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Tasmanian Secondary Assessment Board

Tasmanian Certificate of Education

External Assessment

2001

BY826 BIOLOGY

SECTION A

Time: 35 minutes

On the basis of your performance in this examination, the examiners will provide a rating of A, B, C or D on the following criterion taken from the syllabus statement:

Criterion 3 Demonstrate understanding and knowledge of biological principles and how they apply to the molecular and cellular levels of biological organisation.

Pages: 7
Questions: 6

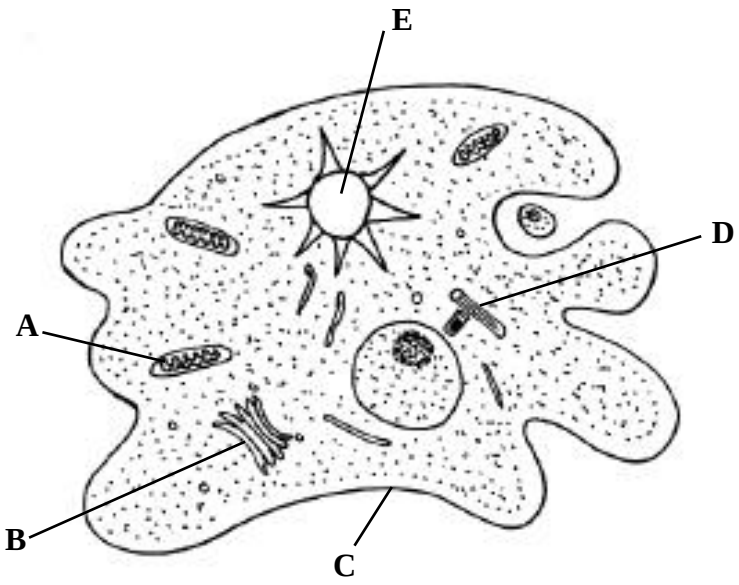
CANDIDATE INSTRUCTIONS

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

Candidates are reminded that spelling and expression which make it difficult for the examiner to understand what candidates mean, will result in loss of marks.

Question 1

Amoeba proteus is a single-celled organism which is commonly found in freshwater ponds and streams. It is a slow moving, large micro-organism which feeds mainly on other single-celled organisms.



The diagram below shows some of the internal structures found in a typical *Amoeba.*

(a) Name the structures in the diagram which are labelled as follows:

B ..... **C** .....

D ..... **E** .....

(2 marks)

(b) You are observing this cell under the low power of a microscope. The diameter of the field of view is 1.5 mm and you estimate that five cells would fit across the field of view.

What is the approximate width of an Amoeba cell in µm? (2 marks)

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(c) (i) Name structure **A** and outline its function. (2 marks)

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Question 1 continues opposite.

Question 1 (continued)

(ii) Name two structures not shown in the diagram and which you would expect to find in a single-celled plant. (1 mark)

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Total Question 1: /7

Question 2

The table below gives the distribution of RNA, DNA and protein in the cells of the liver. The figures are percentages of the total in a typical cell.

	X	**Y**	**Z**
Nucleus	15	12	99
Mitochondria	17	4	1
Endoplasmic reticulum plus ribosomes	19	60	0
Remainder of cell	49	24	0

Identify, with reasons, which of substances **X**, **Y** and **Z** are:

(i) DNA: (2 marks)

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(ii) RNA: (2 marks)

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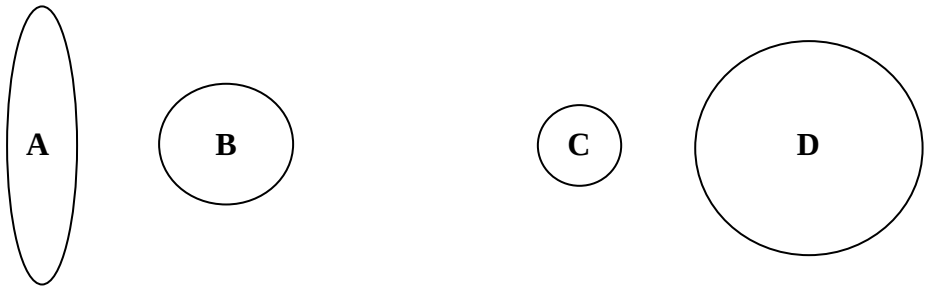
Total Question 2: /4

Question 3

A to **D** below represent 4 different organisms that vary in size and shape.



A and **B** are equal in volume, but **A** is longer and thinner than **B**, which is spherical. **C** and **D** are both spherical, but **C** is much smaller than **D**.

(a) Which of the organisms **A** or **B** would turn completely red more quickly when placed in a red dye solution? Explain your answer. (2 marks)

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(b) Which of the organisms **C** or **D** would turn completely red more quickly when placed in a red dye solution? Explain your answer. (2 marks)

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(c) Give an example of a situation when organism **D** would have an advantage over organism **C** in terms of its physiological adaptation to the environment. Explain your answer. (2 marks)

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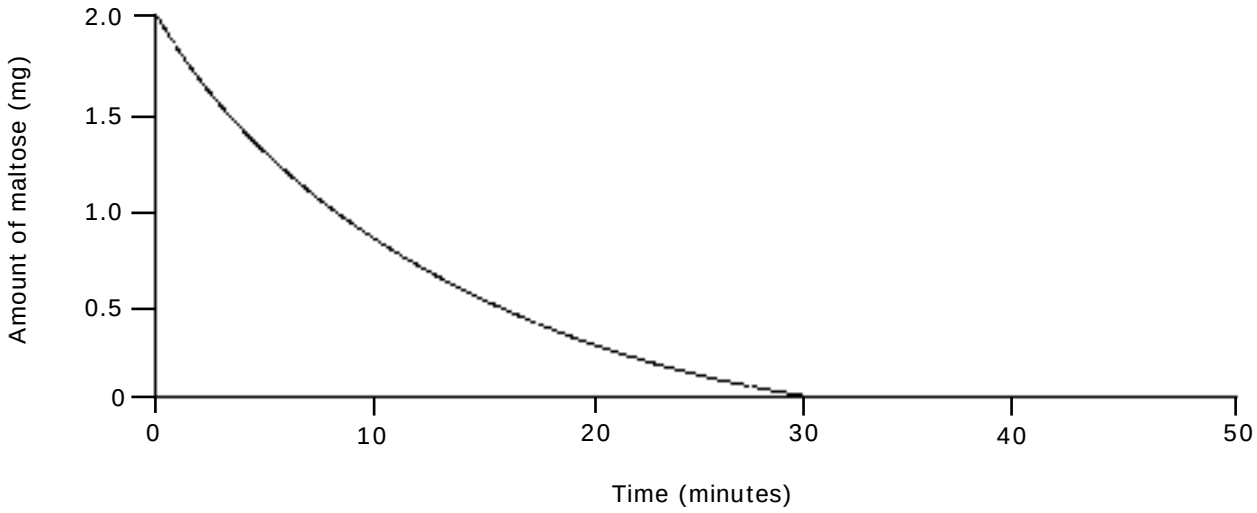
Total Question 3: /6

Question 4

Maltase is an enzyme that catalyses the breakdown of the sugar maltose into glucose. It works most efficiently at pH 6.8.

A sample of the enzyme maltase was added to a solution containing 2 mg maltose at pH 6.8. The breakdown of maltose was measured over the next 30 minutes as shown on the graph.



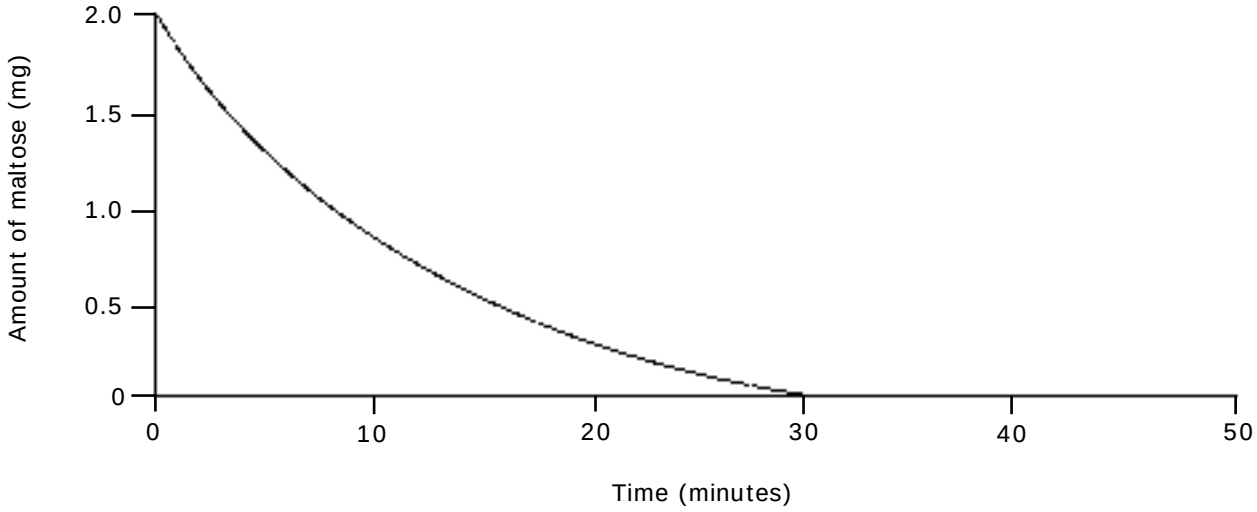
For each of the following changes, sketch a labelled line on the graph above.

(a) Twice as much enzyme is added at time zero. (1 mark)

(b) The reaction is performed at pH 6.0. (1 mark)

(c) A further 1g of maltose is added after 10 minutes. (1 mark)

Spare Graph for Question 4 (above)



Total Question 4: /3

Question 5

Many students have the impression that living in water is easier for organisms than living on land. However, there are problems in terms of maintaining water balance no matter where the organism lives.

(a) Describe what happens to a unicellular animal in freshwater. (4 marks)

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(b) How would this be different for a unicellular plant in freshwater. (2 marks)

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(c) Outline one mechanism or strategy the unicellular animal mentioned in part (a) might use to survive in a very salty environment. (2 marks)

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Total Question 5: /8

Question 6

When rivers flood for an extended period of time both the aquatic plants and other plant material that has been submerged begin to decay. Many fish then die from apparent suffocation.

Explain this observation in terms of **photosynthesis** and **respiration**.

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Total Question 6: /5

PLACE LABEL HERE

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2001

BY826 BIOLOGY

SECTION B

Time: 35 minutes

On the basis of your performance in this examination, the examiners will provide a rating of A, B, C or D on the following criterion taken from the syllabus statement:

Criterion 4 Display understanding and knowledge of biological principles and how they apply to the organism.

Pages: 7
Questions: 5

CANDIDATE INSTRUCTIONS

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

Candidates are reminded that spelling and expression which make it difficult for the examiner to understand what candidates mean, will result in loss of marks.

Question 7

The table below shows the habitat of three different kinds of turtle and the proportion of different nitrogenous wastes which each produces.

Turtle name	Habitat	Uric acid	Ammonia	Urea
Kinosternon subrubum	Water	0.7	24.0	22.9
Kinixys erosa	Damp places	4.2	6.1	61.0
Testudo elegans	Desert	56.1	6.2	8.5

(a) What is the main form of nitrogenous waste produced by each of these turtles? (1 mark)

Kinixys erosa .....

Testudo elegans .....

(b) What is the origin of the nitrogenous waste products in animals? (1 mark)

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(c) Explain why some turtles produce mostly ammonia, even though it is a very toxic chemical, whilst others produce uric acid. (3 marks)

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Total Question 7: /5

Question 8

During exercise both the breathing rate and the pulse rate of mammals increases.

(a) Explain how each of these helps to increase the rate of diffusion between the alveoli and the bloodstream.

(4 marks)

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(b) Explain the resulting benefit to the mammal. (2 marks)

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Total Question 8: /6

Question 9

In an experiment conducted in 1775, two men walked into a dry air oven that had been heated to 127˚C and after 20 minutes they emerged unharmed. In contrast, a piece of steak they carried in with them had partially 'cooked'.

(a) Explain in detail why the steak was 'cooked' yet the men were able to survive. (4 marks)

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(b) Explain whether a lizard would have been able to survive under similar conditions. (2 marks)

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(c) Give reasons why some people die on humid days when the temperature is only 45˚C. (2 marks)

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Total Question 9: /8

Question 10

Parts of the digestive system are frequently removed during surgery. For each body part removed carefully explain:

- what effect it would have on the functioning of the digestive system
- how this effect could be compensated for

(a) the gall bladder (3 marks)

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(b) part of the large intestine (3 marks)

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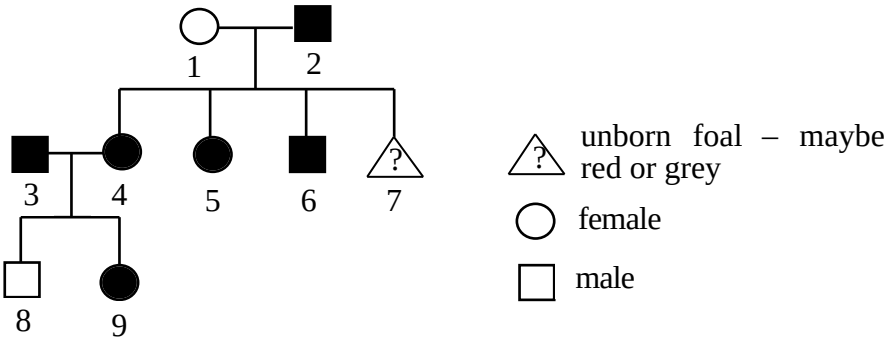
Total Question 10: /6

Question 11

In a particular group of donkeys coat colour can be grey or red. Grey coat colouring (G) is dominant to red coat colour (g). Study the following pedigree which shows the coat inheritance for one breeding pair of donkeys.



(a) From the information above determine the colour of the female donkey, 1. Show your reasoning. (2 marks)

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(b) If 3 and 4 have another foal, what is the chance it will have a grey coat? Explain your answer. (2 marks)

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Question 11 continues opposite.

Question 11 (continued)

When animals of different species are kept together in captivity they sometimes mate and produce offspring. A donkey can mate with a zebra to produce a hybrid animal known as a *zonkey.*

A donkey has a diploid number of 62 chromosomes and a zebra has a diploid number of 44 chromosomes.

(c) How many chromosomes are found in the body (somatic) cells of a *zonkey.* (1 mark)

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(d) From this information clearly explain why the *zonkey* is infertile. (2 marks)

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Total Question 11: /7

PLACE LABEL HERE

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SECTION C

Time: 35 minutes

On the basis of your performance in this examination, the examiners will provide a rating of A, B, C or D on the following criterion taken from the syllabus statement:

Criterion 5 Demonstrate understanding and knowledge of biological principles and how they apply to the interrelationships between organism and environments.

Pages: 7
Questions: 4

CANDIDATE INSTRUCTIONS

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

Candidates are reminded that spelling and expression which make it difficult for the examiner to understand what candidates mean, will result in loss of marks.

Question 12

The common name and the scientific name are given for six 'wild cats'.

COMMON NAME	**SCIENTIFIC NAME**
lion	*Panthera leo*
snow leopard	*Panthera uncia*
eastern native cat	*Dasyurus viverrinus*
fishing cat	*Felis viverrinus*
cheetah	*Acinonyx jubalis*
jaguar	*Panthera onca*

In light of the scientific names, comment on the statement:

'The most closely related pair is the snow leopard and the lion', and briefly explain your answer.

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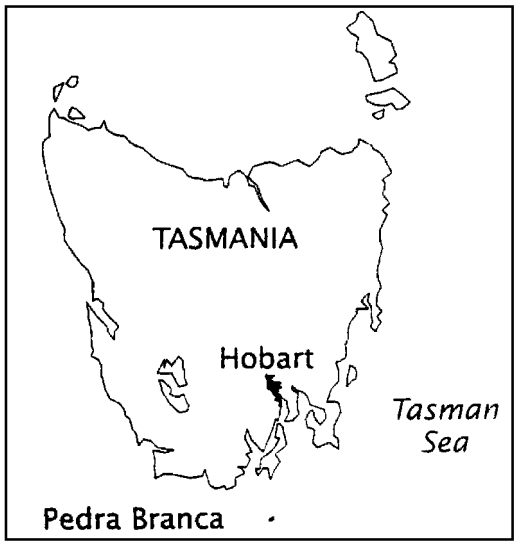
Total Question 12: /2

Question 13

Pedra Branca is an island in the Southern Ocean off the south coast of Tasmania. Living on the island and in the surrounding waters is a community that forms part of an ecosystem and comprises many kinds of organisms, including phytoplankton (microscopic plants), zooplankton (microscopic animals), krill (small shrimp like organisms), various species of fish, squid, and birds such as the Australian gannet, *Morus serrator*, and the shy albatross, *Diomedea cauta.*



(a) Draw and label a food web showing part of the energy flow in the ecosystem. Include an indication that gannets eat fish that feed on krill, that the shy albatross eats fish and squid, and that squid feed on fish, that krill eats phytoplankton and zooplankton, and zooplankton eats phytoplankton. (4 marks)

(b) Name one essential trophic level that has been omitted from the above foodweb. (1 mark)

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(c) Identify from the food web: (2 marks)

(i) a first order consumer .....

(ii) a second order consumer.....

Question 13 continues over the page.

Question 13 (continued)

(d) Large quantities of krill are harvested by the commercial fisheries. Predict what effect this could have on the population of the shy albatross. (2 marks)

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(e) Gannets spend much time grooming their feathers, in part, this is to remove any lice. What is the relationship between lice and gannets? (1 mark)

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(f) In general food chains do not exceed five levels. Explain why food chains are usually short. (2 marks)

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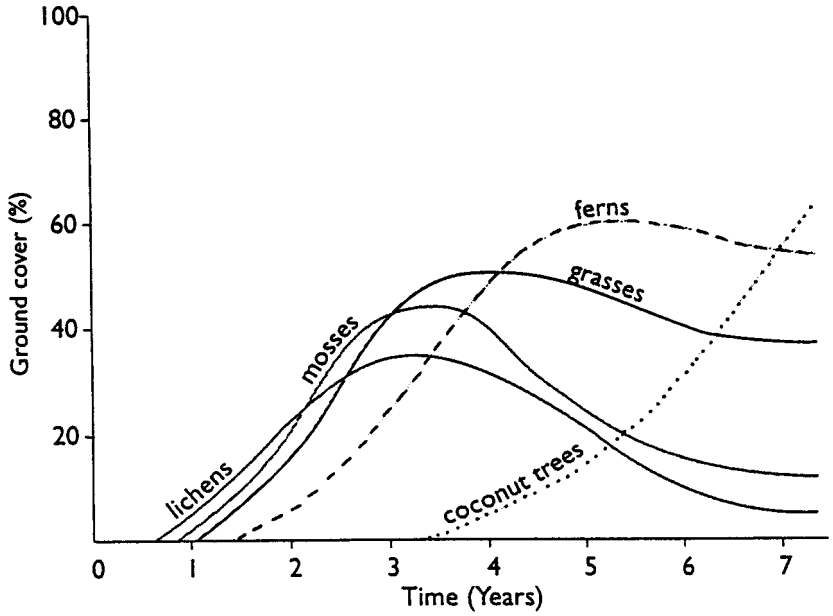
Total Question 13: /12

Question 14

Krakatoa is a volcano on a small island off the west coast of Java, Indonesia. In 1883 two volcanic eruptions destroyed all the plant and animal life on the island. In the years that followed the gradual return of the plants to the island was documented and the first seven years of recovery is shown in the graph below.



(a) What ecological process was taking place on the island? (1 mark)

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(b) Discuss how this process occurred on Krakatoa and suggest why the changes shown on the graph took place. (6 marks)

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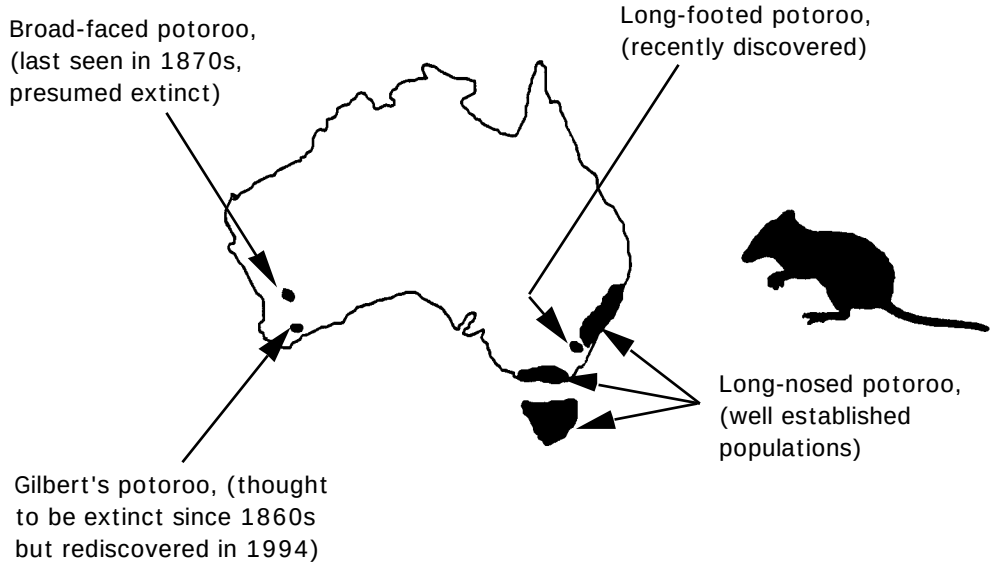
Total Question 14: /7

Question 15

Potoroos are small omnivorous marsupials commonly found in the Tasmanian bush and there are other populations of the same, and related species, on the mainland. The map below shows the distribution for the potoroo.



(a) Describe a sequence of events that explains how the four species of potoroo might have evolved from a common ancestral population.

(6 marks)

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Question 15 continues opposite.

Question 15 (continued)

(b) In the last 150 years many changes have occurred to the distribution of Australian native animals. Give **three** explanations for the survival of Gilbert's potoroo and the apparent extinction of the broad-faced potoroo.

Explanation 1 (2 marks)

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Explanation 2 (2 marks)

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Explanation 3 (2 marks)

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Total Question 15: /12

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SECTION D

Time: 35 minutes

On the basis of your performance in this examination, the examiners will provide a rating of A, B, C or D on the following criterion taken from the syllabus statement:

Criterion 8 Develop feasible hypotheses and design controlled experiments to test hypotheses.

Pages: 7
Questions: 4

CANDIDATE INSTRUCTIONS

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

Candidates are reminded that spelling and expression which make it difficult for the examiner to understand what candidates mean, will result in loss of marks.

Question 16

Hydrangea macrophylla is a garden shrub which may have either pink or blue flowers. A gardener claims that she can change the colour of *Hydrangea* flowers from pink to blue simply by adding lime to the soil, which makes the soil alkaline.

(a) Express this belief in the form of a testable hypothesis. (2 marks)

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(b) If you were to perform an experiment to test this hypothesis:

What would be your dependent variable? (1 mark)

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What would be your independent variable? (1 mark)

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(c) Name **four** variables that should be controlled in an experiment to test your hypothesis. (2 marks)

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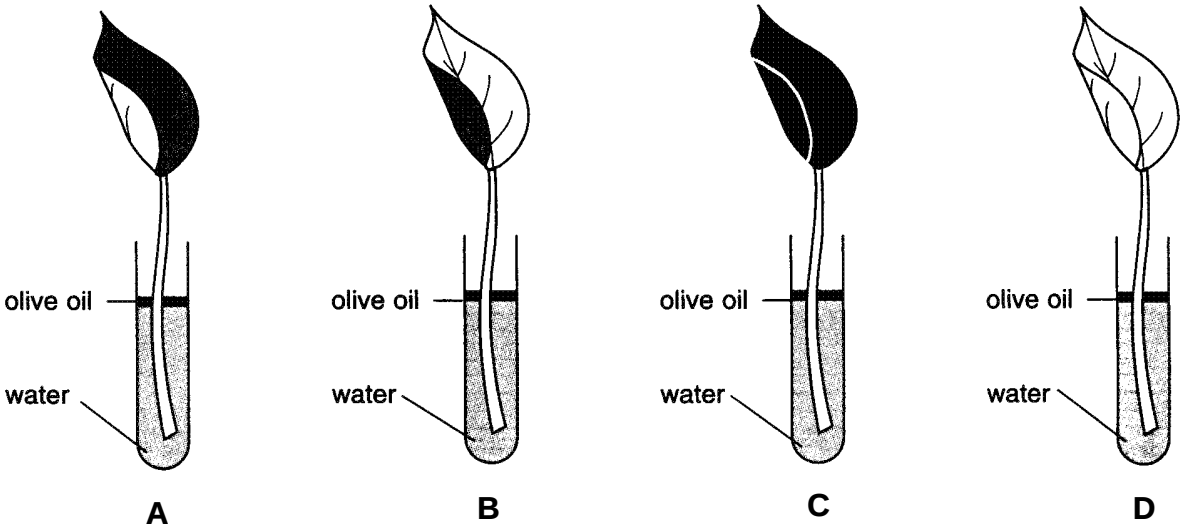
Total Question 16: /6

Question 17

Four leaves were placed in test tubes of water. Olive oil was poured onto the surface of the water in each tube to prevent water loss by evaporation.



Grease (shown as dark shading in the diagram) can be used to prevent water loss from the leaf surface.

If the hypothesis being tested is: "Plants lose most water from the underside of the leaf" explain clearly why each treatment was included. (6 marks)

Tube **A**

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Tube **B**

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Tube **C**

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Tube **D**

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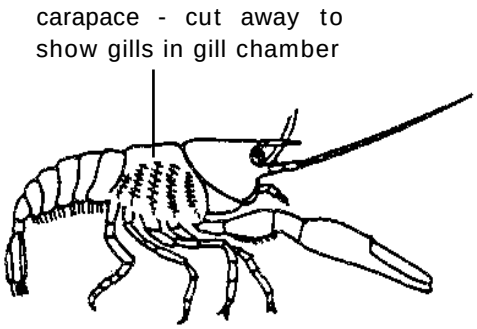
Total Question 17: /6

Question 18

The respiratory gills of freshwater crayfish are located in a chamber on each side of the body, protected by a large overhanging plate called the carapace. A small limb at the front of each gill chamber pumps water across the gills with a beating action. A scientist measured the beating rate of this limb for a single crayfish when it was kept at different temperatures. The table below shows the data that were recorded.



Number of Beats per Minute	Water Temperature ˚C
16	10
42	20
64	30
64	40
0	50

(a) The scientist was advised to repeat the experiment using five crayfish. Explain whether this was good advice. (2 marks)

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(b) More than 100 crayfish were available in a large tank. Clearly explain an appropriate method by which the scientist could select just five specimens for repeating the experiment. (2 marks)

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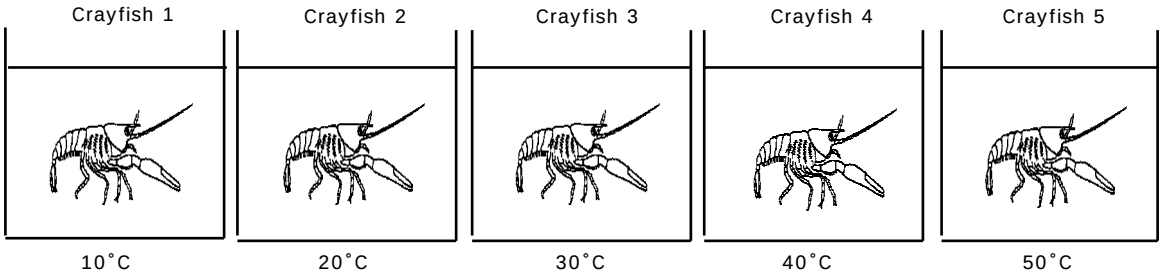
Question 18 continues opposite.

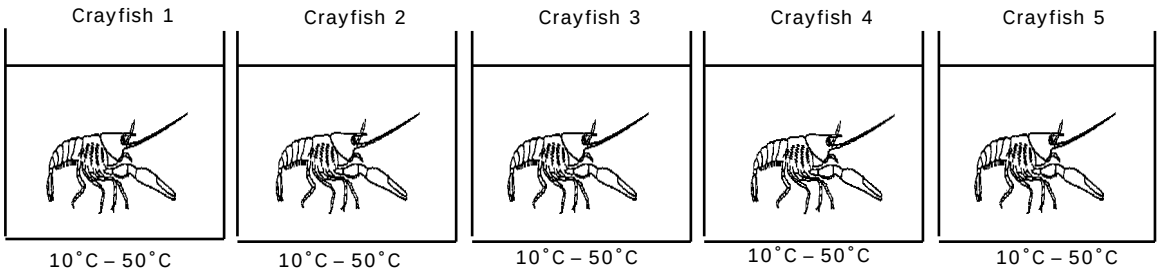
Question 18 (continued)

(c) The experiment could have been conducted by:

(i) Placing 1 crayfish into each tank at a different target temperature and commencing 'counting the beats' after 1 hour.



(ii) Heating each of the tanks continuously from 10˚C – 50˚C over a 4 hour period and counting beats as each target temperature is reached.



Discuss the relative advantages and disadvantages of each method. (4 marks)

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Total Question 18: /8

Question 19

Zinc lozenges have been reported as having a potentially beneficial effect on recovery from the common cold, although findings have been contradictory.

New research further supports the use of zinc, a hypothesis could be: "the average cold duration could be halved by taking 6.4 mg of a zinc supplement every two to three hours within 24 hours of first developing cold symptoms" (*Annals of Internal Medicine*, 2000; 133: 245-252).

(a) Design an experiment that could have been used in this new research, including the dosage required to be most effective. (11 marks)

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Question 19 continues opposite.

Question 19 (continued)

(b) What results would negate the hypothesis given. (2 marks)

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Total Question 19: /13

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SECTION E

Time: 35 minutes

On the basis of your performance in this examination, the examiners will provide a rating of A, B, C or D on the following criterion taken from the syllabus statement:

Criterion 9 Analyse, interpret and evaluate information and data gained (from individual investigations and the investigations of others) and to evaluate the methods used and conclusions drawn from these investigations.

Pages: 7
Questions: 4

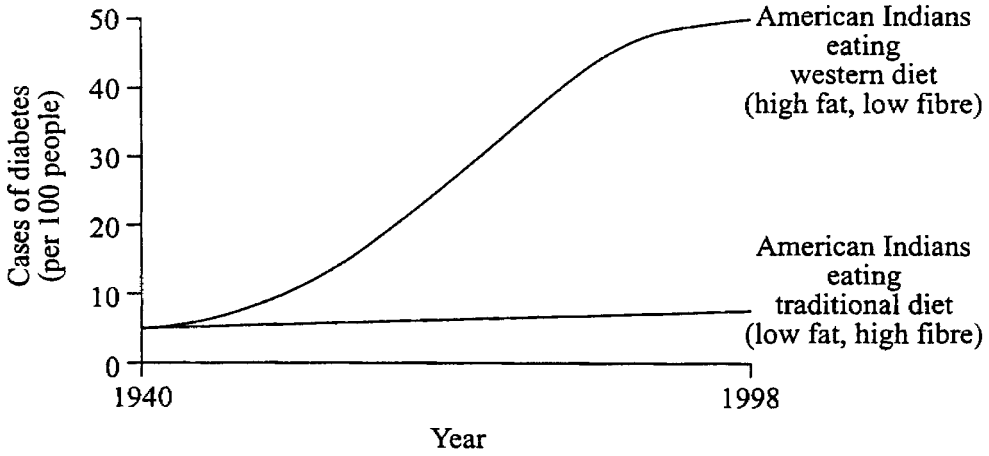
CANDIDATE INSTRUCTIONS

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

Candidates are reminded that spelling and expression which make it difficult for the examiner to understand what candidates mean, will result in loss of marks.

Question 20

Over the last 50-60 years some native American Indians have adopted a western diet. The graph below shows the estimated incidence of diabetes in two groups of American Indians.



Comment on the validity of each of the following statements and justify your answer by using the information given.

(a) (i) Diabetes did not exist in these American Indians before 1940. (2 marks)

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(ii) Not all American Indians who adopt a western diet will get diabetes. (2 marks)

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(b) The incidence of diabetes in American Indians eating a western diet took 50 years to plateau out at 50%. Suggest why there was a time lag between the change in diet and its full impact. (2 marks)

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Total Question 20: /6

Question 21

In 1995 the results of two studies on the link between hormone replacement therapy (HRT) and breast cancer were published in two reputable journals; and each study came to a different conclusion.

One study appeared in the New England Journal of Medicine (NEJM) and reported the results of an ongoing 20 year study tracking the medical records of 120 000 women. It identified groups of women who were more at risk of breast cancer as a result of taking HRT.

The other study, published in the Journal of the American Medical Association (JAMA), was a study which interviewed 1029 women, and concluded that HRT did not appear to increase the risk of breast cancer.

There are at least three significant differences between the two studies. Identify these differences and comment on how they contribute to the reliability of the conclusions.

Difference 1 .....

Effect on results .....

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(3 marks)

Difference 2 .....

Effect on results .....

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(3 marks)

Difference 3 .....

Effect on results .....

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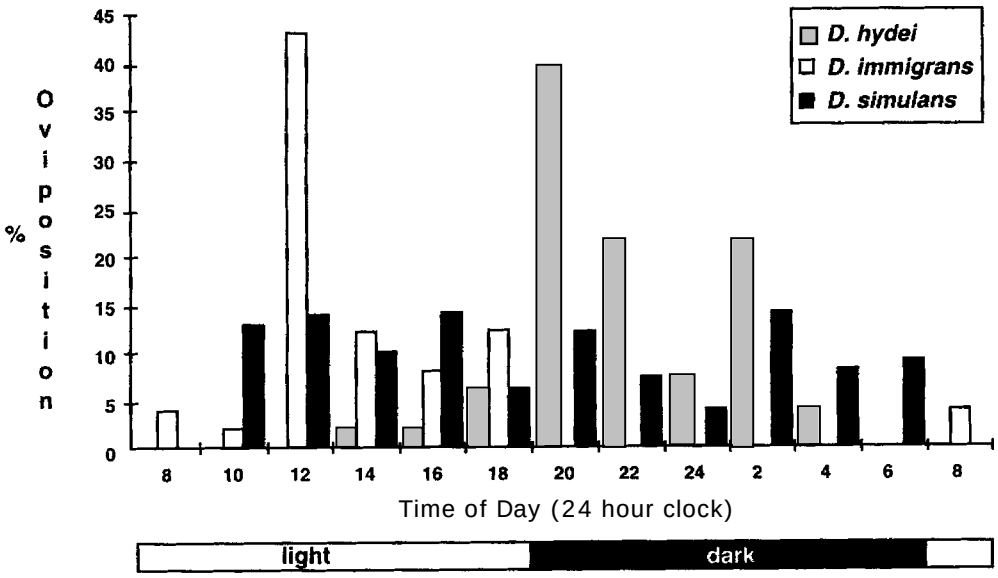
(3 marks)

Total Question 21: /9

Question 22

A university student investigated the effect of light exposure (the photoperiod) and intensity on the egg laying (oviposition) patterns of three species of fruit flies. The maximum light intensity was at midday. Her results are given below.

Times of oviposition by *Drosophila* species



(a) During which times are ALL three species laying eggs? (2 marks)

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(b) Use the data to compare and contrast the effect of light exposure on the egg laying of each of the three species. (6 marks)

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Question 22 continues opposite.

Question 22 (continued)

(c) Explain **two** likely consequences that would result from halving the maximum light intensity.
(3 marks)

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Total Question 22: /11

Question 23

The diet of little penguins *Eudyptula minor* was investigated during 1995/96 and particularly during the 1996/97 breeding seasons at Phillip Island, Victoria. There was a high mortality of small fish known as pilchards, *Sardinops sagaux,* throughout Bass Strait in 1995. Pilchards are a major prey species of little penguins.

The breeding cycle of little penguins begins in October with egg laying. Chicks hatch at about the end of November and small chicks of 0–3 weeks old are found in December. Older chicks of about 4–8 weeks old are found in January–February. The chicks are fed by the parents and are reared until fledgling (chicks are ready to leave the nest) stage in February.

The breeding success rate of the little penguins was above average during these years.

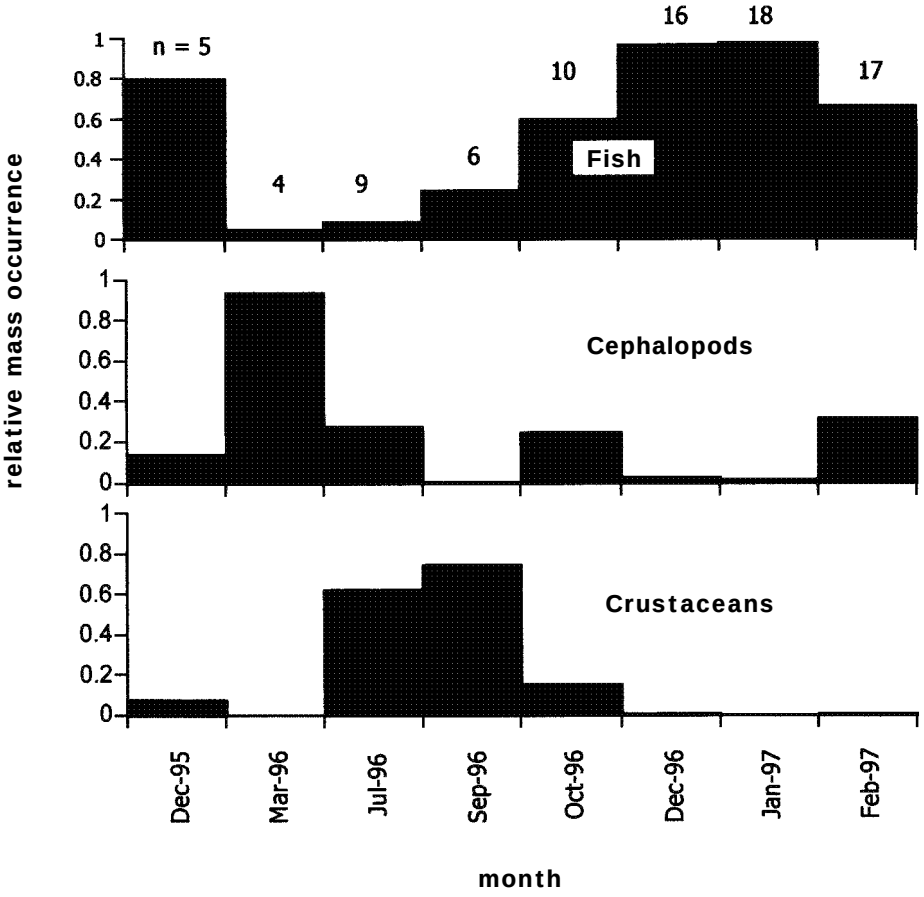

Figure 1

Relative mass occurrence of the three main prey groups in the penguins' diet at sampling date over two breeding seasons, 1995/96 and 1996/97. The 'n' value on top of each row represents the number of birds sampled in that month.

Question 23 continues opposite.

Question 23 (continued)

The relative mass occurrence is a method whereby food samples from the penguins were drained, blotted dry and weighed.

(a) How does the diet of the little penguin vary through the time period measured and how does this relate to the breeding cycle? (6 marks)

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(b) Suggest why the mortality of pilchards had no apparent effect on the ability of little penguins to rear chicks based on the data given. (1 mark)

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Total Question 23: /7