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STUDENT NUMBER

Letter

Figures

Words

VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY



**Victorian Certificate of Education
2001**

BIOLOGY

Written examination 1

Wednesday 13 June 2001

Reading time: 9.00 am to 9.15 am (15 minutes)

Writing time: 9.15 am to 10.45 am (1 hour 30 minutes)

QUESTION AND ANSWER BOOK

Structure of book

<i>Section</i>	<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>
1	25	25	25
2	9	9	50
			Total 75

Materials

- Question and answer book of 21 pages.
- Answer sheet for multiple-choice questions.
- At least one pen, pencil and an eraser.

Instructions

- Write your **student number** in the space provided on this book.
- Check that your **name** and **student number** as printed on your answer sheet for multiple-choice questions are correct and sign your name in the space provided to verify this.
- All written responses should be in English.

At the end of the examination

- Place the answer sheet for multiple-choice questions inside the front cover of this book.

SECTION 1**Specific instructions for Section 1**

Section 1 consists of 25 multiple-choice questions, each worth one mark. You should attempt all questions. You should spend approximately 30 minutes answering this section of the paper.

Choose the response that is **correct** or **best answers the question**, and shade the square on the multiple-choice answer sheet according to the instructions on that sheet.

A correct answer is worth 1 mark, an incorrect answer is worth no marks. No mark will be given if more than one answer is shown for any question. Marks will **not** be deducted for incorrect answers. You should attempt every question.

Question 1

Viruses

- A. have lipid coats.
- B. reproduce independently by mitosis.
- C. have a core of either DNA or RNA.
- D. respire aerobically.

Question 2

Bovine spongiform encephalopathy (BSE) is also called mad cow disease. It has been detected in many cattle in Europe, particularly England, since the mid 1980s. In humans, a similar disease in which nerve cells are damaged is Creutzfeldt-Jakob disease.

These diseases are caused by

- A. fungi.
- B. bacteria.
- C. viruses.
- D. prions.

Question 3

Ribosomes

- A. are found only in animal cells.
- B. are the site of polypeptide synthesis.
- C. are the site where proteins are modified and packaged.
- D. are the site of rapid ATP synthesis.

Question 4

Large molecules move out of a cell by

- A. exocytosis.
- B. phagocytosis.
- C. plasmolysis.
- D. pinocytosis.

Question 5

If a plant cell is placed in a drop of concentrated sucrose solution on a slide and viewed under a microscope, you would most likely observe

- A. the shrinkage of the cytoplasm.
- B. destruction of the membrane around the vacuole.
- C. the cell swelling.
- D. the rupturing of the cell wall.

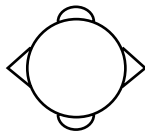
Question 6

Facilitated diffusion and active transport

- A. both require ATP.
- B. both carry solutes in only one direction.
- C. both depend on the solubility of the compound in lipid.
- D. both require the use of proteins as carriers.

Question 7

A bacterium with two different proteins on its surface can be represented as follows.



Antibodies produced against this bacterium include

- A. A Y-shaped antibody with two arms that have a concave, hook-like shape at their tips. The stem is a simple vertical line.
- B. A Y-shaped antibody with two arms that have a convex, rounded shape at their tips. The stem is a simple vertical line.
- C. A Y-shaped antibody with two arms that have a concave, hook-like shape at their tips, similar to option A. The stem is a simple vertical line.
- D. A Y-shaped antibody with two arms that have a convex, rounded shape at their tips, similar to option B. The stem is a simple vertical line.

Question 8

Specific immunity in a person includes

- A. ingestion of bacteria by phagocytes.
- B. involvement of helper T cells and B cells.
- C. development of inflammation around a cut.
- D. production of lysozymes in tears.

Question 9

Cellular respiration is best described as

- A. intake of carbon dioxide and output of oxygen by cells.
- B. excretion of waste products.
- C. inhalation of oxygen and exhalation of carbon dioxide.
- D. a series of metabolic reactions during which ATP is produced.

Question 10

Bergmann's rule states that the average body size of a particular animal species is larger in populations inhabiting colder climates than the average body size of populations of the same species that inhabit warmer climates.

This relationship between body size and climate can be explained because

- A. larger animals tend to lose body heat more slowly than smaller animals.
- B. larger animals have larger surface area to volume ratios than smaller animals.
- C. larger animals have reduced insulation from the cold compared with smaller animals.
- D. larger animals have higher metabolic rates than smaller animals.

Question 11

The axillary buds, also called 'eyes' of a potato, can be prevented from growing by the application of the hormone

- A. ethylene.
- B. gibberellin.
- C. cytokinin.
- D. auxin.

The following data is required for Questions 12 and 13.

The table shows the maximum concentration of urine produced by four different animals.

animal	maximum urine concentration (arbitrary units)
human	1.4
kangaroo rat	5.5
cat	3.1
pig	1.1

Question 12

The animal most likely to survive in a desert is a

- A. human.
- B. kangaroo rat.
- C. cat.
- D. pig.

Question 13

The animal most likely to have the longest Loop of Henle in the kidney tubules is a

- A. human.
 - B. kangaroo rat.
 - C. cat.
 - D. pig.
-

Question 14

Core body temperature of a mammal increases as a result of

- A. shivering.
- B. sweating.
- C. vasodilation of blood vessels in the skin.
- D. a decrease in metabolic rate.

Question 15

One rotten apple in a barrel of apples results in rapid ripening of the other apples in the barrel.

The rapid ripening is caused by

- A. bacteria transferring from the rotten apple to the other apples.
- B. grubs transferring from the rotten apple to the other apples.
- C. the release of ethylene from the rotten apple.
- D. the lack of carbon dioxide in the barrel.

Question 16

When green cells of a plant are exposed to bright light

- A. the consumption of CO₂ in photosynthesis is equal to the production of CO₂ in respiration.
- B. photosynthesis and respiration both occur in chloroplasts.
- C. glucose is an input for both photosynthesis and respiration.
- D. oxygen is produced by photosynthesis and consumed by respiration.

Question 17

Passive immunity involves

- A. receiving antigens from a donor source.
- B. short-lasting protection against a disease.
- C. production of plasma cells.
- D. production of memory cells.

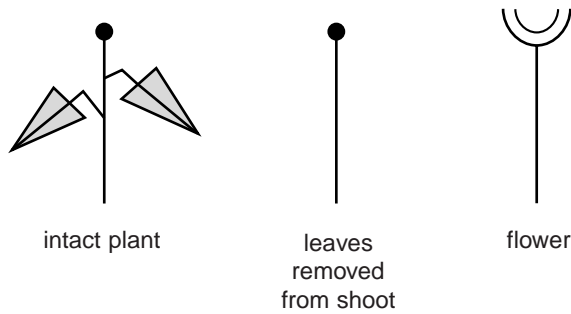
Question 18

Situations leading to active immunity include a

- A. baby receiving antibodies from the mother’s placenta prior to birth.
- B. baby receiving antibodies in the mother’s milk one month after birth.
- C. baby receiving a vaccination against diphtheria three months after birth.
- D. teenager receiving immunoglobulin after exposure to a person with hepatitis.

Question 19

Symbols used in this question include



It has been suggested that a hormone called florigen is important in flowering. An experiment was carried out to investigate how the flowering response of plants was affected by the length of day and night.

A large group of identical plants was halved. The plants in one half were left intact. The plants in the other half had their leaves removed. Each half was divided into three groups. Each group was placed in a different environmental condition with respect to day length. Any changes in the plants were noted. The setups and results are given in the following table.

	long days	short days	darkness
intact plants	 An intact plant with leaves and a flower bud is shown on the left. An arrow points to the right, with the word 'flowered' written below it. On the right, the same intact plant is shown, but the flower bud has opened into a crescent shape.	 An intact plant with leaves is shown. Below it, the text 'no change' is written.	 An intact plant with leaves is shown. Below it, the text 'no change' is written.
plants with leaves removed	 A shoot with no leaves is shown. Below it, the text 'no change' is written.	 A shoot with no leaves is shown. Below it, the text 'no change' is written.	 A shoot with no leaves is shown. Below it, the text 'no change' is written.

From this data you could reasonably conclude that

- A. day length has no influence on the production of florigen.
- B. florigen is produced in flower buds at a particular light period.
- C. the presence or absence of leaves has no impact on the production of florigen.
- D. leaves contain a light-receptive pigment involved in the production of florigen.

Question 20

When all the beta cells in the pancreas of a person become non-functional, it would be reasonable to expect

- A. increased secretion of glucagon.
- B. decreased secretion of insulin.
- C. increased uptake of glucose by cells.
- D. decrease in glycogen in the liver.

Question 21

Hormone controlled responses generally last longer than responses controlled by the nervous system because

- A. hormones travel long distances around the body and nerve cells are relatively small.
- B. different hormones have different actions whereas all nerve action is similar.
- C. hormones remain in the bloodstream for some time before being destroyed.
- D. hormones are generally proteins and nerve action is electrical.

Question 22

One of the new technological developments for the treatment of insuline-dependent diabetes is an electronic monitor that can be implanted in an affected person. The monitor gives a continuous read-out of the level of glucose in the blood.

An advantage of this technology is that a person with diabetes would know when it is necessary to

- A. have an insulin injection.
- B. do a blood test.
- C. have a glucagon injection.
- D. reduce water intake.

Question 23

Cells undergo cycles and changes. Cell death, also called apoptosis or programmed cell death, is an essential phase in many tissues.

Disruption to the normal process of apoptosis is indicated by the

- A. death of red blood cells after about four months in the bloodstream.
- B. death of cells between developing toes in an embryo.
- C. development of breast cancer.
- D. destruction of excess B cells after infection.

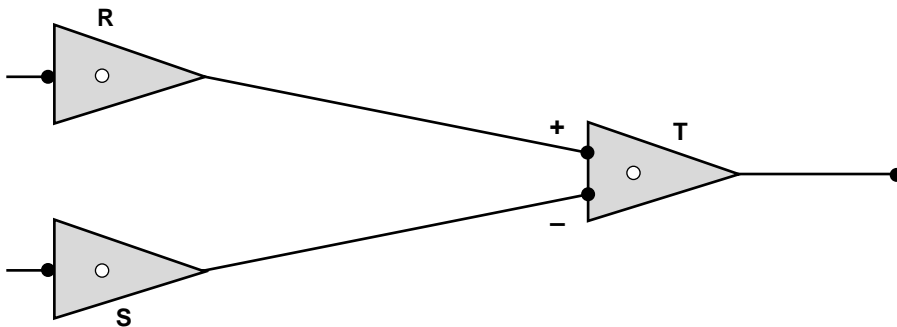
Question 24

The homeostatic control of water concentration in the blood as a person becomes dehydrated

- A. involves hormones only, without any participation of nervous tissue.
- B. is one in which the negative feedback response is a decrease in the concentration of blood solutes.
- C. involves an increase in blood pressure as production of ADH by the hypothalamus decreases.
- D. would result in the person producing large volumes of diluted urine.

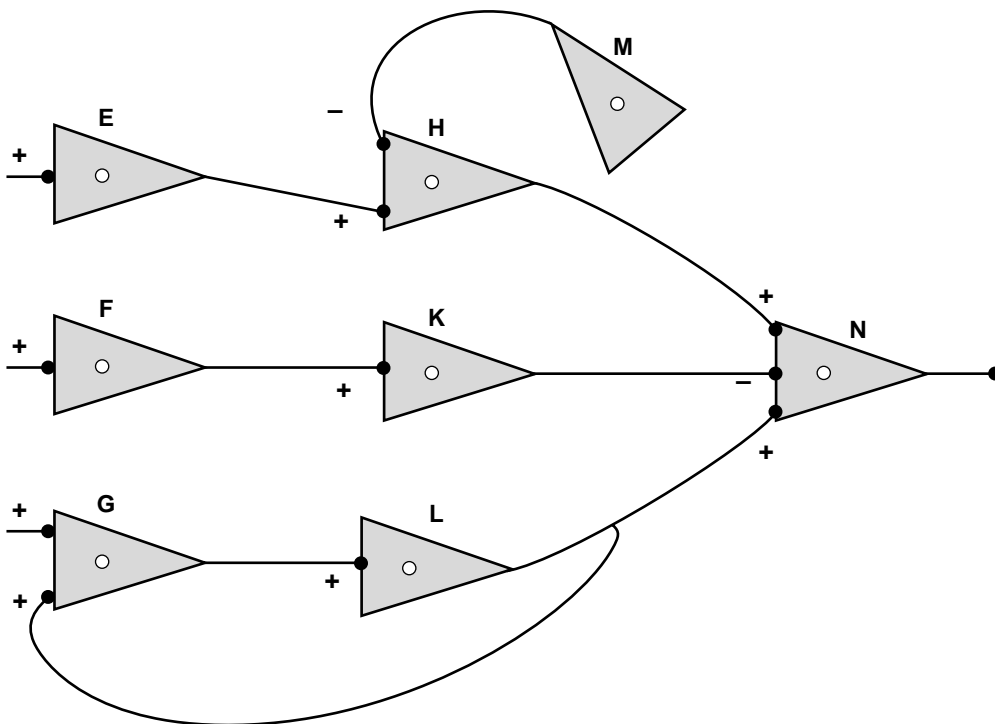
Question 25

Networks of neurons interact to cause a desired effect in the body. Some neurons activate processes, while others inhibit processes. For example, the autonomic nervous system both activates and inhibits organs such as the heart at appropriate times. The interaction in neuron networks can be represented diagrammatically as follows.



The diagram shows a network of three neurons. A plus sign (+) indicates that neuron R activates neuron T. A minus sign (-) indicates that neuron S inhibits the activation of neuron T. If R and S are stimulated at the same time, no change occurs to neuron T. A single activation signal is cancelled out by a single inhibition signal if they are given at the same time.

Consider the following network of neurons.



You would expect neuron N to transmit impulses if

- A. neurons E and F were stimulated at the same time.
- B. neurons F and G were stimulated at the same time.
- C. neuron L was stimulated.
- D. neuron M was stimulated.

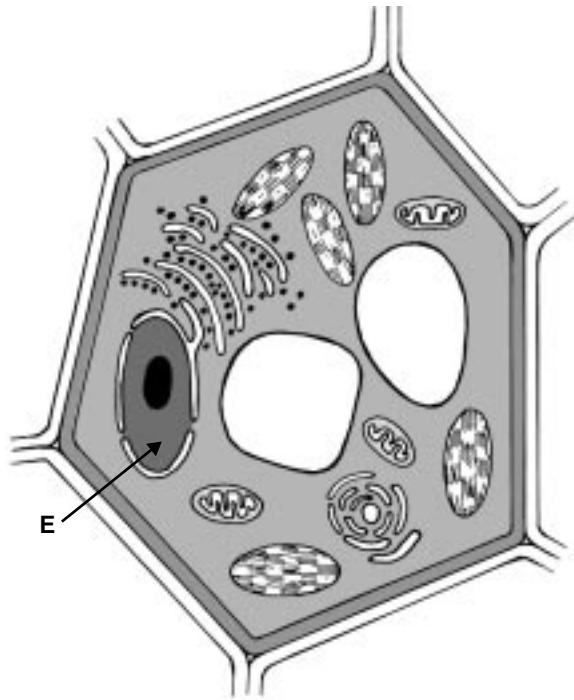
SECTION 2

Specific instructions for Section 2

Section 2 consists of nine questions. You should attempt all questions. The marks allotted to each question are shown at the end of the question. You should spend approximately 60 minutes answering this section of the paper. You must answer this section with pen or biro.

Question 1

The following diagram shows two cells, Cell R and Cell S.



Cell R

Width 10–100 μm



Cell S

Width 1 μm

- a. i. Which of the two cells, Cell R or Cell S, represents a prokaryotic cell?

- ii. Use information in the diagrams to give two reasons for your answer to part a.i.

Reason 1 _____

Reason 2 _____

1 + 2 = 3 marks

b. In Cell R, what is the function of the structure labelled E?

1 mark

c. Name two features in Cell R which indicate that it is from a plant.

Feature 1 _____

Feature 2 _____

2 marks

Total 6 marks

Question 2

Anclostoma caninum is a hookworm found in dogs. An adult worm is 12–15 mm long and uses 2–3 tooth-like structures to attach itself to the lining of the intestine of its host. An adult worm feeds on blood and uses compounds in the blood for cellular respiration. Any undigested blood appears in the faeces of the dog.

An adult female lays 15 000 oval-shaped eggs per day. These pass out in the faeces of the dog, and hatch into larvae. Another dog is infected by eating the larvae, or in some cases by the larvae burrowing into the skin. If larvae enter the skin of a young pup, they travel via the blood or lymph and enter the lungs. The larvae eventually reach the digestive tract when the pup coughs and swallows. Newborn pups can also be infected via the milk of the mother.

- a. Name a compound in the blood of the dog which the hookworm would metabolise in cellular respiration.

1 mark

- b. Describe the most likely method a veterinarian would use to diagnose whether a dog was infected with hookworm.

1 mark

- c. Name one feature of an adult *Anclostoma* and explain why it contributes to the hookworm being a successful parasite.

Feature _____

Explanation _____

1 mark

- d. Describe two methods that would be effective in controlling the spread of hookworm.

Method 1 _____

Method 2 _____

2 marks

Total 5 marks

Question 3

Arctic and Antarctic waters are near freezing. Despite these low temperatures seals and whales live successfully in these seas.

- a. Name one way in which heat could be lost from a seal’s body in Antarctic waters.

1 mark

Data was collected on some of the characteristics of seals and compared with equivalent data about humans. The data is given in the following table.

feature	human	seal
1. mass (kg)	80	80
2. average body temperature (°C)	37	37
3. O ₂ consumption/kg/hr	0.21	0.80
4. body fat (%)	25	58

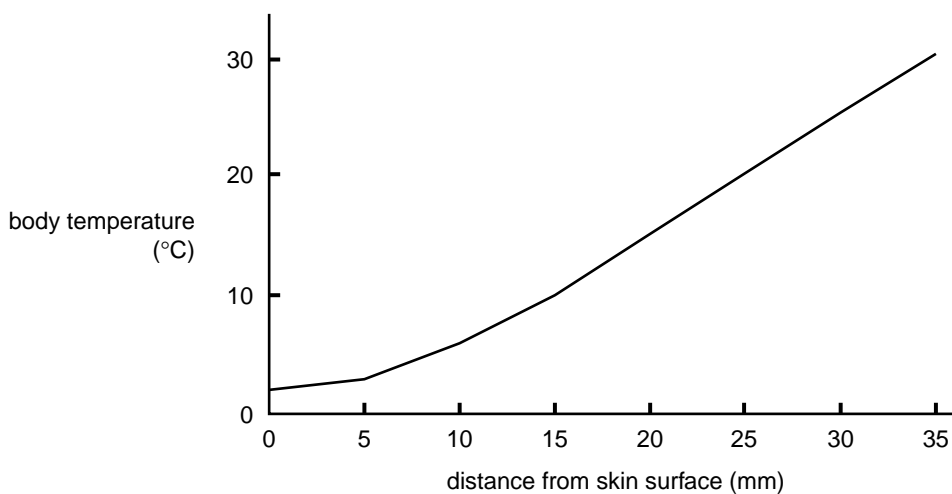
- b. From the data provided, explain how features 3 and 4 assist seals to live in Arctic and Antarctic waters.

Feature 3 _____

Feature 4 _____

2 marks

Temperature readings were taken at a number of locations at the surface and inside the body of a seal in water at 0°C. The data is summarised in the following graph.



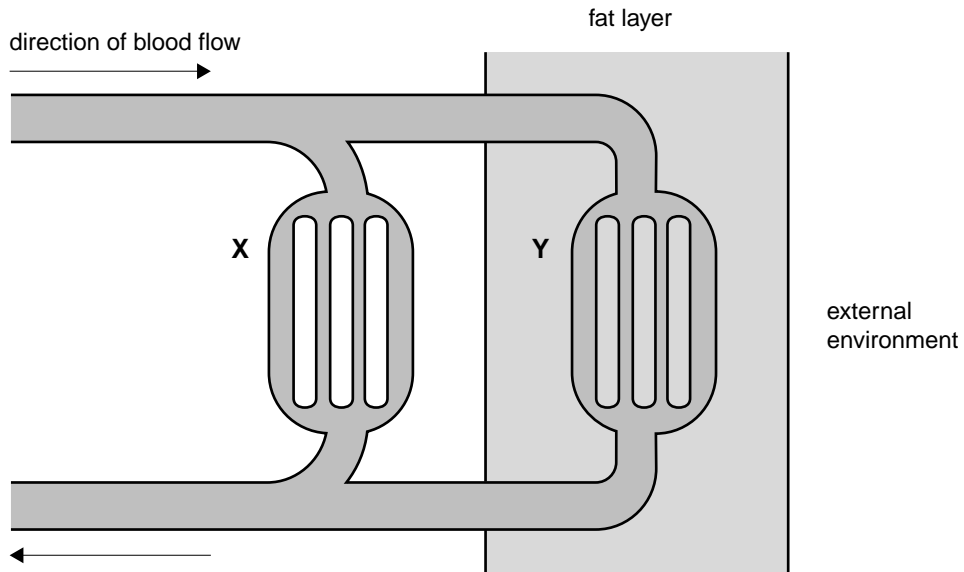
- c. What is the temperature of the skin surface of the seal in water at 0°C?

1 mark

d. What advantage does this skin temperature provide when the seal is in near freezing water?

1 mark

Seals spend part of their time lying in the sun. In this situation, a seal faces a potential problem of overheating. The following diagram shows the arrangement of blood vessels in the body of a seal. Note that there are alternative pathways and blood flow can bypass the fat layer.



e. Explain the conditions under which blood would mainly flow through

i. capillary network X

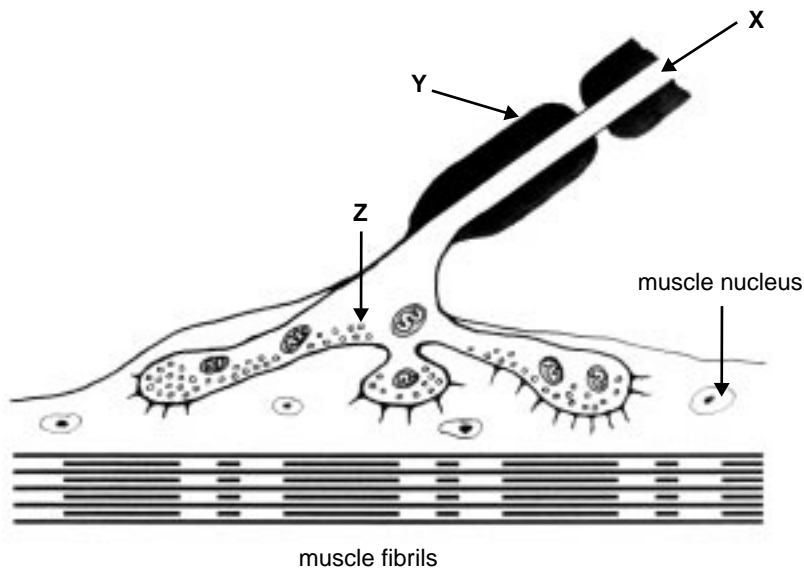
ii. capillary network Y

1 + 1 = 2 marks

Total 7 marks

Question 4

The diagram represents a nerve–muscle junction.



a. Name the following structures.

X _____

Y _____

Z _____

3 marks

b. What compound does structure Z contain?

1 mark

c. Explain the function of the compound in structure Z.

1 mark

d. Why do nerve cells contain a large number of mitochondria?

1 mark

Total 6 marks

Question 5

Phagocytes are one type of cell involved in immunity.

- a. Describe the role played by the phagocytes in the immune response.

2 marks

Rheumatoid arthritis is a disorder in which the body's immune system attacks its own tissue. A person with rheumatoid arthritis has tenderness and stiffness in the joints of the body. Left untreated, scar tissue develops in joints and joint movement is restricted. A group of scientists claim that they have found a way to 'cure' the disease. The cure involves initially killing all the B cells in a person's body.

- b. Where are B cells formed in the body?

1 mark

- c. What role do the B cells play in an immune response?

2 marks

- d. What potential problem may this person encounter when being treated for rheumatoid arthritis in this way?

1 mark

Total 6 marks

Question 6

Dutch Elm disease affects elm trees and is caused by infection with the fungus *Ophiostoma novo-ulmi*. The fungus is carried from tree to tree by a beetle. The spores of the fungus rapidly reproduce in the vascular system of the tree causing blockages. Initially the leaves show signs of wilting and eventually a tree dies.

- a. i.** Which particular vascular tissue of an elm tree is most likely affected by the fungus?

- ii.** Explain your answer to **a.i.**

1 + 2 = 3 marks

Researchers have developed a treatment for Dutch Elm disease made from proteins from a mild strain of the fungus. When introduced into the vascular system of the tree it triggers the release of compounds called mansonones which attack the mitochondria of the fungus.

- b.** Explain how mansonones kill the fungus by attacking its mitochondria.

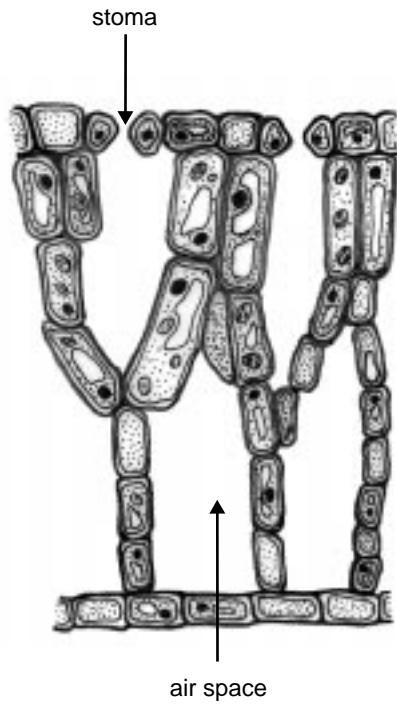
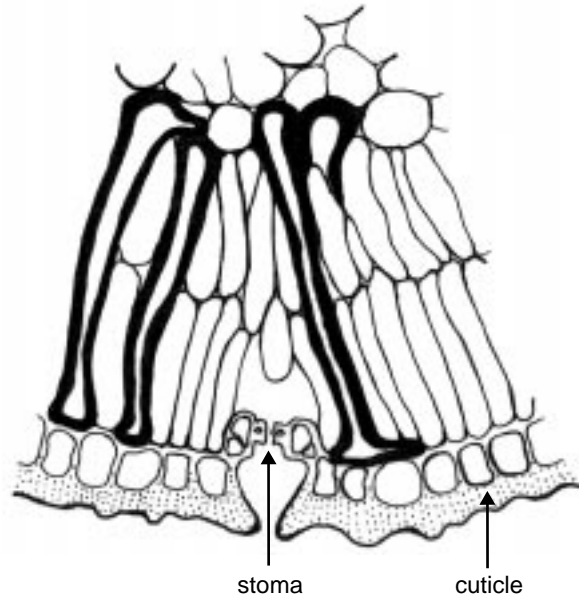
2 marks

Total 5 marks

Question 7

Some plants live in water. One such plant is a pondweed, *Potamogeton*, that grows on the surface of ponds. A transverse section of a portion of a pondweed leaf is shown below as Leaf R.

Other plants live in dry places. Leaf S is a transverse section of a portion of a *Hakea* leaf.

**Leaf R****Leaf S**

Note the location of stomata in each of the leaves.

- a. i. Explain the advantage of stomata being located on the upper rather than the lower surface of pondweed leaves (Leaf R).

- ii. What is the function of the large air spaces in pondweed leaves?

1 + 1 = 2 marks

- b. i.** Explain the advantage in stomata being located at the base of pits in *Hakea* leaves (Leaf S).

- ii.** What is the function of the very thick cuticle of *Hakea* leaves?

1 + 1 = 2 marks

Total 4 marks

Question 8

A major cause of stomach ulcers is infection with the bacterium *Helicobacter pylori*. The bacterium is able to prevent an effective immune response by the host. Scientists are working on a vaccine that will boost the natural immune response, be active against existing infection and prevent reinfection. A trial vaccine tested on infected mice contained two proteins found normally on the surface of *H. pylori* cells. The results of the trial are shown in the table below.

	number of mice clear of infection three weeks after vaccination	number of mice infected three weeks after vaccination
mice receiving trial vaccine	44	4
mice receiving saline (salt) solution	3	38

- a. Explain the purpose of injecting some mice with a saline solution.

1 mark

- b. In the above trial, what is the antigen?

1 mark

- c. Explain how the immune response in a vaccinated mouse would kill invading *H. pylori* cells.

2 marks

Total 4 marks

Question 9

Amylase is an enzyme that hydrolyses starch into sugars in humans. An experiment was performed to determine the effect of temperature on amylase activity. The data collected is given in the following table.

temperature (°C)	rate of production of sugar (g/min)
0	0.0
10	0.4
20	0.6
30	0.8
40	1.0
50	0.4
60	0.2
70	0.0

- a. Incubation at 0°C and 70°C gave the same rates of sugar production. If the tubes containing these samples were then incubated at 40°C, what results would you expect and why? Answer the question by completing the following table.

prior incubation temperature (°C)	new incubation temperature (°C)	expected result (g/min)	reason
0	40		
70	40		

4 marks

An observer commented that the optimal temperature may in fact be lower than that indicated by the data in the table.

- b. Design an experiment to test this comment.

1 mark

- c. Predict the results of your experiment and explain your prediction.

2 marks

Total 7 marks