VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

Victorian Certificate of Education 2005

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

STUDENT NUMBER

									Letter
Figures									
Words									

BIOLOGY

Written examination 1

Monday 6 June 2005

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)*
A	25	25	25	30
B	8	8	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 25 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 A – Multiple-choice questions

Instructions for Section A

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

Question 1

A plant cell can be distinguished from an animal cell because of the presence of

A. cytosol.
B. a cell wall.
C. a nucleus.
D. chloroplasts.

Question 2

When using a light microscope, magnification of the structure being observed can be increased by a variation in the

A. light intensity.
B. stage position.
C. objective lens power.
D. iris diaphragm setting.

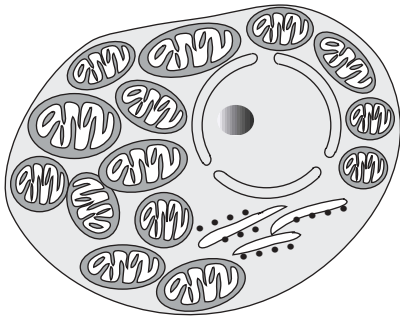
Question 3

The plasma membrane of a cell

A. is inflexible due to the presence of protein molecules.
B. allows substances to pass through only by active transport.
C. contains cholesterol molecules which can act as cell receptors.
D. is relatively impermeable to large water-soluble molecules due to the presence of the bilipid layer.

Question 4

Examine the following cell.



Based on the internal structure, the cell is likely to

A. be a cheek epithelial cell.

B. be a mature red blood cell.

C. require high levels of oxygen.

D. produce high levels of sugars.

Question 5

A prokaryotic cell contains

A. a nucleus.

B. a vacuole.

C. ribosomes.

D. endoplasmic reticulum.

Question 6

Pieces of leaf epidermis were peeled from the plant *Commelina communis*. The pieces were then placed in a solution of a dye that binds to potassium ions.

You would expect that most of the dye would be concentrated in the

A. guard cells when the stomata are open.

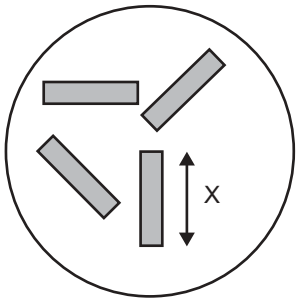
B. stomatal pore when the stomata are closed.

C. epidermal cells when the stomata are open.

D. intercellular spaces of the leaf when the stomata are closed.

Question 7

A student was examining a sample of pond water under high power of a light microscope. She observed some rod-shaped organisms similar to those in the diagram below. For this particular microscope the diameter of the field of view is 450 µm.



The length of the organisms (shown as X on the diagram) is approximately

A. 450 µm.

B. 225 µm.

C. 150 µm.

D. 45 µm.

Question 8

In a practical class a student prepared a peel of onion plant epidermis. During the preparation of the slide the student used iodine stain. He examined the preparation under high power of a light microscope.

The purpose of the iodine stain is to

A. kill the cell.

B. show the structure of the cell membrane.

C. allow the mitochondria to be seen more easily.

D. provide contrast between structures of the cell.

Question 9

The production of organic molecules in a crop is reduced when leaves begin to wilt because

A. stomata close preventing the entry of CO_2.

B. the chlorophyll of wilting leaves decomposes.

C. flaccid mesophyll cells of a leaf are not capable of photosynthesis.

D. accumulation of CO_2 in the leaf inhibits the enzymes required for photosynthesis.

Question 10

Lettuce seeds were exposed to flashes of light of two wave lengths, red (R) and far red (FR). The percentage of seeds germinating after each treatment was measured. The data is shown in the table.

Light exposure	Germination %
None	9
Red	98
Red + FR	54
Red + FR + Red	100
Red + FR + Red + FR	43
Red + FR + Red + FR + Red	99
Red + FR + Red + FR + Red + FR	54
Red + FR + Red + FR + Red + FR + Red	98

From this data it is possible to conclude that germination of lettuce

A. requires far red light.

B. requires both far red and red light.

C. is influenced by whether the last flash is red or far red light.

D. requires equal amounts of far red and red to get maximum germination.

Question 11

The beef tapeworm, *Taenia saginata*, is called a parasite because it

A. kills its host.

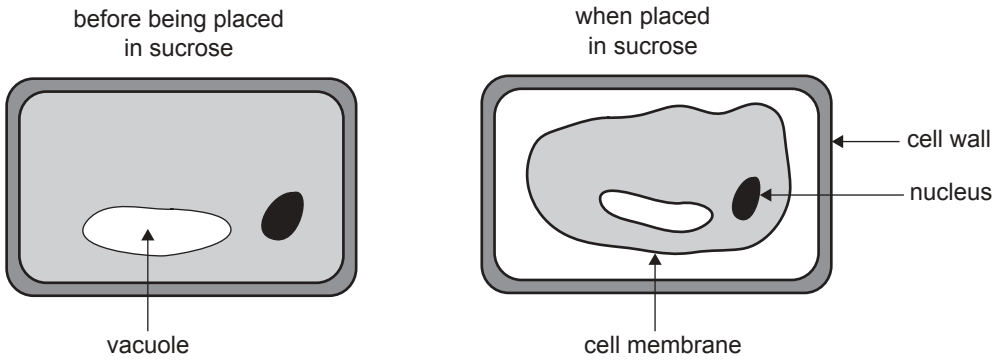
B. benefits at the expense of the host.

C. is transmitted via an intermediate host.

D. lives within the body of another animal.

Question 12

A plant cell was placed in a sucrose solution and changes within the cell were observed.



From the information in the diagrams you can conclude that while the cell was in the sucrose solution

A. the cell wall was impermeable to water molecules.

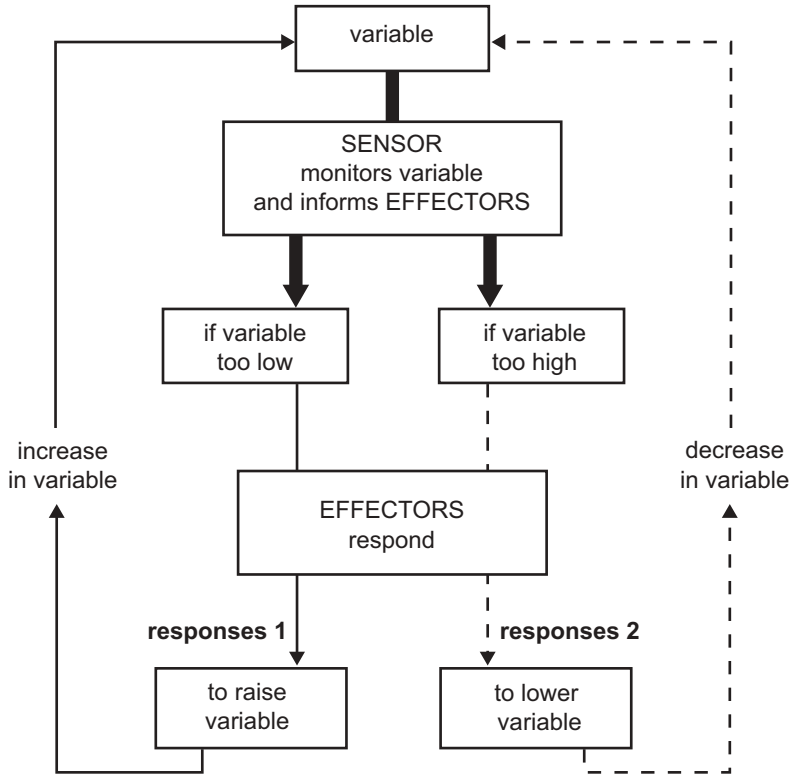
B. the vacuole membrane was impermeable to water molecules.

C. sucrose molecules passed through the cell membrane.

D. water molecules passed through the cell membrane.

The following information is required for Questions 13 to 15.

One way in which the general principle of homeostasis can be outlined is given in the following diagram.



Question 13

Consider homeostasis in the control of body temperature.

If body temperature rises above normal limits then

A. responses 2 involve constriction of the blood vessels.

B. responses 2 involve an increase in shivering.

C. the sensor is the anterior pituitary gland.

D. the sweat glands act as an effector.

Question 14

Consider homeostasis in the control of body water.

If a person becomes dehydrated, the concentration of the solutes in their body fluids increases and

A. this change is detected by sensor cells within the hypothalamus.

B. as a consequence responses 1 become relevant.

C. effectors include cells within the digestive tract.

D. as a consequence responses 2 involve a decrease in water reabsorption from nephron tubules.

Question 15

Considering the diagram above, the component that is being kept relatively constant is

A. the variable.

B. input to the sensor.

C. input to the effectors.

D. output from the effectors.

Question 16

Macrophages are large white blood cells that

A. give rise to monocytes.

B. engulf bacteria and destroy them.

C. produce proteins called ‘complement proteins’.

D. secrete bacterial-destroying enzymes into the bloodstream.

Question 17

An example of specific immunity is the

A. action of mucus to remove bacteria from the respiratory tract.

B. presence of ‘natural flora’ bacteria in different areas of the body.

C. presence of antibacterial agents, such as enzymes, in saliva.

D. action of memory cells when an individual is subjected to a second infection of measles.

Question 18

If a person has an adverse reaction when they come into contact with a particular substance, the person has an allergy to the substance. For example, some people are allergic to garlic.

During an allergic reaction, the material that causes most tissue damage is

A. pus.

B. histamine.

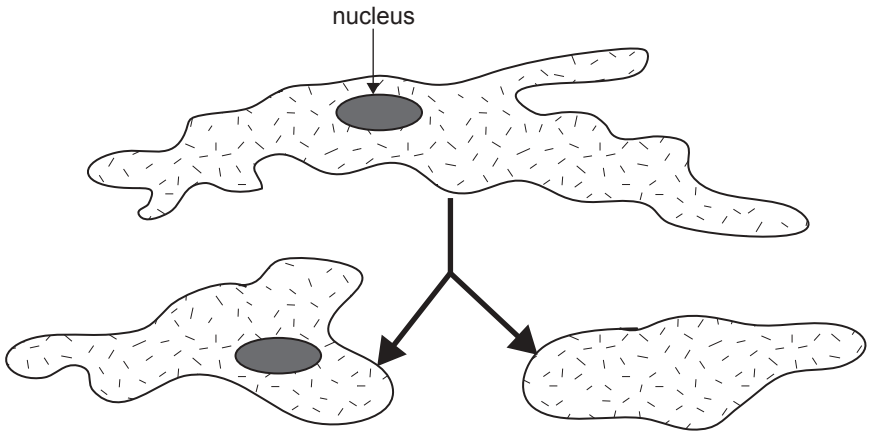
C. interferon.

D. complement proteins.

Question 19

Early experiments to investigate cell functioning used amoebae (*Amoeba proteus*). An amoeba is a relatively large, single-celled organism. It is possible to bisect an amoeba to produce half with the nucleus and the other half without a nucleus (enucleated).

The following diagram shows the results.



The most likely reason for the enucleated half-cell to die after seven days is that

A. water was lost by osmosis.

B. protein synthesis was reduced.

C. the fluidity of the membrane was lost.

D. no mitochondria were in the enucleated half-cell.

Question 20

An amoeba, *Amoeba proteus*, is a relatively large nonphotosynthetic, single-celled organism. Pond water can be used to grow cultures of amoebae. At a constant temperature of 18°C, and given an adequate food supply at regular intervals, the majority of amoebae reproduce every 50 hours.

Factors that affect the time for amoebae to reproduce were investigated. The modification of one factor did not influence another.

If the culture medium is modified as indicated, it is reasonable to predict that the effect on the time for amoebae to reproduce is

	Modification of culture medium	**Effect on time for amoebae to reproduce**
A.	bubble carbon dioxide into the pond water	more than 50 hours
B.	double the density of amoebae in the pond water	less than 50 hours
C.	decrease temperature of the pond water from 18°C to 10°C	less than 50 hours
D.	increase the intensity of light falling on the pond water	more than 50 hours

The following information is required for Questions 21 and 22.

Yeast cells divide rapidly provided they are mixed with warm water to form a suspension and sucrose is added.

Sucrose is unable to cross the yeast cell membrane and is digested into glucose and fructose by the enzyme sucrase. Sucrase is synthesised within the yeast cell but acts in the water surrounding the yeast cells.

Question 21

Warming the yeast suspension increases the rate at which sucrose is broken down to glucose and fructose because warming

A. increases the concentration of the products.

B. increases the frequency of collisions between molecules.

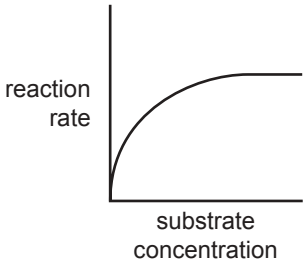
C. improves the 'fit' between active site of the enzyme and substrate.

D. ensures the pH is optimal for formation of enzyme-substrate complex.

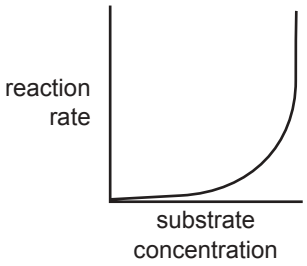
Question 22

The graph that shows the effect of adding more sucrose to the yeast suspension is

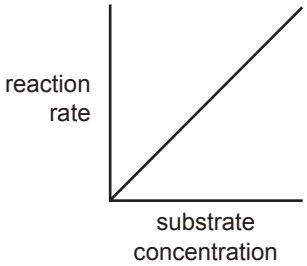
A.



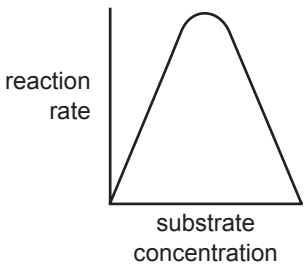
B.



C.

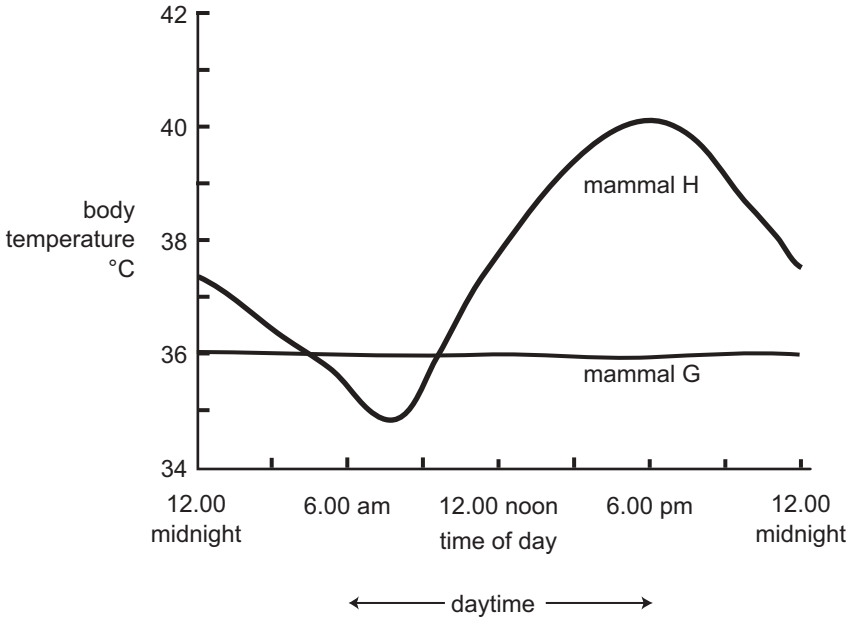


D.



Question 23

The body temperature of two different mammals was recorded over 24 hours. The average daytime temperature was 40°C and average night-time temperature was 20°C. The temperatures of the mammals over the 24 hours are shown in the graph below.



From the information given it would be reasonable to conclude that

A. between midnight and 6.00 am, mammal **H** would be gaining heat by conduction.

B. at 12.00 noon, mammal **H** would be gaining heat by radiation.

C. at 12.00 noon, mammal **G** is losing heat by radiation.

D. between midnight and 6.00 am, mammal **G** would be losing heat through evaporation of sweat.

Question 24

Mammals that live in very cold environments have behavioural adaptations that help reduce the rate at which they lose heat.

One behavioural adaptation could be

A. decreasing food intake.

B. having fur that fluffs out.

C. curling up into the shape of a ball.

D. isolating themselves from other individuals.

Question 25

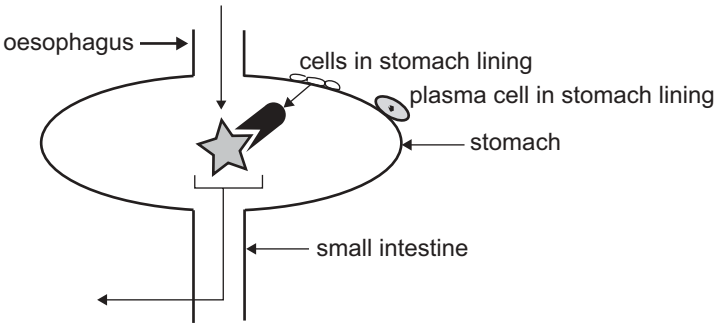
In humans, failure to absorb vitamin B_{12} results in pernicious anaemia.

Normally, vitamin B_{12} enters the stomach and becomes attached to a 'factor' that is produced by cells in the stomach wall. The vitamin with the attached factor then moves into the small intestine and is transported across the small intestine wall into the bloodstream.

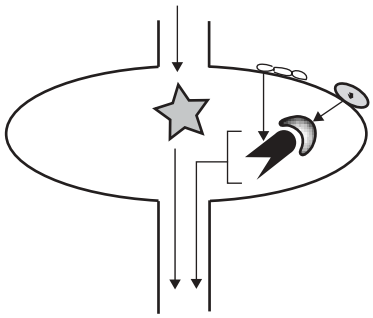
In pernicious anaemia, antibodies against the factor are produced by plasma cells in the stomach wall. The antibodies combine with the factor so that it is no longer available to combine with the vitamin. Therefore the vitamin cannot be absorbed.

The pathway involved when a person has pernicious anaemia is

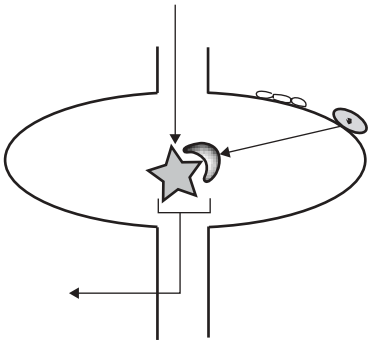
A.



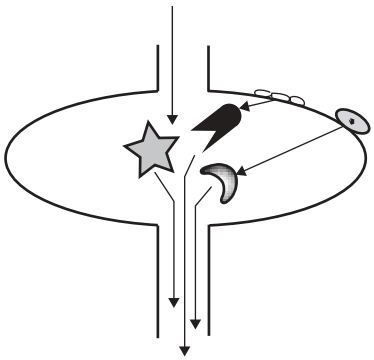
B.



C.



D.



END OF SECTION A
TURN OVER

SECTION B – Short-answer questions

Instructions for Section B

Answer this section in **pen**.

Answer all questions in the spaces provided.

Question 1

The table below contains the names of six cellular structures found in a plant cell.

In the list below the table, a number of functions of cellular structures are given. Complete the table by matching **the letter of a function** to the appropriate cellular structure in the plant cell. You are not required to use every function given.

Cellular structure in the plant cell	**Matching function choose one from (A–H)**
Golgi apparatus	
mitochondria	
chloroplast	
lysosome	
vacuole	
cell membrane	

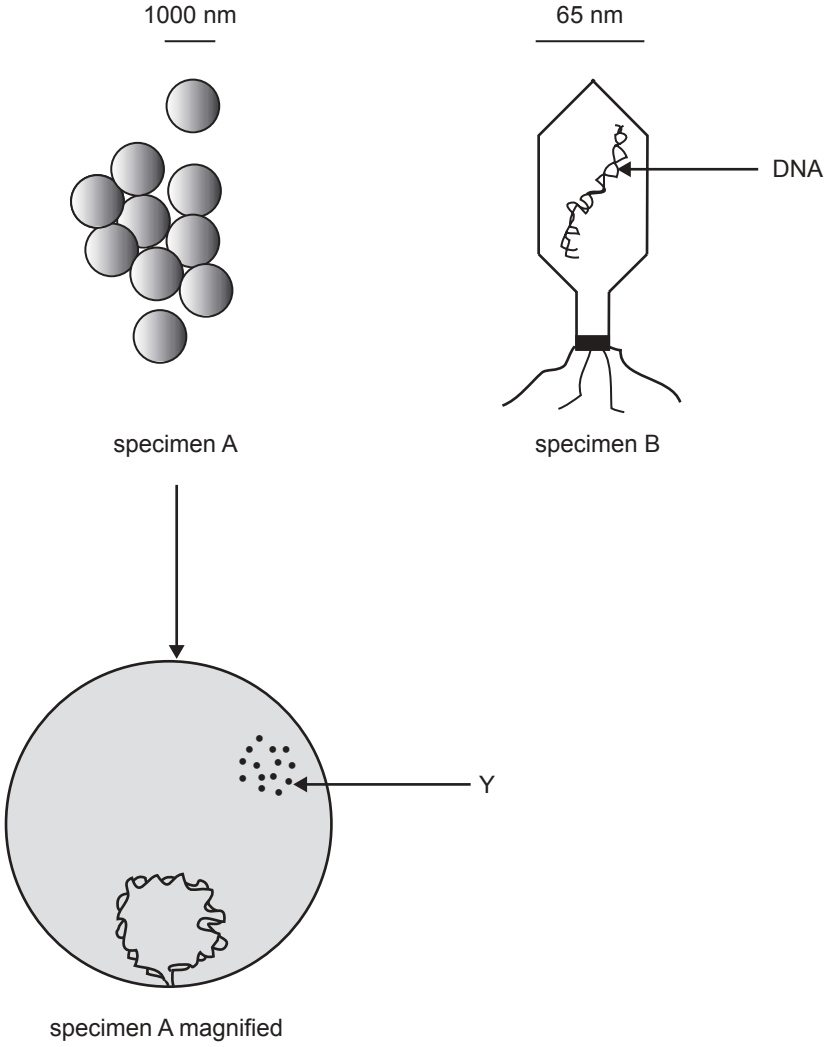
Functions of various cellular structures of the plant cell

A. site where ATP is generated
B. digestion of macromolecules
C. site of protein synthesis
D. proteins modified and packaged for transport
E. selective barrier that limits movement in or out of cell
F. solar energy is converted to chemical energy
G. contains DNA, a template for mRNA synthesis
H. storage of wastes and other materials

Total 3 marks

Question 2

The following diagram shows two examples of pathogens. The relative size of each is indicated.



a. **i.** The structures at **Y** are distributed uniformly throughout specimen A. What are the structures at **Y**?

_____

ii. What is the function of these structures?

_____

1 + 1 = 2 marks

Specimen B is an example of a pathogenic agent.

b. **i.** Name the kind of pathogenic agent.

_____

ii. What is the significant feature that is used to distinguish a pathogenic agent from a pathogenic organism?

_____

1 + 1 = 2 marks

Elephantiasis is a human disease caused by the presence in the lymphatic system of a particular parasitic worm, *Wuchereria bancrofti.* The adult worms block the lymphatic vessels so accumulation of lymph causes swelling in the surrounding tissues. Adult female worms produce larvae that enter the human bloodstream.

When an infected person is bitten by a mosquito the larvae pass, with the ingested blood, into the stomach of the mosquito. The larvae burrow their way through the mosquito stomach wall. After going through a series of body changes the larvae move back to the mouth of the mosquito. These larvae are then passed into the blood of a human the next time the mosquito bites a human. The larvae then move to the lymph nodes and mature into adult worms.

c. What is the role of the mosquito in the life cycle of *Wuchereria bancrofti*?

_____

_____

1 mark

d. What is one structural feature you would expect to find in the larvae that helps it survive in the mosquito?

_____

1 mark

e. What is another different structural feature you would expect to find in the larvae that helps it survive in the human?

_____

1 mark

After a person has been bitten by a mosquito carrying the larvae, the symptoms of the disease may not appear for several months or even years.

Millions of people living in tropical areas of the world have been infected with this parasitic worm.

f. Describe one method that may be used to control the spread of this parasitic worm.

_____

_____

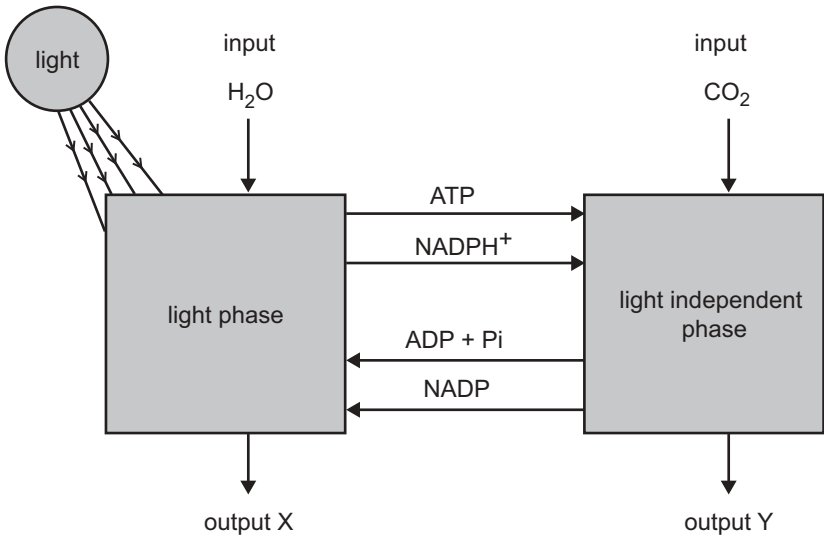
_____

1 mark

Total 8 marks

Question 3

Although photosynthesis is often summarised by a single equation, in fact the process occurs in two distinct phases; the light phase and another phase called the carbon fixation phase or the light independent phase. These two phases can be summarised in diagrammatic form as follows.



The diagram shows outputs X and Y.

a. **i.** What is output X?

_____

ii. How is output X produced?

_____

1 + 1 = 2 marks

b. What is output Y?

_____

1 mark

Cellular respiration provides energy for cells. It may be aerobic or anaerobic.

c. Aerobic respiration in plants and animals ultimately depends on photosynthesis. Explain this dependence.

_____

_____

1 mark

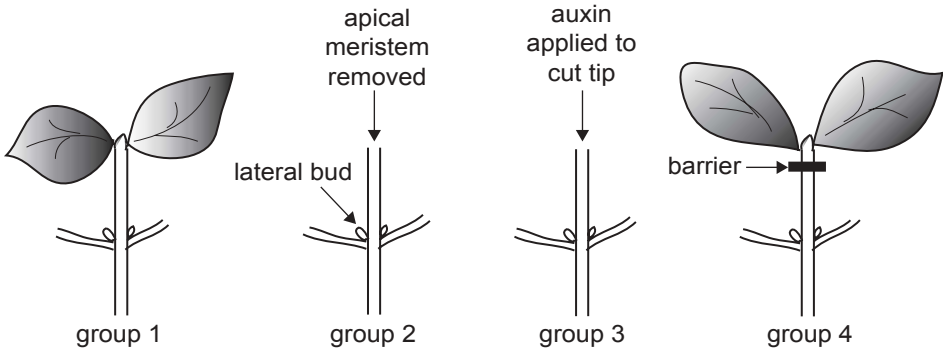
d. What is an advantage of aerobic over anaerobic respiration?

_____

_____

1 mark

An experiment was conducted to investigate apical dominance in bean plants. Four groups of plants were used.



Group 1: untreated

Group 2: apical meristem was removed

Group 3: apical meristem was removed and auxin applied to the cut tip

Group 4: apical meristem removed and replaced intact but a barrier to the movement of compounds was placed under the tip

The results are shown in the table.

Group 1	**Group 2**	**Group 3**	**Group 4**
untreated	apical meristem removed	apical meristem removed and auxin applied to the cut tip	apical meristem intact but barrier to the movement of compounds was placed under the tip
Growth of apical meristem but not lateral buds	Growth of lateral buds	No growth of lateral buds	Growth of lateral buds

e. Using the information from the experiments, what are three conclusions you can make about the growth of lateral buds?

Explain how you reached each conclusion.

Conclusion **1** and explanation

Conclusion **2** and explanation

Conclusion **3** and explanation

3 marks

Total 8 marks

Question 4

To determine the effect of a plant parasite on the plant's growth, an experiment was carried out with alfalfa plants. Two alfalfa seeds were planted into each of 30 pots. Into 10 of these pots the root parasite, *Odontites rubra*, was also introduced. Into another 10 pots a different root parasite, *Rhinanthus serotinus*, was introduced.

When the plants were mature the total dry weight of the twenty plants in each group was measured.

The results were

Group 1:	10 pots with 2 alfalfa plants only	1483 gm
Group 2:	10 pots with 2 alfalfa plants and the root parasite *Odontites rubra*	927 gm
Group 3:	10 pots with 2 alfalfa plants and the root parasite *Rhinanthus serotinus*	968 gm

a. Why was the dry weight of the plants measured?

1 mark

b. Suggest what the root parasites were obtaining from the plant.

1 mark

c. Given the data above, state one conclusion about the effect of the parasites on the alfalfa.

1 mark

Total 3 marks

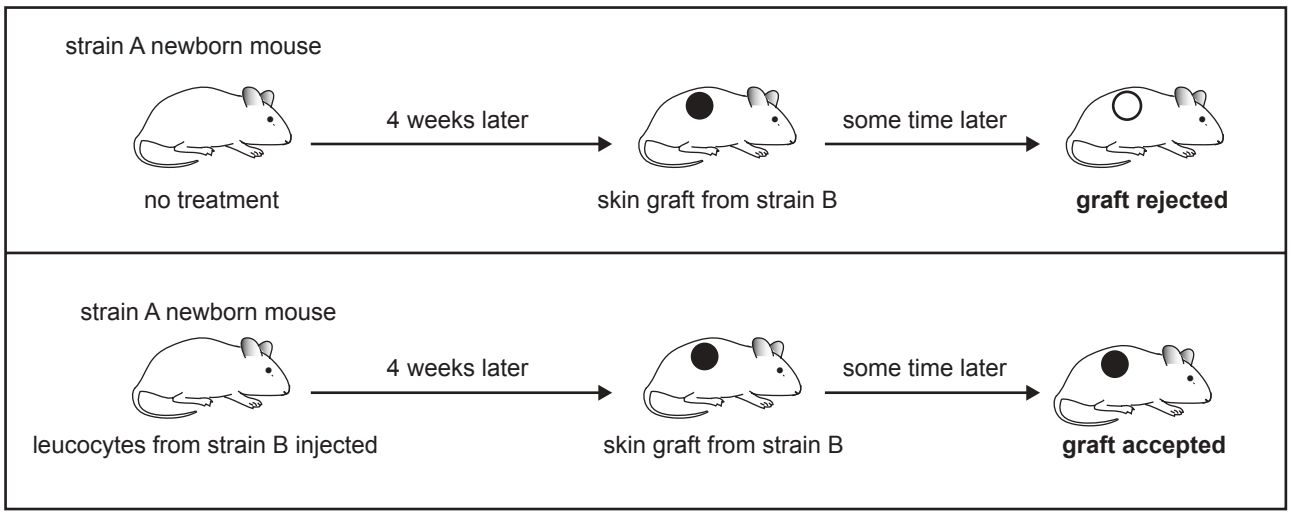
Question 5

A scientist carried out a number of immunity experiments with mice.

First experiment

The scientist took several newborn mice of the same strain A. Half of the mice received no treatment. The rest of the mice each received an injection of leucocytes from a strain B adult mouse. Four weeks later several pieces of skin were taken from strain B mice. A single piece was grafted onto each of the strain A mice. Some time later, the grafts were examined.

The experiment and the results are outlined in the table below.



a. What are two conclusions you can make, with regard to the mouse immune system, from this experiment? Outline the evidence you have for each conclusion.

Conclusion **1** and evidence _____

_____

_____

_____

Conclusion **2** and evidence _____

_____

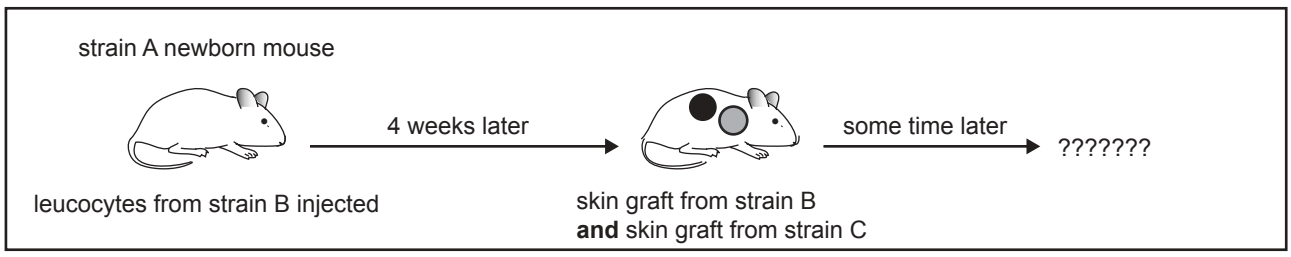
_____

_____

2 marks

Second experiment

Newborn mice of strain A were each injected with leucocytes from strain B mice. Several weeks later, each mouse was given skin grafts from both a strain B mouse and a strain C mouse.



b. Explain what you would expect to happen to the skin graft from strain C.

1 mark

A chemical carcinogen was used to induce a cancerous growth (called a tumour) in a mouse.

c. In what way is apoptosis significant in the formation of a tumour?

1 mark

d. It was suggested that tumour cells from one mouse could be used to vaccinate another mouse against developing the same type of tumour.

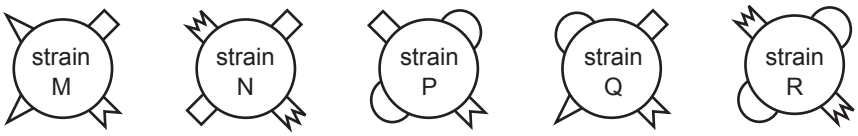
Living tumour cells were removed from an affected mouse. Some of the cells were killed and some were kept alive for several weeks for later use.

Outline an experiment you would perform to test the idea that vaccination against a specific kind of tumour is possible.

2 marks

Antigens exist on cell surfaces.

The following diagrams show the different forms of antigens, and their relative distribution, found on the surfaces of different strains of *Staphylococcus* bacteria.



You wish to make a single vaccine that will be effective against as many strains as possible of the *Staphylococcus* bacteria shown.

e. Which strain would you use to make the vaccine?

_____

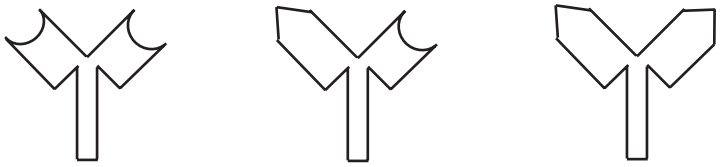
1 mark

f. Against which of the strains would your vaccine be effective?

_____

1 mark

Students were asked to draw an antibody that would be most effective against strain **P**. The following diagrams were presented by three different students.



g. Explain which student has drawn an antibody that would be most effective against strain **P** *Staphylococcus* shown above.

_____

_____

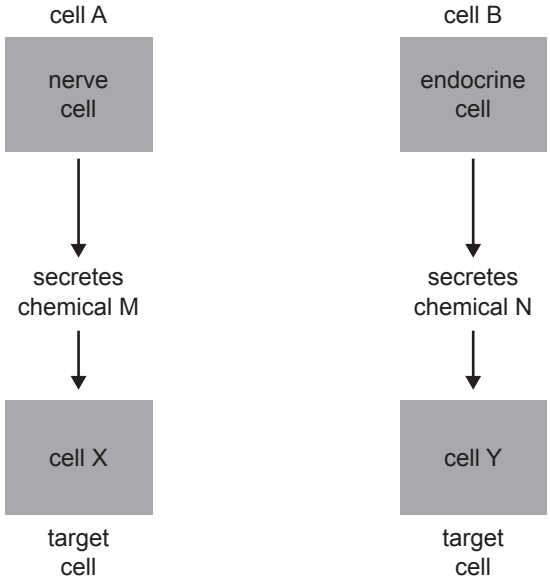
_____

1 mark

Total 9 marks

Question 6

Cell A and cell B represent two types of cells found in complex multicellular animals. Cell A is a nerve cell (neurone). Cell B is an endocrine cell. The diagram below shows how cells A and B interact with other types of cells, cell X and cell Y, in the body.



a. Describe the means by which chemical M reaches cell X.

1 mark

b. Describe the means by which chemical N reaches cell Y.

1 mark

c. **i.** Which system has the quicker response: the nervous system or the endocrine system?

ii. Describe one characteristic of the system you chose in part **c. i.** that is significant in making the difference in response time.

1 + 1 = 2 marks

There are many different types of endocrine cells in complex multicellular animals. Each type of endocrine cell secretes a different chemical.

d. Explain how each type of endocrine cell influences the functioning of only specific cell types within the body.

1 mark

e. A tissue may, over time, lose its response to a particular hormone, even though the hormone concentration remains unchanged.

Based on your understanding of how a hormone controls the functioning of other cells, suggest a reason for this decrease in responsiveness.

1 mark

Total 6 marks

Question 7

Treatment of burns has been improved by the use of 'spray on skin'. Spray on skin consists of a suspension of individual skin cells from the patient that is sprayed directly onto the burnt area. These cells then grow and divide rapidly to produce a continuous layer of skin cells. Spray on skin results in rapid healing of the burnt area.

a. Describe one way in which intact skin contributes to homeostasis.

1 mark

Spray on skin uses the body fluids of the patient as a culture medium for the skin cells.

A continuous layer of skin cells can be produced more rapidly with spray on skin than with another technique in which the patient's skin cells are grown *in vitro* until a sheet of skin cells is formed.

b. Suggest a reason for more rapid cell growth and division with the spray on skin technology.

1 mark

The concentration of glucose in human blood is kept within a narrow 'normal' range. All body cells need a continuous supply of glucose. The uptake of glucose into the muscle cells occurs by facilitated diffusion.

c. Explain how the process of facilitated diffusion enables the uptake of glucose.

2 marks

To prevent the concentration of glucose in the blood falling below the normal range the pancreas releases a hormone.

d. **i.** What is the target organ for this hormone?

ii. How does this hormone cause an increase in blood glucose concentration?

1 + 1 = 2 marks

When the concentration of glucose in the blood rises above the normal range the pancreas releases another hormone. Some humans cannot make enough of this hormone and must have regular injections of this hormone. Different forms of this hormone have been produced by pharmaceutical companies. The table below shows information on three forms of the hormone.

Different forms of the hormone	Onset of action	Peak action	Duration
A	15 minutes	30 to 90 minutes	3 to 5 hours
B	30 minutes	2 to 4 hours	6 to 8 hours
C	4 to 8 hours	12 to 18 hours	24 to 28 hours

e. State one advantage of form C.

1 mark

f. Describe one situation when it would be advantageous to use form A.

1 mark

Total 8 marks

Question 8

A study was carried out comparing camels, cattle and sheep. The average amount of body water the mammals lost per day when the temperature was 42°C was calculated. The results are shown in the table below.

Mammal	Body water lost each day
camel	1–2%
cattle	7–8%
sheep	4–6%

a. Using the information given, explain which animal will survive for the longest time in a hot dry environment.

1 mark

Water can be lost from a mammal due to evaporative cooling.

b. i. Explain how evaporative cooling leads to a reduction in body temperature.

ii. Describe one other way in which a mammal may lose water.

1 + 1 = 2 marks

In another mammalian study, the relative contribution of sweating or panting to evaporative cooling was investigated when the animals were exposed to a hot, dry environment.

c. Describe one advantage to a mammal of panting rather than sweating.

1 mark

d. Mammals that live in hot, dry environments have physiological adaptations that help them to survive. Describe one of these adaptations.

1 mark

Total 5 marks

END OF QUESTION AND ANSWER BOOK