



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

CANDIDATE
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BIOLOGY

9700/22

Paper 2 Structured Questions AS

October/November 2011

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 ink.

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 **11** printed pages and **1** blank page.



Answer **all** the questions.

- 1 Fig. 1.1 is a scanning electron micrograph of part of the wall of the bronchus of a healthy human.

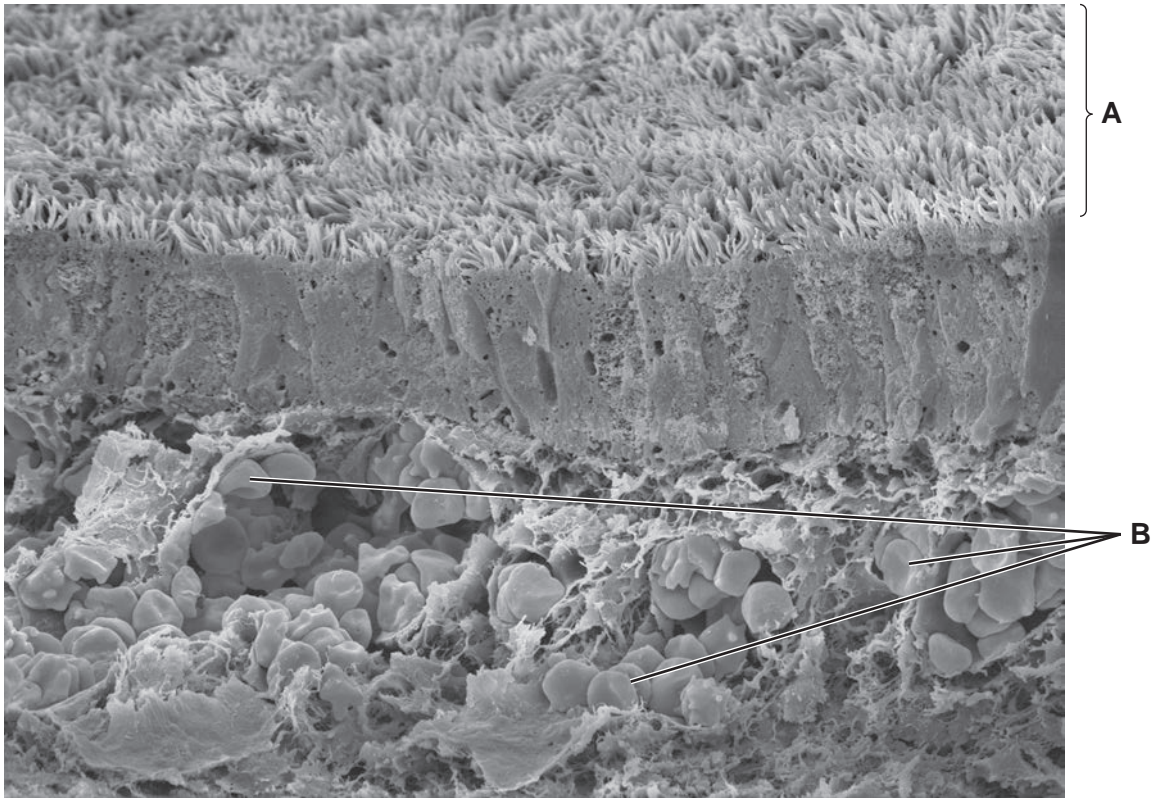


Fig. 1.1

- (a) (i) Name the structures labelled **A**.

.....[1]

- (ii) State the function of the cells labelled **B**.

.....[1]

- (b) Name two tissues found in the wall of the bronchus that are not visible in Fig. 1.1.

1.

2.[2]

2 (a) White blood cells play an important role in defence.

State precisely the type of white blood cell that fits each of the descriptions given in (i) to (iv).

(i) It is formed in the bone marrow and matures from a monocyte. It contains many lysosomes with hydrolytic enzymes.

.....[1]

(ii) It is formed, and matures in, the bone marrow. It contains a lobed nucleus and has the ability to ingest microorganisms by endocytosis.

.....[1]

(iii) When activated, it differentiates into a cell that secretes a chemical, which causes other cells to lyse (burst). It contains a large, spherical nucleus.

.....[1]

(iv) It is formed as a result of a primary immune response and remains in the body. On activation, it has the potential to produce antibodies during a secondary immune response.

.....[1]

(b) In 1980, it was announced that the highly infectious viral disease, smallpox, had been eradicated. This was mainly due to a worldwide vaccination programme planned by the World Health Organization (WHO).

Attempts have been made to control other diseases, such as measles, sickle cell anaemia and cholera, without the same success as smallpox.

(i) Define the term *disease*.

.....
.....
.....
.....
.....[2]

(ii) Describe two features of the vaccine that contributed to the success of the smallpox eradication programme.

1.
.....
.....
.....

2.
.....
.....[2]

(iii) Discuss the reasons why vaccination has **not** eradicated cholera **and** sickle cell anaemia.

cholera
.....
.....
.....
.....
.....
.....
.....
.....
.....

sickle cell anaemia
.....
.....
.....
.....
.....
.....
.....
.....
.....[5]

[Total: 13]

3 *Azotobacter vinelandii* is a bacterium found in the soil that is able to fix atmospheric nitrogen. One feature of nitrogen-fixing bacteria is the ability to synthesise the enzyme nitrogenase, a molybdenum- and iron-containing, protein complex.

(a) (i) Molybdenum is a mineral ion found in the soil solution. It enters the cell as molybdate ions, through membrane transport proteins. The proteins have the ability to bind to, and hydrolyse, ATP.

Name **and** describe the mechanism of transport of molybdate ions into the cell.

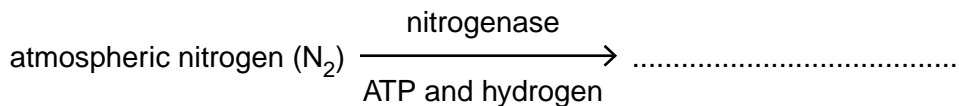
.....
.....
.....
.....
.....
.....
.....[3]

(ii) State the structures in the bacterial cell where the protein components of nitrogenase are synthesised.

.....[1]

(iii) Part of the equation for the reaction that is catalysed by nitrogenase in *A. vinelandii* is shown below.

Complete the equation by naming the product of the reaction.



[1]

(b) Table 3.1 shows the various types of nitrogen fixation that occur throughout the world and gives estimates of the mass of atmospheric nitrogen fixed in a year.

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Table 3.1

| type of nitrogen fixation | | mass of nitrogen fixed / $\times 10^9 \text{ kg yr}^{-1}$ |
|---------------------------|-----------------------|---|
| non-biological | Haber process | 50 |
| | combustion | 20 |
| | lightning | 10 |
| biological | agricultural land | 90 |
| | non-agricultural land | 50 |
| | sea | 35 |

(i) Using data from Table 3.1, calculate the percentage of nitrogen fixation carried out worldwide by nitrogen-fixing organisms, such as *A. vinelandii*, in **agricultural land**.

Show your working and express your answer to the nearest whole number.

answer% [2]

(ii) Explain why the proportion of nitrogen gas in the atmosphere remains stable at 78%, even though nitrogen fixation removes nitrogen gas from the atmosphere.

.....

 [2]

(c) Describe **and** explain the benefits to humans of the presence of nitrogen-fixing bacteria, such as *A. vinelandii*, in agricultural land.

.....

 [3]

[Total: 12]

- 4 (a) Fig. 4.1 shows the structure of deoxyribose sugar.

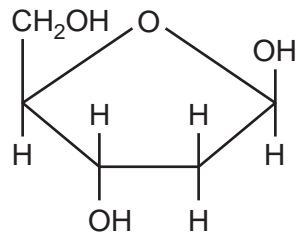


Fig. 4.1

State the differences between the structure of deoxyribose shown in Fig. 4.1 and the ring structure of α -glucose.

You may use the space below to help you in your answer.

.....

.....

.....

.....

[3]

- (b) Match the biological macromolecule with the type of bond that is formed when the molecule is synthesised. Choose from the list below.

amylose cellulose triglyceride protein amylopectin mRNA

| type of bond(s) | biological macromolecule |
|--|--------------------------|
| β , 1-4 glycosidic | |
| α , 1-4 glycosidic and α , 1-6 glycosidic | |
| phosphodiester | |
| peptide | |

[4]

Semi-conservative replication of DNA and transcription involve the formation of polynucleotide chains.

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(c) State the type of reaction that occurs in the formation of a polynucleotide chain.

.....[1]

(d) Complete Table 4.1 to show **four** differences between DNA replication and DNA transcription.

Table 4.1

| | replication | transcription |
|---|-------------|---------------|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |

[4]

[Total: 12]

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Question 1, Fig. 1.1 © STEVE GSCHMEISSNER/SCIENCE PHOTO LIBRARY

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