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| Centre Number | | Candidate Number | |
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General Certificate of Secondary Education
June 2005



**BIOLOGY (MODULAR) SPECIFICATION A
HIGHER TIER**

3413/H

Monday 6 June 2005 1.30 pm to 3.00 pm

H

In addition to this paper you will require:
a ruler.
You may use a calculator.

| For Examiner's Use | | | |
|---------------------|------|--------|------|
| Number | Mark | Number | Mark |
| 1 | | 9 | |
| 2 | | 10 | |
| 3 | | 11 | |
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| Total (Column 1) | → | | |
| Total (Column 2) | → | | |
| TOTAL | | | |
| Examiner's Initials | | | |

Time allowed: 1 hour 30 minutes

Instructions

- Use blue or black ink or ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked.

Information

- The maximum mark for this paper is 90.
- Mark allocations are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

ENVIRONMENT

1 In 1991, the body of a man was found in melting ice in the Alps. The body was over 5000 years old and had been trapped in the ice since the man died.

(a) Explain why the body did **not** decay.

.....
.....

(2 marks)

(b) Scientists suggested that the ice had melted because the earth was getting warmer. Increased amounts of methane and carbon dioxide in the atmosphere may be causing this rise in temperature.

Explain why the amounts of methane and carbon dioxide are increasing.

(i) Methane

.....
.....

(1 mark)

(ii) Carbon dioxide

.....
.....

(1 mark)

(c) In some parts of the world the amount of sulphur dioxide gas has also increased.

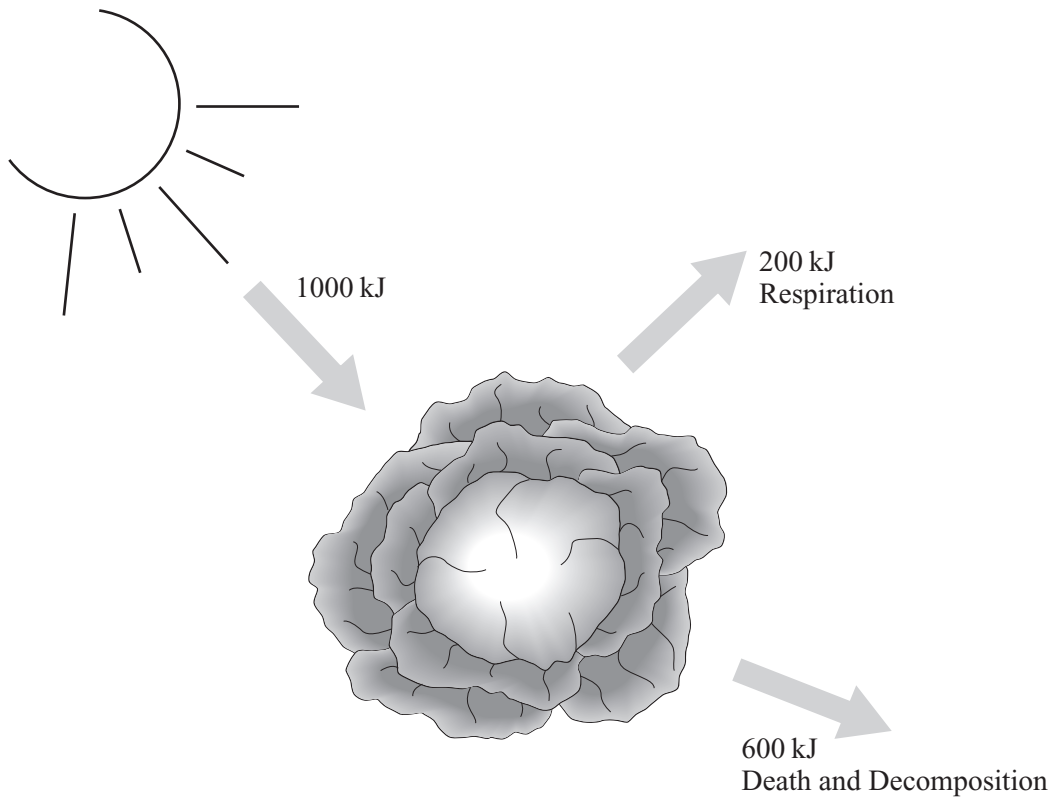
How does sulphur dioxide affect the environment?

.....
.....

(1 mark)

5

2 The diagram shows some of the energy transfers in a lettuce plant.



(a) What percentage of the energy absorbed by the lettuce is available to the humans who eat it?
Show your working.

.....

.....

.....

.....

..... %
(2 marks)

(b) Explain why humans do **not** use all of this energy in growth.

.....

.....

.....

(2 marks)

(c) Describe **two** ways in which hormones can be used when producing food from plants.

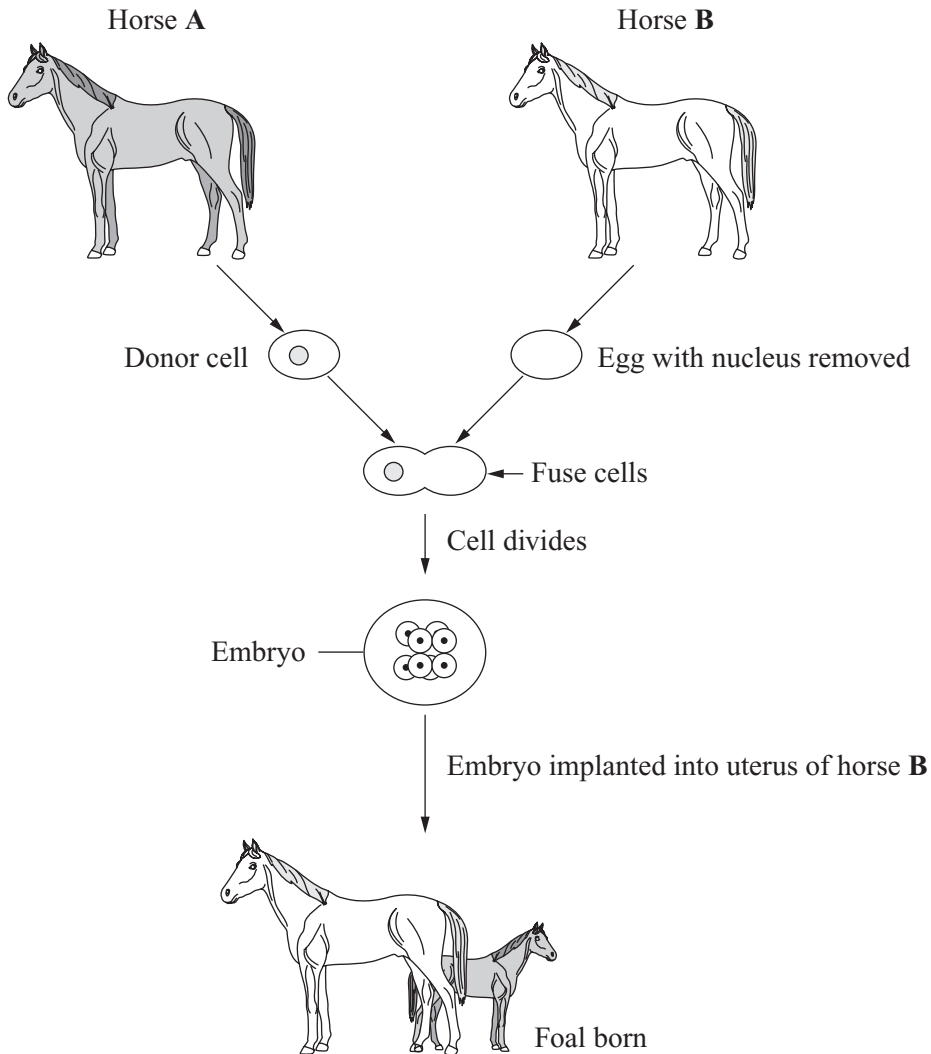
1

2

(2 marks)
Turn over ▶

INHERITANCE AND SELECTION

3 The diagram shows how embryo transfer can be used in horse breeding.



(a) Explain why the foal has the same characteristics as horse A.

.....

.....

.....

(2 marks)

(b) This method of breeding horses decreases the number of alleles in the horse population. Explain why this might be a disadvantage.

.....

.....

.....

(2 marks)

4 A species of bacteria cannot grow when an antibiotic is in the culture medium. A scientist exposed some of these bacteria to ionising radiation. She then transferred them to a culture medium containing the antibiotic. Some of the bacteria were now able to grow and reproduce.

(a) Describe the effect of ionising radiation on these bacteria.

.....
.....

(1 mark)

(b) Many people with bacterial infections are treated with antibiotics such as penicillin. However, an increasing number of species of bacteria are becoming resistant to commonly used antibiotics.

Describe how the over-use of antibiotics can result in the evolution of resistant bacteria.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

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(4 marks)



TURN OVER FOR THE NEXT QUESTION

Turn over ►

BIOLOGY IN ACTION

- 5 In the nineteenth century, diphtheria was a common disease in children. It is caused by bacteria that infect the throat. The bacteria produce a toxin (poison) that can cause death. When an infected person coughs, the bacteria can be passed on.

Table 1: Information about diphtheria in a town in Britain.

| Year | Number of people with diphtheria | Number of deaths from diphtheria |
|------|----------------------------------|----------------------------------|
| 1860 | 2100 | 252 |
| 1910 | 1840 | 105 |
| 1940 | 1800 | 45 |
| 1970 | 2 | 0 |

- (a) In 1860, 88% of people with diphtheria recovered.

Calculate the recovery rate in 1940. Show your working.

.....

.....

.....

.....

.....%
(2 marks)

(b) **Table 2: Information about the treatment of diphtheria in Britain.**

| Year | Information |
|--------------|--|
| 1883 | Bacteria that cause diphtheria were identified |
| 1900–1950 | Infected people were isolated in special hospitals |
| 1921 | Antitoxin against diphtheria becomes widely used |
| 1942 onwards | Increased use of antibiotics |
| 1941 onwards | Diphtheria vaccinations widely available |

- (i) Use the information given in **Table 2** to explain why the death rate changed between 1860 and 1940.

.....

.....

.....

.....

(2 marks)

- (ii) By 1950, most isolation hospitals had closed.

Explain why these hospitals were no longer needed.

.....

.....

.....

.....

(3 marks)

7

TURN OVER FOR THE NEXT QUESTION

Turn over ►

6 Kidney disease may be treated using dialysis. A kidney transplant may be carried out as an alternative to dialysis.

What are the advantages and disadvantages of a kidney transplant to a patient with kidney disease?

Advantages:

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Disadvantages:

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(5 marks)

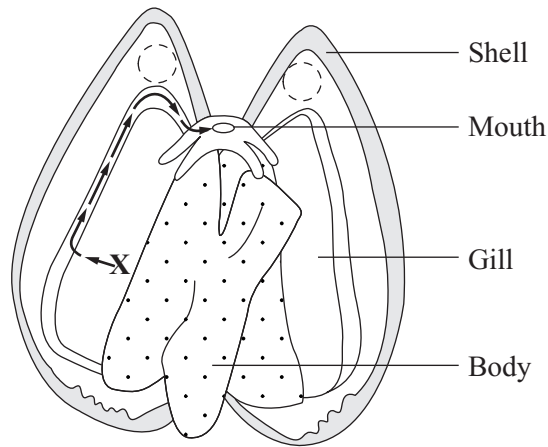
5

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

7 (a) What does a mussel usually feed on?

..... (1 mark)

(b) A group of students investigated feeding in mussels. They put some coloured starch grains on the gill at X and watched their movement. The results are shown in the diagram.



(i) Explain how the starch grains moved across the gill.

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.....

(2 marks)

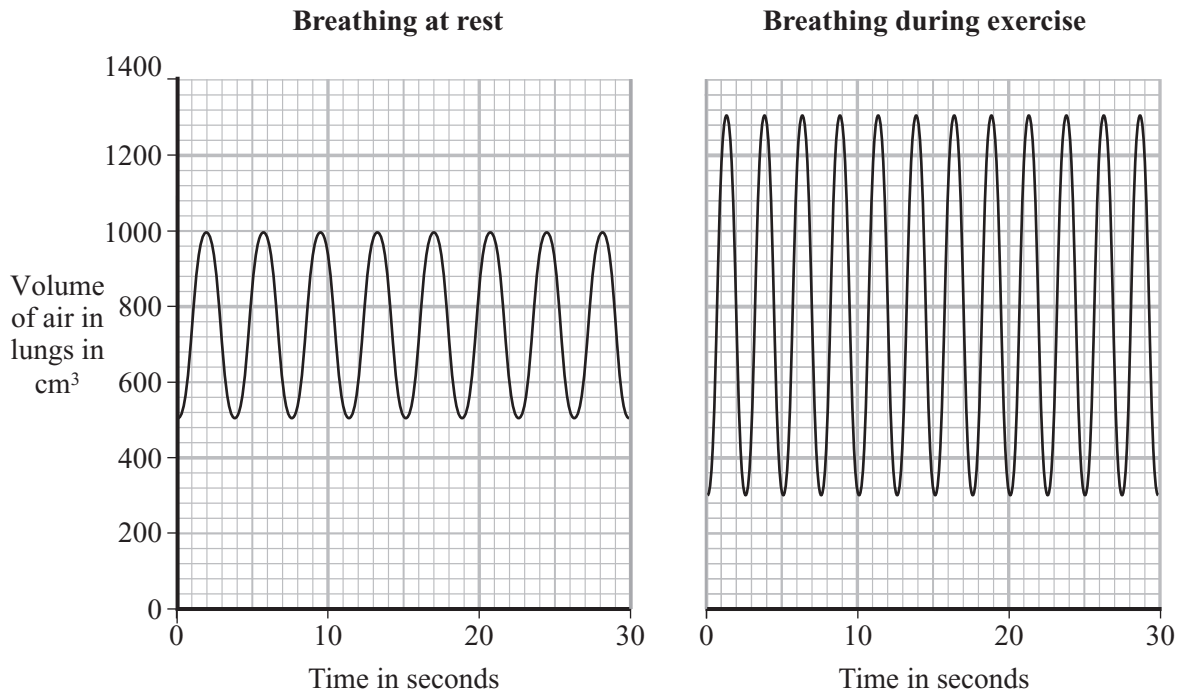
(ii) The students repeated the experiment at a lower temperature. They saw that the starch grains moved more slowly.

Explain why the starch grains moved more slowly when the temperature was lower.

.....
.....
.....
.....

(2 marks)

8 The graphs show the effect of exercise on breathing.



(a) How does exercise affect breathing?

.....

.....

(2 marks)

(b) Explain why exercise affects breathing in this way.

.....

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.....

.....

(2 marks)

(c) Calculate the breathing rate during exercise. Show your working.

.....

.....

.....

Breathing rate = breaths per minute
(2 marks)

$\frac{\quad}{6}$

TURN OVER FOR THE NEXT QUESTION

Turn over ►

ENVIRONMENT

9 (a) Why do farmers use fertiliser containing nitrate on their fields?

.....
.....
.....

(2 marks)

(b) Read the information in the box.

Fish die in Mill Pond

The fishing club has blamed local farmers for the death of fish in Mill Pond. A fisherman said that after the heavy rain of the last few months the pond had turned green. A week later there were dead fish floating in the pond. He thought that the cause of the problem was the fertiliser used on the wheat field next to the pond.

Explain how the fertiliser that was spread on the field could have caused the death of the fish in the pond.

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.....

(6 marks)

- (c) Most of the nitrogen from the fertiliser ends up in the protein of the decaying material on the bottom of the pond.

Explain how microbes can convert this nitrogen into nitrate.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

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.....

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(4 marks)

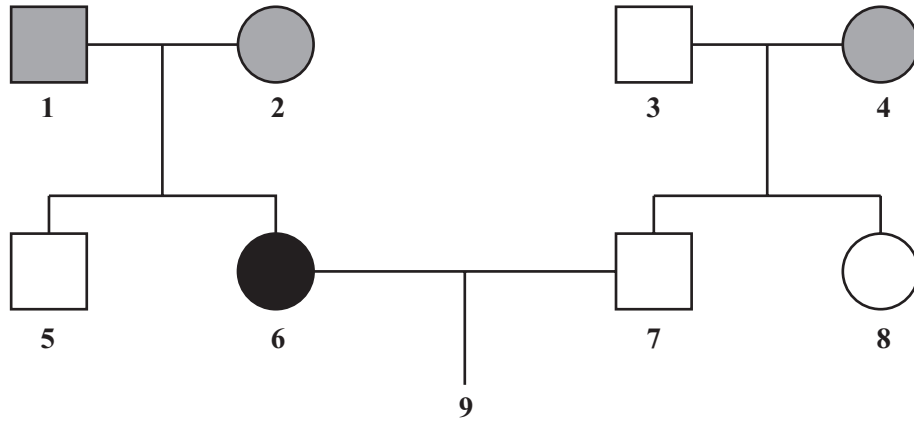
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TURN OVER FOR THE NEXT QUESTION

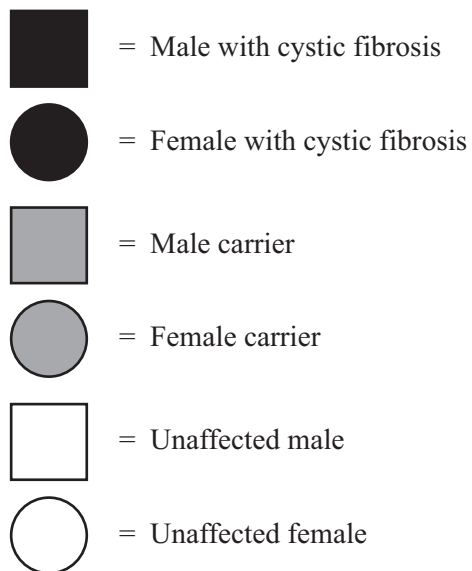
Turn over ►

INHERITANCE AND SELECTION

10 The diagram shows the inheritance of cystic fibrosis in two families.



Key:



(a) How many people in these families will show symptoms of cystic fibrosis?

.....
(1 mark)

- (b) (i) Person 6 is having her first child (9). Person 7 is the father.

Draw a genetic diagram to show whether this child will have cystic fibrosis.

Use the following symbols. A = unaffected allele
 a = cystic fibrosis allele

Person 6 × **Person 7**

(3 marks)

- (ii) Give the probability that this child will have cystic fibrosis.

.....
(1 mark)

- (c) Explain why people with cystic fibrosis produce an abnormal protein in their cell membranes.

.....

(3 marks)

11 (a) Name the **two** female reproductive hormones produced by the pituitary gland in the brain.

1

2

(2 marks)

(b) The contraceptive patch releases hormones, including oestrogen, through the skin during the monthly cycle.

Explain how the use of a contraceptive patch will prevent pregnancy.

.....

.....

.....

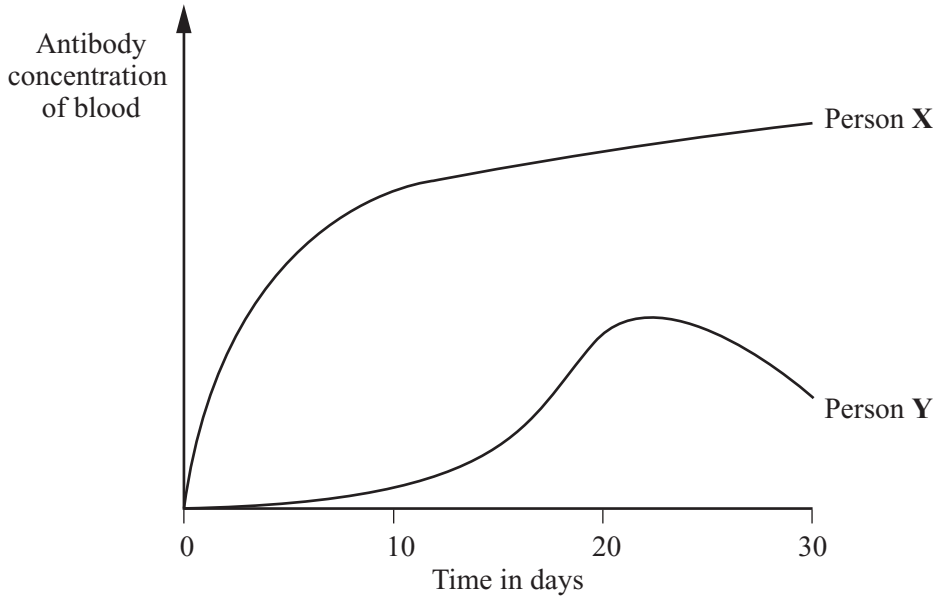
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(2 marks)

4

BIOLOGY IN ACTION

12 Two people, X and Y, were injected with the same antigen. The graph shows the changes in antibody concentration in their blood.



(a) Describe the difference in the responses of Person X and Person Y to the injection of antigen.

.....
.....
.....

(2 marks)

(b) Suggest why Person X and Person Y showed different responses to the antigen.

Explain your answer.

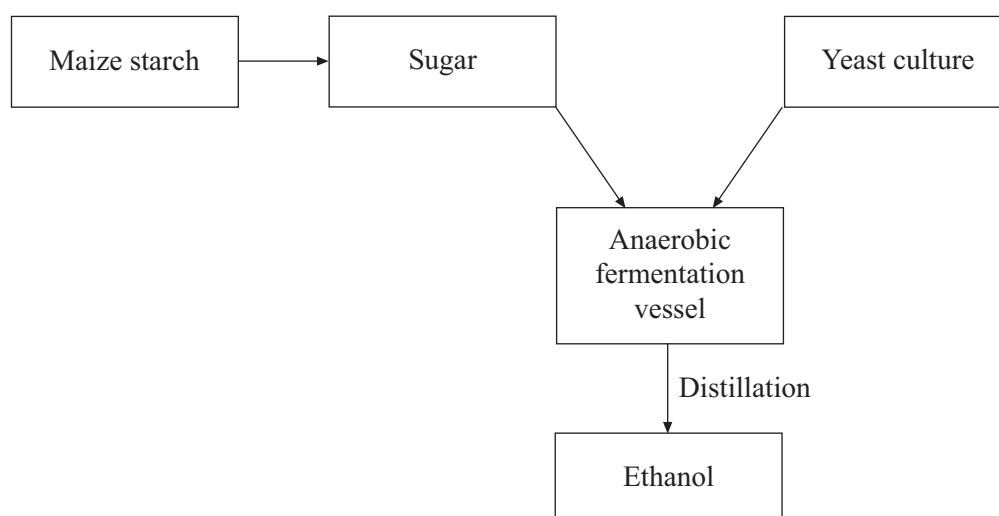
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(3 marks)

5

Turn over ►

13 The diagram shows some stages of an industrial process for making ethanol from maize starch.



(a) Name the type of enzyme used to obtain sugar from maize starch.

.....
(1 mark)

(b) Explain why it is important to maintain anaerobic conditions in the fermenter.

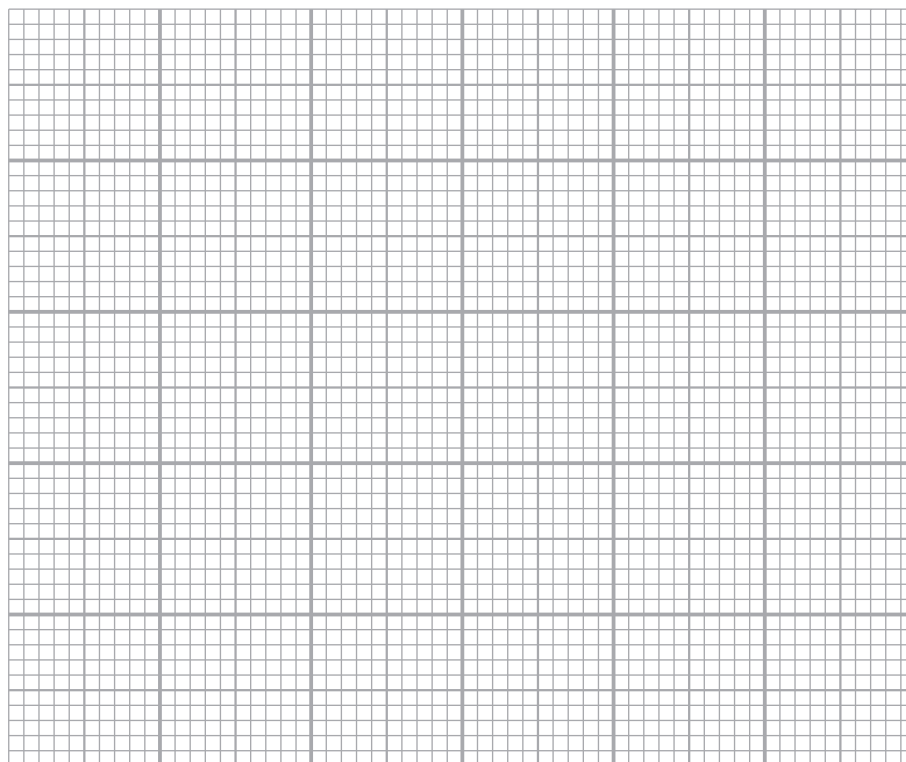
.....
(1 mark)

(c) The table shows how the concentration of ethanol increases during fermentation.

Draw a graph of these data on the graph paper opposite.

| | | | | | | |
|---|-----|-----|-----|-----|-----|-----|
| Time in hours | 5 | 10 | 15 | 20 | 25 | 30 |
| Percentage of ethanol in the fermentation vessel | 0.5 | 2.0 | 3.8 | 7.6 | 8.6 | 9.0 |

Percentage of
ethanol



Time in hours

(3 marks)

- (d) Suggest a use for the ethanol made by this method.

.....
(1 mark)

- (e) Explain why it is necessary to distil the products of fermentation.

.....
.....
(1 mark)

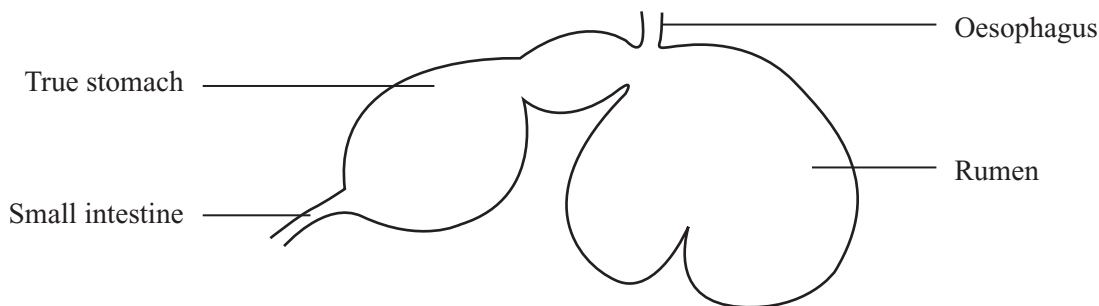
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TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

- 14 A cow eats a large amount of cellulose in its diet. The diagram shows the structure of part of a cow's digestive system. The rumen is an additional chamber, which contains a large number of mutualistic bacteria.



- (a) Explain why the diet of a cow contains a high proportion of cellulose.
-
-
- (2 marks)*

- (b) Describe how the cow benefits from having bacteria living in its rumen.
-
-
-
-
- (3 marks)*

- (c) In what way do the bacteria benefit from living in the cow's rumen?
-
-
- (1 mark)*

- (d) Other herbivores have mutualistic bacteria living in their digestive systems. In the rabbit, the bacteria are found in the caecum, an organ between the small intestine and the large intestine.
- Explain why it is an advantage to the cow to have the mutualistic bacteria in its rumen rather than in its caecum.
-
-
- (1 mark)*

15 One effect of drinking too much alcohol is dehydration. The body becomes short of water because alcohol inhibits ADH production.

(a) Which organ of the body produces ADH?

.....
(1 mark)

(b) Explain why drinking too much alcohol can result in the body being short of water.

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(3 marks)

END OF QUESTIONS

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