

SUPERVISOR TO ATTACH PROCESSING LABEL HERE

SP-28v

STUDENT NUMBER

Letter

Figures										
Words										



Victorian Certificate of Education
1999

BIOLOGY

Common Assessment Task 1: Written examination

Monday 7 June 1999: 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

<i>Number of questions</i>	<i>Number of questions to be answered</i>
9	9

Directions to students

Materials

Question and answer book of 19 pages.

The task

Please ensure that you write your student number in the space provided on the cover of this book.
Answer all questions.

Write your answers in the spaces provided in this question and answer book.

The marks for each question give you an idea of how much time you should spend, and how much information you should provide. There is a total of 75 marks available for this task.

All responses should be in ink or ball point pen.

All written responses should be in English.

Question 1

Fresh beetroot was cut into rectangular strips of approximately the same size (2 mm × 5 mm × 5 cm). Five strips of beetroot were immersed in each of three different solutions of sucrose, 0.0 M, 0.3 M and 1.5 M sucrose, in petri dishes. Each petri dish was covered and the strips of beetroot examined after 24 hours.

- a. i. Explain why five beetroot strips were used in each concentration of sucrose.

large sample size to ensure results are reliable

1 mark

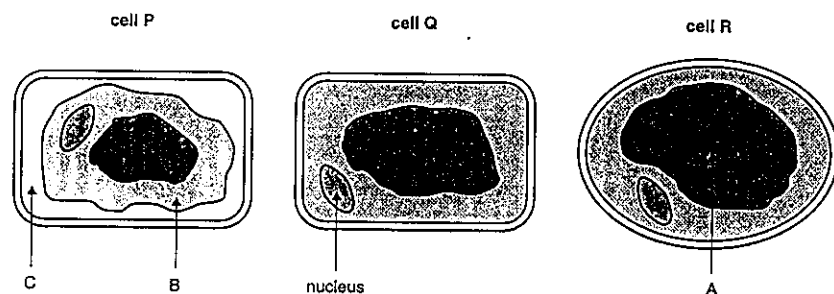
- ii. The petri dishes were covered throughout the experiment. Explain why this procedure was an important part of the experimental design.

to prevent evaporation of water from the solutions

2 marks

Typical cells from each container were examined. A sample cell from each is shown in Figure 1. Cell P was prepared from the beetroot immersed in 1.5 M sucrose solution, cell Q from 0.3 M solution and cell R from the beetroot strips in 0.0 M sucrose solution.

Figure 1



- b. i. Name the structures labelled A and B in Figure 1.

Structure A _____

Structure B _____

2 marks

- ii. What would be found in the region labelled C?

1 mark

- c. Explain what has happened during the process that leads to the increased size of cell R.

Cell R is in a hypotonic solution (0.0 M sucrose), so water enters the cell by osmosis, causing it to swell and become turgid.

2 marks

Total 8 marks

Question 2

Easter eggs with a creamy middle, or filling, are likely to crack. The mould, *Chrysosporium*, has been shown to grow well on the inside surfaces of chocolates, such as Easter eggs, which contain a filling rich in glucose. *Chrysosporium* can grow in conditions with very little oxygen, consuming glucose and producing alcohol. This chemical reaction causes Easter eggs to crack and the creamy filling to ooze out.

- a. i. What name is given to the chemical reaction described above?

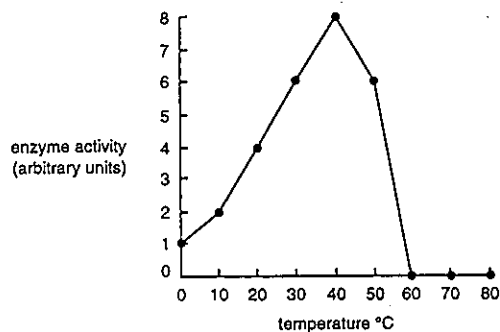
_____ 1 mark

- ii. Of what importance to the mould is the reaction you named in part a.i.?

_____ 1 mark

Mammalian enzyme was added to a series of test tubes containing the same substrate. The test tubes were then placed in a water bath. The activity of the enzyme was measured in each tube for a range of temperatures from 0°C to 80°C. Results were averaged. The graph in Figure 2 shows the effect of temperature on the activity of the mammalian enzyme.

Figure 2



- b. i. Describe what happens to the activity of the enzyme between 50°C and 60°C.

_____ 1 mark

- ii. Between 60°C and 80°C no enzyme activity was observed. Explain what has happened to produce this result.

_____ 1 mark

- iii. Test tubes containing samples tested at 70°C were returned to a water bath at 30°C and tested for enzyme activity. Explain what result you would expect to find when you tested for enzyme activity.

_____ 1 mark

Total 5 marks

Question 3

- a. i. What is meant by positive phototropism?

_____ 1 mark

- ii. Name the hormone responsible for phototropism.

_____ 1 mark

- iii. Explain the action of this hormone in producing a phototropic response. Use labelled diagrams to illustrate your answer.

2 marks

Question 3 – continued
TURN OVER

Marram grass, *Amnophila arenaria*, is a plant that inhabits dry coastal sands. Figures 3 and 4 show cross-sections of marram grass under two different environmental conditions.

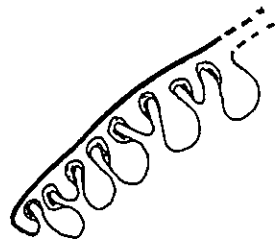


Figure 3

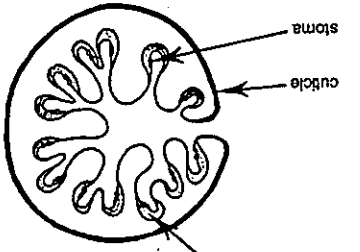


Figure 4

The leaves of marram grass have a number of features which assist its survival in a dry environment.

- b. i. Identify two such features shown in either of Figures 3 or 4.

Feature 1 _____
Feature 2 _____

- ii. For one of the features you have indicated in part b.i., explain how it assists survival of marram grass in a dry environment.

The area between the photosynthetic tissue and the thickened cuticle is mainly filled with woody fibres called sclerenchyma fibres.

- c. Explain a function that these woody fibres may have in the plant.

Total 9 marks

Question 4

- a. Explain the significance of the following behaviours to the survival of the animals involved.



- i. Cape ground squirrels live in southern African deserts. About midmorning they lift their fluffy tails so that they are held above their backs. They hold their tails in this position until late in the afternoon.



- ii. After a leopard kills an animal it keeps the carcass in the fork of a tree.



- iii. In a colony of African meerkats, some of the individuals take a vertical posture at a high point in the colony and may make chattering, whining and barking noises.

- b. From the information given, name the kind of behaviour being shown by the animals involved in each of the following situations.

- i. Harris hawks hunt in groups of two or three to confuse a rabbit until it becomes so tired that it can be attacked and killed.

1 mark

Question 4 – continued

ii. It has been estimated that about 220 million swallows arrive in northern Europe from Africa each spring and leave Europe in autumn to make the return journey.

1 mark

As they search for food, many species of birds stay in flocks, sometimes with members of their own species, though frequently with other species.

c. Outline two reasons why this behaviour is an advantage to the birds involved.

i.

1 mark

ii.

1 mark

Superb Fairy-wrens, *Malurus cyaneus*, sometimes breed in pairs but also breed in larger groups, where some members of the group act as helpers after the young have hatched. The relative success of groups and pairs of Superb Fairy-wrens is given in the following table.

number of nests	32	32
eggs laid	97	96
eggs hatched	76	52
young birds raised	34	24
Pairs	Groups	

d. i. Given that help is not given until after hatching, suggest one reason why more eggs are hatched by the groups.

1 mark

ii. Suggest one reason why it could be an advantage to a mother to have a helper when the young are newly hatched.

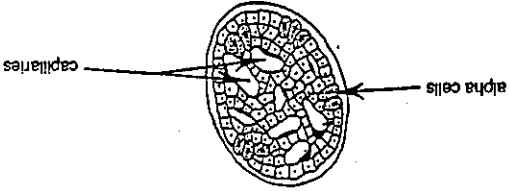
1 mark

Total 9 marks

Question 5

The microscopic structure of the human pancreas was examined by a student. The section of the pancreas seen by the student is shown in Figure 5.

Figure 5



There is a range of hormones produced by the pancreas.

a. Define the term hormone.

1 mark

The hormone produced by the alpha cells of the pancreas increases blood glucose levels.

b. i. Name this hormone.

1 mark

ii. What is the primary target organ for this hormone?

1 mark

iii. Explain how this hormone acts to increase blood glucose levels.

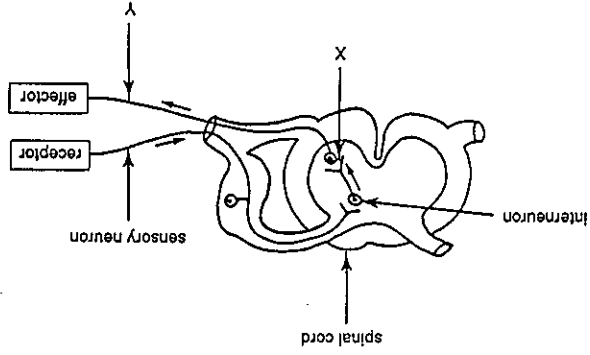
2 marks

c. The student noted many capillaries associated with the alpha cells. Name two functions of these capillaries that relate to alpha cells.

2 marks

Figure 6 illustrates the basic components of all human reflex arcs. The small arrows indicate the direction in which impulses are transmitted.

Figure 6



d. Explain the term receptor.

1 mark

e. i. What is the name of the region labelled X?

1 mark

ii. Describe how the nerve impulse is transferred across region X.

2 marks

Question 5 – continued

f. Name the type of neuron at X.

1 mark

g. Many nerve axons are covered with a whitish, fatty sheath called myelin. What is an important role of this myelin sheath?

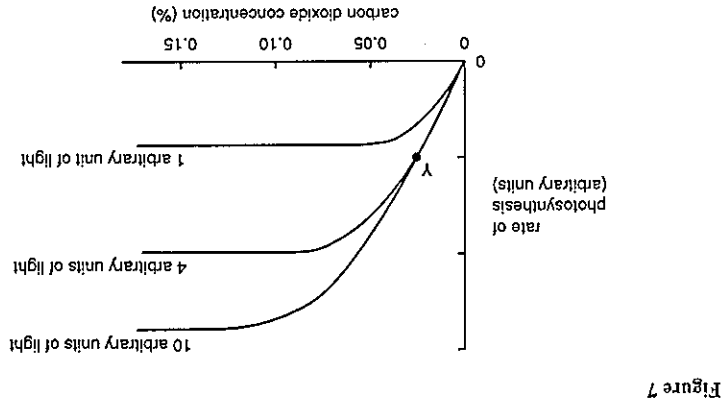
1 mark

Total 13 marks

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TURN OVER

Question 6
Scientists carried out experiments to investigate factors affecting the rate of photosynthesis in fully developed leaves of sugar-beet plants. At a given carbon dioxide concentration, the rate of photosynthesis was measured at three different light intensities (1, 4 and 10 arbitrary units). All other factors were kept constant. The same procedure was repeated at different carbon dioxide concentrations. The results for these experiments are shown in Figure 7.



a. In which organelle does photosynthesis occur?

1 mark

b. Name the process by which carbon dioxide enters the leaf.

1 mark

Consider the results of the experiments.

i. Which light intensity gave the highest rate of photosynthesis at a 0.1% CO_2 concentration?

1 mark

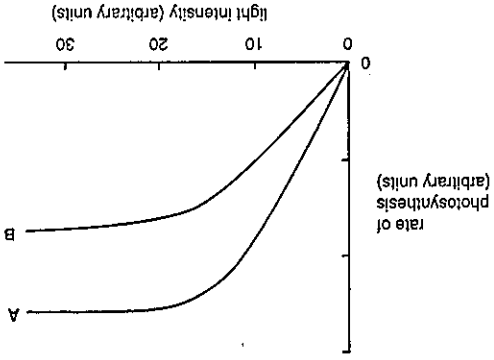
ii. Consider point Y on the graph. What do you notice about the photosynthetic rate for the leaves at light intensities of 4 and 10 arbitrary units? Suggest a reason for your answer.

2 marks

Question 6 – continued

The scientists carried out further experiments. The results are shown in Figure 8.

Figure 8



d. The scientists noted that in one of their experiments many of the leaves were yellow.

i. In which experiment, A or B, would you expect many of the leaves to have been yellow?

ii.

Explain why you made the choice you did in part d.i.

1 mark

2 marks

Total 8 marks

TURN OVER

Question 7

In an investigation of temperature regulation in dogs, observations were made on two groups of dogs kept in the same external temperature of 25°C. Dogs have a body temperature of approximately 38°C. One group of dogs was allowed to rest. They breathed in and out through their noses. Their mouths were closed. The temperature of the exhaled (breathed out) air was about 29°C. The second group of dogs was exercised. These dogs breathed in through their noses and out through open mouths. This is called panting. In this case the exhaled air was about 38°C.

- a. i. Explain how panting cools the internal body temperature of a dog.

2 marks

- ii. Using the above information, which method is more effective for reducing body temperature, exhaling through the nose or mouth?

1 mark

Normally, the thermostat which controls the human body temperature is set at approximately 37°C. Consider a person who feels unwell, is shivering, has pale cold skin and has a body temperature that is not 37°C.

- b. Would you expect the body temperature to be higher or lower than 37°C?

1 mark

- c. Explain why the person is shivering.

2 marks

- d. Why is the skin pale and cold to touch?

1 mark

Total 7 marks

Question 8

- a. i. Explain why the skin is called a first line of defence against infection by microorganisms.

1 mark

- ii. You cut your hand. Name a specific type of cell of the defence system that acts against any invading bacteria within the wound.

1 mark

- iii. Where, in the body, are these cells of the defence system made?

1 mark

- iv. Explain how these cells destroy the invading bacteria.

2 marks

In the Duffy blood-group system, a person can be classified into one of four different types based on the presence of particular proteins on the surface of their red blood cells. The groups are as follows.

group	protein on surface of red blood cells
Duffy 'a'	protein 'a'
Duffy 'b'	protein 'b'
Duffy 'ab'	both 'a' and 'b' proteins
Silent Duffy	neither 'a' nor 'b' protein

When 'a' antibody is added to Duffy 'a' blood, agglutination of the red blood cells occurs.



Two different samples of blood were tested to determine their Duffy group. Each sample was tested with antibody 'a' and antibody 'b'. The results are shown in the table below.

sample	antibody 'a' added	antibody 'b' added	Duffy group
one			
two			

b. What was the Duffy group of each individual? Using the correct terminology, write your answers in the spaces provided in the table.

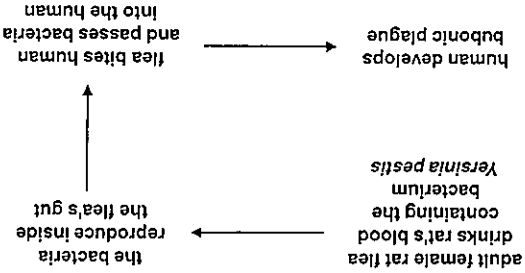
1 mark

Total 6 marks

Question 9

The plague is an infectious disease caused by the bacterium, *Yersinia pestis*. If untreated it is often fatal. Outbreaks of this disease during 14th Century Europe are thought to have caused around 25 million deaths, about 30% of the population at that time. The plague occurs in different forms, including bubonic and pneumonic. The bacterium, *Yersinia pestis*, usually infects rats but it can enter humans causing the bubonic form of the disease as indicated in Figure 9.

Figure 9



a. From the above information, which organism is the pathogen?

1 mark

In the natural history of the plague outlined above, the flea can be regarded as a vector.

i. Explain what is meant by the term vector.

ii. Of what advantage is a vector to a pathogen?

1 mark

1 mark

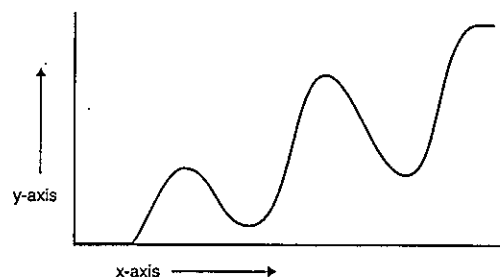
Nowadays, an injectable vaccine for the plague is available for people travelling to or working in high-risk situations. The vaccine contains *Yersinia pestis* bacteria which have been inactivated with the chemical formaldehyde.

c. Why are inactivated bacteria used to produce the vaccine, rather than living bacteria?

1 mark

The primary vaccination is given as a series of three injections. Figure 10 shows an example of the immune response in an individual over the period of the primary vaccination.

Figure 10



- d. i. Give an appropriate label for the x-axis.

1 mark

- ii. Give an appropriate label for the y-axis.

1 mark

The more deadly pneumonic form of the plague can be transmitted by coughing or sneezing from an infected person to an uninfected person. The current vaccine is thought to be of limited use against the pneumonic form. Recently, scientists have been working on developing a nasal spray vaccine against the pneumonic form. The spray includes a surface protein from *Yersinia pestis*. Tests have shown that when treated with the spray, mice developed antibodies which protected them against live inhaled *Yersinia pestis*.

- e. *Yersinia pestis* proteins in the spray cause an active immune response.

- i. What general term is used for substances which cause an active immune response?

1 mark

- ii. Explain what is meant by an active immune response.

1 mark

- f. Explain the role of B lymphocytes in the production of antibodies specifically against *Yersinia pestis* following vaccination with the nasal spray.

2 marks

Total 10 marks