Location Entry Codes

As part of CIE's continual commitment to maintaining best practice in assessment, CIE uses different variants of some question papers for our most popular assessments with large and widespread candidature. The question papers are closely related and the relationships between them have been thoroughly established using our assessment expertise. All versions of the paper give assessment of equal standard.

The content assessed by the examination papers and the type of questions is unchanged.

This change means that for this component there are now two variant Question Papers, Mark Schemes and Principal Examiner's Reports where previously there was only one. For any individual country, it is intended that only one variant is used. This document contains both variants which will give all Centres access to even more past examination material than is usually the case.

The diagram shows the relationship between the Question Papers, Mark Schemes and Principal Examiners' Reports that are available.

Question Paper	**Mark Scheme**	**Principal Examiner's Report**
Introduction	Introduction	Introduction
First variant Question Paper	First variant Mark Scheme	First variant Principal Examiner's Report
Second variant Question Paper	Second variant Mark Scheme	Second variant Principal Examiner's Report

Who can I contact for further information on these changes?
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The titles for the variant items should correspond with the table above, so that at the top of the first page of the relevant part of the document and on the header, it has the words:

- First variant Question Paper / Mark Scheme / Principal Examiner's Report

or

- Second variant Question Paper / Mark Scheme / Principal Examiner's Report

as appropriate.

First Variant Question Paper

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

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2709766077

BIOLOGY **9700/21**

Paper 2 Structured Questions AS **May/June 2009**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator
Ruler

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 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.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
Total	

This document consists of **16** printed pages and **4** blank pages.

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Answer all the questions.

For Examiner's Use

1 Fig. 1.1 shows the outline of a ciliated cell from the human gas exchange system.

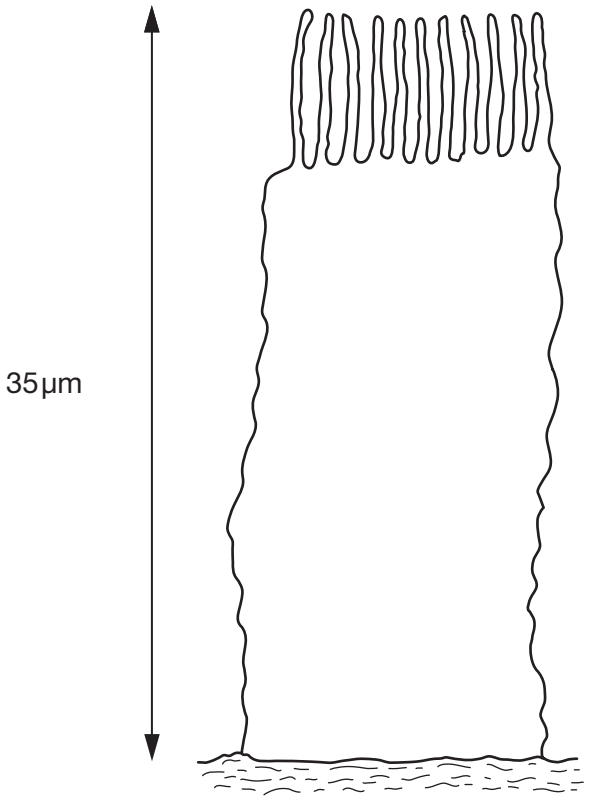


Fig. 1.1

(a) (i) Inside the ciliated cell in Fig. 1.1, draw the nuclear envelope and a mitochondrion as they would be seen with an electron microscope.

Label these structures. [3]

(ii) Calculate the magnification of the ciliated cell in Fig. 1.1.

Show your working and express your answer to the nearest whole number.

magnification = ... [2]

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Fig. 1.2 is a drawing of *Mycobacterium tuberculosis*.

For Examiner's Use

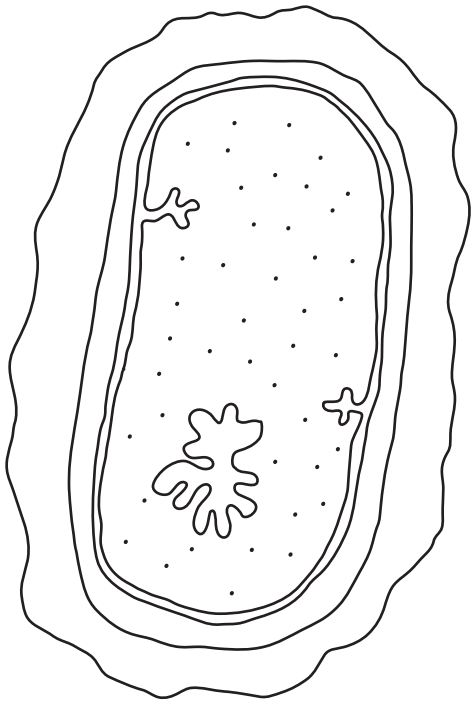


Fig. 1.2

(b) State three structural features that are found in **both** *M. tuberculosis* and animal cells, such as the ciliated cell in Fig. 1.1.

1. .....

2. .....

3. .....[3]

(c) Describe how *M. tuberculosis* is transmitted from an infected person to an uninfected person.

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.....[2]

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[Turn over

Table 1.1 shows the numbers of new cases of tuberculosis (TB) and the death rates from TB in selected countries in 2005. The fatality ratio is the number of deaths as a proportion of the number of new cases.

For Examiner's Use

Table 1.1

country	number of new cases per 100 000 people	number of deaths per 100 000 people	fatality ratio
China	100	16	0.16
Pakistan	181	37	0.20
South Africa	600	71	0.12
Uganda	369	91	
United Kingdom	14	1	0.07
United States of America	5	0	0.00

(d) (i) Complete Table 1.1 by calculating the fatality ratio for Uganda.

Enter your result in Table 1.1. [1]

(ii) Suggest why fatality ratios are higher in some of the countries shown in Table 1.1 than in others.

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.....[4]

[Total: 15]

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QUESTION 2 STARTS ON PAGE 6

For Examiner's Use

2 **(a)** The table below gives some terms that are used in ecology and their definitions.

Complete the table.

term	definition
ecosystem	all the organisms and the physical factors that influence them in an area, such as a forest
	a place where an organism lives
community	
	role of organism in an ecosystem
	all the organisms of the same species in an ecosystem at the same time

[4]

Fig. 2.1 shows a three-toed sloth, *Bradypus variegatus*, that lives in forest ecosystems in Central America. The sloths living in these forests form part of the community. Sloths feed mainly on the leaves of many different tree species that grow in the under canopy in the forest. These leaves are rich in cellulose, which is digested by bacteria and other microorganisms in the stomachs of sloths. The main predators of sloths are jaguars, harpy eagles, snakes and humans.



Fig. 2.1

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(b) With reference to the information above,

For Examiner's Use

(i) state the trophic level occupied by the sloth in the food chain;

.....[1]

(ii) suggest **one** advantage to the sloth of having bacteria and other microorganisms in its stomach;

.....

.....[1]

(iii) suggest why there are few predators, such as jaguars and harpy eagles, in the forest ecosystem even though there are many producers, such as trees.

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.....[3]

[Total: 9]

3 Fig. 3.1 shows a flatworm which lives in ponds, streams and rivers. The dimensions of the flatworm are 12.5 mm long by 3.0 mm wide. Its volume was estimated as 12.6 mm^3. Flatworms do not have a transport system for the respiratory gases, oxygen and carbon dioxide.

For Examiner's Use

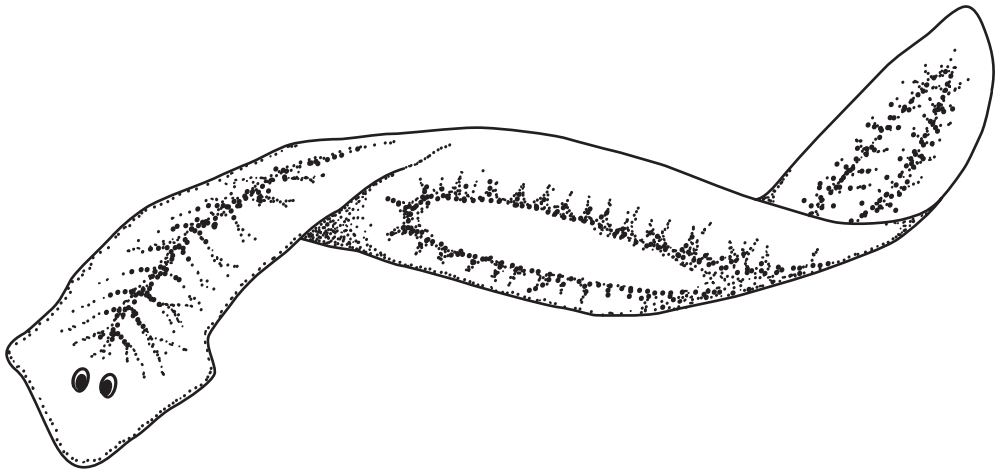


Fig. 3.1

(a) With reference to Fig. 3.1 and the information above, explain how flatworms survive without a transport system for respiratory gases.

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.....[4]

(b) This flatworm lives in freshwater that has a low concentration of sodium ions. The flatworm's body fluids have a higher concentration of sodium ions than the surrounding water.

For Examiner's Use

(i) Suggest how the flatworm retains sodium ions in its body fluids.

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.....[2]

(ii) State **one** role of sodium ions in organisms.

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.....[1]

[Total: 7]

4 Catalase is an enzyme with a molecular structure composed of four identical sub-units.

For Examiner's Use

Fig. 4.1 is a diagram that shows how catalase is produced in cells.

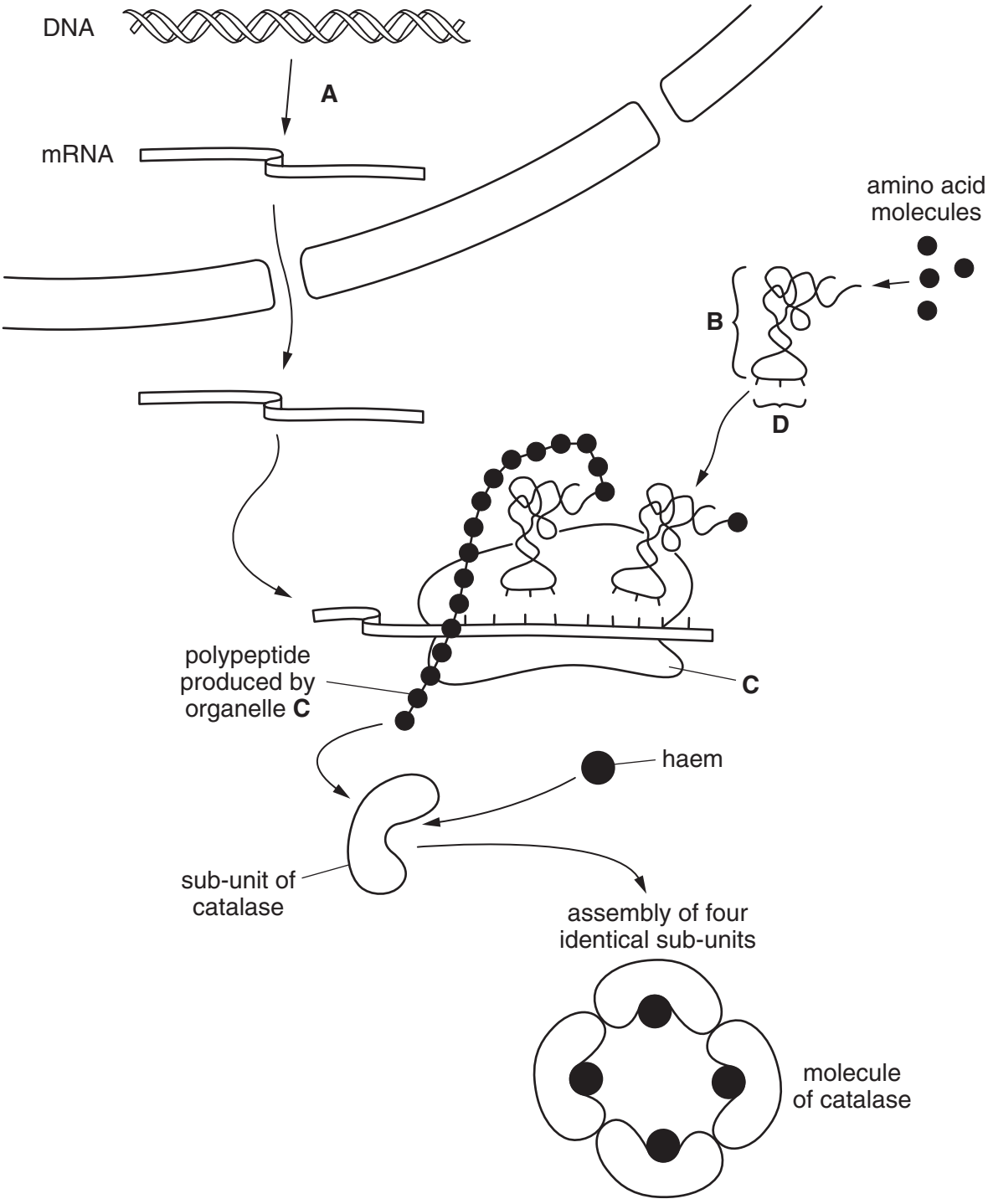


Fig. 4.1

For Examiner's Use

(a) With reference to Fig. 4.1,

(i) name

process **A** .....

molecule **B** .....

structure **C** .....

sequence of bases **D** .....[4]

(ii) state two ways in which the structure of catalase is similar to the structure of haemoglobin and one way in which it differs

structural similarities

1. .....

2. .....[2]

structural difference

.....[1]

(iii) State why it is possible for a catalase molecule to bind to four substrate molecules at the same time.

.....[1]

(b) The enzyme amylase catalyses the following reaction:

starch + water $\rightarrow$ maltose

The progress of this reaction may be followed by measuring either the starch concentration or the maltose concentration at intervals of time.

State which chemicals you would use to detect the disappearance of the substrate and the appearance of the product, in order to follow the progress of the reaction.

disappearance of substrate .....

.....

appearance of product .....

.....[2]

[Total: 10]

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[Turn over

5 Fig. 5.1 shows part of a transverse section of a leaf.

For Examiner's Use

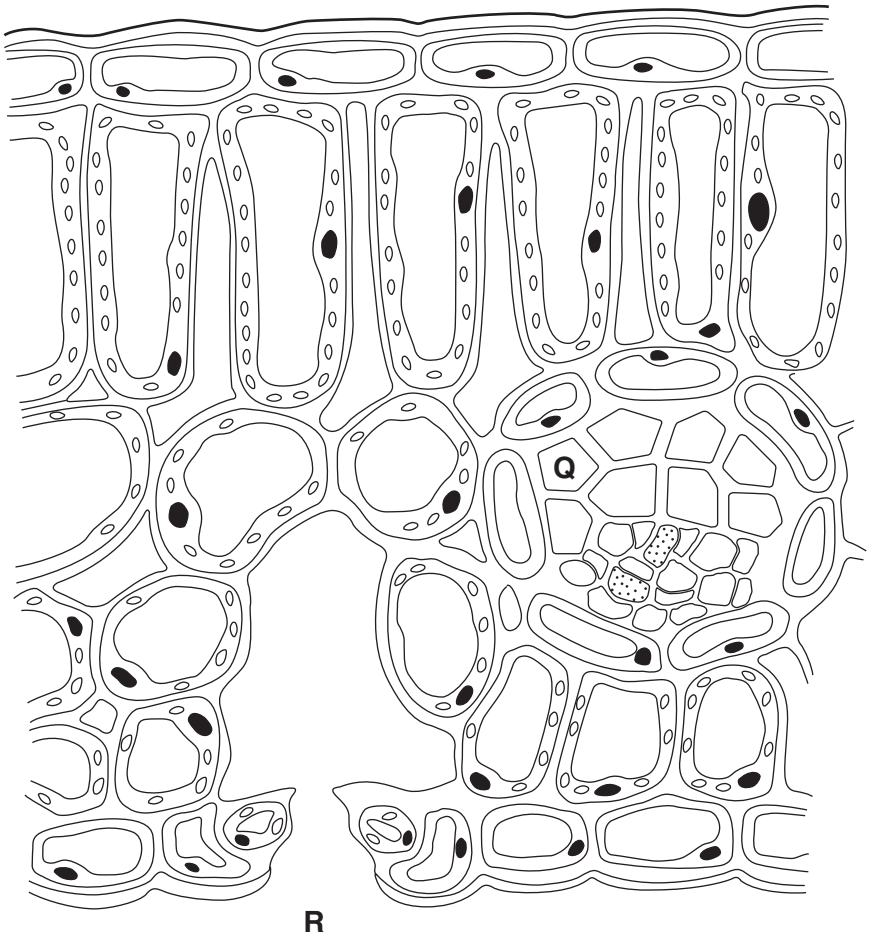


Fig. 5.1

(a) Explain, in terms of **water potential**, how water moves from **Q** to **R**.

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..... [4]

(b) State and explain three ways in which the **structure** of xylem vessels is adapted to transport water.

For Examiner's Use

1. .....

explanation .....

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2. ....

explanation .....

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3. .....

explanation .....

.....[6]

[Total: 10]

6 Fig. 6.1 is an electron micrograph of a cancer cell in the process of dividing by mitosis.

For Examiner's Use

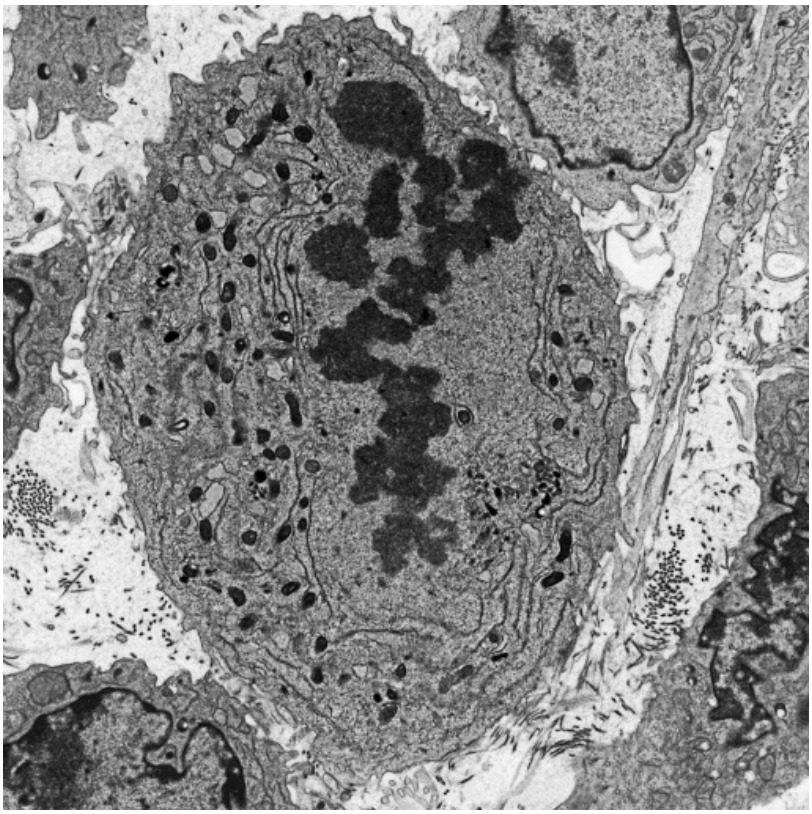


Fig. 6.1

(a) The stage of mitosis visible in Fig. 6.1 is metaphase.

State which features of the cell shown in Fig. 6.1 indicate that it is at metaphase and not at anaphase.

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.....[2]

(b) People who have smoked cigarettes for many years are at risk of developing lung cancer.

For Examiner's Use

Describe how cigarette smoke is responsible for the development of lung cancer.

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.....[4]

(c) Fig. 6.2 shows the change in the percentage of smokers in the male population of the UK between 1950 and 2005.

Fig. 6.3 shows the change in mortality rate in the UK in men aged 75 to 84 between 1950 and 2005.

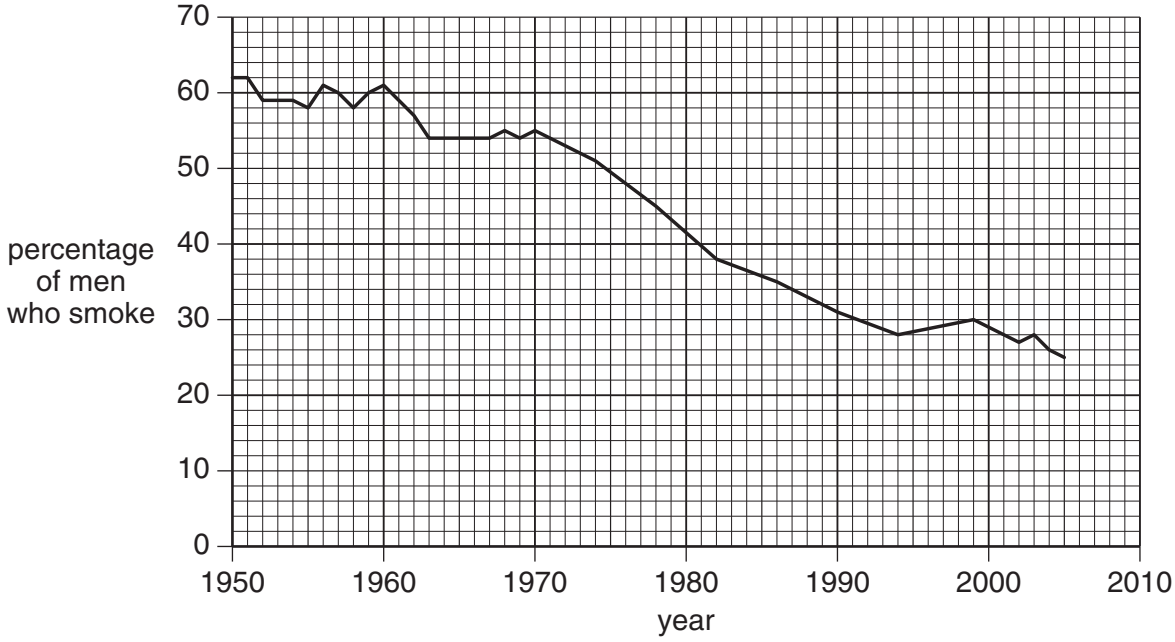


Fig. 6.2

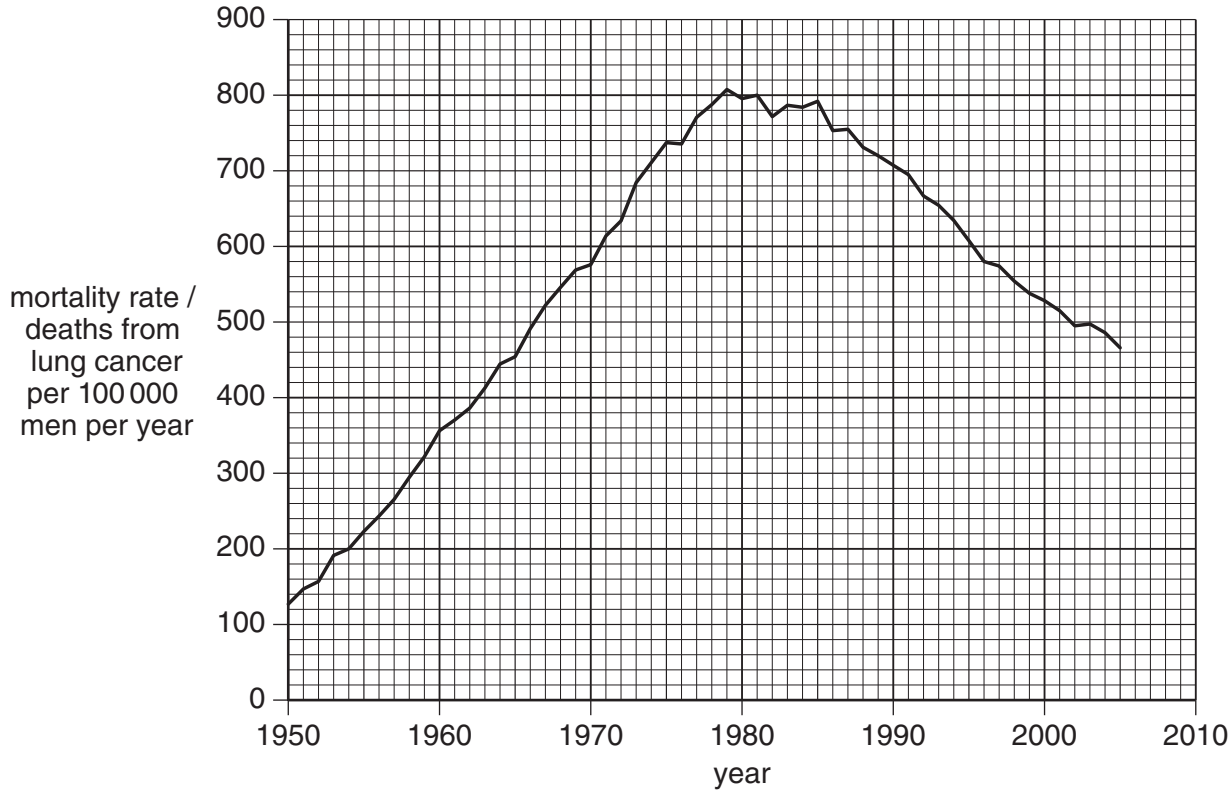


Fig. 6.3

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Fig. 6.2 and Fig. 6.3 appear to show that there is no link between the percentage of the population that smoke and the death rate from lung cancer.

For Examiner's Use

Explain why the mortality rate from lung cancer among men increased and then decreased over the period shown in Fig. 6.3, even though the percentage of smokers decreased over the same period of time.

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.....[3]

[Total: 9]

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Figure 4.1 © Electron Micrograph of Senecio minor vein, from 'Plant Cell Biology on DVD'; 2007 by B E S Gunning; www.plantcellbiologyonDVD.com

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Second Variant Question Paper

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

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

* 6 1 0 3 0 8 8 7 2 7 *

BIOLOGY **9700/22**

Paper 2 Structured Questions AS **May/June 2009**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator
Ruler

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.
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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.

For Examiner's Use	
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Total	

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Answer **all** the questions.

For Examiner's Use

1 Many of the cells in the pancreas produce enzymes. Golgi bodies in the cells produce secretory vesicles full of enzymes which are released at the cell surface by exocytosis.

Fig. 1.1 is a diagram of an enzyme-producing cell from the pancreas. The diagram is **not** complete.

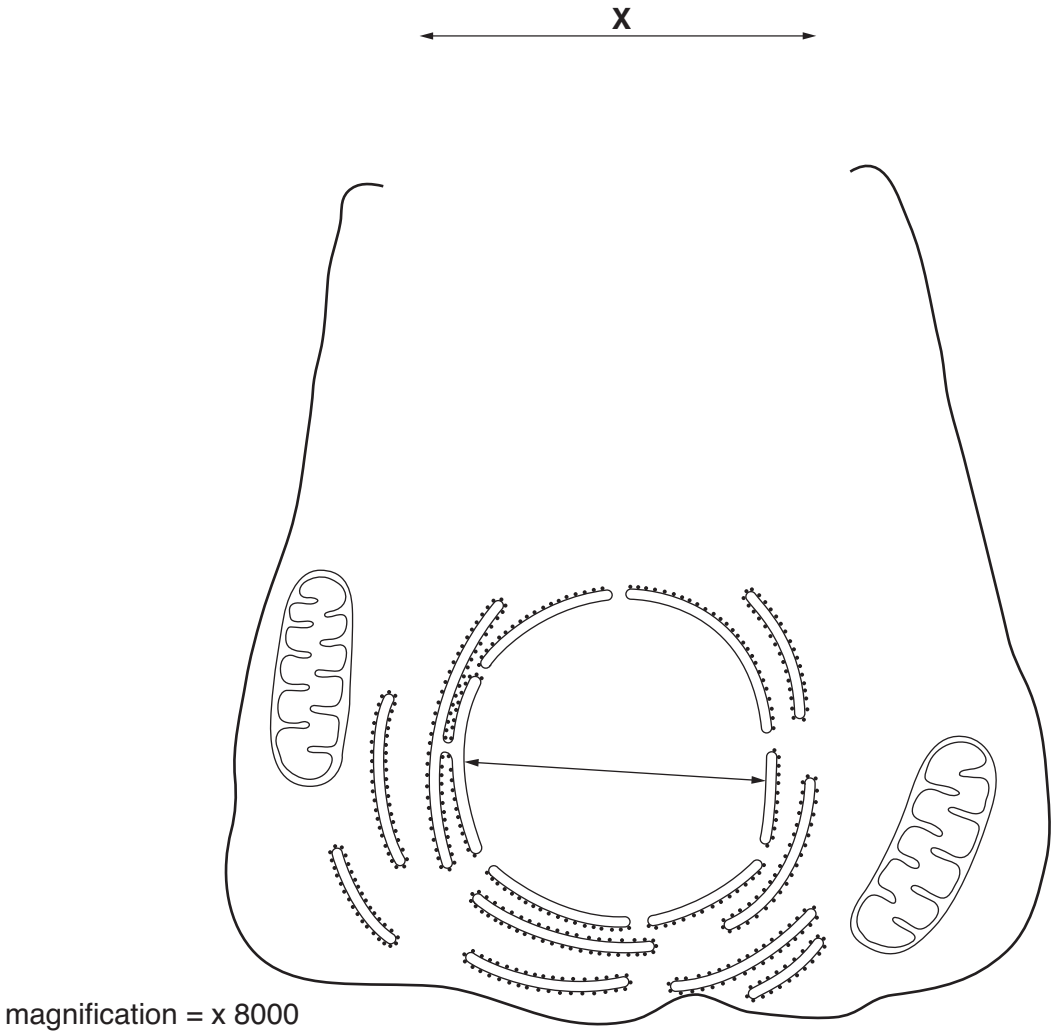


Fig. 1.1

(a) (i) Complete Fig. 1.1 by drawing in the following:

- a Golgi body forming secretory vesicles
- a secretory vesicle releasing its contents by exocytosis in the region labelled **X**

[3]

(ii) Calculate the actual diameter of the nucleus of the pancreatic cell. Show your working and express your answer to the nearest micrometre.

Answer = ...µm [2]

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Fig. 1.2 is a drawing of the bacterium *Vibrio cholerae* the causative agent of cholera.

For Examiner's Use

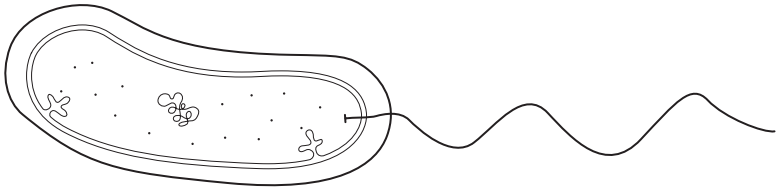


Fig. 1.2

(b) State three structural features of *V. cholerae*, that are **not** found in animal cells.

1. .....

2. .....

3. .....[3]

Table 1.1 shows the numbers of new cases of cholera and the number of deaths from cholera in selected countries in West Africa in 2005. The mortality rate is the number of deaths as a percentage of the number of cases.

Table 1.1

country	total number of cases	number of deaths	mortality rate
Côte d'Ivoire	39	6	15.38
Ghana	3166	51	1.61
Guinea Bissau	25111	399	1.59
Liberia	3823	18	
Nigeria	4477	174	3.89
Senegal	31719	458	1.44

(c) Calculate the mortality rate for cholera in Liberia. Write your answer in the space in the table. [1]

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[Turn over

(d) Cholera tends to emerge as a risk to health following natural disasters. It is said that every death from cholera is a death that could have been prevented.

For Examiner's Use

Explain how it is possible to reduce the number of deaths during a cholera epidemic in countries such as those in West Africa.

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.....[4]

(e) The total number of cases of cholera in the Americas and Europe during 2005 was 34. Explain why cholera is unlikely to be transmitted in developed countries.

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.....[2]

[Total: 15]

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QUESTION 2 STARTS ON PAGE 6

For Examiner's Use

2 **(a)** The table below gives some terms that are used in ecology and their definitions.

Complete the table.

term	definition
ecosystem	all the organisms and the physical factors that influence them in an area, such as a forest
	a place where an organism lives
community	
	role of organism in an ecosystem
	all the organisms of the same species in an ecosystem at the same time

[4]

Fig. 2.1 shows a three-toed sloth, *Bradypus variegatus*, that lives in forest ecosystems in Central America. The sloths, that live in these forests, form part of the community. Sloths feed mainly on the leaves of many different tree species that grow in the under canopy in the forest. These leaves are rich in cellulose, which is digested by bacteria and other microorganisms in their stomachs. The main predators of sloths are jaguars, harpy eagles, snakes and humans.



Fig. 2.1

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(b) With reference to the information above,

For Examiner's Use

(i) state the trophic level occupied by the sloth in the food chain;

.....[1]

(ii) suggest **one** advantage to the sloth of having bacteria and other microorganisms in its stomach;

.....

.....[1]

(iii) suggest why there are few predators, such as jaguars and harpy eagles, in the forest ecosystem even though there are many producers, such as trees.

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.....[3]

[Total: 9]

3 Fig. 3.1 shows a flatworm which lives in ponds, streams and rivers. The dimensions of the flatworm are 12.5 mm long by 3.0 mm wide. Its volume was estimated as 12.6 mm^3. Flatworms do not have a transport system for the respiratory gases, oxygen and carbon dioxide.

For Examiner's Use

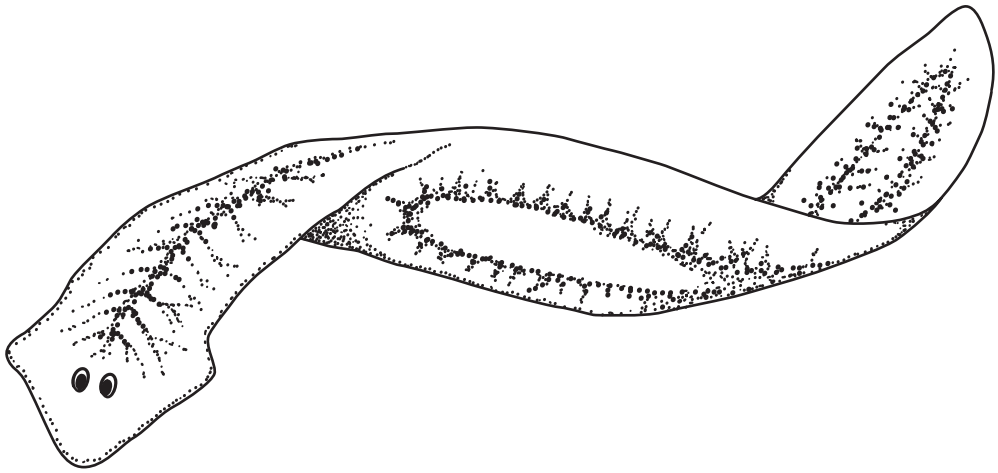


Fig. 3.1

(a) With reference to Fig. 3.1 and the information above, explain how flatworms survive without a transport system for respiratory gases.

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.....[4]

(b) This flatworm lives in freshwater which has a low concentration of sodium ions. The flatworm's body fluids have a higher concentration of sodium ions than the surrounding water.

For Examiner's Use

(i) Suggest how the flatworm retains sodium ions in its body fluids.

.....

.....

.....

.....[2]

(ii) State **one** role of sodium ions in organisms.

.....

.....[1]

[Total: 7]

4 Catalase is an enzyme with a molecular structure composed of four identical sub-units.

For Examiner's Use

Fig. 4.1 is a diagram that shows how catalase is produced in cells.

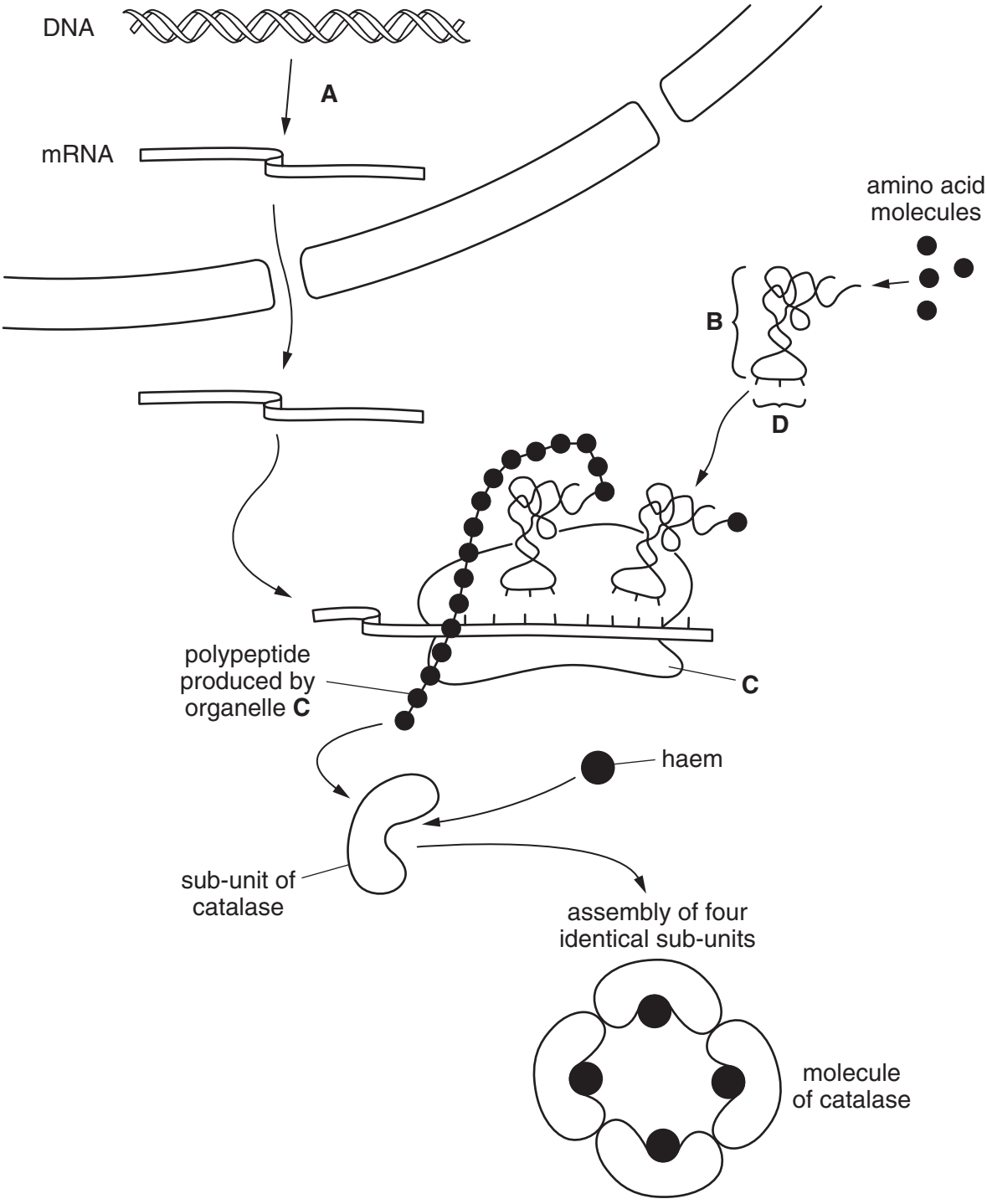


Fig. 4.1

For Examiner's Use

(a) With reference to Fig. 4.1,

(i) name

process **A** .....

molecule **B** .....

structure **C** .....

sequence of bases **D** .....[4]

(ii) state two ways in which the structure of catalase is similar to the structure of haemoglobin and one way in which it differs

structural similarities

1. .....

2. .....[2]

structural difference

.....[1]

(iii) State why it is possible for a catalase molecule to bind to four substrate molecules at the same time.

.....[1]

(b) The enzyme amylase catalyses the following reaction:

starch + water $\rightarrow$ maltose

The progress of this reaction may be followed by measuring either the starch concentration or the maltose concentration at intervals of time.

State which chemicals you would use to detect the disappearance of the substrate and the appearance of the product, in order to follow the progress of the reaction.

disappearance of substrate .....

.....

appearance of product .....

.....[2]

[Total: 10]

5 Fig. 5.1 shows a vascular bundle from the stem of *Peperomia dahlstedtii*, a plant from Brazil. The vascular bundles in the stems of *P. dahlstedtii* are unusual because they are surrounded by an endodermis with a Casparian strip.

For Examiner's Use

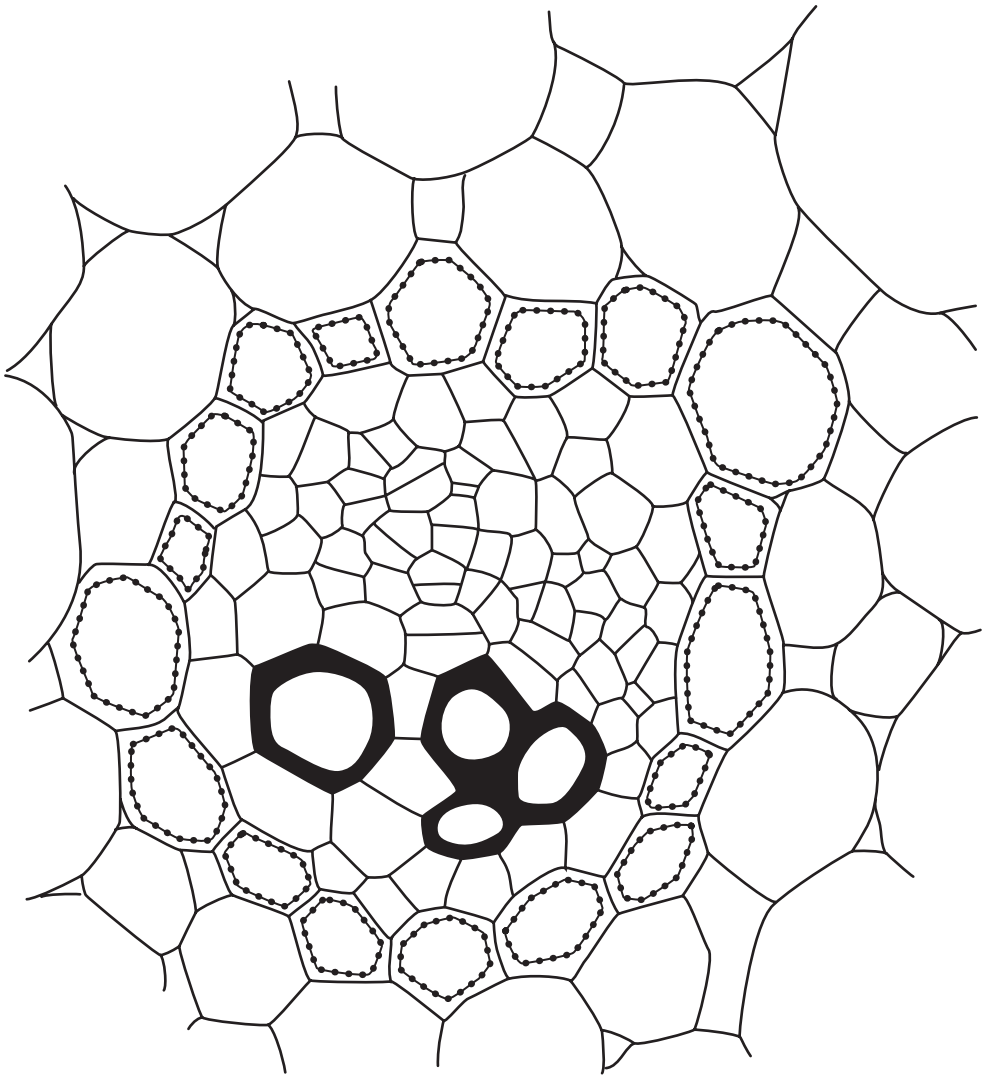


Fig. 5.1

(a) Use label lines and the letters **P**, **Q** and **R** to identify the following in the vascular bundle.

P an endodermal cell with a Casparian strip

Q a cell wall strengthened with lignin

R a tissue that transports assimilates [3]

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(b) Vascular tissue in roots is surrounded by an endodermis.

Describe the function of the endodermis in roots.

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.....[3]

(c) State and explain two ways in which the **structure** of a phloem sieve tube is adapted for the transport of assimilates.

1. .....

explanation .....

.....

2. .....

explanation .....

.....[4]

[Total: 10]

For Examiner's Use

6 Fig. 6.1 is an electron micrograph of a cancer cell in the process of dividing by mitosis.

For Examiner's Use

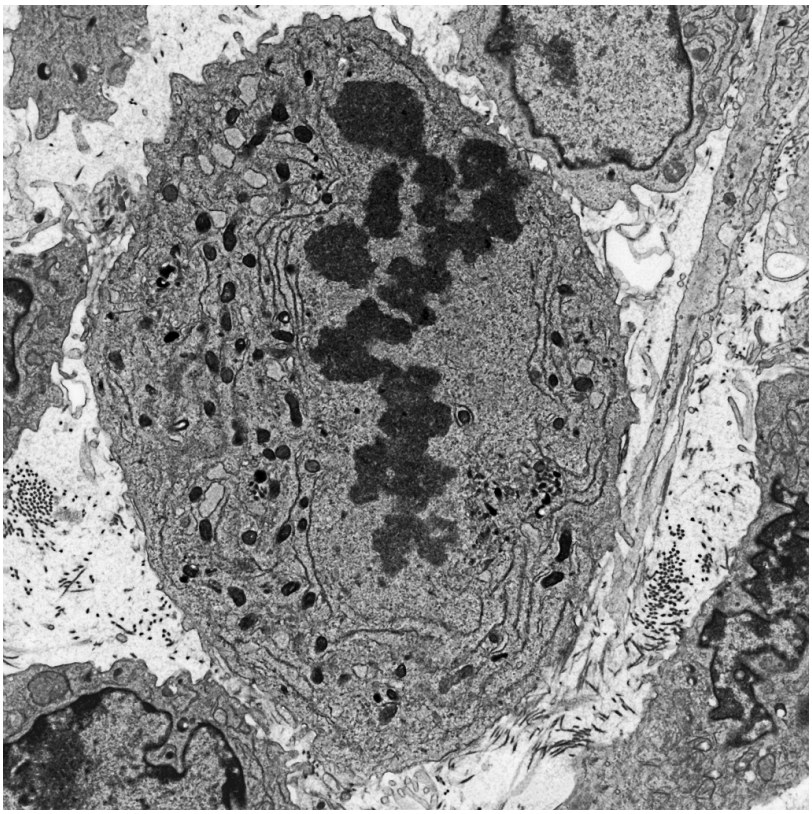


Fig. 6.1

(a) The stage of mitosis visible in Fig. 6.1 is metaphase.

State which features of the cell shown in Fig. 6.1 indicate that it is at metaphase and not at anaphase.

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..... [2]

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(b) People who have smoked cigarettes for many years are at risk of developing lung cancer.

For Examiner's Use

Describe how cigarette smoke is responsible for the development of lung cancer.

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.....[4]

(c) Fig. 6.2 shows the change in the percentage of smokers in the male population of the UK between 1950 and 2005.

For Examiner's Use

Fig. 6.3 shows the change in mortality rate in the UK in men aged 75 to 84 between 1950 and 2005.

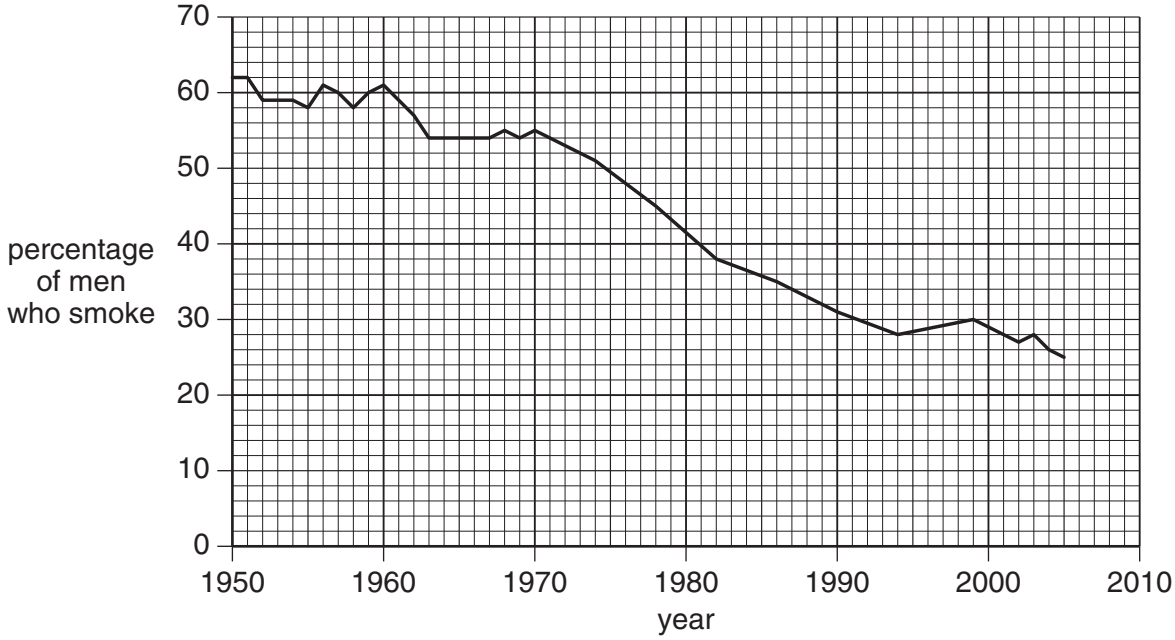


Fig. 6.2

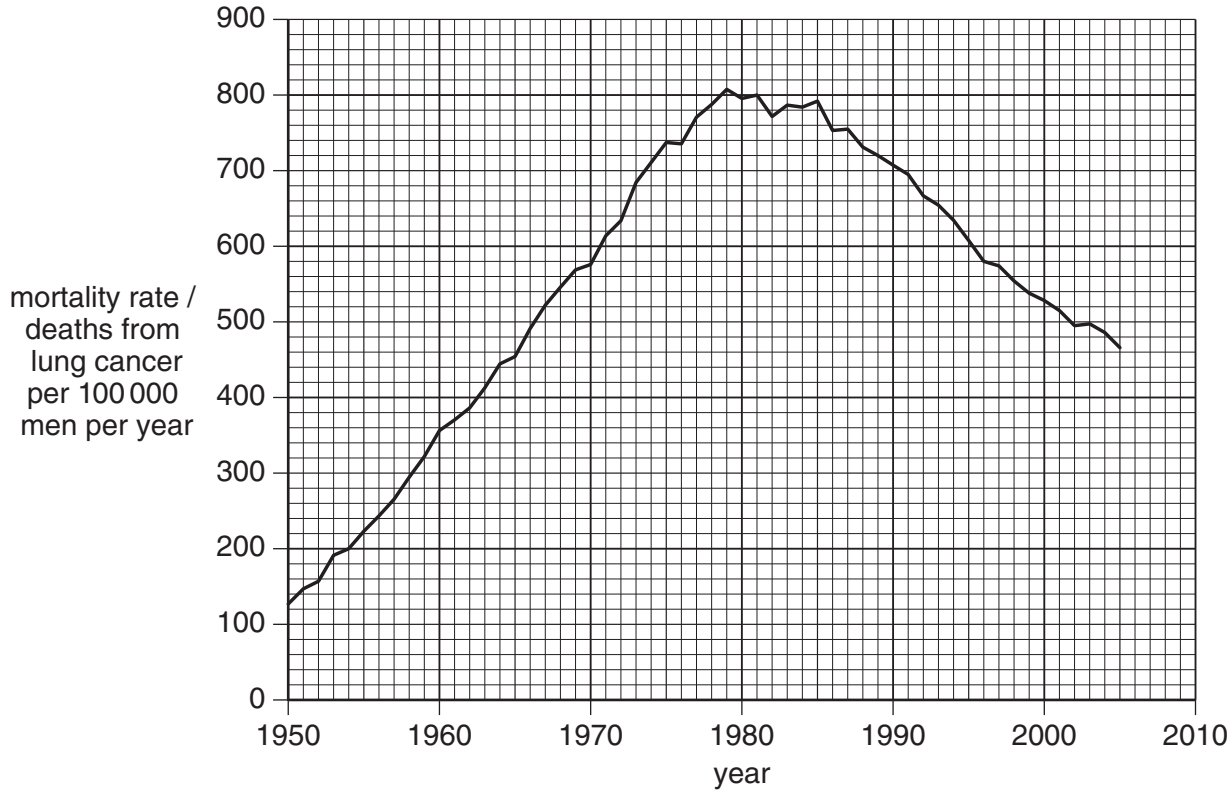


Fig. 6.3

Fig. 6.2 and Fig. 6.3 appear to show that there is no link between the percentage of the population that smoke and the death rate from lung cancer.

For Examiner's Use

Explain why the mortality rate from lung cancer among men increased and then decreased over the period shown in Fig. 6.3, even though the percentage of smokers decreased over the same period of time.

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.....[3]

[Total: 9]

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