Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7860908195

BIOLOGY **9700/21**

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 ink.
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 **11** printed pages and **1** blank page.

DC (LK/CGW) 79170/3

CAMBRIDGE International Examinations

[Turn over

Answer **all** the questions.

1 *Vibrio cholerae* is a prokaryotic organism.

Fig. 1.1 shows the structure of a cell of *V. cholerae.*

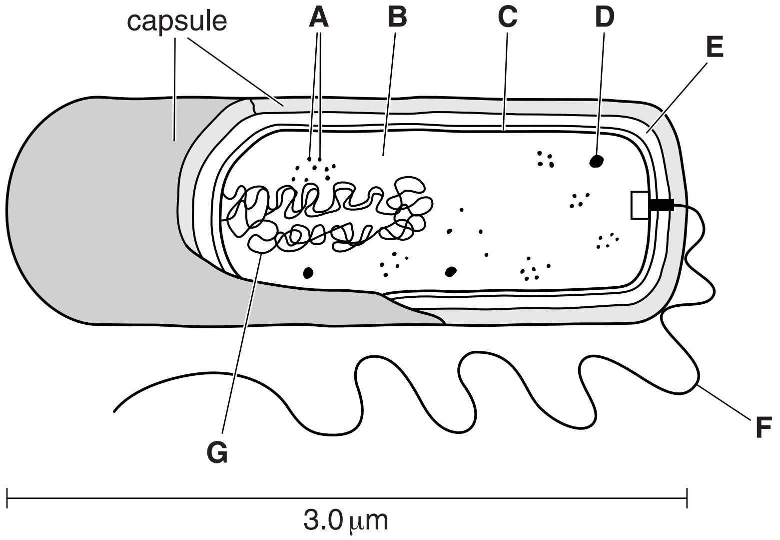

Fig. 1.1

(a) Calculate the magnification of Fig. 1.1.
Show your working and give your answer to the nearest whole number.

magnification × .... [2]

(b) Locate the structures in Fig. 1.1 that apply to each of the features shown in Table 1.1.
Complete Table 1.1 by writing the appropriate letter and the name of the structure.
You must only give one letter in each case. You may use each letter once, more than once or not at all. The first answer has been completed for you.

Table 1.1

feature	identity	name
provides motility	**F**	flagellum
stores genetic information		
partially permeable		
composed of murein (peptidoglycan)		
site of translation		

[4]

(c) State three **structural** features that are present in a mesophyll cell in a leaf [illegible] present in a prokaryotic cell such as that of *V. cholerae*.

1. ....

2. ....

3. ....
[3]

(d) Describe how *V. cholerae* is transmitted from an infected person to an uninfected person.

....

....

....

....

.... [2]

(e) It is important to know how pathogens are transmitted in order to develop effective control methods.

Explain how this knowledge is used to control the spread of *V. cholerae* in the human population.

....

....

....

....

....

....

.... [3]

[Total: 14]

2 *Azolla filiculoides* is an aquatic fern that floats on the surface of lakes.

The nitrogen-fixing microorganism, *Anabaena azollae*, lives within the leaves of the fern. The beetle, *Stenopelmus rufinasus*, feeds on *A.filiculoides*.

(a) State the ecological terms applied to each of the following descriptions of these species.

description	ecological term
all the members of the species *A. filiculoides* floating on a lake	
all the organisms, including *A. filiculoides, A. azollae* and *S. rufinasus*, found living in and on the lake	
organisms, such as *A. filiculoides*, that absorb light energy, fix carbon dioxide and make organic compounds available to animals that eat them	
the role of species, such as *A. filiculoides*, *A. azollae* and *S. rufinasus*, in the lake ecosystem	

[4]

(b) Explain the importance of nitrogen-fixing organisms, such as *A. azollae*, in ecosystems.

....

....

....

....

....

....

....[3]

[Total: 7]

3 Starch is composed of two polysaccharides, amylose and amylopectin.

Fig. 3.1 shows a molecule of α-glucose before being added to the end of a molecule of amylose.

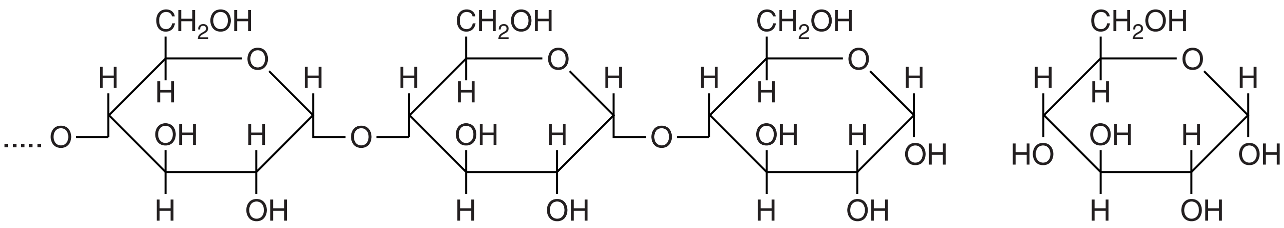

Fig. 3.1

(a) (i) Complete Fig. 3.1 to show how a molecule of α-glucose is added to the amylose. [3]

(ii) Name the bond that forms between glucose molecules in polysaccharides, such as amylose.

....[1]

(b) Glycogen and cellulose are two other polysaccharides.

Complete Table 3.1 to compare glycogen and cellulose with amylose.

Table 3.1

feature	amylose	glycogen	cellulose
monomer	α-glucose		
branched or unbranched molecule	unbranched		
role in organisms	energy storage		

[3]

(c) Type 2 diabetes (insulin-independent diabetes) is a non-infectious disease.

If not treated, this disease is characterised by large fluctuations in the concentra glucose in the blood.

Maltase is an enzyme that completes the digestion of starch in humans. Molecules of maltase are bound to the microvilli of epithelial cells in the small intestine.

Ascorbase is a drug used in the treatment of type 2 diabetes. Molecules of ascorbase have a very similar shape to that of the substrate for maltase.

(i) Explain how ascorbase acts to inhibit these membrane-bound enzymes.

....

....

....

....

....

....

.... [3]

(ii) Suggest why ascorbase can be used to treat people who have type 2 diabetes.

....

....

....

....

....

.... [2]

[Total: 12]

4 B-lymphocytes respond to the presence of a non-self antigen by dividing as shown in

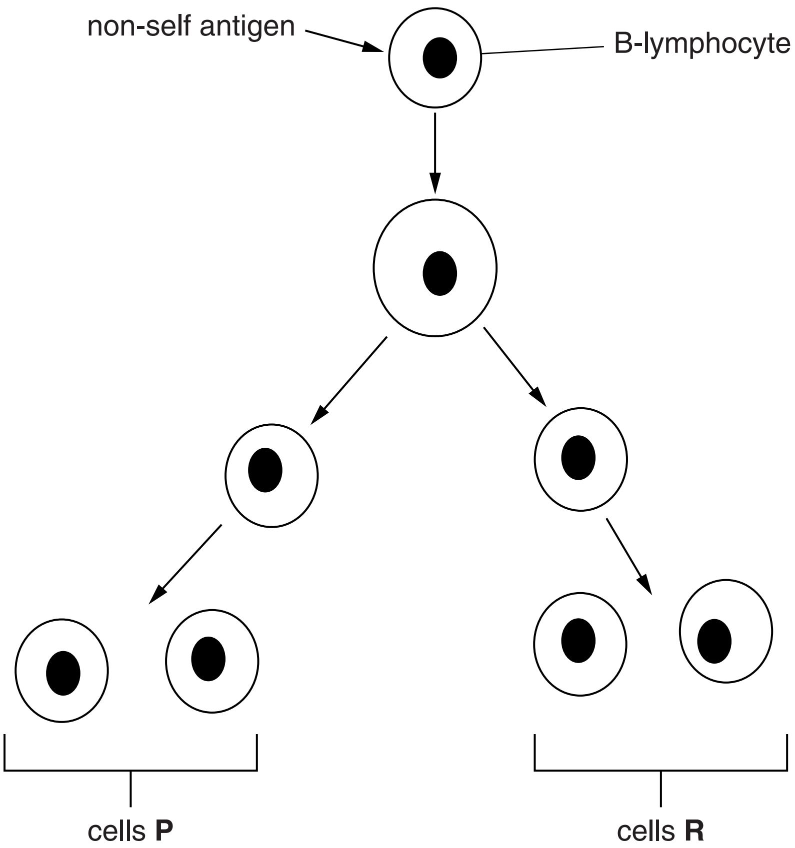

Fig. 4.1

(a) **(i)** Explain what is meant by the term *non-self antigen*.

....

....

....

....

.... [2]

(ii) Outline how B-lymphocytes recognise non-self antigens.

....

....

....

....

.... [2]

The cells labelled **P** on Fig. 4.1 continue to divide to give rise to many cells that diffe short-lived plasma cells. The plasma cells release antibody molecules.

(b) **(i)** Outline how plasma cells produce antibody molecules.

[4]

(ii) Describe how antibody molecules are released from the plasma cell.

[2]

(c) The cells labelled **R** on Fig. 4.1 divide to give more cells that do not differentiate into plasma cells. These cells have an important role in the immune system.

Explain the role of these cells.

[3]

The mass of DNA in the cells shown in Fig. 4.1 was determined. The results are show

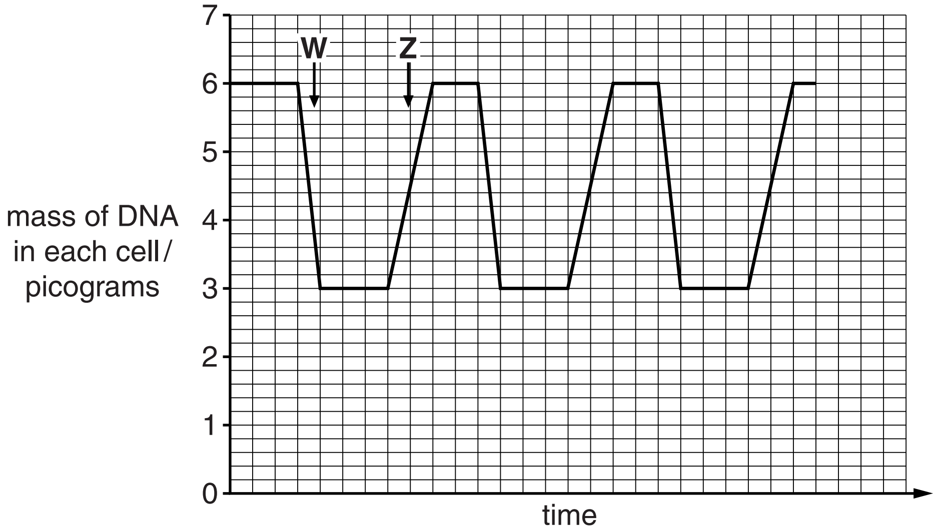

Fig. 4.2

(d) State what happens at **W** and **Z** to change the mass of DNA in each cell.

W ....

Z ....

[2]

(e) Acute lymphoblastic leukaemia (ALL) is a cancer of B-lymphocytes. It is very rare in adults, but more common in children. A study in 2009 found that exposure to tobacco smoke in the home may put children at risk of developing ALL.

Suggest how smoking by adults in the home may put their children at risk of cancers, such as ALL.

....

....

....

....

....

....

....

.... [3]

[Total: 18]

5 Fig. 5.1 shows a vertical section of the left side of the heart of a mammal.

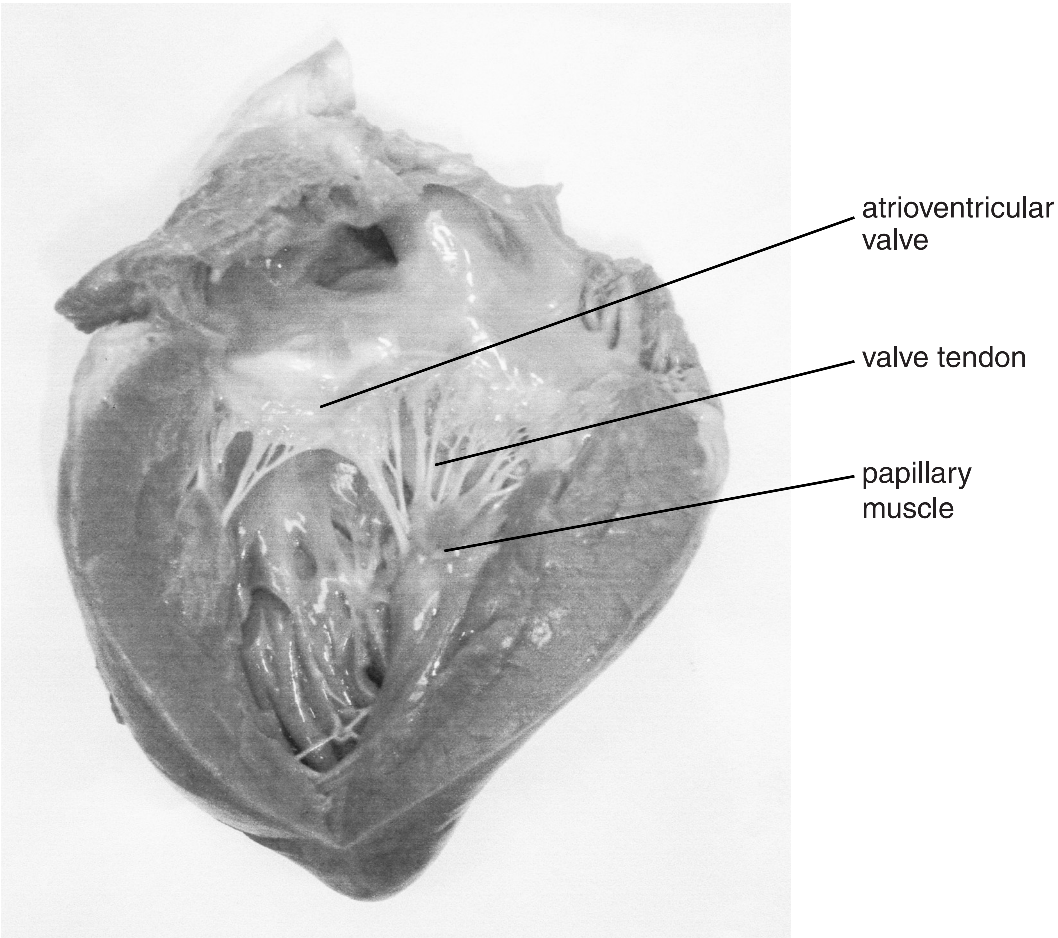

Fig. 5.1

(a) Explain the difference in the thickness of the left ventricle and the left atrium.

....

....

....

....

....[2]

(b) Explain how the structures labelled on Fig. 5.1 ensure that blood flows in the cor

....

....

....

....

....

....

.... [3]

(c) During one cardiac cycle, blood is pumped from the heart into the pulmonary and systemic circulations.

Explain how the contraction of the four chambers of the heart are coordinated and controlled to enable blood to be pumped simultaneously into both the pulmonary and systemic circulations.

....

....

....

....

....

....

....

....

....

....

....

.... [4]

[Total: 9]

BLANK PAGE