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

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

1134123604

BIOLOGY **9700/23**

Paper 2 Structured Question AS **May/June 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 red ink, 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 **14** printed pages and **2** blank pages.

1 Fig. 1.1 shows a stage in the mitotic cell cycle in an animal cell.

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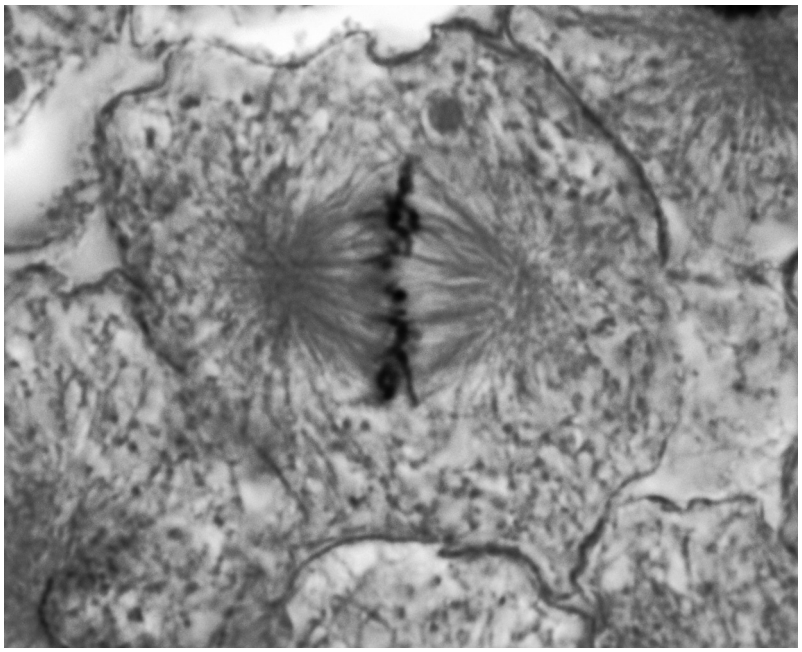

Fig. 1.1

(a) (i) Name the stage of mitosis shown in Fig. 1.1.

..... [1]

(ii) State three features which are characteristic of the stage of mitosis shown in Fig. 1.1.

1. .....

.....

2. .....

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3. .....

..... [3]

(b) Explain the importance of mitosis in organisms.

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..... [3]

(c) In many multicellular organisms, such as mammals, the time taken for the mitotic cell cycle varies considerably between different tissues, but is very carefully controlled in each cell.

Suggest the importance of this control in mammals.

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.....

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..... [2]

[Total: 9]

2 **(a)** Complete the table to show **three** ways in which the **structure** of DNA differs from RNA.

	DNA	RNA
1		
2		
3		

[3]

(b) Table 2.1 shows two messenger RNA (mRNA) codons. Fill in the complementary transfer RNA (tRNA) anticodons in the spaces provided.

Table 2.1

mRNA codons	GCG	ACA
complementary tRNA anticodons		

[2]

(c) Calculate the minimum number of DNA nucleotides necessary to code for a polypeptide with 238 amino acids.

Show your working.

answer ..... nucleotides [2]

(d) Describe the role played by tRNA in polypeptide synthesis.

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..... [4]

[Total: 11]

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3 **(a)** Plants take in mineral ions through their root hair cells. This may happen by a process which moves the ions from a low concentration in the soil to a higher concentration in the root hair cell.

(i) Name and describe this process by which mineral ions are taken in.

name .....

description .....

.....

.....

..... [3]

(ii) Phosphate is an example of an ion transported in this way. State **one** use for this ion in plant cells.

.....

..... [1]

Fig. 3.1 is a plan diagram of a transverse section of a plant root.

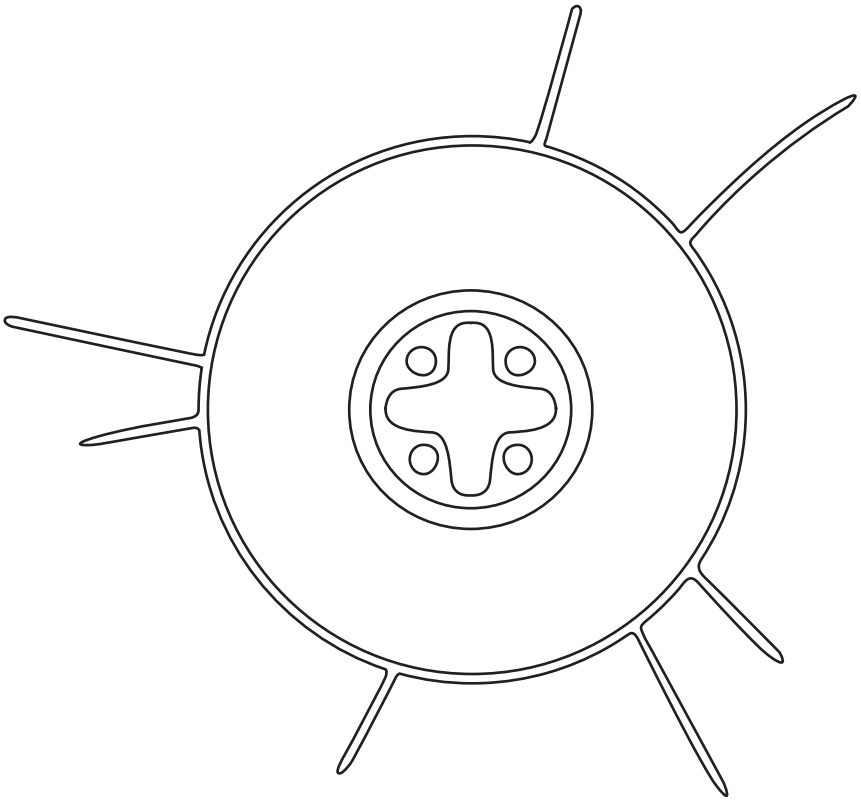

Fig. 3.1

(b) (i) Write the letter **W** on Fig. 3.1 in the area where cells are specialised for the transport of water and mineral ions. [1]

For Examiner's Use

(ii) Water is also absorbed from the soil by the root hair cells.

Outline the mechanism by which this occurs.

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..... [2]

(iii) Describe the pathway taken by water as it passes from the root hair cells into the cells which are specialised for transport of water and mineral ions.

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..... [4]

[Total: 11]

4 In mammals, haemoglobin is used to transport oxygen and myoglobin is used to store oxygen in muscles.

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Fig. 4.1 shows the oxygen dissociation curves for myoglobin, fetal haemoglobin and adult haemoglobin.

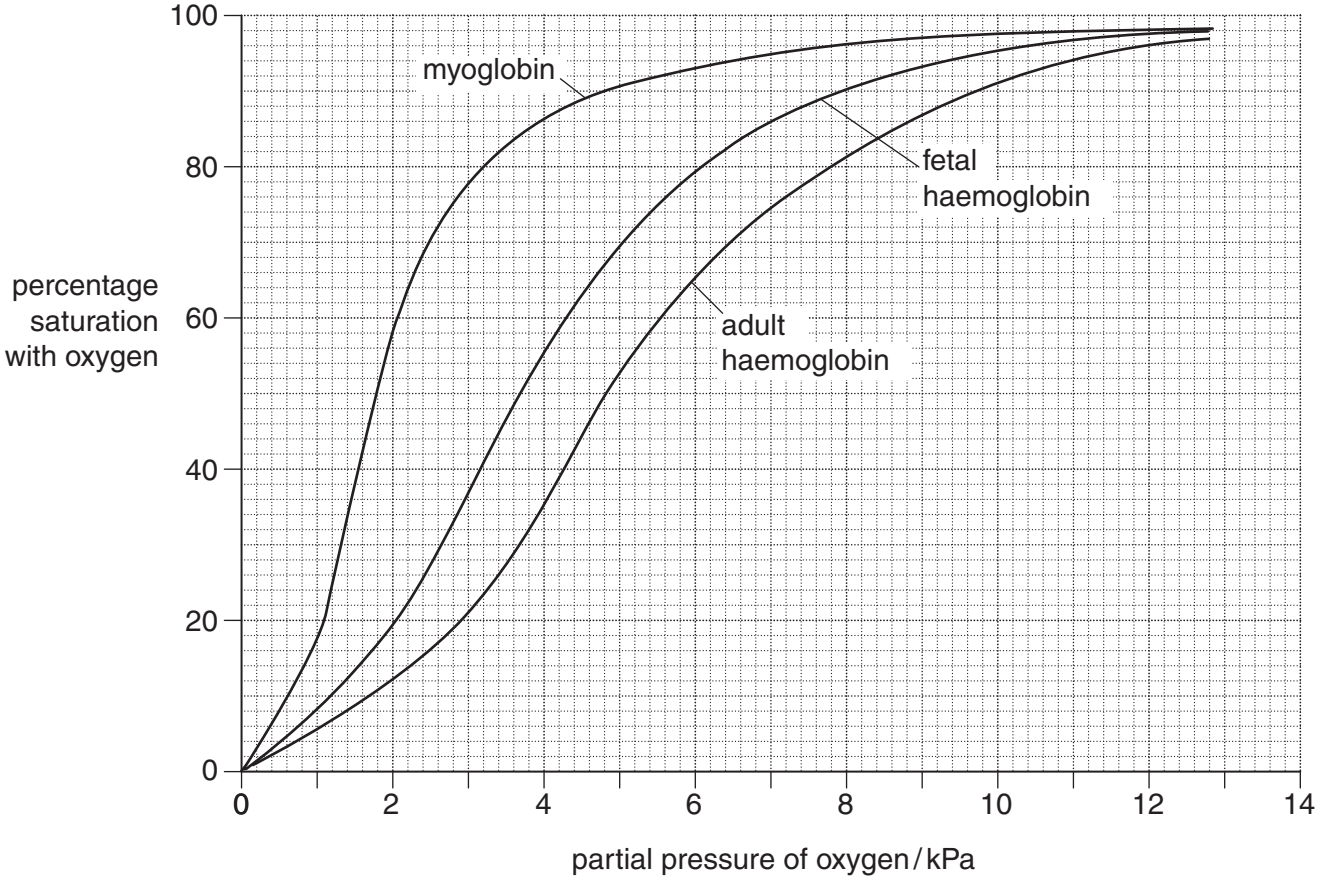

Fig. 4.1

(a) (i) Name the cells in which haemoglobin is found.

..... [1]

(ii) Use Fig. 4.1 to determine the percentage saturation of **myoglobin** and **adult haemoglobin** when the partial pressure of oxygen is 3kPa.

myoglobin .....

adult haemoglobin ..... [1]

(iii) There is a large difference between the percentage saturation of myoglobin and that of adult haemoglobin at **low** partial pressures of oxygen. Suggest reasons for this.

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..... [2]

(b) Fetal haemoglobin has a different oxygen binding affinity to that of adult haemoglobin, as shown in Fig. 4.1. Normally, after birth, the production of the fetal form stops and the adult form is produced.

In a rare condition known as Hereditary Persistence of Fetal Haemoglobin (HPFH), fetal haemoglobin continues to be produced well into adulthood in addition to adult haemoglobin. This condition, however, usually lacks any symptoms.

(i) Explain, with reference to Fig. 4.1, the significance of the difference in oxygen binding affinity between fetal and adult haemoglobin.

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..... [2]

(ii) Suggest why HPFH usually lacks symptoms.

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..... [1]

(c) Sketch on Fig. 4.2 the dissociation curve you would expect for adult haemoglobin if the concentration of carbon dioxide is increased. [2]

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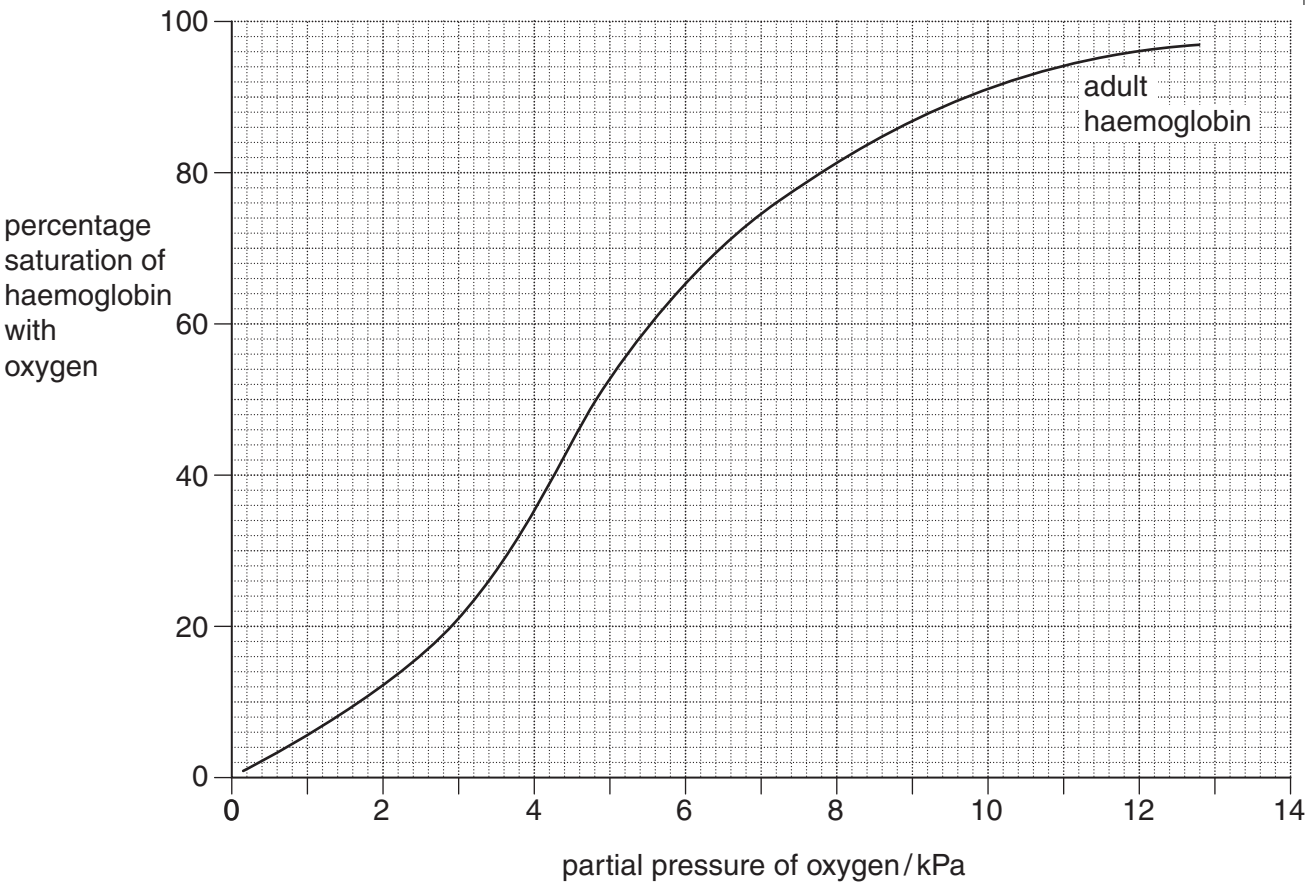

Fig. 4.2

[Total: 9]

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5 Fig. 5.1 is an electron micrograph of a transverse section through part of a plant stem.

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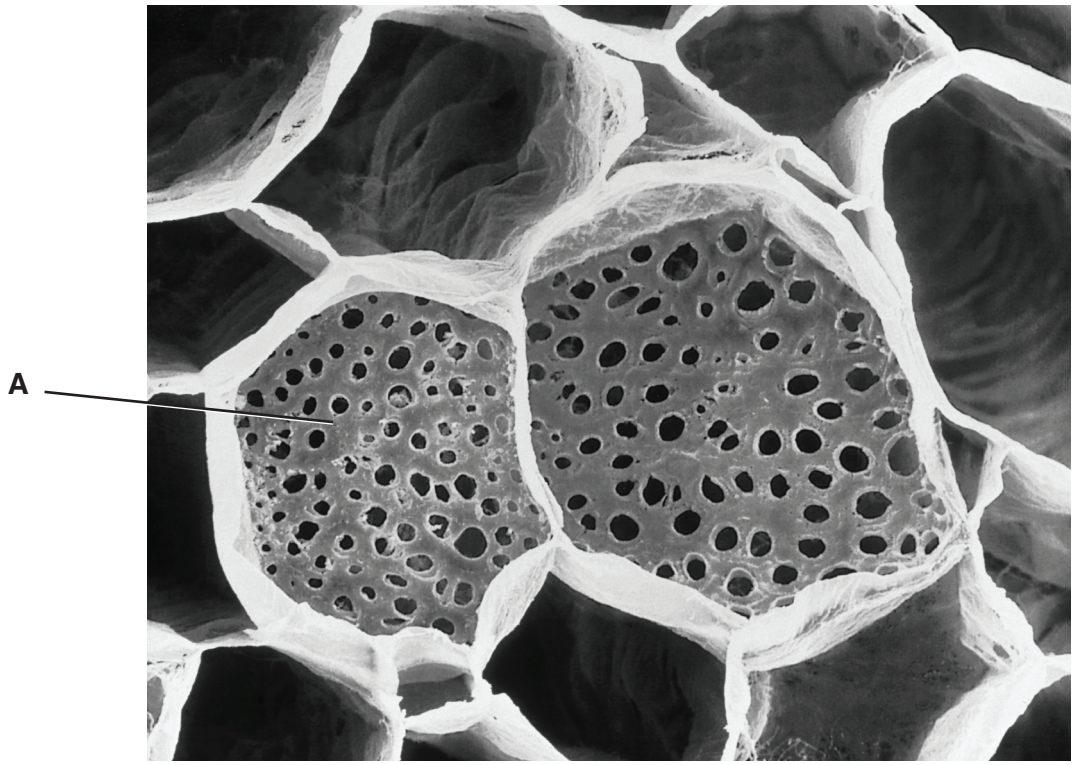

Fig. 5.1

(a) Name structure **A**.

..... [1]

(b) Specialised cells visible in Fig. 5.1 are involved in transporting assimilates through the plant from source to sink.

(i) Name **one** assimilate transported by these cells.

..... [1]

(ii) Give **one** example of a source and **one** example of a sink.

source .....

sink ..... [2]

(c) Describe how the assimilate you have named in **(b)(i)** is transported from the source to the sink.

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..... [5]

(d) Aphids are insects with mouthparts adapted to penetrating the cells of plants which transport assimilates.

Suggest why aphids feed specifically from these cells.

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..... [1]

[Total: 10]

6 In anaerobic soil, bacteria, such as *Pseudomonas stutzeri*, can use nitrate ions (NO_3^-) as a source of oxygen for their respiration. The word equation below summarises the process:

glucose + nitrate $\longrightarrow$ water + carbon dioxide + nitrogen

(a) (i) State the name of this process in the nitrogen cycle.

..... [1]

(ii) In agriculture, this reaction can be undesirable. Explain why.

.....

.....

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..... [2]

High concentrations of nitrate ions in drinking water obtained from rivers and lakes can be toxic, especially to infants. These nitrate ions enter rivers and lakes dissolved in water which drains from the soil.

(b) (i) Name the process, carried out by soil bacteria, which produces nitrate ions.

..... [1]

(ii) Suggest how bacteria, such as *Pseudomonas stutzeri*, can be used in the process of purifying water for drinking.

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..... [2]

(c) In recent years there has been an increase in flooding of agricultural land worldwide.

For Examiner's Use

Explain why crop yields are often significantly reduced even after the flood water has drained away.

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..... [4]

[Total: 10]

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