitochondria.

[4 marks]

Inputs \_\_\_\_\_

\_\_\_\_\_

Outputs \_\_\_\_\_

\_\_\_\_\_

- (iii) The seminal fluid, which transports the sperm cells, contains large amounts of a simple sugar called fructose. What is the likely function of this simple sugar?  
 [1 mark]

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A student examined four cell types from four different living organisms using an electron microscope. She placed a mark in the table below when she was certain a structure was present, otherwise she left the space blank.

CELL COMPONENT	CELL TYPE			
	I	II	III	IV
nucleus	+		+	+
nucleolus			+	+
cell wall		+		
cell membrane	+		+	+
cytoplasm	+	+	+	+
vacuole				+
chloroplast		+		
mitochondrion		+	+	

- (c) From these observations the student made the following conclusions. Indicate whether, on the basis of the data in the table, you believe her conclusions are true or false. Give reasons for your decision in each case.  
 [4 marks]

- (i) Cells II and III must be from animals.

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- (ii) Cells I and IV require no energy.

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- (d) Two of the cell components in the table shown earlier are able involved in the process of respiration.  
 [4 marks]

- (i) Name the **two** cell components (organelles).

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- (ii) Write the word equation for the reaction occurring in respiration.

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- (e) From the structure of the cells shown in the diagrams at the beginning of this question and the information you have been given or provided, give two reasons why sperm cells have a higher surface area to volume ratio than ova.

*[2 marks]*

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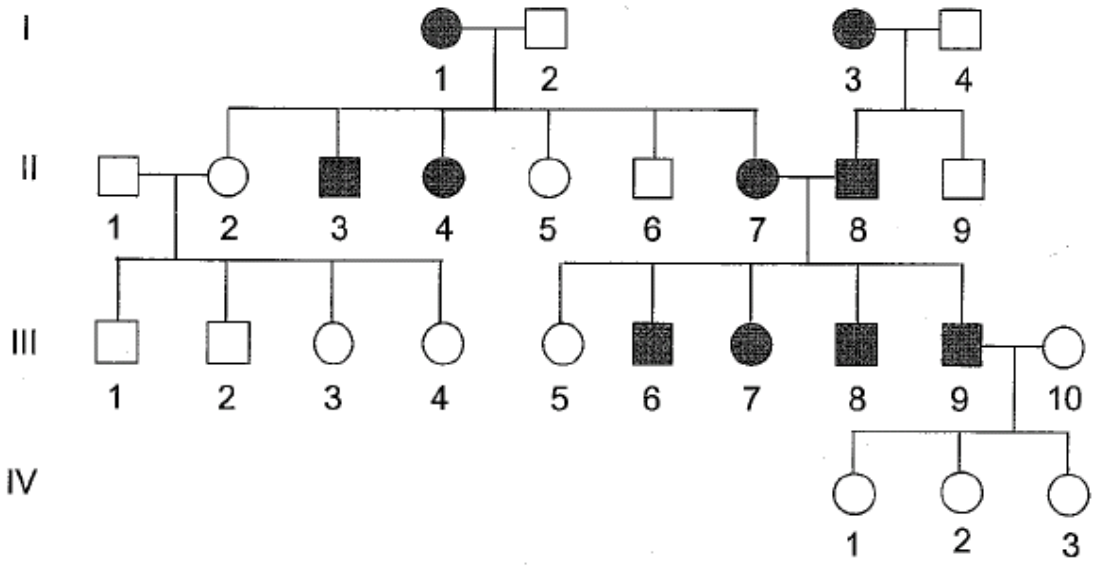
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DRAFT (WEB VERSION ONLY)

**Question 3**

The pedigree below shows the pattern of inheritance of a heart disease in sheep. It causes no problems with younger sheep but weakens older animals.



(a) Using symbols of your own choosing and evidence from the pedigree, explain clearly the mechanism of inheritance of the heart disease. [4 marks]

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(b) Indicate the likely genotype/s of the following four individuals. [4 marks]

- (i) I 2. \_\_\_\_\_
- (ii) II 7. \_\_\_\_\_
- (iii) III 4. \_\_\_\_\_
- (iv) III 8. \_\_\_\_\_

(c) The farmer plans to cross II 4 and III 2.

- (i) What is the probability that their first offspring will have the disease?  
Show your working.

[4 marks]

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- (ii) What is the probability that their second offspring will be a normal male?  
Show your working.

[4 marks]

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(d) Define the following terms

[4 marks]

(i) Alleles

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(ii) Homozygous

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(iii) Heterozygous

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(iv) Autosomal chromosomes (autosomes)

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(e) The farmer wishes to know whether individual III 6 is homozygous or heterozygous. How could this be determined? Show your working.

[4 marks]

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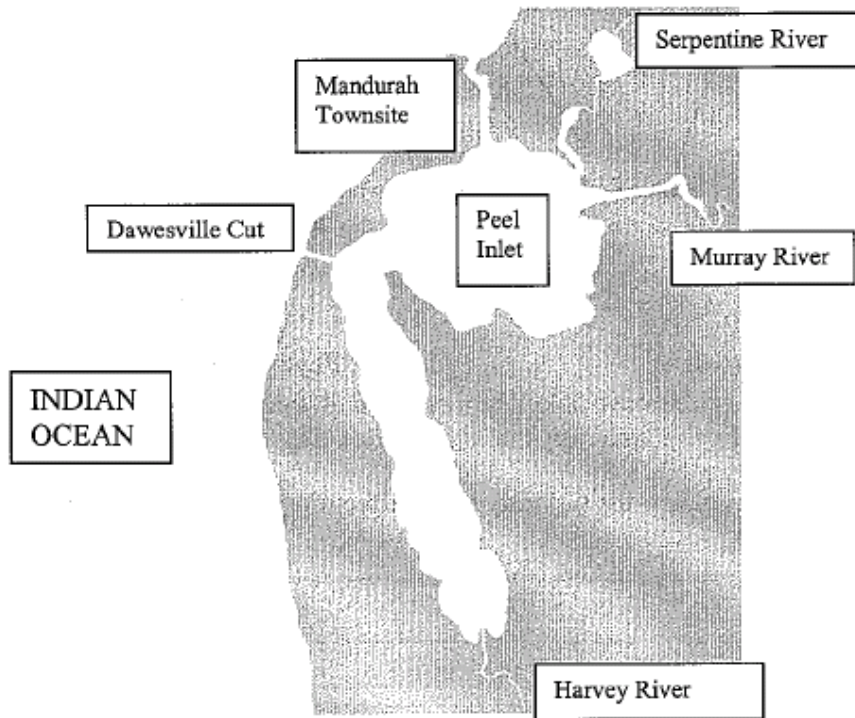
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**Question 4****[16 marks]**

(This question is common to the stage three sample examination.)

Eutrophication is an environmental problem that occurs in inland water bodies such as lakes, rivers and inlets. It occurs when excessive nutrient levels in the water cause overgrowth of producer organisms. This can lead to major disruptions in the ecosystem.

The Peel Inlet near Mandurah in Western Australia is a popular area for water sports. The surrounding land is used mostly for agriculture. For several decades, the Peel Inlet has had problems with eutrophication and water turbidity (cloudiness).



In 1995 the Dawesville Cut was completed south of Mandurah. This is a deep channel joining the inlet to the ocean. As a result, the inlet waters are extensively flushed by the rise and fall of the tides and the waters of the inlet are circulated more effectively.

- (a) (i) Name two possible sources of excess nutrients in the Peel Inlet.

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[2 marks]

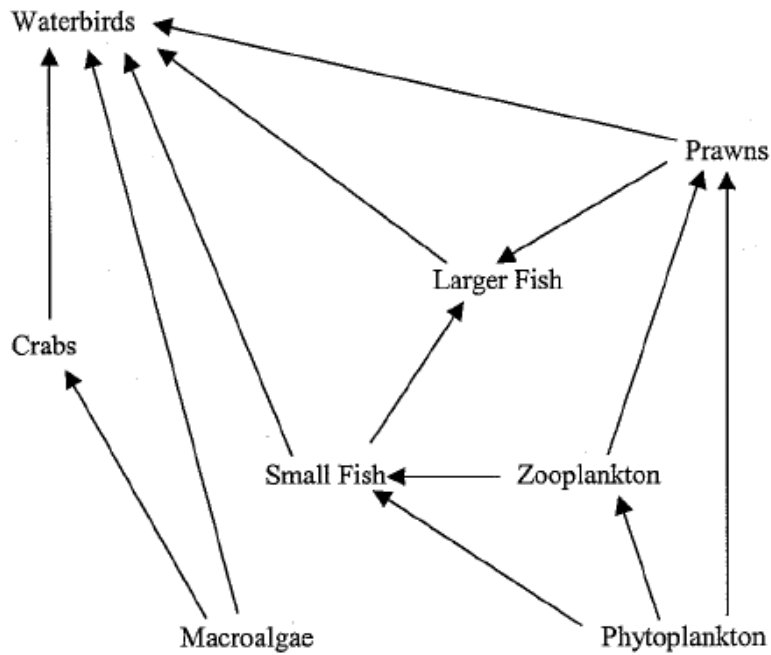
- (ii) Name two possible causes of water turbidity in the Peel Inlet.

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[2 marks]

The diagram below shows a simplified food web for the Peel Inlet.



- (b) (i) Briefly explain two ways the turbidity could affect the population of macroalgae.

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[2 marks]

- (ii) Explain briefly how the turbidity would affect the populations of commercially important species such as larger fish, crabs and prawns.

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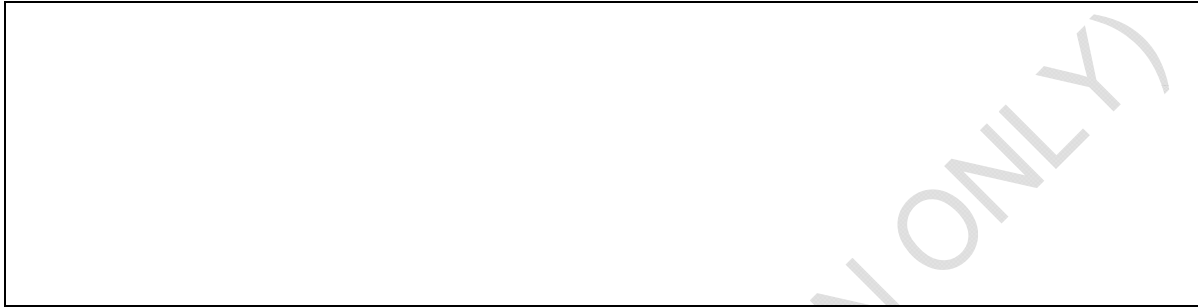
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[2 marks]

Since the Dawesville Cut was opened tidal variation in water levels has increased, leading to greater areas of salt marsh. Mosquitoes breed in these salt marshes and have become a problem to people living in the area, both as a nuisance and as a carrier of disease. An obvious solution is to spray salt marsh areas with chemical insecticides to kill the aquatic mosquito larvae.

- (c) (i) Draw a biomass pyramid for the following food chain: [2 marks]

Phytoplankton ----- prawns ----- waterbirds



- (ii) Briefly explain the shape of the food pyramid you have drawn in terms of energy flow and dissipation. [2 marks]

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- (iii) Give **two** reasons why spraying insecticide is bad for the ecosystem. Briefly explain your answers. [2 marks]

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- (iv) Suggest two methods, besides spraying, which could help reduce the mosquito population. [2 marks]

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**Question 5**

Cells use a range of structures and processes to regulate their metabolism and to interact with the environment.

*[4 marks]*

**(a)** Give two reasons why all organisms need each of the following.

(i) DNA

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(ii) Nutrients

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**(b)** Briefly describe, or present a clearly labelled diagram, to illustrate the process of osmosis.

*[6 marks]*

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(c) One of the key processes involved in the metabolism of green plants is photosynthesis.

(i) Define photosynthesis.

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[2 marks]

(ii) What are the raw materials required for photosynthesis?

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[2 marks]

(iii) What are the products of photosynthesis?

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[2 marks]

(iv) Name the cellular structures (organelles) essential for photosynthesis and explain their role in the process of photosynthesis?

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[3 marks]

(v) Specialised structures are present in a typical leaf to aid the process of photosynthesis. Name these structures and briefly explain their role.

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[2 marks]

d) (i) Suggest one way in which the processes of diffusion and osmosis are similar.

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[1 mark]

(ii) Suggest one way in which the processes of diffusion and osmosis are different.

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[1 mark]

**Question 6**

(a) Biological classification is based upon a hierarchical system of grouping organisms.

(i) Briefly describe three key features of this particular system.

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[3 marks]

(ii) In classifying plants, classification is mainly based upon the presence of cellular features such as:

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[3 marks]

(iii) List three reasons why it is important to classify organisms?

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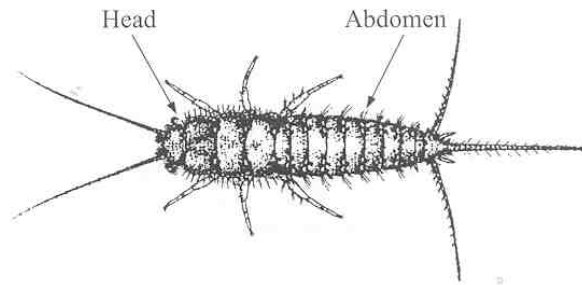
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[3 marks]

- (b) (i) Using the key provided, identify the order to which the organism, pictured below, belongs. Make sure you list the numbers, including the letters, of all the steps of the key that you used (e.g. 1a – 2b – ).



Classification key	
1. (a) Wings present	5
1. (b) Wings absent	2
2. (a) Abdomen with six segments or less	Collembola
2. (b) Body more elongated with more than six segments	4
3. (a) Antennae and eyes absent, forelegs held upward	Protura
3. (b) Longer, slender antennae	5
4. (a) Three long bristles at the end of the abdomen, antennae held forward	Thysanura
4. (b) Two long bristles at the end of the abdomen	Diplura
4. (c) Three long bristles at the end of the abdomen with antennae held close to the body	Archaeognatha
5. (a) Last abdominal segment bears a pair of curved forceps	Dermaptera
5. (b) Forewings very hard and do not take part in flight	Coleoptera

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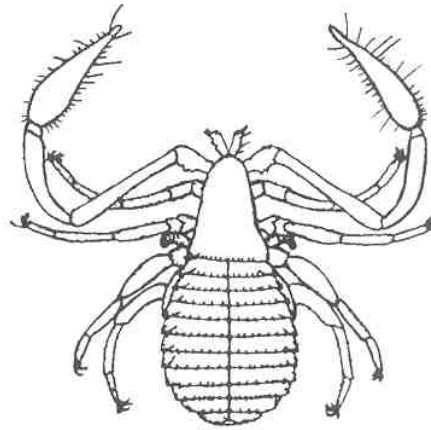
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[From: Board of Studies New South Wales, 1998]

[4 marks]

(ii) Is the organism shown below an insect?

\_\_\_\_\_ [1 mark]



(iii) Describe two features that justify your decision.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

[From: Board of Studies New South Wales, 1998]

[2 marks]

(c) (i) Define the term species.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

[2 marks]

(ii) A donkey can mate with a zebra to produce a hybrid animal known as a zonkey. Would a zonkey have a scientific name? Explain your answer.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

[2 marks]

**END OF SECTION TWO**

**SEE NEXT PAGE**

**SECTION THREE—EXTENDED ANSWERS****(40 marks)**

Suggested time: 60 minutes

Section Three consists of two questions. There are two parts to each question. All parts are compulsory. You must answer both parts from both questions.

Each question carries twenty 20 marks.

Question 7 mainly tests your **knowledge** of syllabus content.

Question 8 mainly tests **how you apply** your understanding of biological principles.

ANSWER SECTION C IN THE STANDARD ANSWER BOOK. 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
- write notes beside a clear diagram
- write lists of points, with sentences which link them
- write concisely worded sentences
- use some other appropriate way to present ideas.

Marks may be deducted for answers that are poorly presented or difficult to read. Use a blue or black ball point or ink pen for written answers and a pencil for diagrams.

**Question 7****Answer both parts of this question****[20 marks]**

- (a) Explain, with the aid of a large and clearly labelled diagram, exactly how carbon dioxide from the air enters the living component of an ecosystem. Your explanation, supported by a labelled diagram, should show how and why carbon dioxide is used by plants and ways by which carbon dioxide might eventually return to the non-living environment.

*[10 marks]*

- (b) Adaptations for survival can be considered as structural, physiological or behavioural. Clearly distinguish the difference between the three types of adaptation and describe, using named examples, how each type of adaptation might help an organism survive in a terrestrial habitat.

*[10 marks]*

**Question 8****Answer both parts of this question****[20 marks]**

- (a) Transpiration can be considered as a necessary evil for plants. Using clearly labelled diagram(s) to support your answer summarise the process of transpiration and discuss why transpiration can be seen as an advantage and a disadvantage for plants.

*[10 marks]*

- (b) For copyright reasons this text cannot be reproduced in the online version of this document but may be viewed at <http://www.nrw.qld.gov.au/factsheets/pdf/pest/pa21.pdf> (p.1, adaptation)

[From: Land Protection, 2006]

Suggest steps that should have been taken before the cane toad was first introduced to prevent it from becoming a pest and discuss the kinds of biological controls that might be used to control the cane toad population in the future.

*[10 marks]***END OF PAPER**

## ACKNOWLEDGEMENTS

### SECTION ONE

**Questions 4–6** Diagram from: Raven, P.H., Evert, R.F., & Eichhorn, S.E. (1992). *Biology of plants* (5<sup>th</sup> ed.), New York: Worth, p. 20, fig. 2-6.

### SECTION TWO

**Question 6(b)** Adapted from: Board of Studies New South Wales. (1998). *1998 Biology 2 Unit: Higher School Certificate Examination* (pp. 22–23, q. 35(f)). Retrieved August, 2007, from [http://www.boardofstudies.nsw.edu.au/hsc\\_exams/hsc2000exams/hsc00\\_biology/98BIOLGY.PDF](http://www.boardofstudies.nsw.edu.au/hsc_exams/hsc2000exams/hsc00_biology/98BIOLGY.PDF).  
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### SECTION THREE

**Question 8(b)** Adapted from: Land Protection. (2006). *Cane toad: Bufo marinus* (p. 1). Retrieved August, 2007, from Department of Natural Resources and Water website: <http://www.nrw.qld.gov.au/factsheets/pdf/pest/pa21.pdf>.

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