

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

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General Certificate of Secondary Education
June 2003



**BIOLOGY A (MODULAR)
HIGHER TIER**

3413/H

H

Monday 2 June 2003 1.30 pm to 3.00 pm

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	
4		12	
5		13	
6		14	
7		15	
8		16	
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** the 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.

INHERITANCE AND SELECTION

- 1 (a) (i) What is a mutation?

.....
(1 mark)

- (ii) Name **one** environmental factor that could increase the chance of a mutation occurring.

.....
(1 mark)

- (b) Mutations in the body cells may result in cancer.
The protein interferon is a drug used to treat some types of cancer.

Describe how bacterial cells can be used in genetic engineering to produce interferon.

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(4 marks)

- 2 Hormones can be given to a woman to prevent her having children.

- (a) Name **two** parts of her body that produce reproductive hormones.

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.....
(2 marks)

- (b) Women may take hormones as a contraceptive.

- (i) How can hormones be used to stop a woman becoming pregnant?

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

- (ii) Give **one** disadvantage of using hormones as a contraceptive.

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

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6

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4

ENVIRONMENT

3

Diagram of an Emperor Penguin and a Galapagos Penguin – not reproduced here, due to third-party copyright constraints.

The Galapagos Penguin lives and breeds near the equator. The Emperor Penguin breeds in Antarctica in the winter.

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.

Use the information in the diagram, and your own knowledge, to suggest how the Emperor Penguin is adapted to survive the icy winters.

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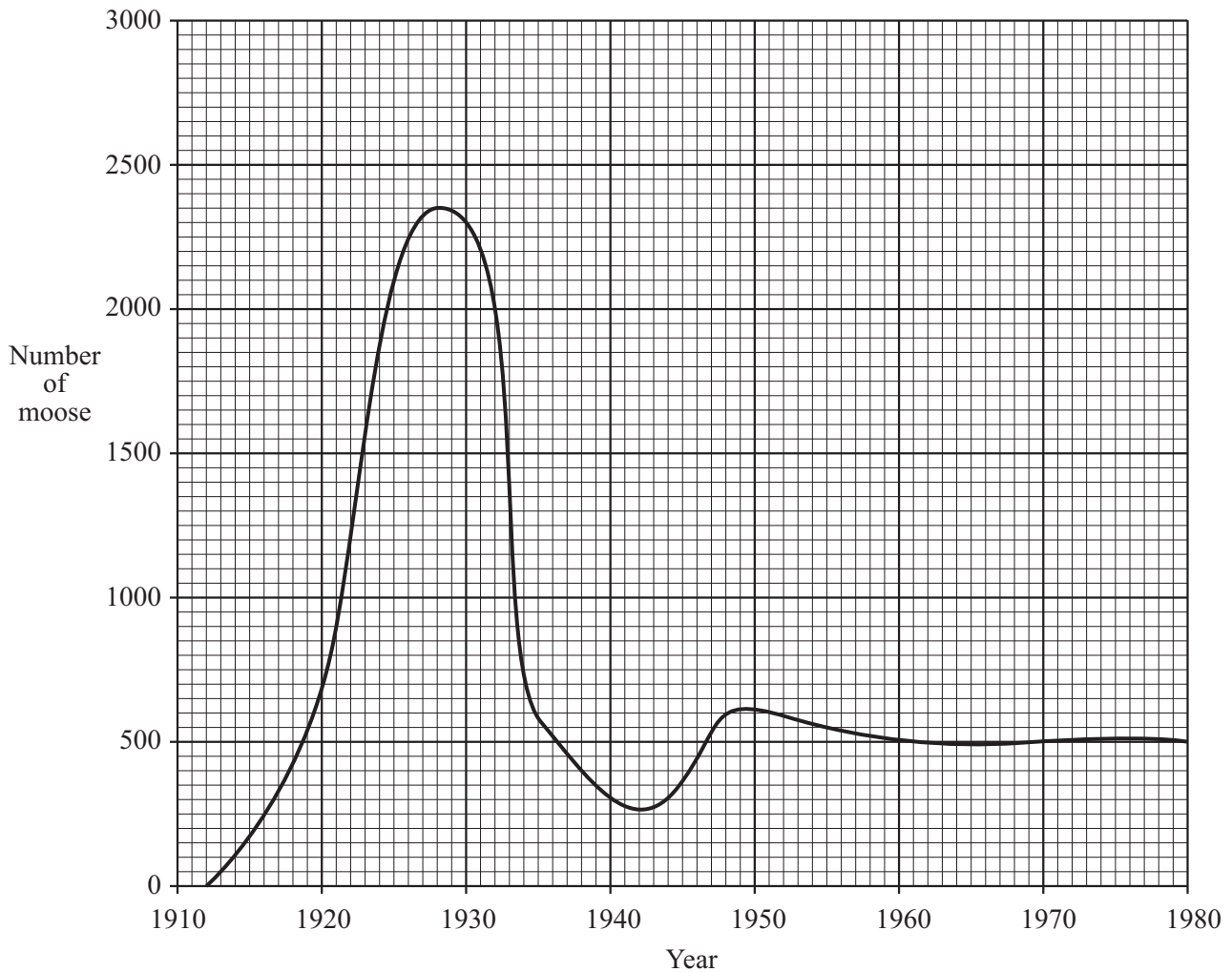
.....

(4 marks)

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4

Turn over ▶

- 4 A moose is a large herbivore. Some moose swam to an island in 1912 and began to breed. There were no predators of the moose on this island. The graph shows how the size of the moose population changed between 1912 and 1980.



(a) What was the maximum population size?
(1 mark)

(b) Suggest a reason, apart from there being no predators, why the population rose between 1912 and 1928.

.....
(1 mark)

(c) Suggest **two** reasons why the population fell rapidly during the 1930s.

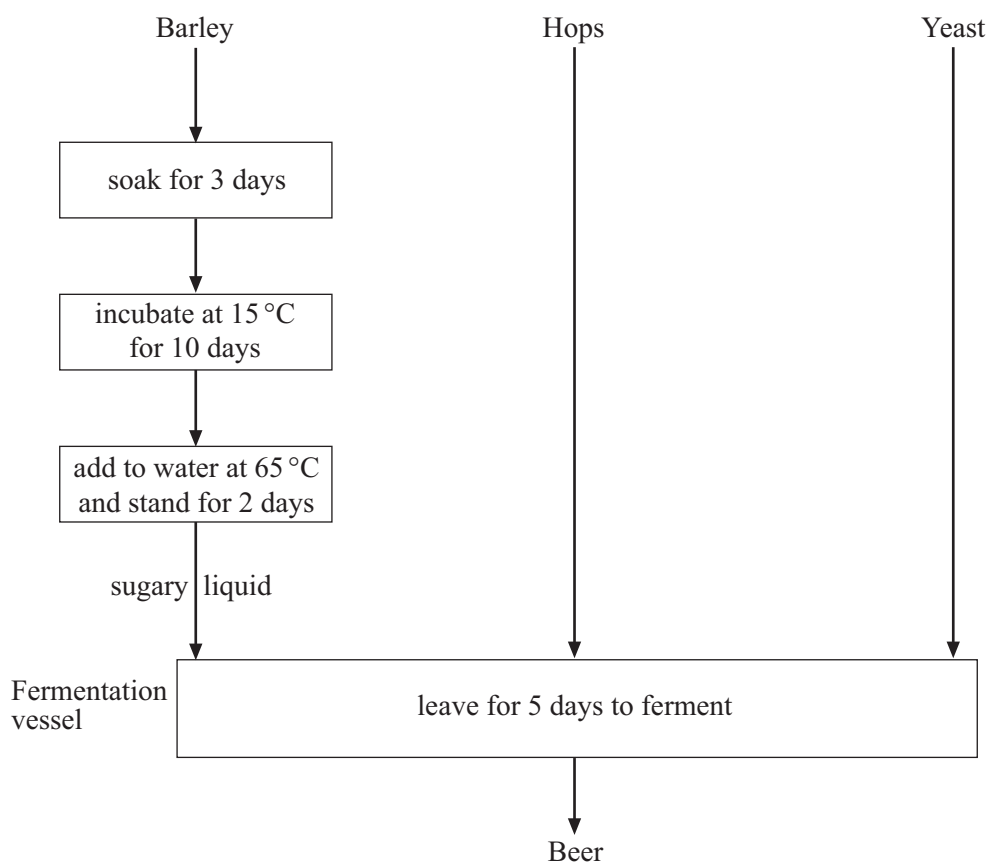
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(2 marks)

4

BIOLOGY IN ACTION

5 Beer is made from malted barley.



The sugary liquid is produced by malting the barley.

(a) Which substance in the barley grain is broken down to produce these sugars?

..... (1 mark)

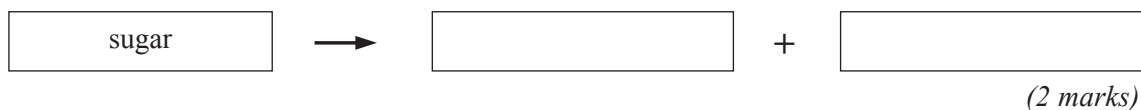
(b) Why should the germinating barley be kept at 15 °C?

..... (1 mark)

(c) Why are hops added to the beer?

..... (1 mark)

(d) The yeast then ferments the mixture.
Complete the equation to summarise this process.



(2 marks)

6 A virus causes the disease rabies. Rabies is rare in Britain but more common in France.

A dog with rabies bites a British man on holiday in France. He asks the doctor to vaccinate him against rabies. The doctor explains that a vaccination would not be helpful.

(a) Explain, in detail, why a vaccination would not prevent the disease from developing.

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(3 marks)

(b) The doctor gives him an injection to stop the disease from developing.

(i) What would this injection contain?

.....

(1 mark)

(ii) Explain how it would stop the disease from developing.

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

(2 marks)

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

- 7 Bats are mammals that eat mainly insects, such as moths.
The diagram shows the skull of a bat.

Diagram of the skull of a bat – not reproduced here, due to third-party copyright constraints.

- (a) On the diagram, draw labelling lines to show the position of:

- (i) an incisor tooth;
- (ii) a canine tooth.

(2 marks)

- (b) Explain, as fully as you can, how the teeth of the bat are suited to its diet.

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(4 marks)

6

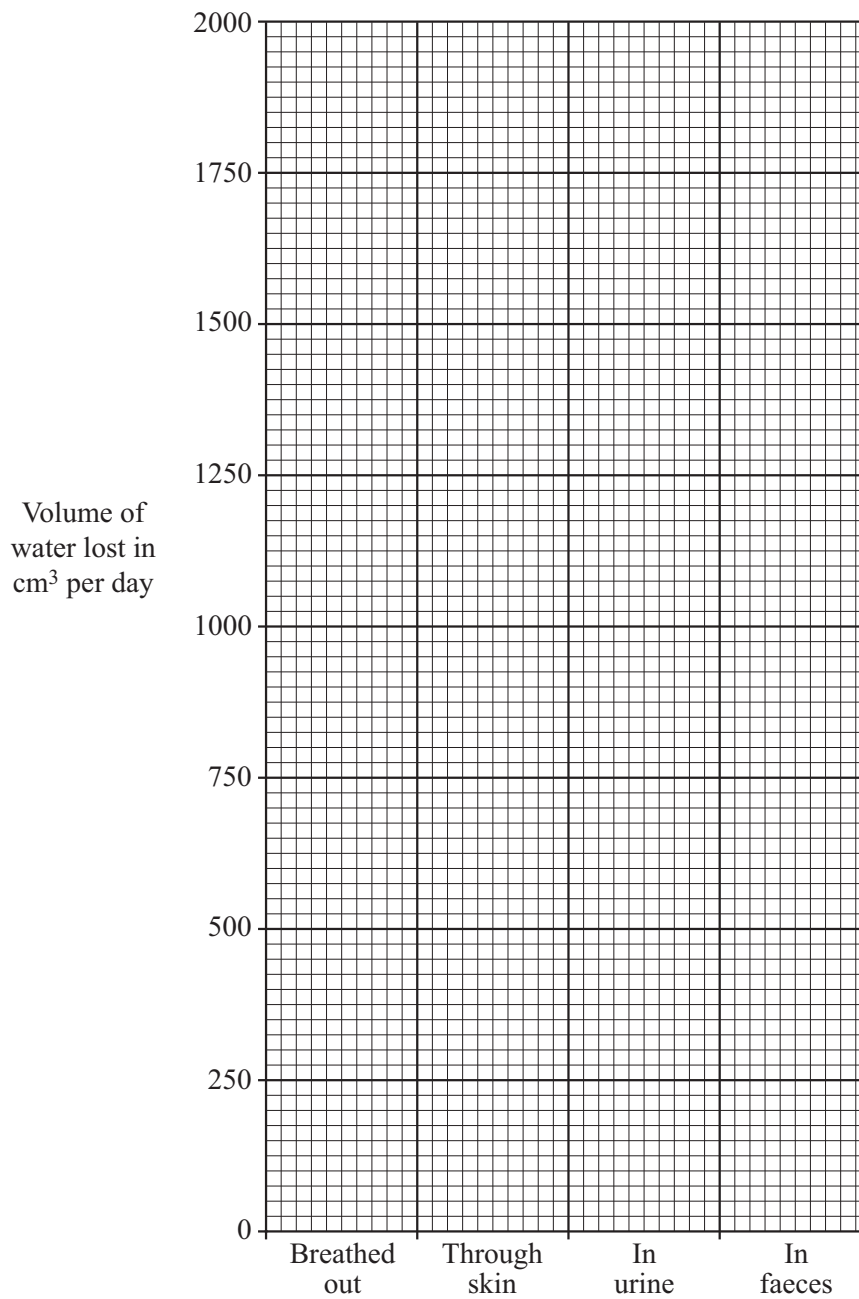
TURN OVER FOR THE NEXT QUESTION

Turn over ▶

- 8 A man loses water from his body in several ways.
The table shows the amount of water lost in each way during a single day.

	Volume of water in cm ³ per day
Breathed out	350
Through skin	500
In urine	1500
In faeces	150

- (a) Draw a bar chart of the data.



(2 marks)

- (b) Calculate the percentage of water lost through the skin.
Show your working.

..... %
(2 marks)

- (c) The percentage of water lost through the skin increases when the man exercises.
Explain why.

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.....
(2 marks)

- (d) Name **one** substance, other than water, which is lost in urine.

.....
(1 mark)

7

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

INHERITANCE AND SELECTION

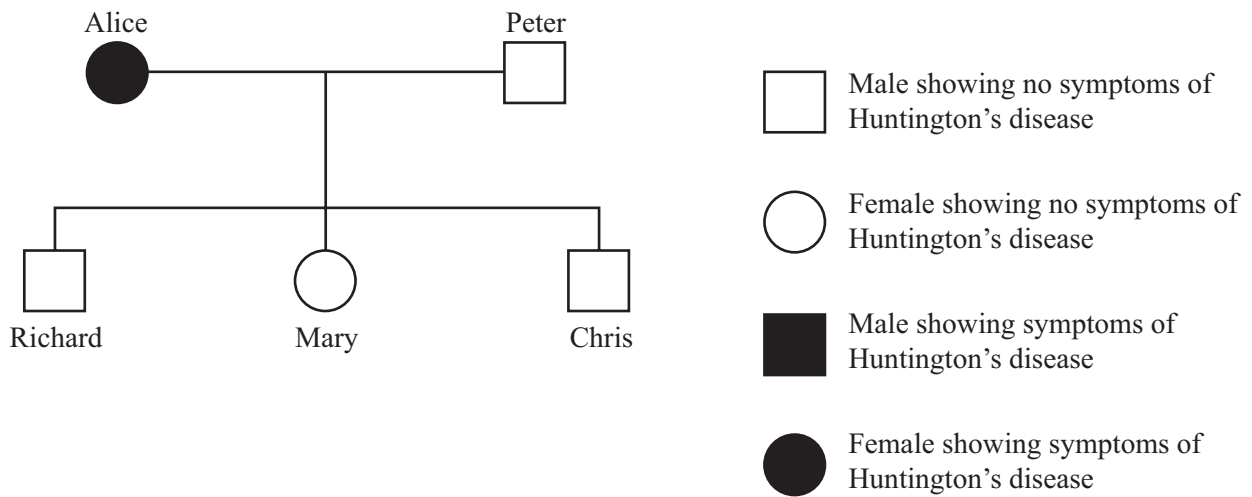
9 Huntington's disease is a genetic disorder. The symptoms do not develop until the person is at least 30 years old.

(a) Which organ system does the disease affect?

.....
(1 mark)

(b) The diagram shows the pattern of inheritance for Huntington's disease in a family with three young children.

Alice's father had Huntington's disease but her mother did not.



(i) Why do people with the Huntington's allele always develop the symptoms of the disease?

.....
(1 mark)

- (ii) What is the chance that Richard will develop Huntington's disease in middle age?

.....
(1 mark)

- (iii) Using symbols, draw a genetic diagram to explain your answer.

(3 marks)

6

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

10 Lysenko was an important Russian biologist in the 1930s. This was a time when there were great food shortages in Russia.

He believed that he could develop new varieties of crops by growing them in better environments. Any improvements developed would be passed on to the next generation. He gained the support of the Russian leader, Stalin, and scientists who criticised his ideas were sent to prison camps.

(a) Suggest a reason why people accepted Lysenko’s ideas at the time, even though many important scientists disagreed with him.

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.....
.....

(1 mark)

(b) Explain why most scientists today do **not** agree with Lysenko.

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.....

(2 marks)

(c) *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.*

Today, crop plants have been improved by artificial selection.

Explain how a plant breeder would use artificial selection to increase the size of the tomatoes produced on every tomato plant.

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(4 marks)



NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

ENVIRONMENT

11 The amount of carbon dioxide in the atmosphere is much higher now than it was 150 years ago.

(a) In many parts of the world, large areas of forest have been cleared for agriculture. Describe **three** ways in which this large-scale removal of trees could have contributed to the increased levels of carbon dioxide in the atmosphere.

1

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(3 marks)

(b) Explain why an increase in the carbon dioxide concentration is thought to be harmful to the environment.

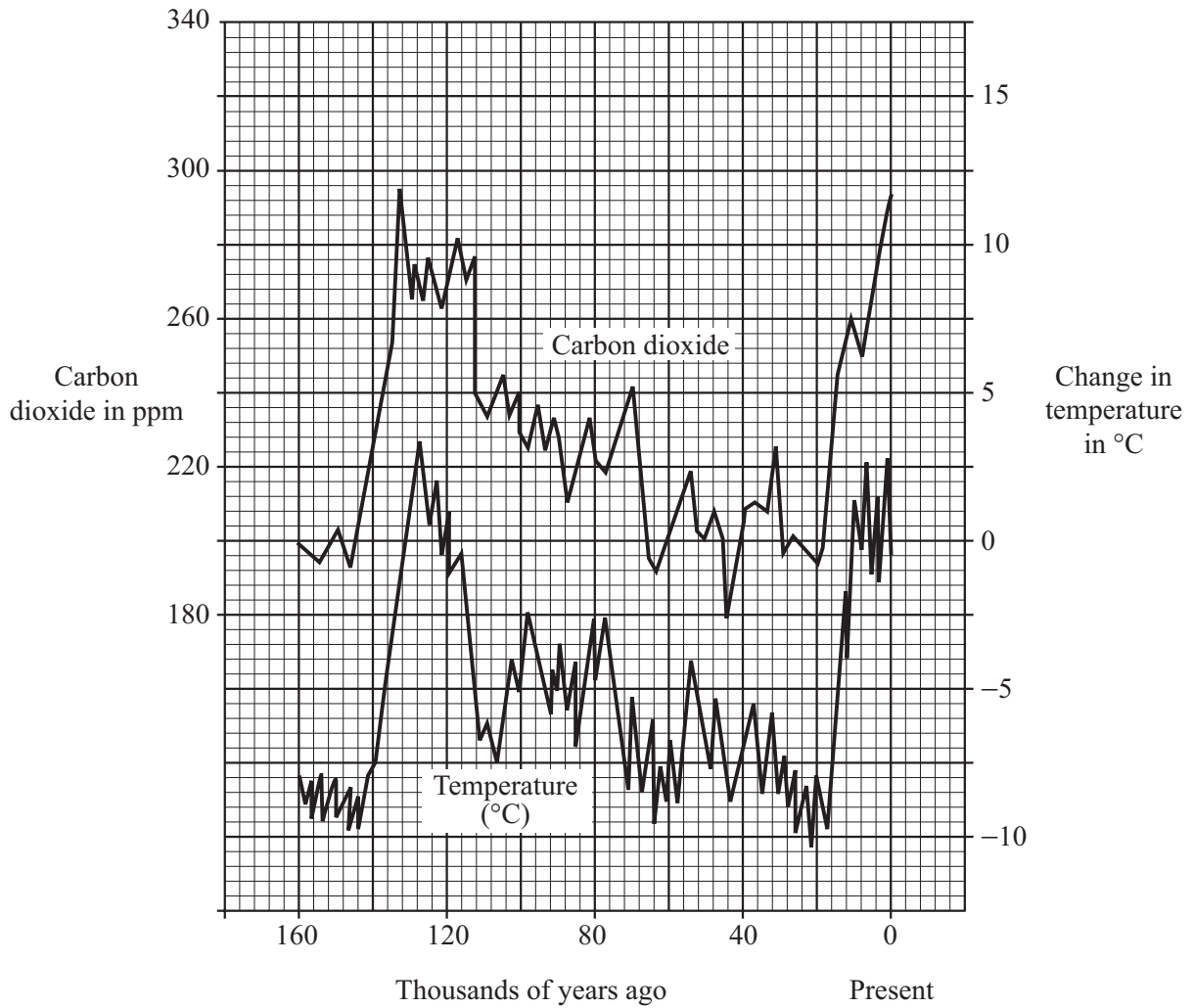
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(2 marks)

(c) Many scientists think that human activities have affected the carbon dioxide concentration in the atmosphere.



Source: ALAN CADOGAN AND GERRY BEST, *Environment and Ecology* (Nelson Blackie) 1992

Use the information in the graph to explain why some scientists do **not** agree that human activity has had a significant effect on the carbon dioxide levels.

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(2 marks)

- 12 The table shows the food intake and egg production for the same number of hens living in different environments. Battery hens are kept in small cages inside a barn whereas free-range hens spend much of the time outside.

	Battery hens	Free-range hens
Food intake in kg per week	80	100
Egg production in kg per week	12	9

- (a) Calculate the percentage of food biomass which is converted to egg biomass in battery hens. Show your working.

Answer %
(2 marks)

- (b) Give **two** reasons why some of the food biomass is not converted into egg biomass.

1

.....

2

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(2 marks)

- (c) Explain why the battery hens are more efficient at converting food into egg biomass.

.....

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(3 marks)

NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

BIOLOGY IN ACTION

13 The table shows the concentration of some substances in the blood.

Substance	Percentage (%) concentration in blood
Protein	7.0
Salt	0.3
Glucose	0.1
Urea	0.04

(a) A patient suffering from kidney failure may be treated by dialysis. Dialysis regulates the concentrations of substances in the blood. Suggest a suitable percentage (%) concentration of glucose and urea in dialysis fluid. Explain your reasoning.

(i) Concentration of glucose in dialysis fluid%

Reason

.....

.....

.....

(ii) Concentration of urea in dialysis fluid%

Reason

.....

.....

.....

(5 marks)

- (b) Many patients on dialysis are waiting for a kidney transplant. Sometimes a close relative may donate a kidney for transplant. Explain why kidney transplants which use a kidney from a close relative have a greater chance of success.

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(2 marks)

- (c) The bone marrow of a transplant patient is usually treated with radiation. Explain, in detail, how this treatment increases the chance of a successful transplant.

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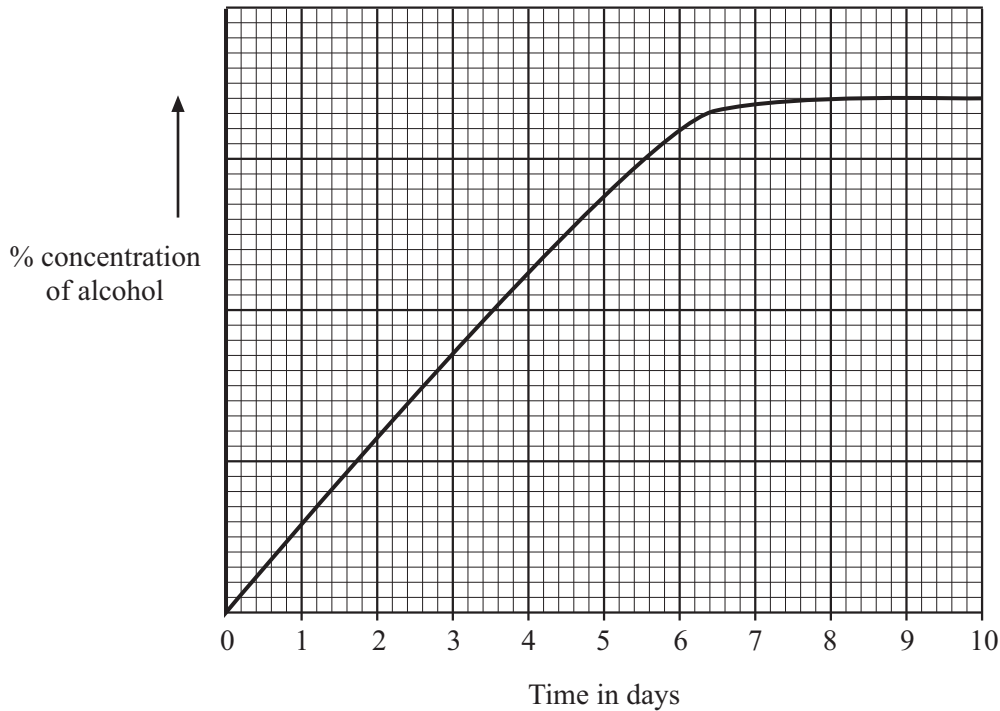
(3 marks)

10

TURN OVER FOR THE NEXT QUESTION

Turn over ▶

- 14 In Brazil, many vehicles run on alcohol and not petrol. The alcohol is produced using waste from sugar cane.
The graph shows the changes in the concentration of alcohol during the fermentation process.



- (a) Suggest **two** different reasons why the alcohol concentration stops increasing after 8 days.

1

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2

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(2 marks)

- (b) The technology for the production of fuel alcohol is more widespread in Brazil compared with Britain. Suggest why.

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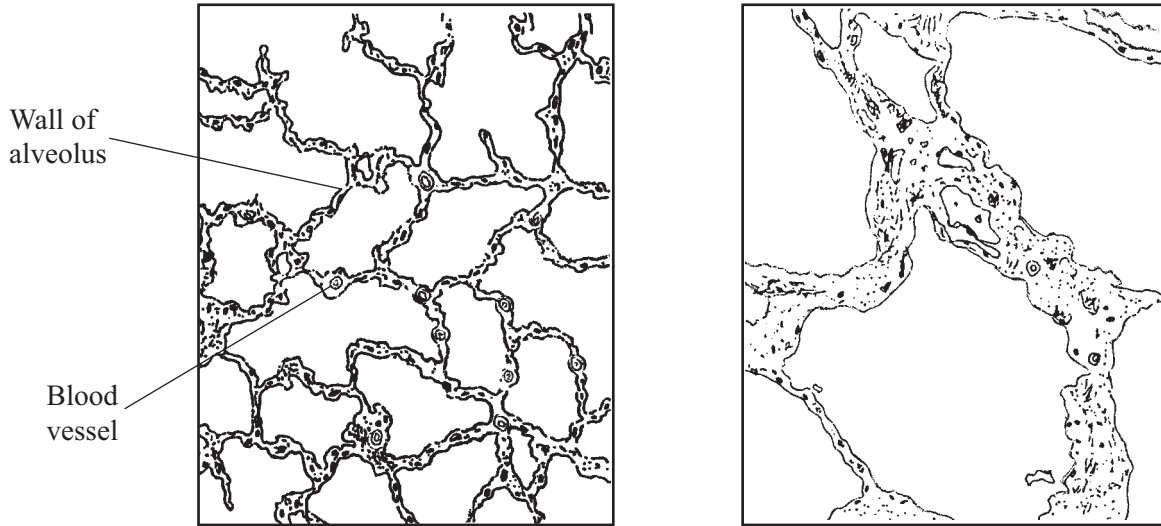
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(2 marks)

QUESTIONS RELATING TO PREVIOUSLY TESTED MODULES

- 15** The diagrams show sections of the lung, showing the alveoli. The two sections are drawn to the same scale.
The section of diseased lung is from a smoker with the disease emphysema.



A
Thin section of healthy lung tissue

B
Thin section of diseased lung tissue

- (a) Describe the functions of the alveoli.

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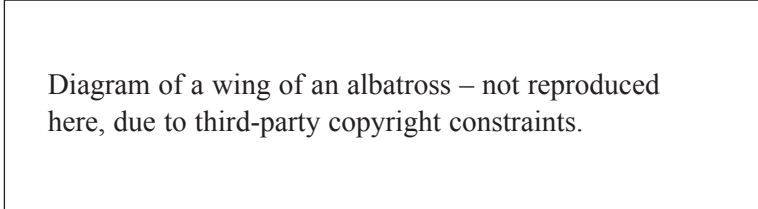
 (2 marks)

- (b) Use the information in the diagram to explain why people with emphysema are often short of breath.

.....

 (2 marks)

- 16 Flapping flight requires a lot of energy. Some birds, such as the albatross, can glide for some time to conserve energy.
The diagram shows a section through the wing of an albatross, which acts as an aerofoil.



Explain how the shape of the wing shown in the diagram enables the bird to glide through the air without losing too much height.

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(3 marks)

3

END OF QUESTIONS

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