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

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/21**

Paper 2 Structured Questions AS **May/June 2013**

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 red ink, staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.

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.

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

UNIVERSITY of CAMBRIDGE International Examinations

Answer **all** the questions.

For Examiner's Use

1 Capillaries are known as exchange vessels. Substances are exchanged between blood and tissue fluid as the blood flows through the capillaries.

Fig. 1.1 is an electron micrograph of a section through a capillary with two red blood cells.

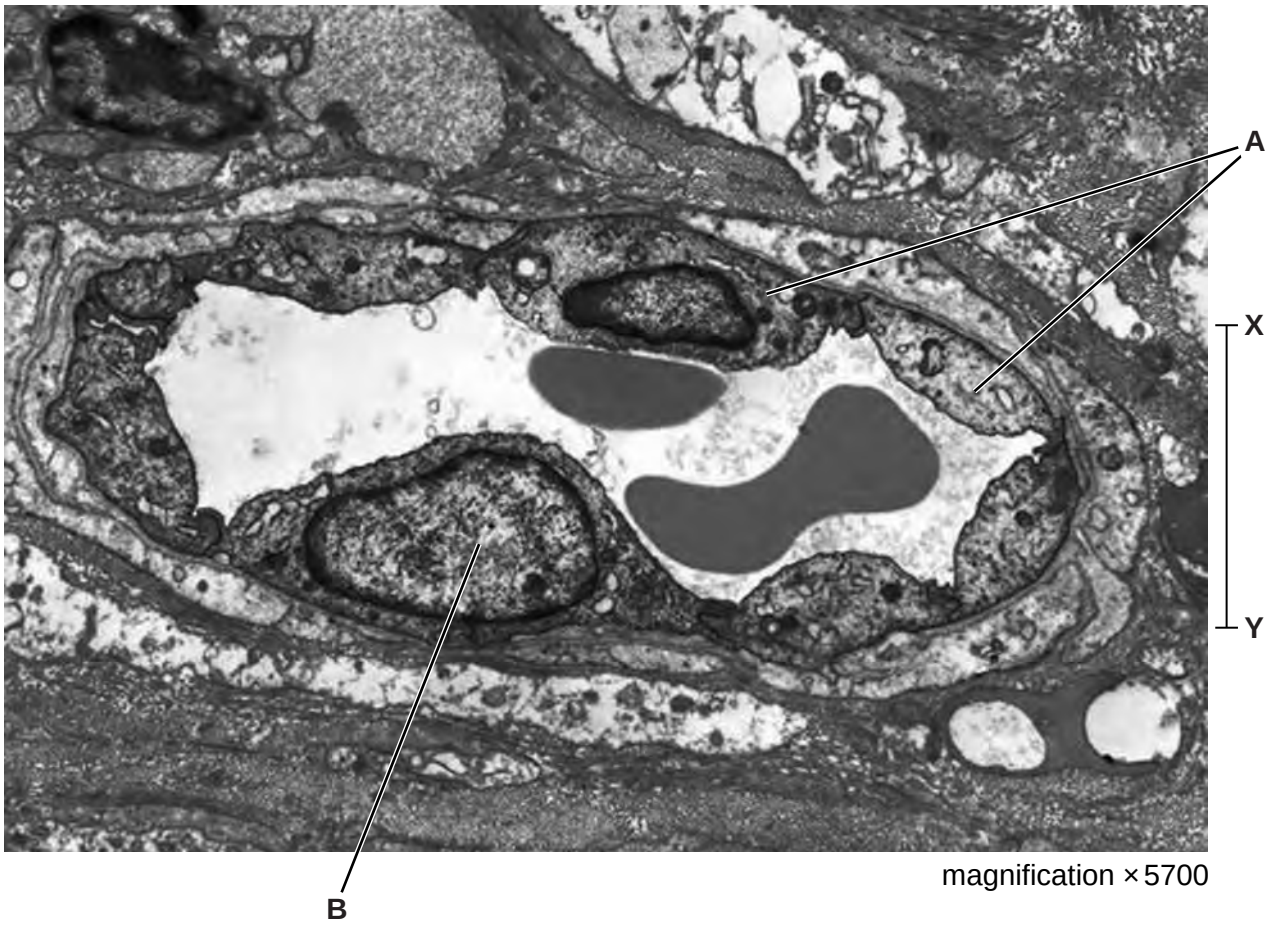

Fig. 1.1

(a) (i) Name the cells labelled **A** and the structure labelled **B**.

A .....

B ..... [2]

(ii) Calculate the actual distance **X** – **Y** on Fig. 1.1.

Show your working and give your answer to the nearest micrometre (μm).

answer ..... μm [2]

(iii) Explain how capillaries are adapted for their function as exchange vessels.

For Examiner's Use

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..... [2]

(b) Table 1.1 shows the composition of blood, tissue fluid and lymph.

Table 1.1

component	blood	tissue fluid	lymph
red blood cells / cells $mm^{-3} \times 10^6$	5.1	0.0	0.0
white blood cells / cells mm^{-3}	9 000	75	1 000 000
glucose / g dm^{-3}	800	800	775
protein / g dm^{-3}	71	1	26

Explain the differences between the composition of blood, tissue fluid and lymph as shown in Table 1.1, for white blood cells, glucose and protein.

white blood cells .....

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glucose .....

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protein .....

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(c) Outline how **red blood cells** are involved in the transport of carbon dioxide.

For Examiner's Use

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[Total: 14]

2 **(a)** Explain how the virus that causes measles is transmitted.

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(b) Antibodies against measles are produced by plasma cells during an immune response.

Fig. 2.1 shows a diagram of an antibody molecule.

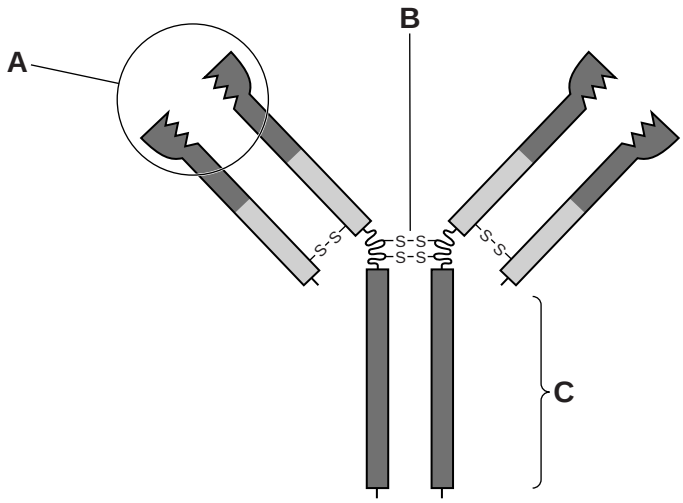

Fig. 2.1

Explain the functions of the parts labelled **A**, **B** and **C**.

(i) **A** .....

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..... [2]

(ii) **B** .....

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..... [1]

(iii) **C** .....

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..... [1]

[Total: 6]

3 **(a)** Transpiration is often described as an 'inevitable consequence of gas exchange in plants'.

For Examiner's Use

Explain what is meant by this statement.

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The buttonwood tree, *Conocarpus erectus*, grows in coastal areas of the Americas. A study was carried out on its ability to survive on Socorro Island off the Pacific coast of Mexico. The island is exposed to high winds, which can lead to high rates of transpiration.

The transpiration rates of trees at sheltered and exposed locations at the same altitude on Socorro Island were compared. The results are shown in Fig. 3.1.

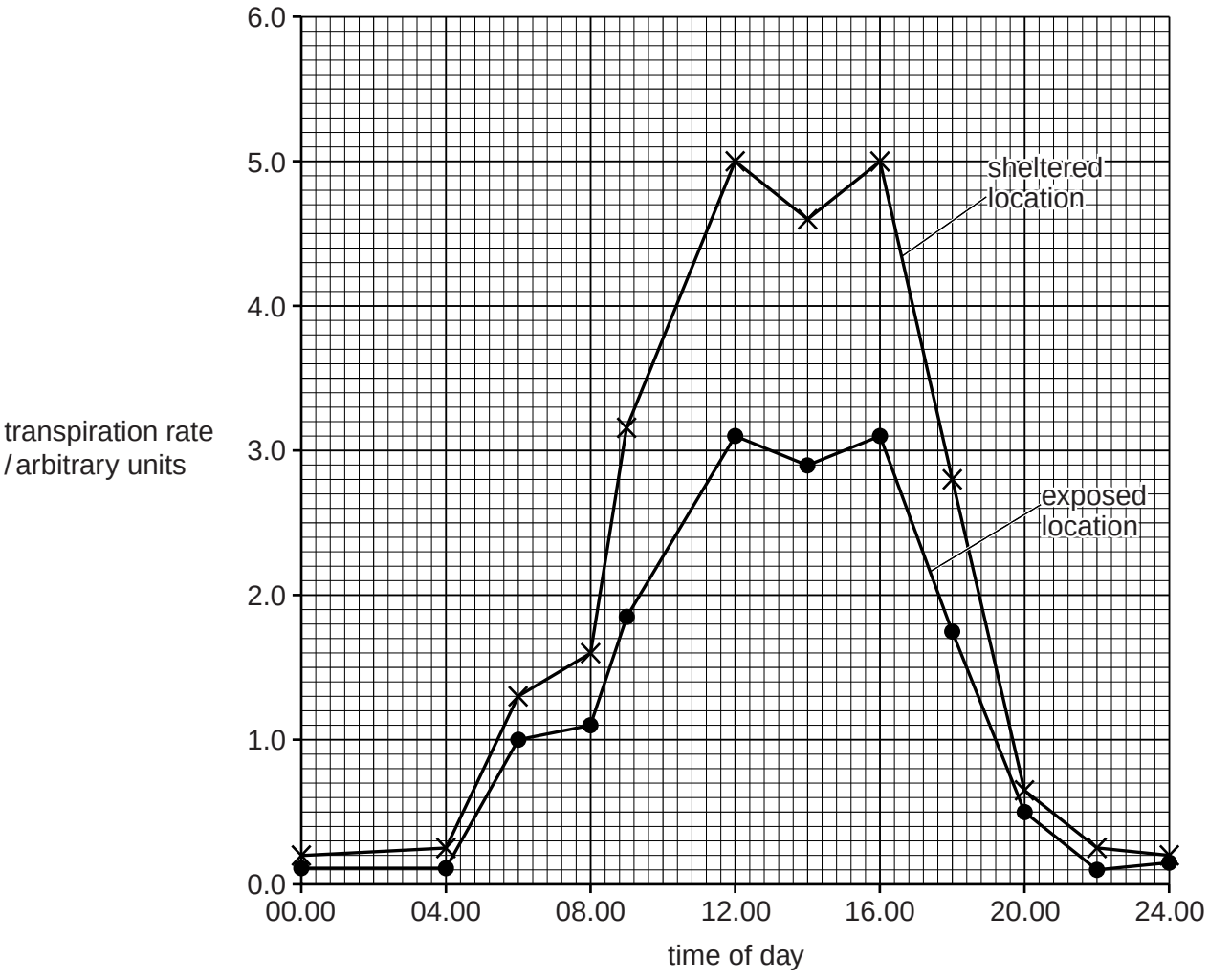

Fig. 3.1

(b) Describe the results shown in Fig. 3.1.

For Examiner's Use

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(c) The leaves of the buttonwood trees at the exposed site were significantly smaller than those at the sheltered site.

Describe three ways, **other than small size**, in which leaves are adapted to reduce the rate of transpiration.

1. .....

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2. .....

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3. .....

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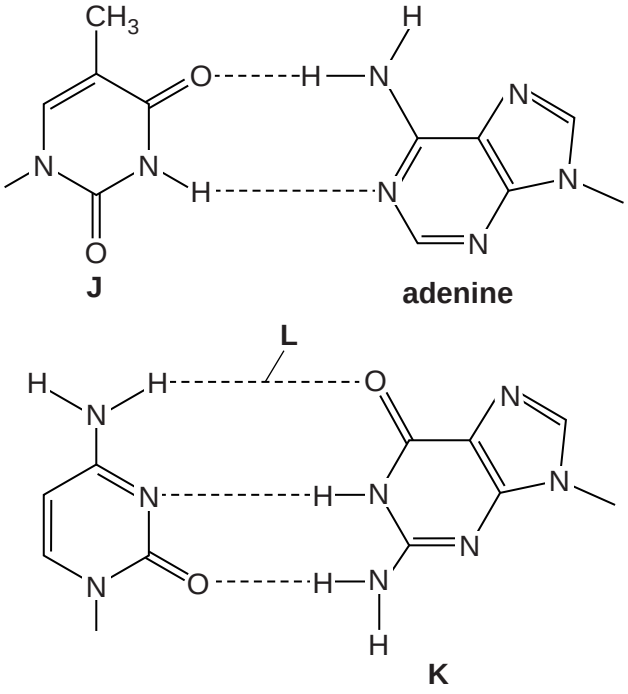
..... [3]

[Total: 11]

4 Fig. 4.1 shows the two base pairs in a DNA molecule.

For Examiner's Use



K

Fig. 4.1

(a) Name the bases labelled **J** and **K** and the bond labelled **L**.

J .....

K .....

L ..... [3]

HIV enters T-lymphocytes by a form of endocytosis. Two of the enzymes in HIV are:

- reverse transcriptase, which uses viral RNA as a template to make DNA to incorporate into the chromosomes of the host's cells
- protease, which is used to break a polypeptide into smaller molecules. These molecules are used to make the protein coat of new viral particles, which will infect other cells.

Various drugs have been developed to treat HIV infections. Table 4.1 gives information about some of these drugs.

Table 4.1

drug	**enzyme inhibited**	**mode of action**
zidovudine	reverse transcriptase	occupies active site
tenofovir	reverse transcriptase	occupies active site
efavirenz	reverse transcriptase	occupies sites other than the active site
atazanavir	protease	occupies active site

(b) Explain the difference between the mode of action of zidovudine and efavirenz.

For Examiner's Use

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(c) People who receive drug treatment for HIV take a mixture of drugs that act in different ways.

Suggest the advantage of taking a mix of the drugs shown in Table 4.1.

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(d) Antibiotics are prescribed to people who have HIV/AIDS for the treatment of secondary infections, but not to treat the HIV infection.

Explain why this is so.

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[Total: 11]

5 Fig. 5.1 shows a section of a cell surface membrane.

For Examiner's Use

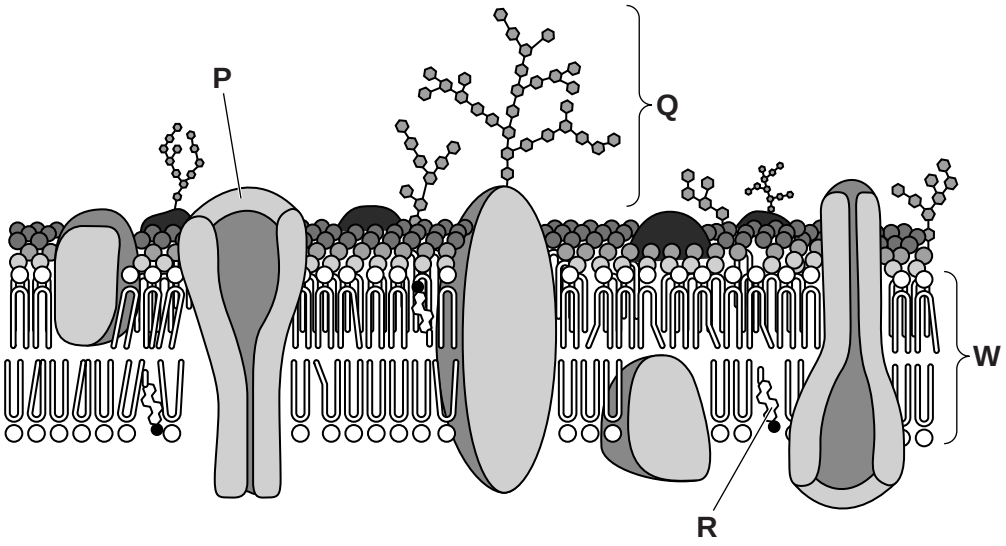

Fig. 5.1

(a) State the functions of structures **P**, **Q** and **R**.

P .....

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Q .....

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R .....

..... [3]

(b) Circle the width of the membrane shown as **W** in Fig. 5.1.

17.0 μm 1.7 μm 0.7 μm 70.0 nm 17.0 nm 7.0 nm 0.7 nm [1]

(c) Membranes, such as the cell surface membrane, are described as having a fluid mosaic structure.

Explain what is meant by the term *fluid mosaic*.

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(d) Aquaporins are membrane channel proteins in plant and animal cells. They permit the movement of water across membranes. Explain why they are necessary.

For Examiner's Use

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[Total: 9]

6 **(a)** Explain how uncontrolled cell division can result in cancer.

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(b) Describe the experimental evidence that shows that smoking causes lung cancer.

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(c) Fig. 6.1 shows the changes in mortality rates for lung cancer in five countries between 1950 and 2006 for males.

For Examiner's Use

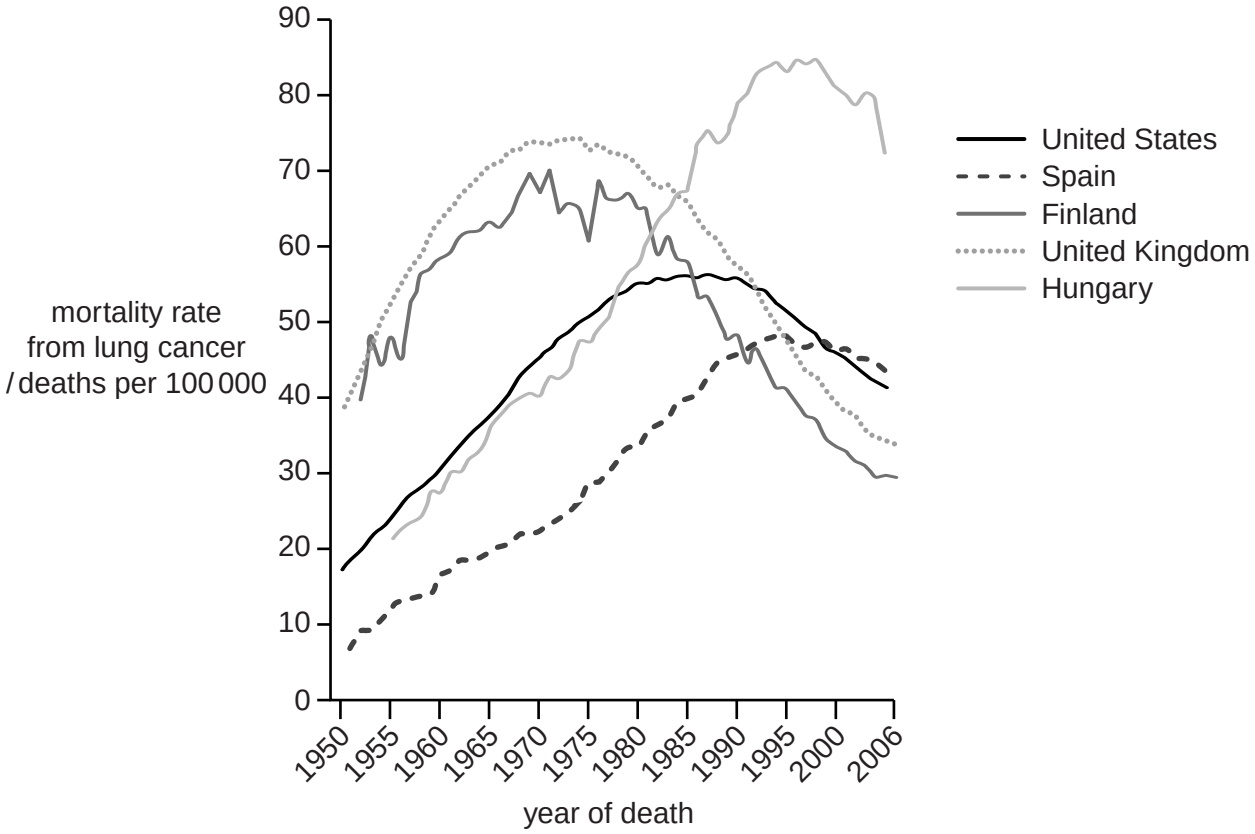

Fig. 6.1

With reference to Fig. 6.1, describe the similarities **and** differences in the trends in mortality rates in the countries shown.

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[Total: 9]