Cambridge International AS & A Level

**Cambridge International Examinations**
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER



**BIOLOGY** **9700/21**

Paper 2 AS Level Structured Questions **May/June 2018**

**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 document consists of **16** printed pages.


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Answer **all** questions.

**1** Fig. 1.1 is a transmission electron micrograph of a cell from the root of thale cress, *Arabidopsis thaliana*.

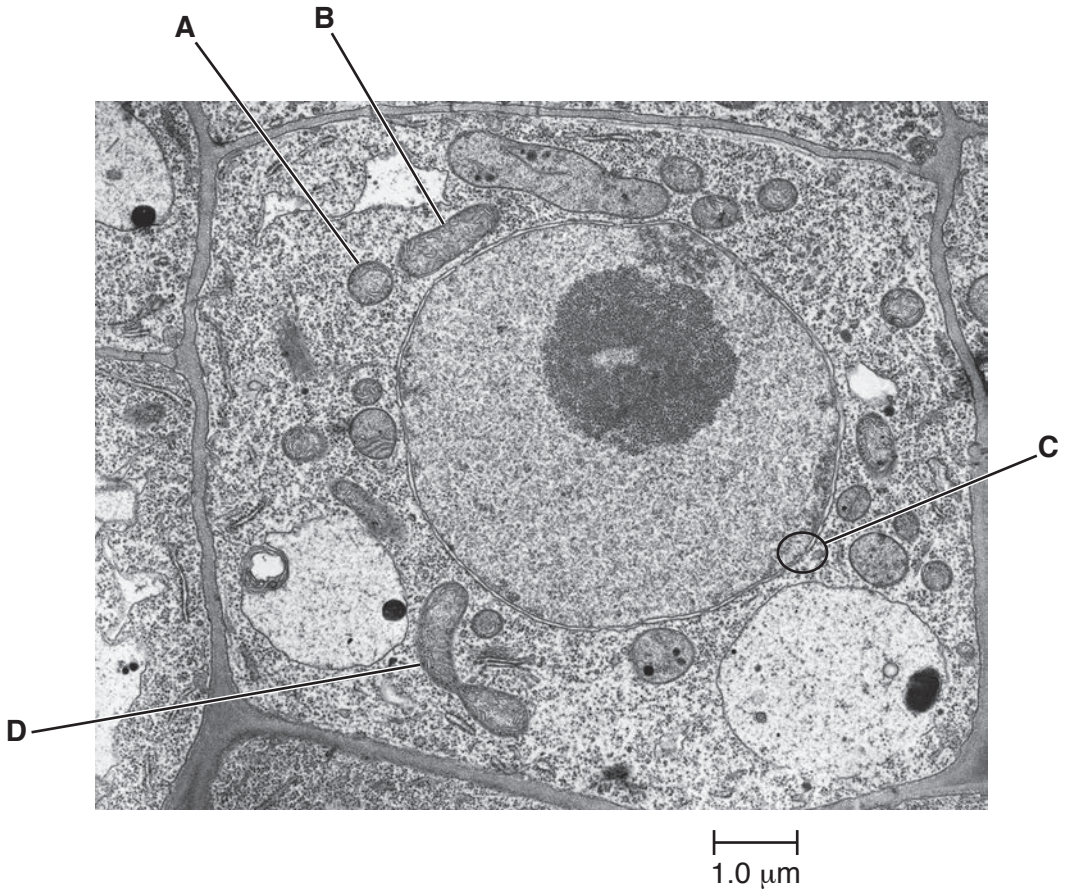



**Fig. 1.1**

**(a) (i)** The structures labelled **A** and **B** on Fig. 1.1 are sections of two mitochondria.

Suggest why **A** and **B** are different shapes.

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.....[1]

**(ii)** The structure labelled **D** on Fig. 1.1 is a mitochondrion about to divide.

Explain the importance of the division of mitochondria for the cell shown in Fig. 1.1 **and** for cells in the root tips of thale cress.

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.....[2]

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**(b)** Within a cell, substances move between the nucleus and the cytoplasm. The area labelled **C** in Fig. 1.1 shows an area where this communication occurs.

Make a large, labelled drawing of area **C** to show where this communication occurs.

[2]

**(c)** Outline the functions of the nucleus in non-dividing cells, such as the cell in Fig. 1.1.

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.....[4]

[Total: 9]

**2** **(a)** Sucrose is a disaccharide.

Fig. 2.1 shows how sucrose is broken down in a reaction with hydrochloric acid.

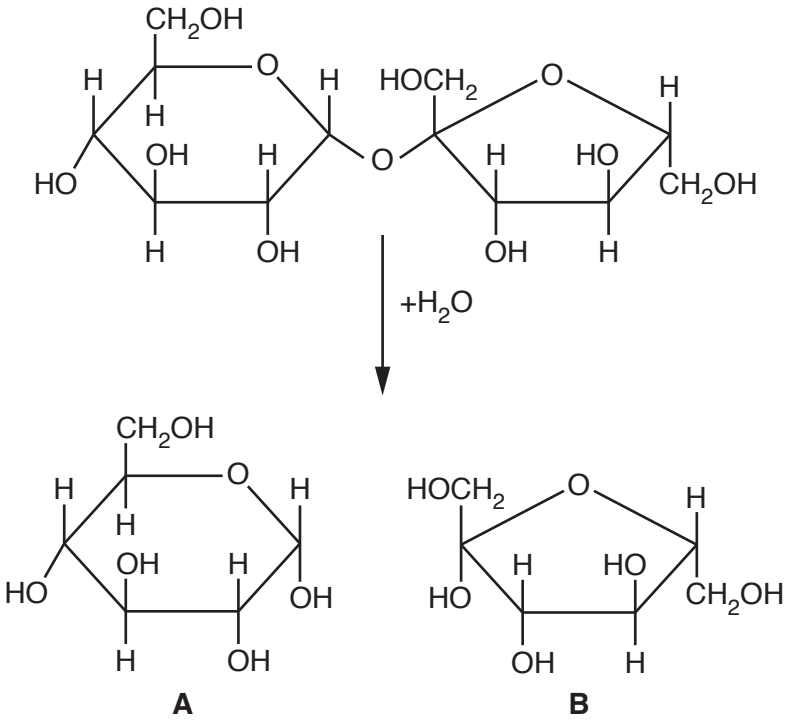



**Fig. 2.1**

**(i)** Name the products, **A** and **B**, of the reaction shown in Fig. 2.1.

**A** .....

**B** .....
[2]

**(ii)** Name the type of bond that is broken in the reaction shown in Fig. 2.1.

.....[1]

**(iii)** State the type of reaction shown in Fig. 2.1.

.....[1]

**(b)** When Benedict's solution is added to a sucrose solution and put into a boiling water-bath, no change in colour is observed.

State why no colour change is observed.

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.....[2]

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**(c)** Sugar beet plants, *Beta vulgaris*, store sucrose in their roots.

Describe **and** explain how sucrose is transported from the phloem in the leaves of sugar beet to storage tissues in the root.

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.....[4]

[Total: 10]

**3** Researchers isolated a sucrase enzyme from the bacterium *Bacillus subtilis*. They immobilised the enzyme in alginate beads.

The researchers investigated the effects of temperature on the activity of the immobilised sucrase compared with the activity of the same enzyme free in solution.

The results are shown in Fig. 3.1.

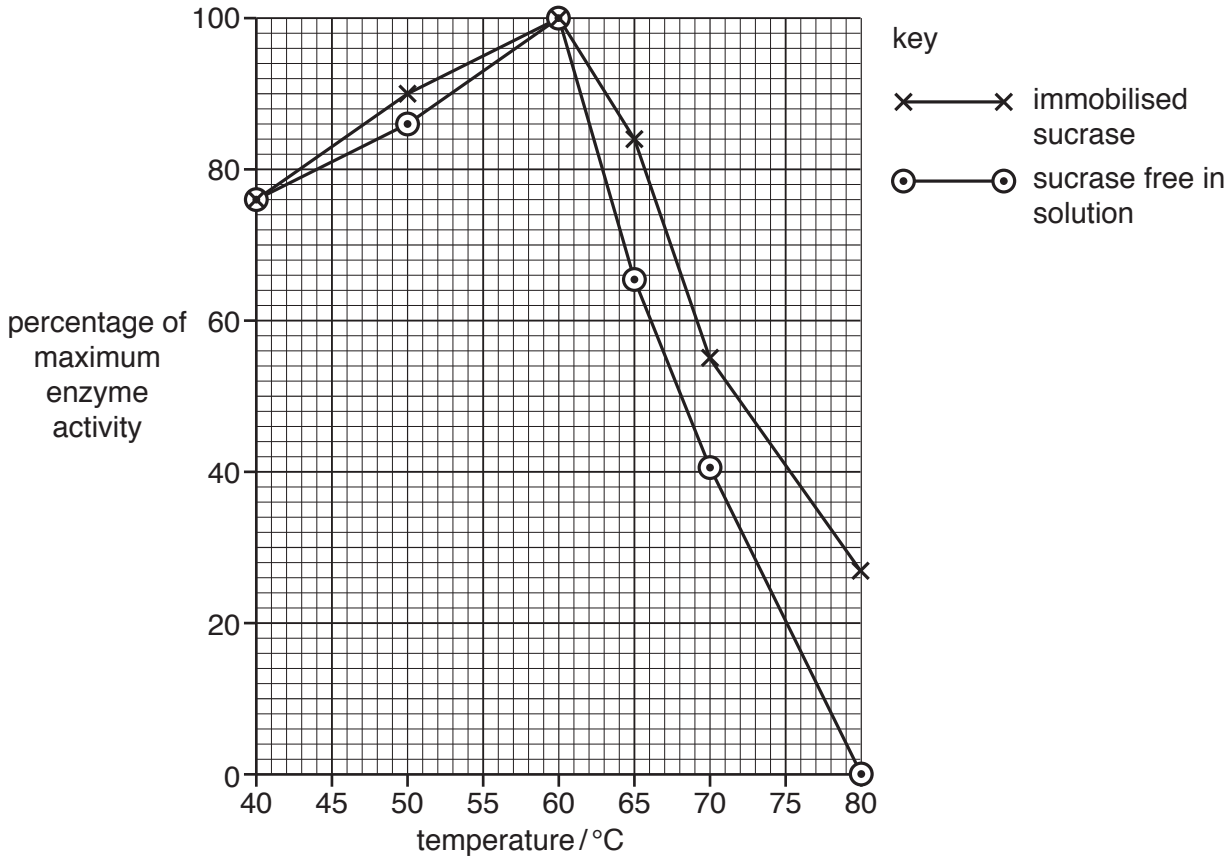



**Fig. 3.1**

**(a)** With reference to Fig. 3.1, **compare** the effects of temperature on the activity of immobilised sucrase with the activity of sucrase free in solution.

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.....[4]

The researchers also investigated the effects of pH on the activity of the immobilised sucrase compared with its activity free in solution.

The results are shown in Fig. 3.2.

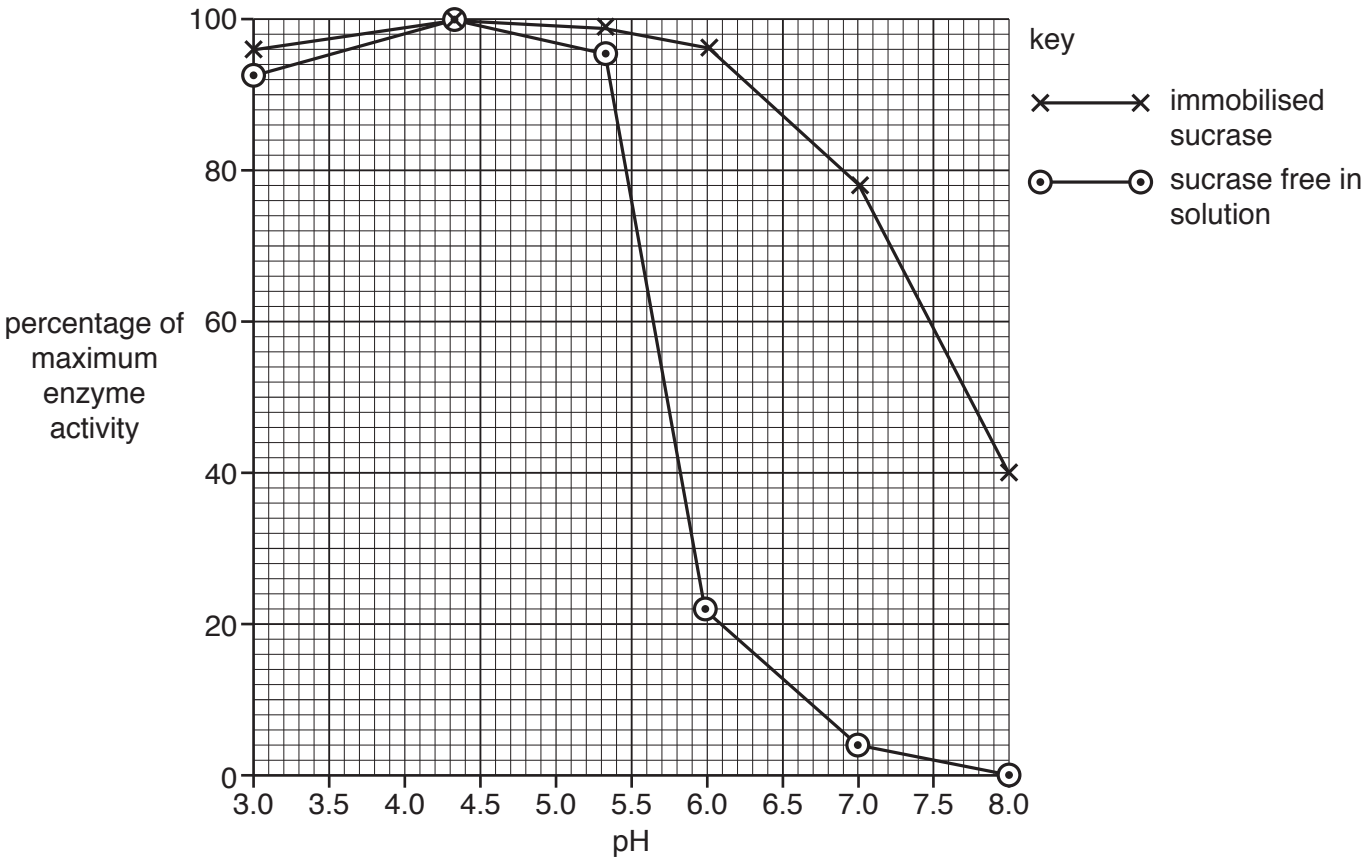



**Fig. 3.2**

**(b)** Fig. 3.2 shows that immobilised sucrase remains active over a wider range of pH compared with sucrase free in solution.

Suggest reasons for the higher activity of immobilised sucrase over the range of pH between 5.5 and 8.0.

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.....[2]

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**[Turn over**

**(c)** State **one** variable that the researchers should keep constant in **both** investigations **and** explain your answer in terms of enzyme action.

*variable* .....

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*explanation* .....

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.....[2]

**(d)** There are many advantages of using immobilised enzymes in industry.

Suggest **two** advantages of using immobilised enzymes in industry **other than** remaining active over a greater range of pH.

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[Total: 10]

**4** Fig. 4.1 is a ribbon model of a molecule of haemoglobin.

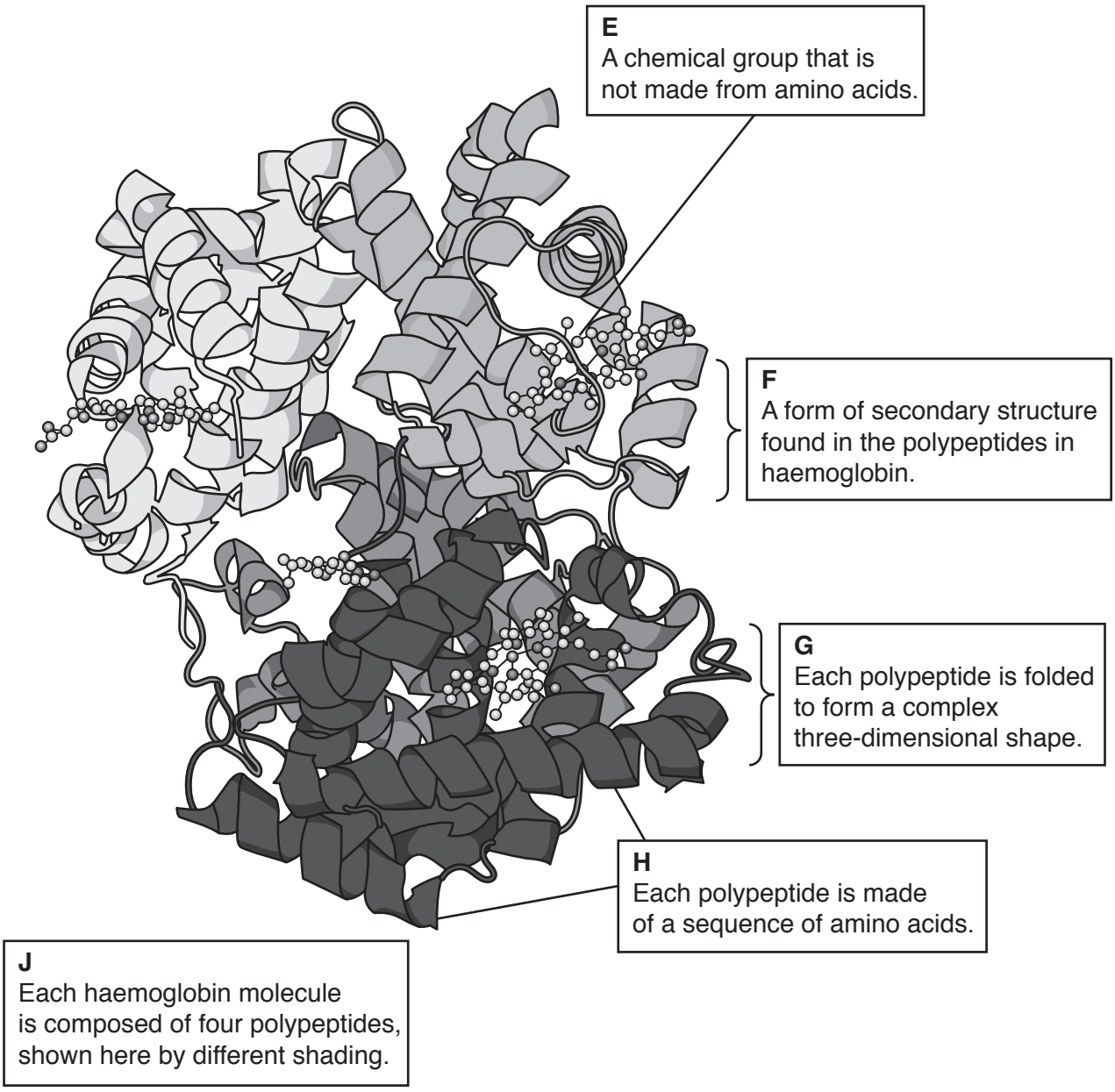



**Fig. 4.1**

**(a)** State the term that matches each of the descriptions given in boxes **E**, **F**, **G**, **H** and **J** in Fig. 4.1.

**E** .....

**F** .....

**G** .....

**H** .....

**J** .....

[5]

**(b)** The effect of carbon dioxide on the percentage saturation of haemoglobin with oxygen was investigated.

A sample of mammalian blood was exposed to a gas mixture that contained increasing partial pressures of oxygen ($pO_2$). Throughout the investigation the partial pressure of carbon dioxide ($pCO_2$) was maintained at 5.3 kPa. The percentage saturation of haemoglobin in the sample was determined as the $pO_2$ increased.

The investigation was repeated with a second sample of blood in which the $pCO_2$ was maintained at 10.7 kPa.

The results are shown in Fig. 4.2.

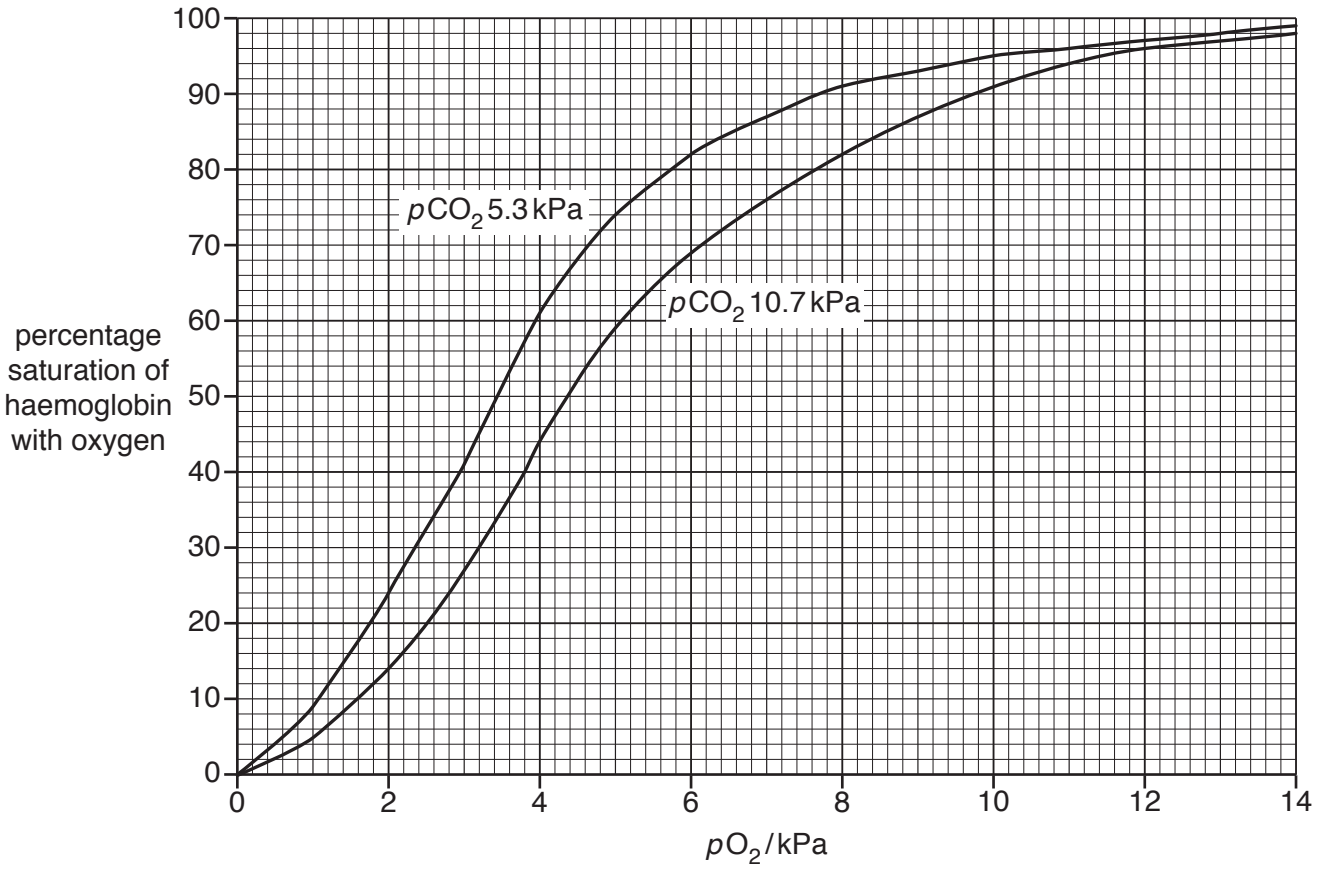



**Fig. 4.2**

**(i)** The $pO_2$ in alveolar air is 13.0 kPa and the $pCO_2$ is 5.3 kPa.

Use Fig. 4.2 to suggest the percentage saturation of haemoglobin in blood entering the pulmonary veins.

.....[1]

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**(ii)** Use the information in Fig. 4.2 to state **and** explain the effect of increasing $pCO_2$ in muscle tissues during strenuous exercise.

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[Total: 10]

**5** **(a)** The toxins released by some pathogenic bacteria can be altered chemically so that they are harmless. These harmless toxins are called toxoids.

Toxoids are used in vaccines to provide protection against some infectious diseases.

Describe the response of the immune system to the injection of a toxoid.

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.....[5]

**(b)** Myasthenia gravis (MG) is described as an autoimmune disease. It is a long-term condition that results from a failure of the immune system.

**(i)** Explain why MG is known as an autoimmune disease.

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**(ii)** Suggest why MG is a long-term condition.

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.....[2]

[Total: 10]

**Question 6 starts on page 14**

**6** Water absorbed by plant roots travels by different pathways from root hairs to the xylem.

Fig. 6.1 shows these pathways in the root of *Ranunculus acris*.

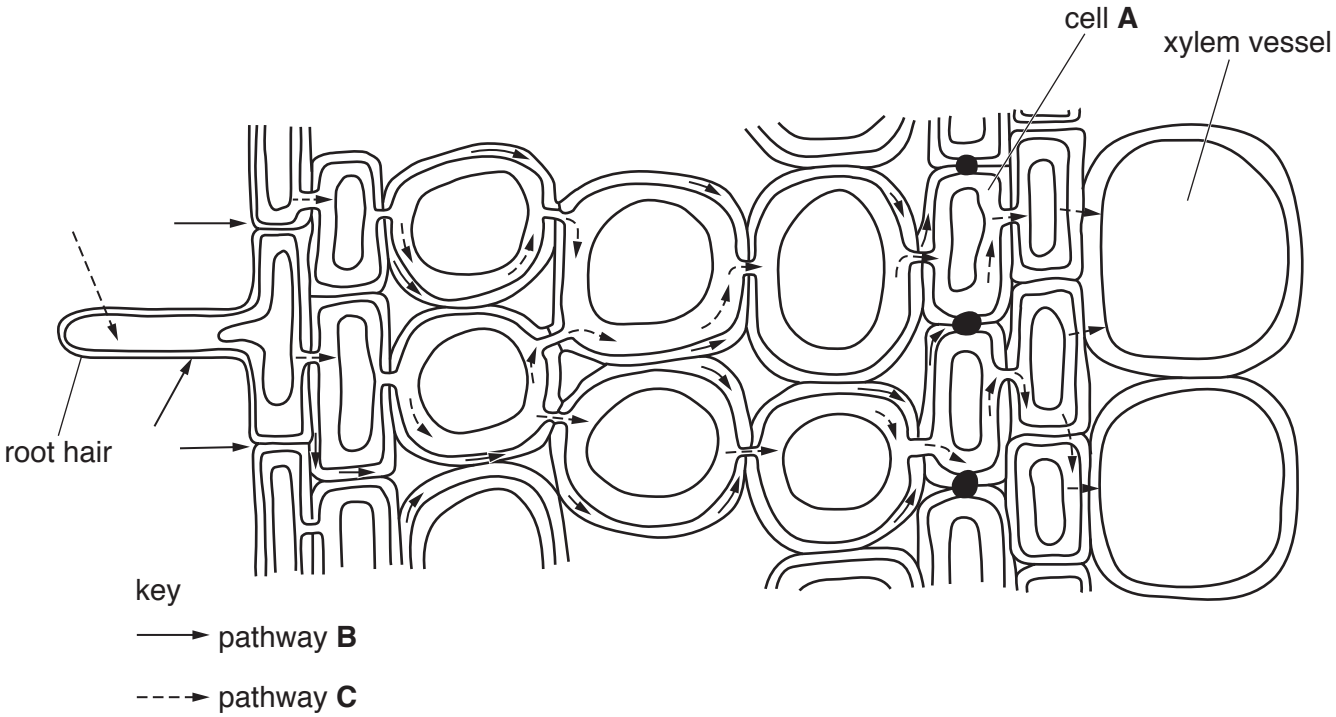



**Fig. 6.1**

**(a)** Name cell **A** and pathway **B** as shown in Fig. 6.1.

cell **A** .....

pathway **B** .....

[2]

**(b)** Transpiration occurring at the leaves is mainly responsible for movement of water across the root of *R. acris*.

Explain how transpiration is responsible for the movement of water across the root as shown in Fig. 6.1.

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**(c)** Explain why the movement of water in pathway **C** is slower than in pathway **B**.

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**Question 6 continues on page 16**

**(d)** Ions are taken up by root hair cells using active transport and facilitated diffusion.

Describe **two** ways in which facilitated diffusion differs from active transport.

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2 .....

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[2]

[Total: 11]

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