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

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

6382567461

BIOLOGY **9700/22**

Paper 2 Structured Questions AS **October/November 2012**

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.

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1	
2	
3	
4	
5	
6	
Total	

This document consists of **13** printed pages and **3** blank pages.

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Answer **all** the questions.

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1 Fig. 1.1 is a labelled diagram of a leaf palisade mesophyll cell, as seen with a high quality light microscope.

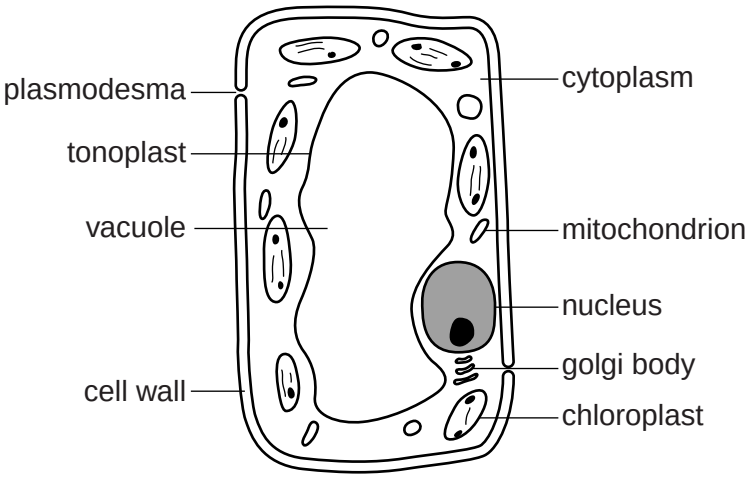


Fig. 1.1

An electron micrograph of the same leaf mesophyll cell at the **same magnification** would show more detail than is shown in Fig. 1.1.

(a) Explain why, at the **same magnification**, an electron micrograph is able to provide more detail than a light micrograph.

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..... [2]

(b) **Describe** three additional features that could be seen on an electron micrograph of the leaf mesophyll cell that are not seen in Fig. 1.1.

1. .....

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2. .....

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3. .....

..... [3]

(c) The length of the labelled chloroplast in Fig. 1.1 is 5.0 μm. Calculate the magnification of the cell shown in Fig. 1.1.

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Show your working.

magnification × ..... [2]

(d) In Fig. 1.1, starch granules are visible within the chloroplasts. Starch is the most common storage compound of plants. It is composed of amylopectin and amylose.

(i) Describe the structural differences between amylopectin and amylose.

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..... [2]

(ii) State **one** role of magnesium ions within chloroplasts.

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..... [1]

[Total: 10]

2 The fluid mosaic model of membrane structure was first proposed in 1972 by Singer and Nicolson. The model describes in detail how the components of a membrane are organised.

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(a) Some of the components of the cell surface membrane are:

- phospholipid molecules
- protein molecules
- cholesterol molecules.

(i) In the box below, draw a labelled diagram of a section through a cell surface membrane to show how the above components are organised within the membrane.

The diagram should include other named components of the membrane.

Label the inner and outer surfaces of the membrane.

[5]

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(ii) Suggest why 'fluid mosaic' is an appropriate term to use to describe membrane structure.

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..... [3]

[Total: 8]

3 The humpback whale, *Megaptera novaeangliae*, is one of the world's largest aquatic mammals. It can grow to a length of up to 15 metres and a mass of up to 36 000 kg. A large proportion of the mass of a humpback whale is a very thick layer of fat-filled cells stored under the skin, called blubber.

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The humpback whales are seasonal feeders. They feed in polar regions during the summer and then migrate to warmer temperate and tropical waters to mate and have their young during the polar winter.

(a) One reason that the humpback whale has managed to reach its enormous size is because it is a member of a simple food web. Fig. 3.1 is an example of such a food web.

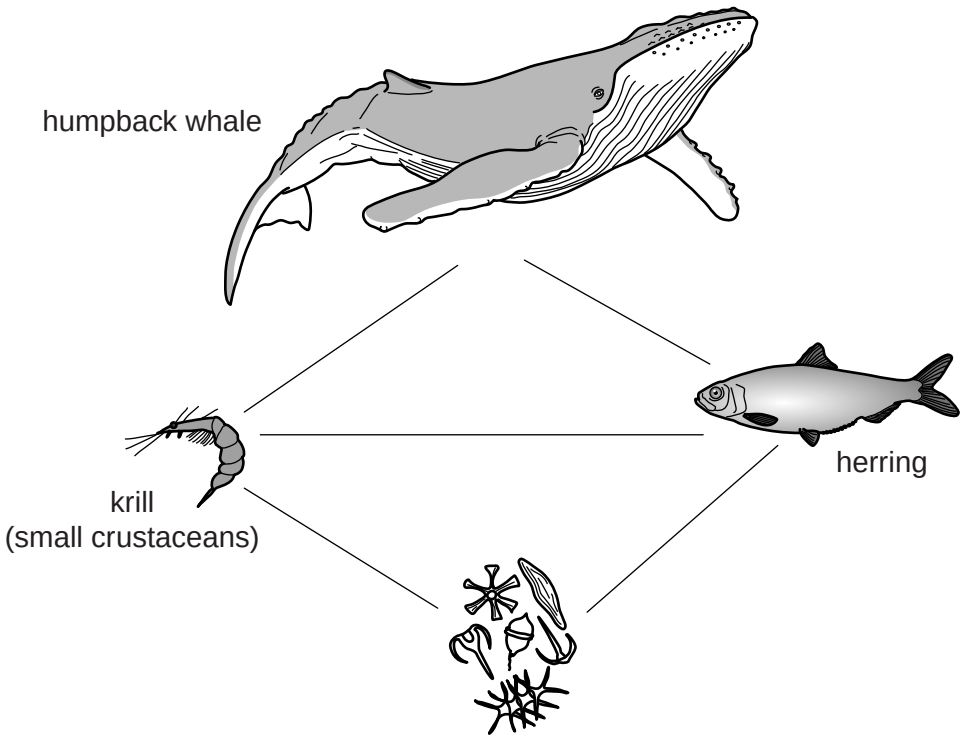


Fig. 3.1

(i) The humpback whale is a carnivore, feeding on krill and herring. The herring feed on krill.

Add **arrow heads** to the lines drawn on Fig. 3.1 to show the direction of energy flow in the food web. [1]

(ii) State the trophic level to which the humpback whale belongs.

..... [1]

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(iii) In terms of energy transfer, explain how the humpback whale is able to reach such a large size.

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..... [3]

(b) The thickness of blubber in humpback whales decreases during the non-feeding season and increases during the feeding season.

Suggest explanations for this observation.

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..... [2]

(c) Describe the roles of water as an environment for organisms, such as those shown in Fig. 3.1.

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[Total: 10]

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[Turn over

4 Diseases are either infectious or non-infectious.

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(a) Complete Table 4.1 to produce a summary of four important infectious diseases.

Table 4.1

name of disease	type of causative organism	name of causative organism
cholera	bacterium	*Vibrio cholerae*
HIV/AIDS	virus	
malaria		
tuberculosis (TB)		*Mycobacterium tuberculosis*

[4]

(b) Typhoid is an example of an infectious disease.

Some features of typhoid include:

- caused by a bacterium that can only infect humans
- caused by the ingestion of contaminated food and water
- can be treated with drugs
- can be prevented by a vaccine.

(i) State which of the diseases named in Table 4.1 is transmitted in the same way as typhoid.

..... [1]

(ii) State which type of drug can be used in the treatment of typhoid. Give a reason for your answer.

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..... [1]

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(iii) Child vaccination programmes against typhoid in some countries have had considerable success. The numbers contracting the disease have decreased, not only in the vaccinated children, but also in other age groups that were not part of the programme.

Suggest explanations for this observation.

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..... [2]

(c) After infection, the ingested typhoid bacteria are engulfed by phagocytes.

(i) Explain why the phagocytes act only against the bacteria and not against human cells.

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(ii) Unlike other bacteria, the typhoid bacteria are able to survive and multiply within the phagocytes.

Suggest an explanation for this observation.

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(iii) Explain why people with HIV/AIDS are more susceptible to infections, such as typhoid.

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..... [2]

[Total: 14]

5 **(a)** State the structural features of DNA that make it a stable molecule.

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..... [2]

(b) DNA has been described as a 'carrier of coded information'.

Explain this statement.

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..... [2]

(c) State when, during a cell cycle, DNA replication occurs.

..... [1]

(d) There are two alleles of the gene for the β-haemoglobin polypeptide:

- HbA (normal)
- HbS (sickle cell).

Describe **and** explain the difference between the HbA and HbS alleles of this gene.

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..... [3]

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(e) DNA polymerase is an enzyme involved in the replication of DNA.

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One of the substrates required by DNA polymerase is ATP.

ara-ATP is a chemical that affects DNA polymerase activity.

In an investigation, the effect of different concentrations of ATP on the rate of DNA synthesis was determined:

- with no ara-ATP
- with a low concentration of ara-ATP
- with a high concentration of ara-ATP.

The results of the investigation are shown in Fig. 5.1.

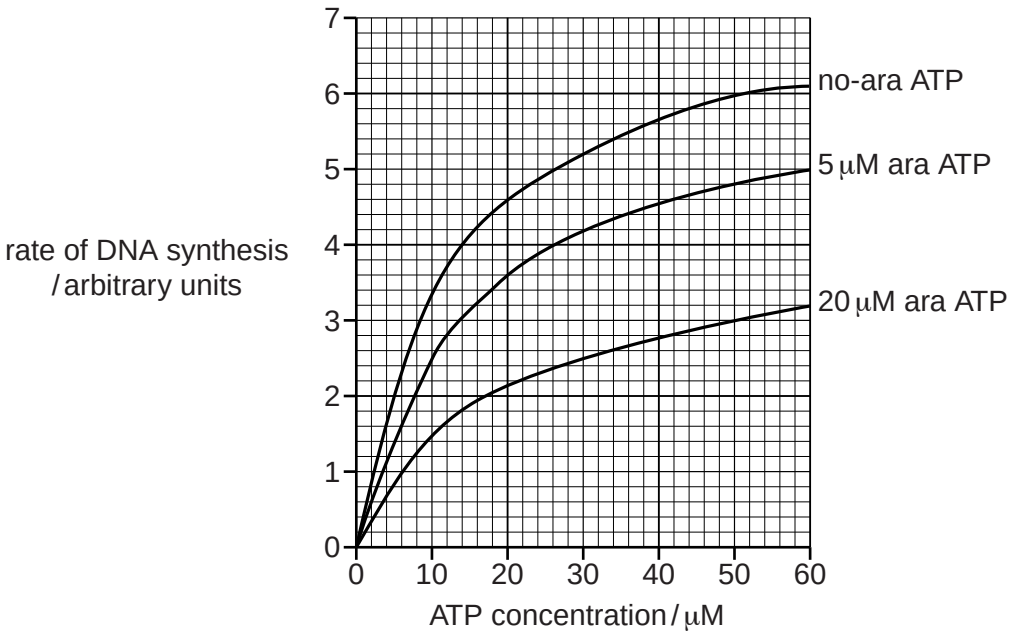


Fig. 5.1

Explain, in terms of the mode of action of enzymes, the results of the investigation shown in Fig. 5.1.

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[Total: 11]

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6 Coronary artery bypass grafting is the most common heart operation in the world.

Fig. 6.1 is a diagram of a coronary bypass. The graft is a section of a healthy blood vessel. The blood vessel used in Fig. 6.1 is the internal mammary artery. It is a common choice for surgeons as it is quite resistant to arteriosclerosis.

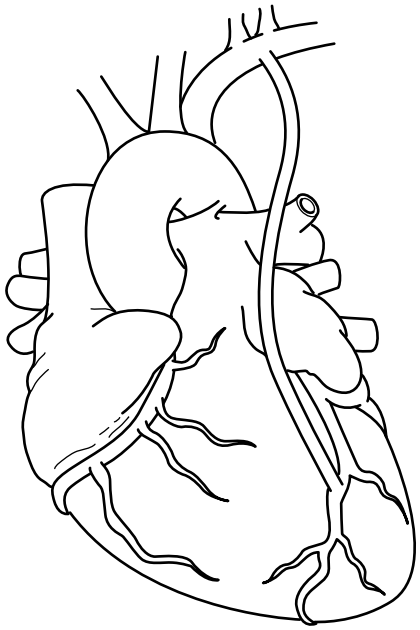


Fig. 6.1

(a) Use label lines and the following letters to label the following on Fig. 6.1:

A aorta
B coronary artery
C internal mammary artery
D pulmonary artery
E right atrium
F vena cava [3]

(b) On Fig. 6.1, mark with an **X**, the diseased area of the coronary artery for which the surgery has been performed. [1]

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(c) With reference to coronary heart bypass surgery, discuss the difficulties in achieving a balance between prevention and cure.

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[Total: 7]

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