Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

BIOLOGY **9700/22**

Paper 2 Structured Questions AS **May/June 2014**

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 pen.
You may use a soft pencil for any diagrams, graphs, or rough working.
Do not use red ink, staples, paper clips, 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 **15** printed pages and **1** blank page.

DC (LK/CGW) 79171/4

CAMBRIDGE International Examinations

[Turn over

Answer **all** the questions.

1 Fig. 1.1 is a summary of energy flow in a forest ecosystem. The width of the arrows is proportional to the energy that flows between each component in the ecosystem.

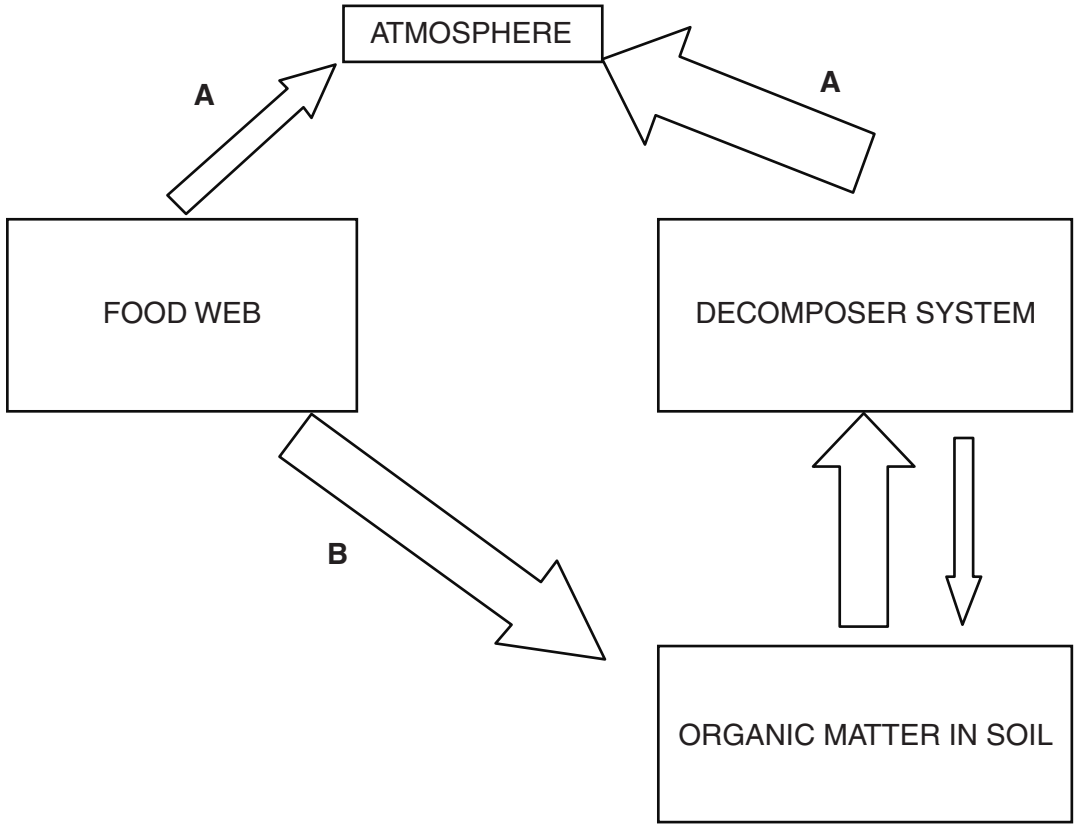

Fig. 1.1

(a) Add an arrow to Fig. 1.1 to show where the ecosystem receives its initial input of energy. [1]

(b) State the process represented by **A**.

.....[1]

(c) State one type of organism that is a member of the decomposer system.

.....[1]

(d) Name two processes represented by arrow **B**.

1. .....

2. .....
[2]

[Total: 5]

2 Fig. 2.1 is a transmission electron micrograph of cells from a spinach leaf.

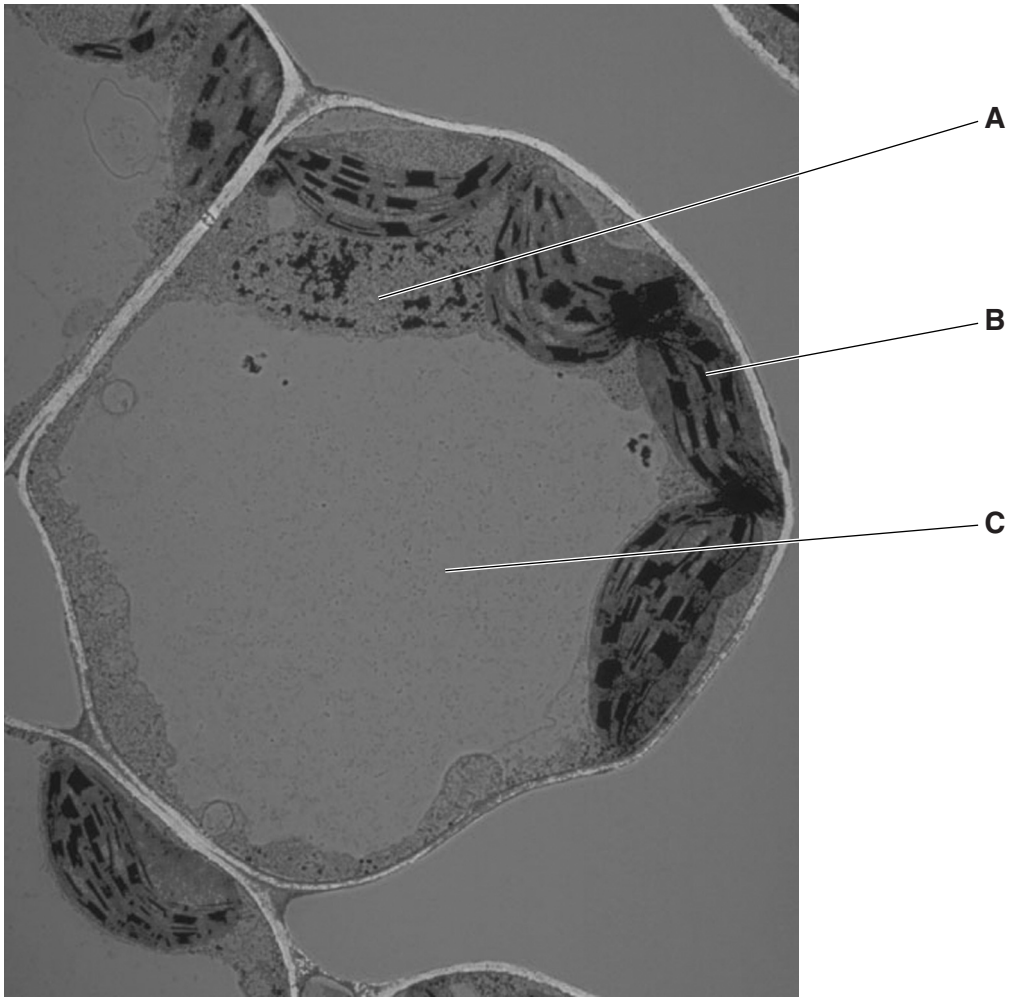

Fig. 2.1

(a) Name the organelles **A**, **B** and **C**.

A .....

B .....

C .....

[3]

(b) List two cell structures that could be present in animal cells that are not present in plant leaf cells.

1. .....

2. .....

[1]

(c) Water is transported up the stem, to the spinach leaf, in the xylem. Once it leaves the xylem it moves via the apoplast and symplast pathways, to reach the cells in Fig. 2.1.

Outline the differences between the apoplast and symplast pathways after the water has left the xylem.

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.....[4]

(d) Water, containing dissolved mineral ions such as magnesium, enters spinach leaf cells.

(i) State **two** ways that water is used in the leaf cell.

1. .....

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2. .....

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[2]

(ii) State **one** role of magnesium ions in the leaf cell.

.....[1]

[Total: 11]

3 **(a)** Cartilage is present in some parts of the gas exchange system to prevent collapse due to pressure changes during inhalation.

State the parts of the gas exchange system in which cartilage is located.

.....[1]

(b) Fig. 3.1 shows the changes that occur in atmospheric pressure and oxygen partial pressure as altitude changes. The highest altitude at which people live permanently is 5100 m.

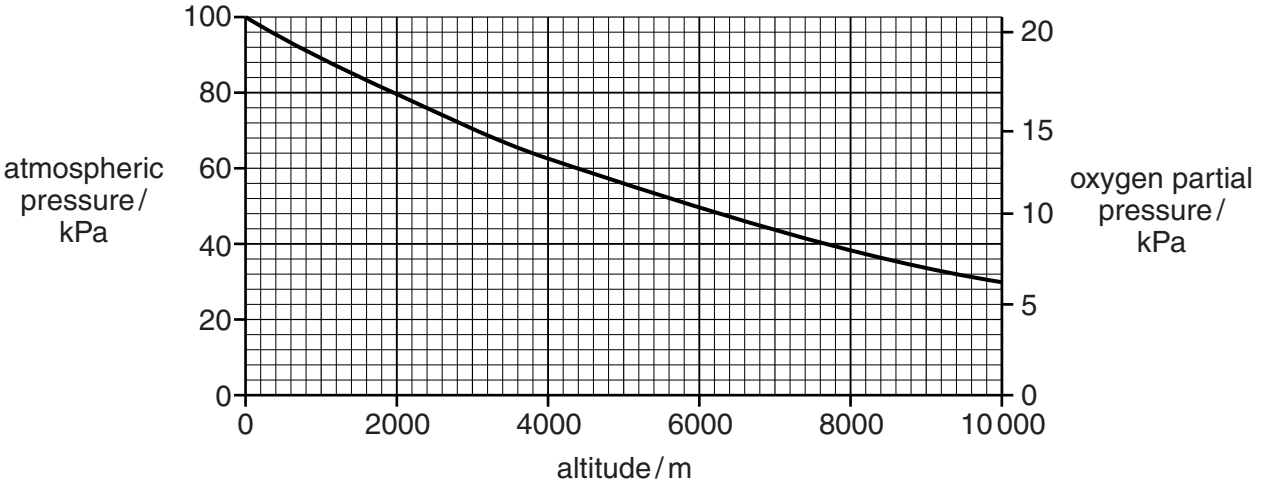

Fig 3.1

With reference to Fig. 3.1:

(i) describe the effect of increasing altitude on both atmospheric pressure and the partial pressure of oxygen

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.....[2]

(ii) calculate the change in the atmospheric pressure when a person travels from sea level to an altitude of 3500 m.

Show your working.

answer .....[2]

(c) When a person travels from 0 m (sea level) to a high altitude, gas exchange in the lungs is affected. A condition known as hypoxia results, where the body tissues do not receive an adequate oxygen supply.

Explain how hypoxia occurs when a person ascends from sea level to a high altitude.

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.....[4]

(d) At high altitudes, short-term responses by the body to hypoxia include:

- a decrease in the volume of plasma in the blood
- a decrease in the volume of blood pumped out of the heart per heart beat
- an increase in the heart rate
- an increase in the breathing rate.

(i) Suggest why a decrease in the volume of plasma in the blood may reduce the effects of hypoxia.

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.....[1]

(ii) Explain why an increase in the heart rate occurs in response to hypoxia.

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.....[2]

(e) People with sickle cell anaemia have a form of haemoglobin that is unable to bind to oxygen efficiently. The cause of the condition is a mutation in the gene coding for the β-globin polypeptide of haemoglobin.

Outline how this mutation can lead to an altered amino acid sequence of the β-globin polypeptide.

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.....[3]

[Total: 15]

4 Table 4.1 shows some information about five infectious diseases.

Table 4.1

infectious disease	name of causative organism(s)	type of causative organism	main mode of transmission
HIV/AIDS	human immunodeficiency virus (HIV)	virus	sexual contact
cholera	*Vibrio cholerae*		ingestion of contaminated water and food
tuberculosis	*Mycobacterium tuberculosis*	bacterium	
measles		virus	aerosol / droplet infection
	Plasmodium vivax or *P. malariae* or *P. falciparum* or *P. ovale*		

(a) Complete Table 4.1. [3]

(b) In 2011, the World Health Organization (WHO) published recommendations to help countries develop plans to prevent the spread of HIV.

Discuss the factors that should be considered when making recommendations concerning the prevention of sexual transmission of HIV.

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.....[4]

(c) HIV infects cells of the immune system, particularly helper T-lymphocytes (T_h cells). HIV can infect both non-dividing and dividing helper T-lymphocytes, including memory cells.

The onset of disease, which can occur many years later, coincides with a severely lowered primary and secondary immune response, owing to greatly reduced numbers of T_h cells in the body.

(i) An infected T_h cell can still carry out a normal cell cycle and divide to produce two cells.

The following processes occur during one cell cycle:

DNA replication **mitosis** **growth** **cytokinesis**

List the processes in a correct sequence.

1. .....

2. .....

3. .....

4. .....

[1]

(ii) Suggest **and** explain how the destruction of **memory** T_h cells will contribute to a lowered **secondary** immune response.

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.....[3]

[Total: 11]

Question 5 starts on page 12

5 B-lymphocytes have antibodies located on their external surface. When B-lymphocytes become plasma cells they then secrete antibodies.

Fig. 5.1 shows how the enzyme papain digests an antibody to obtain three fragments.

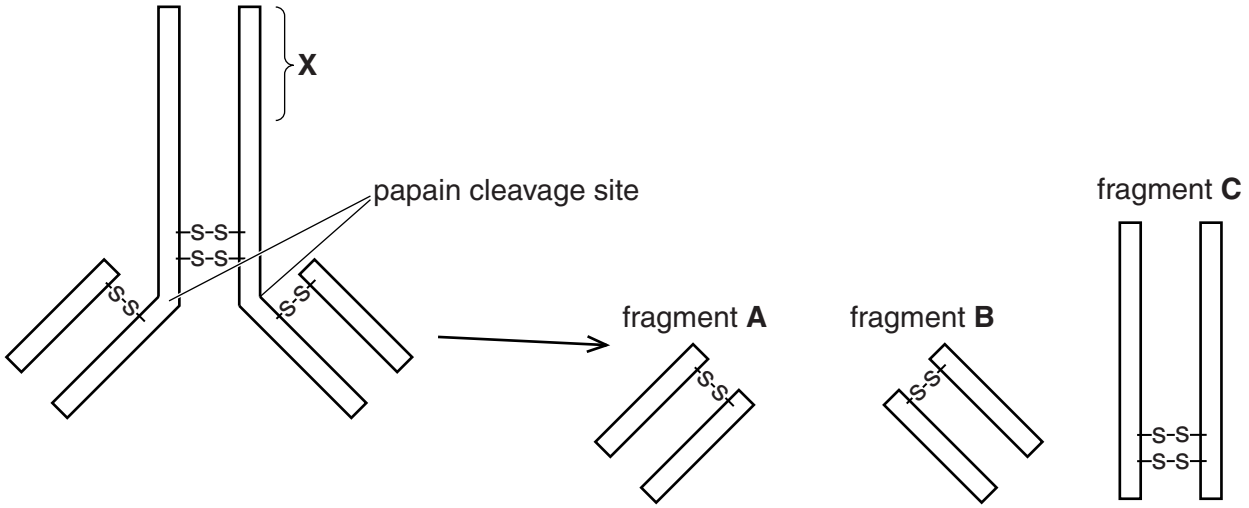

Fig. 5.1

(a) Fig. 5.1 shows the location of the region where papain acts.

State **one** role of this region in the intact antibody molecule.

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.....[1]

(b) The three fragments, **A**, **B** and **C** still retain their ability to function.

State the function of:

(i) fragments **A** and **B**

.....

.....[1]

(ii) fragment **C**.

.....

.....[1]

(c) The region labelled **X** in Fig. 5.1 is hydrophilic in antibodies that are secreted by plasma cells, whereas in antibodies located on the surface of B-lymphocytes, region **X** is hydrophobic.

Suggest reasons for this difference.

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.....[2]

(d) Papain is a globular protein with a tertiary structure but no quaternary structure.

(i) State how many polypeptides there are in a molecule of papain.

.....[1]

(ii) Explain how the tertiary structure of the protein results in papain being globular.

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.....[2]

[Total: 8]

6 **(a)** Explain the need for transport systems in multicellular plants and animals.

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.....[3]

(b) In mammals, the role of the heart is to pump blood around the body. The events that occur during one heart beat are known as the cardiac cycle. The timing for one cardiac cycle is shown in Fig. 6.1.

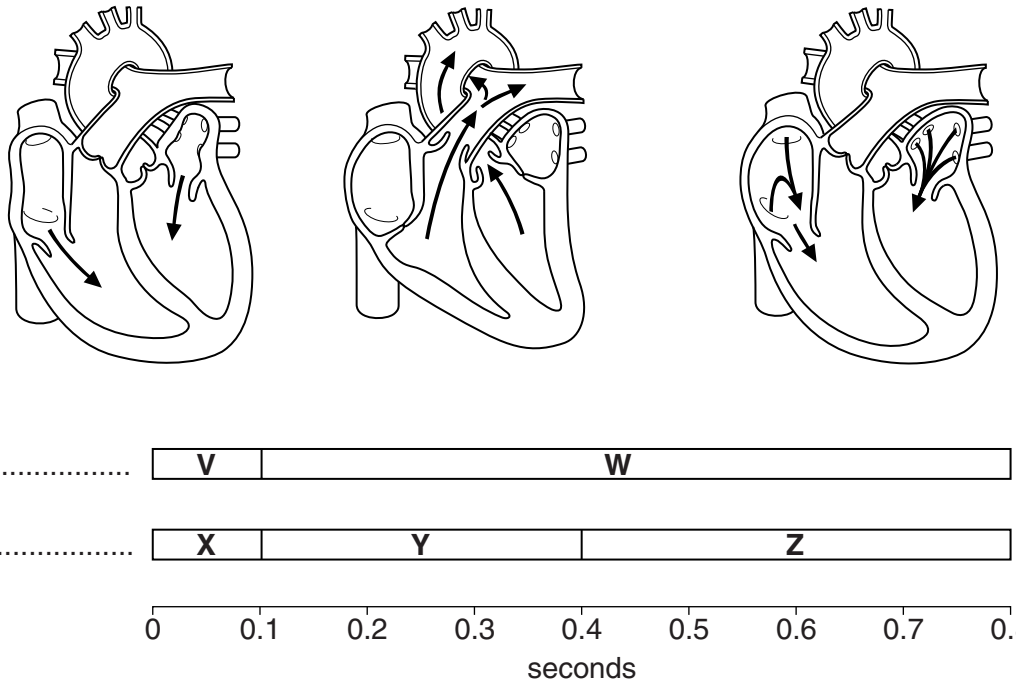

Fig. 6.1

P and **Q** represent the two types of heart chambers.

V, **W**, **X** , **Y** and **Z** represent the systolic (contracted) or diastolic (relaxed) state of the relevant heart chambers.

(i) In the spaces provided on Fig. 6.1, identify chambers **P** and **Q**. [1]

(ii) Complete the table by writing the letters **V**, **W**, **X**, **Y** and **Z** in the appropriate box to indicate the state of the heart chambers during the cardiac cycle as shown in Fig. 6.1.

systole	
diastole	

[2]

(c) In plants, assimilates are transported in phloem sieve tube elements by a process known as translocation.

Explain how assimilates that arrive in the phloem sieve tubes from mesophyll cells can be translocated to other parts of the plant.

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.....[4]

[Total: 10]

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