Location Entry Codes

As part of CIE's continual commitment to maintaining best practice in assessment, CIE uses different variants of some question papers for our most popular assessments with large and widespread candidature. The question papers are closely related and the relationships between them have been thoroughly established using our assessment expertise. All versions of the paper give assessment of equal standard.

The content assessed by the examination papers and the type of questions is unchanged.

This change means that for this component there are now two variant Question Papers, Mark Schemes and Principal Examiner's Reports where previously there was only one. For any individual country, it is intended that only one variant is used. This document contains both variants which will give all Centres access to even more past examination material than is usually the case.

The diagram shows the relationship between the Question Papers, Mark Schemes and Principal Examiners' Reports that are available.

Question Paper	**Mark Scheme**	**Principal Examiner's Report**
Introduction	Introduction	Introduction
First variant Question Paper	First variant Mark Scheme	First variant Principal Examiner's Report
Second variant Question Paper	Second variant Mark Scheme	Second variant Principal Examiner's Report

Who can I contact for further information on these changes?
Please direct any questions about this to CIE's Customer Services team at:
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The titles for the variant items should correspond with the table above, so that at the top of the first page of the relevant part of the document and on the header, it has the words:

- First variant Question Paper / Mark Scheme / Principal Examiner's Report

or

- Second variant Question Paper / Mark Scheme / Principal Examiner's Report

as appropriate.

First Variant Question Paper

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/02**

Paper 2 Structured Questions AS **October/November 2008**

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 in the spaces provided at the top of this page.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
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.

For Examiner's Use	
1	
2	
3	
4	
5	
Total	

This document consists of **12** printed pages.

UNIVERSITY of CAMBRIDGE International Examinations

[Turn over

Answer **all** the questions.

For Examiner's Use

1 **(a)** Phagocytes and lymphocytes are both involved in defence against infectious diseases. Active B lymphocytes are known as plasma cells.

Fig. 1.1 shows drawings made from electron micrographs of a phagocyte, **A**, and a plasma cell, **B**.

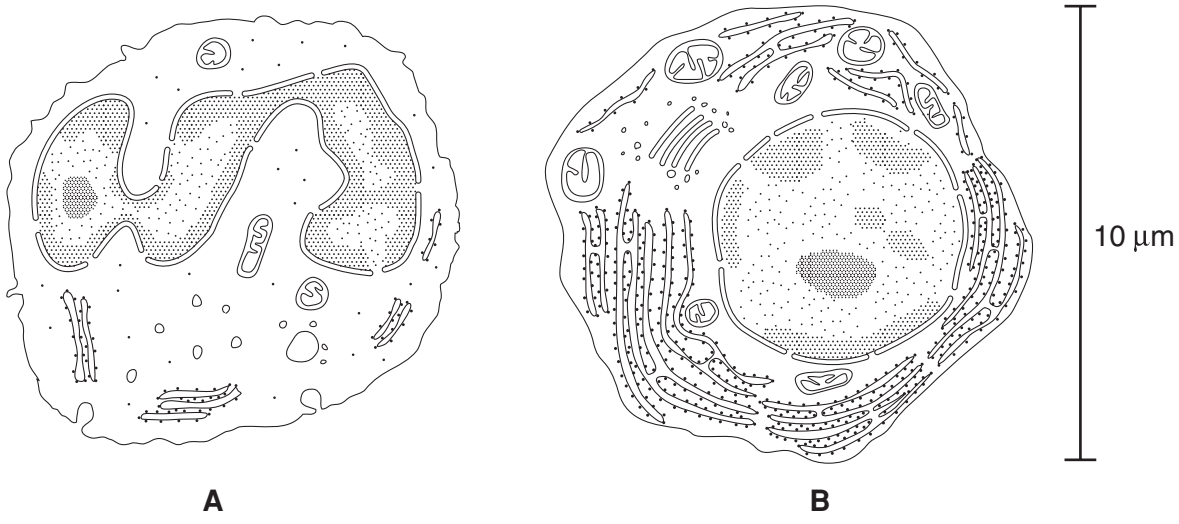

Fig. 1.1

Complete the table to show three **visible structural** differences between the cells **A** and **B**.

feature	cell **A**	cell **B**

[3]

(b) Calculate the magnification of the cells in Fig. 1.1.

Show your working and give your answer to the **nearest whole number**.

..... [2]

(c) With reference to Fig. 1.1, describe the modes of action of the two cells in defence against infectious diseases.

For Examiner's Use

phagocyte .....

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..... [3]

plasma cell .....

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..... [3]

(d) The bacteria that cause tuberculosis (TB) infect cells in the lungs, including some phagocytic cells. TB is treated with a combination of several antibiotics that are taken over a period of about nine months.

Explain why the antibiotics used to treat TB are taken in combination over a long period of time.

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..... [4]

[Total: 15]

2 **(a)** Plants absorb water from the soil.

For Examiner's Use

Describe the pathways taken by water as it moves from the soil into the xylem of the root.

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..... [4]

Fig. 2.1 is a plan diagram of a transverse section of a leaf from *Nerium oleander*, a plant that is adapted to survive in dry areas.

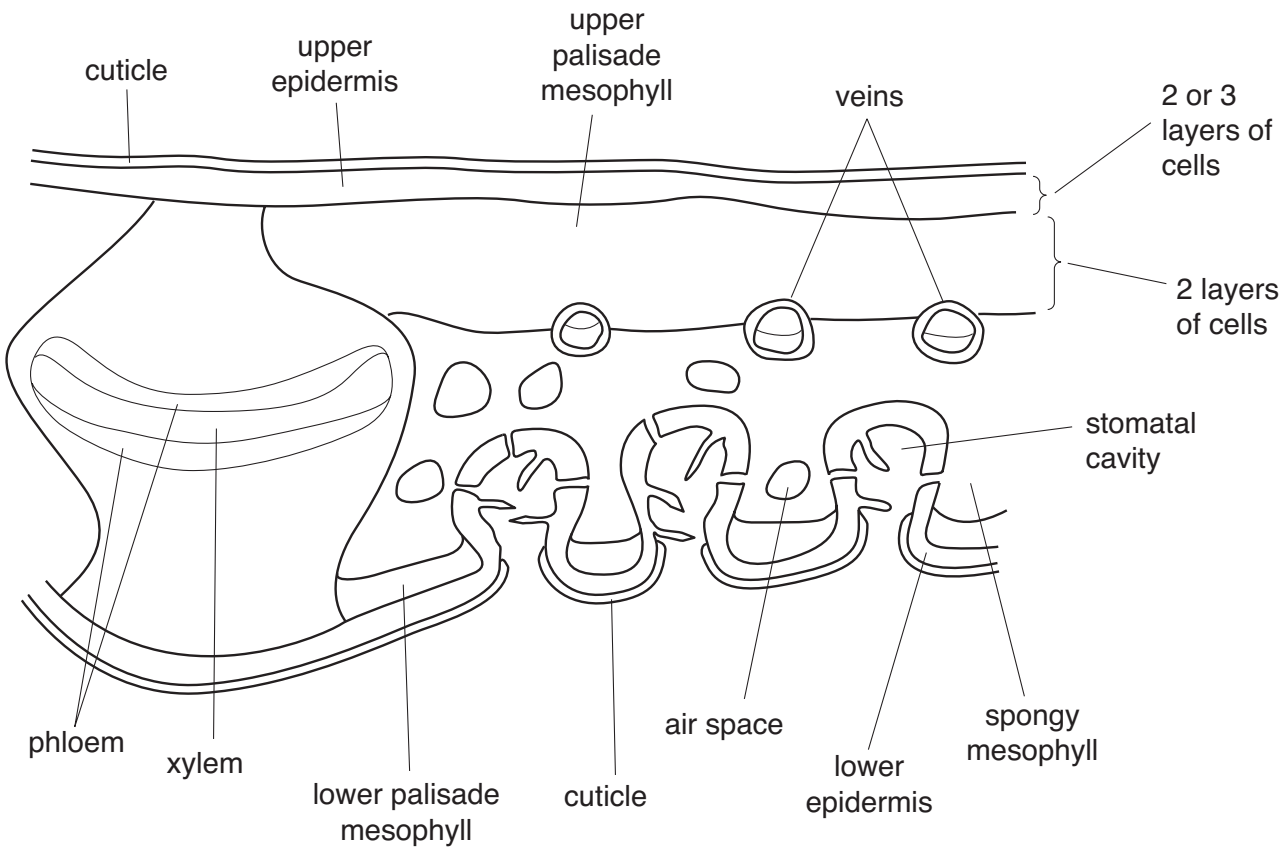

Fig. 2.1

Fig. 2.2 shows detail of the lower epidermis that lines the stomatal cavities of *N. oleander*.

For Examiner's Use

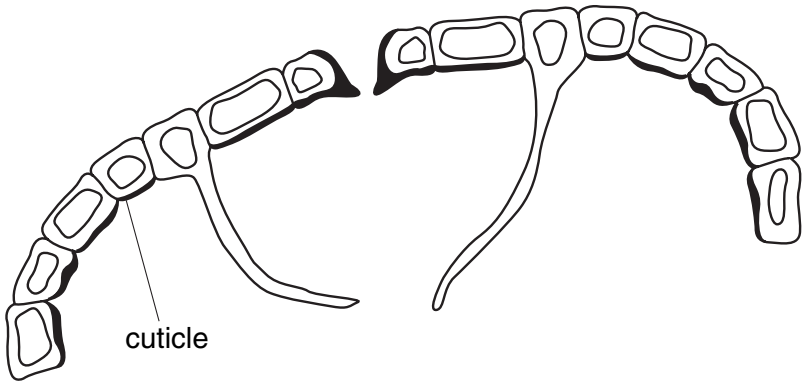

Fig. 2.2

(b) Using information in Fig. 2.1 and Fig. 2.2,

(i) explain why transpiration is considered to be an "inevitable consequence of gas exchange" in plants, such as *N. oleander*

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..... [3]

(ii) explain how the leaves of *N. oleander* are adapted to reduce water loss.

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..... [3]

[Total: 10]

3 Lysozyme is an enzyme found in many places within the human body. It consists of a single polypeptide folded into a complex shape.

Fig. 3.1 shows a ribbon model of lysozyme.

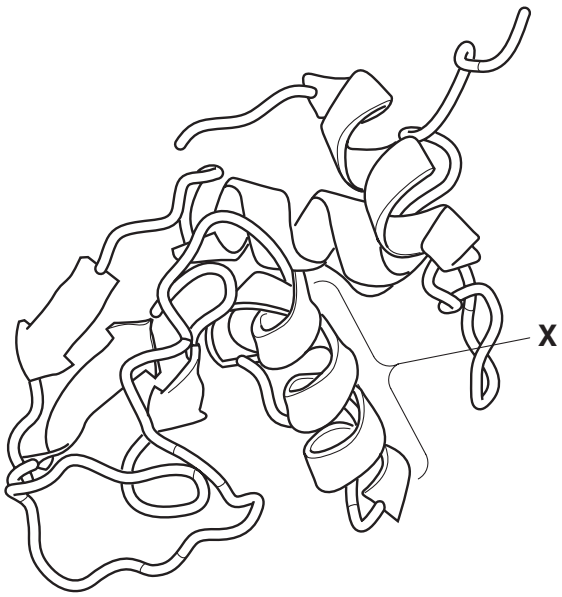

Fig. 3.1

(a) With reference to Fig. 3.1, state the name given to the level of organisation shown,

(i) by the whole polypeptide

..... [1]

(ii) at region **X**.

..... [1]

(b) Name the part of the enzyme where the reaction occurs.

..... [1]

(c) Table 3.1 shows some mRNA codons and the amino acids for which they code.

For Examiner's Use

Table 3.1

amino acid	abbreviation	mRNA codons					
glutamic acid	glu	GAA	GAG	–	–	–	–
phenylalanine	phe	UUU	UUC	–	–	–	–
lysine	lys	AAA	AAG	–	–	–	–
proline	pro	CCA	CCC	CCG	CCU	–	–
threonine	thr	ACA	ACC	ACG	ACU	–	–
valine	val	GUA	GUC	GUG	GUU	–	–
cysteine	cys	UGC	UGU	–	–	–	–
arginine	arg	CGC	CGA	CGU	CGG	AGA	AGG

Fig. 3.2 shows,

- the sequence of three amino acids in the human lysozyme polypeptide
- part of a possible sequence of nucleotide bases for the mRNA that codes for these amino acids
- one of the corresponding nucleotide bases in the DNA.

amino acids	arg	cys	glu
mRNA	.....	.....	GAA
DNA	GCA	.....	.....

Fig. 3.2

(i) Use the information in Table 3.1 to complete the nucleotide sequences for the mRNA and the DNA shown in Fig. 3.2. Write your answer on Fig. 3.2. [3]

(ii) Explain why the human gene for lysozyme may have a different nucleotide sequence from the answer you have given in **(c)(i)**.

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..... [2]

(d) In an investigation of the effects of lysozyme, researchers isolated the enzyme from mice to find how effective the enzyme was at destroying bacteria. Lysozyme catalyses the hydrolysis of glycosidic bonds in certain polysaccharides found in the cell walls of some bacteria.

For Examiner's Use

Four different concentrations of lysozyme were made. Two pathogenic bacteria, *Escherichia coli* and *Staphylococcus aureus*, were incubated in each concentration for three hours at 37 °C. At the end of the incubation, the researchers determined the number of bacteria still alive and expressed their results as percentages of the number of bacteria present at the start of the incubation.

The results are shown in Fig. 3.3.

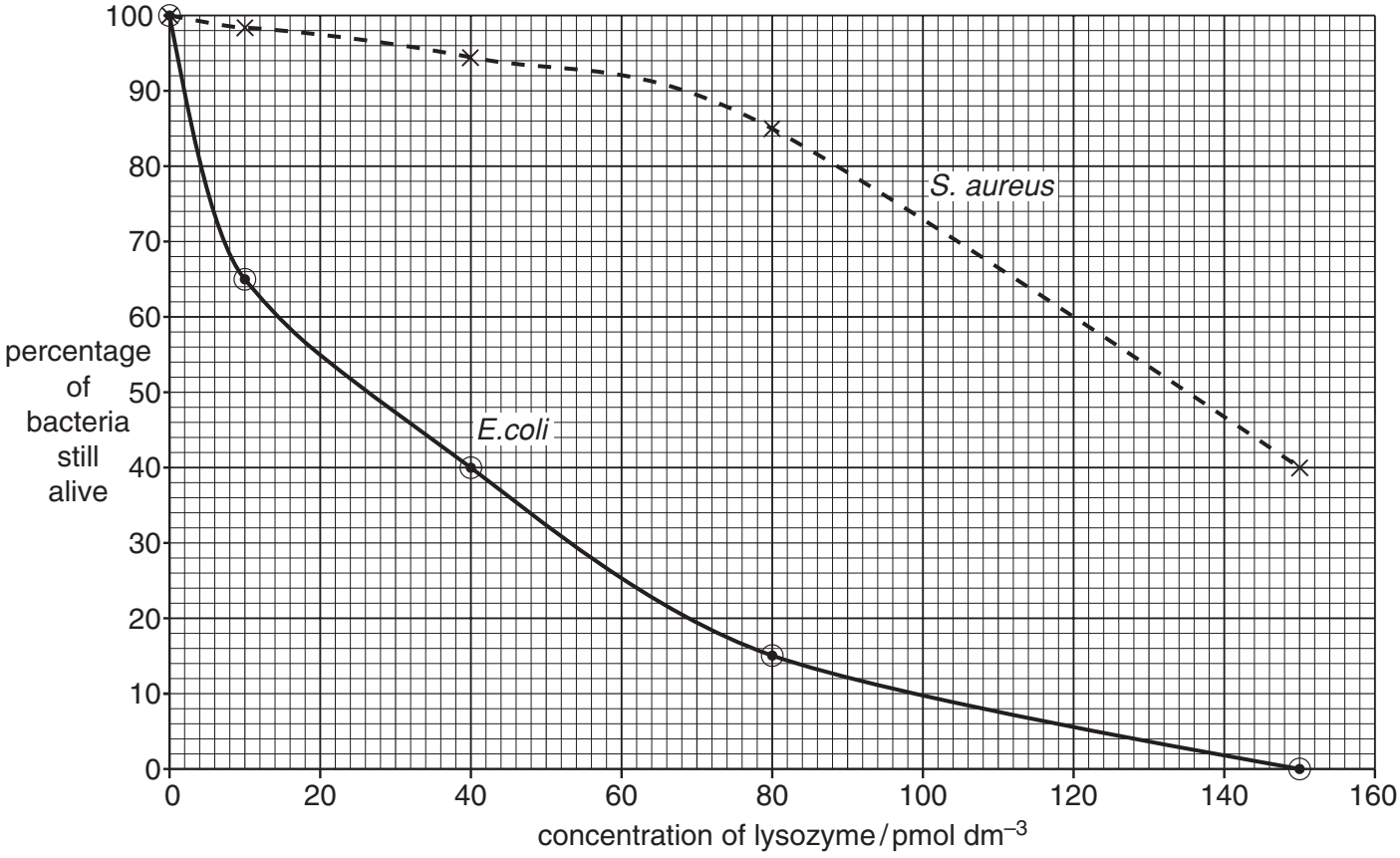

Fig. 3.3

(i) Using the information in Fig. 3.3, describe the effect of the different concentrations of lysozyme on *E. coli* and *S. aureus*.

For Examiner's Use

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..... [4]

(ii) Suggest a possible explanation for the different effects of lysozyme on *E. coli* and *S. aureus*.

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..... [2]

[Total: 14]

[Turn over

4 **(a)** Mammals have a closed, double circulation.

State what is meant by the term *double circulation*.

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..... [1]

Fig. 4.1 shows part of the circulation in a mammalian tissue. The central part is enlarged to show a capillary, a cell supplied by the capillary, and vessel **Z.**

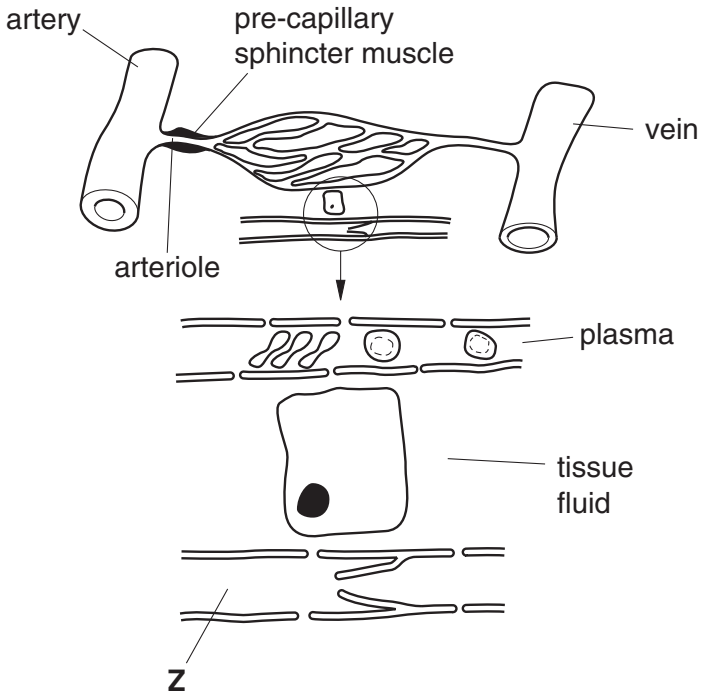

Fig. 4.1

(b) Explain why the wall of the artery is thicker than the wall of the vein.

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..... [2]

(c) Suggest one role for the pre-capillary sphincter muscle shown in Fig. 4.1.

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..... [1]

(d) With reference to Fig. 4.1, describe the role of capillaries in forming tissue fluid.

For Examiner's Use

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..... [3]

(e) **(i)** Describe three ways in which plasma differs from tissue fluid.

1. .....

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2. .....

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3. .....

..... [3]

(ii) Name the fluid in vessel **Z**.

..... [1]

[Total: 11]

5 **(a)** Table 5.1 contains statements about four molecules.

For Examiner's Use

Complete the table by indicating with a tick (✓) or a cross (✘) whether the statements apply to haemoglobin, DNA, phospholipids or antibodies.

You should put a tick or a cross in each box of the table.

Table 5.1

statement	haemoglobin	DNA	phospholipids	antibodies
contains iron				
contains phosphate				
able to replicate				
hydrogen bonds stabilise the molecule				
contains nitrogen				

[5]

(b) Water is sometimes described as providing an ideal environment for many organisms.

Explain how the hydrogen bonds between water molecules affect the properties of water and help to make water an ideal environment for many organisms.

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..... [5]

[Total: 10]

Second Variant Question Paper

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2154760135

BIOLOGY **9700/02**

Paper 2 Structured Questions AS **October/November 2008**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator
Ruler (cm/mm)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces provided at the top of this page.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs or rough working.
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DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
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.

For Examiner's Use	
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Total	

This document consists of **15** printed pages and **1** blank page.

UNIVERSITY of CAMBRIDGE International Examinations

[Turn over

Answer **all** the questions.

For Examiner's Use

1 Receptor proteins are part of the fluid mosaic structure of cell surface (plasma) membranes of T-lymphocytes. Each type of receptor protein is specific to a particular antigen.

Fig. 1.1 shows a receptor protein and the surrounding phospholipids of a cell surface membrane of a T-lymphocyte.

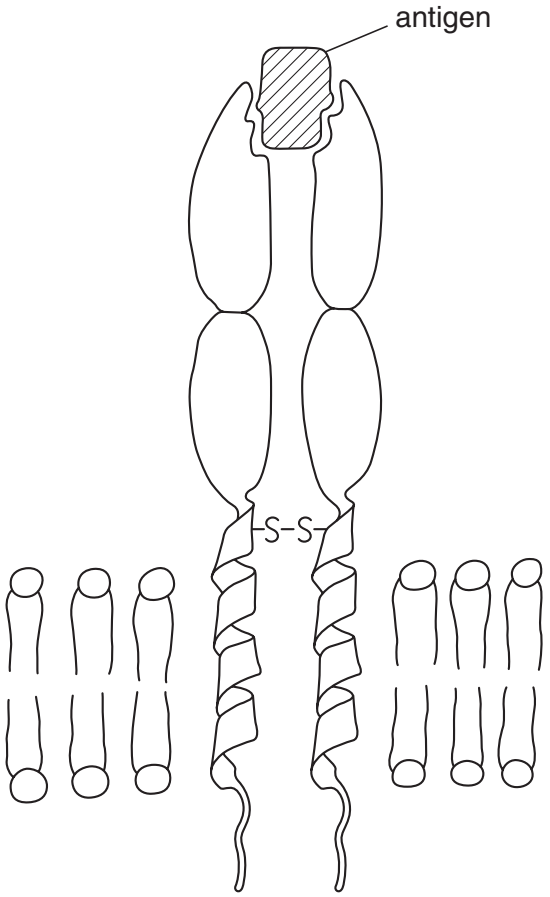

Fig. 1.1

(a) (i) Draw a bracket (}) on Fig. 1.1 to indicate the width of the phospholipid bilayer. [1]

(ii) Explain the term *fluid mosaic*.

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..... [2]

(iii) Describe how the **structure** of the receptor shown in Fig. 1.1 is similar to the structure of an antibody molecule.

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.....

..... [2]

(b) Describe the roles of T-lymphocytes in a primary immune response.

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..... [4]

(c) Describe three functions of cell surface membranes, **other than** the recognition of antigens.

1 .....

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2 .....

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3 .....

..... [3]

[Total: 12]

2 Polysaccharides, such as glycogen, amylopectin and amylose, are formed by polymerisation of glucose. Fig. 2.1 shows part of a glycogen molecule.

For Examiner's Use

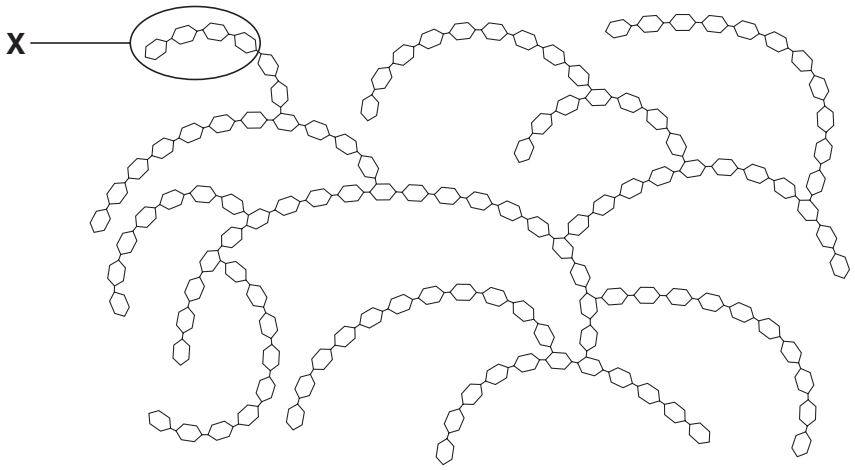

Fig. 2.1

(a) With reference to Fig. 2.1,

(i) describe how the **structure** of glycogen differs from the structure of amylose;

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..... [2]

(ii) describe the advantages for organisms in storing polysaccharides, such as glycogen, rather than storing glucose.

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..... [3]

(b) Glycogen may be broken down to form glucose.

For Examiner's Use

Fig. 2.2 shows region **X** from the glycogen molecule in Fig. 2.1 in more detail.

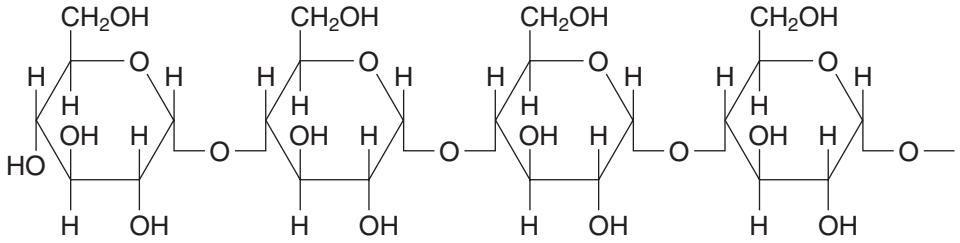

Fig. 2.2

Draw an annotated diagram in the space provided to explain how a glucose molecule is formed from the free end of the glycogen molecule shown in Fig. 2.2.

[3]

[Total: 8]

3 Trypsin is a protease enzyme, which hydrolyses protein molecules, such as albumen, to amino acids.

A student investigated the effect of substrate concentration on the activity of trypsin. Six different concentrations of albumen were prepared and trypsin was added to each in turn. The student measured the time for albumen to break down and then calculated the rate of reaction. The investigation was carried out at 35 °C.

The student's results are shown in Fig. 3.1.

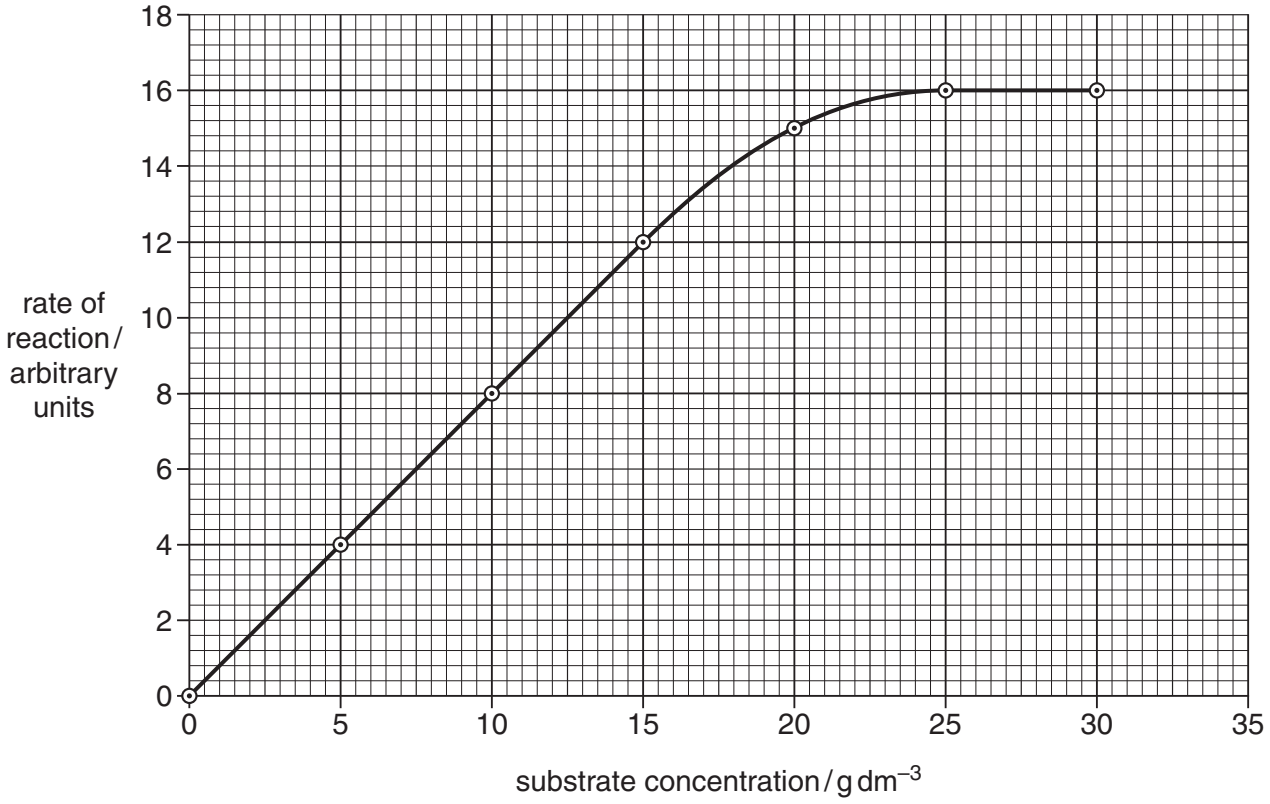

Fig. 3.1

(a) Explain the results shown in Fig. 3.1.

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..... [3]

(b) The student repeated the investigation at 25 °C.

Draw on Fig. 3.1 a curve to show the results that you would expect. [2]

During infections of the lungs, phagocytes move from the blood to the lining of the alveoli.

For Examiner's Use

Phagocytes release the enzyme elastase (a protease) in order to digest a pathway through the alveolar wall. Most people produce a glycoprotein, alpha 1-antitrypsin (AAT), in the lung which inhibits elastase and so prevents widespread breakdown of alveoli. The inhibitory action of AAT was investigated using the enzyme trypsin.

(c) Describe **one** way in which AAT may act to inhibit the enzyme elastase.

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..... [3]

(d) Explain how you would adapt the student's investigation with trypsin to find out how AAT acts as an inhibitor.

You may use the space below to sketch the graph of the results that you might expect.

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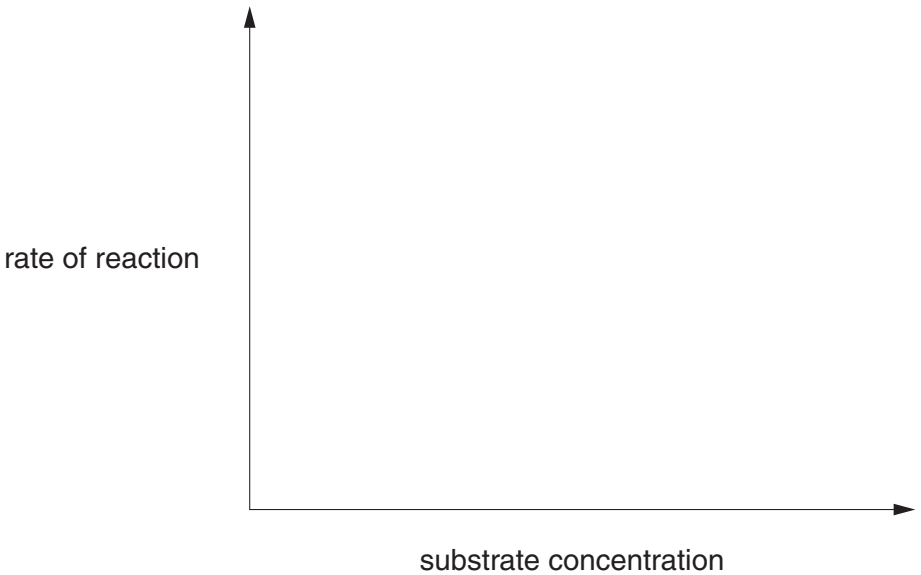

[4]

(e) Elastase breaks down the protein elastin. Describe the function of elastin in the lungs.

For Examiner's Use

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..... [2]

(f) Tobacco smoke inactivates AAT. In long-term smokers this can result in the breakdown of much of the elastin in the lungs.

State the name of the condition that results from breakdown of elastin that occurs in some long-term smokers.

..... [1]

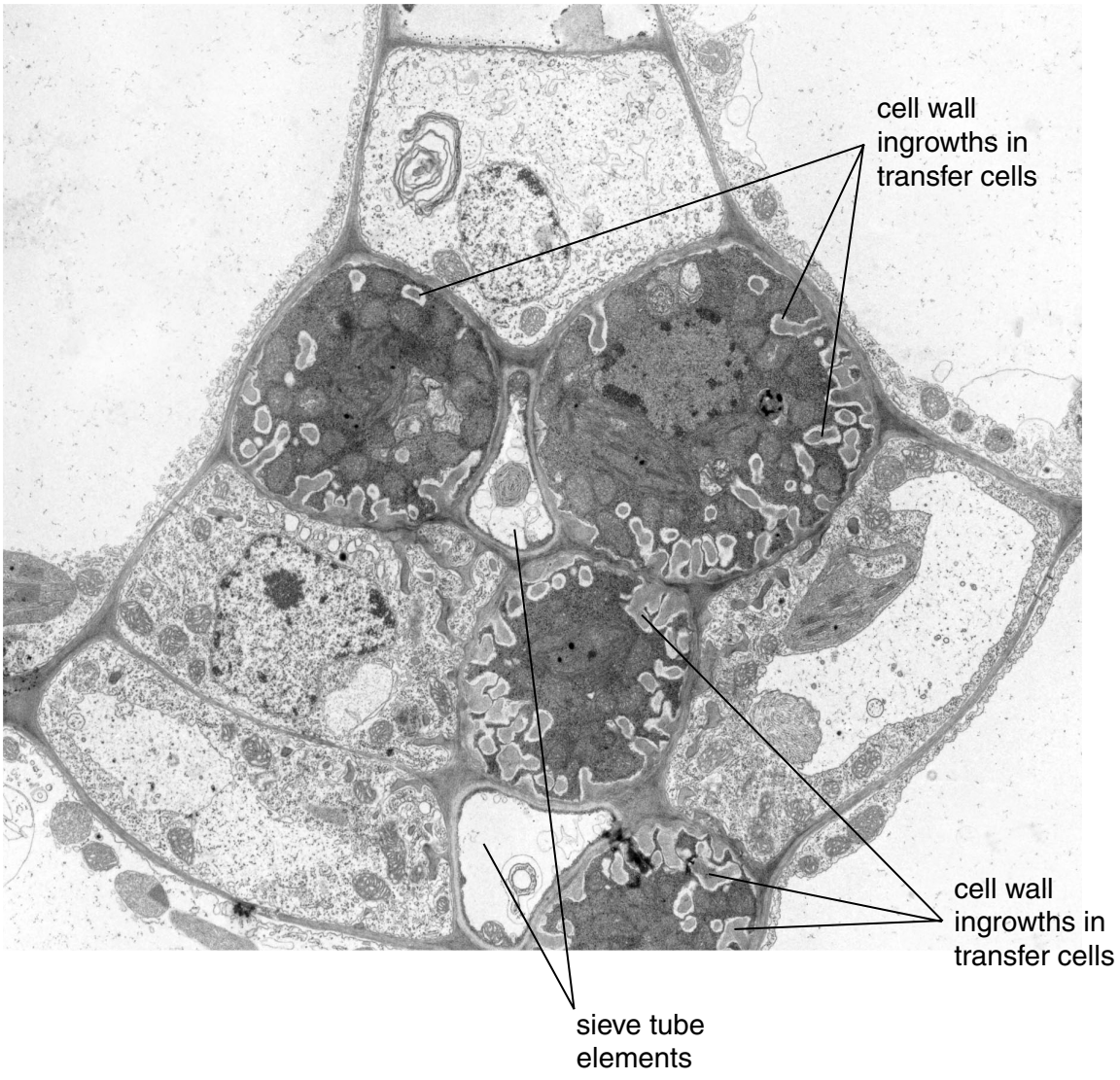
[Total: 15]

4 Phloem transfer cells are specialised companion cells that load sucrose into sieve tube elements.

For Examiner's Use

Fig. 4.1 is an electron micrograph of a transverse section showing phloem tissue from a leaf of *Senecio vulgaris*. The section shows two sieve tube elements and four phloem transfer cells. The sieve tube elements are small in this section because it is taken at the end of a vein in the leaf.

It is thought that the many ingrowths of the cell walls visible in Fig. 4.1 are related to the movement of large quantities of sucrose.



magnification = ×10,000

Fig. 4.1

(a) Describe how companion cells load sucrose into phloem sieve tubes.

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..... [4]

(b) Transfer cells move large quantities of sucrose into phloem sieve tubes.

Suggest why these cells have cell wall ingrowths as shown in Fig. 4.1.

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..... [2]

(c) **(i)** Explain the advantage of studying cells, such as transfer cells, with the electron microscope rather than the light microscope.

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..... [2]

(ii) Describe the appearance of the phloem sieve tubes when viewed in longitudinal section.

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..... [2]

[Total: 10]

5 *Plasmodium falciparum* is the causative agent of the most severe form of malaria.

It is distributed throughout the tropics.

For Examiner's Use

(a) Explain why malaria is restricted to the tropics.

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..... [2]

The haploid number of *P. falciparum* is 14.

For Examiner's Use

Fig. 5.1 shows the life cycle of *P. falciparum*.

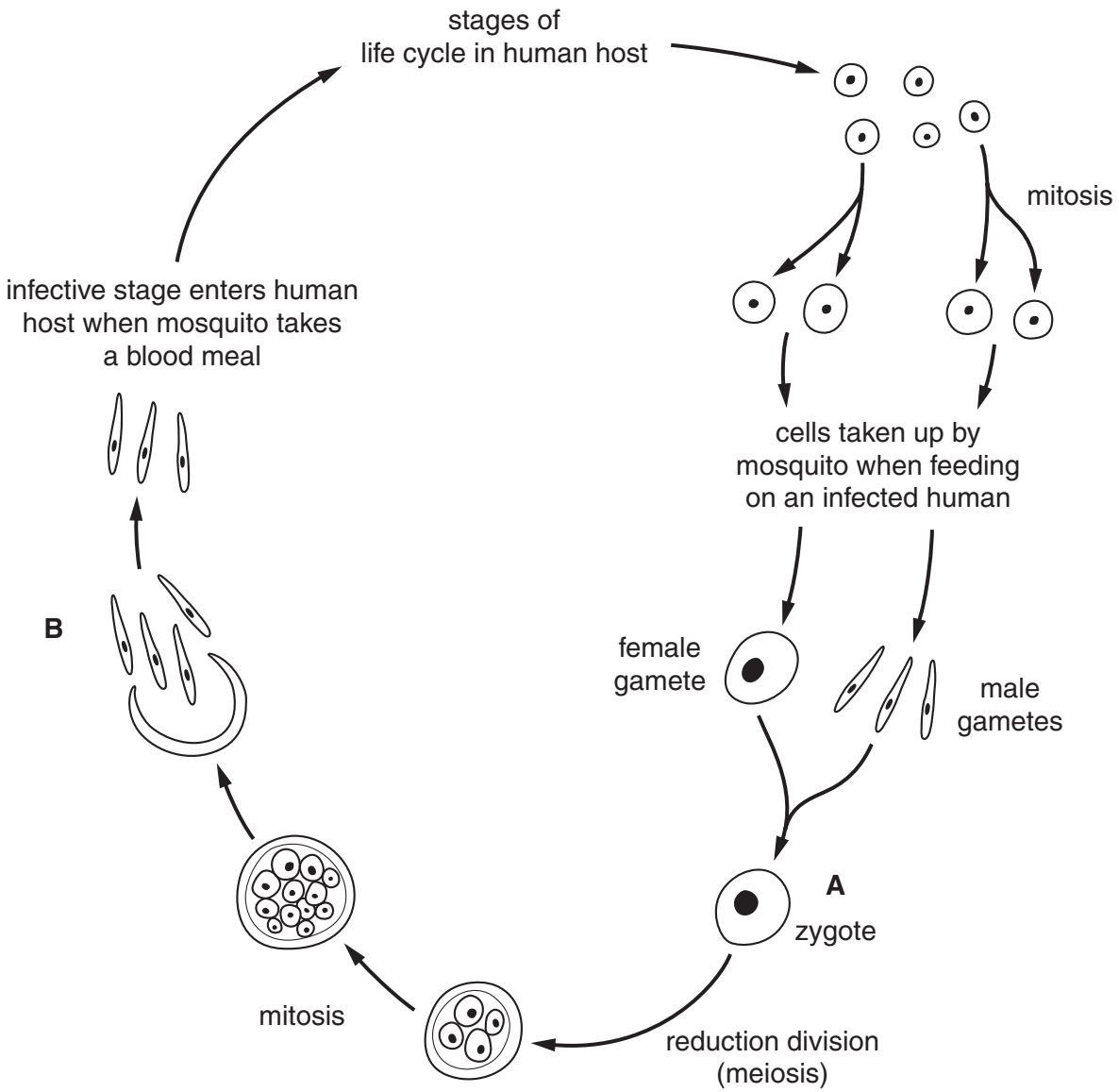

Fig. 5.1

(b) (i) State the number of chromosomes present at stages **A** and **B**.

A .....

B ..... [2]

(ii) Explain why a reduction division (meiosis) occurs during the life cycles of organisms, such as *Plasmodium*, that reproduce sexually.

For Examiner's Use

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.....

.....

..... [2]

(c) Explain why it has proved difficult to develop a vaccine for malaria.

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..... [4]

[Total: 10]

6 The element nitrogen is present in many biological molecules, such as amino acids, proteins and nucleotides.

For Examiner's Use

Fig. 6.1 shows part of the nitrogen cycle.

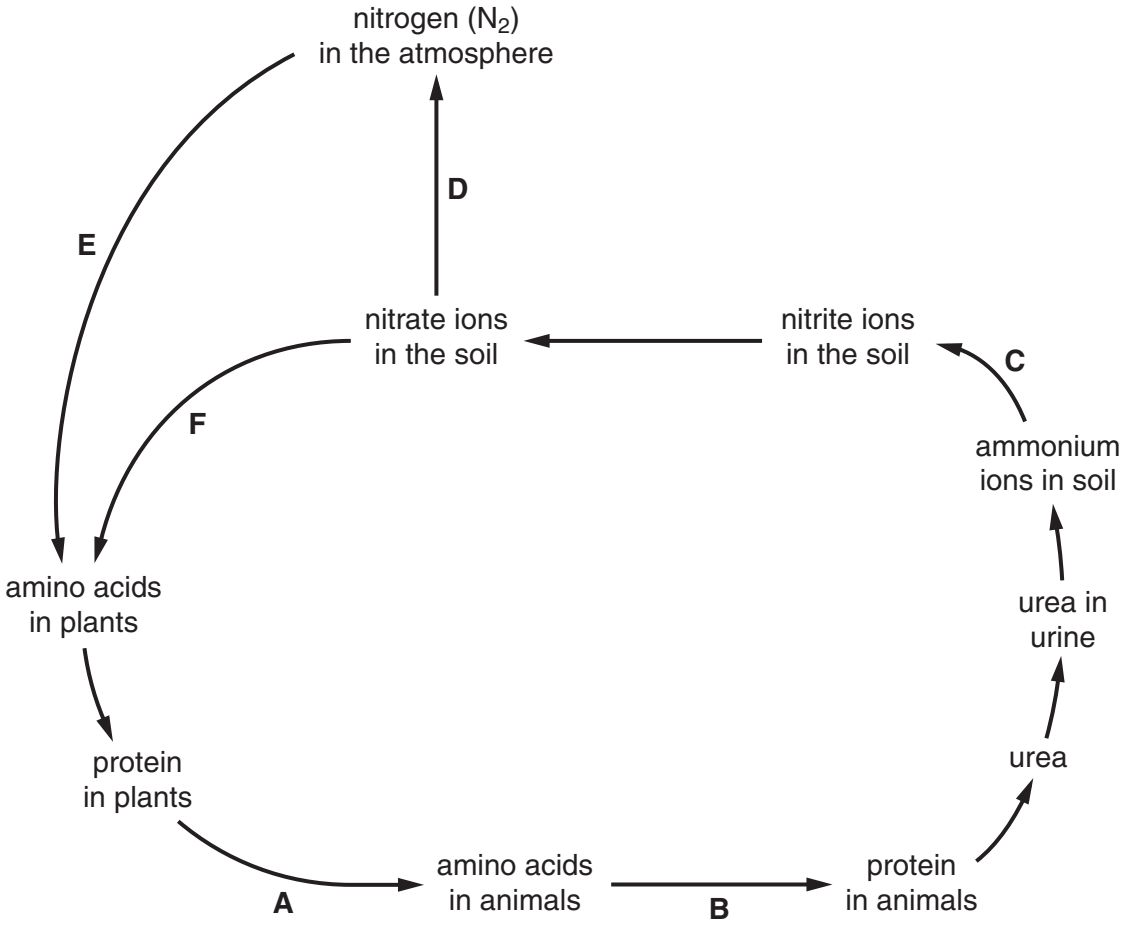

Fig. 6.1

The statements 1 to 10 are processes that occur during the nitrogen cycle.

For each of the stages **B** to **F** shown on Fig. 6.1, select the appropriate description from the list of statements and write it in the box provided.

Write only **one** number in each box.

The first one (**A**) has been selected and completed for you.

1 digestion by primary consumers

2 amino acid synthesis in plants

3 protein synthesis in primary consumers

4 nitrification

5 decomposition

6 nitrogen fixation

7 excretion

8 deamination in primary consumers

9 denitrification

10 deamination by bacteria and fungi

A	1
B	.....
C	.....
D	.....
E	.....
F	.....

[Total: 5]

For Examiner's Use

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