Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

5913274259

BIOLOGY **0610/41**

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 **18** printed pages and **2** blank pages.

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[Turn over

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1 All commercial breeds of sheep belong to the species *Ovis aries*.

(a) Define the term *species*.

.....

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.....

.....

..... [2]

The Merino is a breed of sheep that is farmed mainly for its wool. The wool is very thick and is made of lots of very thin hairs.

Fig. 1.1 shows a female Merino sheep with her newborn lamb.

Fig. 1.1

(b) The presence of hair is a feature that is only found in mammals.

State **two other** features that distinguish mammals from all other vertebrates.

1 .....

2 .....
[2]

(c) Merino sheep in South Africa have high quality wool with very thin hairs.

Breeders in New Zealand have used selective breeding programmes to improve the wool of their sheep to match the quality of South African wool.

Describe the steps that breeders would take to breed sheep that have wool with very thin hairs.

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..... [5]

(d) Explain how natural selection differs from selective breeding.

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..... [3]

[Total: 12]

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2 The rate of photosynthesis of terrestrial plants can be determined by measuring the uptake of carbon dioxide.

(a) Explain why plants take up carbon dioxide during photosynthesis.

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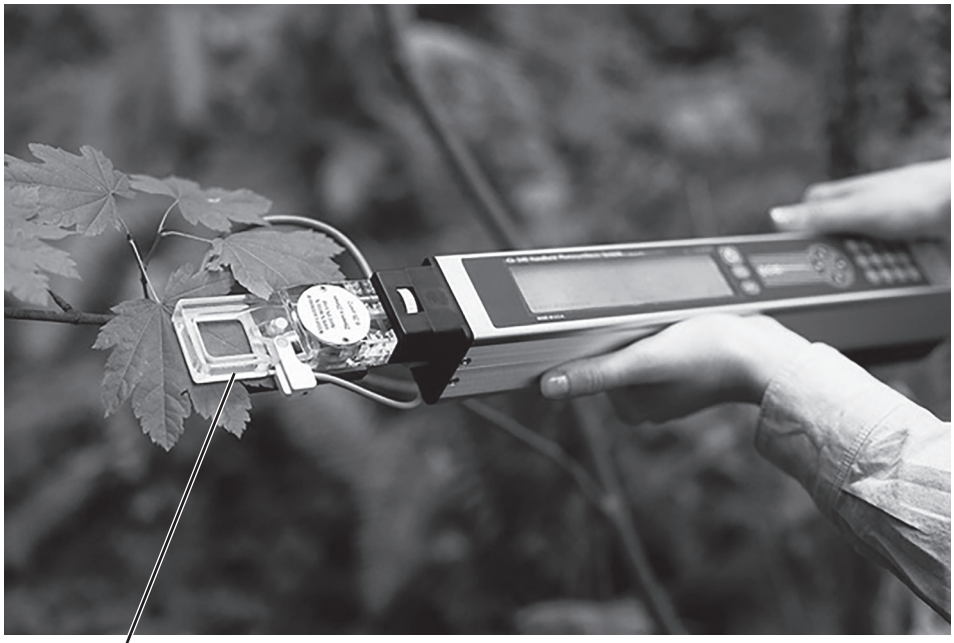
..... [2]

(b) The rate of photosynthesis of parts of individual leaves can be measured using a hand-held device as shown in Fig. 2.1.



transparent chamber

Fig. 2.1

This apparatus allows air to flow through the transparent chamber that encloses part of the leaf. The apparatus measures the carbon dioxide concentration of the air entering and leaving the chamber.

Explain how the results from the apparatus can be used to calculate the rate of photosynthesis.

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..... [2]

(c) A student used the apparatus shown in Fig. 2.1 to investigate the effect of temperature on the rate of photosynthesis of the leaves of Chinese plantain, *Plantago asiatica*, at two different concentrations of carbon dioxide, **A** and **B**.

Fig. 2.2 shows the results of the investigation.

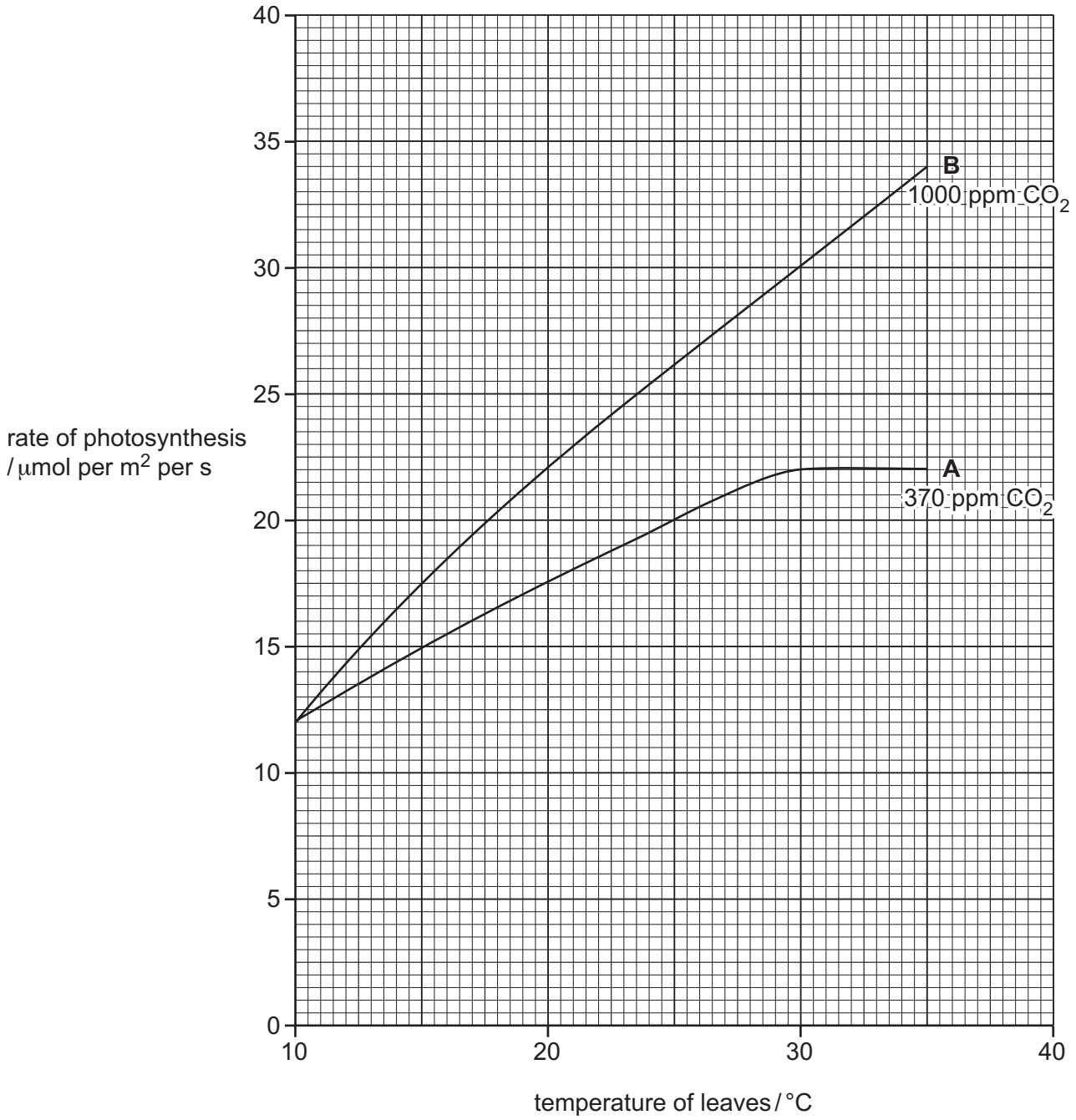

Fig. 2.2

(i) State **one** environmental factor that should have been kept constant in this investigation.

..... [1]

(ii) Describe the effect of temperature on the rate of photosynthesis when carbon dioxide concentration **A** was supplied.

Use the data from Fig. 2.2 in your answer.

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..... [3]

(iii) Calculate the percentage increase in the rate of photosynthesis at 30 °C when the carbon dioxide concentration was increased from **A** to **B** as shown in Fig. 2.2.

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

..... %
[2]

(iv) Explain the effect of increasing temperature on the rate of photosynthesis for carbon dioxide concentration **B**.

Use the term *limiting factor* in your answer.

.....

.....

.....

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..... [3]

(v) The student concluded that carbon dioxide concentration is the factor limiting the rate of photosynthesis between 30 °C and 35 °C for the results shown for **A** in Fig. 2.2.

State the evidence for this conclusion.

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.....

..... [1]

(d) A similar investigation was carried out on Arizona honeysweet, *Tidestromia oblongifolia*, that grows in Death Valley in California where the highest temperatures may be greater than 45 °C.

The results are shown in Fig. 2.3.

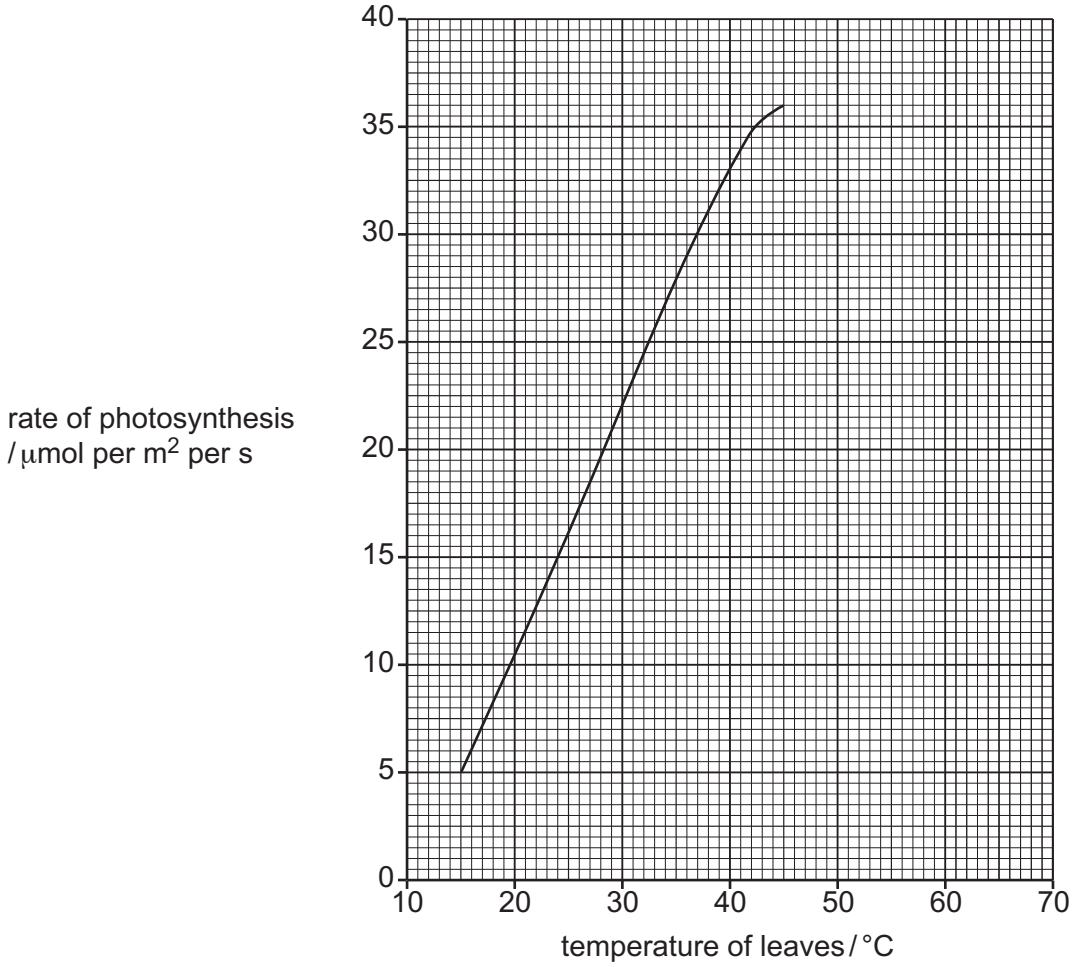

Fig. 2.3

Predict **and** explain what would happen to the rate of photosynthesis if the investigation is continued at temperatures higher than 45 °C.

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..... [2]

[Total: 16]

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3 **(a)** Complete the five sentences about the eye and the nervous system.

Structures in the eye change the shape of the lens so that the eye can focus on near and distant objects. This is called ..... .

The radial and circular muscles in the iris of the eye are a pair of ..... muscles that work against each other.

Muscles in the eye are controlled by the nervous system. The ..... nervous system contains only sensory and motor neurones.

The ..... nerve from the eye contains sensory neurones that conduct impulses to the ..... .

[5]

(b) Transmission of impulses relies on the flow of ions through the cell membranes of neurones down their concentration gradients. Active transport is responsible for maintaining the concentration gradients of ions across the membranes of neurones.

Explain how ions are moved across membranes by active transport.

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..... [3]

(c) Fig. 3.1 shows the junction between two neurones.

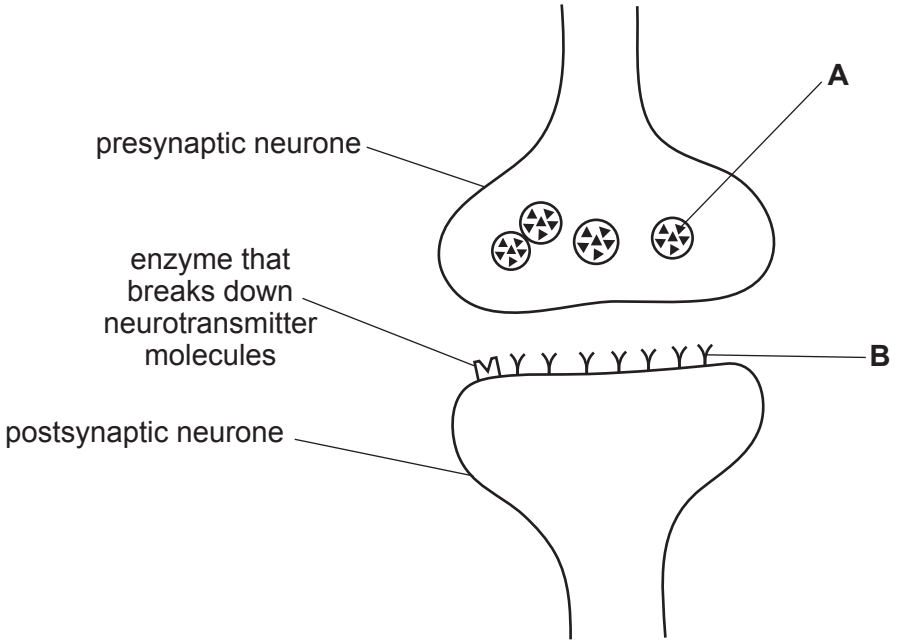

Fig. 3.1

Many drugs interfere with the action of neurotransmitters at the junctions between neurones.

Two drugs that influence the transmission of impulses between neurones are atropine and eserine. The actions of these drugs are shown in Table 3.1.

Table 3.1

drug	action at junctions between neurones
atropine	blocks receptor molecules for neurotransmitters
eserine	blocks the enzyme that breaks down neurotransmitters

Explain the effects of these two drugs on the nervous system using the information in Fig. 3.1 and Table 3.1.

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..... [6]

(d) A scientific paper was published in 1997 that described the effects of anabolic steroids on female athletes. Many of these athletes achieved great success in international sport competitions during the 1960s and 1970s.

Discuss the arguments against the use of anabolic steroids in sport.

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..... [3]

[Total: 17]

4 **(a)** Table 4.1 shows four structures associated with the human male reproductive system.

Complete Table 4.1 by identifying the level of organisation of each structure.

Choose your answers from the list.

cell **cell structure** **organ**

organ system **organism** **tissue**

Table 4.1

structure	level of organisation
epithelium	
nucleus	
sperm	
testis	

[4]

(b) Fig. 4.1 shows the male reproductive system.

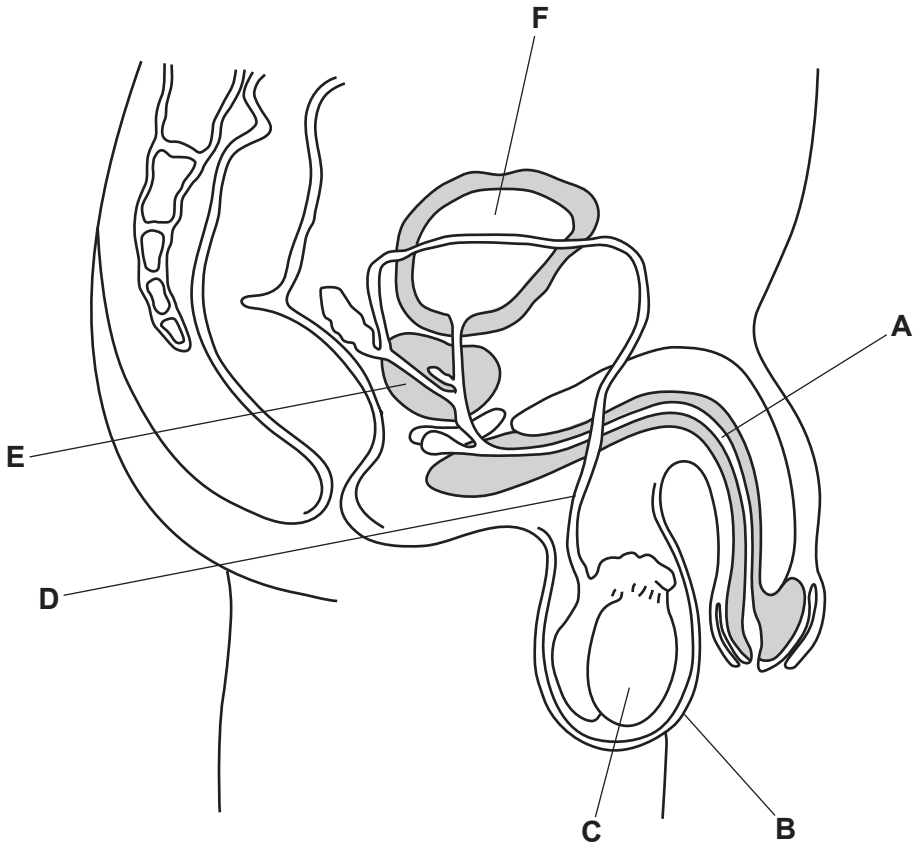

Fig. 4.1

Table 4.2 shows information about the male reproductive system shown in Fig. 4.1.

Complete Table 4.2.

Table 4.2

name of structure	function	letter in Fig. 4.1
testis		
	transports sperm but not urine	
	tube for urine and seminal fluid through the penis	
prostate gland		
	contains the testes	

[5]

(c) Draw an **X** on Fig. 4.1 on the structure where meiosis occurs. [1]

(d) Sperm and eggs each have a nucleus which is haploid.

(i) Define the term *haploid nucleus*.

.....

.....

..... [1]

(ii) State the number of chromosomes in a human haploid nucleus.

..... [1]

[Total: 12]

5 **(a)** Tissue plasminogen activators (TPAs) are human proteins that are used as drugs to break down blood clots.

TPAs break down blood clots by activating plasminogen. Plasminogen is a protein that is always present in the blood.

When activated, plasminogen forms a protease that breaks down fibrin molecules.

(i) Plasminogen is found in the plasma.

State what is meant by the term *plasma*.

..... [1]

(ii) State the products of the action of protease on the protein fibrin.

..... [1]

TPAs can be produced by genetically-engineered bacteria.

Fig. 5.1 shows some of the stages involved in genetically engineering a bacterium to make a TPA.

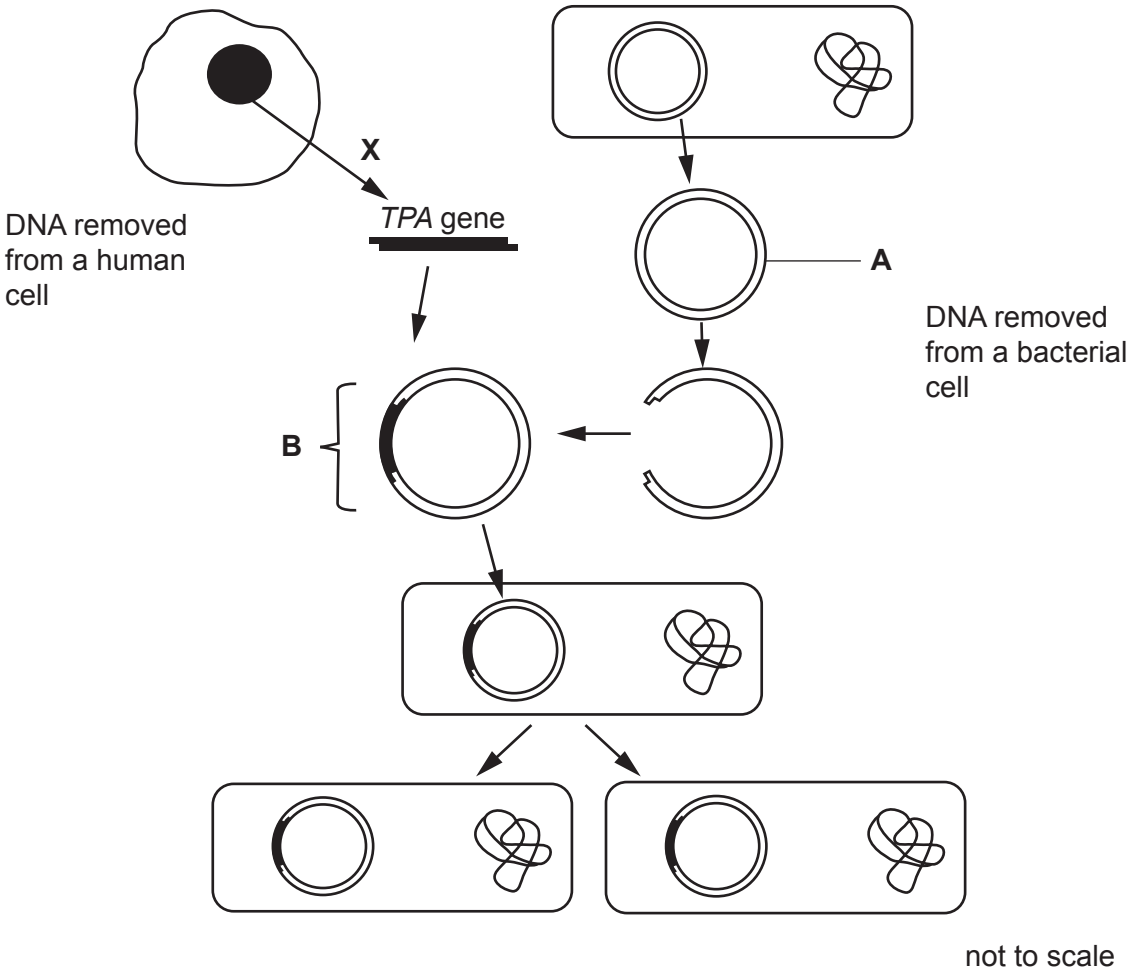

Fig. 5.1

(b) **(i)** State the name of structure **A** in Fig. 5.1.

..... [1]

(ii) In the flow chart, **X** represents the action of an enzyme on a molecule of DNA.

State the name of this enzyme.

..... [1]

(iii) The *TPA* gene is inserted into structure **A**.

Explain how the gene is inserted into structure **A** to form structure **B** as shown in Fig. 5.1.

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..... [3]

(iv) Before TPA was made by genetically-engineered bacteria it was only available from blood donated by people.

Suggest **one** advantage of producing TPA by genetically-engineered bacteria.

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..... [1]

(v) The genetically-engineered bacteria produce mRNA that is a copy of the human *TPA* gene.

Explain the role of mRNA in the bacterium.

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..... [2]

[Total: 10]

6 Fig. 6.1 shows some cells from the shoot tip of an onion, *Allium cepa*.

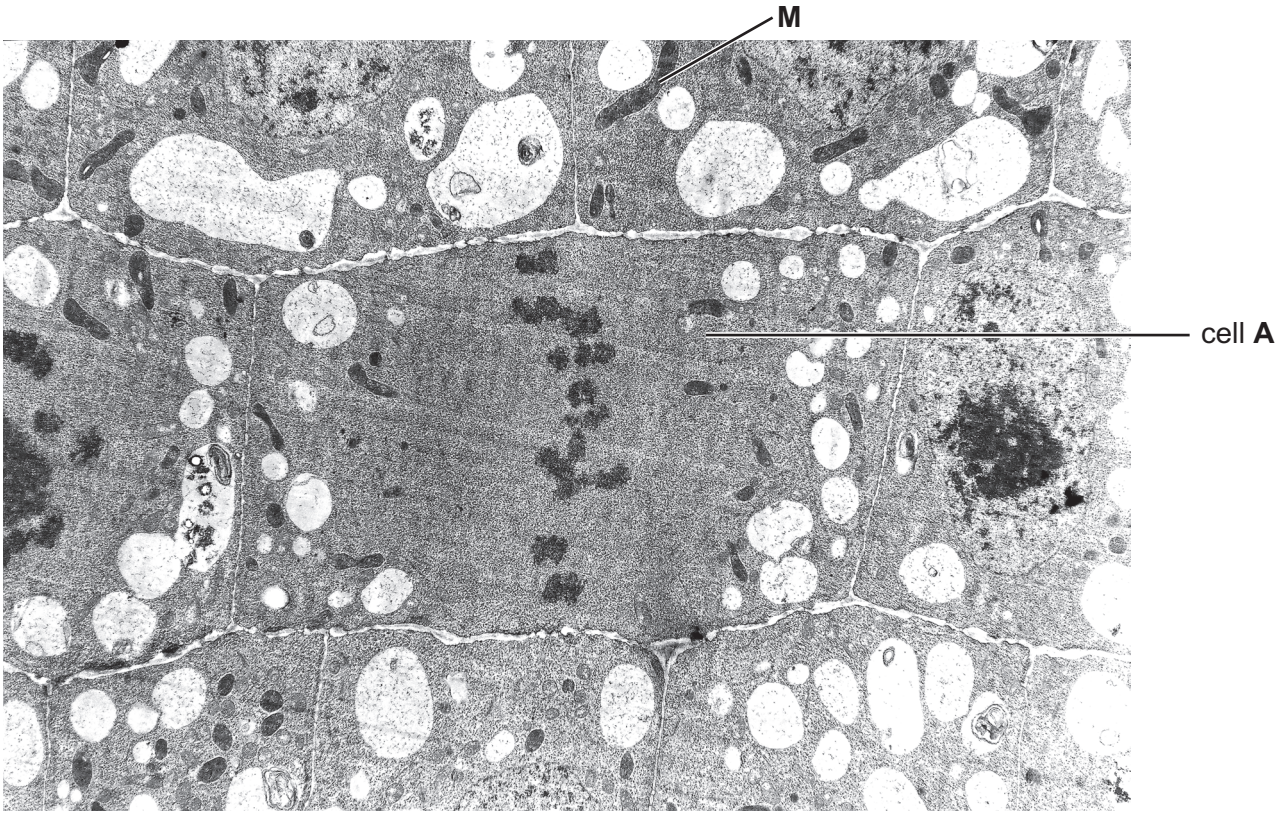

Fig. 6.1

(a) **(i)** State the evidence visible in Fig. 6.1 that identifies the cells of *A. cepa* as plant cells.

..... [1]

(ii) Cell **A** is dividing by mitosis.

State the role of mitosis in a shoot tip.

.....

.....

..... [1]

(b) The area labelled **M** is a mitochondrion.

Explain why mitochondria have an important role in dividing cells.

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..... [3]

(c) Cells just behind a shoot tip absorb water and grow in length. A plant hormone stimulates cell elongation and controls the response of stems to gravity.

(i) State the name of the plant hormone that stimulates cell elongation in stems.

..... [1]

(ii) Explain how the response of stems to gravity is controlled.

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..... [4]

(d) Some cells in shoot tips become leaf cells and others become cells in the stem or in flowers.

Explain why it is important that only some of the genes in cell **A** are expressed in these cells.

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..... [3]

[Total: 13]

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