Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

1180038132

BIOLOGY **0610/43**

Paper 4 Theory (Extended) **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.

This syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

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

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Cambridge Assessment International Education

[Turn over

1 Bacteria are classified in the Prokaryote kingdom.

(a) State **two** features of animal cells that are **not** found in bacteria.

1 .....

2 .....
[2]

(b) The bacterium *Bacillus megaterium* was grown in the laboratory fermenter shown in Fig. 1.1.

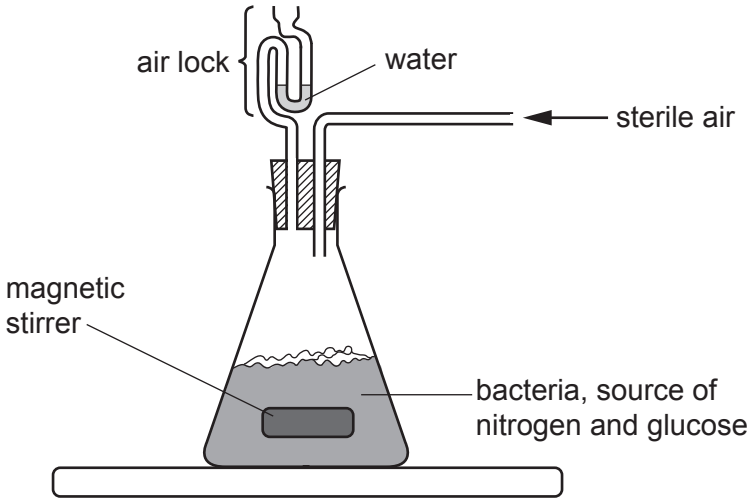

Fig. 1.1

(i) Explain why a source of nitrogen and glucose were added to the fermenter.

nitrogen .....

.....

glucose .....

.....
[2]

(ii) Suggest why it is important to stir the contents of the fermenter continuously.

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..... [3]

(c) Samples were taken from the fermenter at frequent intervals and the number of live bacteria was determined. The results are shown in Fig. 1.2.

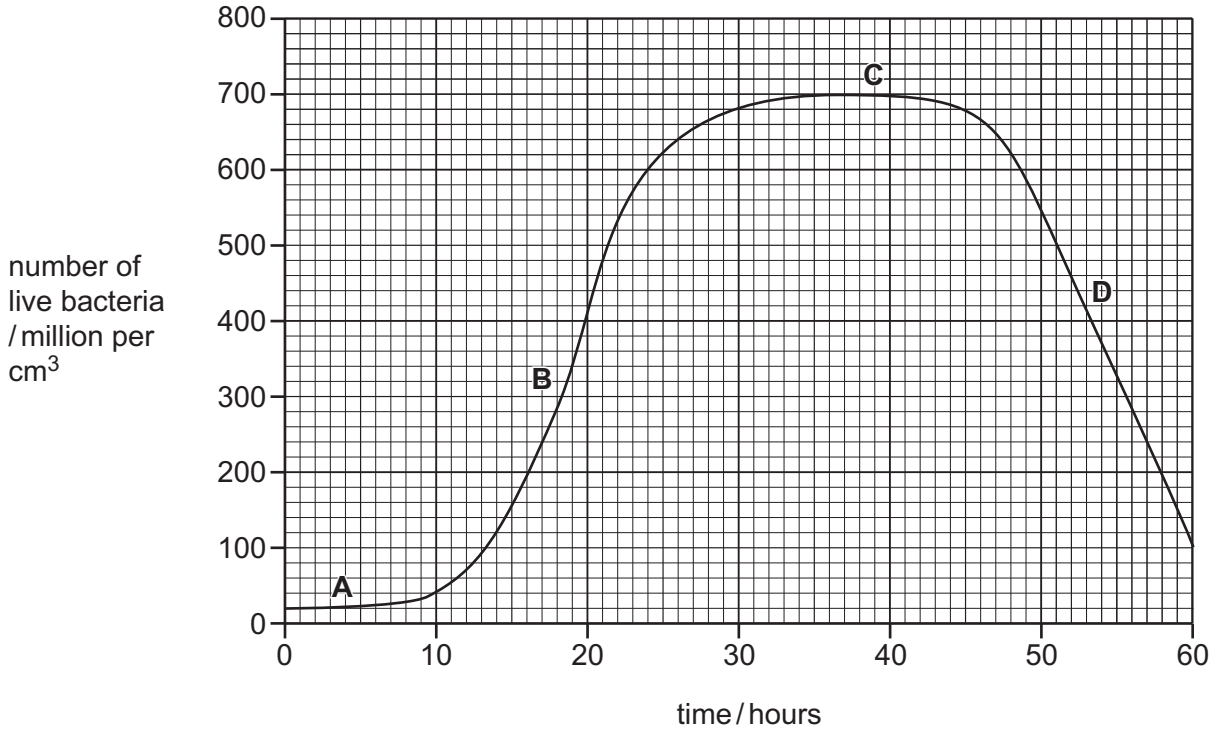

Fig. 1.2

Describe **and** explain what happens to the number of live bacteria shown in the stages labelled **A**, **B**, **C** and **D** in Fig. 1.2.

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..... [6]

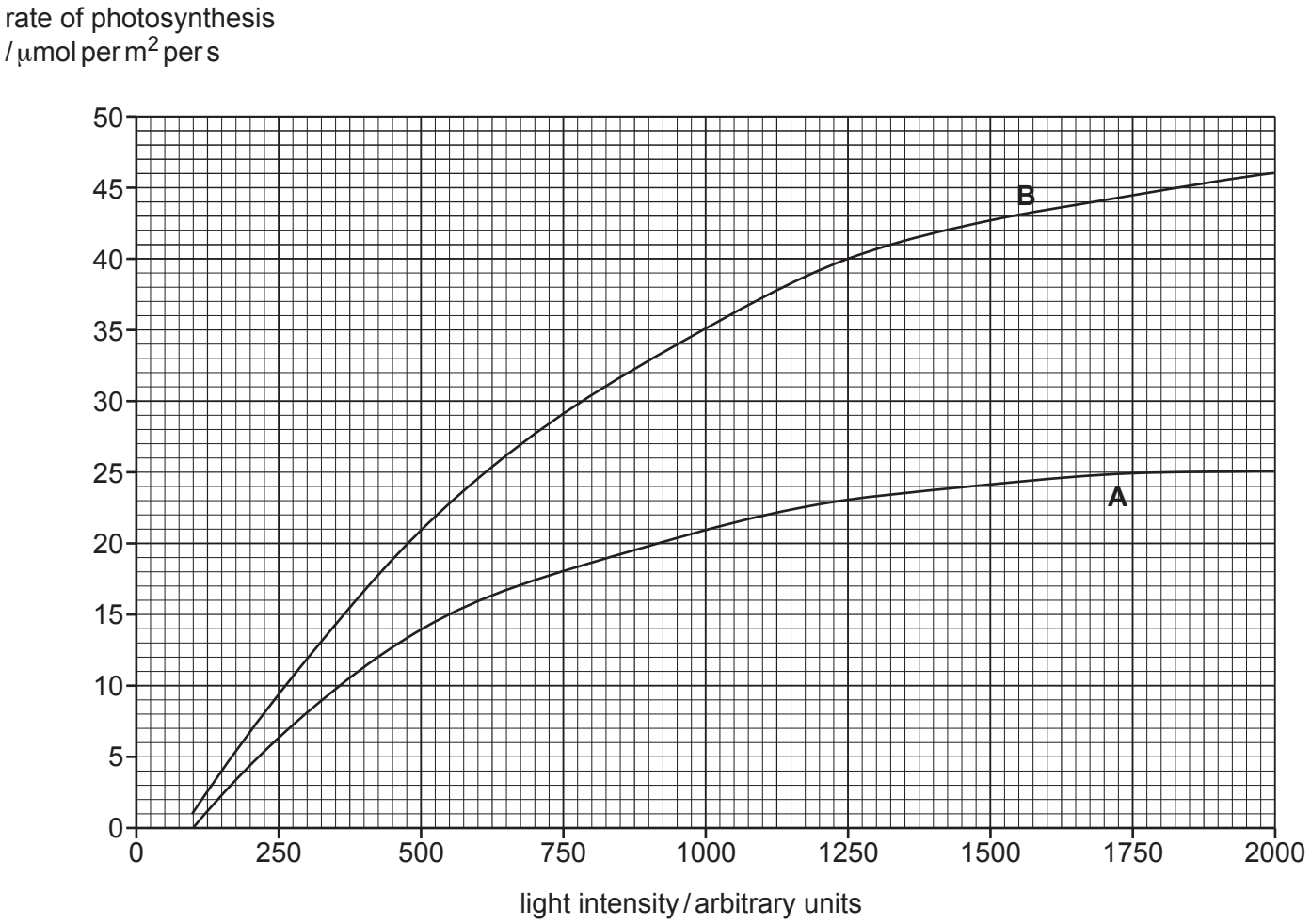
[Total: 13]

2 **(a)** State the **word** equation for photosynthesis.

..... [2]

(b) Scientists investigated the effect of light intensity on the rate of photosynthesis in the leaves of eucalyptus trees at two different concentrations of carbon dioxide, **A** and **B**.

The results are shown in Fig. 2.1.



Key:

A carbon dioxide concentration 140 ppm

B carbon dioxide concentration 1000 ppm

Fig. 2.1

(i) Suggest **and** explain why the scientists kept the temperature of the leaves at 20 °C while they recorded results.

.....

.....

.....

.....

..... [2]

(ii) Calculate the percentage increase in the rate of photosynthesis at a light intensity of 1250 arbitrary units when the carbon dioxide concentration was increased from 140 ppm to 1000 ppm.

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

..... %
[3]

(iii) Describe the effect of increasing light intensity on the rate of photosynthesis when the concentration of carbon dioxide was 140 ppm.

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..... [3]

(iv) Explain the effect of increasing light intensity on the rate of photosynthesis when the concentration of carbon dioxide was 1000 ppm.

Use the term *limiting factor* in your answer.

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..... [4]

[Total: 14]

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3 Cotton, *Gossypium hirsutum*, is grown for the fibres that form within the fruits after fertilisation, as shown in Fig. 3.1.

Fibres from the fruits of cotton plants are used in the textile industry.

Fig. 3.1

Cotton plants have been genetically engineered to produce a protein that is toxic to the caterpillars of several insect pests. This gives the cotton plants resistance to the pests.

The *cry* gene for pest resistance was isolated from the bacterium *Bacillus thuringiensis* and inserted into the cells of cotton plants as shown in Fig. 3.2.

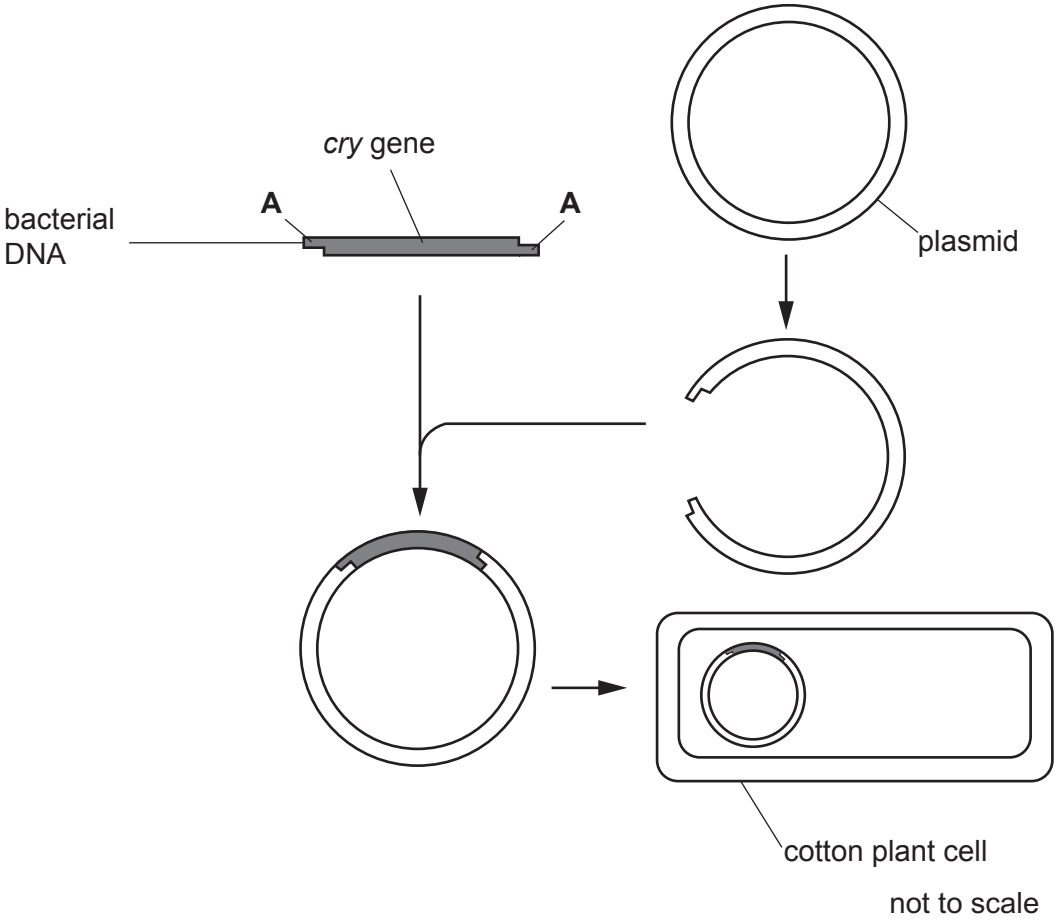

Fig. 3.2

(a) An enzyme cuts the *cry* gene from the DNA of *B. thuringiensis*.

(i) State the name of the enzyme that cuts DNA.

..... [1]

(ii) State the name of the regions labelled **A** on Fig. 3.2.

..... [1]

(iii) Explain how the DNA is inserted into the plasmid.

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..... [3]

(b) The plasmids containing the *cry* gene are inserted into the cells of cotton plants.

Outline how the cells of cotton plants use the *cry* gene to make the toxic protein.

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..... [4]

(c) Outline the advantages to farmers of growing genetically engineered cotton plants that contain the toxic protein.

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..... [3]

[Total: 12]

4 Mammals have a double circulation.

(a) State what is meant by the term *double circulation*.

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..... [1]

(b) Table 4.1 shows some information about the functions of the components of blood.

Complete Table 4.1.

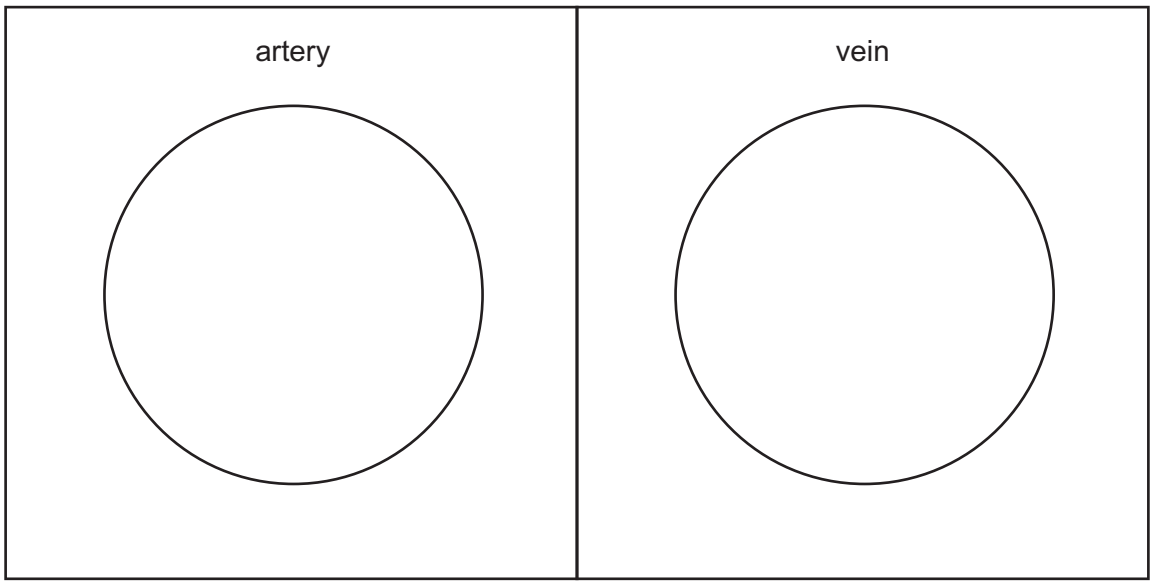
Table 4.1

function	type of cell
production of antibodies	
	phagocyte
promotes blood clotting	
transports oxygen	

[4]

(c) Blood is transported in arteries and veins.

Complete the drawings of the cross-sections of an artery and a vein to show the differences between these two types of blood vessel. Label the lumen in each drawing.



[2]

(d) A diagram of a mammalian heart and associated blood vessels is shown in Fig. 4.1.

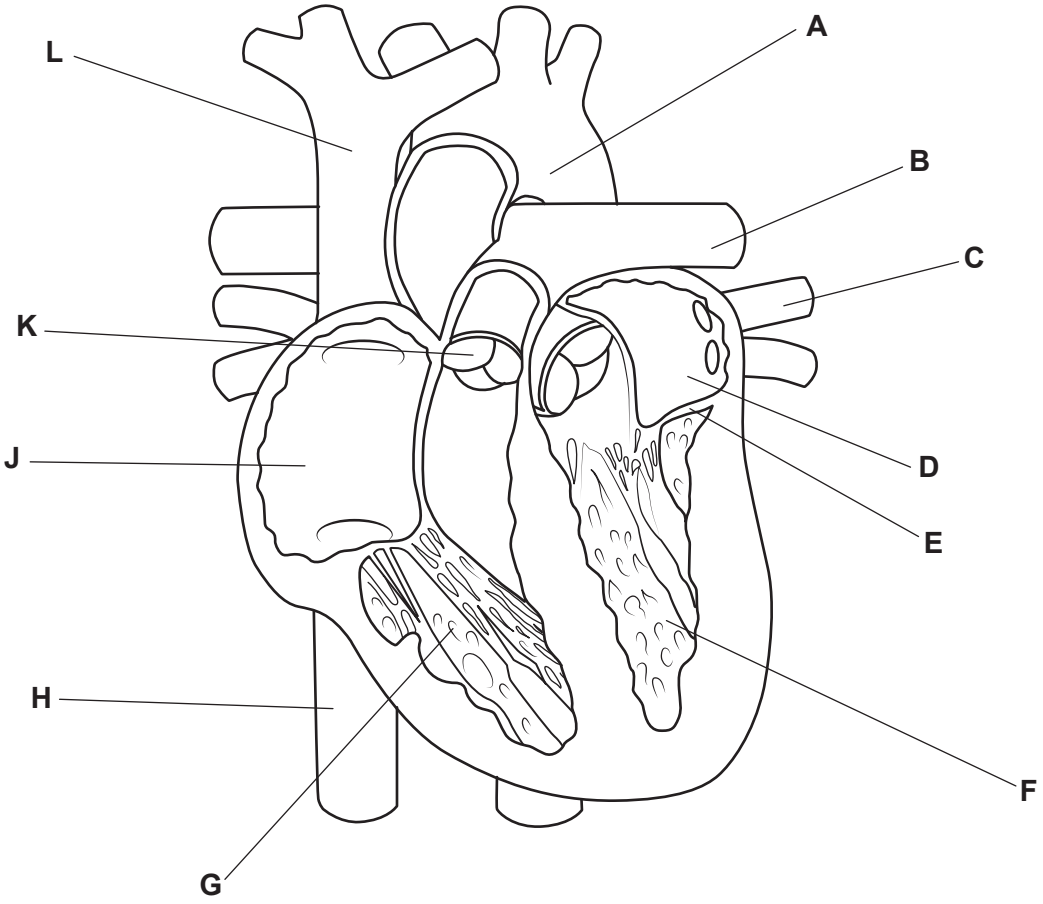


Fig. 4.1

(i) Sketch arrows on Fig. 4.1 to show the pathway taken by deoxygenated blood from the heart towards the lungs. [2]

(ii) Table 4.2 contains statements about the structures visible in Fig. 4.1.

Complete Table 4.2 by:

- stating the name of each structure
- identifying the structure with the corresponding letter from Fig. 4.1.

Table 4.2

statement	name of structure	letter from Fig. 4.1
chamber that creates the highest blood pressure		
blood vessel containing blood with the highest concentration of oxygen		
structure that prevents blood going from ventricle to atrium		
structure that prevents backflow of blood from artery to ventricle		
chamber that receives blood from vena cava		

[5]

(e) Mammals also have a lymphatic system.

Outline the functions of the lymphatic system.

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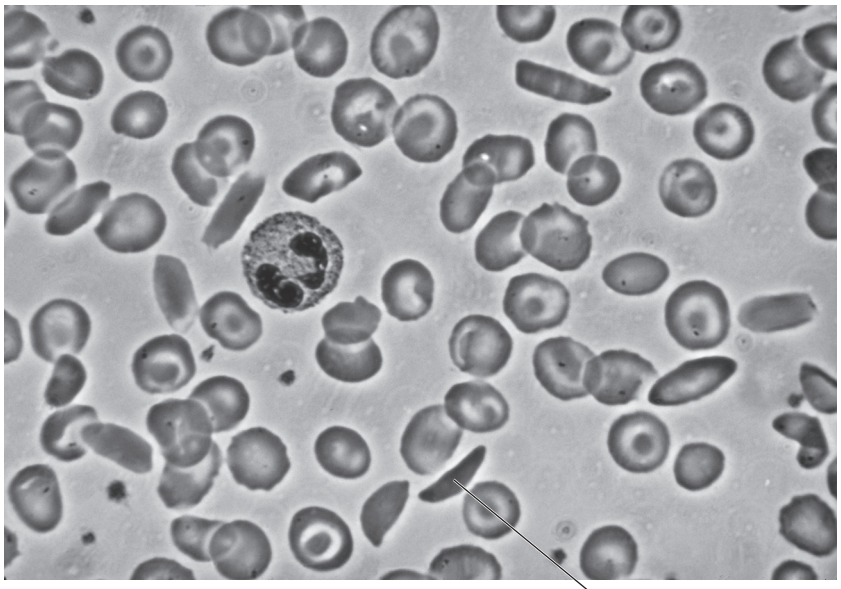
..... [3]

[Total: 17]

5 Sickle-cell anaemia is an inherited disease.

Fig. 5.1 is a photomicrograph of some blood cells from a person who has sickle-cell anaemia.



a sickle-shaped red blood cell

Fig. 5.1

(a) Explain how red blood cells become sickle-shaped.

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..... [3]

(b) Some people who have sickle-cell anaemia have parents who do not have sickle-cell anaemia.

Explain how people with sickle-cell anaemia inherit the disease.

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..... [4]

(c) Sickle-cell anaemia is most common in areas of the world where the infectious disease malaria is found.

Some species of the genus *Plasmodium* cause malaria in humans.

(i) Define the term *species*.

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..... [2]

(ii) The distribution of sickle-cell anaemia is the result of natural selection.

Explain the distribution of the sickle-cell allele in human populations.

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..... [5]

[Total: 14]

6 Fig. 6.1 is a photomicrograph of part of a cell from the pancreas that produces enzymes that are released into the small intestine.

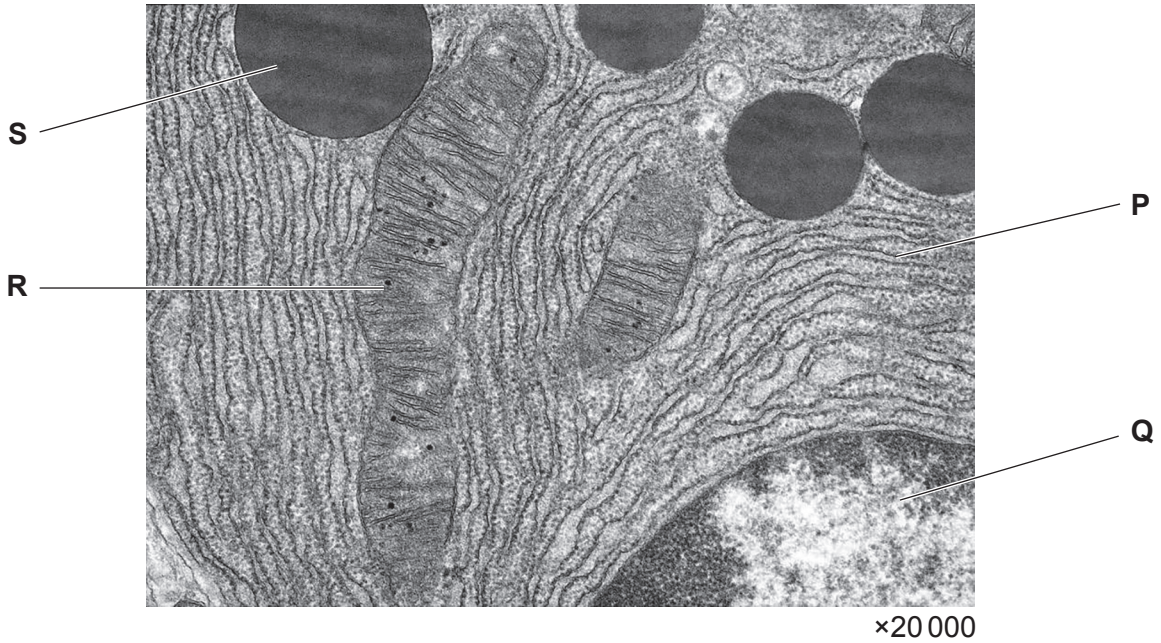

Fig. 6.1

(a) **(i)** Structure **Q** is part of the nucleus of the cell.

State **one** function of a nucleus.

.....

.....

..... [1]

(ii) State the names of the structures labelled **P** and **R** in Fig. 6.1.

P .....

R .....
[2]

(b) The structure labelled **S** transports enzymes to the cell membrane for release into the pancreatic duct. These structures contain molecules of amylase, trypsin and lipase.

Complete the sentences with the most appropriate words.

Enzymes are made of protein and act as ..... because they increase the rate of chemical reactions, but are not changed in those reactions. Amylase speeds up the digestion of ..... to ..... Trypsin continues the chemical digestion of protein begun by the enzyme ..... in the stomach.

The optimum pH for pancreatic enzymes is greater than pH 7. Bile is produced by the ..... and enters the small intestine, where it ..... stomach acid to provide the appropriate pH. Bile also breaks down fat by ..... to increase the surface area for the action of lipase.

[7]

[Total: 10]

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