Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/23**

Paper 2 AS Level Structured Questions **May/June 2019**

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 on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

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.

DC (ST/CT) 166734/3

Answer **all** questions.

1 Fig. 1.1 is a diagram showing the structure of a section of a DNA molecule.

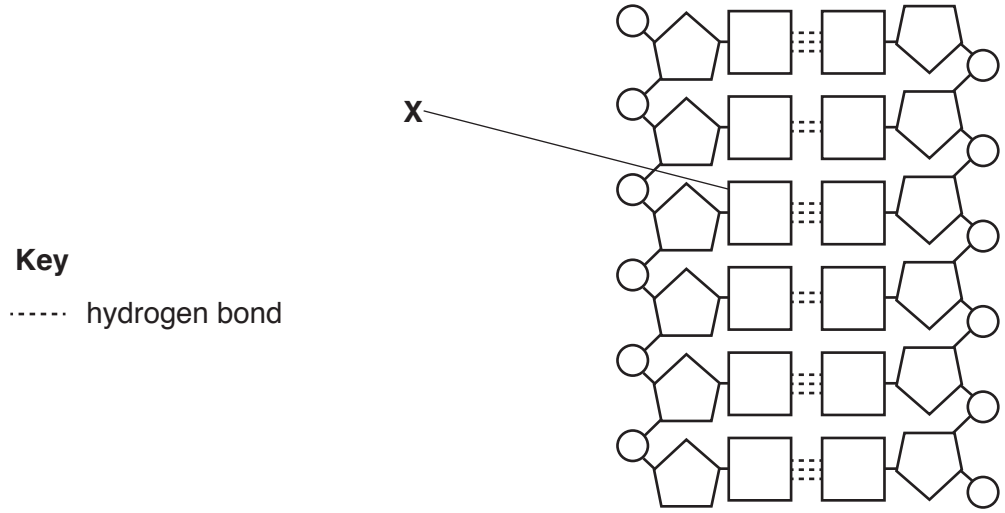

Fig. 1.1

(a) Draw a circle around **one** monomer of DNA in Fig. 1.1. [1]

(b) Name the two bases forming the base pair at **X** in Fig. 1.1 **and** give a reason for your answer.

bases .....

reason .....

.....

.....

..... [2]

(c) The statements 1–5 describe events that occur during DNA replication.

1 DNA polymerase forms a phosphodiester bond
2 DNA double helix forms
3 hydrogen bonds break
4 hydrogen bonds form
5 two strands of the double helix separate

Write the numbers 1 to 5 in the spaces below to show the order in which these events occur. The first one has been done for you.

..... **3** .... [1]

(d) The telomere is a region found at the end of a chromosome.

Outline the function of telomeres.

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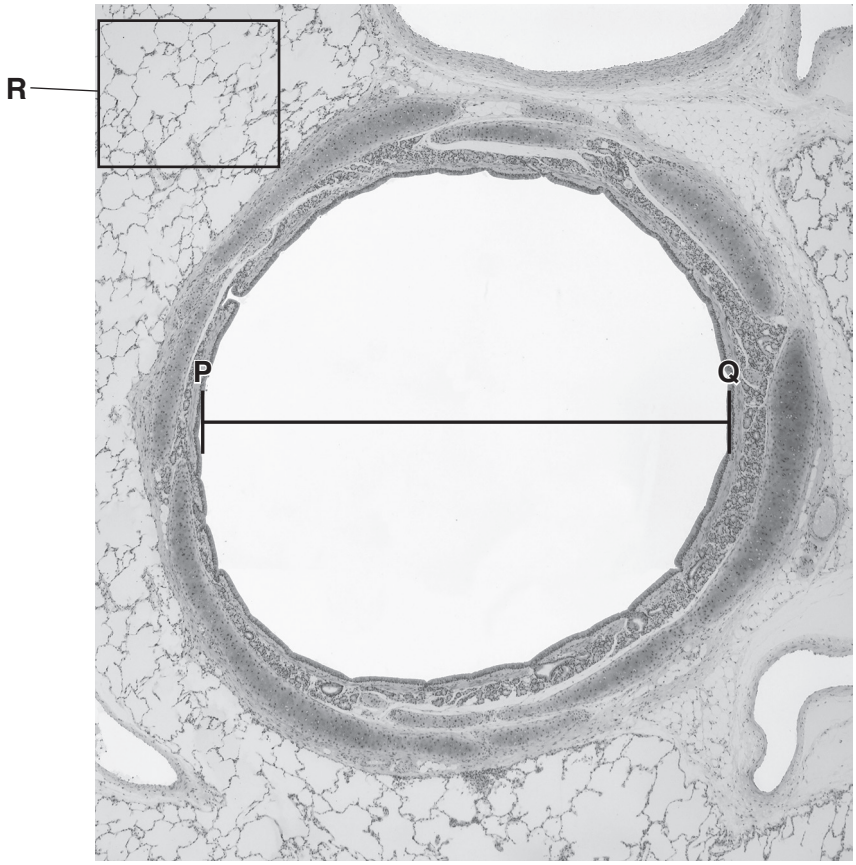
..... [2]

[Total: 6]

2 Fig. 2.1 is a photomicrograph showing a transverse section through a bronchus and the surrounding lung tissue.



magnification x40

Fig. 2.1

(a) Calculate the actual diameter of the lumen of the bronchus using the line **P**–**Q**.

Write down the formula used to make your calculation.

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

formula

actual diameter = ... μm [2]

(b) (i) In Fig. 2.1, the area labelled **R** shows a section through some alveoli.

Name the tissue that lines the air spaces of the alveoli.

..... [1]

(ii) Suggest how the alveoli are adapted for gas exchange.

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..... [2]

(c) In the leaves of plants, both gas exchange and transpiration occur through open stomata.

Suggest how the arrangement of cells in the leaf of a dicotyledonous plant contributes to the loss of water by transpiration.

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..... [3]

(d) Fig. 2.2 shows the mean transpiration rate of a xerophyte between 08:00 and 19:00.

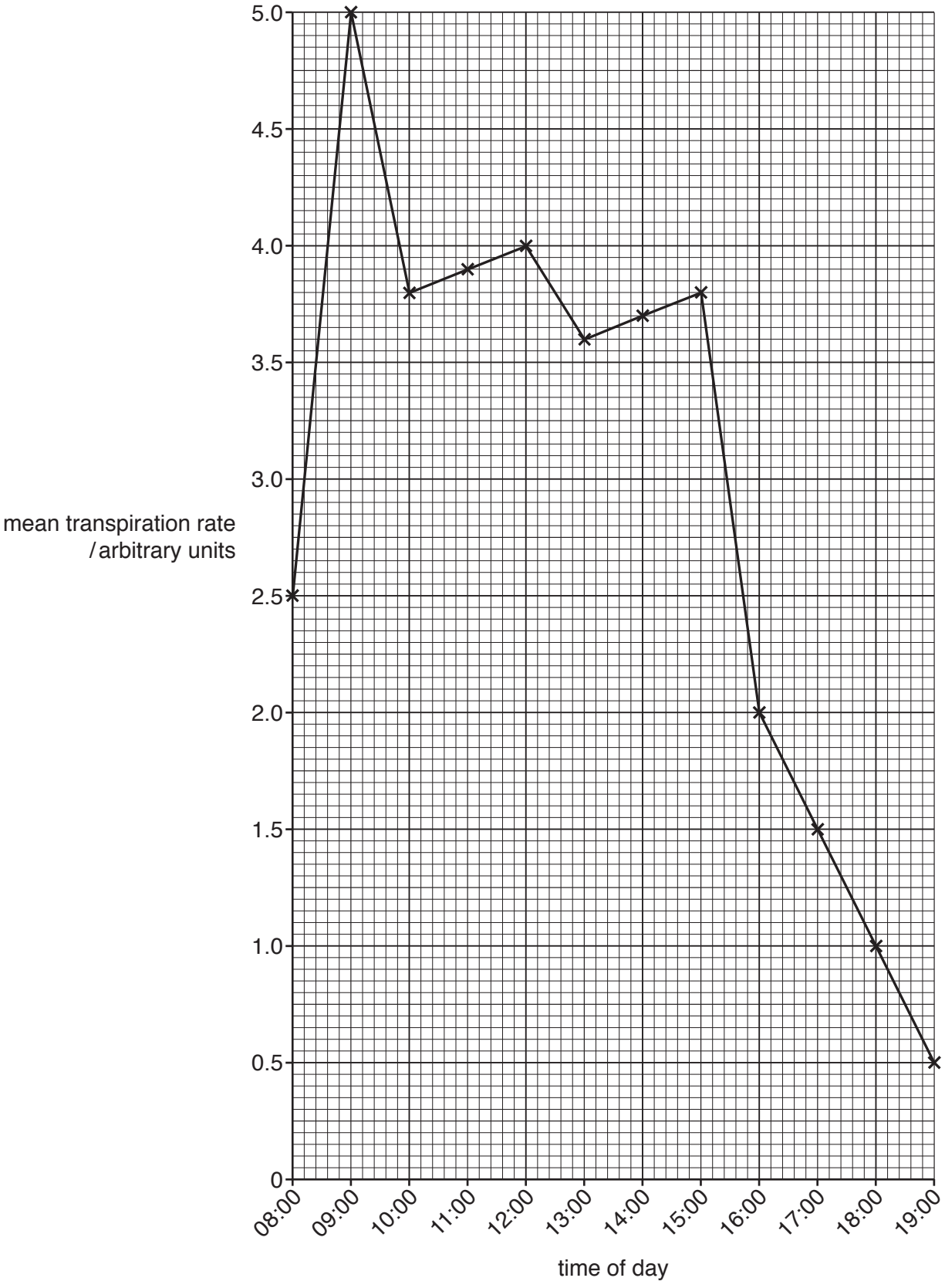

Fig. 2.2

(i) Describe the data shown in Fig. 2.2.

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..... [3]

(ii) Suggest why the transpiration rate changed between 09:00 and 10:00.

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..... [2]

[Total: 13]

3 Cholera is an infectious disease caused by the bacterium *Vibrio cholerae*. The pathogen causes disease by disrupting the activity of the epithelial cells in the human intestine.

(a) Complete Table 3.1 to compare the structure of *V. cholerae* and an epithelial cell from the human intestine.

Use a tick (✓) to indicate the presence of the structure.

Use a cross (✗) to indicate the absence of the structure.

The first row has been completed for you.

Table 3.1

cell structure	*V. cholerae*	epithelial cell from the human intestine
cell wall	✓	✗
cell surface membrane		
ribosomes		
large permanent vacuole		
organelles surrounded by a double membrane		

[4]

(b) Describe the methods that can be used to prevent the spread of cholera.

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..... [5]

(c) The World Health Organization has suggested that people with HIV/AIDS take a longer time to recover from cholera and are at an increased risk of death from cholera.

The human immunodeficiency virus (HIV) only infects certain types of cell. These cells have CD4 receptor proteins in their cell surface membrane. Helper T-lymphocytes have CD4 receptor proteins.

(i) Fig. 3.1 is a diagram of HIV showing the glycoprotein gp120.

This glycoprotein is embedded in a membrane envelope which surrounds the viral protein coat.

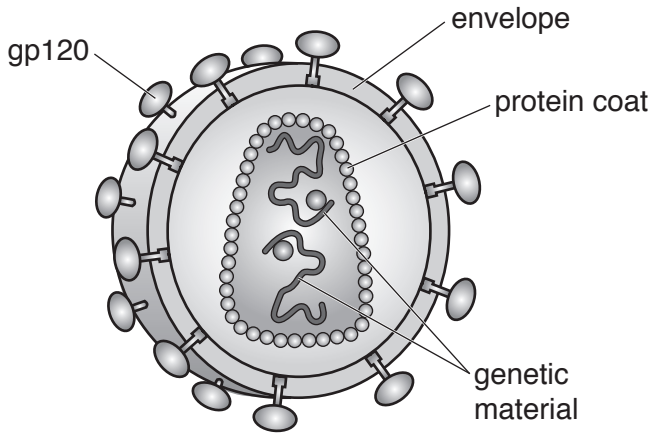

Fig. 3.1

The glycoprotein gp120 is important in allowing HIV to only infect certain types of cell.

Suggest the role of gp120.

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..... [2]

(ii) People with HIV/AIDS have a low helper T-lymphocyte count.

Explain how a low helper T-lymphocyte count could reduce the body's ability to produce antibodies against *V. cholerae*.

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..... [2]

[Total: 13]

4 Phloem sieve tube elements and xylem vessel elements are cells that are involved with the transport of substances in plants.

(a) Describe **two** differences between the structure of a phloem sieve tube element and a xylem vessel element.

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.....

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..... [2]

(b) Sucrose is transported in phloem sieve tubes.

A student carried out a test to identify the presence of sucrose in a sample of sap taken from inside a phloem sieve tube. One of the steps in the procedure instructed the student to heat the phloem sap with hydrochloric acid.

Explain why it is necessary to carry out this step in the procedure.

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..... [2]

(c) The process of loading sucrose into a phloem sieve tube element involves a companion cell.

(i) Fig. 4.1 shows a stage in the process of loading sucrose into the phloem.

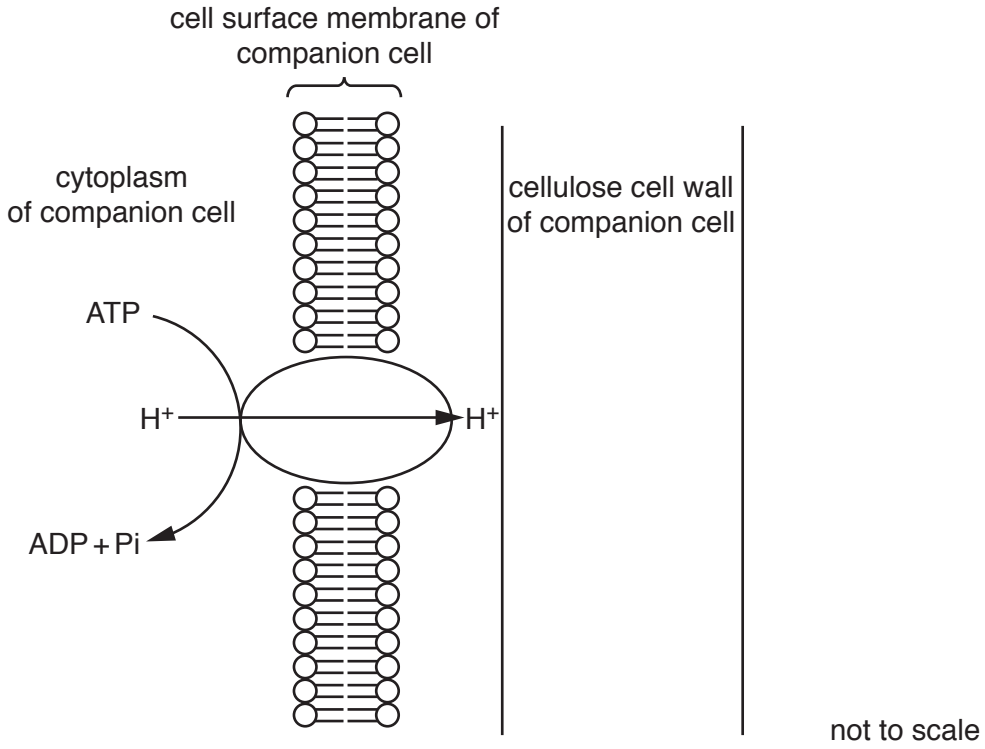

Fig. 4.1

Companion cells contain large numbers of mitochondria and ribosomes.

Explain the roles of mitochondria and ribosomes for the stage shown in Fig. 4.1.

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..... [2]

(ii) Describe **and** explain how sucrose is transported from the cell wall of the companion cell into the cytoplasm.

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..... [3]

[Total: 9]

5 **(a)** Fig. 5.1 is a photomicrograph of human blood cells that have been placed in a solution of sodium chloride.

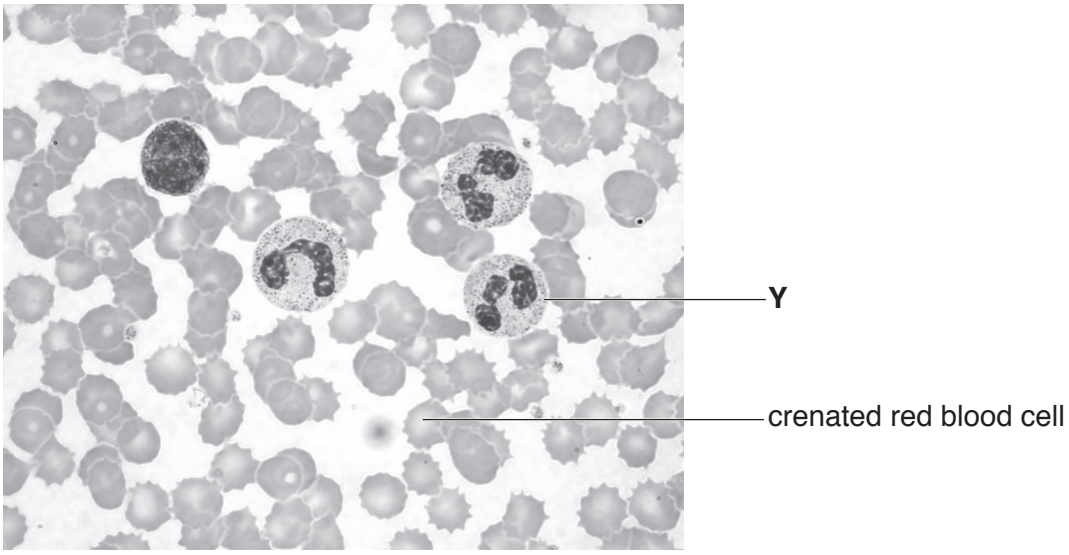

Fig. 5.1

(i) State the function of the cell labelled **Y**.

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..... [1]

(ii) The red blood cell labelled in Fig. 5.1 is described as crenated because it has an abnormal, shrivelled appearance.

Explain how this red blood cell has become crenated.

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..... [2]

(b) Researchers studied the effect of altitude on the red blood cell count of humans. They recorded the red blood cell count of healthy adults from populations living at four different altitudes in a mountainous region.

The results are shown in Table 5.1.

Table 5.1

population	altitude of population / m above sea level	mean red blood cell count / number of cells $\times 10^6$ mm^{-3}
A	695	4.50
B	1676	5.14
C	2003	5.04
D	2118	5.11

(i) Calculate the percentage increase in mean red blood cell count between population **A** and population **D**.

.....% [1]

(ii) Describe and suggest explanations for the data shown in Table 5.1.

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..... [4]

(c) Carbonic anhydrase is an enzyme found in red blood cells which has an important role in the transport of respiratory gases.

Explain why a non-competitive inhibitor of carbonic anhydrase will reduce the supply of oxygen to actively respiring tissues.

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..... [2]

[Total: 10]

6 Fig. 6.1 is a diagram of a vertical section of the human heart and the associated blood vessels.

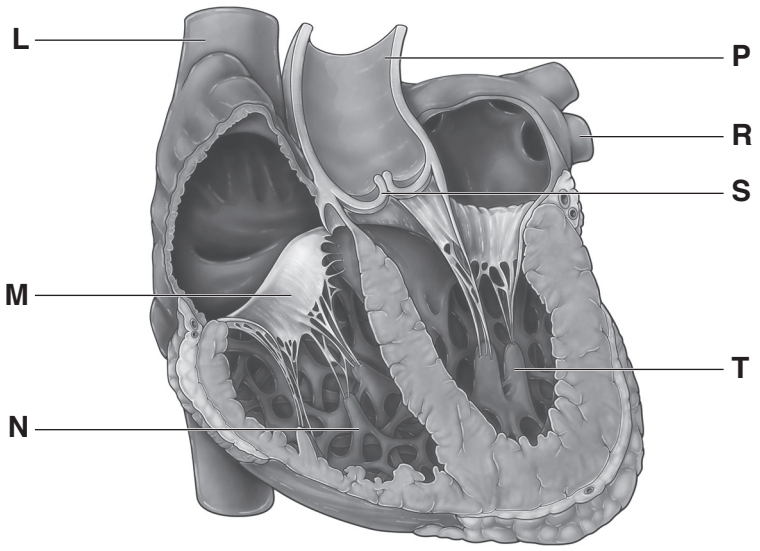

Fig. 6.1

(a) Complete Table 6.2 by writing the letter from Fig. 6.1 that identifies each of the structures described.

Table 6.2

structure in the heart	letter
valve preventing back flow of blood into a ventricle	
blood vessel carrying blood under highest pressure	
chamber that pumps blood to the lungs	

[3]

(b) Describe the short-term effects of nicotine on the cardiovascular system.

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..... [3]

Question 6 continues on page 16

(c) Cardiac myocytes are heart muscle cells.

Fetal cardiac myocytes are present before birth and divide rapidly during fetal development.

Soon after birth the cell cycle in most of these fetal cardiac myocytes stops, forming adult cardiac myocytes. Most of the adult cells have completed the cell cycle but in some the cell cycle stops at the end of mitosis.

(i) State the difference between adult cardiac myocytes that have completed the cell cycle and those that have stopped at the end of mitosis.

..... [1]

(ii) Suggest why it could be a disadvantage that the cell cycle has stopped in most adult cardiac myocytes.

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..... [2]

[Total: 9]