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.
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	
6	
Total	

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

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.

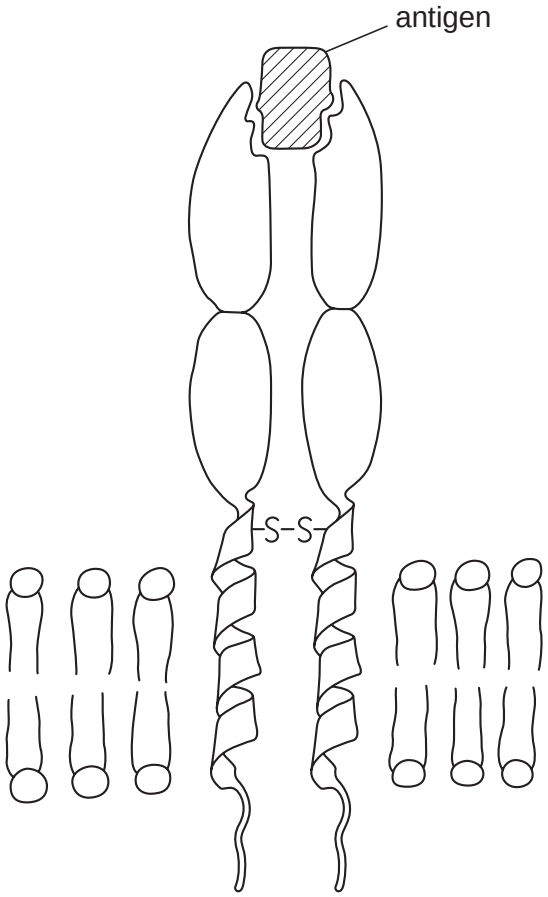

Fig. 1.1

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

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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

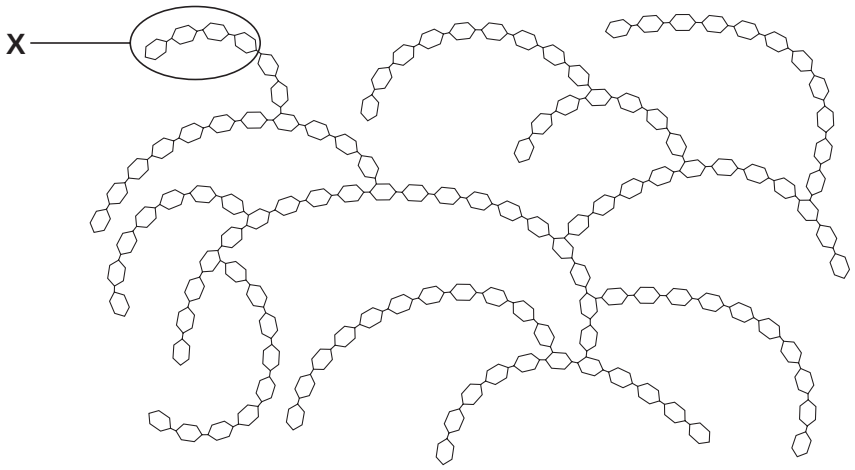

Fig. 2.1

(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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(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.

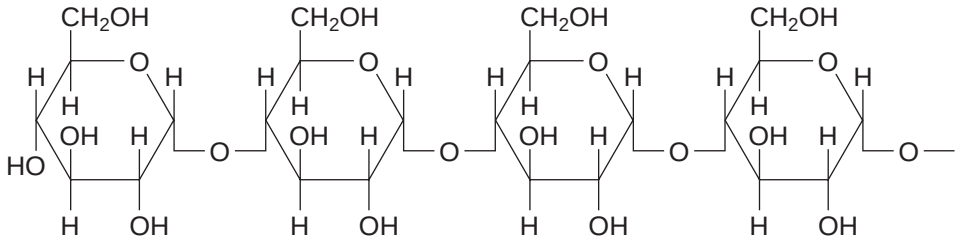

Fig. 2.2

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.

For Examiner's Use

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.

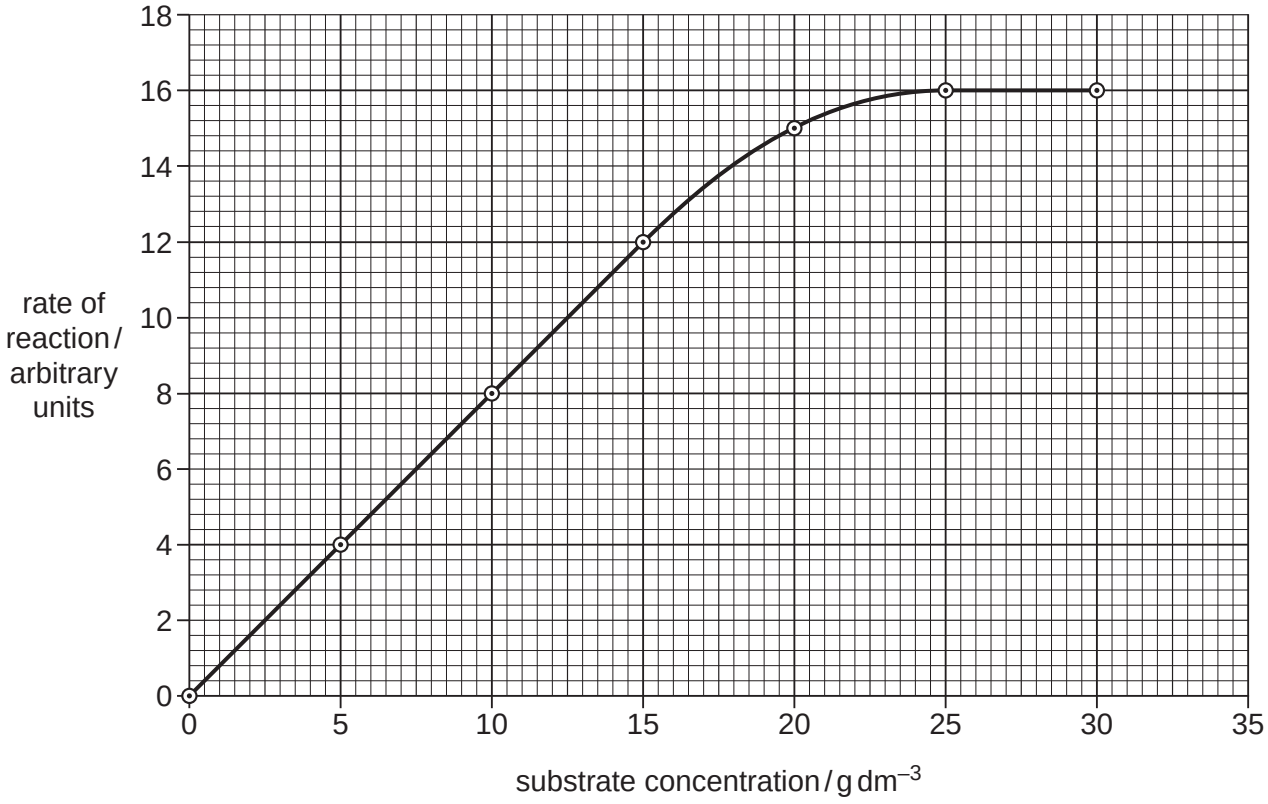

Fig. 3.1

(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.

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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(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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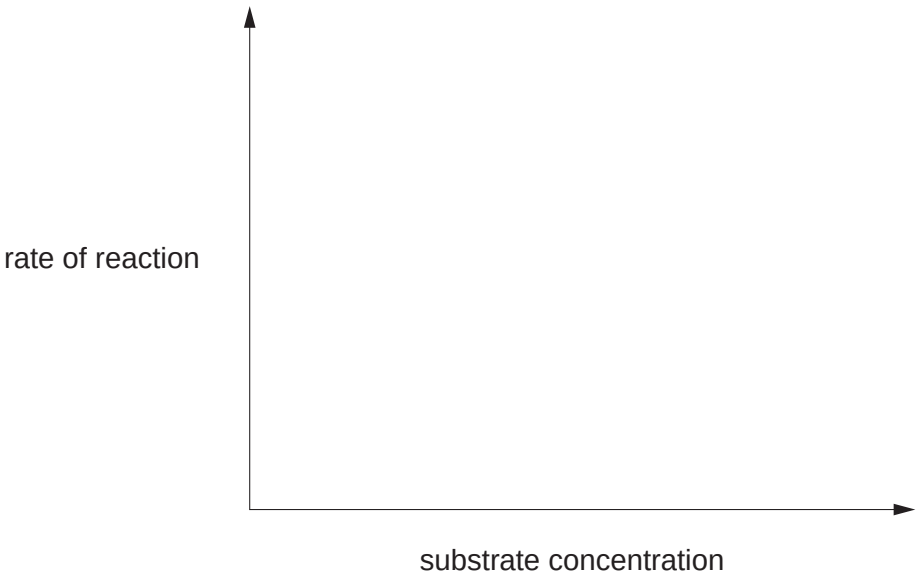

[4]

(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.

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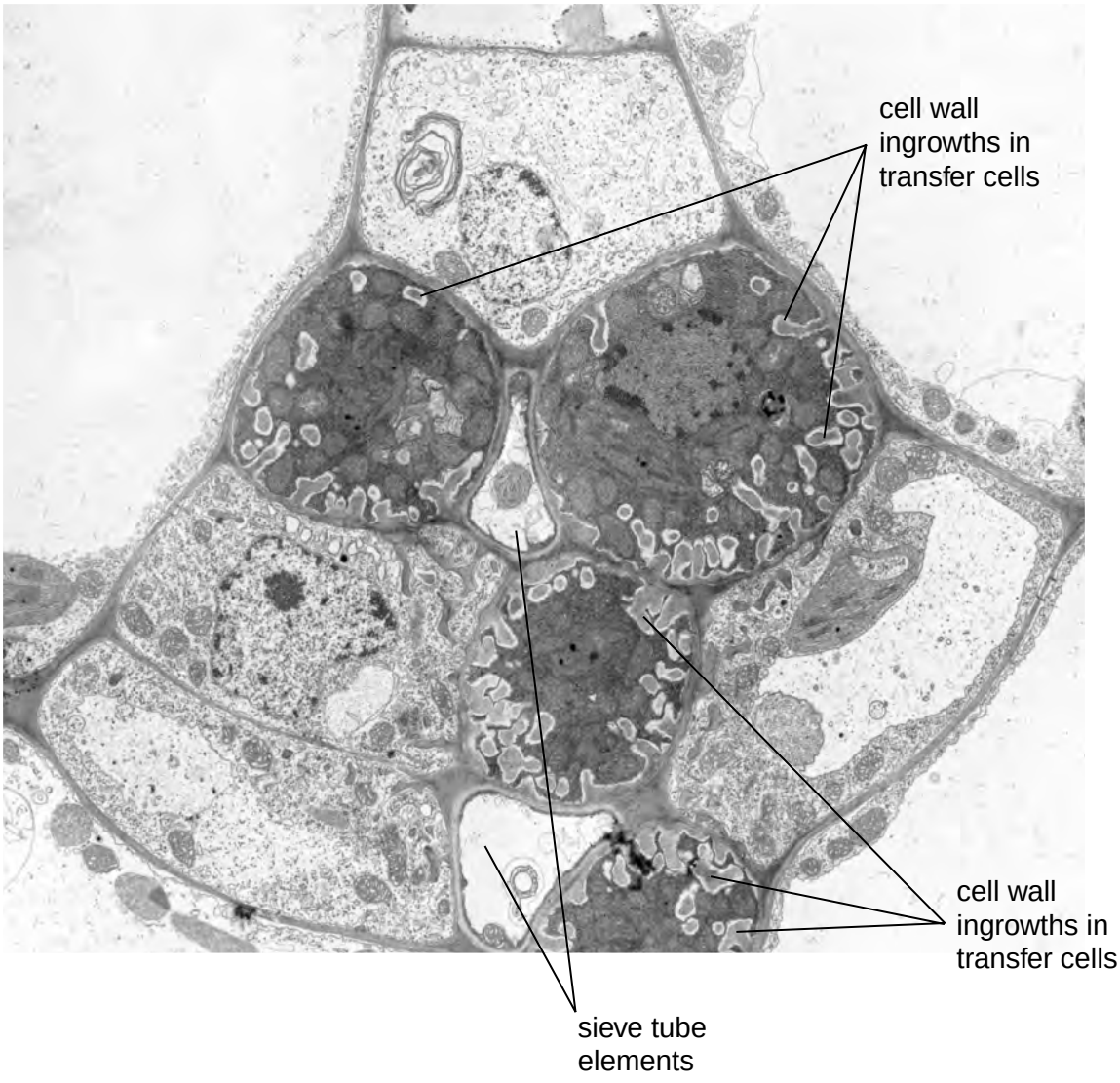
Fig. 4.1 is an electron micrograph of a transverse section showing phloem tissue from a leaf of *Senecio vulgaris*. The section shows two sieve tube elements and four phloem transfer cells. The sieve tube elements are small in this section because it is taken at the end of a vein in the leaf.

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.

For Examiner's Use

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

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

For Examiner's Use

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

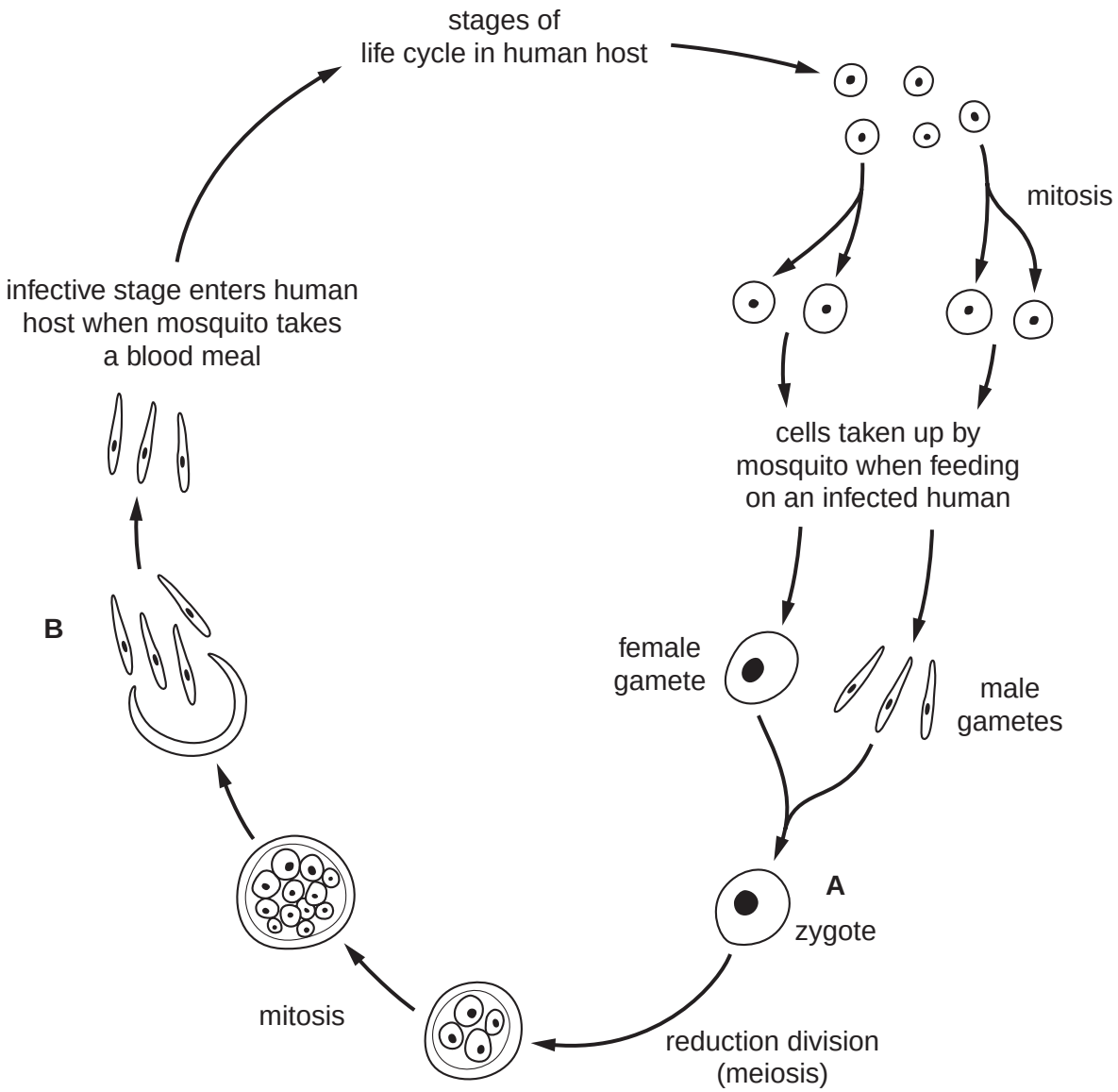

Fig. 5.1

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

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[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.

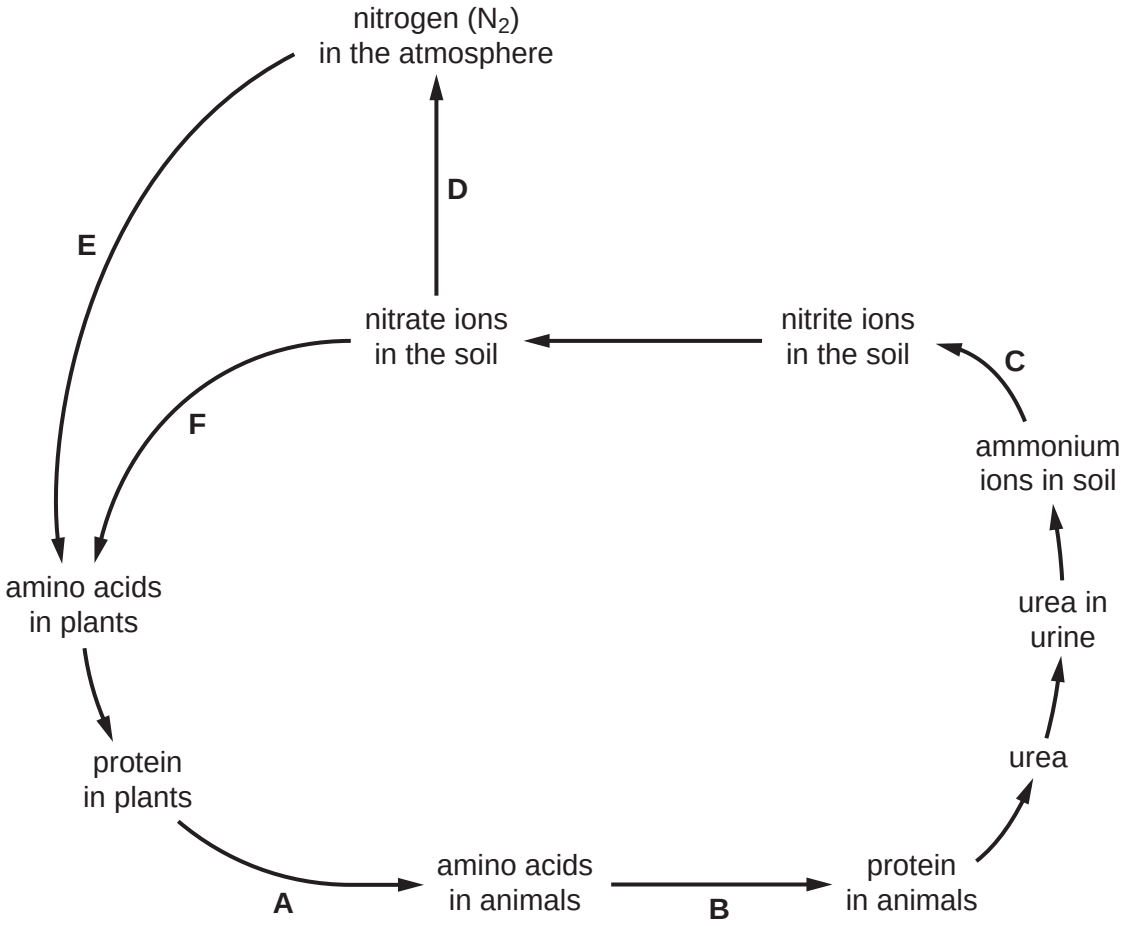

Fig. 6.1

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]

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