SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

Figures										Letter
Words										

Victorian Certificate of Education 2000

BIOLOGY

Written examination 1

Wednesday 14 June 2000: 9.00 am to 10.45 am
Reading time: 9.00 am to 9.15 am
Writing time: 9.15 am to 10.45 am
Total writing time: 1 hour 30 minutes

QUESTION AND ANSWER BOOK

Structure of book

Section	*Number of questions*	*Number of questions to be answered*
1	24	24
2	10	10

Directions to students

Materials
Question and answer book of 23 pages.
Answer sheet for multiple-choice questions. You should have at least one pencil and an eraser.

The task
Please ensure that you write your **student number** in the space provided on this book and 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.
This paper consists of two sections, Section 1 and Section 2.
Answer **all** questions from Section 1. Section 1 is worth 24 marks.
Section 1 questions should be answered on the answer sheet provided for multiple-choice questions.
Answer **all** questions from Section 2. Section 2 is worth 51 marks.
Section 2 questions should be answered in the spaces provided in this book.
There is a total of 75 marks available.
All written responses should be in English.

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

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SECTION 1

Specific instructions for Section 1

Section 1 consists of 24 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

The golgi apparatus of a cell

A. packages and modifies proteins.

B. is found only in animal cells.

C. is the site of rapid ATP production.

D. is called 'rough' when ribosomes are attached to its surface.

Question 2

When comparing a typical plant cell to a typical animal cell, you would expect to find

A. ribosomes in the animal cell but not in the plant cell.

B. a nucleus containing a nucleolus in the animal cell but not in the plant cell.

C. a plasma membrane in the animal cell but not in the plant cell.

D. endoplasmic reticulum in both the plant and animal cell.

Question 3

Enzymes are

A. carbohydrates that have the ability to catalyse reactions.

B. proteins that speed up chemical reactions.

C. carbohydrates that are denatured at very high temperatures.

D. proteins that are used up in chemical reactions.

Question 4

Cellular respiration is a chemical reaction that

A. occurs in animal cells but not in plant cells.

B. like photosynthesis, requires oxygen.

C. is important in the maintenance of body temperature in mammals.

D. like photosynthesis, occurs in animal cells.

Question 5

The photosynthetic cells of a green plant

A. carry out significant levels of photosynthesis in green light.

B. carry out significant levels of photosynthesis in red or blue light.

C. only photosynthesise in white light.

D. contain chlorophyll in solution in the cytosol.

Question 6

In photosynthesis

A. glucose is a product of the **dark reaction**.

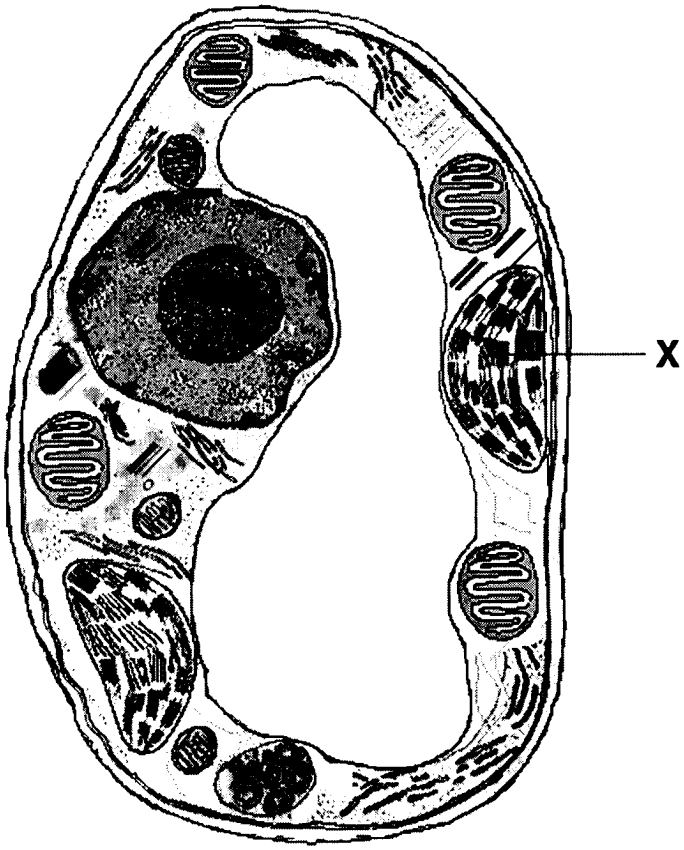
B. the **light reaction** occurs in the chloroplasts and the **dark reaction** occurs in the cytosol.

C. the **light reaction** depends on the presence of carbon dioxide.

D. oxygen is produced in the **dark reaction**.

The following diagram relates to Questions 7 and 8.

The diagram shows the drawing of a cell observed with an electron microscope.



Question 7

Structure X is the site where

A. 3-carbon compounds are converted to CO_2.

B. 6-carbon compounds are produced.

C. glucose is converted to pyruvate.

D. polypeptides are produced.

Question 8

The cell is a eukaryote because it

A. is likely to be found in a heterotrophic organism.

B. contains circular DNA molecules.

C. has distinct membrane-bound organelles.

D. is able to fix nitrogen from the atmosphere.

Question 9

Anaerobic respiration can involve

A. the production of lactic acid in muscle cells.

B. the production of ADP in skin cells.

C. the use of oxygen by mitochondria.

D. the production of ATP by the electron transport system.

Question 10

Large nerves contain a large number of sensory and motor neurons. The sensory neurons

A. synapse directly with motor neurons in glands.

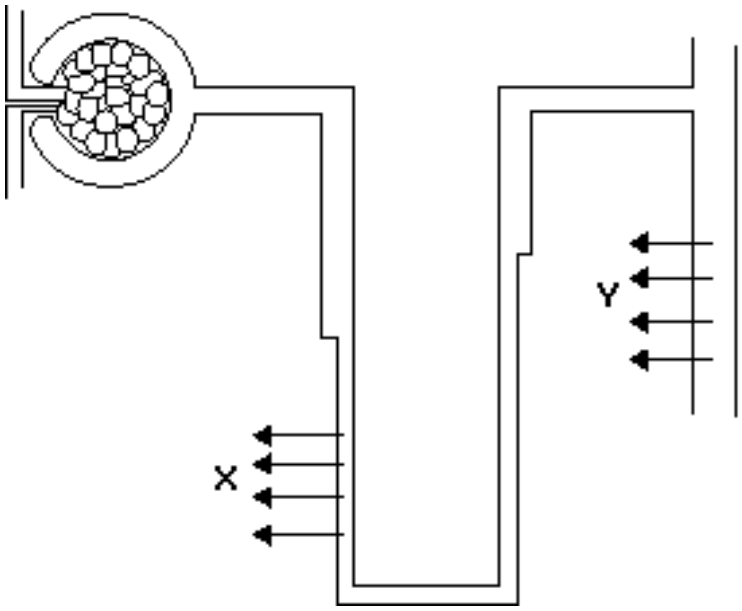
B. form part of the autonomic nervous system.

C. transmit impulses from the central nervous system to muscles.

D. transmit impulses from receptors to the central nervous system.

Question 11

The diagram shows a kidney nephron from a person.



An increased movement of water would occur in the direction of

A. X if the person drinks copious amounts of water.

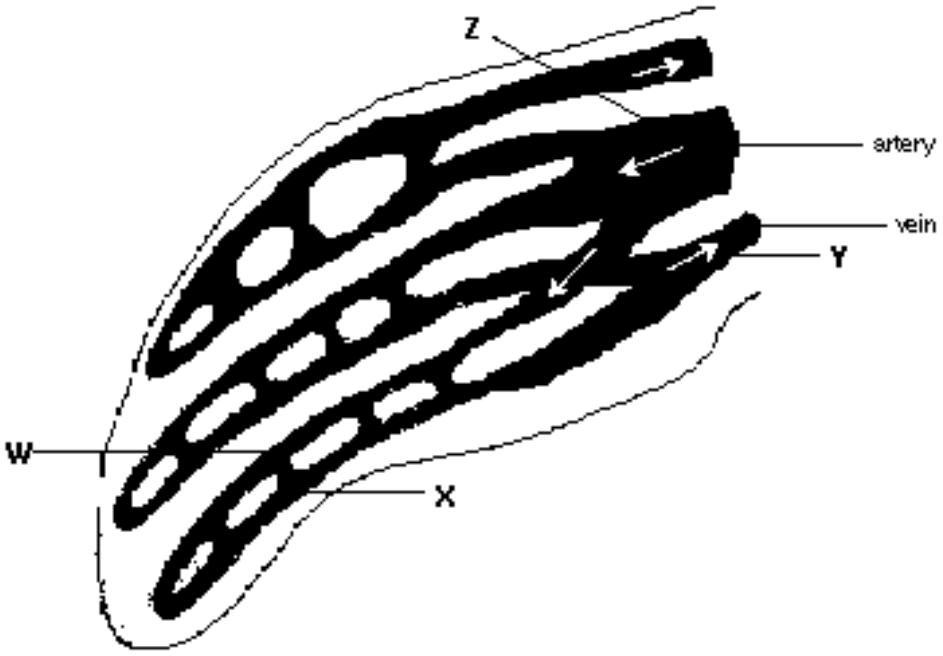
B. Y if the person produced more antidiuretic hormone.

C. Y if the person produced less renin.

D. X if the person has an inactive adrenal gland.

Question 12

The following diagram shows the route of blood flow through the flipper of a dolphin. Arrows show the direction of blood flow. The labels W, X, Y and Z refer to blood vessels.



It would be reasonable to conclude that

A. blood at X absorbs heat from the surrounding sea.

B. blood at W absorbs heat from blood in X.

C. blood at Y absorbs heat from blood in Z.

D. blood at Z has a lower temperature than blood in W.

Question 13

Bumblebees show some ability to control their own temperature. During cold weather they have been observed to warm up their flight muscles by shivering. They are able to maintain a body temperature considerably above that of the surrounding air. Based on this observation you could reasonably conclude that

A. bumblebees are ectothermic.

B. bumblebees maintain a constant body temperature at all times.

C. shivering in bumblebees is an example of endothermy.

D. changes in the body temperature of bumblebees would closely match changes in the temperature of the external environment.

Question 14

You are sitting in front of an open window. The air temperature is 18°C. A breeze blows through the window and you feel cold. The increase in heat loss from your body is largely caused by an increase in

A. radiation.

B. evaporation.

C. conduction.

D. convection.

Question 15

Many diabetics require regular injections of insulin to remain healthy. This is because insulin

A. increases the uptake of glucose by body cells.

B. increases the absorption of glucose from the small intestine.

C. increases the rate of conversion of glycogen to glucose in the liver.

D. acts on the pancreas to stimulate the release of glucagon.

Question 16

If a potted plant is left on its side for a few days the shoots will begin to bend upwards, and the roots will bend downwards. It is reasonable to say that

A. this response of the roots is referred to as negative phototropism.

B. both responses are examples of geotropism.

C. if the potted plant is returned to its upright position, the shoots will respond with negative phototropism.

D. these responses are caused by the action of the plant hormones known as gibberellins.

Question 17

The response of plants to particular periods of light and dark is called

A. photosynthesis.

B. phototropism.

C. photoperiodism.

D. photosensitivity.

Question 18

A plant which normally produces flowers in summer could be prevented from flowering by subjecting it to the following periods of light and dark in a 24-hour cycle.

A. 16 hours of light/8 hours of darkness

B. 8 hours of light/8 hours of darkness/flash of light/8 hours of darkness

C. 8 hours of light/6 hours of darkness/flash of light/6 hours of darkness/flash of light/4 hours of darkness

D. 8 hours of light/16 hours of darkness

Question 19

The chemical composition of the infective agents called **prions** is

A. DNA.

B. RNA.

C. protein.

D. carbohydrate.

Question 20

Non-specific immunity in mammals includes

A. the action of lysozymes in tears and saliva.

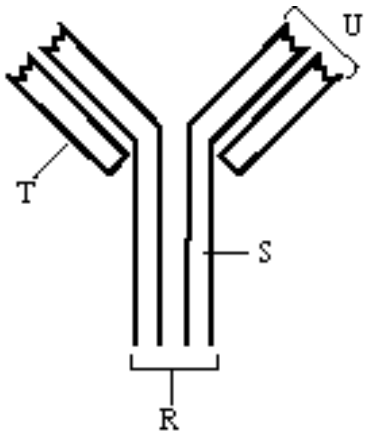
B. the production of antibodies after infection.

C. the production of memory cells.

D. the action of T helper cells.

Question 21

The diagram shows the general structure of an antibody.



A. R indicates the hinge region of the antibody

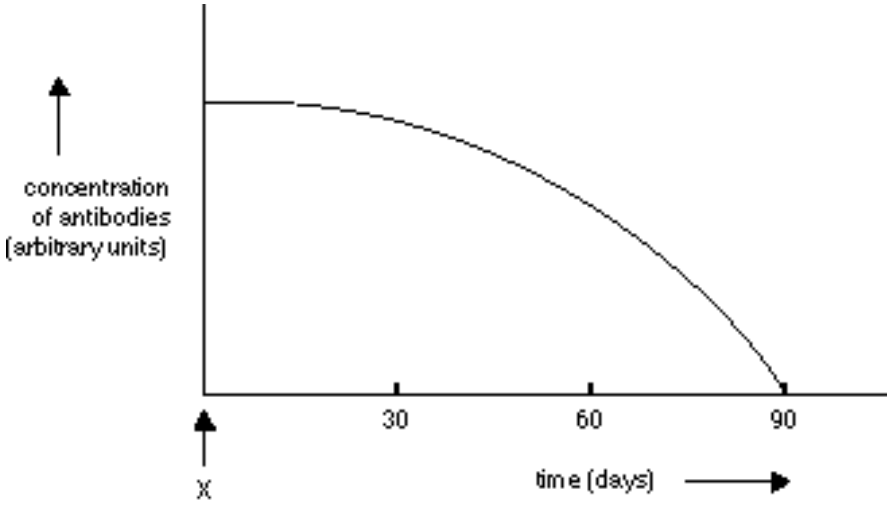
B. S indicates the light chain

C. T indicates the heavy chain

D. U indicates the antigen binding site

Question 22

The concentration of measles antibody in a particular person's blood was measured over a period of time. The results are shown in the following graph.



It is reasonable to conclude that the graph represents the concentration of the measles antibodies in

A. a newborn baby whose mother had been vaccinated against measles.

B. a newborn baby whose mother had been injected with antibodies to measles 12 months prior to pregnancy.

C. an adult infected with measles at time X.

D. an adult vaccinated against measles at time X.

Question 23

Some cells release large quantities of histamine when they are damaged. Such cells include

A. B lymphocytes.

B. mast cells.

C. monocytes.

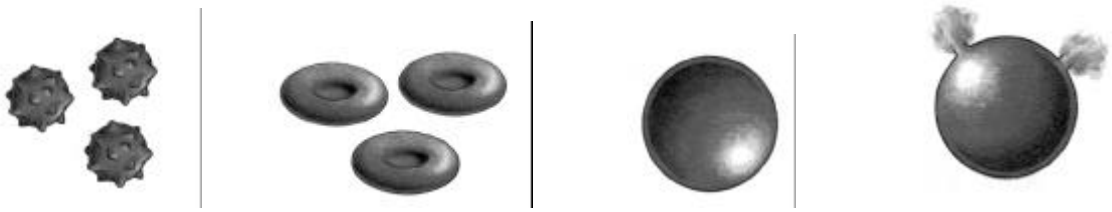
D. T lymphocytes.

Question 24

The following diagram shows what red blood cells look like in blood vessels.

Some of these red blood cells were placed in a range of solutions with different solute concentrations. The appearance of the cells after one minute in the solutions is shown in the following diagram.

Solution P	**Solution Q**	**Solution R**	**Solution S** (cell bursting)



From the results of this experiment it would be reasonable to conclude that

A. solution P is hypotonic to the cytosol of the red blood cell.

B. solution Q has a higher water concentration than the cytosol of the red blood cell.

C. solution R has a lower solute concentration than the cytosol of the red blood cell.

D. solution S has approximately the same solute concentration as the cytosol of the red blood cell.

END OF SECTION 1

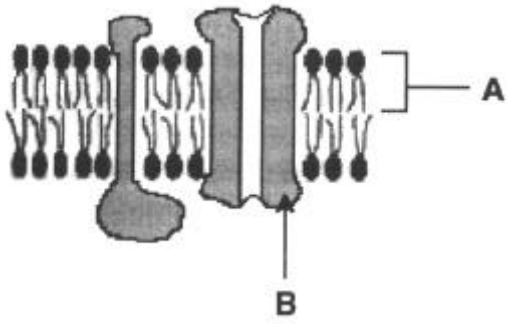
SECTION 2

Specific instructions for Section 2

Section 2 consists of 10 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.

Question 1

The diagram represents part of a plasma or cell membrane.



a. Name the compound in structure

i. A _____

ii. B _____

1 + 1 = 2 marks

b. What is the function of structure B in the membrane shown in the figure above?

_____

_____

1 mark

Total 3 marks

Question 2

It has been said that transpiration is a ‘necessary evil’ for a plant. Transpiration is essential for water movement from the roots of a plant to the leaves, but under certain conditions a plant may wilt as a result of excessive water loss.

a. In what tissue within a vascular bundle is water transported from roots to the leaves?

1 mark

b. It has been claimed that one of the benefits to a plant of transpiration on a warm day is to cool leaves. Explain how transpiration could assist the plant in this way.

1 mark

c. The opening and closing of stomata is related to the movement of potassium ions into and out of guard cells.

Explain the effect of the movement of potassium ions into guard cells from the surrounding epidermal cells on the

i. guard cells

ii. stomatal pore.

2 + 1 = 3 marks

Total 5 marks

Question 3

Water balance in frogs is controlled physiologically by the hormone arginine vasotocin (AVT). This hormone is produced in the brain when receptors within the brain detect an increase in the concentration of body fluids. Frog skin is permeable to water.

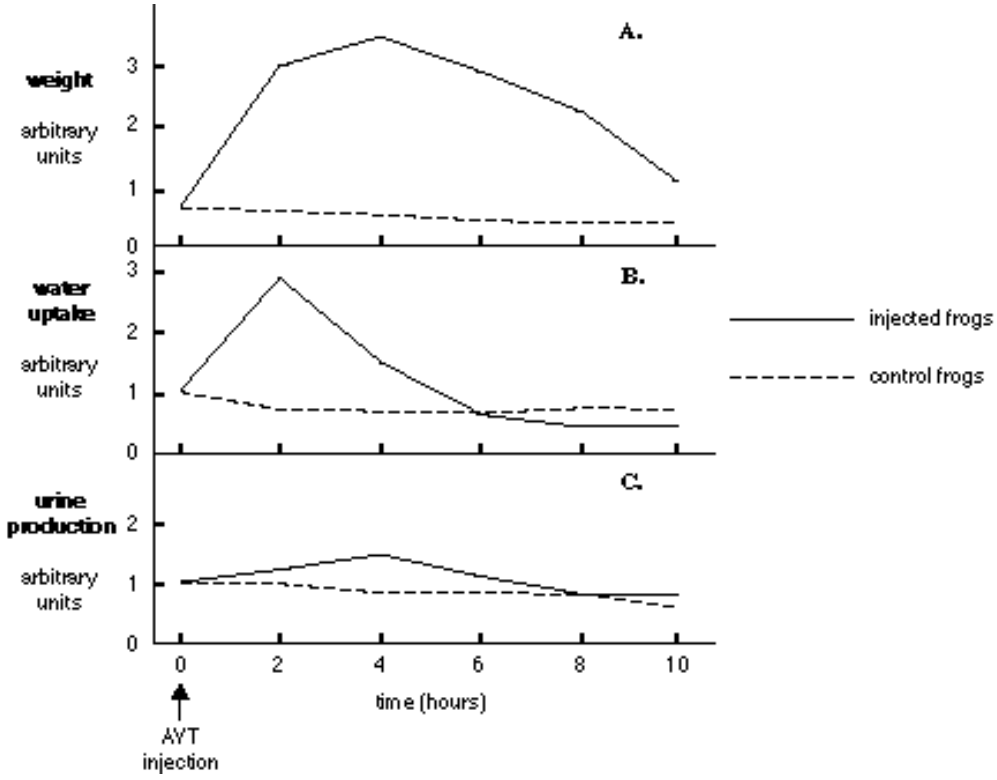
a. Apart from the skin, name one other organ that might be a target tissue for AVT.

1 mark

b. How would AVT move from the brain to the target organs?

1 mark

An experiment was carried out on the New Zealand frog, *Leiopelma archeyi*, to determine the effect of AVT on water balance. Frogs which had been kept in a moist environment were placed in water and injected with a small amount of AVT. These frogs do not drink and they were not fed during the experiment. Changes in their weight, water uptake through the skin, and urine production, were recorded over several hours. Control frogs were kept and measured in the same way but were not injected with AVT. The results of the experiment are shown in the graphs below.



c. Explain how the experimental results shown in graph A support the conclusion that injection of AVT results in an increase in the frogs' weight.

1 mark

d. In the first 2 hours after the injection of AVT, which process is causing the increase in frogs' weight?

_____

_____

1 mark

e. List two ways by which frogs may lose water.

i. _____

ii. _____

1 + 1 = 2 marks

f. In its natural environment, *Leiopelma archeyi* does not enter water. It lives and breeds on land. Describe one behavioural mechanism by which this species may reduce water loss.

_____

_____

1 mark

Total 7 marks

Question 4

Virus infection of plants is common.

a. What are two characteristics of a virus?

i. _____

ii. _____

1 + 1 = 2 marks

b. Explain how virus particles could spread through a crop of vulnerable plants.

_____

_____

1 mark

One common effect of Mosaic Viruses found in cucumbers and tobacco is the presence of light-green or yellow areas on leaves.

c. Describe the effect that yellowed or light-green leaves would have on a cucumber or tobacco plant.

_____

_____

_____

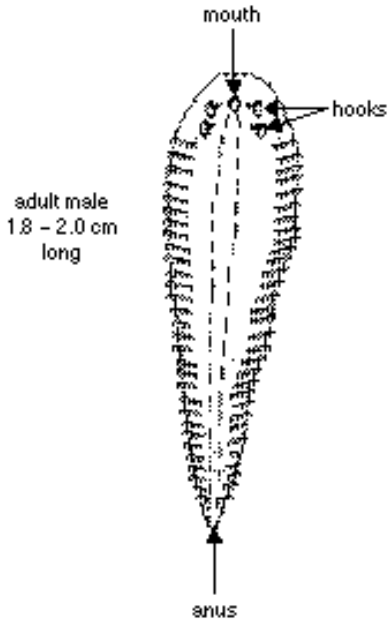
1 mark

Total 4 marks

Question 5

A parasite which belongs to the same animal group as spiders is the tongue worm, *Linguatula serrata*. The adults are parasitic in a number of animals including dogs, and settle in the nose and other respiratory passages. The adult body is long, thin and 'worm-like' in appearance. The limbs are modified as two pairs of strong hooked claws at the anterior end of the body. The adult produces many eggs which leave the host in the nasal discharge or the faeces. The eggs attach to grass and are eaten by an intermediate host such as wild rabbits. The egg contains a fully formed larva which hatches into a nymph resembling the adult, but it is not sexually mature. Nymphs often form cysts in the intermediate host. The final host, for example, a dog, is infected by eating the cysts in the flesh of the intermediate host.

Linguatula serrata



a. List two features of the adult *Linguatula* which would assist the species in being a successful parasite.

i. _____

ii. _____

1 + 1 = 2 marks

b. Select one of the features you have chosen in **a.** and explain how it would assist *Linguatula* in being a successful parasite.

_____

_____

1 mark

c. Discuss two advantages to a parasitic species of having an intermediate host in its life cycle.

2 marks

Total 5 marks

CONTINUED OVER PAGE

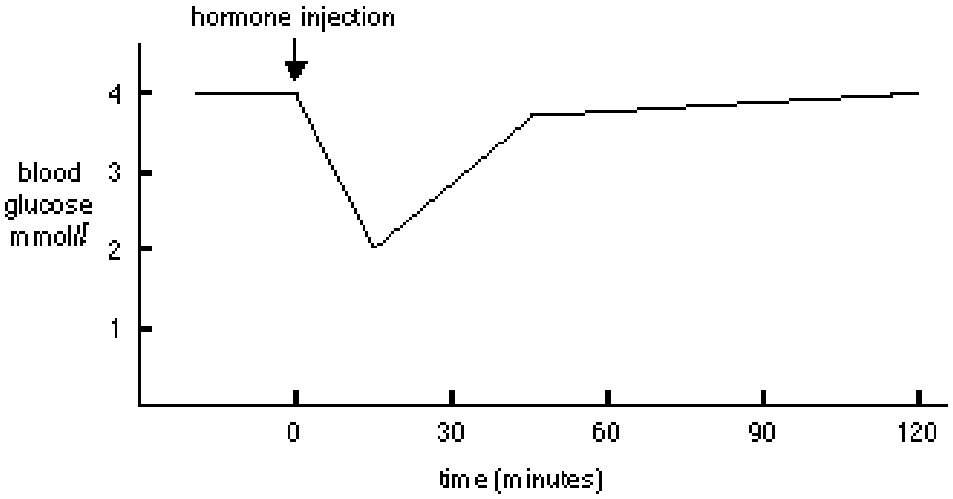
Question 6

In animals, homeostasis is a term used to describe a relatively stable internal environment.

a. What is the internal environment of the body?

1 mark

In an investigation of the control mechanisms that help maintain a constant blood glucose level in humans, a healthy person was given an intravenous injection of a hormone. The blood glucose concentration was recorded for 120 minutes after the injection. The result is shown in the following figure.



b. What hormone would have been injected to produce the effect observed in the first 15 minutes?

1 mark

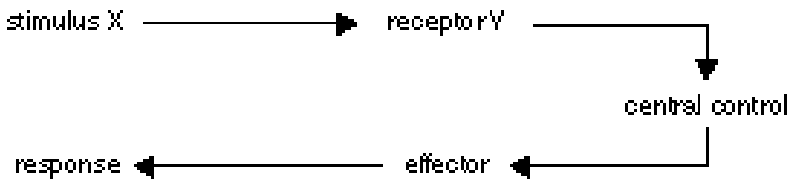
c. Explain what events are occurring to change the blood glucose concentration between 15 and 45 minutes.

2 marks

Total 4 marks

Question 7

The diagram represents a model of the biological control system involved in body temperature regulation.



If stimulus X was a lowering of core body temperature

a. name the location in the body where you would find receptor Y.

_____

1 mark

b. **i.** Name an effector that would bring about a physiological response to stimulus X.

_____

ii. Describe how the effector that you have named in part **i.** brings about a response that alters the stimulus.

_____

_____

_____

_____

1 + 2 = 3 marks

Total 4 marks

Question 8

An autoimmune disease is one in which the body does not identify 'self' tissue. Multiple sclerosis is an autoimmune disease in which the myelin sheaths of nerve fibres are damaged.

a. Explain what effect the loss of the myelin sheath would have on the conduction of impulses along a nerve fibre.

1 mark

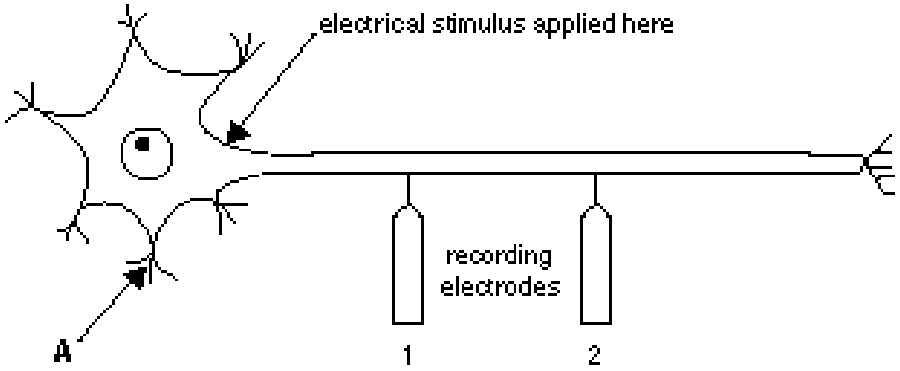
b. A student suggested that one way to diagnose multiple sclerosis would be to test for the presence of antibodies against myelin.

Explain whether you agree or disagree with the suggestion.

2 marks

Electrodes can be inserted into a neuron and a voltage applied to generate an electrical impulse in a nerve cell. This impulse can be recorded.

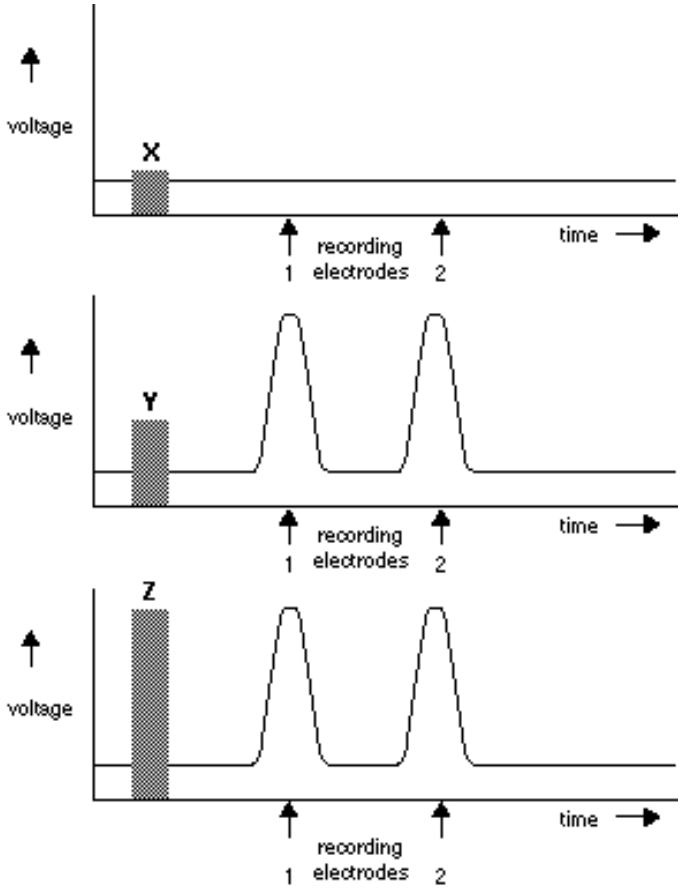
The setup is shown in the following diagram.



c. Name structure A in the diagram.

1 mark

The neuron was stimulated three times, each time with a different voltage. Any impulse generated was measured with two recording electrodes. The graphs below indicate the voltage given in each case, and the trace obtained through the recording electrodes.



d. Compare the results obtained for the three different voltages.

i. Suggest why there is no response when voltage X was applied and yet a response was observed for voltage Y.

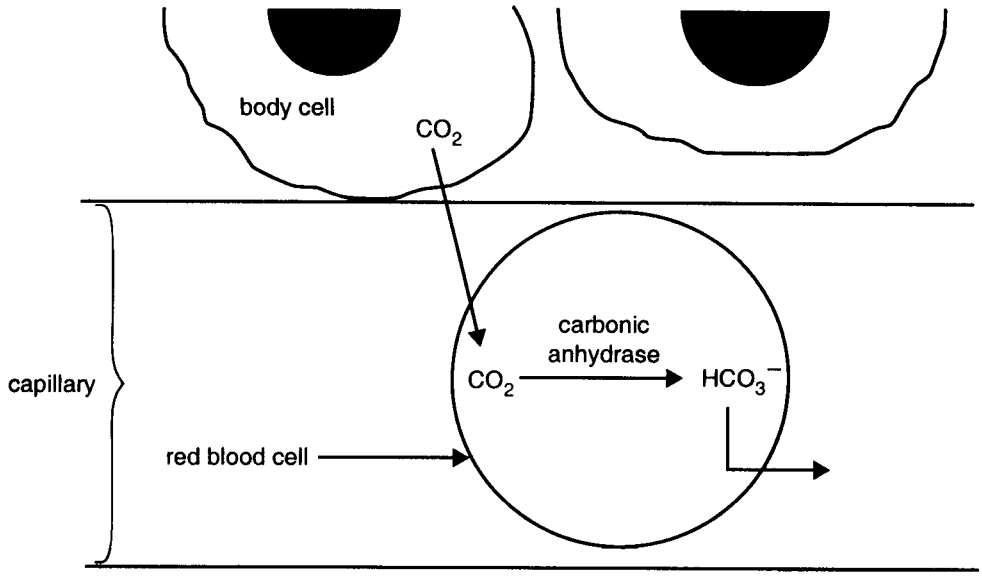
ii. Suggest why the response for Z was the same as the response for Y despite the fact that the voltage applied was higher.

1 + 1 = 2 marks

Total 6 marks

Question 9

In mammalian blood, carbon dioxide (CO_2) is transported largely in the form of the bicarbonate ion (HCO_3^-). CO_2 produced in cells moves into capillaries and then into red blood cells where it is converted to bicarbonate ions by the action of the enzyme carbonic anhydrase. The bicarbonate ions produced in the red blood cells move back into the plasma. These events are summarised in the following diagram.



a. Name a cellular process occurring in mammalian tissues that produces carbon dioxide.

1 mark

Transport of carbon dioxide from body cells to red blood cells is passive.

b. Explain what is meant by the term passive transport.

1 mark

c. Explain how this conversion of carbon dioxide to bicarbonate ions in red blood cells assists the removal of carbon dioxide from body cells.

2 marks

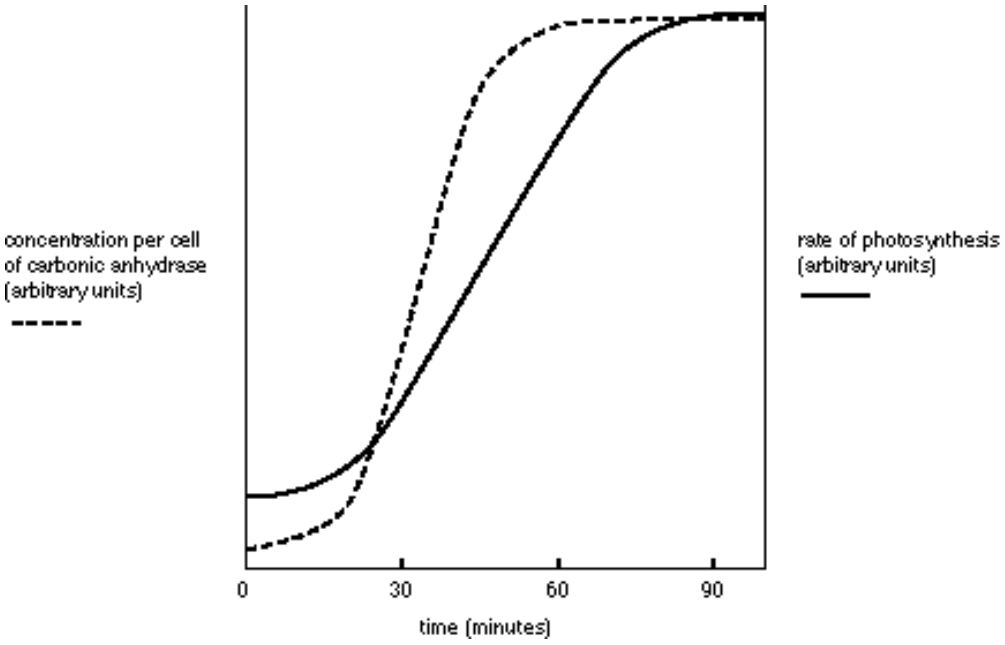
In plants the enzyme carbonic anhydrase can also assist the reverse of the reaction described opposite, that is, the conversion of bicarbonate ions into carbon dioxide $HCO_3^- \rightarrow CO_2$.

Chlorella is a type of alga found in fresh and salt water. In many of these environments, bicarbonate ions may be common. *Chlorella* photosynthesises to produce carbohydrates for energy.

d. Write a balanced chemical equation for photosynthesis.

2 marks

When carbon dioxide is in high concentration, *Chlorella* produces little carbonic anhydrase. In an experiment *Chlorella* cells were transferred from water with a high concentration of carbon dioxide to water with a low concentration of carbon dioxide. Light and temperature were kept constant and a high concentration of bicarbonate ions was provided. The results are shown in the following graph.



e. Based on the above information, what effect did the increase in the carbonic anhydrase concentration have on the rate of photosynthesis?

1 mark

f. Suggest an explanation for the constant rate of photosynthesis after 90 minutes.

1 mark

g. Carbonic anhydrase has an optimum pH of 8.5. What would you expect to happen to the activity of this enzyme if the pH were reduced to 7.0?

1 mark

Total 9 marks

Question 10

In an effort to reduce wildlife predation by foxes, scientists in Australia are planning an experiment to reduce the fox population in some areas. They hope to achieve this by using immunological methods to reduce reproduction in fox populations.

One proposal includes the following steps.

Step 1: Collect fox egg and sperm and remove surface proteins from these gametes.

Step 2: Inject these fox-gamete proteins into rabbits. Rabbits do not naturally contain these proteins.

Step 3: A few weeks later, collect blood from the rabbits and isolate particular material from the rabbit blood – called material X.

Step 4: Insert material X into foxes which would then be allowed to re-enter the 'wild' population.

a. What name could be applied to the sperm and egg proteins injected into rabbits?

1 mark

b. Describe the events that would occur in the rabbit's immune system after the injection of egg protein and sperm protein into the rabbit.

2 marks

c. What cells in the rabbit produce material X?

1 mark

Total 4 marks

END OF QUESTION AND ANSWER BOOK