| Centre Number | Candidate Number | Name |
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| | | |

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

**BIOLOGY** **9700/02**

Paper 2 Structured Questions AS

May/June 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 in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs, or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

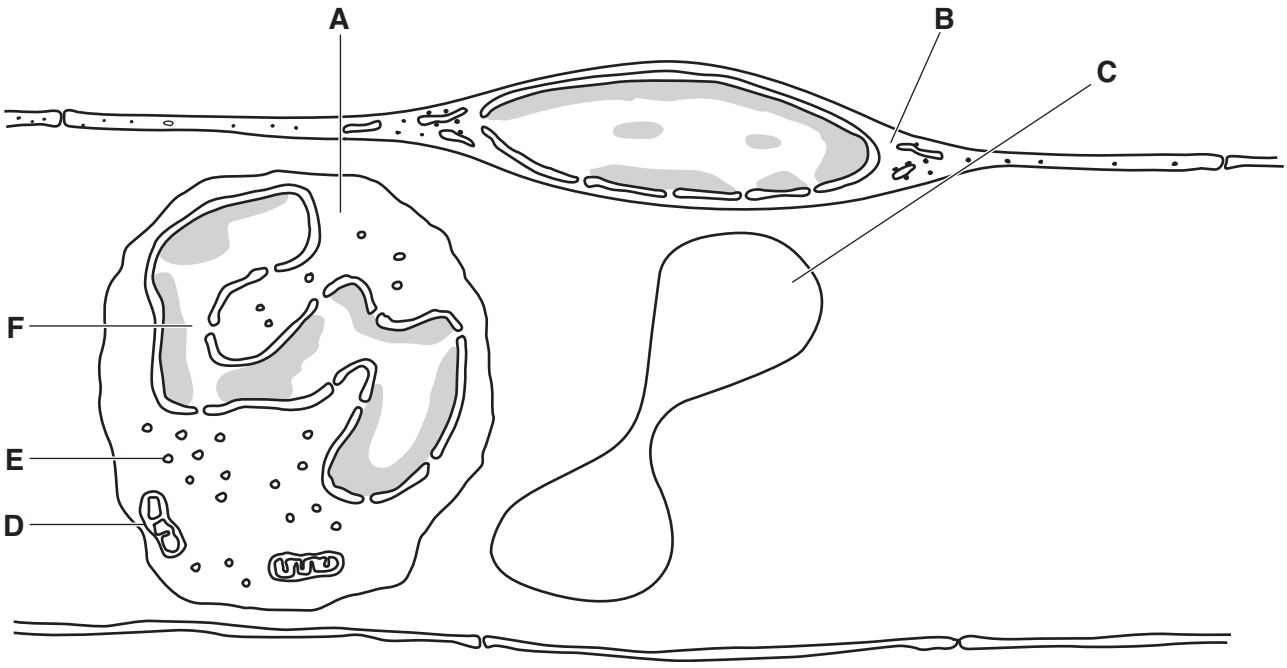
Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.

| For Examiner's Use | |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| TOTAL | |

This document consists of **12** printed pages and **4** blank pages.

Answer **all** the questions.

**1** Fig. 1.1 is a drawing made from an electron micrograph of a longitudinal section of a capillary in muscle tissue.




× 8000

**Fig. 1.1**

**(a)** Complete the table below using the information in Fig. 1.1 to help you.

| | cell **A** | cell **B** | cell **C** |
|---|---|---|---|
| name of cell | | | red blood cell |
| function of cell | ingest bacteria | permit exchange of gases | |
| diameter / μm | | 20 | 7 |

[4]

**(b)** Name the organelles **D**, **E** and **F**.

**D** .....

**E** .....

**F** .....[3]

**(c)** Explain how oxygen and glucose move from the blood inside the capillary to the tissue fluid in the muscle.

oxygen .....

.....

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glucose .....

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.....[3]

**(d)** Describe how the **structure** of the **wall** of a vein differs from that of a capillary.

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.....[3]

[Total: 13]

**2** Fig. 2.1 shows part of a summer squash, *Cucurbita pepo*. Fig. 2.2 is a high power drawing of an area of phloem from a transverse section of the stem of *C. pepo*.

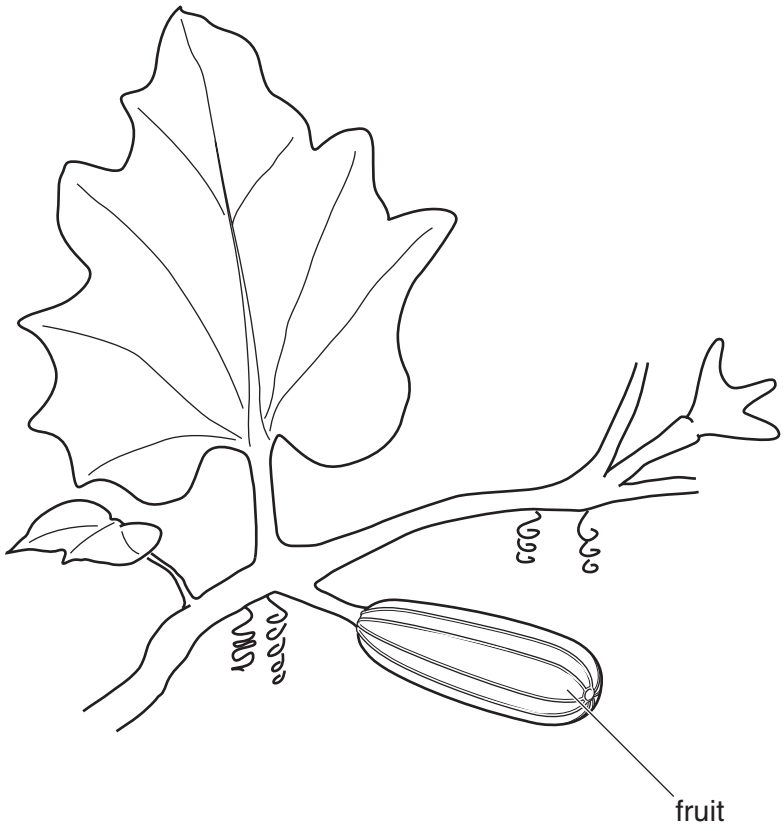


**Fig. 2.1**

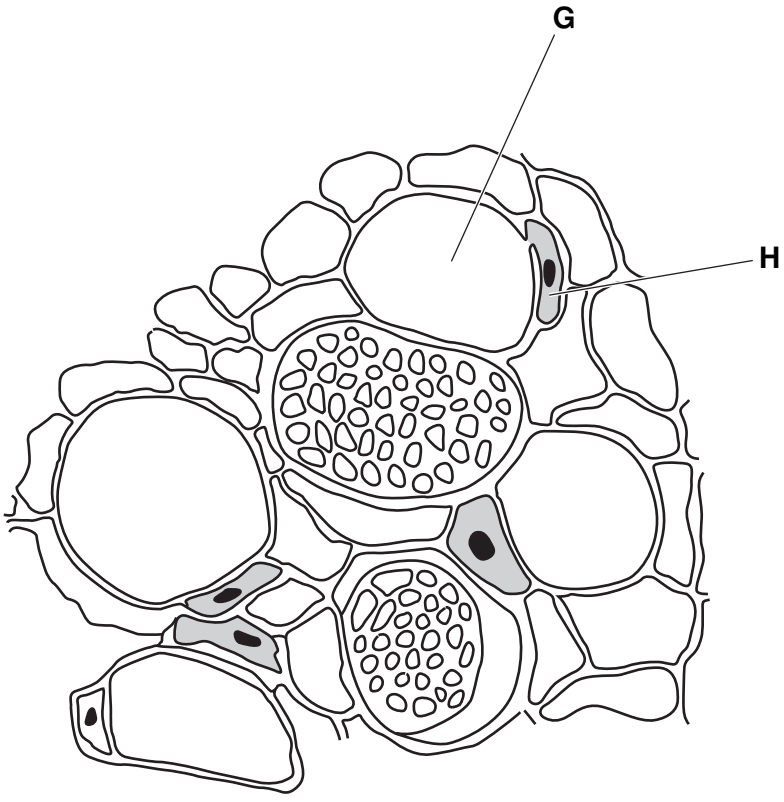


**Fig. 2.2**

**(a) (i)** Name **G** and **H**.

**G** .....

**H** .....[1]

**(ii)** Describe three ways in which the **structure** of a xylem vessel differs from the structure of cell **G**.

1. .....

2. .....

3. .....[3]

**(b)** The liquid extracted from the phloem of *C. pepo* contains sucrose.

Explain how sucrose is transported in the phloem along the stem from the leaf to the fruit.

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.....[4]

**(c)** Most of the sucrose transported in the phloem enters the fruit.

Suggest why summer squash fruits are not sweet.

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.....[1]

[Total: 9]

**3** **(a)** Complete the table by indicating with a tick (✔) or a cross (✘) whether the statements apply to proteins, DNA, messenger RNA and cellulose.

You should put a tick or a cross in each box of the table.

| statement | protein | DNA | messenger RNA | cellulose |
|---|---|---|---|---|
| hydrogen bonds stabilise the molecule | | | | |
| glucose is the subunit molecule | | | | |
| subunits are joined by peptide bonds | | | | |
| may be hydrolysed to amino acids | | | | |
| contains uracil | | | | |

[5]

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**Question 3 continues on page 8**

During an immune response, B-lymphocytes become plasma cells and begin to make polypeptides that are assembled into antibodies.

Fig. 3.1 is a diagram showing the formation of a polypeptide at a ribosome in a plasma cell.

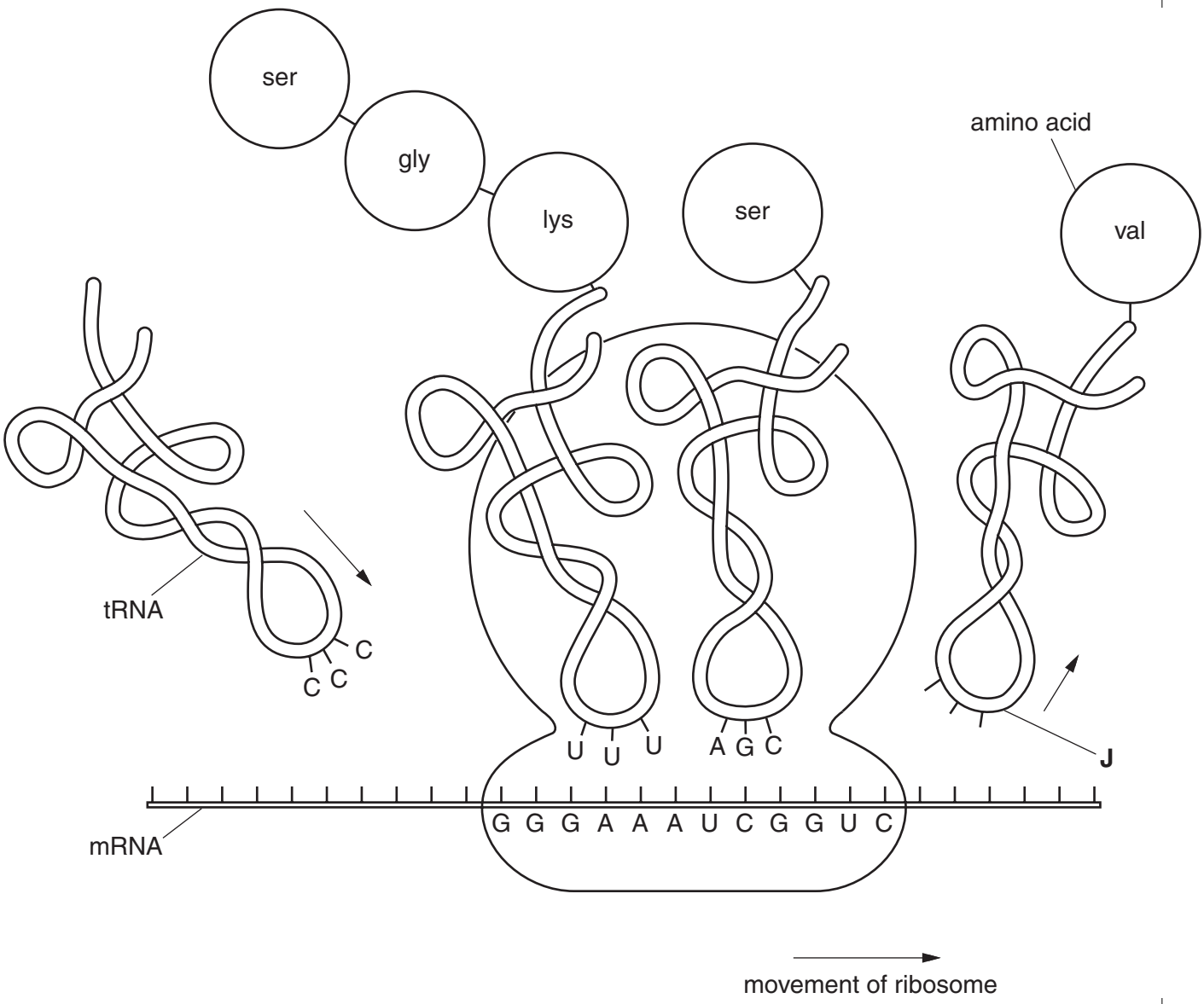


**Fig. 3.1**

**(b)** State the sequence of bases at **J**.

.....[1]

**(c)** **Use the information in Fig. 3.1** to describe the role of transfer RNA molecules in translation.

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.....[5]

The bacterium that causes cholera, *Vibrio cholerae*, releases a toxin known as choleragen. During an immune response to cholera some B-lymphocytes produce antibodies that combine with choleragen so inactivating it. Antibodies that inactivate toxins are called antitoxins.

**(d)** Explain how the structure of an antibody, such as the antitoxin for choleragen, makes it specific to one substance.

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.....[3]

**(e)** Explain why cholera remains a significant infectious disease in some parts of the world.

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.....[3]

[Total: 17]

**4** Fig. 4.1 is an electron micrograph of a chloroplast from a mesophyll cell in a leaf.

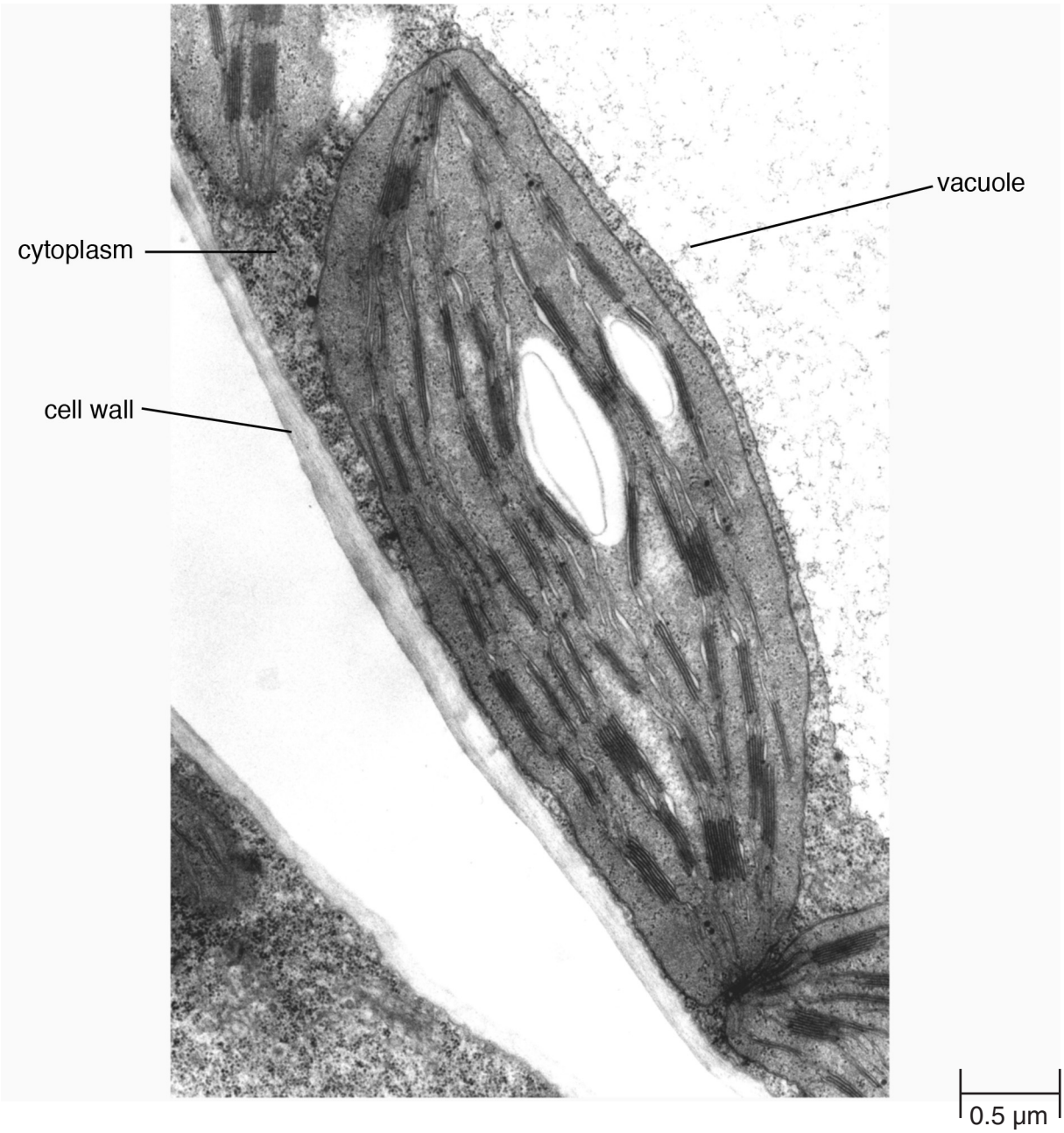


**Fig. 4.1**

**(a)** Calculate the magnification of the electron micrograph in Fig. 4.1.

Answer = .....[1]

**(b)** State two features **visible in Fig. 4.1** that identify the organelle shown as a chloroplast.

1. .....

2. .....[2]

**(c)** Chloroplasts absorb phosphate ions from the surrounding cytoplasm. Suggest one way in which chloroplasts use phosphate ions.

.....[1]

**(d)** Starch grains in plant cells contain both amylose and amylopectin.

Explain how **both** of these substances are formed from glucose in plant cells.

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.....[4]

**(e)** State three functions of the water stored in the vacuoles of plant cells.

1. .....

2. .....

3. .....[3]

[Total: 11]

**5** Some bacteria that are found in soils contain the enzyme urease.

Urease catalyses the hydrolysis of urea to form ammonia and carbon dioxide:

$$\text{urea} + \text{water} \longrightarrow \text{carbon dioxide} + \text{ammonia}$$

Some fertilisers added to soils to help crop growth contain urea. Although some crop plants can absorb ammonium ions, most obtain their source of nitrogen as nitrate ions.

**(a)** Describe how urea from fertilisers becomes available to plants as nitrate ions.

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.....[3]

The activity of urease can be measured by following the increase in pH as ammonia is produced in the reaction. A student was provided with urease extracted from bacteria and solutions of urea and two chemical inhibitors, thiourea and lead nitrate. The student prepared six reaction mixtures (**1** to **6**) as shown in Table 5.1 in order to investigate the effect of the two chemical inhibitors on the activity of urease.

**Table 5.1**

| reaction mixture | urea | water | thiourea | lead nitrate | urease | boiled urease |
|---|---|---|---|---|---|---|
| **1** | ✔ | ✔ | ✘ | ✘ | ✔ | ✘ |
| **2** | ✔ | ✘ | ✔ | ✘ | ✔ | ✘ |
| **3** | ✔ | ✘ | ✘ | ✔ | ✔ | ✘ |
| **4** | ✔ | ✔ | ✘ | ✘ | ✘ | ✘ |
| **5** | ✘ | ✔ | ✔ | ✘ | ✔ | ✘ |
| **6** | ✔ | ✔ | ✘ | ✘ | ✘ | ✔ |

Key ✔ = present in reaction mixture ✘ = absent from reaction mixture

The student recorded an increase in pH in reaction mixtures **1** and **2**. The reaction was faster in **1** than in **2**. The pH in the other reaction mixtures did not change.

**(b)** The student made some conclusions about the results from the test-tubes. Match the statements to the reaction mixtures, **1** to **6**. You may use the numbers once, more than once or not at all.

**(i)** 'No reaction took place because urease was denatured.' [1]

**(ii)** 'There was no reaction because there was no substrate for urease.' [1]

**(iii)** 'The reaction did not occur because there was an inhibitor present.' [1]

Thiourea has a molecular structure that is very similar to that of urea. The student designed an experiment to find out whether thiourea is a competitive inhibitor. The student set up several reaction mixtures like **1** using increasing concentrations of urea. The student determined the initial rate of the reaction for urease at each concentration of urea. The results are shown in Fig. 5.1.

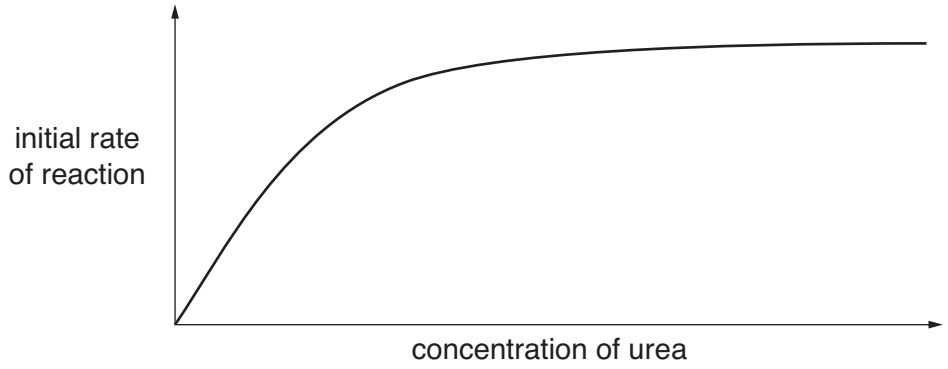


**Fig. 5.1**

The student then repeated the experiment using the same concentrations of urea. However, the student added the same volume and concentration of a thiourea solution to each test-tube in place of the water.

**(c)** Sketch a curve on Fig. 5.1 to show the results that the student would expect if thiourea acts as a competitive inhibitor of urease. [2]

**(d)** Explain why it is important to determine the **initial** rate of reaction when investigating the effect of a competitive inhibitor on an enzyme.

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.....[2]

[Total: 10]

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