Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

BIOLOGY **0610/42**

Paper 4 Theory (Extended) **October/November 2016**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name 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.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **20** printed pages.

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CAMBRIDGE International Examinations

[Turn over

1 Milk is sometimes referred to as a 'complete food' because it contains all the nutrients that a young mammal requires.

(a) Table 1.1 shows three nutrients that are contained in milk.

Complete the table by stating **one** role of each nutrient in the body of a young mammal.

Table 1.1

nutrient	role in the body
protein	
lactose (milk sugar)	
calcium	

[3]

(b) Protein digestion begins in the stomach of the human alimentary canal and is completed in the small intestine.

Describe in detail how enzymes function to digest protein in the alimentary canal.

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..... [6]

(c) Some people are unable to digest lactose (milk sugar) and have a condition known as lactose intolerance.

Fig. 1.1 shows what happens in the intestine of a person who is lactose intolerant if they eat food containing a lot of lactose.

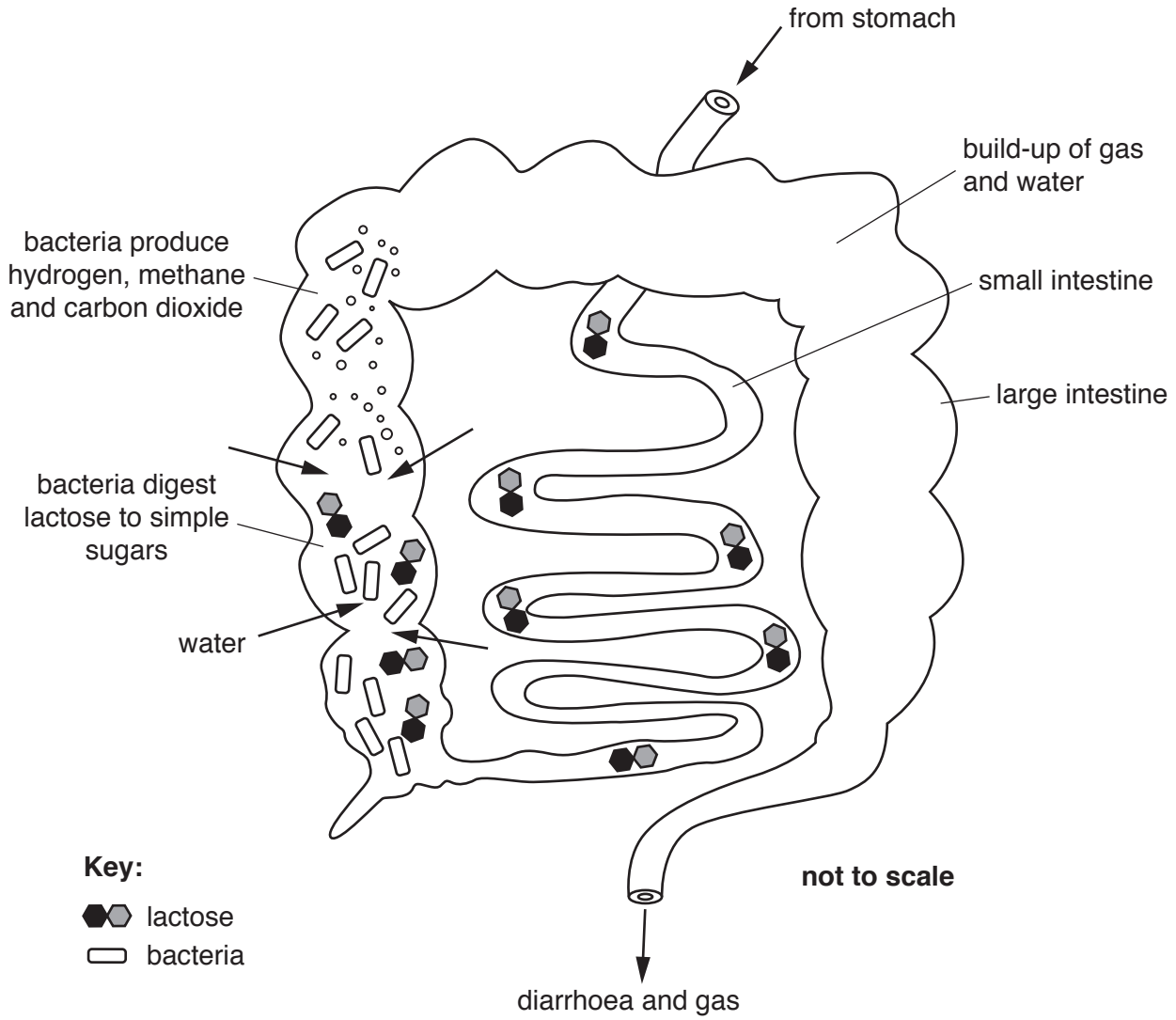

Fig. 1.1

(i) Explain why lactose is not absorbed by the small intestine.

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..... [2]

(ii) Suggest the dangers to health of severe diarrhoea if it is not treated for a long time.

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..... [3]

(d) Hydrogen gas is produced by the bacteria that digest lactose in the large intestine. The gas is absorbed into the blood and excreted through the lungs. Lactose intolerance can be monitored by measuring the hydrogen gas content of the air a person breathes out.

People taking part in an investigation into lactose intolerance consumed the following milk products on different days:

A. untreated milk
B. milk treated with lactase immediately before drinking
C. milk treated with lactase three days before drinking
D. yoghurt made by bacteria that digested the lactose in the milk

The hydrogen gas content of the air breathed out was measured every hour for five hours following the ingestion of each milk product.

The mean results are shown in Fig. 1.2.

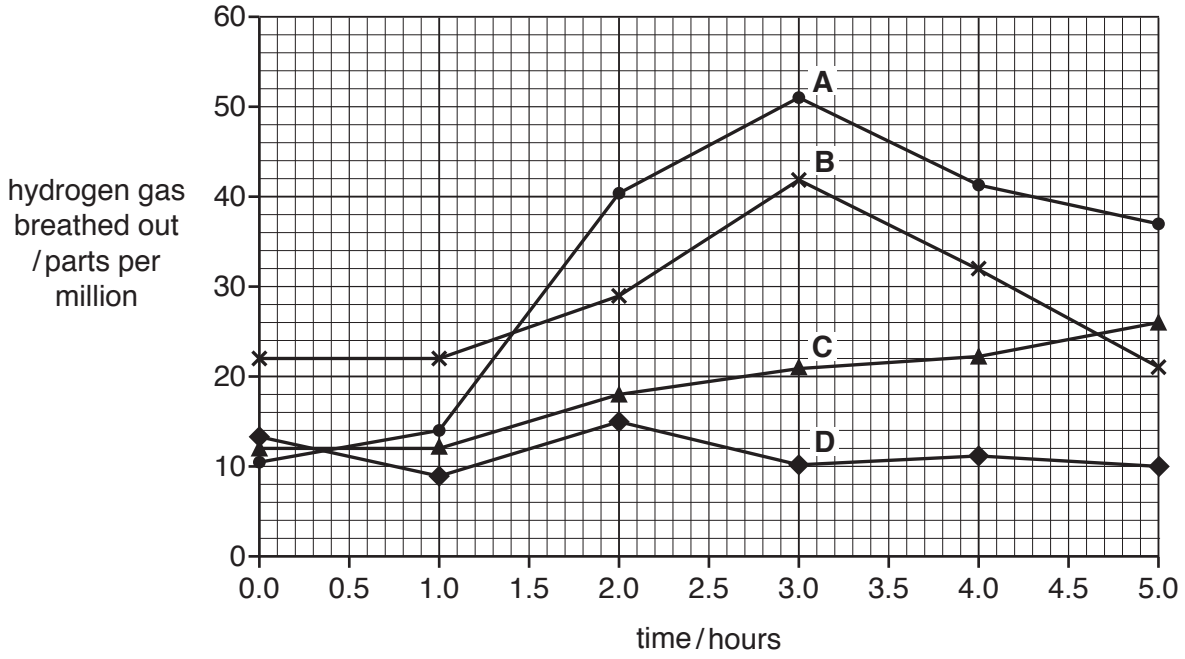

Fig. 1.2

(i) Explain why untreated milk was included in the investigation.

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..... [2]

(ii) Suggest why lactase might be added to milk.

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..... [2]

(iii) Use the results in Fig. 1.2 to explain why yoghurt is the best milk product for people with lactose intolerance.

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..... [3]

[Total: 21]

2 Fig. 2.1 is a diagram showing a small region of DNA.

Fig. 2.1

Fig. 2.2 shows part of the DNA enlarged to show the sequence of bases.

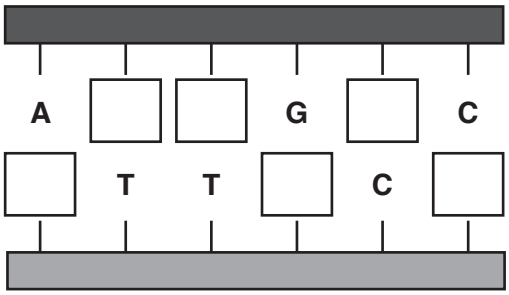

Fig. 2.2

(a) Complete Fig. 2.2 by adding the letters for the bases that are missing. [2]

(b) Fig. 2.3 shows how DNA is involved in protein synthesis.

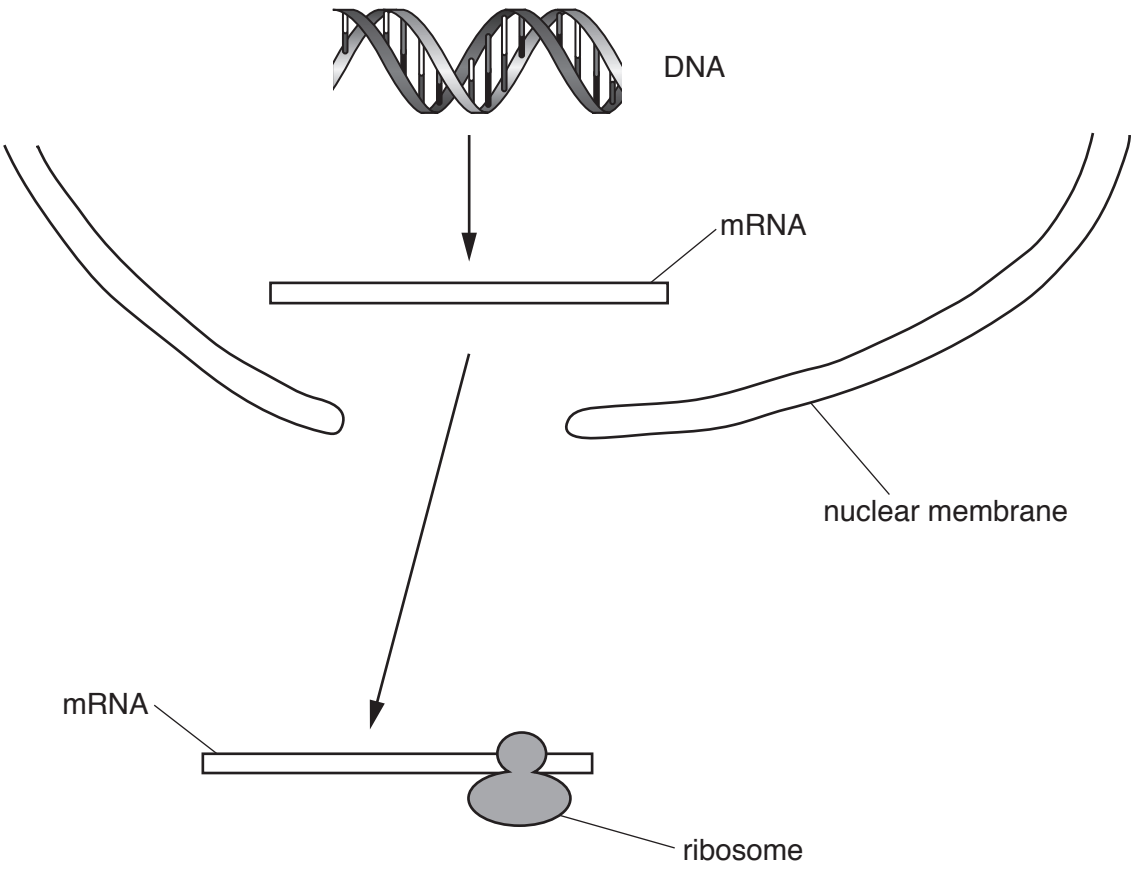

Fig. 2.3 not to scale

Explain how mRNA is involved in protein synthesis.

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..... [3]

(c) Base sequences of the DNA of different species are compared to investigate how species are related to one another. The most closely related species have the shortest distance from a branching point on a classification tree.

Fig. 2.4 shows how six species of fungi are related to each other.

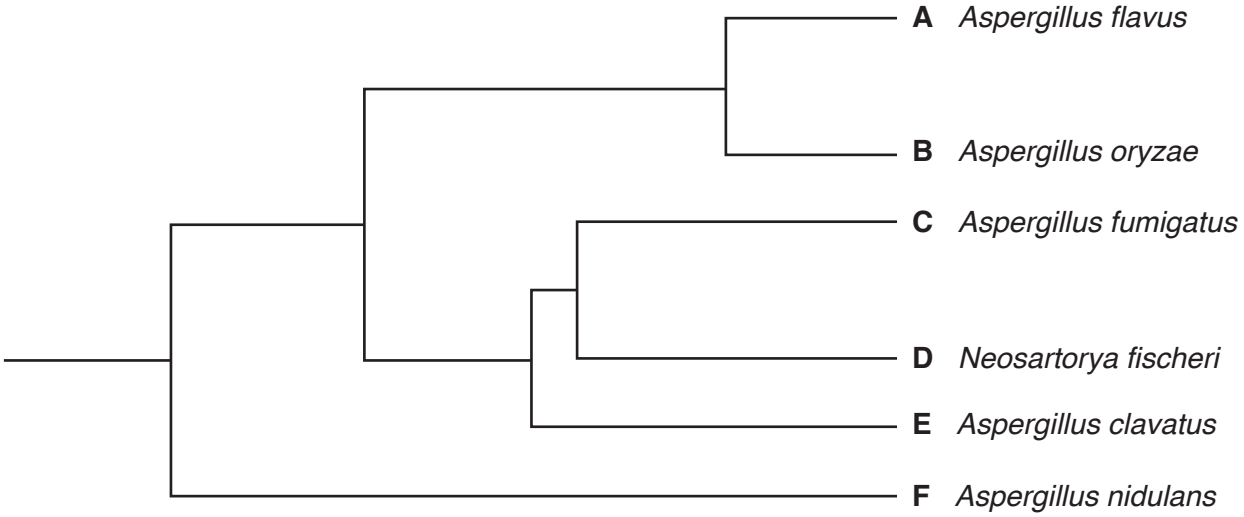

Fig. 2.4

(i) Use the letters on Fig. 2.4 to state the two species that are most closely related.

..... [1]

(ii) Use Fig. 2.4 to explain why *Aspergillus nidulans* is the most distantly related species from all of the other five species.

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..... [2]

(d) Modern methods of classification rely on the analysis and comparison of base sequences in DNA.

Describe the type of evidence that scientists used for classifying organisms before they were able to sequence DNA.

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..... [2]

[Total: 10]

3 Fig. 3.1 shows a section through a kidney.

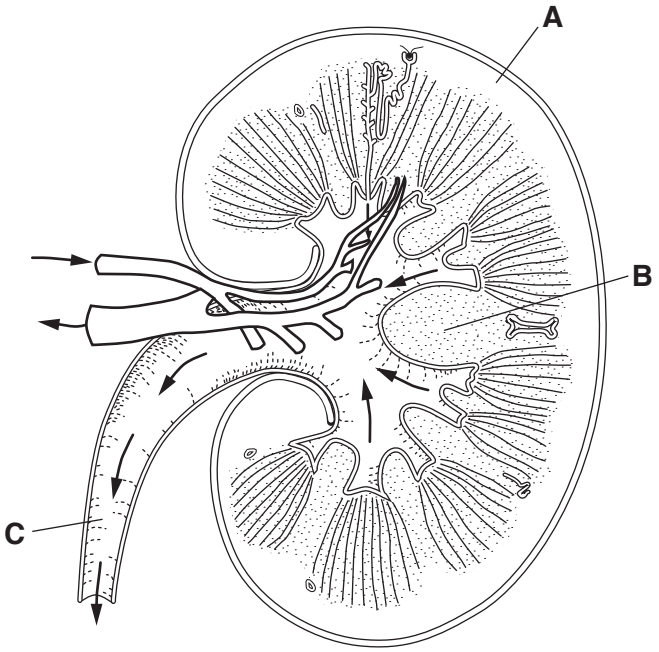

Fig. 3.1

(a) Complete the table by stating the name of the parts labelled **A**, **B** and **C** on Fig. 3.1.

letter	name of part
A	
B	
C	

[3]

(b) **(i)** Name the blood vessel in Fig. 3.1 that has the highest concentration of urea.

..... [1]

(ii) Name the blood vessel in Fig. 3.1 that has the lowest concentration of glucose.

..... [1]

(c) Explain the role of the kidney in excretion.

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..... [4]

(d) Testosterone is a steroid hormone that is also taken as a drug to improve sporting performance.

(i) Define the term *hormone*.

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..... [3]

(ii) State where testosterone is produced in the body.

..... [1]

(iii) State why testosterone is taken by some people to improve sporting performance.

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..... [2]

(e) The half-life of a drug is the time it takes for the concentration in the blood to decrease by a factor of a half. The half-life of one form of testosterone taken to improve sporting performance is 7 days.

A person received an injection of this form of testosterone. A blood sample taken almost immediately showed its concentration to be 50 ng cm^{-3}.

Predict the concentration after 14 days, assuming the person does not have another injection, **and** show your working.

..... ng cm^{-3} [2]

[Total: 17]

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4 Hydrophytes are plants that show many adaptive features for life in aquatic habitats.

Fig. 4.1 shows several species of hydrophyte growing in freshwater.

Fig. 4.1

A student investigated the density of stomata on the leaves of two different species of freshwater hydrophyte.

Table 4.1 shows the results.

Table 4.1

species	location of leaves	mean stomatal density / number per mm^2	
		upper epidermis	lower epidermis
Brazilian waterweed, *Egeria densa*	under the surface of the water	0	0
water lily, *Nuphar lutea*	on the surface of the water	420	0

(a) Name the epidermal cells that control the size of stomata.

..... [1]

(b) Suggest reasons for the difference between the results for the two species.

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..... [2]

(c) Fig. 4.2 shows a section through the leaf of a water lily.

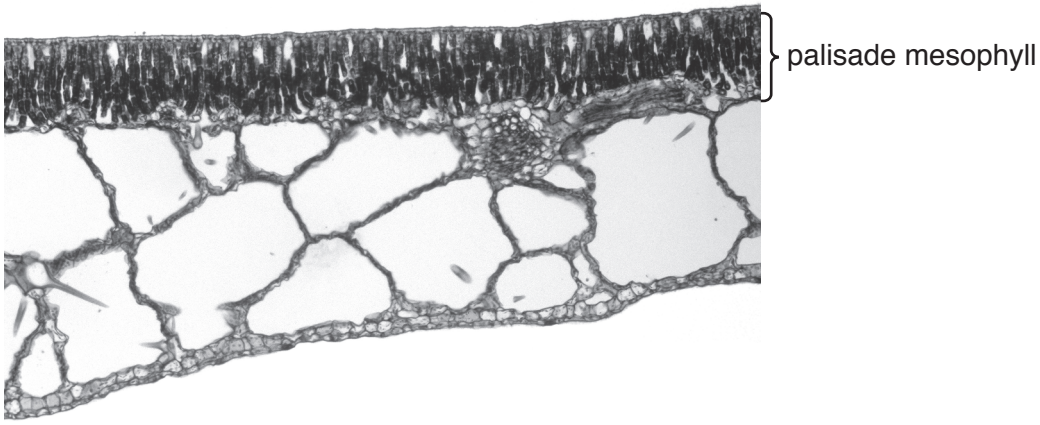

Fig. 4.2

(i) State why the palisade mesophyll is a tissue.

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..... [1]

(ii) Name **two** other tissues that are present in the leaf in Fig. 4.2.

1 .....

2 .....
[2]

(d) The large air spaces are an adaptation of water lily leaves. Suggest why.

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..... [2]

(e) Hydrophytes are adapted to aquatic habitats.

State the name used for plants that are adapted to dry habitats.

..... [1]

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(f) Explain what is meant by the term *adaptive feature*.

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..... [2]

[Total: 11]

5 The numbers of different cells in a blood sample were counted. The results are shown in Table 5.1.

Table 5.1

cell type	number / per mm^3	percentage
red blood cells	4 820 000	94.91
lymphocytes	1 900	0.04
phagocytes	6 000	0.12
platelets	250 000	
total	5 077 900	100.00

(a) Complete the table by calculating the percentage of platelets. Write your answer in Table 5.1 to two decimal places. [1]

(b) State the role of platelets in the blood **and** describe the process they are involved in.

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..... [4]

(c) Lymphocytes are white blood cells that are produced in bone marrow. Lymphocytes travel in the blood from bone marrow to lymph nodes throughout the body.

If a pathogen infects the body, some of these lymphocytes are activated.

State the role of lymphocytes in defence against pathogens.

..... [1]

(d) During a second infection of the same pathogen the response by lymphocytes is much faster. Explain how this happens.

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..... [2]

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(e) HIV invades specific lymphocytes that coordinate immune responses.

Fig. 5.1 shows the change in numbers of these lymphocytes following an HIV infection that has not been treated.

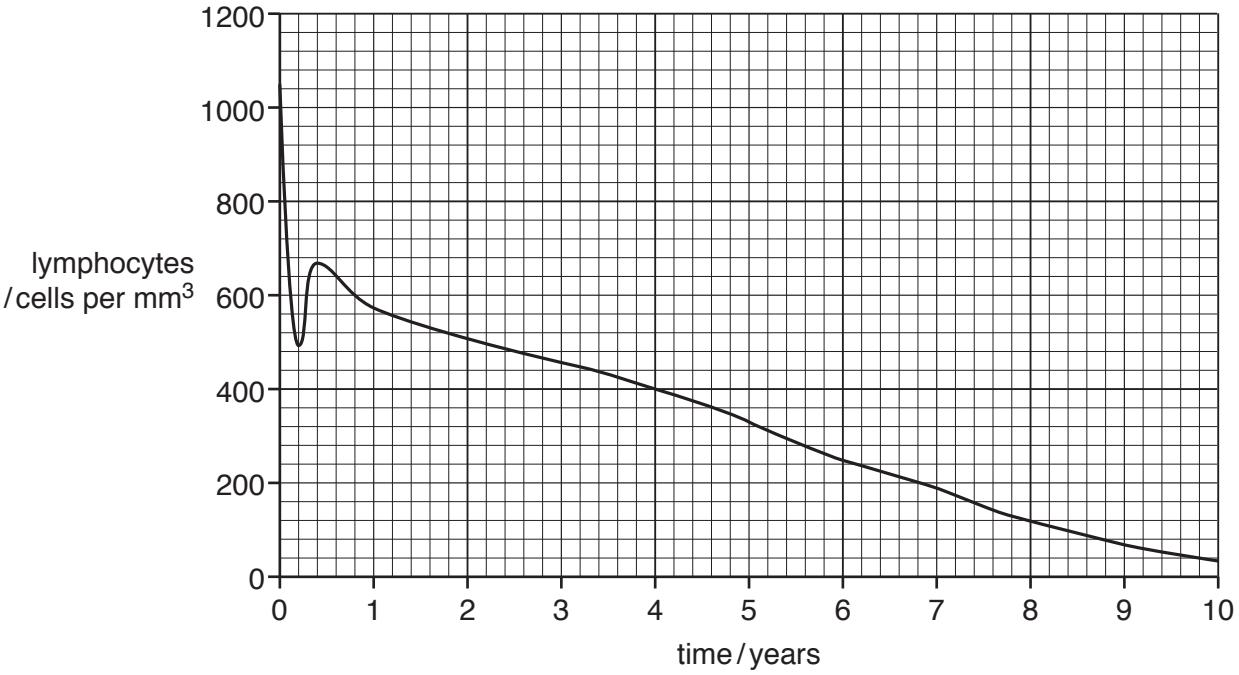

Fig. 5.1

(i) Describe the changes in lymphocyte numbers following HIV infection.

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..... [3]

(ii) Describe the effects on the body of an untreated HIV infection as shown in Fig. 5.1.

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..... [3]

[Total: 14]

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6 Wetlands are internationally important ecosystems. The spoon-billed sandpiper, *Calidris pygmaea*, is an endangered species.

Fig. 6.1 shows a spoon-billed sandpiper feeding in a wetland ecosystem. The wetland is a stopover on the bird's long migration from north-east Russia to south-east Asia.

The smaller photograph is a close-up of the bird's legs to show that it has been ringed.

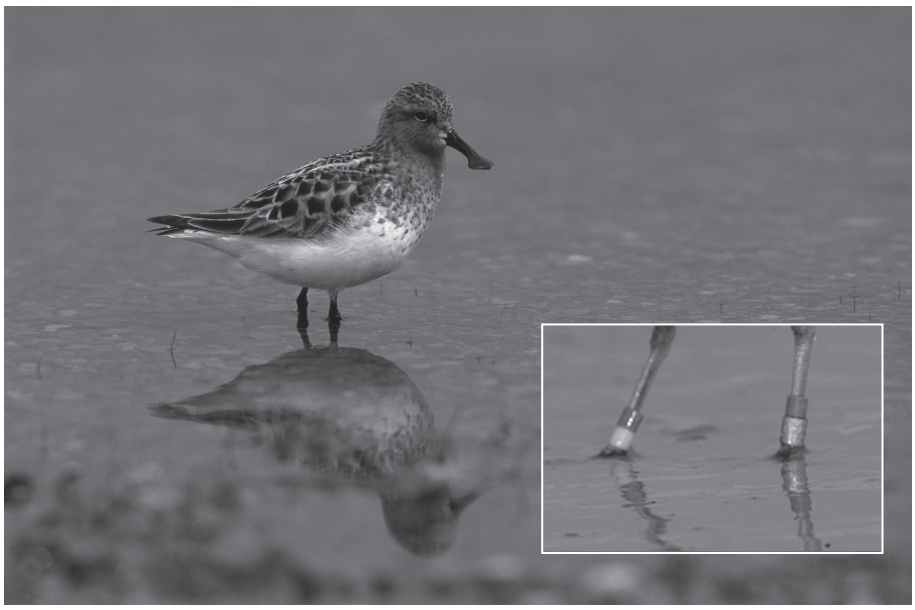

Fig. 6.1

Spoon-billed sandpipers stop to feed at the Rudong mudflats near Shanghai, China.

Putting one or more rings on a bird's leg is a common way to identify individual birds. Spoon-billed sandpipers ringed in Russia have been seen at the Rudong mudflats.

(a) Suggest why scientists put leg rings on birds, such as the spoon-billed sandpiper.

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(b) Explain why it is important to conserve ecosystems, such as wetlands.

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[Total: 7]

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