



Victorian Certificate of Education 2002

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

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BIOLOGY

Written examination 1

Wednesday 12 June 2002

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

Section	Number of questions	Number of questions to be answered	Number of marks	Suggested times (minutes)
1	25	25	25	30
2	7	7	50	60
			Total 75	90

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners and rulers.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.
- No calculator is allowed in this examination.

Materials supplied

- Question and answer book of 21 pages.
- Answer sheet for multiple-choice questions.

Instructions

- Write your **student number** in the space provided above on this page.
- 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 must be in English.

At the end of the examination

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

Students are NOT permitted to bring mobile phones and/or any other electronic communication devices into the examination room.

SECTION 1**Instructions for Section 1**

Answer all questions in pencil on the answer sheet for multiple-choice questions. A correct answer scores 1, an incorrect answer scores 0. Marks will **not** be deducted for incorrect answers. No mark will be given if more than one answer is completed for any question.

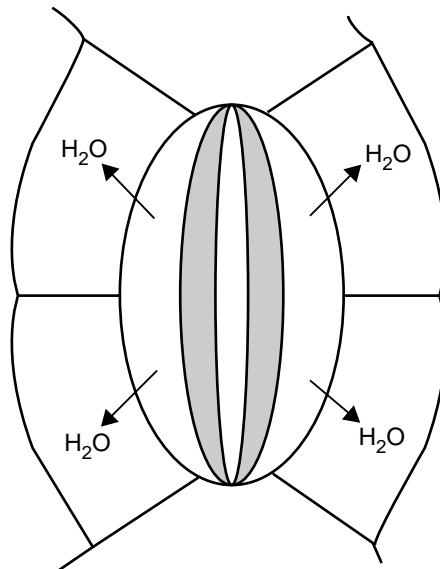
Question 1

A typical prokaryotic cell has

- A. nucleic acid.
- B. chloroplasts.
- C. a small nucleus.
- D. membrane bound organelles.

Question 2

The figure represents two guard cells, with surrounding epidermal cells, in the leaf of a plant. The plant is in bright light. The arrows on the diagram indicate the direction of the net movement of water from the guard cells into the epidermal cells.



In this situation

- A. the stomatal pore will decrease in diameter.
- B. photosynthesis will cease in the guard cells.
- C. carbon dioxide will accumulate in the substomatal chamber.
- D. potassium ions have moved from the epidermal cells to the guard cells.

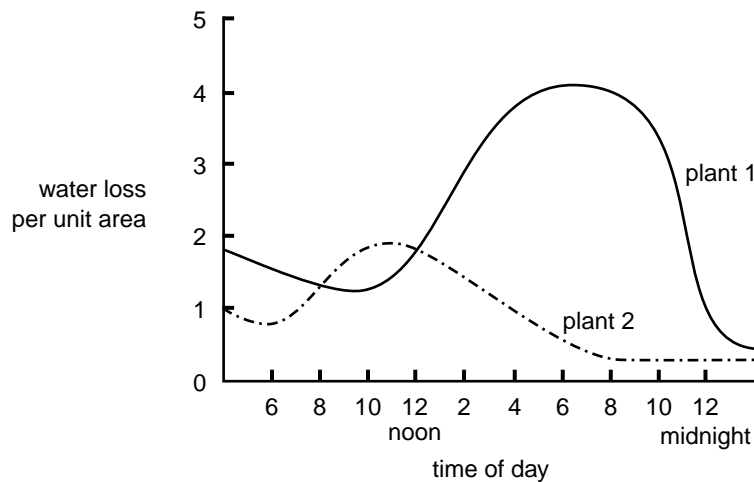
Question 3

A plant wilted but later recovered. During the time the leaves were wilted, the rate of photosynthesis decreased because

- A. enzymes in the leaf cells were denatured.
- B. chlorophyll in the wilting leaves was broken down.
- C. the amount of light reaching the plant was reduced.
- D. the amount of carbon dioxide entering the leaf decreased.

Question 4

The amount of water lost per unit area from the leaf surface of two different plants was measured. Both plants were grown in the same conditions. The results are shown in the graph.



From the information given you can conclude that

- A. plant 2 will be more likely to survive in a dry environment than plant 1.
- B. at 12.00 noon, plant 1 has a greater water loss per unit area than plant 2.
- C. at 10.00 am the average stomatal aperture will be greater in plant 1 than in plant 2.
- D. at 5.00 pm the rate of photosynthesis will be greater in plant 2 than in plant 1.

Question 5

Viruses that infect bacteria are called bacteriophages.

Each bacteriophage

- A. is completely engulfed by a bacterial cell.
- B. multiplies outside a bacterial cell.
- C. contains DNA and RNA.
- D. has a protein coat.

Question 6

Transmission of messages within the nervous system

- A. proceeds in both directions along a nerve axon.
- B. involves both electrical impulses and chemical messengers.
- C. is slower via a myelinated axon than a non-myelinated axon.
- D. relies on the active transport of a neurotransmitter across a synaptic gap.

Question 7

Homeostasis is the condition of a relatively stable internal environment.

The internal environment of a multicellular organism includes

- A. tissue fluid.
- B. digestive fluid.
- C. cytosol.
- D. urine.

Question 8

The plant hormone involved in the development of flower buds is

- A. ethylene.
- B. cytokinin.
- C. gibberellin.
- D. abscisic acid.

Question 9

An elephant maintains its body temperature within a narrow range.

In conditions of extreme heat, factors that contribute to increased heat loss from an elephant include

- A. folding the ears against the body.
- B. decreased blood flow to the ears.
- C. huddling with others.
- D. flapping the ears.

Question 10

Taenia saginata is the beef tapeworm which spends the adult part of its life cycle in the intestine of humans.

It is reasonable to suggest that features important to the parasitic lifestyle of the adult beef tapeworm include

- A. a digestive system with specialised regions for digesting different foods.
- B. production of both male and female gametes by each individual.
- C. a body shape with a high volume to surface area ratio.
- D. well-developed sensory organs.

Question 11

Transpiration in a well-watered potted plant would be expected to be highest when environmental conditions included

- A. still air and shade.
- B. moving air and shade.
- C. still air and bright sunlight.
- D. moving air and bright sunlight.

Question 12

Scrapie, a disease which causes severe brain damage in sheep, is caused by prions.

Prions are composed of

- A. carbohydrate.
- B. nucleic acid.
- C. protein.
- D. lipid.

Question 13

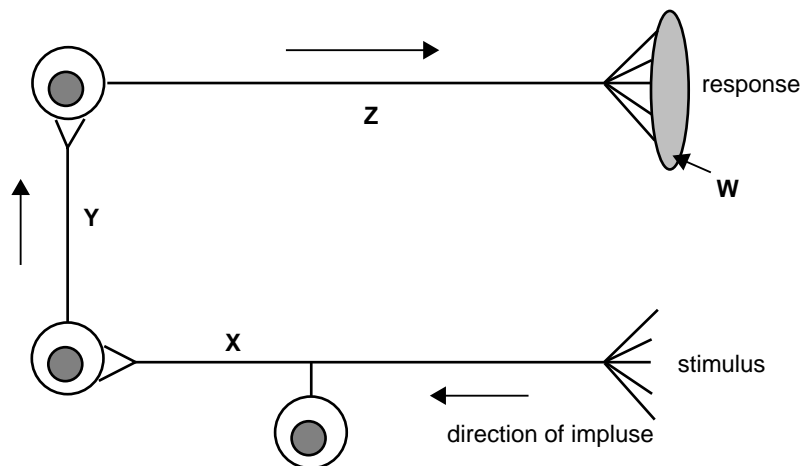
Many plants naturally contain bitter-tasting chemicals called cyanogenic glycosides. In animals, these chemicals interfere with the electron transport stage of cellular respiration.

The effect on animals that eat these plants is

- A. a decrease in ATP production.
- B. an increase in energy storage.
- C. a decrease in oxygen production.
- D. an increased level of aerobic respiration.

The following information is required for Questions 14 and 15.

An electrical impulse can be transmitted along three neurons as shown in the following diagram.

**Question 14**

The sensory neuron is represented by

- A. W
- B. Z
- C. Y
- D. X

Question 15

The effector neuron is represented by

- A. W
- B. Z
- C. Y
- D. X

Question 16

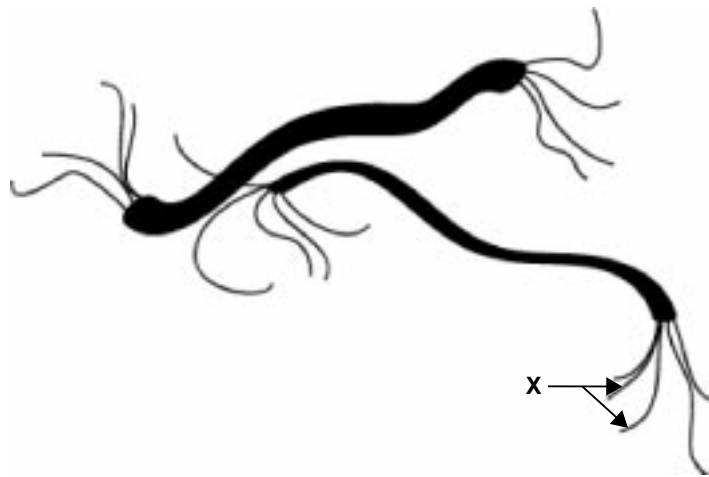
Illness in animals is often accompanied by fever, which is a rise in body temperature. Fever is caused by the resetting of the temperature control centre.

This control centre is located in the

- A. skin.
- B. hypothalamus.
- C. pituitary gland.
- D. thyroid gland.

The following information is required for Questions 17 and 18.

The following diagram shows cells of the bacterium *Spirillum volutans*.

**Question 17**

The structures **X** indicated by the arrows are called

- A. villi.
- B. axons.
- C. flagella.
- D. hair cells.

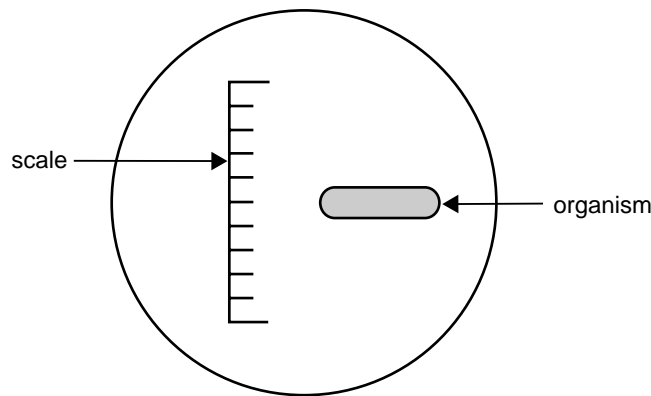
Question 18

The function of the structures indicated in the above diagram is

- A. excretion.
- B. locomotion.
- C. absorption of nutrients.
- D. defence from pathogens.

Question 19

The following diagram represents the high-power field of a light microscope fitted with a 10 x eyepiece and a 40 x objective lens. The field contains a scale and an organism.



Each scale division was calculated to be 20 micron.

The length of the organism is approximately

- A. 5 micron.
- B. 20 micron.
- C. 100 micron.
- D. 40 000 micron.

Question 20

A student examined four different, appropriately stained cells with a light microscope. These were
 nerve cell
 human skin cell
 photosynthesising cell and
 onion epidermal cell.

For each cell, it would be reasonable to expect the student to be able to see

- A. chromosomes.
- B. chloroplasts.
- C. vacuoles.
- D. a nucleus.

Question 21

Apoptosis of a cell is its

- A. replication.
- B. natural death.
- C. ability to photosynthesise.
- D. survival in different environments.

Question 22

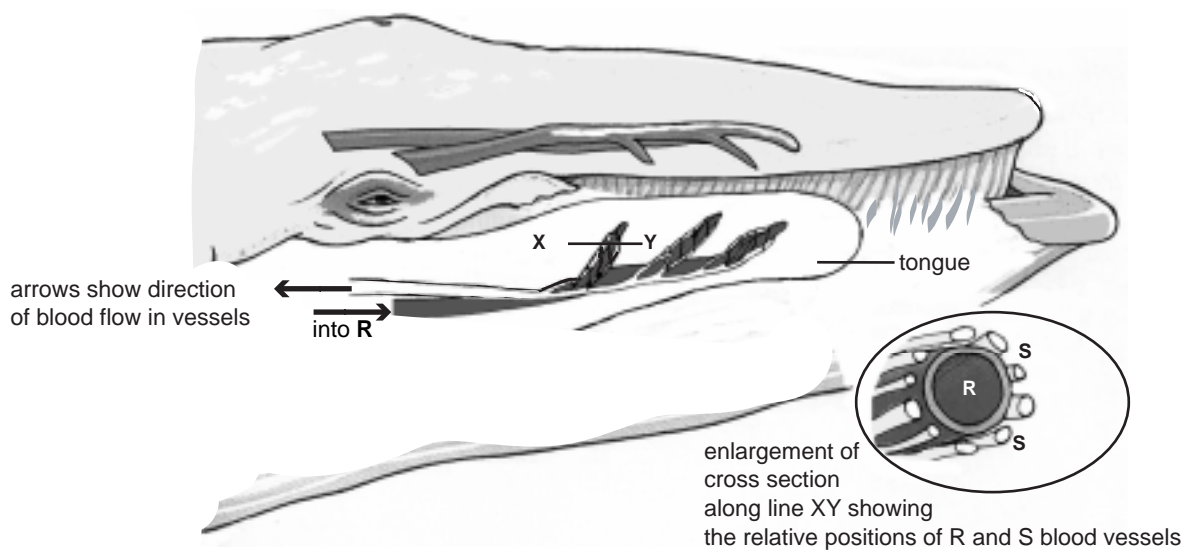
In humans, nonspecific immunity includes

- A. production of antibodies by plasma cells.
- B. different responses for different bacteria.
- C. destruction of bacteria by enzymes in saliva.
- D. presentation of material to a T cell by a phagocyte.

Question 23

Baleen whales feed by taking large quantities of food-laden water into their mouths. They force the water through baleen plates that act as a filter. The food stays in the mouth. Large volumes of cold water are continually moving in and out of a baleen whale's mouth as it feeds.

The blood circulatory system that serves the tongue and the mouth lining of baleen whales is outlined in the following diagram.

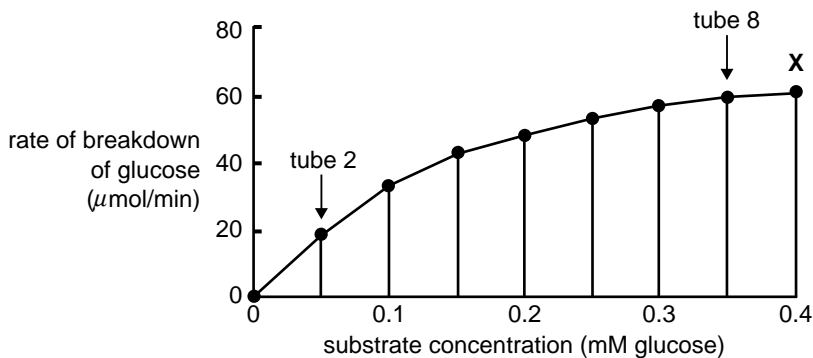


In considering a baleen whale, it would be reasonable to conclude that

- A. blood in the vessels **S** contains a higher concentration of oxygen than blood in vessel **R**.
- B. the core temperature of a baleen whale would vary depending on whether it was feeding or not.
- C. there would be a lower concentration of glucose in blood in vessel **R** than in blood in vessels **S**.
- D. blood in the vessels **S** is at a lower temperature than blood in vessel **R**.

Question 24

Nine tubes, containing the same amount of enzyme and the same volume of solutions of different concentrations of substrate (glucose), were incubated under identical conditions. The rate of breakdown of glucose in each tube was measured and plotted against the original concentration of the substrate. The data collected is summarised in the following graph.

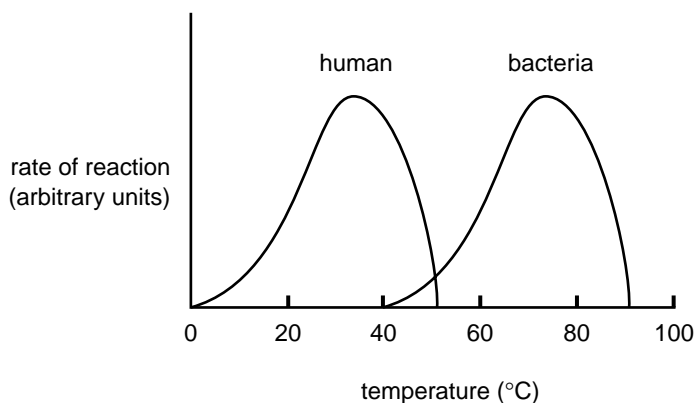


It is reasonable to conclude that

- A. no control tube exists in this experiment.
- B. the rate of breakdown of glucose in tube 8 is $60 \mu\text{mol}/\text{min}$.
- C. the low rate of reaction in tube 2 is due to a low enzyme concentration in that tube.
- D. the graph tapers off at point X because all the substrate has been used in tube 9.

Question 25

The rate of reaction of a typical human enzyme was compared with the rate of reaction of a typical enzyme taken from bacteria that live in hot springs. The rates of reaction were measured over the same range of temperatures. The data obtained is shown in the following figure.



It is reasonable to conclude that

- A. typical human enzymes fail to act at temperatures above 50°C .
- B. the optimal temperature for enzymes for both organisms is about 37°C .
- C. a denatured bacterial enzyme would resume activity if reincubated at 40°C .
- D. enzymes from bacteria that live in hot springs withstand temperatures up to 100°C .

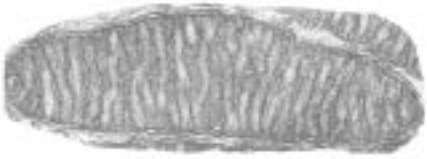
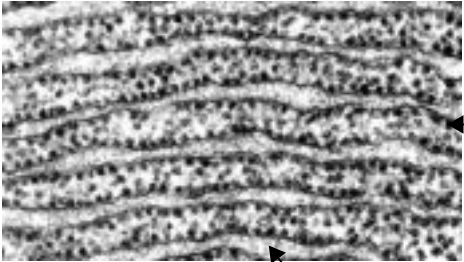


SECTION 2

Instructions for Section 2

Answer this section in pen.
 Answer all questions in the spaces provided.

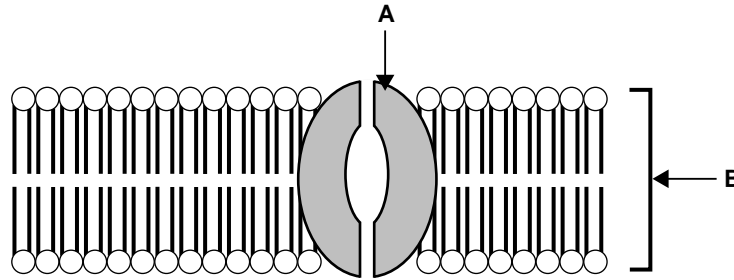
Question 1

- a. The following table contains images of a number of structures seen in cells.
 Name each of the structures and outline the function of each.

Structure		Name and function
	i.	
	ii.	Structure X
	iii.	Structure Y
	iv.	
	v.	

5 marks

The diagram below represents a cross section of part of a cell membrane.



b. Name the structures labelled **A** and **B**.

Structure **A** _____

Structure **B** _____

2 marks

The concentration of sodium ions, Na^+ , in human blood plasma is approximately 150 mmol/L. In the cytosol of red blood cells the concentration of these ions is between 25 and 30 mmol/L.

c. Explain how this difference in concentration is maintained.

2 marks

When an animal cell is placed into distilled water, water enters the cell.

d. What term is used to describe this movement of water into a cell?

1 mark

Animal cells placed in distilled water swell and burst. Plant cells placed in distilled water do not burst.

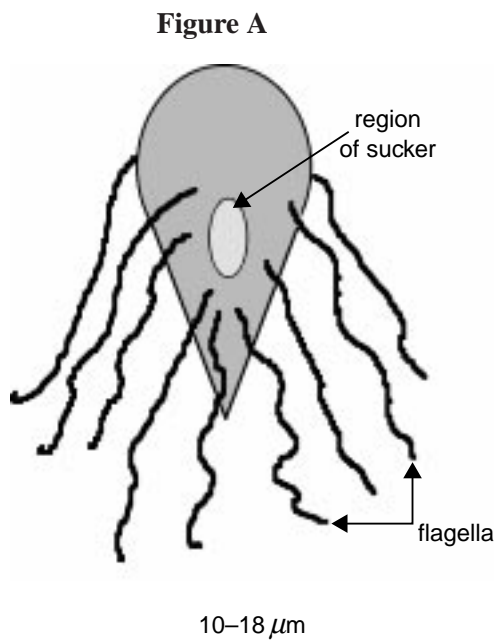
e. Explain why plant cells do not burst in this situation.

1 mark

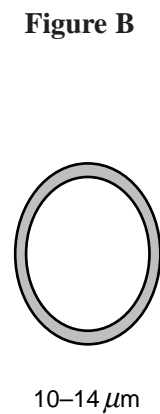
Total 11 marks

Question 2

Giardiasis is the most common form of non-bacterial diarrhoea of people in Australia. The adult parasite, *Giardia lamblia*, responsible for the disease, is shown in Figure A below. The adult is a single cell. Its ventral side is flattened and has a shallow depression used as a type of sucker. The cyst stage of this parasite is shown in Figure B.



Adult parasite



Cyst stage of parasite

Giardia lives in the upper part of the intestine (duodenum) of an infected person where it multiplies rapidly by dividing longitudinally. To pass from one human to another it encloses itself in a cyst that passes out in the faeces. These cysts contaminate the food or drink of other humans.

- a. Suggest an advantage of the cyst stage in the *Giardia* life cycle to the survival of the species.

1 mark

- b. Name two features of the adult *Giardia* and explain how each would assist *Giardia*'s survival in the upper intestine.

Feature 1

Feature 2

2 marks

Giardia infections are more common in children than in adults.

- c. Suggest one reason why this occurs.

1 mark

One form of food poisoning in humans is caused by eating food contaminated with *Salmonella* bacteria. The pathogen reproduces in the intestine and vomiting and diarrhoea occur.

- d. Name the process by which bacterial cells reproduce.

1 mark

- e. Describe two conditions in the intestine that make it an ideal environment for the reproduction of bacteria such as *Salmonella*.

Condition 1 _____

Condition 2 _____

2 marks

In 'fast-food' stores, the area where raw food is prepared is separated from the area where the food is cooked, then packaged for sale.

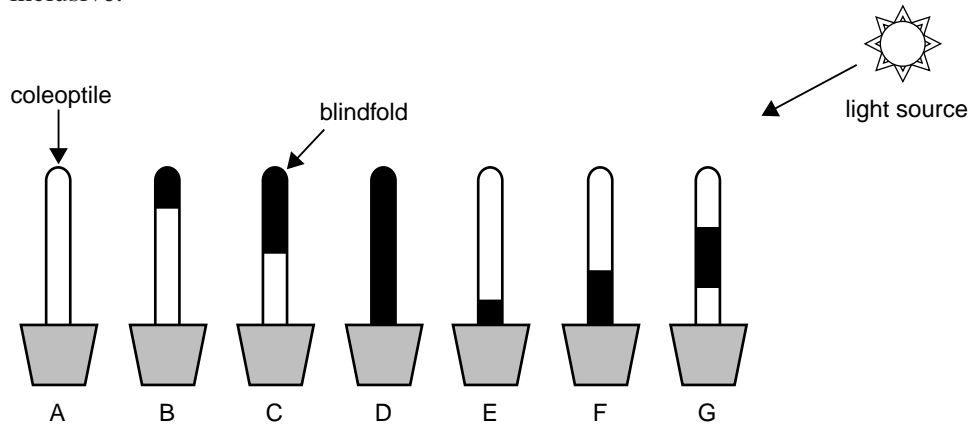
- f. Explain why this separation of areas is important.

1 mark

Total 8 marks

Question 3

Grass seedlings have coleoptiles which respond to light under certain conditions. An experiment was set up in which different parts of coleoptiles were covered by a 'blindfold'. Light could not reach any of the parts covered by a blindfold but could fall on uncovered parts of the coleoptiles. The different treatments were labelled A to G inclusive.



a. What is the term used to describe a plant's growth response to light?

1 mark

b. i. In which of the treatments shown would you expect to see a growth response to light?

ii. Explain why you would expect to see this response in your choices in part b.i.

1 + 1 = 2 marks

c. Use diagrams to explain the processes occurring in a plant when a growth response to light occurs.

3 marks

Total 6 marks

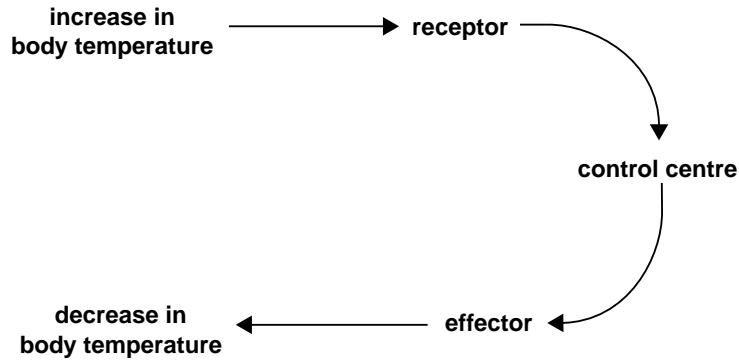
SECTION 2 – continued

Question 4

a. Explain what is meant by the term negative feedback.

1 mark

The diagram below summarises the response to an increased body temperature in a person.



One example of an effector in this system is the smooth muscle in peripheral blood vessels.

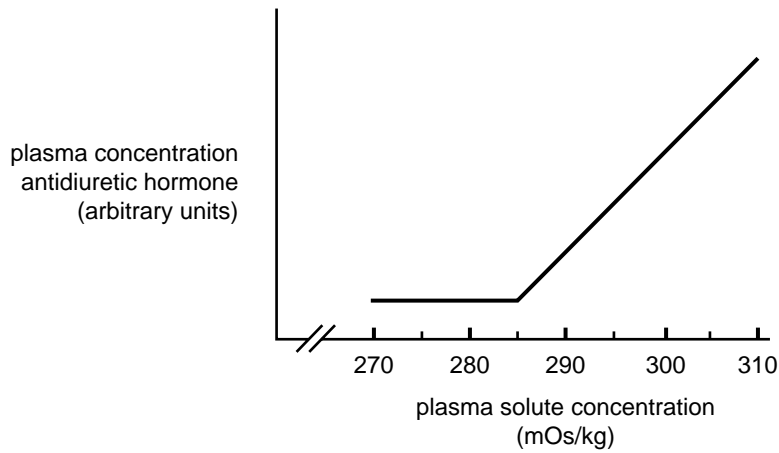
b. i. Explain how this effector brings about a decrease in body temperature.

ii. Apart from smooth muscle in peripheral blood vessels, name one other effector that would be involved in the decrease of body temperature in a person.

2 + 1 = 3 marks

Several hormones are involved in maintaining homeostasis in mammals.

Antidiuretic hormone is important in controlling water balance. The following graph shows changes in the concentration of this hormone as plasma solute concentration increases.



c. At what plasma solute concentration is the release of antidiuretic hormone triggered?

_____ 1 mark

d. Which organ of the body releases antidiuretic hormone?

_____ 1 mark

e. Explain the action of antidiuretic hormone in controlling water balance.

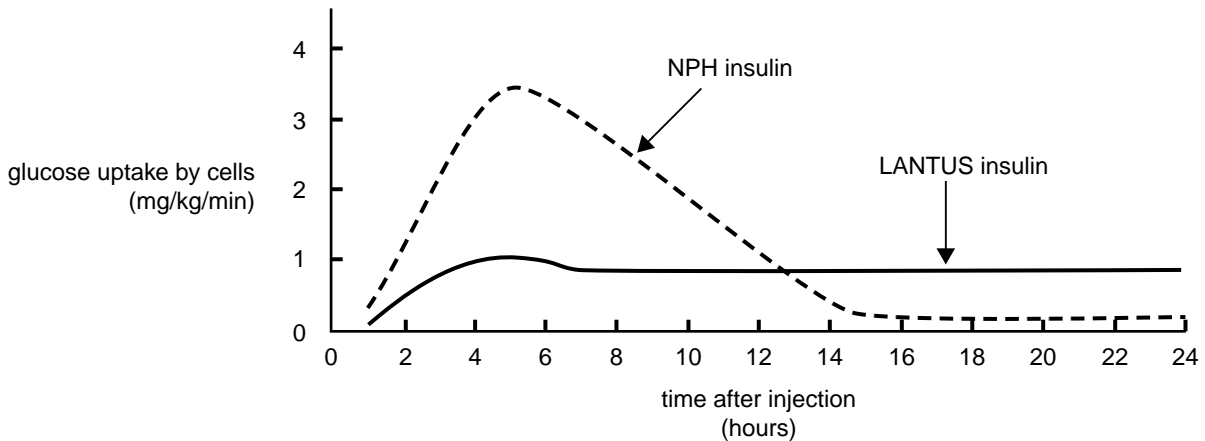
2 marks

Insulin is a hormone involved in the regulation of blood sugar levels. Failure to produce insulin results in insulin-dependent diabetes, and persons with this condition must have regular injections of insulin. A common insulin used has been NPH insulin and it is given from two to four times daily.

Recently the activity of a new type of insulin, called LANTUS insulin, has been tested and compared with NPH insulin.

Participants in the test were divided into two groups. One group received NPH insulin. The second group received LANTUS insulin. All participants received the same amount and concentration of the appropriate insulin.

The following graph shows the average results for participants in each of the two groups.



Insulin is regarded as being effective when the glucose uptake by cells is above 0.4 mg/kg/min.

f. After the injections, for how long was each kind of insulin effective?

NPH insulin _____

LANTUS insulin _____

2 marks

g. Assuming there are no undesirable side effects from using LANTUS insulin, suggest why using LANTUS insulin may be an advantage for a person who has insulin-dependent diabetes.

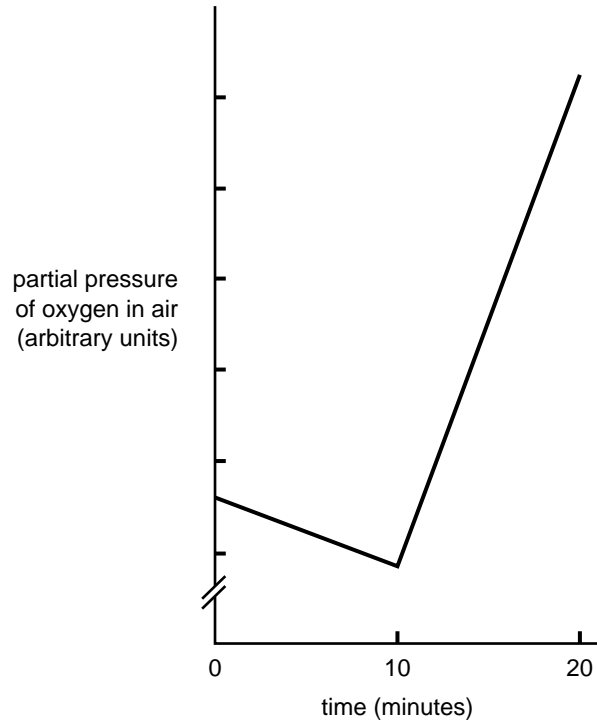
1 mark

Total 11 marks

Question 5

A group of students designed a series of experiments to investigate factors affecting the rate of photosynthesis in plants. The plants were enclosed in clear plastic boxes and kept in the dark for ten minutes. The plants in their boxes were then exposed to light for ten minutes. The students measured the oxygen concentration in the air surrounding the plants.

The results of their experiments are shown in the graph below.



a. i. Write a balanced chemical equation for the process of photosynthesis.

ii. By referring to your balanced equation, explain why the oxygen concentration in the air surrounding the plants can be used as a measure of the rate of photosynthesis.

2 + 1 = 3 marks

b. Explain why the oxygen concentration in the air surrounding the plants decreased during the first 10 minutes of the experiment.

1 mark

Total 4 marks

SECTION 2 – continued

Question 6

Reading a book requires rapid movement of the eyes.

- a. Explain whether the nervous system or the endocrine system of your body controls this rapid movement of the eyes.

2 marks

Situation 1

Regulation of blood sugar levels in your body is under hormonal control and involves most cells in your body.

Situation 2

The release of thyroxine from the thyroid gland is also under hormonal control and only involves cells within the thyroid gland.

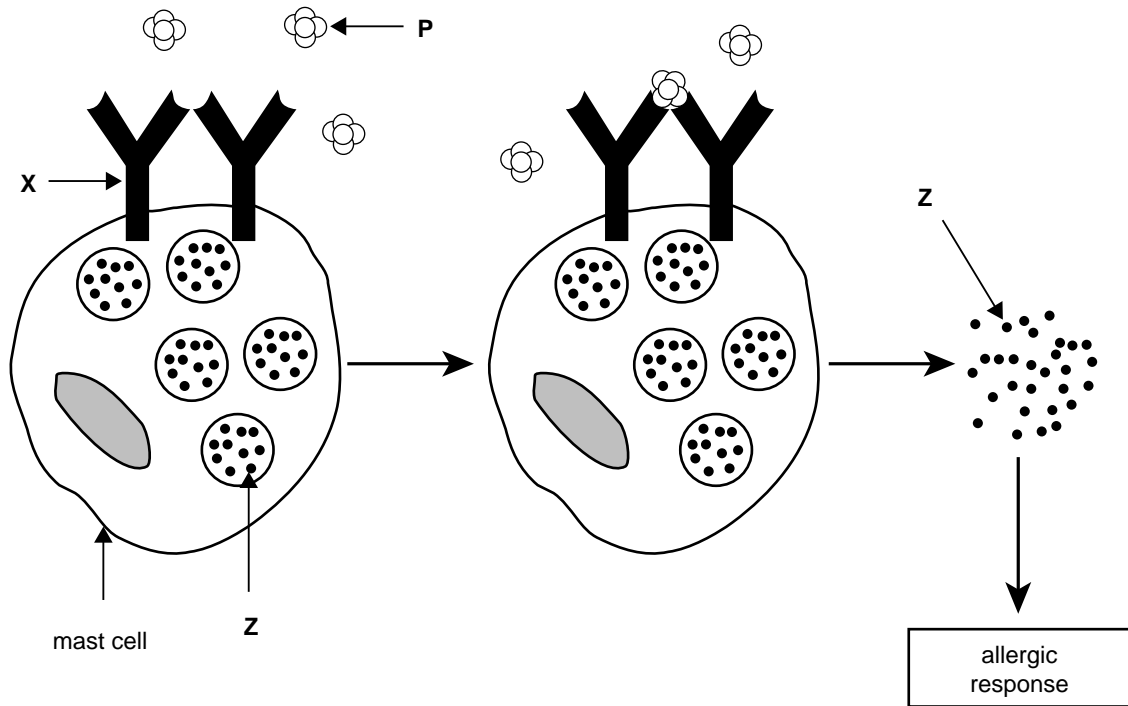
- b. Explain how most cells of the body can be involved in situation 1, while only some cells are involved in situation 2.

2 marks

Total 4 marks

Question 7

Some people have allergic responses to particular compounds or foods. For example, asthma attacks, in which a person has difficulty breathing, may be due to an allergic response. Cells of the immune system, including mast cells, are involved in these allergic responses. A summary of the action of mast cells is shown below.



a. Where are mast cells found in the body?

_____ 1 mark

b. Name the following structures.

Structure X _____

Structure P _____

2 marks

c. Name compound Z.

_____ 1 mark

The release of compound **Z** results in inflammation of the surrounding area.

d. What is the importance of inflammation?

1 mark

Treatment is sometimes given to people with an allergy to reduce the chance of future reactions. Treatment can involve the injection of particular kinds of antigens.

e. Explain how this treatment reduces the chance of a future allergic reaction.

1 mark

Total 6 marks