Centre Number	Candidate Number	Name

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

BIOLOGY **9700/02**

Paper 2 Structured Questions AS

October/November 2006

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 pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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.

Answer **all** the questions.

1 Fig. 1.1 is a photograph taken at low tide in a mangrove swamp in Mozambique.

Fig. 1.1

The photograph shows a hermit crab surrounded by the pneumatophores ('breathing roots') of mangrove trees. The hermit crabs live inside the shells of dead molluscs. Large birds, such as Goliath herons, feed on the hermit crabs. The vertical pneumatophores are an adaptation to the soil in the swampy, coastal environment that contains very little oxygen. They are exposed to the air at low tide. The soil has a very high salt content as the sea often covers the area. Some bacteria are able to grow deep in the rich organic mud where the oxygen concentration is very low.

(a) Listed below are eight ecological terms that can be applied to the mangrove swamp and the organisms that live there.
Use **only** the information given above to match each organism with the most appropriate term from the list. You may use each letter once, more than once or not at all.

mangrove trees	
all the organisms in the mangrove swamp	
bacteria deep in the mud	
all the hermit crabs in the swamp	

A primary consumer
B population
C community
D niche
E secondary consumer
F ecosystem
G decomposer
H producer [4]

(b) Explain how the cells in the roots of mangrove trees obtain sufficient oxygen and water in this extreme environment.

oxygen .....

.....

.....

.....

water .....

.....

.....

.....

.....[5]

[Total: 9]

[Turn over

2 Fig. 2.1 shows a transverse section of a root nodule of a legume. Fig. 2.2 is a drawing of a cell from the centre of the nodule made from an electron micrograph.

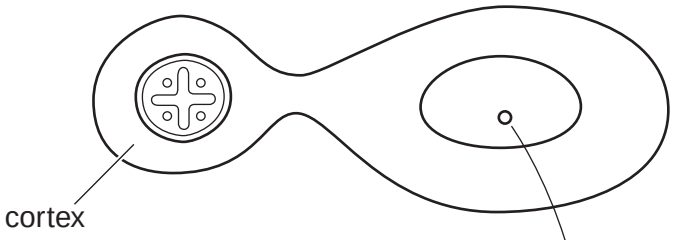


Fig. 2.1

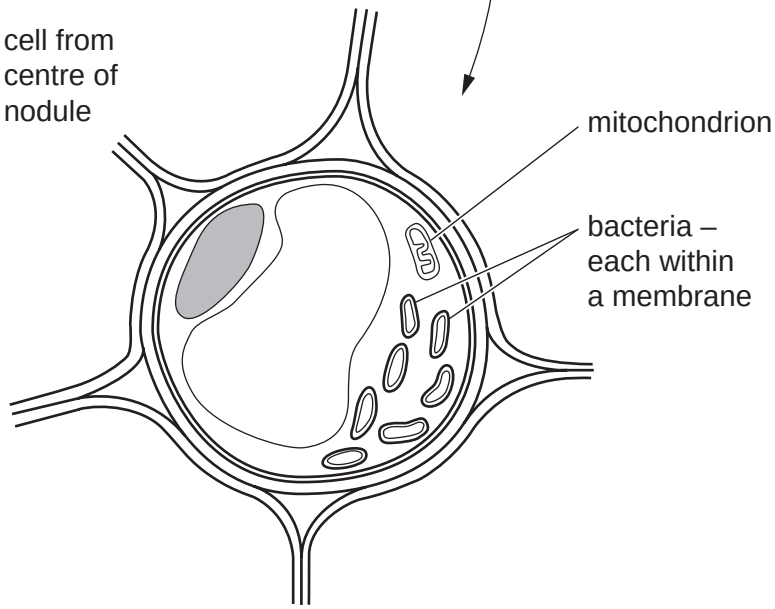


Fig. 2.2

(a) Name three structures that are present in cells in the cortex of the root that are not present in bacterial cells.

1 .....

2 .....

3 .....[3]

(b) Explain the advantages of studying cell structure with an electron microscope rather than with a light microscope.

.....

.....

.....

.....[2]

(c) Describe the role of *Rhizobium* in the root nodule.

.....

.....

.....

.....

.....

.....[3]

(d) Cells in the centre of the root nodule have a high concentration of the pigment, leghaemoglobin. This combines with oxygen in much the same way as haemoglobin in mammals. Leghaemoglobin is responsible for maintaining anaerobic conditions around the bacteria in the nodules. Leghaemoglobin is not found in the roots of other plants.

The base sequence in the gene that codes for the β polypeptide of mammalian haemoglobin is similar to that for leghaemoglobin.

Suggest why this is so.

.....

.....

.....

.....[2]

[Total: 10]

[Turn over

3 Fig. 3.1 shows some cells from the lining of the bronchus from a person who has never smoked.
Fig. 3.2 shows cells from the same area in a heavy smoker who suffers from chronic bronchitis.

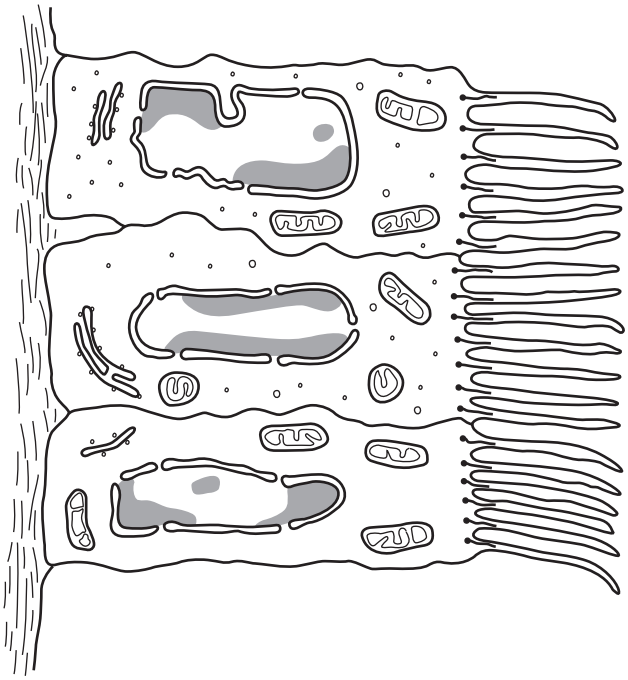


Fig. 3.1

Fig. 3.2

(a) Using label lines and the following letters, label the structures **A** to **C** on Fig. 3.1.

A cilia
B nuclear membrane (nuclear envelope)
C endoplasmic reticulum [3]

(b) Explain why the lungs are at an increased risk of infection when the bronchial epithelium is damaged as is shown in Fig. 3.2.

.....

.....

.....

.....

.....

.....[3]

(c) Chronic obstructive pulmonary disease (COPD) includes chronic bronchitis and emphysema.

A student used the World Health Organisation database to investigate the link between cigarette smoking and deaths from COPD. Fig. 3.3 shows deaths from COPD plotted against the mean annual consumption of cigarettes in 20 countries for the period 1997 to 2002.

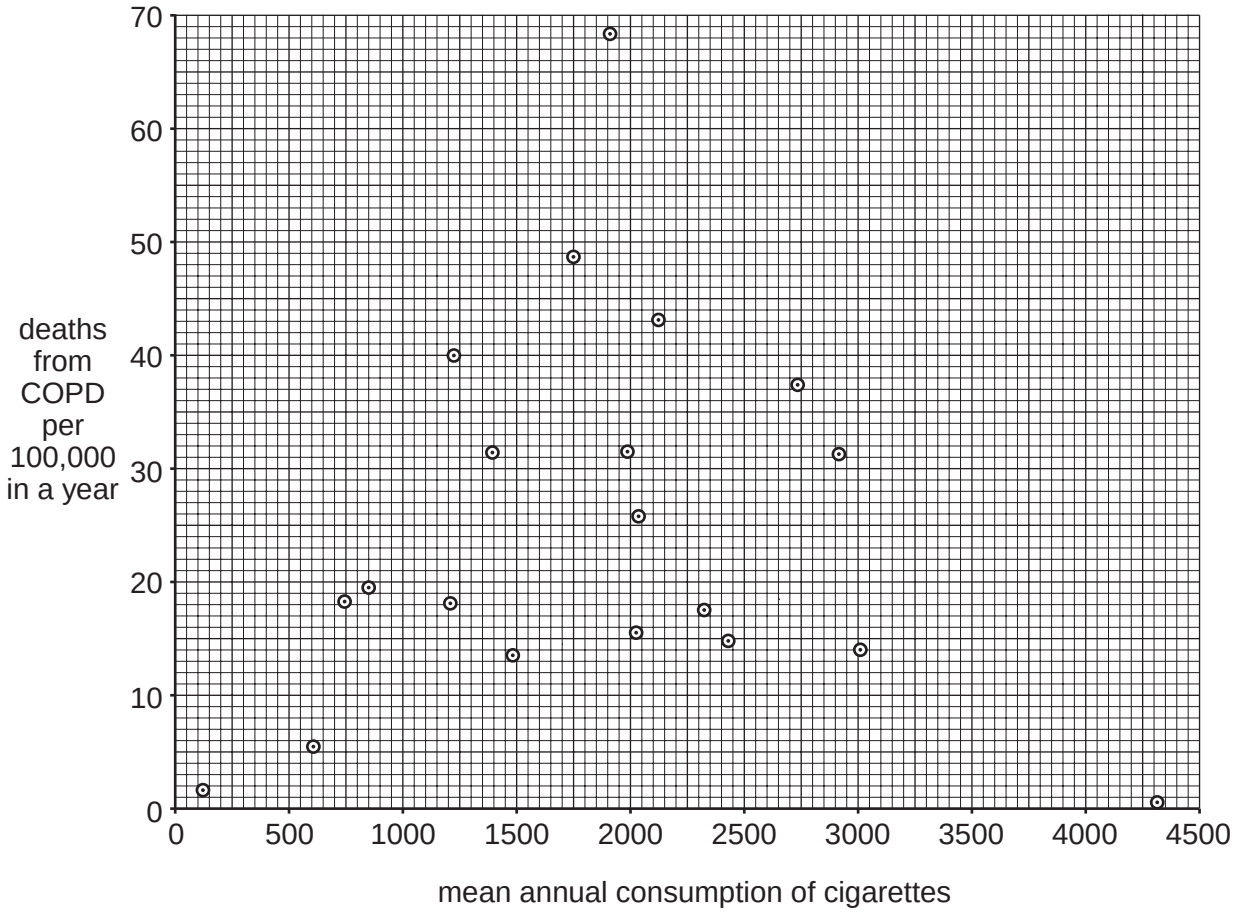


Fig. 3.3

The student concluded that there was no link between cigarette consumption and deaths from COPD.

Use the information in Fig. 3.3 to discuss the student's conclusion.

.....

.....

.....

.....

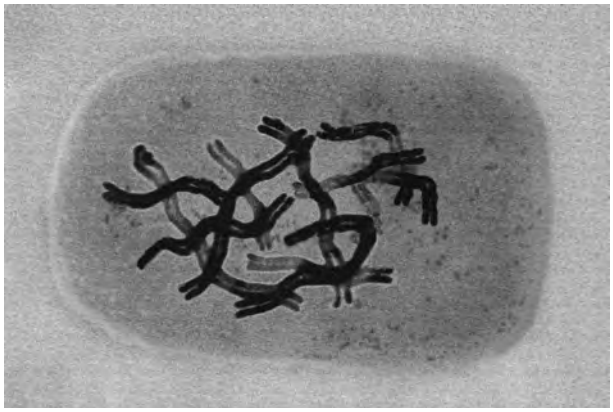
.....

.....[3]

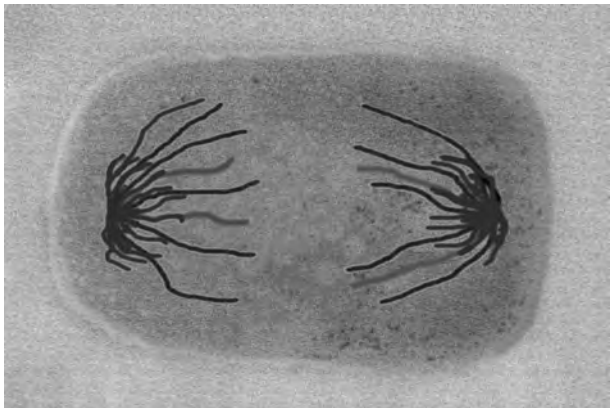
[Total: 9]

[Turn over

4 Fig. 4.1 shows two stages of mitosis in a cell from a root tip of *Allium cepa*.



D



E

Fig. 4.1

(a) Describe what happens to the chromosomes during mitosis between the stage shown in **D** and the stage shown in **E**.

.....

.....

.....

.....

.....

.....

.....

.....[4]

(b) Describe the events that occur within a cell after the stage shown in Fig. 4.1 **E** to allow the formation of two cells.

.....

.....

.....

.....

.....

.....[3]

(c) A root was cut into ten transverse sections at different distances from the tip. The sections were stained and viewed under the microscope. The number of cells in mitosis were counted in each section and the results were used to determine the mitotic index. This is calculated as follows:

$$\text{mitotic index} = \frac{\text{number of cells in mitosis}}{\text{total number of cells}}$$

Fig. 4.2 shows the mitotic index for the ten sections.

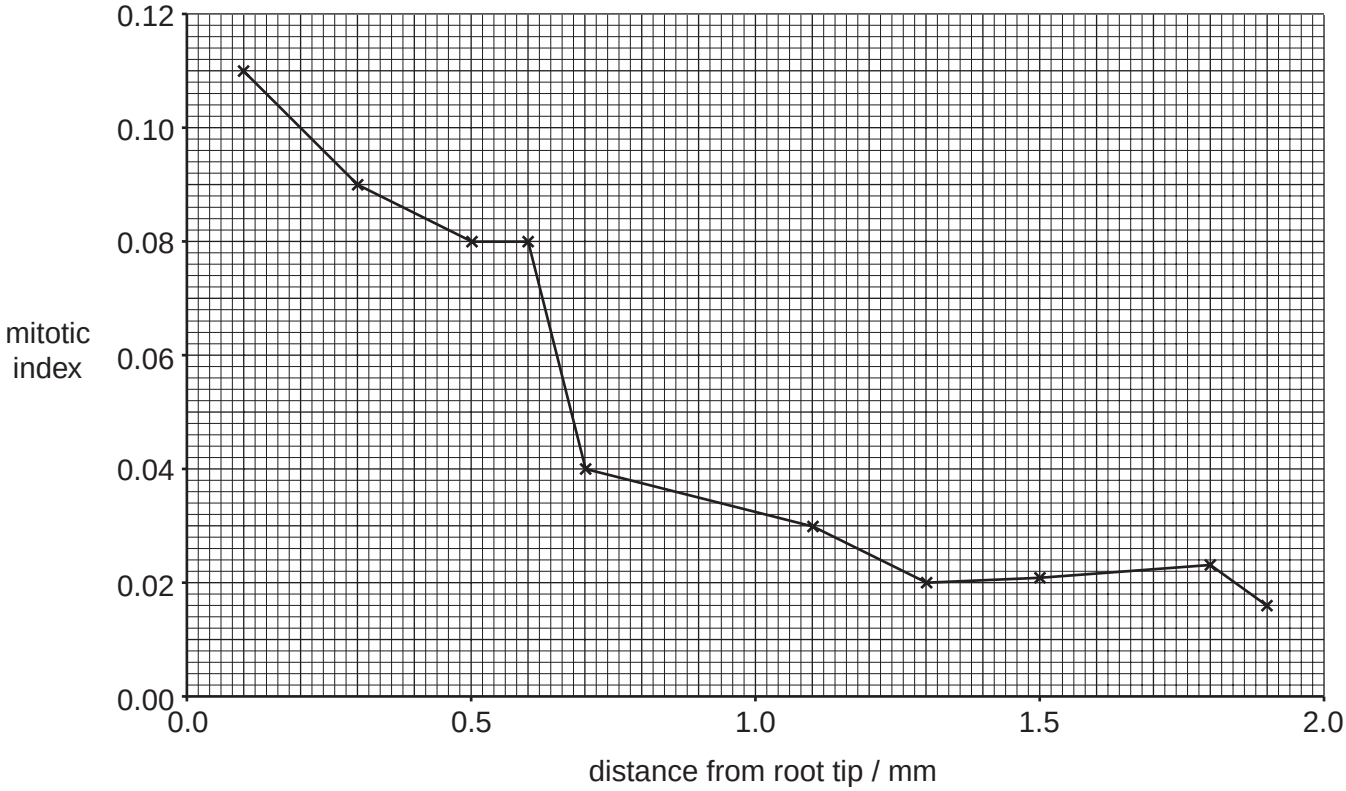


Fig. 4.2

Using the information in Fig. 4.2, describe how the mitotic index changes along the length of the root.

.....

.....

.....

.....

.....

.....[3]

[Turn over

(d) Explain how the events in the mitotic cell cycle ensure that all the cells in the root are genetically identical.

.....

.....

.....

.....

.....

.....

.....

.....[3]

[Total: 13]

BLANK PAGE

5 Table 5.1 shows blood cell counts for three different people.

Table 5.1

	number of cells per mm^3 of blood		
	healthy person at sea level	healthy person acclimatised to high altitude	person with a bacterial infection
red blood cells	5 400 000	6 100 000	5 300 000
T helper lymphocytes	1 000	1 050	850
phagocytes	5 400	5 600	8 750

(a) (i) Calculate the percentage increase in the number of red blood cells in the person acclimatised to high altitude compared with the person at sea level. Show your working and express your answer to the nearest whole number.

Answer = ... [2]

(ii) Explain the advantage of this increase in red blood cells to people who live at high altitude.

.....

.....

.....

.....

.....[2]

(b) State the roles of phagocytes and T helper lymphocytes during an immune response to a bacterial infection.

phagocytes

.....

.....

T helper lymphocytes

.....

.....[2]

(c) Antibiotics are used to treat people with bacterial infections.

Explain the danger of the widespread use of antibiotics to treat disease.

.....

.....

.....

.....[2]

[Total: 8]

[Turn over

6 Fig. 6.1 shows three stages in the cardiac cycle.

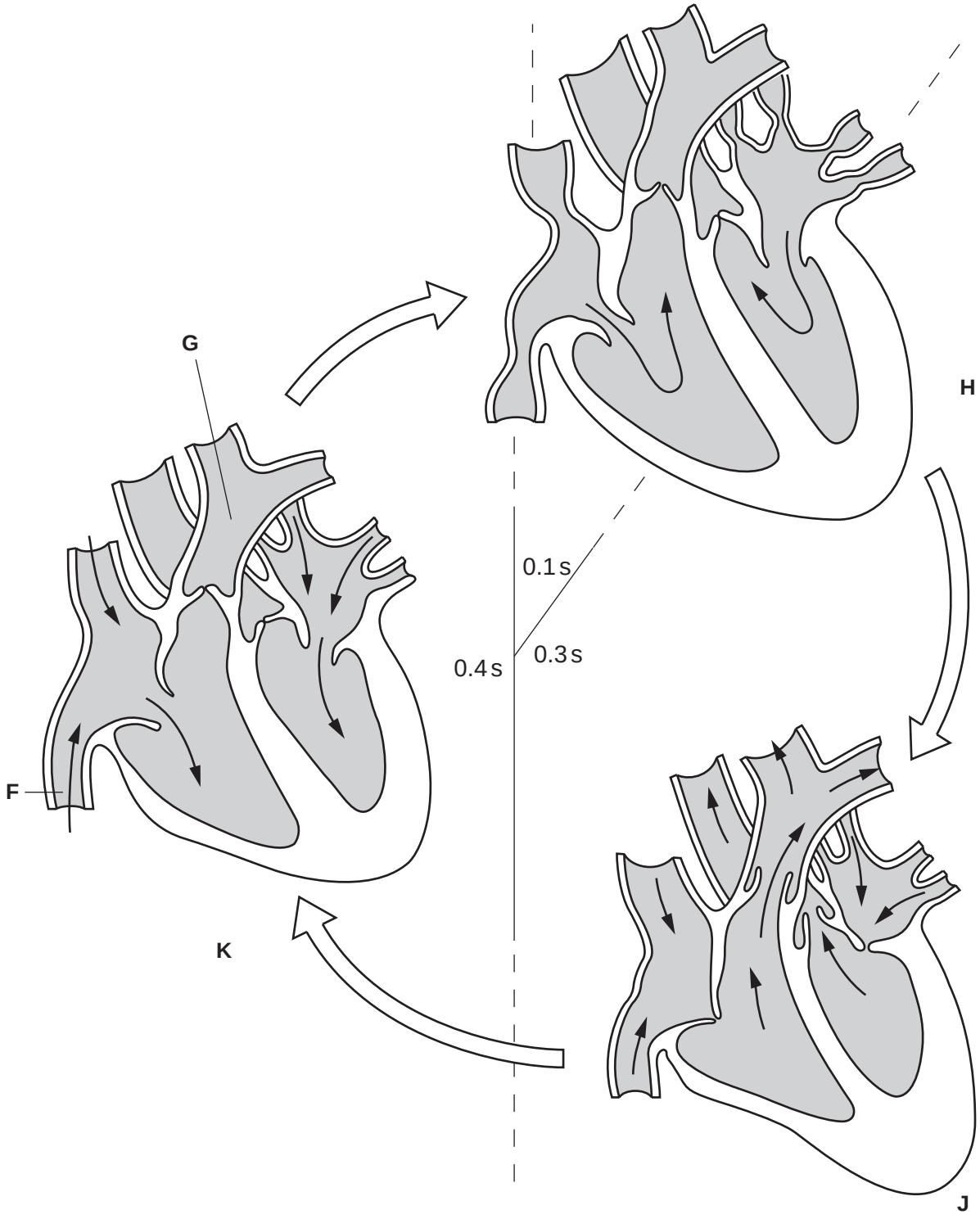


Fig. 6.1

(a) (i) Name the blood vessels labelled **F** and **G**.

F .....

G .....[2]

(ii) Fig. 6.1 indicates that one heart beat takes 0.8 second.
State the heart rate in beats per minute.

Answer = ... [1]

(iii) Explain why the walls of the atria have thinner muscle than the walls of the ventricles.

.....

.....

.....

.....[2]

(b) Complete the table to show what is happening to the following parts of the **left** side of the heart at each of the stages, **H**, **J** and **K** as shown in Fig. 6.1:

- left atrium
- left ventricle
- aortic valve.

stage	left atrium	left ventricle	atrioventricular valve	aortic valve
H	contracts to force blood into left ventricle	....	open	closed
J	....	....	closed	.....
K	....	relaxes and fills with blood from left atrium	open	.....

[6]

[Total: 11]

BLANK PAGE