

STUDENT NUMBER

Figures								
Words								

Letter



Victorian Certificate of Education

1998

BIOLOGY

Common Assessment Task 1: Written examination

Tuesday 9 June 1998: 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 21 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.

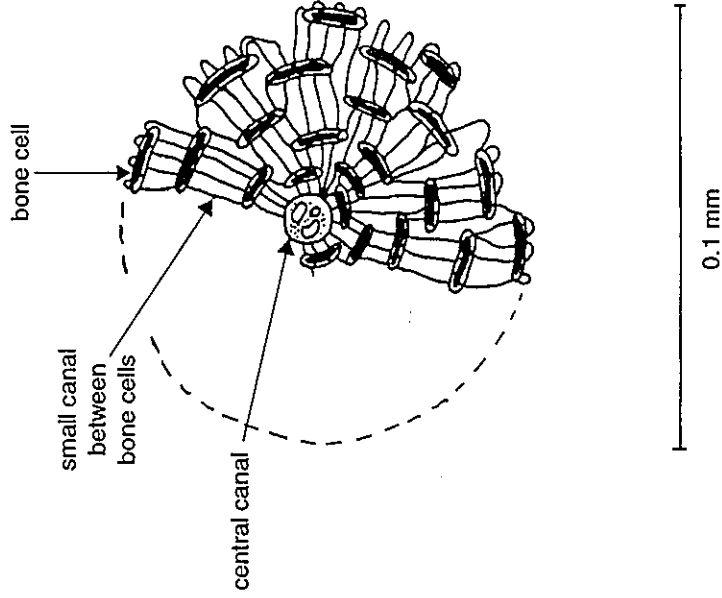
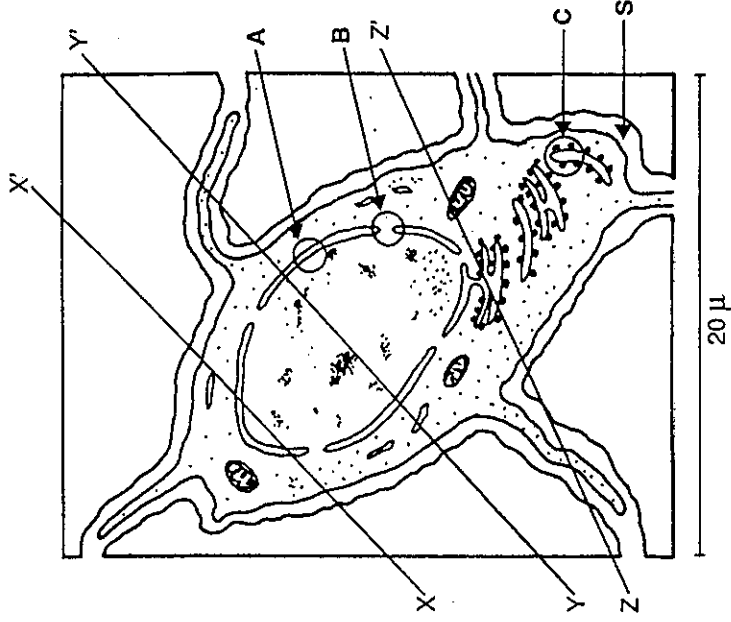
The marks for each question give you an idea of how much time you should spend, and how much information you should provide. There is a total of 75 marks available for this task.

All responses should be in ink or ball point pen.

All written responses should be in English.

Question 1

In some bone tissue, the cells are arranged around a central canal which contains blood capillaries, lymphatics and nerves. These vessels and nerves do not extend beyond the central canal. There is a series of smaller canals linking each bone cell to the central canal. Hard bony substance is found in the areas between the cells and the canals. Figure 1 shows a general cross section of part of bony tissue that includes a central canal. Figure 2 shows a longitudinal section of a bone cell.

Figure 1**Figure 2**

- a. Name the structures within the circles labelled A, B and C.

Structure A _____

Structure B _____

Structure C _____

3 marks

- b. What would be found in the area labelled S?

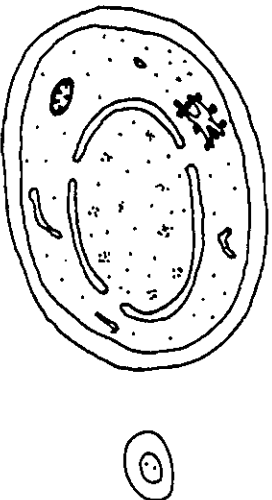
_____ 1 mark

- c. By what process would the bone cells receive nutrients and oxygen from the capillaries in the central canal?

_____ 1 mark

The lines XX', YY' and ZZ' indicate the positions of three transverse sections made through the entire cell shown in Figure 2. Figure 3 shows one of these sections.

Figure 3



- d. Which of the three line cuts would give the section shown in Figure 3?

1 mark

Note the relatively small number of mitochondria in the cell. This is typical of these bone cells.

- e. i. What does this information suggest about the metabolic rate of these bone cells?

1 mark

- ii. What is the name of the metabolic process, occurring in chloroplasts, that converts radiant energy into chemical energy?

1 mark

- iii. Use symbols to write a balanced equation of the metabolic process referred to in e.ii.

2 marks

Mitochondria are organelles found in both plant and animal cells. Chloroplasts are found only in plant cells.

- f.** Name two structures, other than chloroplasts, which could be found in a plant cell but not in an animal cell.

Structure 1 _____

Structure 2 _____

2 marks

Total 12 marks

Question 2

Plant seeds have a special capacity to survive for long periods without germinating. There are records of seeds several thousand years old germinating successfully, although this is extreme. The seeds of many plants require a 'non-growth' period before they will germinate.

- a. What term do biologists use for this 'non-growth' period in plants?

1 mark

- b. Name one structural feature of a seed which would enable it to survive long periods before germination.

1 mark

- c. In what way might the ability of seeds to survive long periods of 'non-growth' assist the survival of a plant species?

1 mark

Once germination starts, the hormone gibberellin stimulates the production of certain enzymes such as amylase.

- d. i. After germination starts, what change would occur in the amount of starch in a barley seed?

1 mark

- ii. What causes this change in the amount of starch present?

1 mark

- iii. What is the importance of this change to the germinating seed?

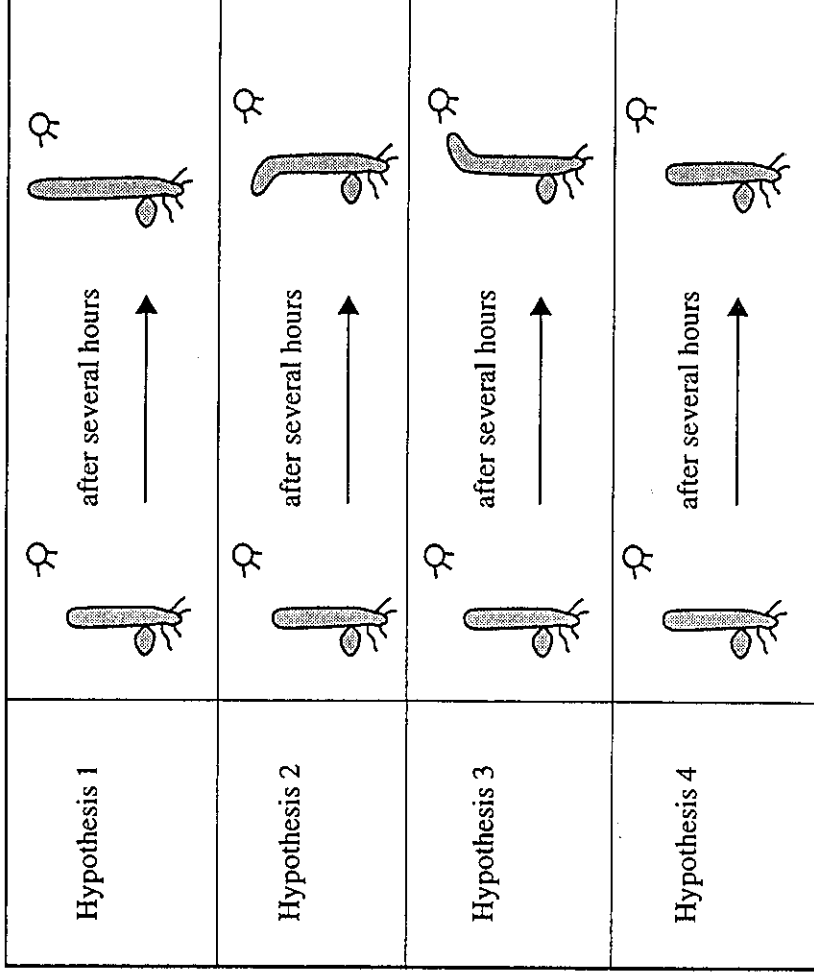
2 marks

Total 7 marks

TURN OVER

Question 3

A student planted oat seedlings and left them to grow in the presence of a light for several hours. The student hypothesised that the oat seedlings would grow in one of four different ways. The different ways suggested are shown in Figure 4.

Figure 4

- a. i. Based on your knowledge of plant responses, which hypothesis (1, 2, 3 or 4) would you support?

Hypothesis _____

1 mark

The student suggested that oat seedlings grow in a particular way in the presence of light for several reasons. The reasons given for the plant growing in a particular way were that the plant hormone involved:

Reason 1: moves toward the light.

Reason 2: stimulates the elongation of cells.

Reason 3: travels in the phloem.

Reason 4: is destroyed by light.

In fact, only one of the above reasons is correct.

- ii. Give the number of the correct reason.

Reason _____

1 mark

Question 3 -- continued

In a cooking program on television, the chef gave the following advice. 'If your mangoes are not ripe enough, leave them for a day or two in a bag of ripe bananas.'

- b. Explain why placing mangoes in a bag of ripe bananas would speed up the ripening of the mangoes.

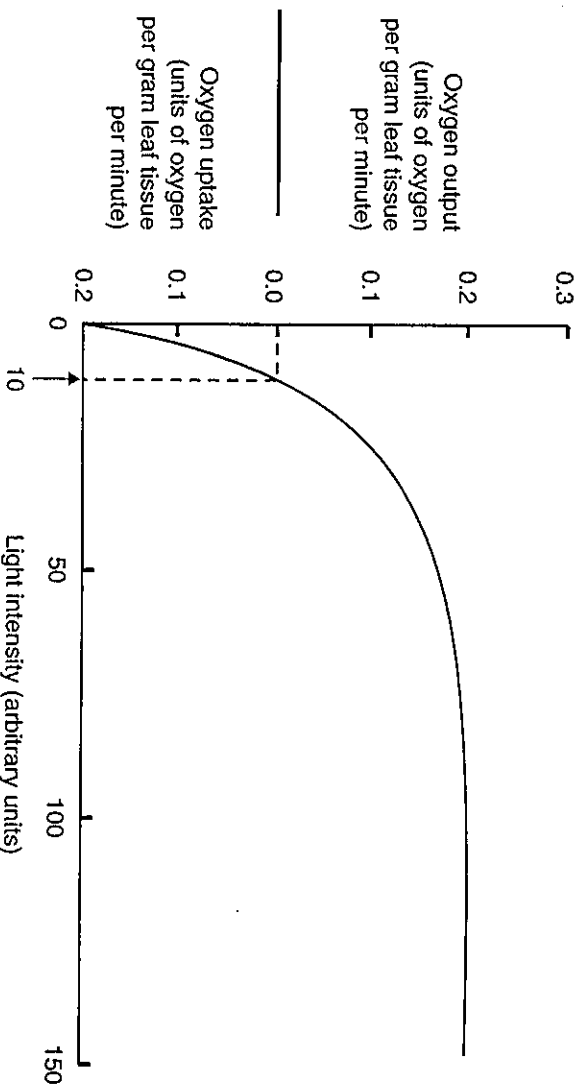
2 marks

Seagrass, *Zostera marina*, the food of dugongs and turtles, is found growing submerged in brightly lit shallow coastal water.

Biologists set up a series of experiments to measure the rate of photosynthesis in seagrass under different light intensities. Individual seagrass plants were grown submerged in normal seawater at different light intensities. All seagrass plants were grown at 15°C.

Figure 5 shows the relationship between light intensity and oxygen uptake or output by the seagrass.

Figure 5



Examine the units used to express oxygen uptake or output in Figure 5.

- c. Why was oxygen uptake or output expressed as units of oxygen per gram leaf tissue per minute and not units of oxygen per plant per minute?

2 marks

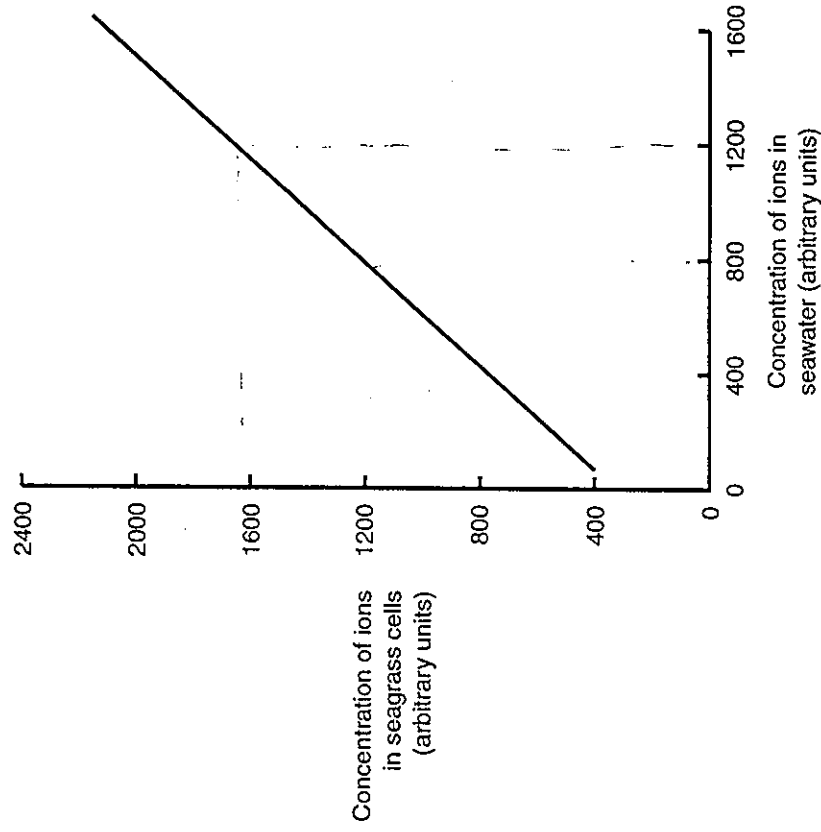
After studying Figure 5, a student claimed that when measurements were taken at a light intensity of 10 units, the rate of respiration in seagrass is equal to the rate of photosynthesis.

- d. Explain whether you agree or disagree with the student.

2 marks

Coastal regions, where large rivers flow into the sea, have seawater in which the salinity is constantly changing with the tides. In another series of experiments, biologists investigated the ion concentration in seagrass cells as the salinity (concentration of ions) of the seawater changed. The results are shown in Figure 6.

Figure 6



- e. Describe the relationship between ion concentration of seawater and ion concentration of seagrass cells as shown in Figure 6.

1 mark

Question 3 – continued

- f. When seawater has an ion concentration of 800 arbitrary units, what is the ion concentration of seagrass cells?

1 mark

- g. Explain whether water will be gained or lost from seagrass cells by osmosis as the salinity of the surrounding seawater increases.

1 mark

Total 11 marks

CONTINUED OVER PAGE

TURN OVER

Question 4

Many behaviours displayed by animals increase their chance of survival.

- a. Explain how each of the following behaviours would increase the chance of survival of the individual animal.

- i. A cheetah leaves scent on a tree by urinating on it, then revisits the tree at regular intervals and repeats the process.

1 mark

- ii. An eastern grey kangaroo shelters in a cave during the summer daytime.

1 mark

- iii. A brown bear hibernates during winter.

1 mark

- iv. A hare (an animal similar to a rabbit) runs from side to side, rather than in a straight line, when being chased by a hawk.

1 mark

- b. A blue-tailed skink increases its chance of survival by dropping off its tail when being attacked by a predator. The tail continues to wriggle after being dropped off by the skink.

- i. Explain how the tail continuing to wriggle after dropping off increases the chance of the skink surviving.

1 mark

- ii. The skink can grow another tail to replace the one that has been lost. While its new tail is growing, the skink is at a considerable disadvantage compared with other skinks. Explain two ways in which the skink would be at a disadvantage.

First way _____

Second way _____

2 marks

Swans have been raised in captivity in America. An attempt has been made to reintroduce these swans to their natural summer habitat in the Arctic. This attempt has focused on teaching young swans to migrate north as winter ends in the northern hemisphere.

Tapes of human voices and ultralight plane engines were played to swans as they developed inside their eggs. Upon hatching, the first moving object the swans saw was the biologist who subsequently piloted the ultralight plane.

- c. i. Name the type of behaviour that the biologist was trying to influence so that the newly hatched swans would follow the plane.

1 mark

In a natural environment, newly hatched swans usually follow their parents.

- ii. How would this behaviour assist the survival of the newly hatched swans in their natural environment?

- iii. Explain one advantage of migration for bird species.

1 mark

1 mark

- iv. State one problem an individual bird may face during migration.

1 mark

Total 11 marks

TURN OVER

Question 5

Pythons are generally large snakes with powerful muscles which they use to squeeze their prey. Female pythons lay eggs which need to be kept within a relatively small temperature range if they are to develop successfully. The females regulate the temperature of their eggs by coiling around them and controlling their own body temperature. If the temperature of a snake drops too low it can generate muscle contractions (shivering) to raise its body temperature. Some female pythons may also leave the eggs for a short period of time in the morning so that they can warm themselves in the sun.

By basking in the sun or shivering, a female python is able to maintain her body temperature within a relatively narrow range.

- a. What specific term is used to describe the maintenance of a body temperature within a narrow range?

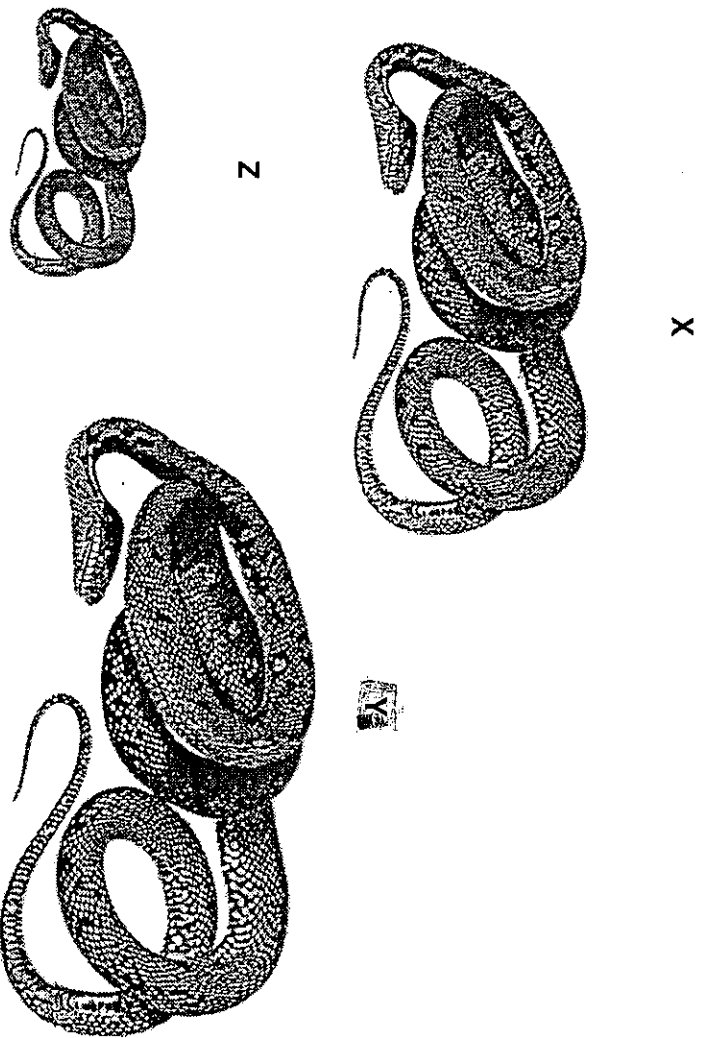
1 mark

- b. How does shivering help to increase a female python's body temperature?

2 marks

- c. Explain which of the snakes, X, Y or Z, in Figure 7 would experience the least drop of body temperature over the same time period in the same cool environment. The three snakes are drawn to the same scale.

Figure 7



Snake _____

Explanation _____

1 mark

Pythons stop shivering if the temperature gets too high. Normal egg development depends on incubation within a narrow range of temperature.

- d. Explain one reason why a normal egg would not develop if its temperature gets too high.

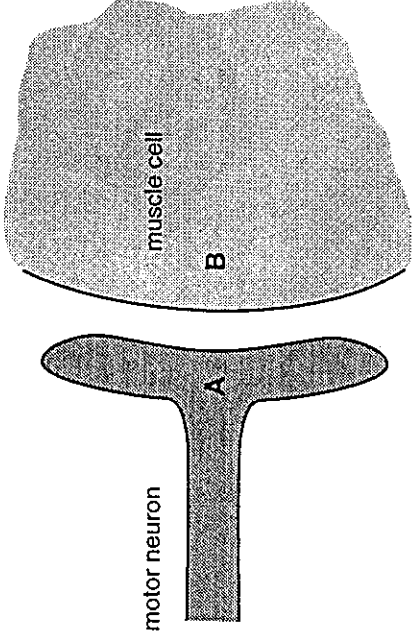
2 marks

Total 6 marks

TURN OVER

Question 6

The venom of the redback spider, *Latrodectus mactans hasselti*, includes components which affect nerve transmission. The main action of the venom, α latrotoxin, occurs at the junction between motor neurons and muscle cells. The venom causes the vesicles that are filled with transmitter substance to empty and remain empty. A diagram of a neuro-muscle junction is shown in Figure 8.

Figure 8

- a. What is the function of this motor neuron?

1 mark

- b. What is the function of the transmitter substance at a neuro-muscle junction?

1 mark

- c. On which side of the neuro-muscle junction, A or B in Figure 8, would you expect the venom, α latrotoxin, to act?

1 mark

- d. Which **one** of the following problems would result from the lack of transmitter substance at a junction between motor neurons and muscle cells?

- | | |
|------------|---------------------------------------|
| Problem 1: | inability to sweat |
| Problem 2: | death of muscle cells |
| Problem 3: | inability of muscle cells to respire |
| Problem 4: | inability of muscle cells to contract |

Problem _____

1 mark

Fortunately, a redback spider bite can be effectively treated using an appropriate antivenom. The antivenom is produced by injecting an animal with redback spider venom. The animal develops factors which counteract the spider venom. These factors are isolated from the animal's blood and used to produce the antivenom for treating humans.

- e. Explain whether the immunity induced in a human by the antivenom is active or passive.

2 marks

- f. Explain whether a person treated with antivenom on one occasion, then bitten again by a redback spider three years later, would still have an immunity against the venom.

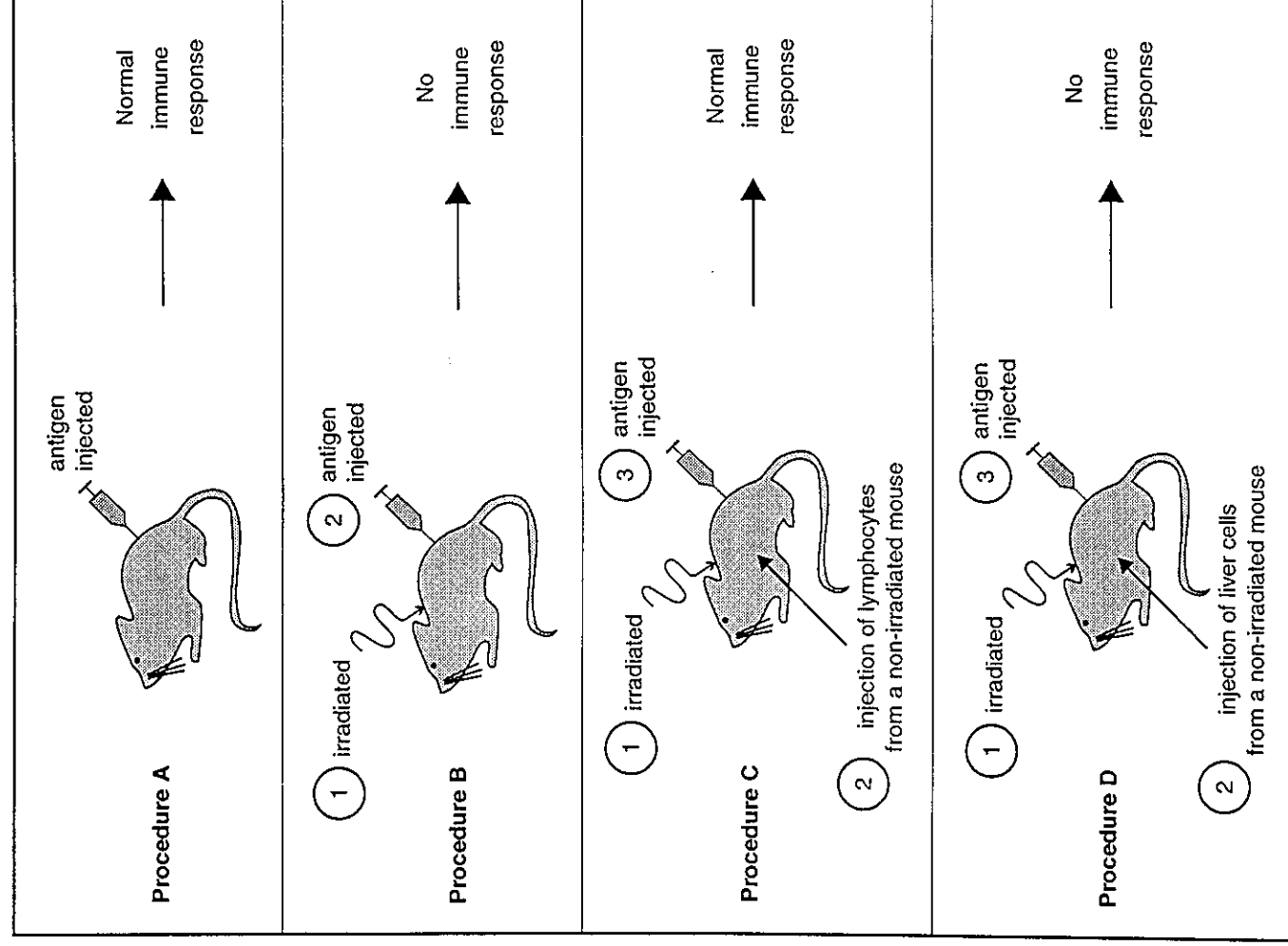
2 marks
Total 8 marks

CONTINUED OVER PAGE

TURN OVER

Question 7

An experiment was carried out to determine which cells recognise and respond to foreign antigens. Mice from the same strain were used in all procedures. The experiment is summarised in Figure 9. The circled numbers indicate the order in which the steps were carried out in each procedure.

Figure 9

- a. i. What is meant by the term 'normal immune response'?

1 mark

Question 7 – continued

- ii. Procedures **A** and **B** were the controls for this experiment. Explain why each procedure was necessary.

Procedure A

Procedure B

2 marks

- b. Explain how this experiment shows that lymphocytes and not liver cells are responsible for recognising and responding to foreign antigens.

2 marks

Total 5 marks

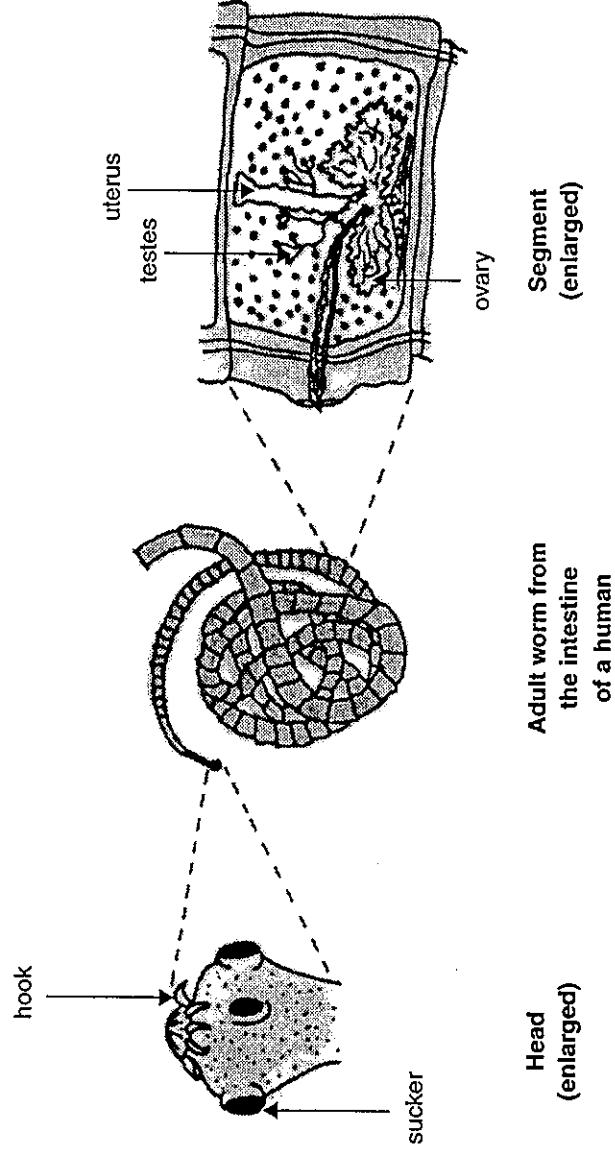
CONTINUED OVER PAGE

TURN OVER

Question 8

Tapeworms are long flat animals. The pork tapeworm, *Taenia solium*, spends its adult stage in the intestine of a human and the larval stage is spent in pigs. The adult tapeworm may be 3–5 metres in length.

Figure 10 illustrates some of the structural features of the adult tapeworm.

Figure 10

- a. Suggest a purpose for the hooks and suckers on the head of the adult tapeworm.

1 mark

There is a thick cuticle covering the outside of the adult tapeworm.

- b. Suggest a reason for the presence of the cuticle.

1 mark

The mature segments of the tapeworm are at the end furthest from its head and are continually being released with faeces. A mature segment may contain 40 000 fertilised eggs. When these eggs are ingested by a pig, embryos hatch and burrow through the wall of the intestine. The embryos are then carried to muscle tissue via the blood. These embryos form cysts. Their development continues in the muscle of the pig. The parasite returns to the human when raw or undercooked pork infected with cysts is eaten.

- c. What is the advantage to the species of having about 40 000 eggs per segment?

1 mark

Medication may be used to remove the adults from the human digestive tract.

- d. Describe another method of controlling the spread of the pork tapeworm and explain why this method would be successful.

2 marks

A parasite of humans which lives on the surface of the scalp is the head louse, *Pediculus humanus capitis*. The adult lice suck blood from the host's scalp. The adult has no wings and a flattened body which allow it to run through the hair close to the scalp. The adult female lays many eggs (about 80–100 in a lifetime) which she attaches to the hair of her host. A nymph hatches from the egg and reaches maturity in two weeks. Nymphs have no wings.

- e. Suggest how head lice are transmitted from one human to another human.

1 mark

The tapeworm and head lice are parasites.

- f. Explain, using the information given, why the tapeworm and head louse are classified as parasites.

2 marks

Total 8 marks

TURN OVER

Question 9

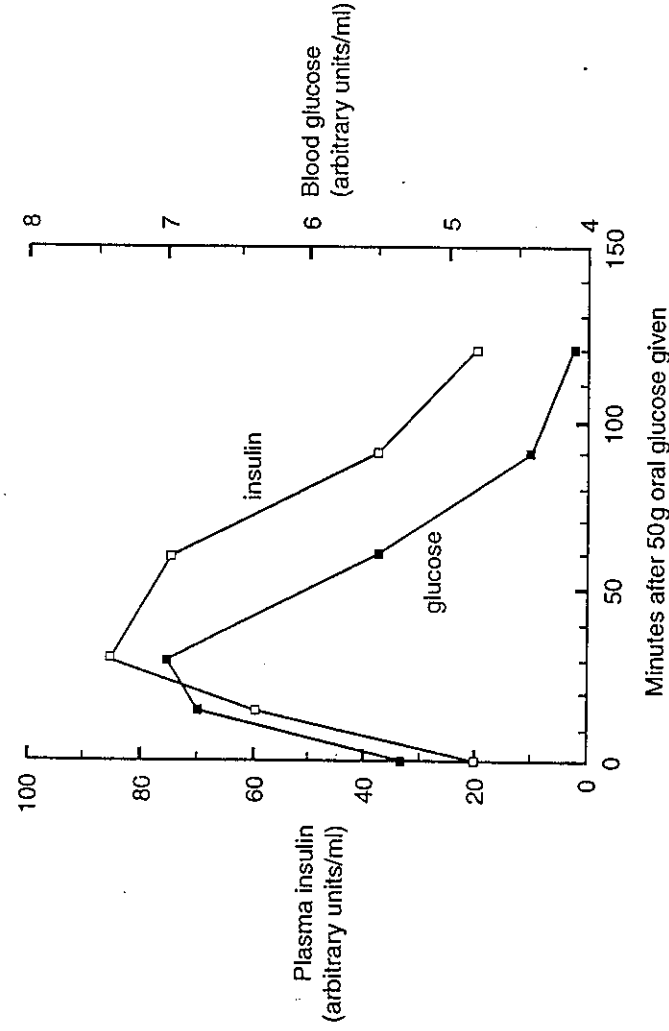
In mammals, the concentration of blood glucose is maintained at a relatively constant level. This process involves negative feedback.

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

1 mark

In an experiment designed to investigate the maintenance of blood glucose levels in humans, 50 gram of glucose was given orally to a number of fasting subjects. The levels of blood glucose and plasma insulin, in each individual, were measured over the next 120 minutes. The results were averaged and then graphed. The results are shown in Figure 11.

Figure 11



- b. Which organ of the body would have produced the insulin?

1 mark

- c. What is the stimulus for the release of the insulin from this organ?

1 mark

Question 9 – continued

Some people suffering from diabetes mellitus do not produce insulin.

- d. i. Would their level of blood glucose after 30 minutes be higher or lower than what is seen on average in the individuals in the experiment (refer to Figure 11)?

1 mark

- ii. Explain your answer to part d.i.

1 mark

- e. i. Name one other hormone which is involved in the maintenance of blood glucose level.

1 mark

- ii. Describe how this hormone acts to change blood glucose levels.

1 mark

Total 7 marks

END OF QUESTION AND ANSWER BOOK

