Anglo-Chinese School (Independent)

PRELIMINARY EXAMINATION
YEAR FOUR EXPRESS

CANDIDATE NAME									
CENTRE NUMBER	**S**	**2**	**0**	**3**	**1**	INDEX NUMBER				

BIOLOGY **6093/02**

Paper 2 **12 August 2024, Monday**
1 hour 45 minutes

Candidates answer on the Question Paper
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name and index number on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Section A
Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.

Section B
Answer only **ONE** question in this section.
Write your answers in the spaces provided on the Question Paper.

The use of an approved scientific calculator is expected, where appropriate.

The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section A	
Section B	
Total	/ 80

This document consists of **21** printed pages, including this cover page.

[Turn Over

Section A

Answer **all** questions.
Write your answers in the spaces provided.

1 Fig. 1.1 shows blood pressure changes as blood flows through part of the circulatory system, beginning at the right atrium, travelling to the lungs, and ending in the pulmonary vein.

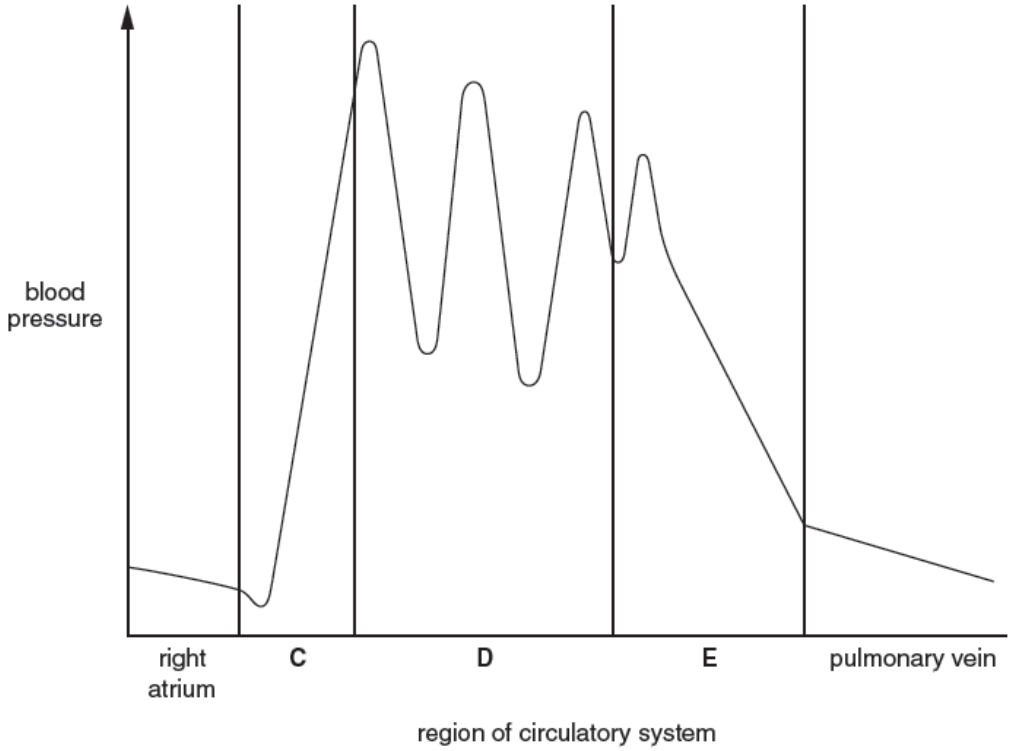

Fig. 1.1

(a) Identify the chamber of the heart represented by **C**.

Chamber **C** ……[1]

(b) Explain the reasons for the regular changes in blood pressure in region **D**.

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(c) Important exchange of substances take place in the blood as it passes through region **E**.

(i) Identify organ **E**.

.....[1]

(ii) Identify and describe the exchange of substances that take place.

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.....[2]

(ii) State **two** features of organ **E** and explain how they help to improve the efficiency of the rate for exchange of substances.

Feature 1 ……..

Explanation ……..……

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Feature 2 ……..

Explanation ……..……

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.....[4]

[Total: 10]

2 The yields of corn grown in open fields in India are low compared to the yields of corn grown in the glasshouses in The Netherlands.

In a study, scientists in India grew corn plants in glasshouses and in open fields nearby. The growth of the plants and the yields of the corn were recorded.

The results are shown in Table 2.1

Table 2.1

	location corn plants grown in	
	glasshouse	open field
mean final height of corn plants / cm	84.1	68.0
mean number of leaves per corn plant	132.0	83.0
mean fresh mass of corn plants / g	978.5	485.2
mass of corn per plant / g	2853.0	832.4
mean fresh mass of corn / g	98.0	86.5

(a) The mean fresh mass of corn grown in glasshouses was greater than the mean fresh mass of corn grown in open fields.

Calculate the difference in mean fresh mass as a percentage of the mean fresh mass of corn grown in open fields.

Show your working. Give your final answer to a whole number.

……..% [2]

(b) Suggest how an increase in the height of the plants **and** the number of leaves on each plant affect the yield of corn.

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(c) The scientists ensured that the only differences between the two groups of plants were the result of the protection provided by the glasshouses.

Suggest **two** factors that the scientists should have kept constant for the two groups of plants in this investigation.

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.....[2]

(d) The growth and final yields of crops grown in open fields are often limited by environmental factors.

Describe how these factors are controlled in a commercial glasshouse to give high yields of crops such as corn.

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[Total: 10]

3 Fig. 3.1 shows a vertical section through the skin in two different environmental conditions, **A** and **B**.

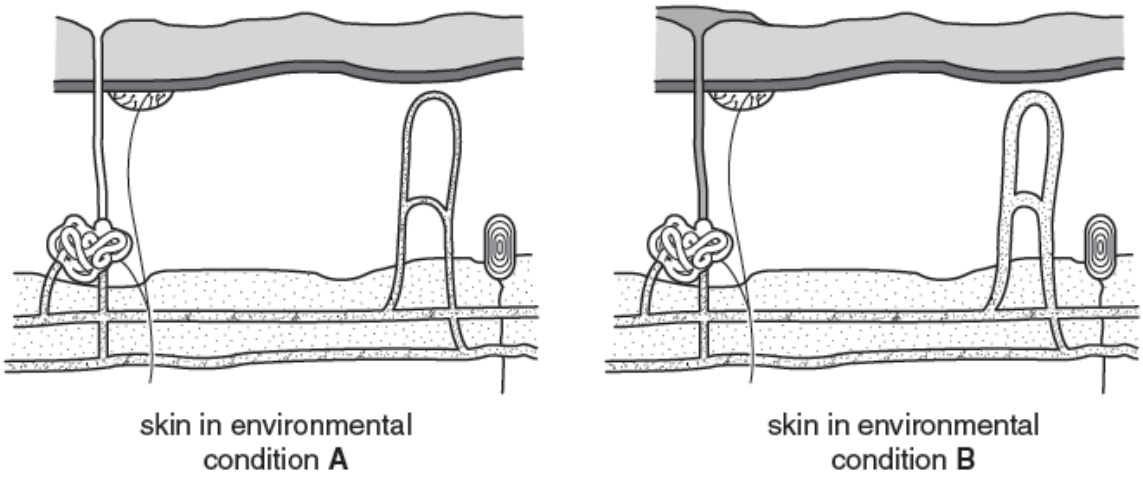

Fig. 3.1

(a) On Fig. 3.1 under condition **A**, label each of the following:

- A sweat gland
- An arteriole. [2]

(b) Using the information in Fig. 3.1, suggest how environmental condition **B** is different from environmental condition **A**.

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.....[1]

(c) With reference to Fig. 3.1, state and explain two differences between the skin in environmental condition **A** and the skin in environmental condition **B**.

1…...……...

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2…...……...

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.....[4]

(d) (i) State the change in the level of anti-diuretic hormone (ADH) in a person if the person is to stay in environmental condition **B** for a period of time without access to drinking water.

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.....[1]

(ii) Explain how the change in ADH level stated in **(d)(i)** affects the urine production of the person.

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.....[2]

[Total:10]

4 The dominant allele for the ability to smell the scent of a particular flower is represented by **A**. The recessive allele, which does not allow a person to smell the scent of the flower, is represented by **a**.

(a) (i) Using these letters, indicate each of the following:

the genotype of a woman who is unable to smell the flower: ……..[1]

(ii) the possible alleles found in the gametes of a woman who can smell the flower.

…… and …… [2]

(b) Fig. 4.1 represents some alleles on part of the sex chromosomes of a woman and of a man.

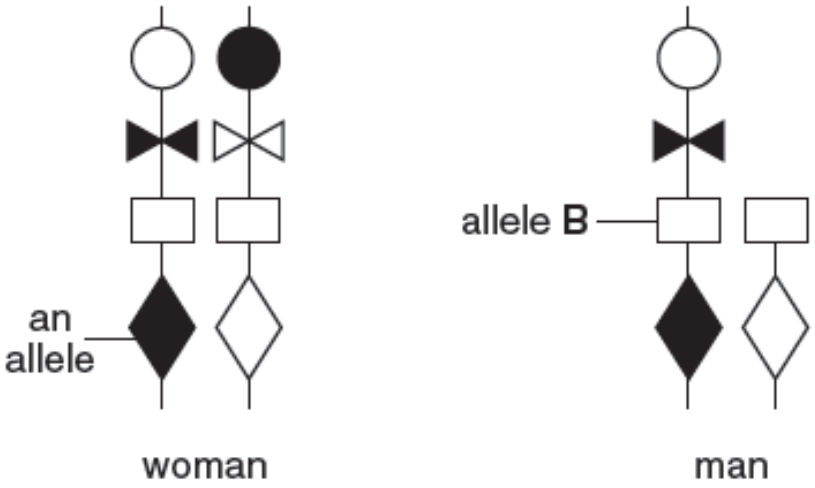

Fig. 4.1

In the space below, draw the possible alleles as they might be carried in sperm cells.

[2]

(c) Fig. 4.2 shows how the alleles on one of the chromosomes might appear in a liver cell in the man's body. Allele **B** shows a mutation.

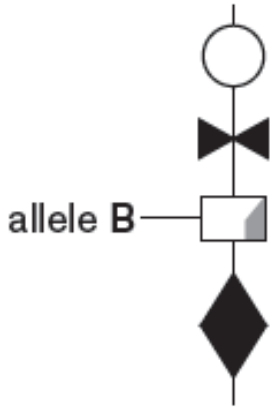

Fig. 4.2

Suggest **two** possible causes of the mutation.

1.....

2.....[2]

(d) Mutated alleles such as that shown in Fig. 4.2 are usually recessive.

Use your knowledge of genetics to explain why society discourages marriages between closely-related people.

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[Total: 10]

5 (a) Define the term, *sexual reproduction*.

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Progesterone is a hormone involved in the control of the menstrual cycle.
Fig. 5.1 shows the level of progesterone in the blood of three women, labelled **X**, **Y** and **Z**, for 30 days.

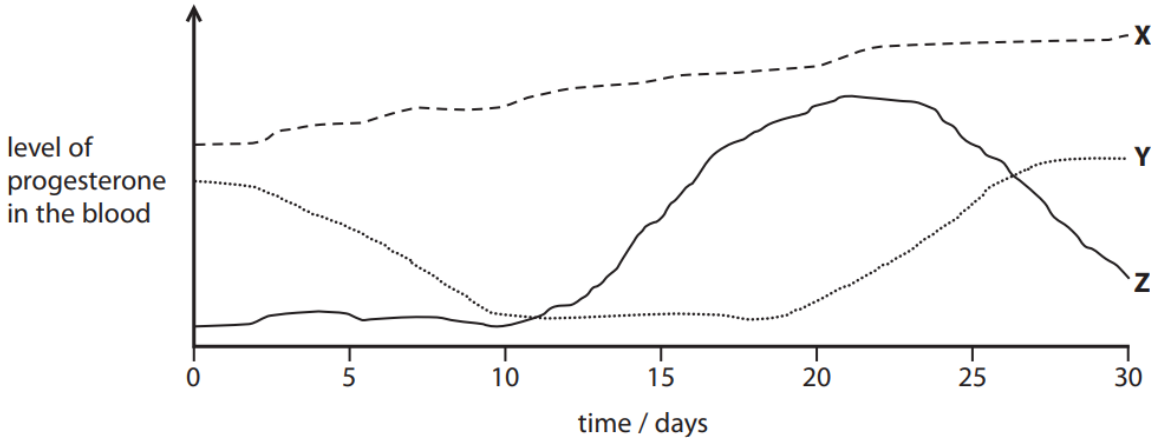

Fig. 5.1

(b) (i) Name the stage of the menstrual cycle that is occurring for person **Y** on day 10.

.....[1]

(ii) Suggest a reason for the increasing progesterone level of person **X**.

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.....[1]

Fig. 5.2 shows a drawing of a section of a human placenta. The arrows show the direction of blood flow.

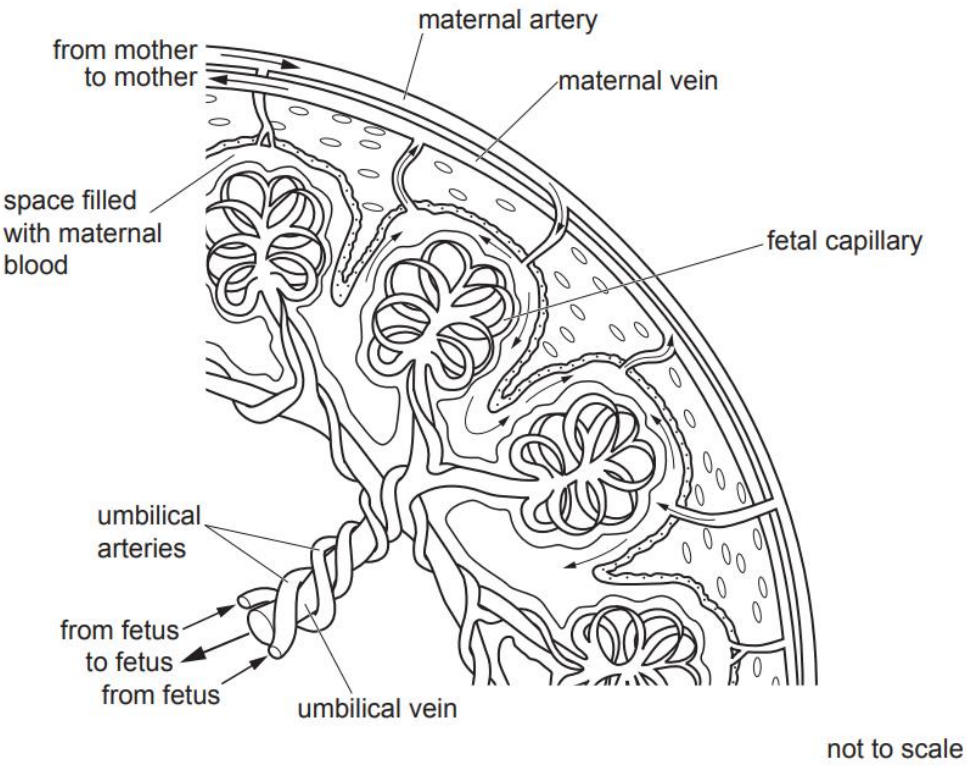

Fig. 5.2

(c) Using the information in Fig. 5.2, suggest how the placenta is adapted for efficient diffusion.

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(d) The placenta is often described as the 'lung and kidney' of the fetus. Explain why this is a valid description.

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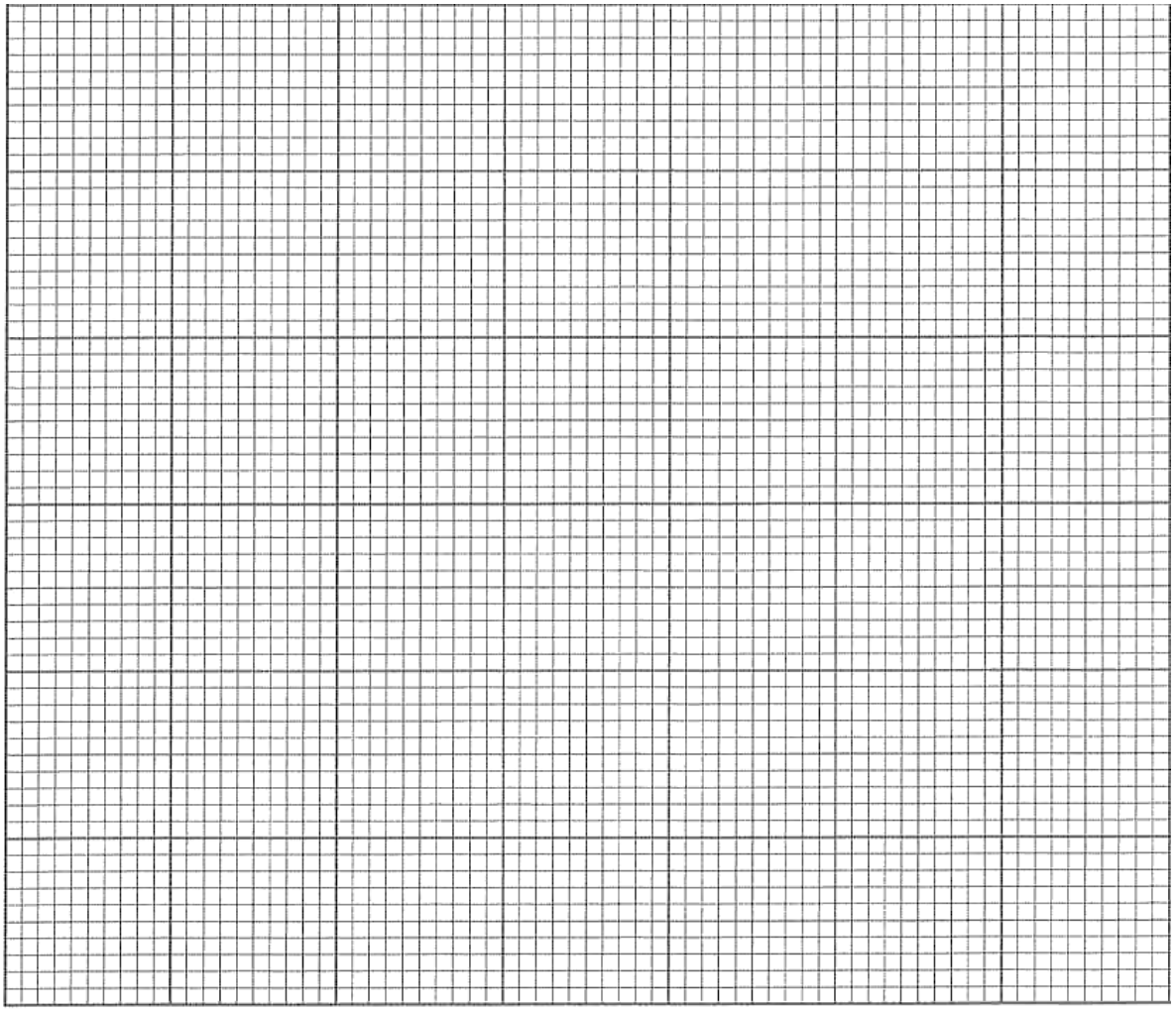
[Total: 10]

6 Table 6.1 shows the results of an investigation to find out how temperature affects the activity of two protease enzymes.

Table 6.1

temperature / °C	enzyme activity / arbitrary units	
	enzyme A	enzyme B
0	0	0
5	10	2
10	24	8
15	60	12
20	98	22
25	80	38
30	66	62
35	52	94
40	40	34
45	30	10
50	20	0
55	10	0
60	0	0

(a) Plot the two graphs on the same axes in the grid provided.



[6]

(b) Using information from Table 6.1, determine which of the two enzymes is obtained from a human. Explain your answer.

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.....[2]

(c) Explain the activity shown by enzyme **A** at temperatures above 20 °C.

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.....[2]

[Total: 10]

7 Bacteria may be classified as pathogenic and non-pathogenic.

(a) Describe **two** features of a bacterial cell that are different from an animal cell.

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2.....

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.....[2]

(b) Non-pathogenic bacteria can be used in the field of genetic engineering.

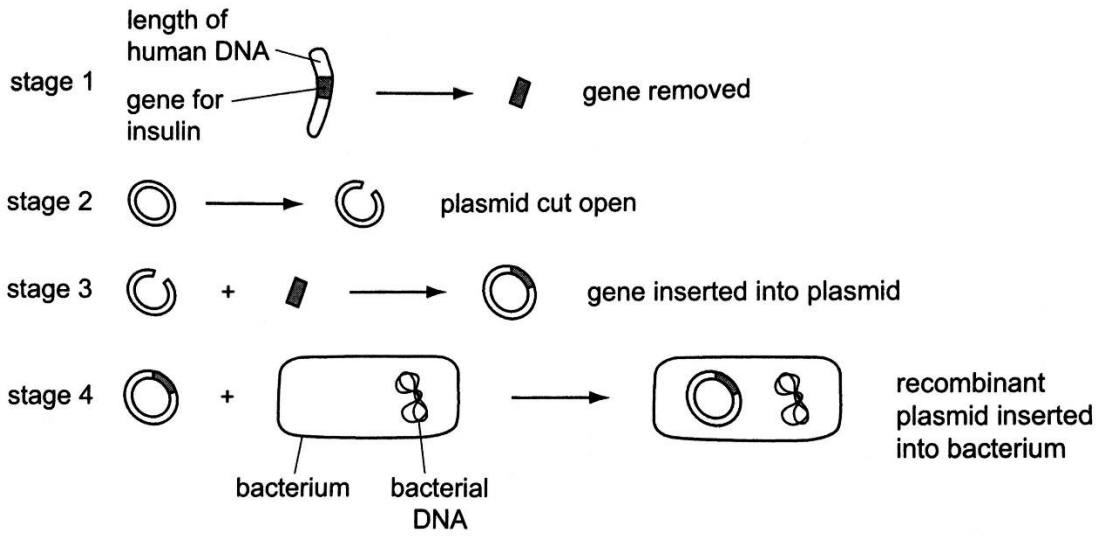

Fig. 7.1

With reference to Fig. 7.1, describe how bacteria can be genetically engineered to produce human insulin.

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(c) Pathogenic bacteria species like *Streptococcus pneumoniae* cause pneumococcal diseases in humans which may lead to death.

Vaccines and antibiotics are used in different ways to reduce the number of deaths from pneumococcal disease.

Explain the different ways in which vaccines and antibiotics are used.

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[Total: 10]

Section B

Answer only **ONE** question from this section.
Write your answers in the spaces provided.

8 Fig. 8.1 shows the Institut Pierre Simon Laplace model, which is a prediction of how carbon emissions may be distributed in the environment from 1920 to 2100.

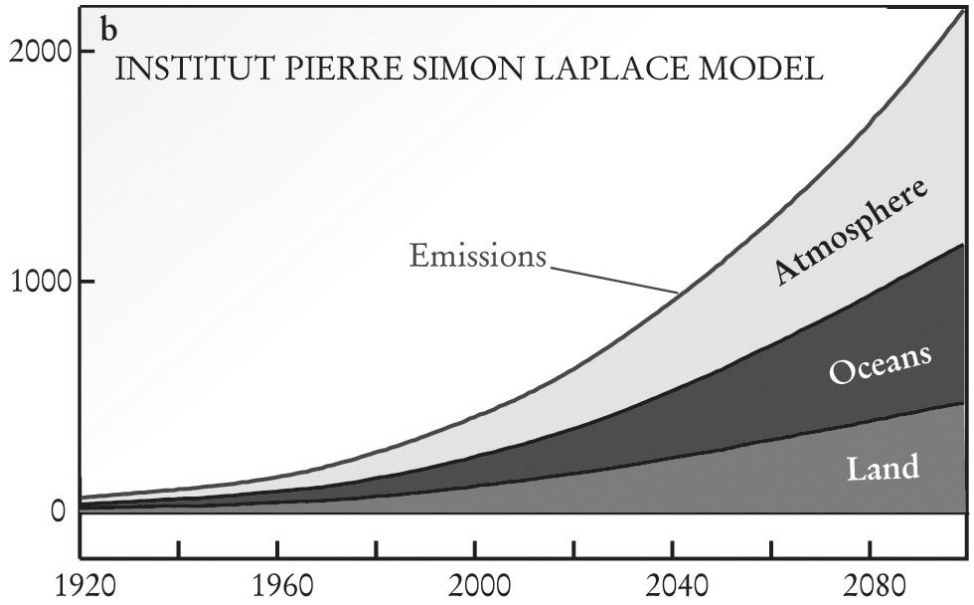

Fig. 8.1
[adapted from Physics Today 55, 8, 30 (2002)]

(a) Describe **two** human activities that cause an increase in carbon emissions observed in Fig. 8.1.

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2.....

.....[2]

(b) With reference to Fig. 8.1, explain why the carbon distribution in both oceans and land increases as carbon emissions increases.

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[Turn Over

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(c) Describe **three** human actions that can reduce the effects of global warming.

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[Total: 10]

9 (a) Fig. 9.1 shows two locations, **X** and **Y**, on the Earth.

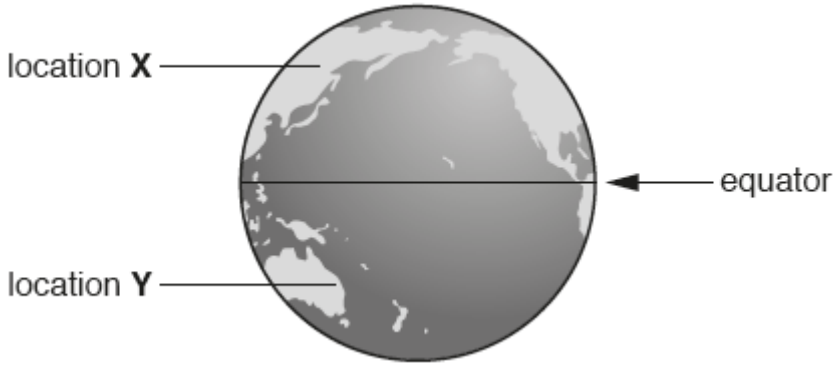


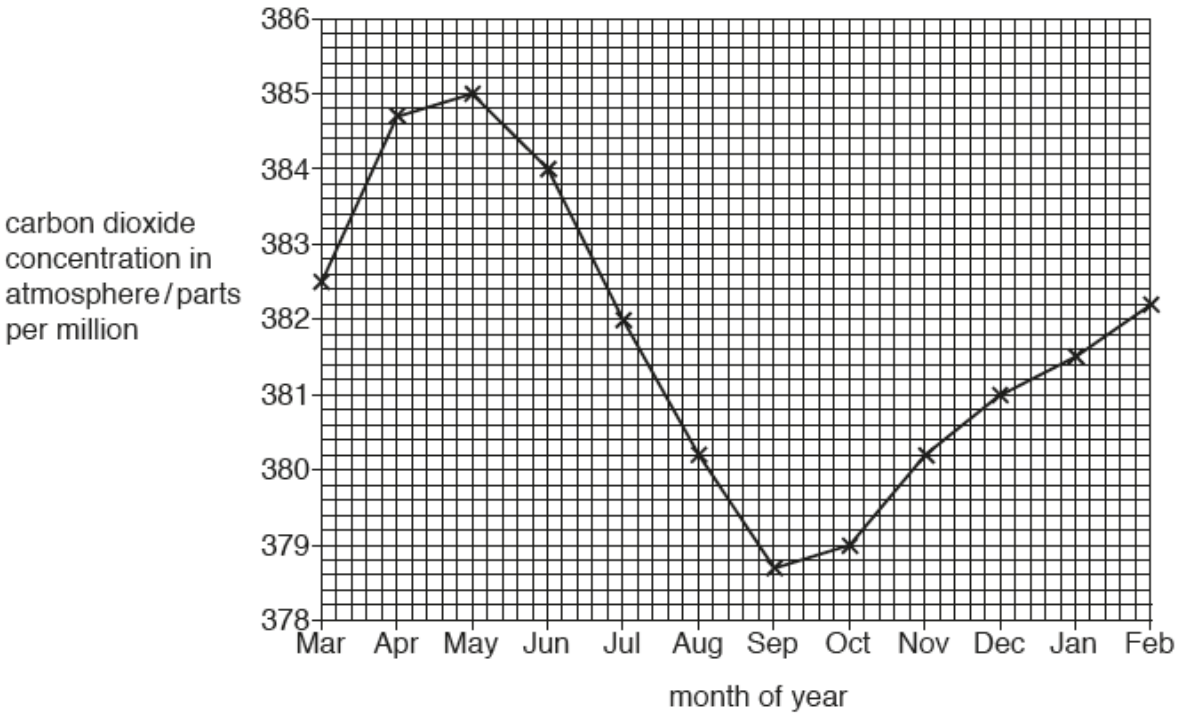
Fig. 9.1

Table 9.1 shows the length of daylight at each location during a year.

Table 9.1

	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
length of daylight at location X	medium			long			medium			short		
length of daylight at location Y	medium			short			medium			long		

Graph 9.1 shows the changes in carbon dioxide concentration in the atmosphere measured during one year at location **X**.



Graph 9.1

(i) With reference to Graph 9.1, suggest an explanation for the pattern of changes in the concentration of carbon dioxide in the atmosphere at location **X**.

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.....[3]

(ii) Sketch a line on Graph 9.1 to suggest the change in carbon dioxide concentration in the atmosphere during the year at location **Y**. [2]

(b) Fig. 9.2 shows two possible uses of the same area of land to produce food.

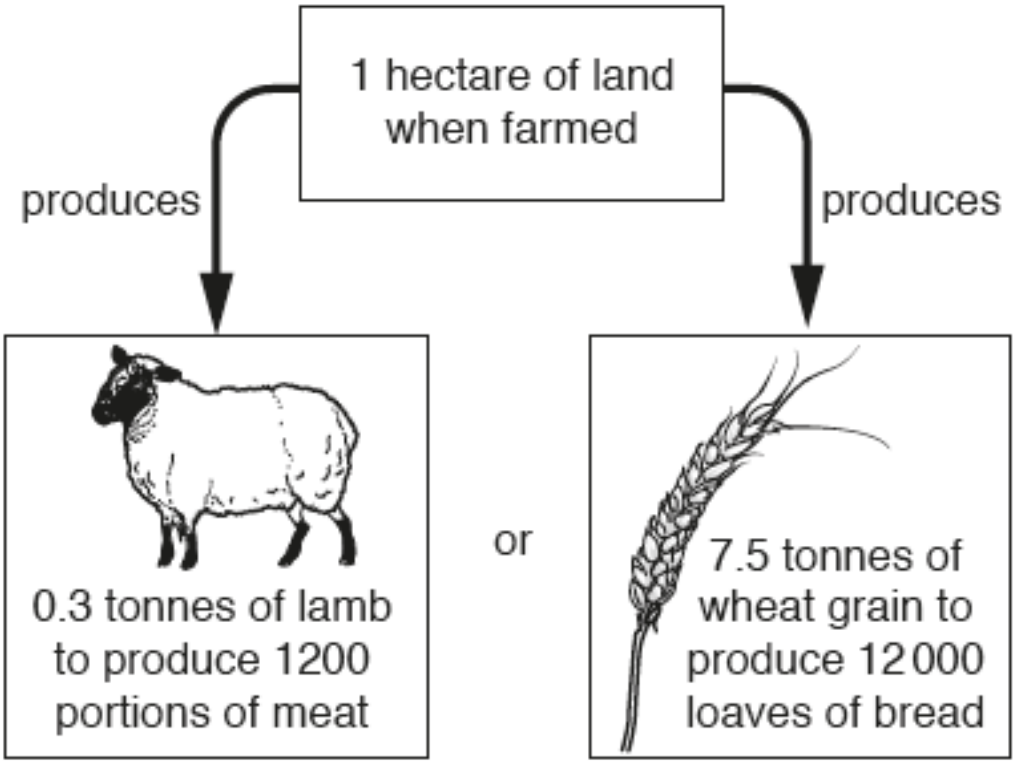

Fig. 9.2

With reference to Fig. 9.2, and your own knowledge, explain why it is possible to feed a greater number of people if the area of land is used to farm crops rather than to farm animals.

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[Total: 10]

--- End of Paper ---