

Student Number

Exam Choice

2006

TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

Biology

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black or blue pen
- Draw diagrams using pencil
- Approved calculators may be used
- Write your student number in the space provided

Total marks – 100

Section I Pages 2 - 22

75 marks

This section has two parts, Part A and Part B

Part A – 15 marks

- Attempt Questions 1-15
- Allow about 30 minutes for this part

Part B – 60 marks

- Attempt Questions 16-29
- Allow about 1 hour and 45 minutes for this part

Section II Pages 24 - 31

25 marks

- Attempt **ONE** Question from Questions 30-34
- Allow about 45 minutes for this section

Section I
75 marks

Part A – 15 marks
Attempt Questions 1-15
Allow about 30 minutes for this part

Use the multiple-choice answer sheet.

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample: $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9

A ☐ B ☒ C ☐ D ☐

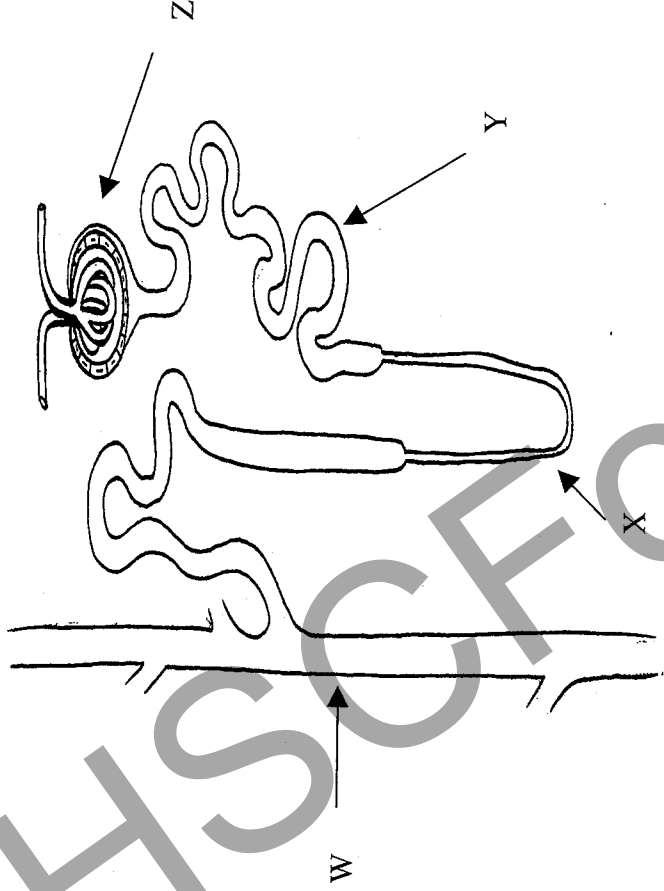
If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ☒ B ☒ C ☐ D ☐

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.

A ☒ B ☒ C ☐ D ☐
correct

1. Identify the part of the nephron in which filtration occurs.

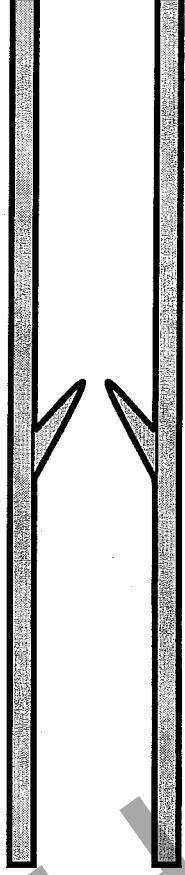


- (A) W
(B) X
(C) Y
(D) Z

2. Sugars are transported around the plant in the phloem. One part of this process is:

- (A) the movement of sugar into the phloem by osmosis.
(B) the evaporation of water from the surface of the mesophyll cells into the air.
(C) the movement of sugar out of the phloem by active transport.
(D) the translocation of sugar through the sieve plate by active transport.

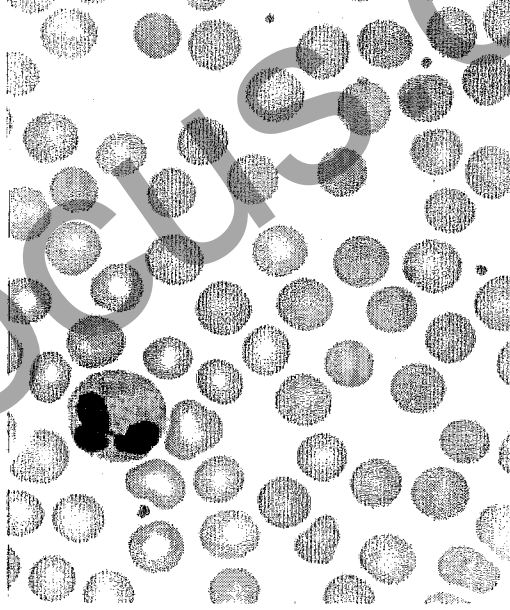
3. The drawing below shows a valve of the type found in the human circulatory system.



In which types of vessel would you find such valves?

- (A) Arteries and veins.
- (B) Capillaries and lymph vessels.
- (C) Veins and lymph vessels.
- (D) Capillaries and arteries.

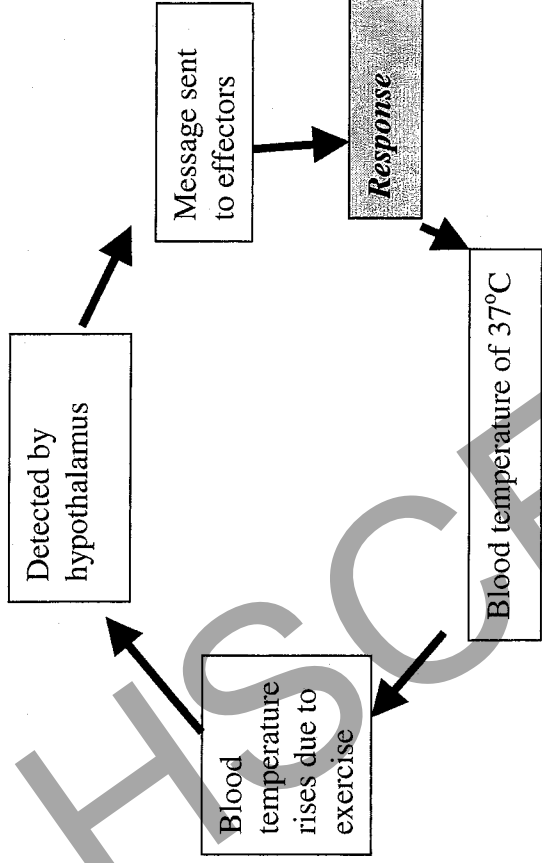
4. The photograph below shows a sample of human blood.



Given that red blood cells have a diameter of about $7\text{ }\mu\text{m}$. Use the photograph to deduce the diameter of a white blood cell.

- (A) $15\text{ }\mu\text{m}$
- (B) $7\text{ }\mu\text{m}$
- (C) $4\text{ }\mu\text{m}$
- (D) $1\text{ }\mu\text{m}$

5. The diagram below summarises the feedback mechanism by which humans regulate blood temperature.



Which one of the following mechanisms could fit in the *Response* box?

- (A) Vasodilation
- (B) Shivering
- (C) 'Goosebumps'
- (D) Vasoconstriction

6. The story of the discovery of the structure of DNA is one which illustrates both the benefits of effective collaboration between scientists, and the negative effects of professional jealousy.

Which one of the four main scientists involved is nowadays considered not to have received due credit for their contribution?

- (A) Watson
- (B) Crick
- (C) Franklin
- (D) Wilkins

7. The photo below shows a fossil of *Peripatus*. This group of invertebrates is represented in the fossil record and in some present day species.



Members of the two families of *Peripatus* - like organisms show a mixture of characteristics typical of the Annelids (segmented worms) and the Arthropods (insects and similar organisms).

Organisms like *Peripatus* are of particular interest to biologists studying evolution because they provide evidence of:

- (A) the evolution of one group from another.
- (B) common ancestry.
- (C) natural selection.
- (D) convergent evolution.

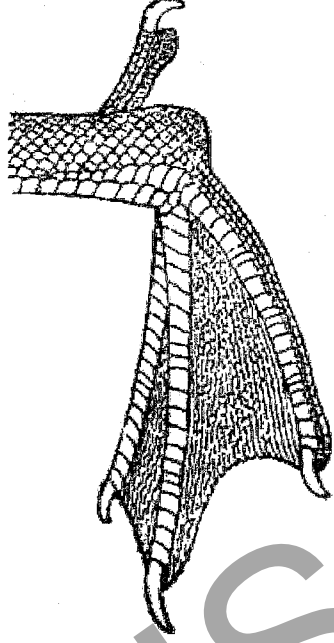
8. Sickle cell anaemia is a disease of the blood, particularly common amongst West Africans. It is genetic in origin.

- People homozygous for the sickling allele are severely anaemic and generally have a reduced life expectancy.
- People homozygous for the normal allele have normal blood and are healthy.
- Heterozygous individuals have a mild version of the disease.

What ratio of offspring might you expect to find in the children of two people with the mild version of the disease?

- (A) 3 sickling : 1 normal.
- (B) 1 sickling : 2 mild sickling : 1 normal.
- (C) all mild sickling.
- (D) 1 sickling : 1 mild sickling.

9. Many species of bird have webbed feet. These are obviously useful for paddling through water.



For many years biologists grouped all birds with webbed feet together and considered them more closely related to each other than to other birds.

In recent years however, techniques such as DNA-DNA hybridization and DNA sequencing have shown that many of the groups of birds with webbed feet are actually more closely related to groups of birds without webbed feet than they are to each other.

The occurrence of webbed feet in birds is an example of:

- (A) adaptive radiation.
 - (B) evidence of common ancestry.
 - (C) divergent evolution.
 - (D) convergent evolution.
10. Artificial pollination, the deliberate, human controlled transfer of pollen from the anther of one specific flower to the stigma of another, is a technique much used by horticulturists.
- Which one of the following is the main reason for its use?
- (A) It allows the production of more vigorous plants since each ovule is fertilized by nuclei from more than one pollen grain.
 - (B) It ensures that all offspring are identical since it is a type of asexual reproduction.
 - (C) It allows for the production of offspring with desirable combinations of traits since the parents are chosen by the horticulturist.
 - (D) It allows for the production of haploid plants since it removes the need for fertilisation.

11. Legionnaires' disease is caused by a bacterial pathogen called *Legionella*.

Legionella is widespread in the environment and tests show that many healthy people are exposed to it and fail to develop the disease.

One group of people who are particularly at risk of dying from Legionnaires' disease are organ transplant patients.

Which one of the following is the best explanation for this?

- (A) Transplanted tissue is always more susceptible to infection.
- (B) Transplant patients cannot take antibiotics as they will attack the transplanted tissue.
- (C) Organ transplant patients take immunosuppressant drugs.
- (D) Pathogens such as *Legionella* are common in hospitals.

12. Analysis of some infected tissue found a pathogen which had distinct nuclei in its cells, a cell wall and a network of thread-like structures which spread out through the cells of its host.

Which type of pathogen is it?

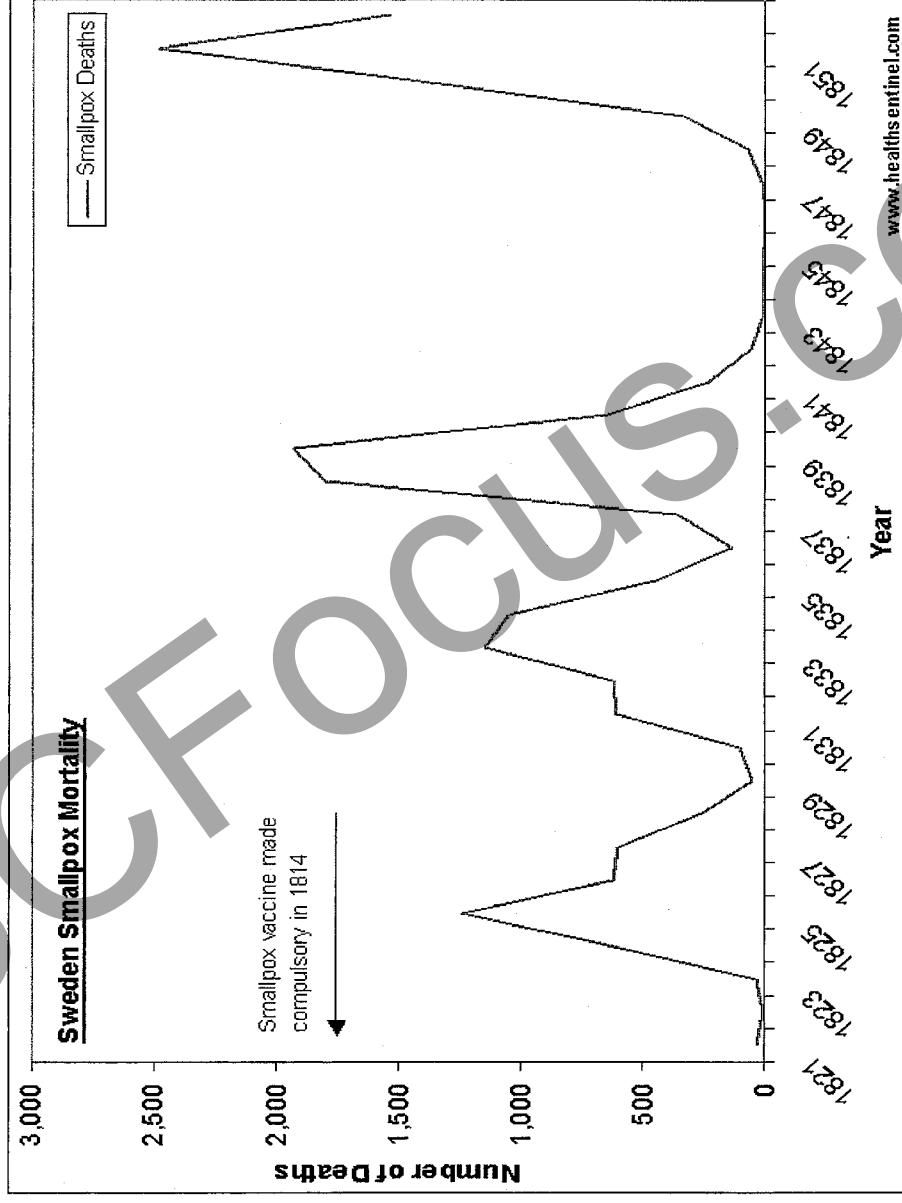
- (A) A fungus.
- (B) A macro-parasitic animal.
- (C) A virus.
- (D) A prion.

13. When a person sustains an injury the damaged cells release histamine. This gives rise to a number of effects, which together are called the inflammation response.

Which type of cell is attracted to the area of the injury?

- (A) Helper T cells.
- (B) Killer (cytotoxic) T cells.
- (C) B cells.
- (D) Phagocytes.

14. Which one of the following is the best description of an antigen?
- (A) An agent which stimulates an immune response.
 - (B) A protein produced by plasma cells to combat pathogens.
 - (C) A chemical which suppresses the inflammation response.
 - (D) A drug used to combat bacterial infection, but ineffective against viruses.
15. The graph below shows the total number of deaths per year from smallpox in Sweden from 1821 to 1852.



Which one of the following inferences can be made from these data?

- (A) The incidence of smallpox in Sweden steadily increased over this period.
- (B) Smallpox in Sweden tended to occur in distinct outbreaks over this period.
- (C) The compulsory vaccination program introduced in 1814 was totally ineffective.
- (D) Swedes were less affected by smallpox than other Europeans during this period.

Section I (continued)

Part B – 60 marks

Attempt Questions 16 – 29

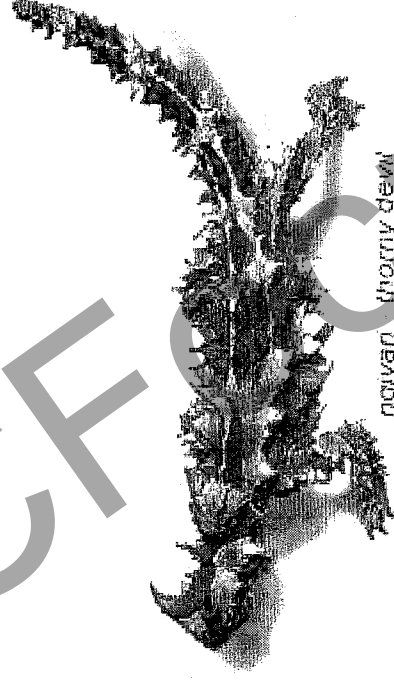
Allow about 1 hour and 45 minutes for this part

Answer the questions in the spaces provided.

Marks

Question 16 (3 marks)

The photograph below shows a Thorny Devil (*Moloch horridus*), a reptile which is found in the dry interior of Australia.

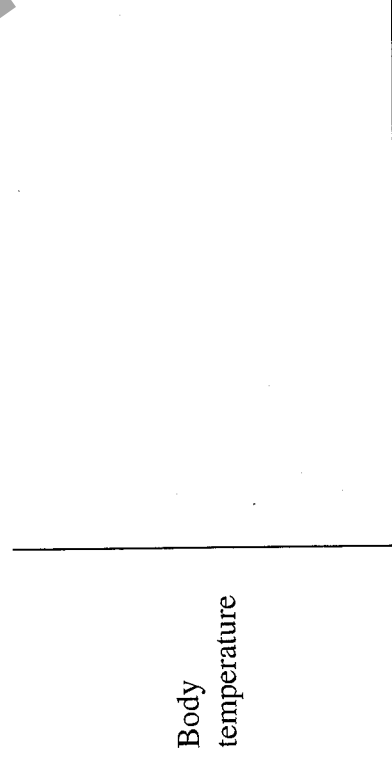


nguyap thorny devil
from <http://www.deh.gov.au>

The Thorny Devil is an ectotherm.

- (a) Using the axes below, sketch a line to show how its body temperature would vary with environmental temperature.

1



Question 16 continues on page 11

Question 16 (continued)

- (b) Outline ways in which an ectotherm such as the Thorny Devil might respond to changes in environmental temperature. 2

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Question 17 (4 marks)

Much of the blood that is donated by blood donors is separated into its different components before use.

- (a) Complete the table below to show two important blood components and a medical use that each is put to. 3

Blood component	Medical use.

- (b) Much research is currently underway into artificial blood. 1
- Propose one advantage of artificial blood over donated blood.

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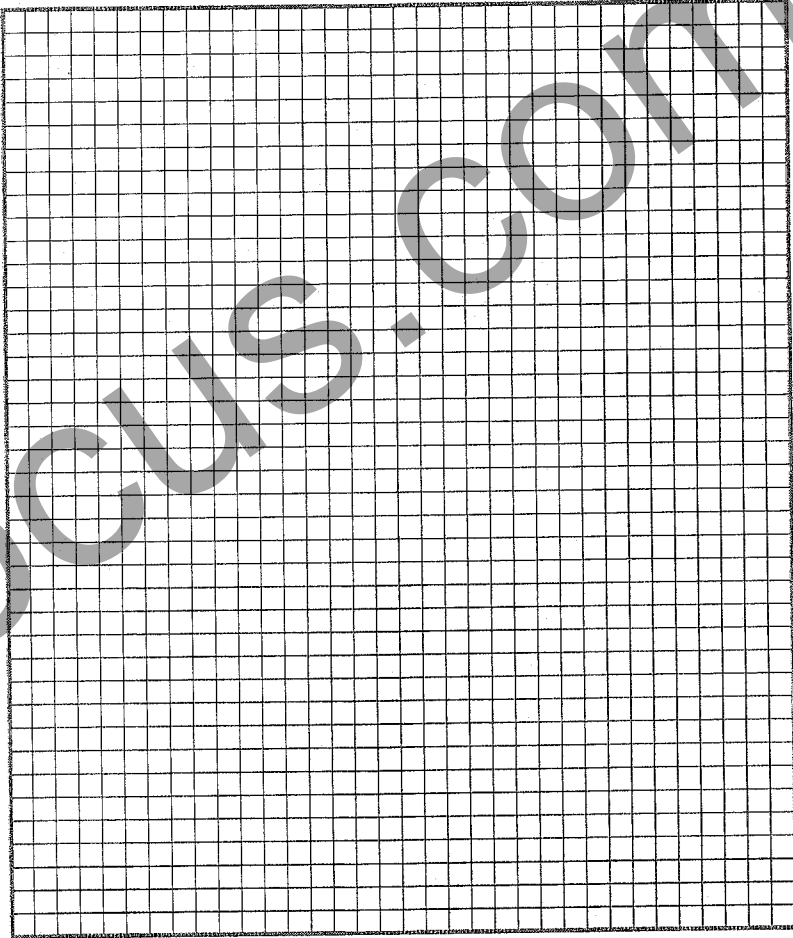
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Question 18 (5 marks)

The data below show the relationship between the average number of cigarettes smoked per day and the incidence of lung cancer for men. (Data extrapolated and simplified from a number of studies)

Average number of cigarettes smoked per day	Incidence of lung cancer (per 100,000 men)
0	8
7	26
12	57
18	90
22	115
27	161
31	231
35	310

- (a) Graph these data on the grid below.



Question 18 continues on page 13

Question 18 (continued)

- (b) Describe the trend observed.

2

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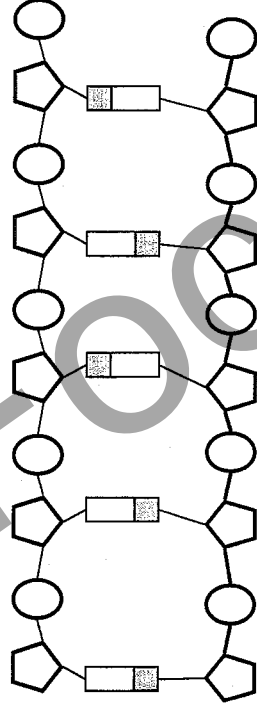
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Question 19 (3 marks)

The drawing below represents a section of DNA.



- (a) Add labels to the drawing to identify a sugar, a phosphate group and a base.

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- (b) Describe what happens during transcription.

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Question 20 (7 marks)

Malaria is probably responsible for more deaths per year than any other infectious disease.

Some authorities estimate that three million people, mostly children under five, die from malaria related causes every year.

- (a) Outline the historical development of our understanding of the causes of malaria. 3

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- (b) The protozoan *Plasmodium*, which causes malaria, is thought to have about 5000 genes. Many of these have very high mutation rates. Explain why this fact has made it very difficult to develop an effective vaccine against malaria. 4

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Question 21 (3 marks)

A biologist performed a cross between two fruit flies, one with normal wings and the other with vestigial, or shrunken wings.

All the offspring of the cross had normal wings, but when two of the flies from the offspring were crossed the results were:

- 93 flies with normal wings
- 29 flies with vestigial wings.

Explain these results using your knowledge of genetics.

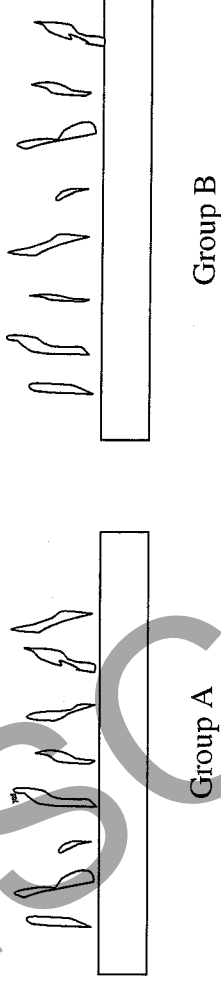
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Question 22 (5 marks)

Marks

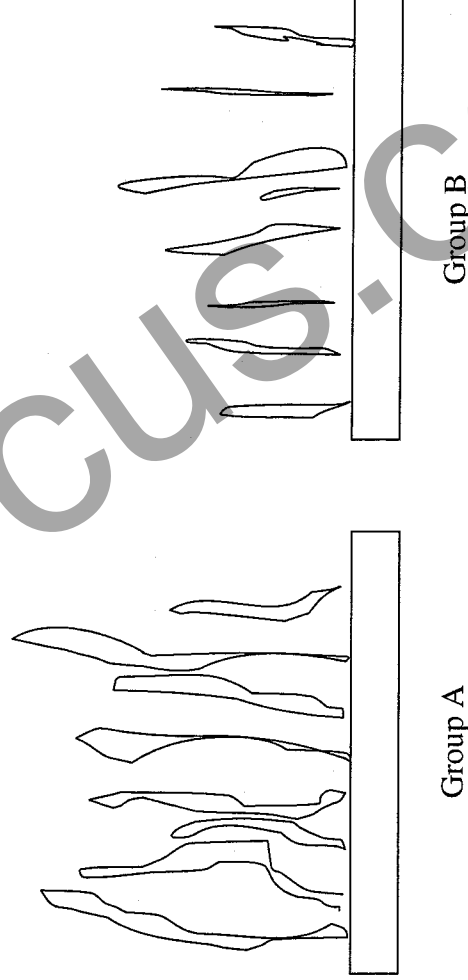
A biologist wished to demonstrate the effect of the environment on the phenotype of a species of plant and set up the following experiment.

She took a group of cuttings from a plant and planted half of them in one tray (Group A) and the others in another tray (Group B).



She recorded the average height of the cuttings in each tray and then watered Group A with water containing a high phosphate fertilizer and group B with normal water.

After a few weeks of this treatment she obtained the following results.



Group A showed a significantly greater increase in height than Group B.

- (a) Which variable was she controlling by using cuttings from the same plant for both groups? 1

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Question 22 continues on page 17

Question 22 (continued)

Marks

(b) Name one other important variable that she would have needed to control. 1

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(c) Explain why it is important to have a large number of cuttings in each group. 1

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(d) The plants from group A were allowed to breed amongst themselves and the seeds were collected. The same was done with group B. 2
The seeds were then all grown together under similar conditions.

How would the plants grown from group A seeds differ from those grown from group B seeds? Justify your answer.

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Question 23 (3 marks)

Speaking recently, Professor John Oxford of London's Queen Mary's School of Medicine, said.

"If everyone washed their hands the risk of colds and flu would be much less."

Discuss this statement.

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Question 25 (4 marks)

Explain how meiosis ensures that all gametes are genetically different.

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Question 26 (3 marks)

All animals need to excrete nitrogenous waste as a product of protein metabolism.

Complete the table below to compare the relative advantages to the animal of producing urea and uric acid as nitrogenous wastes.

3

	Urea	Uric acid
Advantage		
Disadvantage		
Example of animal mainly using this type of waste		

Question 27 (4 marks)

The headline and part of an article about children's health from a popular magazine are printed below.

**KIDS ARE LESS HEALTHY
TODAY THAN WHEN WE WERE
YOUNG!**

We sent our reporters out onto the street to get the facts, and there's no doubt about it, children's health is in crisis.....

2

- (a) Explain why it is difficult to adequately define 'health'.

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2

- (b) Describe how you could assess the reliability of this article.

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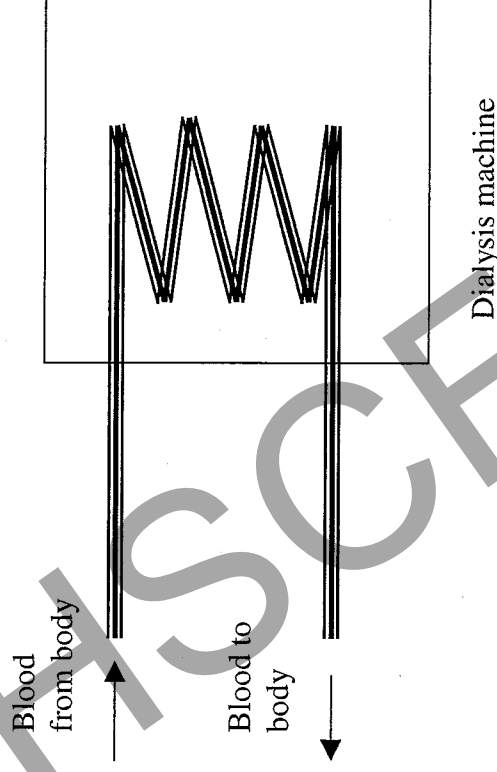
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Question 28 (3 marks)

The drawing below is a very simple representation of a dialysis machine.



- (a) Name the organ of the body whose function the dialysis machine replaces.

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- (b) Compare the composition of the blood flowing into the machine with that of the blood returning from it to the body.

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Question 29 (6 marks)

Marks

Using examples, assess the potential impact of transgenic species on society and the environment.

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Section II

25 marks

Attempt ONE question from Questions 30 - 34

Allow about 45 minutes for this section

Answer in a writing booklet. Extra writing booklets are available.

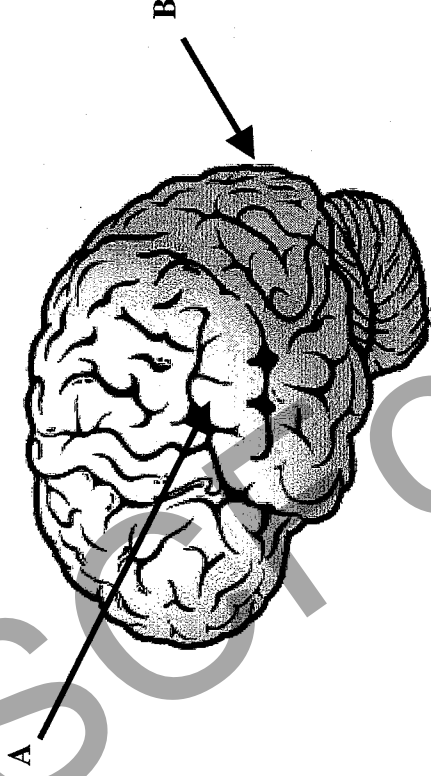
	Pages
Question 30 Communication	25
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Question 33 The Human Story	29 - 30
Question 34 Biochemistry	31

Question 30 --- Communication (25 marks)

Marks

- (a) (i) State the function of the lens in the human eye. **1**
- (ii) Explain how colour vision is achieved in humans. **3**

(b) The diagram below shows the human brain.



- (i) Identify the functions of parts A and B. **2**
- (ii) Discuss the importance of the correct interpretation of sensory signals for the co-ordination of behaviour. **3**
- (iii) Make a labelled drawing of a neurone. **2**
- (c) Evaluate the potential of some named modern technologies to improve eyesight. **7**
- (d) (i) Outline the path of a sound wave from the eardrum to the hair cells in the organ of Corti. **3**
- (ii) Explain how it is possible to distinguish between sounds of different frequencies. **2**
- (iii) Explain how a hearing aid assists hearing. **2**