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

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

6194604481 7

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.

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Answer **all** the questions.

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

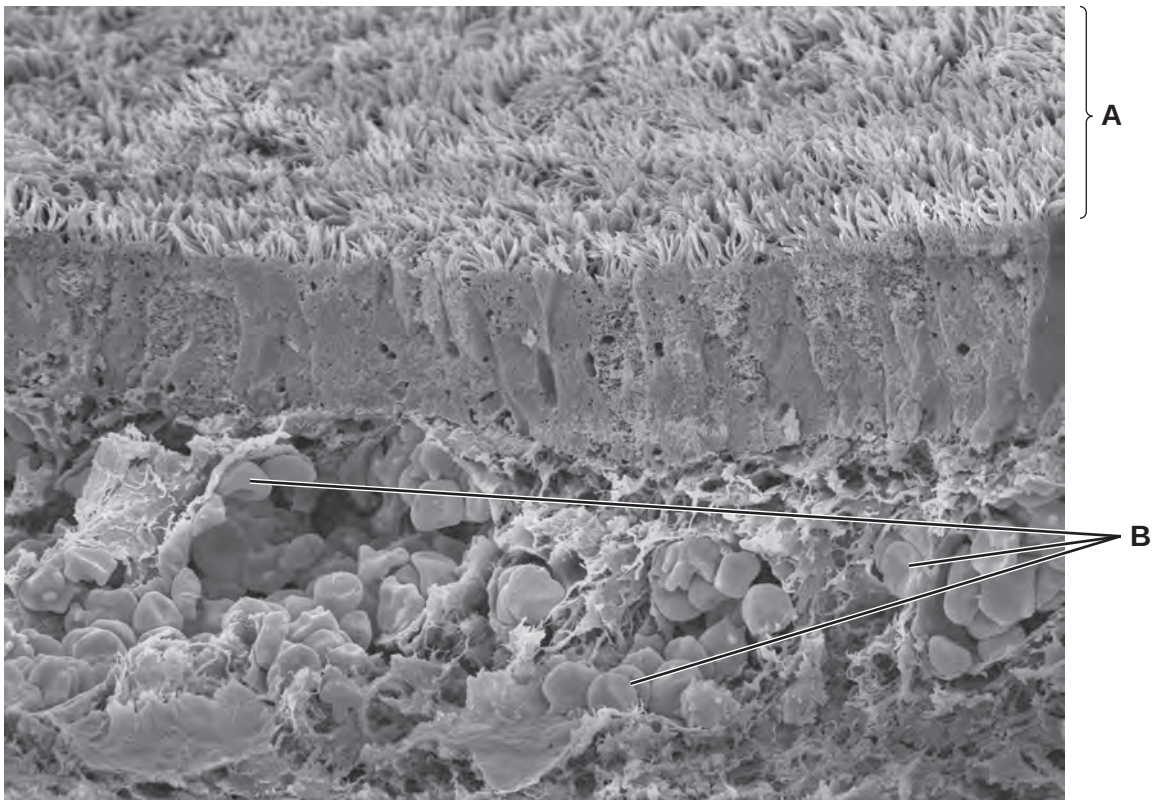

Fig. 1.1

(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]

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Chronic bronchitis is one of the conditions that contributes to chronic obstructive pulmonary disease (COPD).

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(c) State the name of the other condition that contributes to COPD.

.....[1]

(d) Describe the appearance of a section through the **wall** of a bronchus in a person with chronic bronchitis.

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.....[4]

(e) Suggest why a person with chronic bronchitis is more likely than a healthy person to suffer from infectious diseases of the gas exchange system.

.....

.....

.....

.....[2]

[Total: 11]

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[Turn over

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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]

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

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1. .....

.....

.....

2. .....

.....

.....[2]

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

cholera .....

.....

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sickle cell anaemia .....

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.....

.....

.....[5]

[Total: 13]

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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.

$$\text{atmospheric nitrogen } (N_2) \xrightarrow[\text{ATP and hydrogen}]{\text{nitrogenase}} \text{.....}$$

[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 / $\times 10^9$ 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.

.....

.....

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.....[2]

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

.....

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.....[3]

[Total: 12]

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

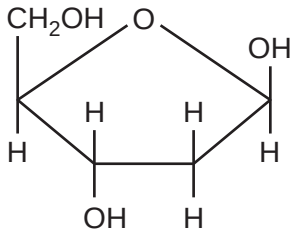

Fig. 4.1

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]

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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]

5 In 1954, an article was published in the British Medical Journal entitled, *The mortality of doctors in relation to their smoking habits*.

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One aspect of the investigation studied a very large number of male doctors in the UK aged 35 years and older. A survey established the quantity of tobacco smoked per day.

Twenty-nine months later, the cause of any deaths in the study group was recorded.

Table 5.1 summarises the results obtained.

Table 5.1

cause of death	**number of deaths**	**death rate per year per 1000 men in the study**			
		non-smokers	**smokers, tobacco smoked / g day^{-1}**		
			1–14	15–24	25 and above
coronary thrombosis (heart attack)	235	3.89	3.91	4.71	5.15
other cardiovascular diseases	126	2.23	2.07	1.58	2.78
lung cancer	36	0.00	0.48	0.67	1.14
other diseases of the gas exchange system	54	0.86	0.88	1.01	0.77

(a) State which group in the study is most at risk from dying of lung cancer.

.....[1]

(b) Using information from Table 5.1 to support your answer, discuss the evidence linking tobacco smoking to disease and early death.

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.....[4]

[Total: 5]

6 Fig. 6.1 shows a phloem sieve tube element, its companion cell and a mesophyll cell in the leaf of a photosynthesising plant.

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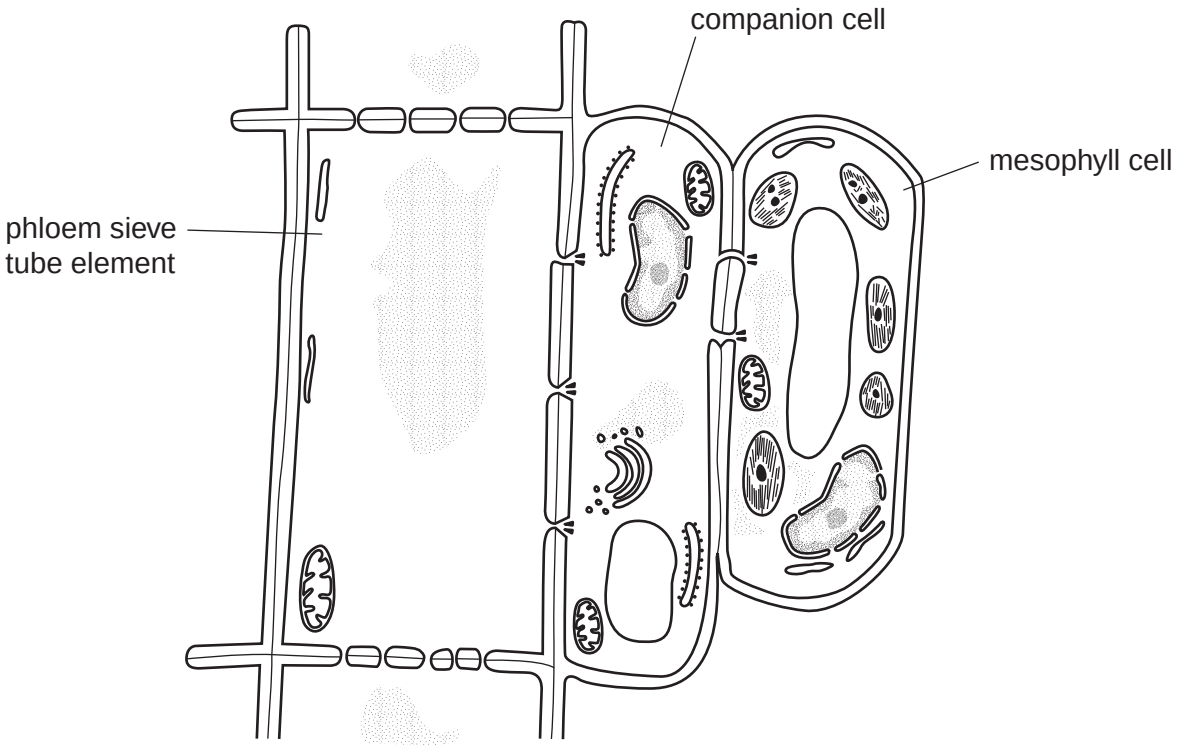

Fig. 6.1

(a) Use label lines and the letters **C** to **E** to identify the following on Fig. 6.1.

C – a structure involved in ribosome synthesis

D – an organelle that is involved in the modification and packaging of proteins

E – an organelle that is involved in aerobic respiration [3]

(b) The concentration of sucrose in the sap of the phloem sieve tube element is much higher than in the cytoplasm of the photosynthesising cell.

Describe **and** explain how sucrose is transported from the photosynthesising cell to the phloem sieve tube element.

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.....[4]

[Total: 7]

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