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Tasmanian Secondary Assessment Board

BIOLOGY

Senior Secondary 5C

Subject Code: BY826

External Assessment

2003

Section A

Time: 35 minutes

On the basis of your performance in this examination, the examiners will provide a result 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: 10
Questions: 4

CANDIDATE INSTRUCTIONS

Candidates **MUST** ensure that they have addressed **ALL** of the externally assessed criteria on this examination paper.

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

(a) Match each of the structures listed on the column on the left with their correct function/explanation from the right hand column.

(4 marks)

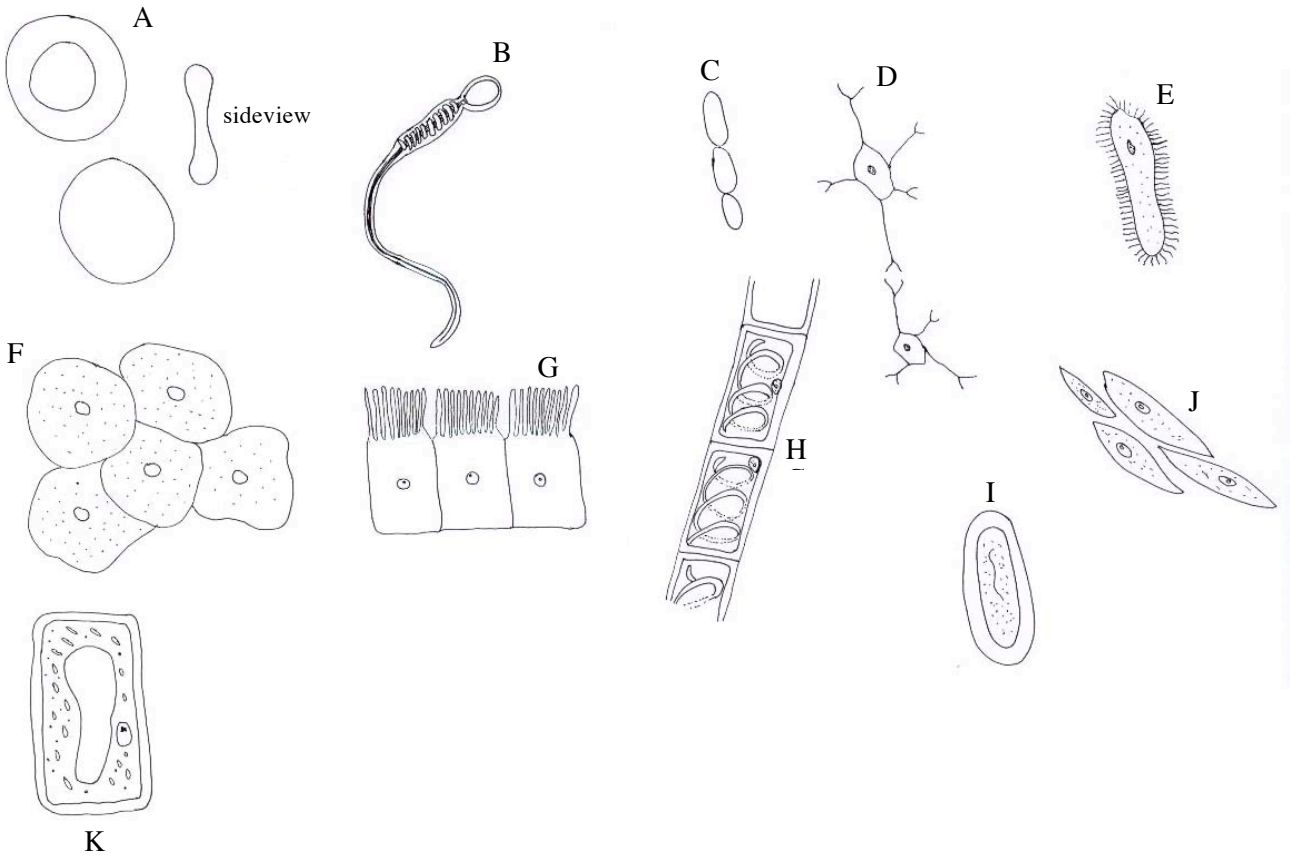
Structure	Function/Explanation
Cell wall	**A.** Produces high concentrations of ATP
Cell membrane	**B.** Site of protein synthesis
Golgi body/apparatus	**C.** Fluid filled membrane bound organelle often used for storage
Mitochondria	**D.** Mostly found in freshwater micro-organisms
Rough Endoplasmic Reticulum	**E.** A structure largely made up of cellulose
Plastid	**F.** Contains most of the cell's DNA
Contractile vacuole	**G.** Packages chemical materials for export from the cell
Nucleus	**H.** Structure directly responsible for regulating most of the cell's input and output

Structure	Corresponding Letter
Cell wall	
Cell membrane	
Golgi body/apparatus	
Mitochondrion	
Rough Endoplasmic Reticulum	
Plastid	
Contractile vacuole	
Nucleus	

Question 1 continues over the page.

Question 1 (continued)

(b) The illustrations below show a number of types of cells or unicellular organisms.



(i) Identify all the prokaryotic cells shown in the above diagrams A – K. (1 mark)

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(ii) Identify the eukaryotic plant cells. (1 mark)

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Question 1 continues opposite.

Question 1 (continued)

(iii) Identify the correct diagram for each of the following and briefly describe one aspect of cell structure that is related to its specialised function. (6 marks)

1. Cell(s) that can suitably act as a lining to protect the inside of the cheek.

Letter: ..... Description:.....

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2. Cell(s) that are specialised for the transport of oxygen.

Letter: ..... Description:.....

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3. Cell(s) that are suitably adapted to help remove unwanted particles from the respiratory tract.

Letter: ..... Description:.....

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Total Question 1: /12

Question 2

The table below shows the results of an experiment in which the synthesis of a polysaccharide from glucose in a test-tube was investigated. The changes in the concentrations of the polysaccharide and four other substances, **W**, **X**, **Y** and **Z**, in the test-tube were recorded over a 20-minute time interval

Time (min)	**Concentration of substance (arbitrary units)**				
	Polysaccharide	**W**	**X**	**Y**	**Z**
0	0	35	0	2	90
5	4	15	20	2	60
10	6	5	30	2	45
15	7	0	35	2	38
20	7	0	35	2	38

Identify which substances **W**, **X**, **Y** and **Z** represent **ATP**, **ADP**, **glucose** and **enzyme** and give one reason for each of your choices. (8 marks)

Substance **W**:.....

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Substance **X**:.....

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Substance **Y**:.....

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Substance **Z**:.....

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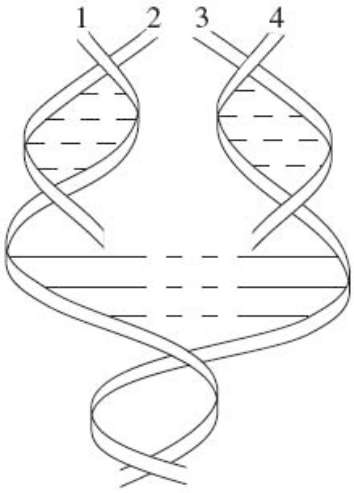
Total Question 2: /8

Question 3

(a) The diagram below shows a section of DNA undergoing replication.



(Source: Mader, S. *Inquiry into Life*, Iowa, 1994)

Identify two strands of DNA in which the sequence of bases would be the same. Explain your reasoning. (2 marks)

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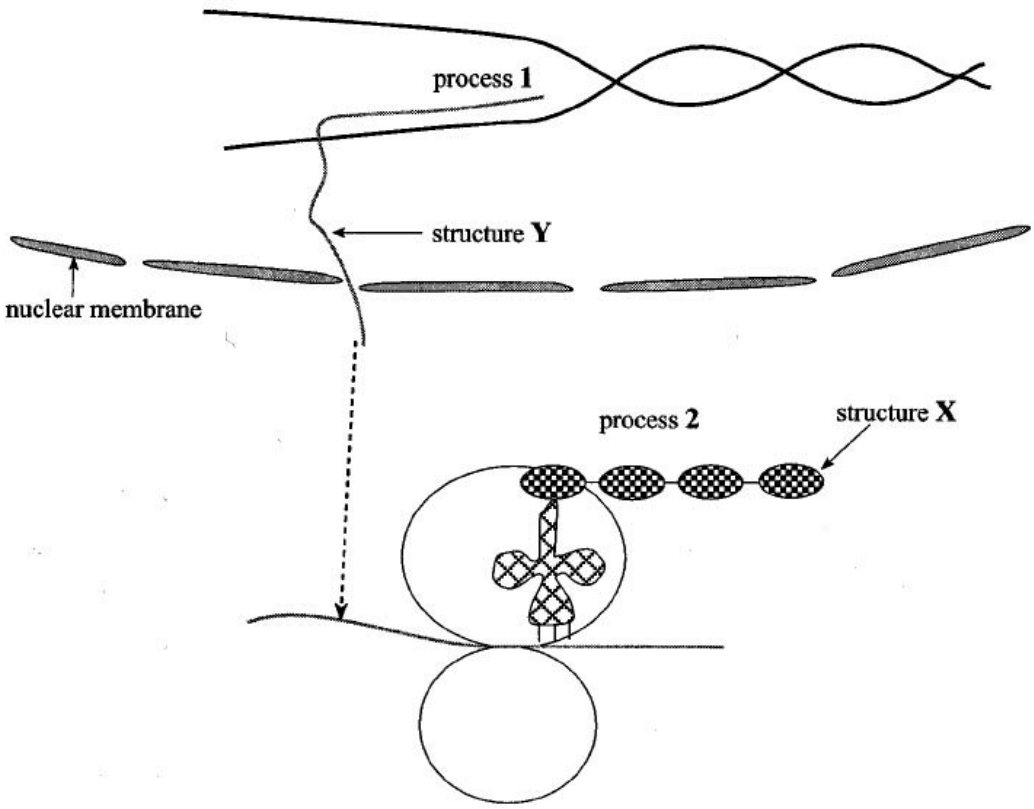
Question 3 continues over the page.

Question 3 (continued)

(b) Refer to the following diagram which shows processes 1 and 2 and structures X and Y, which are involved in protein synthesis.



(i) Name process 1, and explain its significance. (3 marks)

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(ii) Name process 2, and briefly state its significance. (2 marks)

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Total Question 3: /7

Question 4

Four pieces of celery, of equivalent size and shape, were placed in four solutions of different sucrose concentrations.

The table below shows the results of weighing the celery before, and two hours after, being placed in the solutions.

	Weight (g)	
Celery in	**Before**	**After**
Solution A	49.7	50.1
Solution B	49.8	46.1
Solution C	49.9	60.2
Solution D	49.6	42.3

(a) Which sucrose solution was the most concentrated? State one reason for your answer and give an explanation for the process involved. (4 marks)

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(b) Which solution would it be best to keep the celery in if you wanted to keep it as unchanged as possible? Explain. (2 marks)

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Total Question 4: /6

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Tasmanian Secondary Assessment Board

BIOLOGY

Senior Secondary 5C

Subject Code: BY826

External Assessment

2003

Section B

Time: 35 minutes

On the basis of your performance in this examination, the examiners will provide a result 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: 10
Questions: 4

CANDIDATE INSTRUCTIONS

Candidates **MUST** ensure that they have addressed **ALL** of the externally assessed criteria on this examination paper.

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 5

The following table shows the concentrations of five substances found in three fluids taken from different locations inside a kidney.

Substance	Concentration of substance (g L^{-1})		
	Location A	**Location B**	**Location C**
water	920	980	960
glucose	1.2	1.2	0.0
urea	0.3	0.3	20
proteins	80	0.0	0.0
sodium ions	3.2	3.2	3.3

(a) Identify the location **A**, **B**, and **C** from the following list: Bowman's capsule, glomerulus and collecting duct. (2 marks)

A: .....

B: .....

C: .....

(b) Account for the changes in concentrations of glucose, urea and protein in the kidney. (3 marks)

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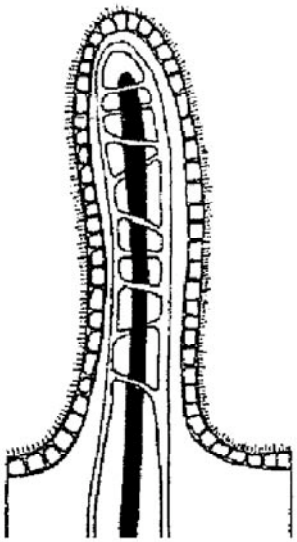
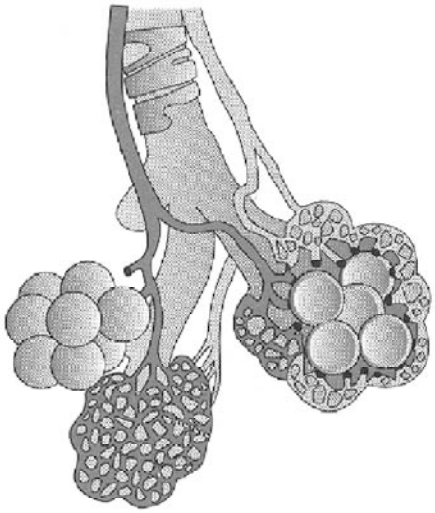
Total Question 5: /5

Question 6

(a) The diagrams below show a villus and clusters of alveoli.



(Source: Adapted from LeCornu, B. & Diercks, T. *Biology: Levels of Life*, Adelaide, 1999).



(Source: Adapted from Crierie, A. & Greig, D.. *Biology: Key Ideas Essential Text Book*, Adelaide, 1999).

State **two** features common to both villi and alveoli that assist in the efficient uptake/exchange of nutrients/wastes and explain why these features are important. (4 marks)

Feature 1: .....

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Feature 2: .....

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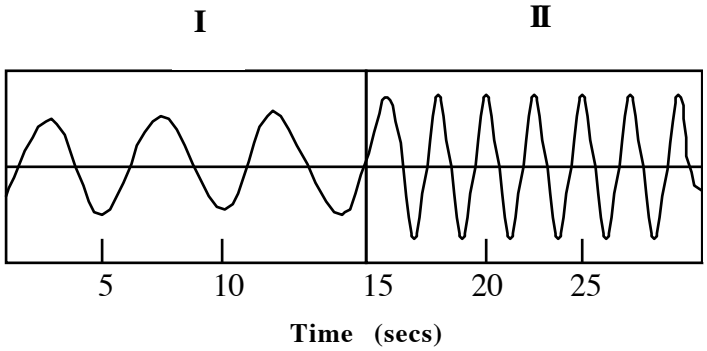
Question 6 continues opposite.

Question 6 (continued)

(b) The graph below shows changes to the tidal volume of a person's lungs under two different conditions.



(i) What is the **most important** stimulus which leads to the changes shown in section II above? (1 mark)

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(ii) Section I in the graph shows the changes to the tidal volume during normal breathing. Describe the changes in the physical mechanisms of inspiration and expiration needed to achieve the changes shown in section II. (3 marks)

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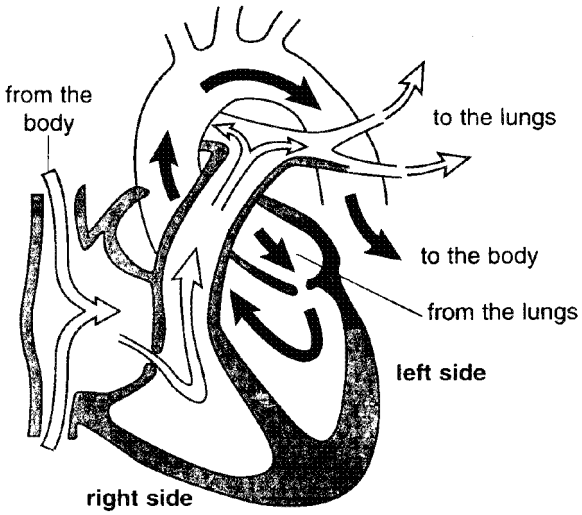
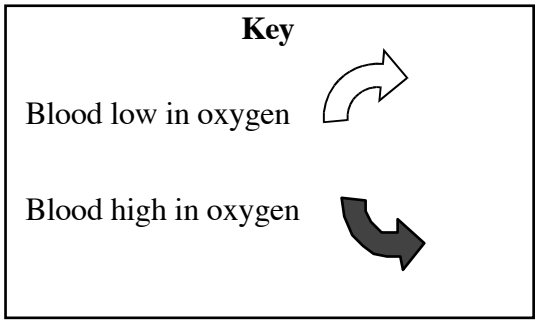
Question 6 continues over the page.

Question 6 (continued)

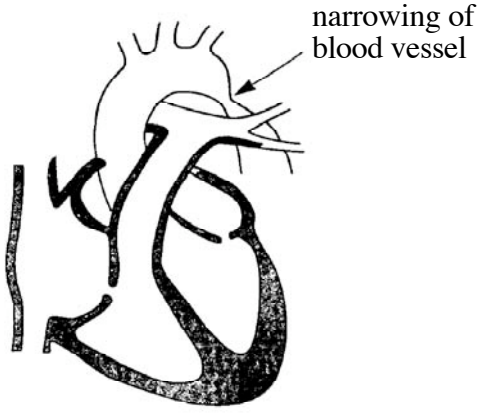
(c) The first diagram below shows the blood flow through a normal human heart.



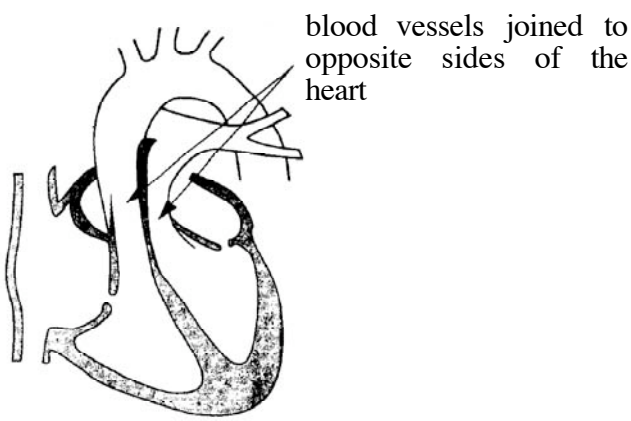


Two heart defects are illustrated below:

A



B



Question 6 continues opposite.

Question 6 (continued)

Outline the effect that each defect has on the efficiency of blood circulation and on the body's functioning. (6 marks)

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B: .....

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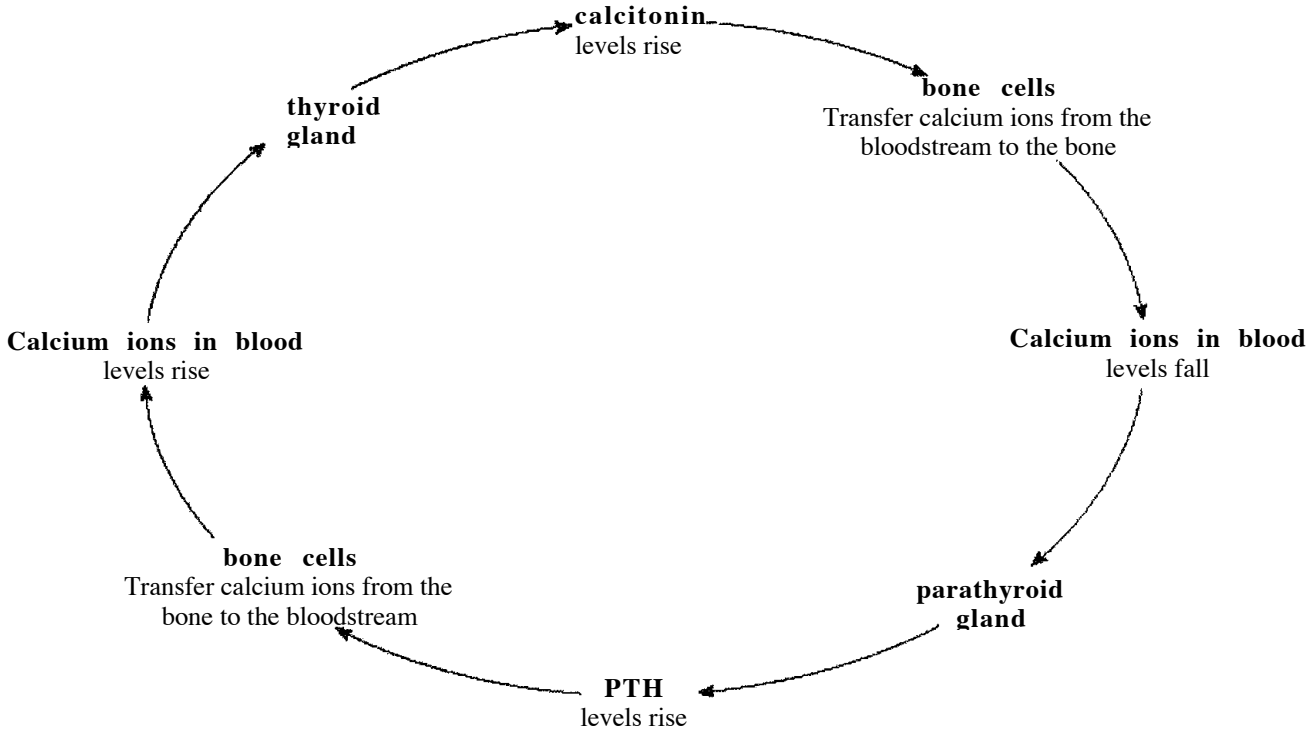
Total Question 6: /14

Question 7

Refer to the following diagram, which shows the mechanisms responsible for regulating the level of calcium ions in the blood of human beings. Calcitonin and PTH are both hormones.



Use the diagram above to outline the key elements/features of the feedback model for the homeostatic control of blood calcium levels. (5 marks)

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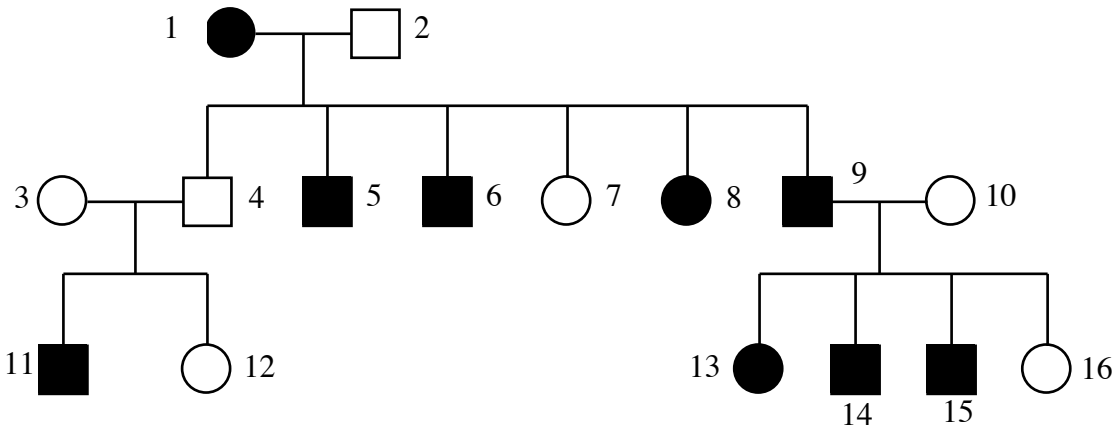
Total Question 7: /5

Question 8

(a) The following diagram shows the occurrence of a particular genetic trait over three generations.



Is the shaded trait:

(i) Dominant or recessive? Justify your answer using evidence from specific crosses in the family tree. (2 marks)

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(ii) Sex-linked (on the X chromosome) or not sex-linked (autosomal). Justify your answer using evidence from specific crosses in the family tree. (2 marks)

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Question 8 continues over the page.

Question 8 (continued)

(b) The following question deals with two gene pairs controlling mice coat colour that are inherited independently. In mice, black coat (B) is dominant to brown coat (b) and an unspotted coat (T) is dominant to white spotted coat (t). A number of black mice with white spots were crossed with brown unspotted mice and all the (F1) offspring had black unspotted coats. If one of these F1 mice with black unspotted coats was crossed with a brown coated mouse which was heterozygous unspotted, what is the chance of getting a brown mouse with white spots? Show all working. (5 marks)

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Total Question 8: /9

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Tasmanian Secondary Assessment Board

BIOLOGY

Senior Secondary 5C

Subject Code: BY826

External Assessment

2003

Section C

Time: 35 minutes

On the basis of your performance in this examination, the examiners will provide a result 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: 10
Questions: 4

CANDIDATE INSTRUCTIONS

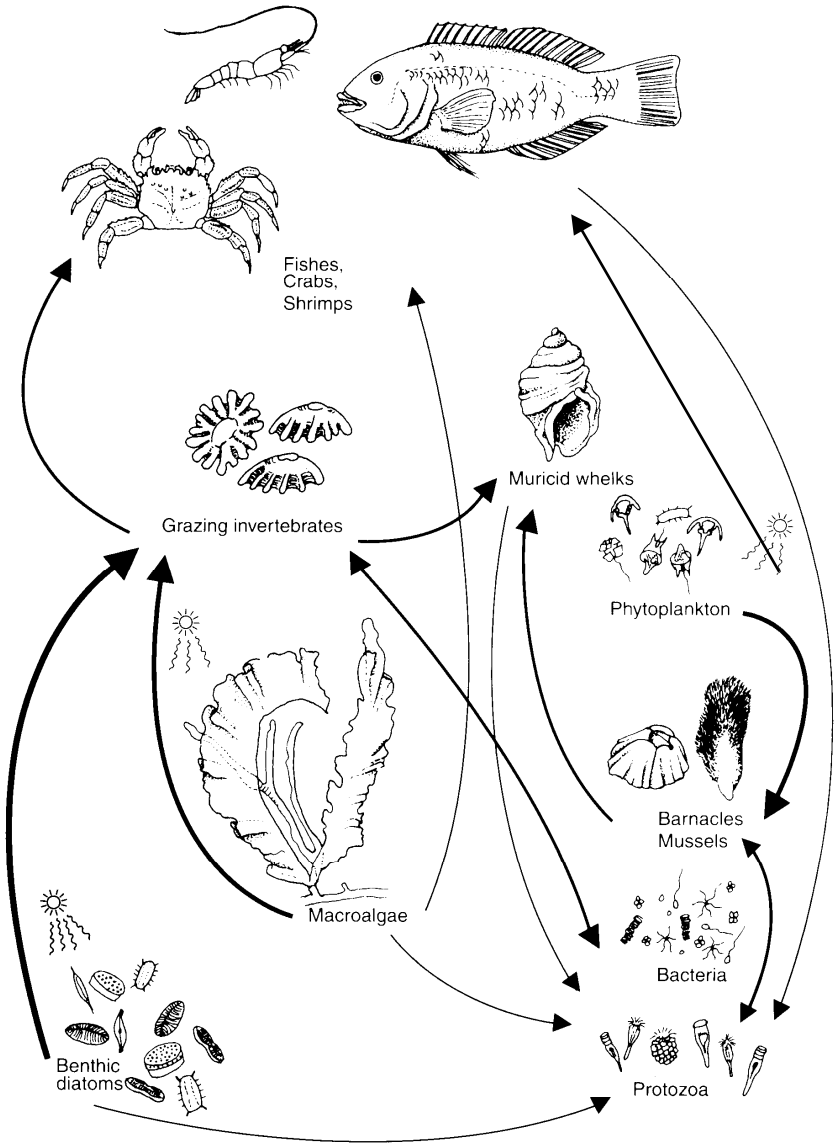
Candidates **MUST** ensure that they have addressed **ALL** of the externally assessed criteria on this examination paper.

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 9

The diagram below is a simplified food web showing some of the major links around intertidal rocky shores. The width of arrows reflects the relative importance of each link. Use the information from the food web diagram to answer the questions opposite.



(Source: Graham J. Edgar. *Australian Marine Habitants in Temperate Waters*. 2001)

Question 9 continues opposite.

Question 9 (continued)

(a) Name the **three** types of producers shown in the food web. (1 mark)

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(b) Indicate which type of producer passes on the most energy. (1 mark)

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(c) Explain the **two** relationships that occur which have two-way arrows. (2 marks)

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(d) If a disease greatly reduces the numbers of grazing invertebrates, outline **three** important consequences of this on the rest of the food web. (3 marks)

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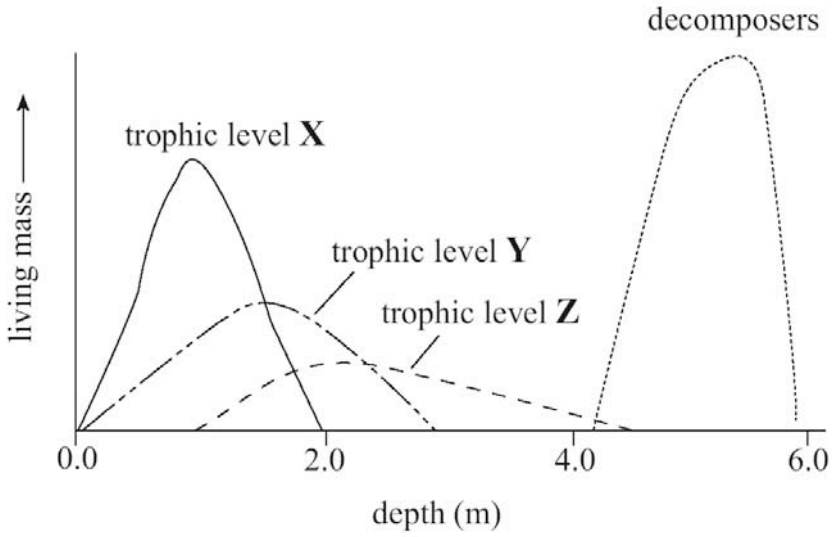
Total Question 9: /7

Question 10

(a) The following graph shows the distribution of living organisms in four trophic levels of a lake community at various depths.



(i) Using the graph, provide **two** reasons which indicate that organisms in trophic level **X** are producers. (2 marks)

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(ii) Explain why decomposers are essential to the lake community. (2 marks)

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(iii) Give **one** reason why the living mass of decomposers is greater than that of any other single trophic level in the lake. (1 mark)

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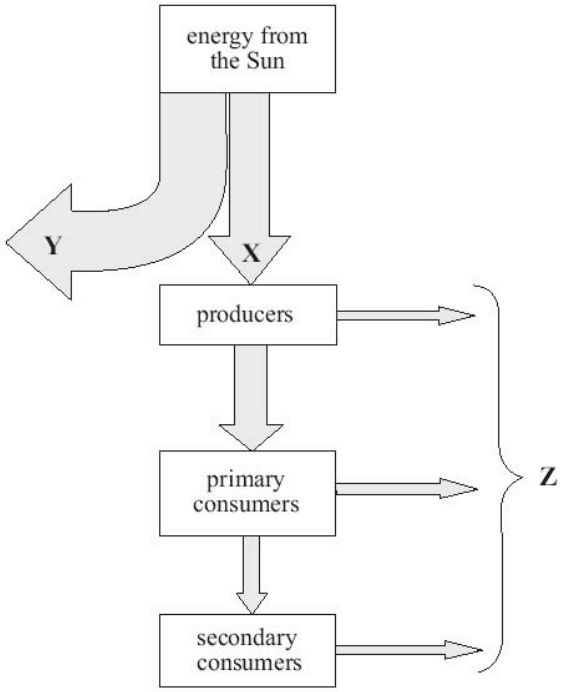
Question 10 continues opposite.

Question 10 (continued)

(b) Refer to the following diagram, which shows the flow of energy through a community. X represents the energy captured by the community, Y represents the energy not captured by the community, and Z represents the energy lost from the community.



Which one of the following statements about the flow of energy through a community is correct. Explain why it is correct. (3 marks)

A. The decomposers absorb the energy at **Y**.

B. All of the energy lost at **Z** is in the form of urine and faeces.

C. More energy would enter the community at **X** if more oxygen were available.

D. Some of the energy that enters the community at **X** is captured in chemical bonds.

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Total Question 10: /8

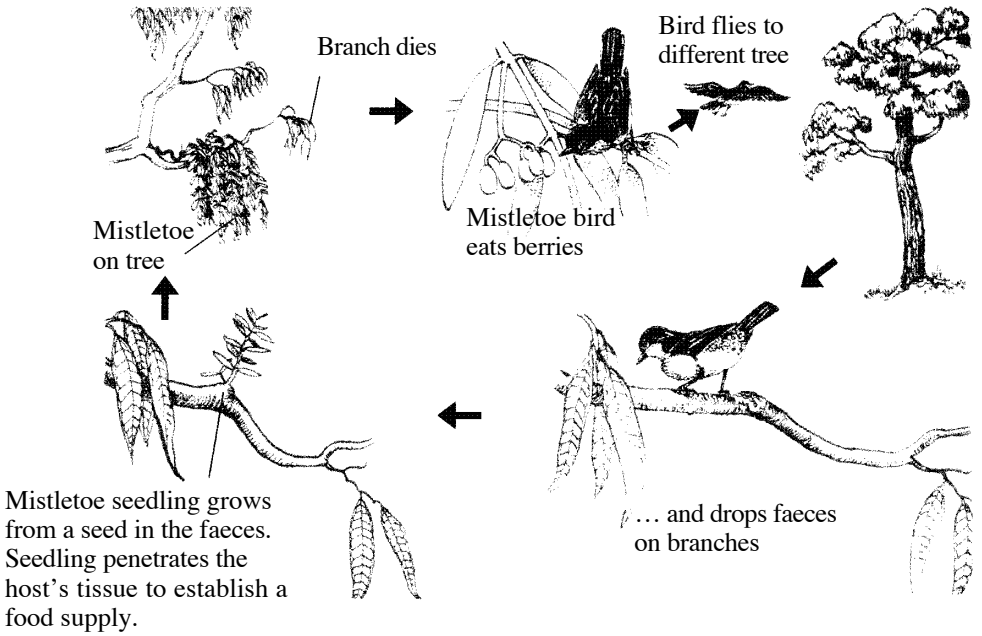
Question 11

Living organisms often share a close relationship.

Three types of relationships are described in the table below.

Name of relationship	Description
Parasitism	one organism benefits from the relationship and the other is adversely affected
Commensalism	one organism benefits from the relationship and the other is not particularly affected
Mutualism	both organisms benefit from the relationship

The diagram below shows the lifecycle of a mistletoe plant. It shows that there is a relationship between the tree and the mistletoe, between the mistletoe and the bird and between the bird and the tree.



Using the descriptions given above, name and justify the type of relationship between:

(a) Bird and mistletoe. **Relationship:** ..... (2 marks)

Justification: .....

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(b) Mistletoe and tree. **Relationship:** ..... (2 marks)

Justification: .....

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Total Question 11: /4

Question 12

(a) The Australian sheep blowfly is a serious pest in the wool and meat industries. In 1955 the insecticide dieldrin was introduced to Australia. Sheep were bathed in a solution of dieldrin to control sheep blowflies. When it was first used, dieldrin gave sheep twelve weeks' protection against blowflies. By 1958 dieldrin gave less than two weeks' protection.

Explain the evolution of dieldrin-resistant blowflies, and in particular the role played by dieldrin in it. (5 marks)

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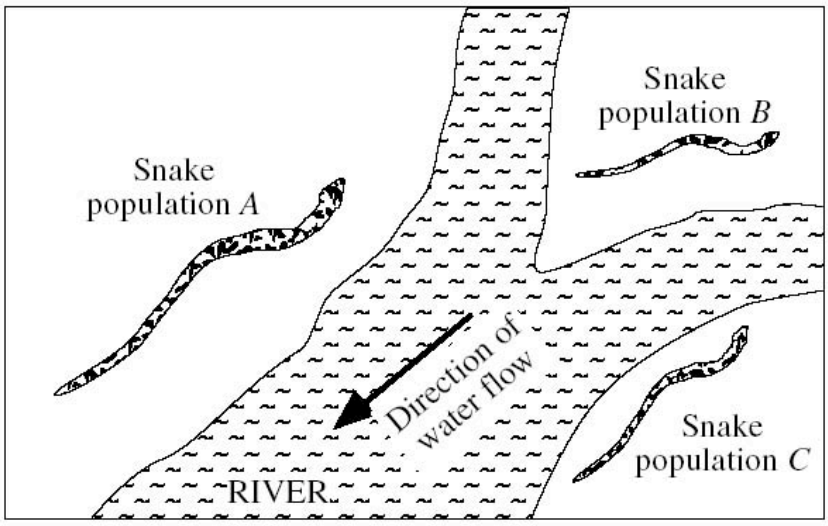
Question 12 continues over the page.

Question 12 (continued)

(b) The diagram shows the distribution of three populations of snakes.



The table below summarises information about these three populations of snakes.

Population	Predominant body colour	Average length of adult	Observed to produce viable offspring with
A	Dark brown	2.0 m	A and B
B	Light brown	1.5 m	A, B and C
C	Red brown	1.0 m	B and C

(i) How many species of snake are there in the area shown in the diagram? Explain your answer. (2 marks)

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Question 12 continues opposite.

Question 12 (continued)

(ii) Explain how more species of snake could arise in the area. (6 marks)

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Total Question 12: /13

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Tasmanian Secondary Assessment Board

BIOLOGY

Senior Secondary 5C

Subject Code: BY826

External Assessment

2003

Section D

Time: 35 minutes

On the basis of your performance in this examination, the examiners will provide a result on the following criterion taken from the syllabus statement:

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

Pages: 7
Questions: 3

CANDIDATE INSTRUCTIONS

Candidates **MUST** ensure that they have addressed **ALL** of the externally assessed criteria on this examination paper.

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 13

(a) A gardener sows 100 seeds of a plant species in a single garden bed. While the plants are growing, the gardener notices that a group of 15 plants in one part of the garden bed is not growing as tall as the rest of the plants. There is no dwarf form of this plant species.

Suggest an hypothesis to account for this observation. (3 marks)

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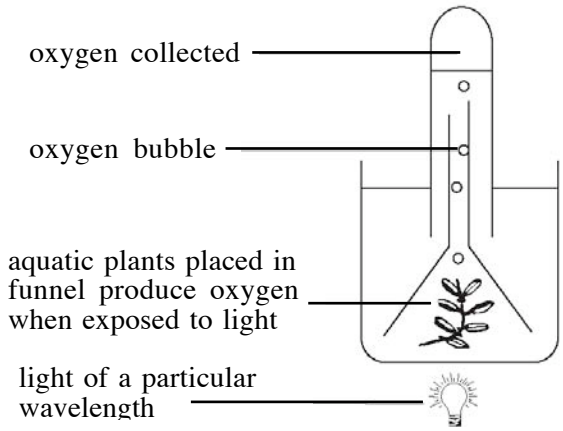
(b) The table below shows the results of an experiment in which identical aquatic plants were exposed to various wavelengths of light and the volume of oxygen collected after 5 minutes for each wave length was recorded. The diagram adjacent shows the apparatus used to collect the oxygen.

Wavelength of light (nm)	Average volume of oxygen collected (mm^3)
400	8.0
425	9.5
475	8.0
500	4.0
550	2.0
600	4.0
625	5.0
675	9.0
700	1.0



Question 13 continues opposite.

Question 13 (continued)

(i) State **one** hypothesis that is being tested in this experiment. (2 marks)

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(ii) Identify the independent variable in this experiment. (1 mark)

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(iii) State **two** factors that must be kept constant in this experiment. (2 marks)

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(iv) Does this experiment have a control group built in? If so explain *how it is*, or if not explain how you could build one in. (3 marks)

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(v) State **two** experimental errors that could occur during this investigation. (2 marks)

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Total Question 13: /13

Question 14

People living in country areas often have problems with rabbits digging up newly planted tree seedlings. It has been suggested that this practice has a selective advantage for the rabbits because it helps reduce the number of trees that would otherwise reduce the amount of grass cover, etc that the rabbits feed on. Alternatively it is suggested that this practice has nothing to do with the seedlings as it is simply related to their natural burrowing behaviour, and they are just taking advantage of where the soil has already been broken up.

(a) Devise an experiment to test the later hypothesis that

'Rabbits will burrow more in areas where the soil is already broken.'

In your experiment make sure that you explain how you would collect and present your results as well as any follow up investigation that would be needed. (10 marks)

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Question 14 continues opposite.

Question 14 (continued)

(b) What results would you expect to find that would support or negate your hypothesis? (2 marks)

Support Hypothesis:

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Negate Hypothesis:

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Total Question 14: /12

Question 15

(a) Four students were asked to design a first-hand investigation to determine the effect of pH on the activity of an enzyme.

Their designs for this investigation are indicated in the tables below.

Design A

Tube Number	Contents	pH	Temp. (˚C)
1	E	3	20
2	E	7	20
3	E	12	20
4	S	3	20
5	S	7	20
6	S	12	20

Design B

Tube Number	Contents	pH	Temp. (˚C)
1	E + S	3	20
2	E + S	7	20
3	E + S	12	20
4	S	3	20
5	S	7	20
6	S	12	20

Design C

Tube Number	Contents	pH	Temp. (˚C)
1	E + S	3	10
2	E + S	7	20
3	E + S	12	30
4	S	3	10
5	S	7	20
6	S	12	30

Design D

Tube Number	Contents	pH	Temp. (˚C)
1	E + S	7	10
2	E + S	7	20
3	E + S	7	30
4	S	7	10
5	S	7	20
6	S	7	30

Key: E = enzyme S = substrate

Which investigation is the most appropriate? Explain your choice and also state why the others are less suitable. (5 marks)

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Question 15 continues opposite.

Question 15 (continued)

(b) Research suggests that plant sterols added to food can reduce the absorption of cholesterol from the intestine into the blood. A researcher was asked to design an experiment to test the effectiveness of adding plant sterols to margarine as a way of reducing blood cholesterol.

Identify **three** factors and concerns that need to be considered in designing this investigation.
(4 marks)

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Total Question 15: /9

PLACE LABEL HERE

Tasmanian Secondary Assessment Board

BIOLOGY

Senior Secondary 5C

Subject Code: BY826

External Assessment

2003

Section E

Time: 35 minutes

On the basis of your performance in this examination, the examiners will provide a result 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: 10
Questions: 5

CANDIDATE INSTRUCTIONS

Candidates **MUST** ensure that they have addressed **ALL** of the externally assessed criteria on this examination paper.

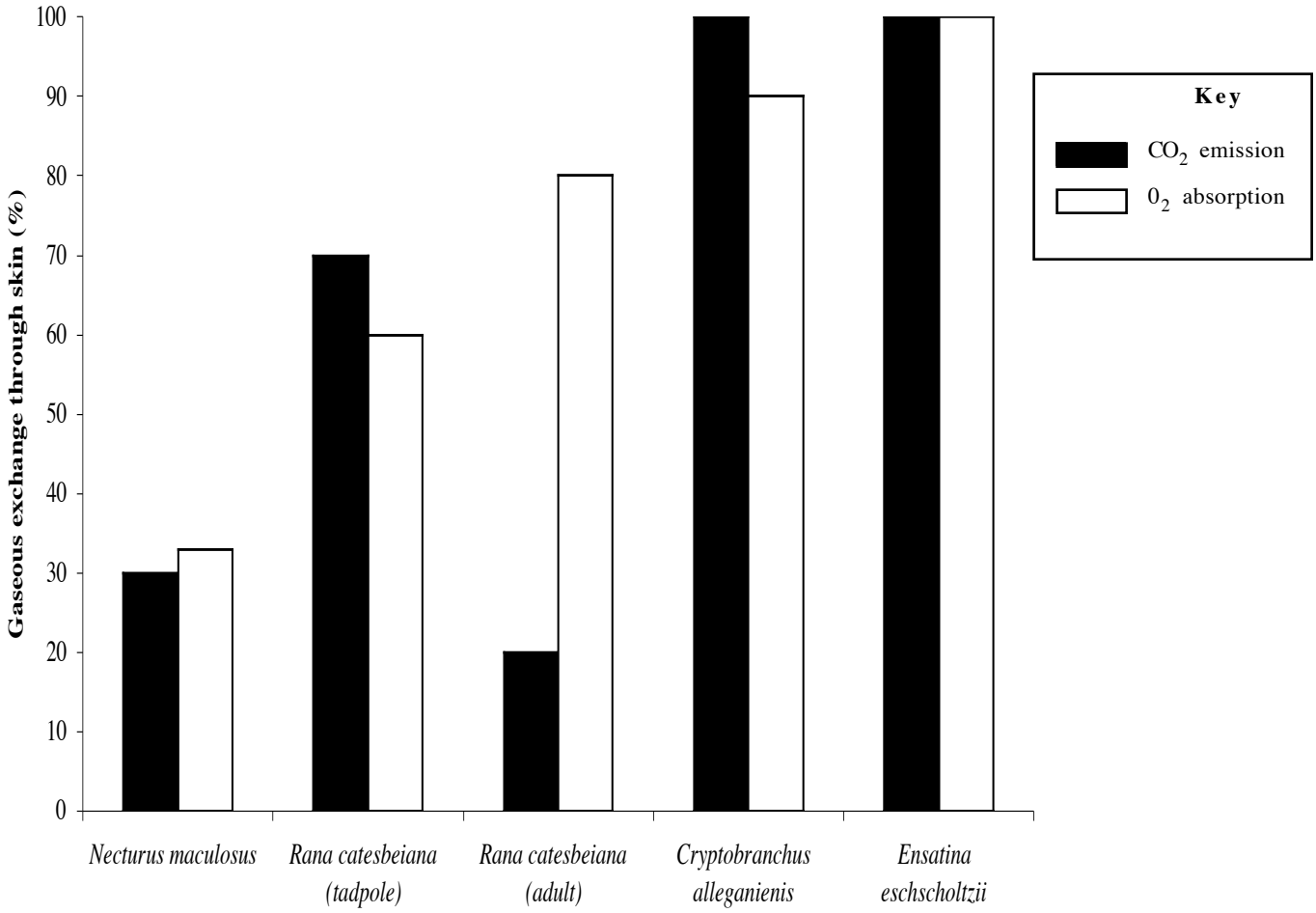
Answer **ALL** questions. Answers must be written in the spaces provided on the examination paper.

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

Tadpoles exchange gases through their gills. In adult frogs the gills are replaced by lungs. In both, gaseous exchange also takes place though the skin.

The graph below, show the proportion of gaseous exchange through the skin of several frog species.



(a) Which species absorbs the smallest percentage of oxygen through the skin and what is this percentage? (1 mark)

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Question 16 continues opposite.

Question 16 (continued)

(b) Using the data, describe the changes that take place in the exchange of gases as *Rana catesbeiana* develops from a tadpole to an adult. (3 marks)

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(c) Compare *Necturus maculosus* and *Ensatina eschscholtzii* in terms of their dependence on gas exchange through the skin. (2 marks)

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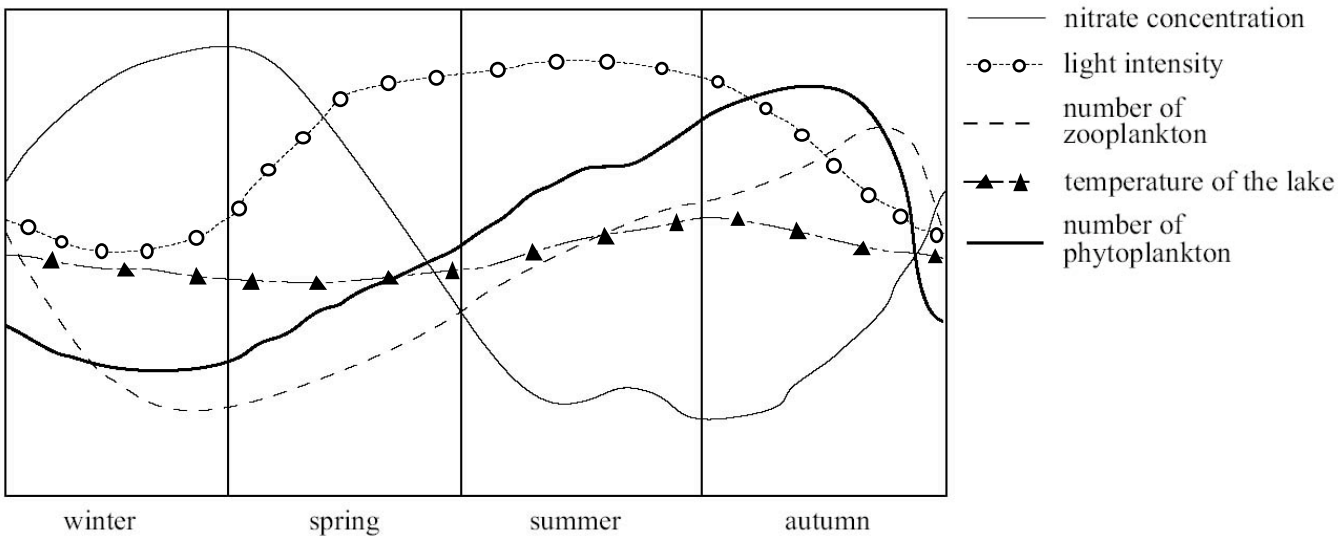
Total Question 16: /6

Question 17

The graph below shows seasonal changes in the following environmental factors in a lake ecosystem: nitrate concentration, light intensity, number of zooplankton, temperature of the lake, and number of phytoplankton.



Zooplankton are microscopic heterotrophs found in the lake. Phytoplankton are microscopic autotrophs found in the lake.

(a) Discuss the relationships that exist between light intensity, zooplankton and phytoplankton as indicated by the graphs over the year. (4 marks)

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(b) Give an explanation to account for the changes in nitrate concentration shown on the graph. (2 marks)

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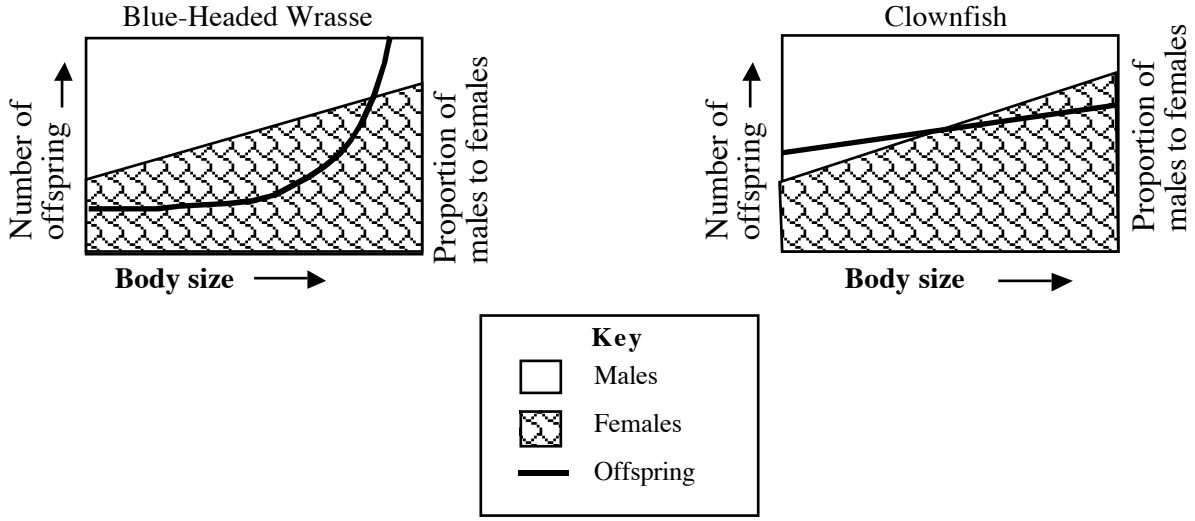
Total Question 17: /6

Question 18

Many species of fish change sex during their lifetime. The graphs below show the number of offspring and proportion of males and females compared to body size for two species of fish, the Blue-headed Wrasse and the Clownfish.



(a) Describe the relationship between body size and numbers of offspring for both species. (3 marks)

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(b) Is it reasonable to conclude from the graphs alone that the fish of both species will **all** change from male to female as they grow in body size. Justify your answer. (3 marks)

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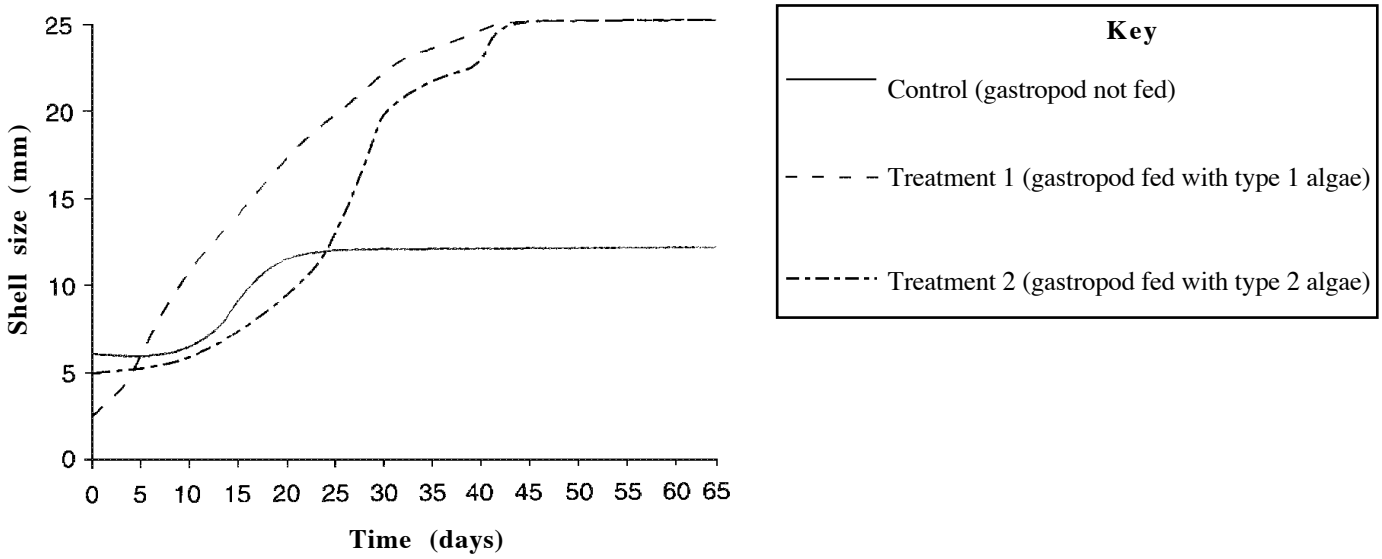
Total Question 18: /6

Question 19

Gastropods are marine snails that eat algae. A student wanted to know whether the type of algae eaten affected the growth of a certain species of gastropod.

She experimented using three individual gastropods of the same species. She fed one of the gastropods with type 1 algae, another with type 2 algae, and she did not feed the third gastropod. She recorded the size of the shells regularly during the period of the experiment.

The graph shows the growth in shell size for each of the gastropods over the duration of the experiment.



(a) From the graph what were the gastropod shell sizes for each of the treatments on the 15th day? (3 marks)

(i) Control.

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(ii) Treatment 1 with type 1 algae.

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(iii) Treatment 2 with type 2 algae.

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Question 19 continues opposite.

Question 19 (continued)

(b) How would the conclusions of the experiment be different if the experiment was stopped at day 20 rather than at day 65? (2 marks)

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(c) The student wanted to ensure that she gained results that would allow her to draw the most reliable conclusion about the effect of algae on the growth of this species of gastropod. What would you recommend she did as a follow up experiment and why? (3 marks)

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Total Question 19: /8

Question 20

Investigators gathered data on a group of 100 smokers for a period of 10 years. During this time 12 people in the group developed lung cancer, two died in traffic accidents, and three died of heart attacks. The investigators used these data to state that smoking caused lung cancer.

(a) Discuss the strengths and weakness of this experiment, including suggestions as to how this investigation could be improved. (5 marks)

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(b) How valid is the investigators conclusion. Explain. (2 marks)

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Total Question 20: /7

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