OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced Subsidiary GCE

BIOLOGY

Biology Foundation

2801

Monday **16 JANUARY 2006** Afternoon 1 hour

Candidates answer on the question paper.
Additional materials:
Electronic calculator
Ruler (cm/mm)

Candidate Name

Centre Number

Candidate Number

TIME 1 hour

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers, in blue or black ink, in the spaces provided on the question paper.
- Pencils may be used for diagrams or graphs only.
- Read the questions carefully before starting your answer.
- Do not write in the bar code. Do not write in the grey area between the pages.
- **DO NOT** WRITE IN THE AREA **OUTSIDE** THE BOX BORDERING EACH PAGE. ANY WRITING IN THIS AREA WILL NOT BE MARKED.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	8	
2	7	
3	18	
4	8	
5	6	
6	13	
TOTAL	60	

This question paper consists of 15 printed pages and 1 blank page.

Answer **all** the questions.

1 **(a)** Fig. 1.1 is a drawing of an organelle from a ciliated cell as seen with an electron microscope.

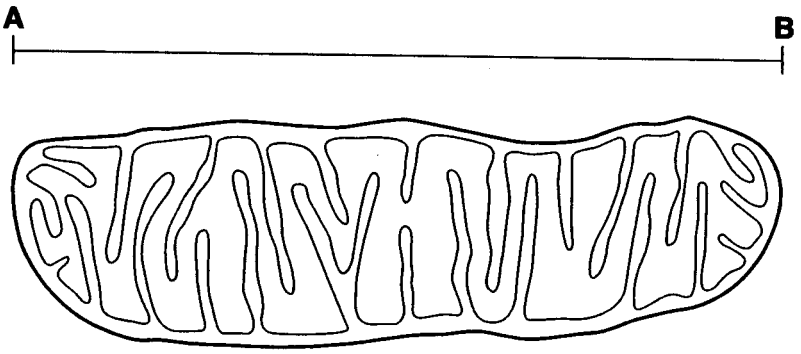

Fig. 1.1

(i) Name the organelle shown in Fig. 1.1.

..... [1]

(ii) State the function of this organelle.

.....

..... [2]

(iii) State why ciliated cells contain relatively large numbers of these organelles.

.....

..... [1]

(iv) Calculate the actual length of the organelle as shown by the line **AB** in Fig. 1.1.
Express your answer to the **nearest micrometre** (μm).

Show your working.

Answer = ... μm [2]

(b) An image drawn to the same magnification as Fig. 1.1 could be produced using a light microscope.

Explain why such an image would be of little use when studying cells.

.....

.....

.....

..... [2]

[Total: 8]

2 Fig. 2.1 shows part of the nitrogen cycle.

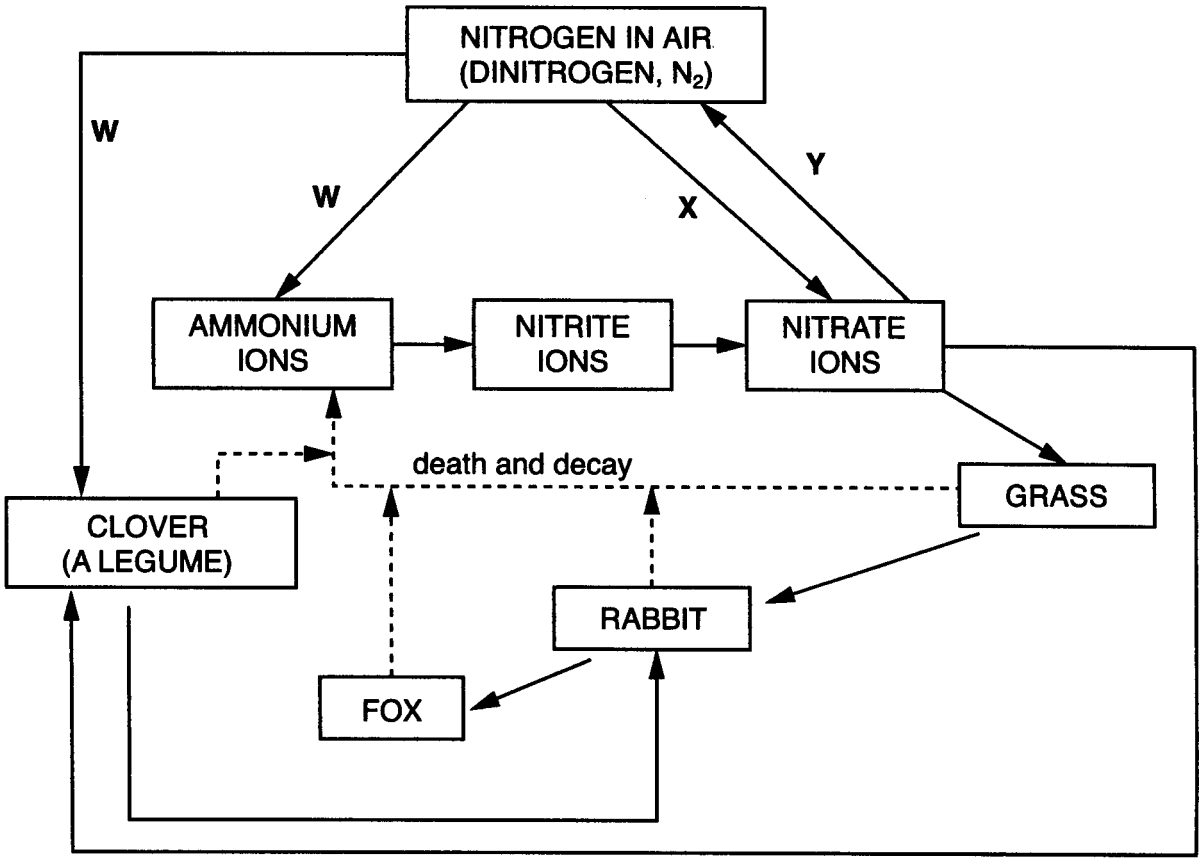

Fig. 2.1

(a) Using **only** the information in Fig. 2.1, state **one** example of each of the following:

(i) secondary consumer;

..... [1]

(ii) producer.

..... [1]

(b) (i) Name the process **W**.

..... [1]

(ii) State a way in which nitrogen in air can be converted directly into nitrate ions, as indicated by arrow **X**.

..... [1]

(iii) State the type of bacteria that carry out process **Y**.

..... [1]

(iv) The bacterium *Rhizobium* also has a role in the cycle shown in Fig. 2.1.

Explain the importance of *Rhizobium* in the nitrogen cycle.

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..... [2]

[Total: 7]

3 **(a)** Fig. 3.1 is a diagram showing the transport of a protein-rich solid particle into an animal cell.

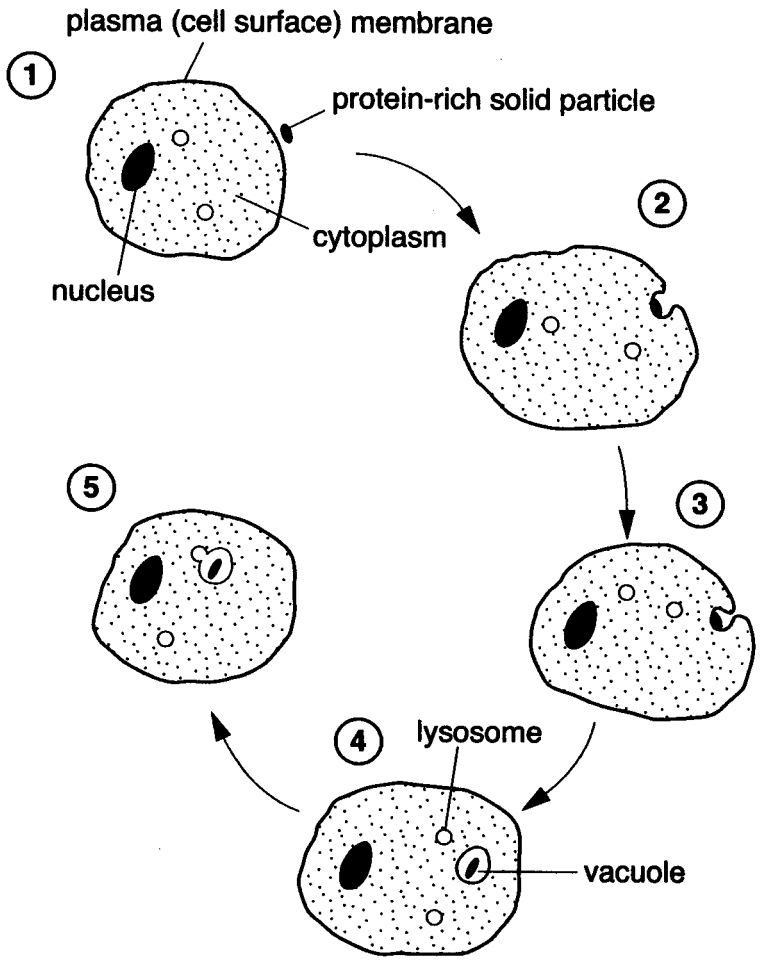

Fig. 3.1

(i) Name the method of transport shown in stages **1** to **4** in Fig. 3.1.

..... [1]

(ii) Describe what happens within the vacuole after it fuses with the lysosome.

.....

.....

.....

.....

.....

..... [3]

(b) Two students carried out an investigation into the effect of pH on the activity of a lysosomal enzyme. Student **A** drew the graph shown in Fig. 3.2.

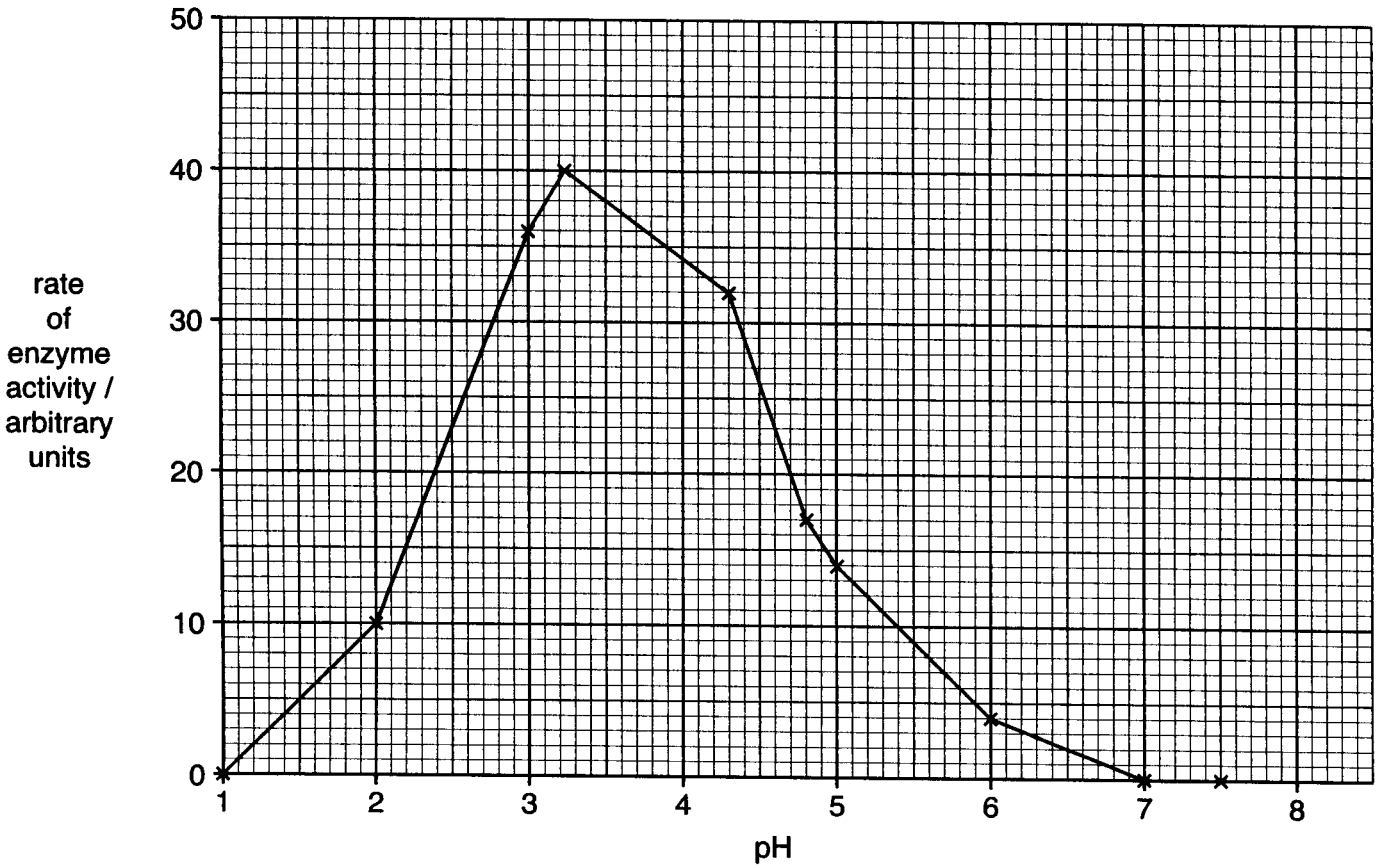

Fig. 3.2

(i) A teacher asked two students to state the optimum pH for this enzyme. Student **A** gave the answer 'pH 3.25' but student **B** gave the answer 'somewhere between pH 3.0 and pH 4.3'.
The teacher said that student **B** had given the better answer.

Explain why student **B**'s answer was better.

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..... [2]

(ii) Explain why this enzyme is not active at pH 7.

.....

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..... [2]

(c) In this question, one mark is available for the quality of spelling, punctuation and grammar.

Explain the effects of enzyme concentration, substrate concentration **and** competitive inhibitors on the rate of an enzyme-controlled reaction.

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..... [9]

Quality of Written Communication [1]

[Total: 18]

4 Read the following passage and then answer the questions that follow.

Human Factor VIII is a glycoprotein found in blood plasma. It is involved in blood clotting.

This glycoprotein contains 2332 amino acids linked into a single chain. This chain is folded and coiled into a secondary structure and then further folded. The chain forms six individual regions, each with its own function.

An artificial source of Factor VIII, created using genetic engineering, is now used to treat patients with haemophilia, a medical condition in which the blood clots more slowly than normal. The Factor VIII gene is first removed from the genome of human cells. It is then inserted into the genome of hamster cells.

Cancer cells or cells taken from an ovary are usually used to produce Factor VIII as these grow very well in industrial tanks. The Factor VIII that is produced is then removed from the tanks and purified before use in treating patients.

(a) State what is meant by the term *glycoprotein* (line 1).

.....

..... [1]

(b) The secondary structure of a protein is identified by its shape.

(i) Name a shape formed by **coiling** of the primary structure.

..... [1]

(ii) Name a shape formed by **folding** of the primary structure.

..... [1]

(c) State the name given to the level of structure formed by **further folding** of the secondary structure (line 4).

..... [1]

(d) **(i)** State the type of enzyme used to remove the gene for Factor VIII from the rest of the human genome (lines 8 and 9).

..... [1]

(ii) Name the enzyme used to insert the gene for Factor VIII into the genome of hamster cells (line 9).

..... [1]

(e) Ovary cells contain large amounts of endoplasmic reticulum (ER).

Suggest the importance of this in using these cells for the production of Factor VIII.

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..... [2]

[Total: 8]

5 Fig. 5.1 shows drawings of nuclei, **A** to **D**, from **two** different plant species seen in the prophase stage of mitosis.

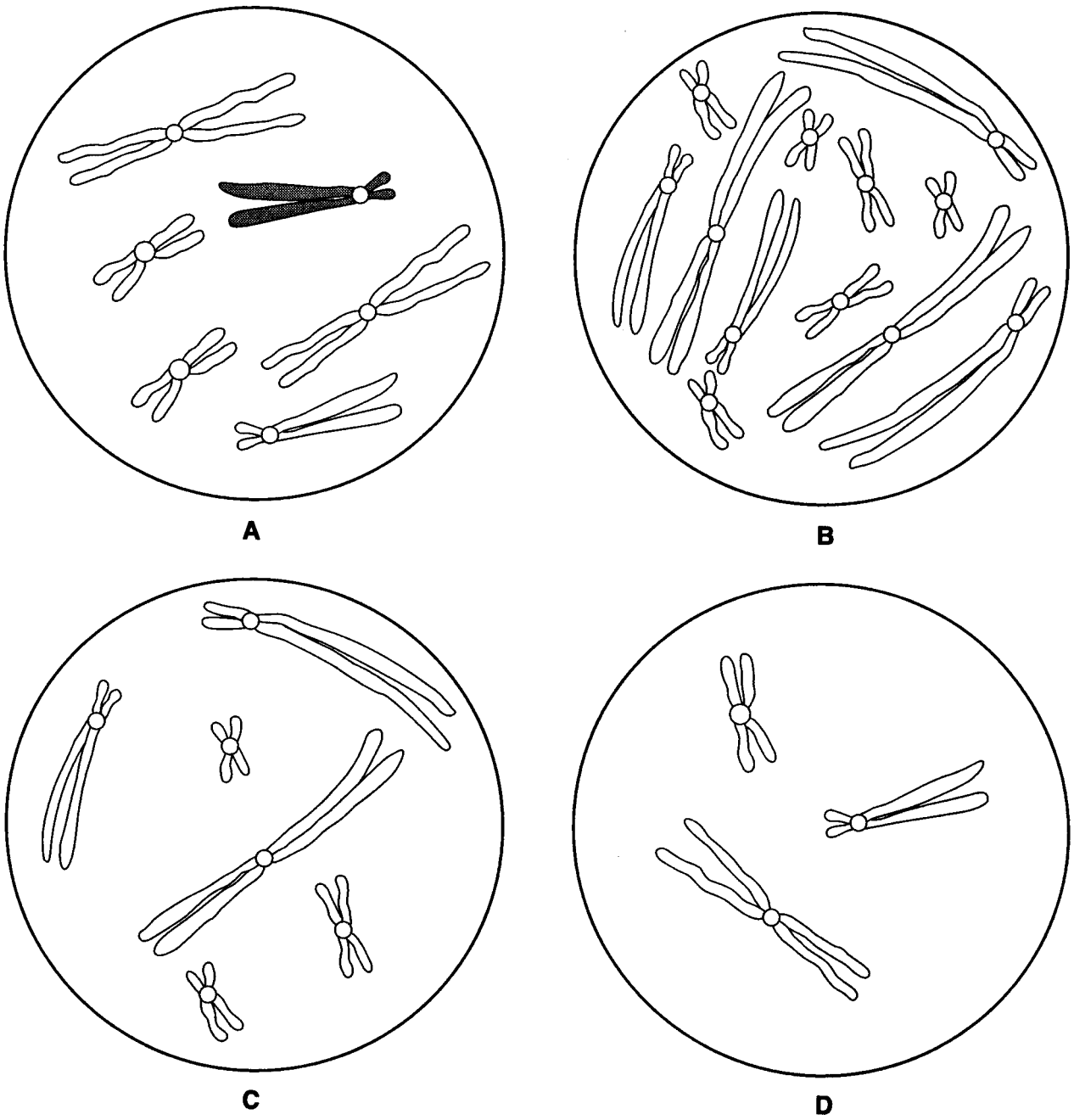

Fig. 5.1

(a) On drawing **A**, one of a pair of homologous chromosomes has been shaded. Shade in the other member of the pair. [1]

(b) **(i)** Name the stage in mitosis that **immediately** follows prophase.

.....[1]

(ii) Describe the behaviour of the chromosomes in this stage.

.....

.....

.....

.....[2]

(c) The diploid number for crocus, *Crocus balansae*, is **6** and the diploid number for broad bean, *Vicia faba*, is **12**.

State which of the drawings, **A**, **B**, **C** or **D**, shown in Fig. 5.1, represents the following:

haploid cell of broad bean .....

root tip cell of crocus .....[2]

[Total: 6]

(a) Complete the following passage by using the most suitable word(s) in each of the blank spaces.

Water is essential for life. It makes up a high proportion of the cytoplasm in a cell. Many different compounds can dissolve in it and it is therefore described as an excellent ..... .

Water remains in the ..... state over a wide range of environmental temperatures. As it cools below 4 °C it becomes less ..... than warmer water. Ice floats on water, forming a layer that ..... the water beneath with the result that large bodies of water rarely freeze entirely.

The ..... bonds that form between water molecules are responsible for its high ....., which allows small insects such as pond skaters to move on its surface without sinking. [6]

(b) Fig. 6.1 represents the appearance of a plant cell in salt solutions of three different concentrations.

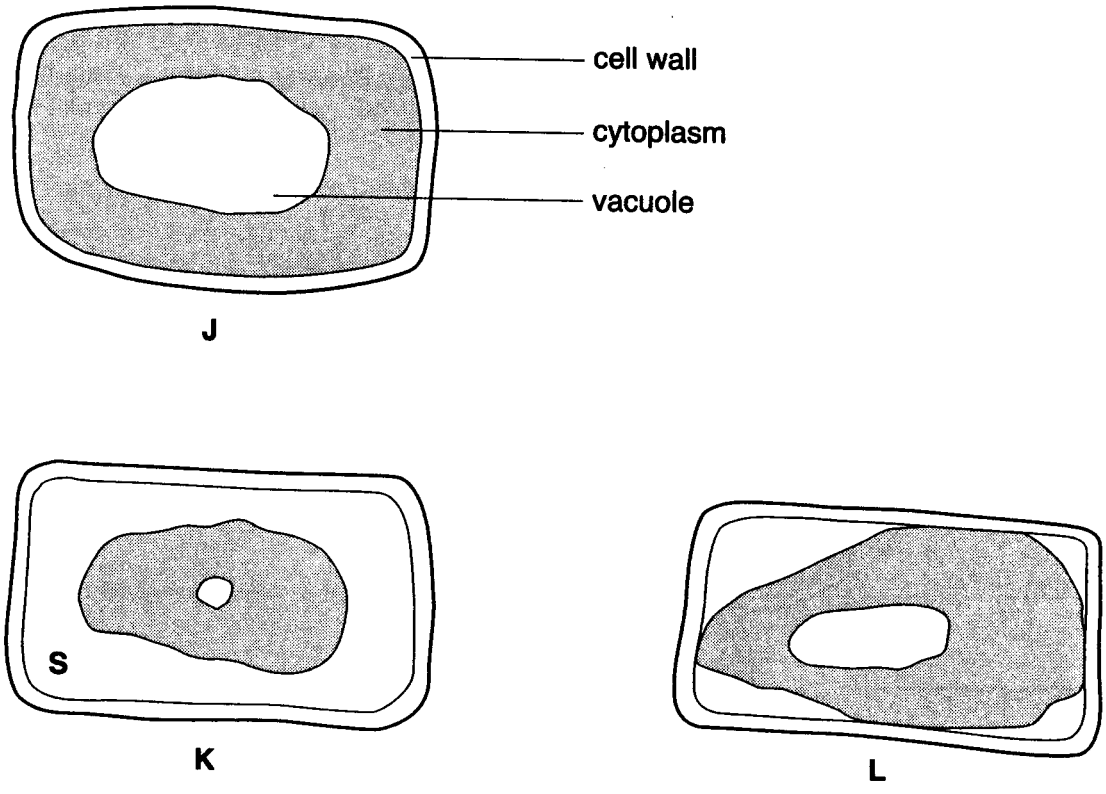

Fig. 6.1

(i) State which of the diagrams, **J** to **L**, represents a fully plasmolysed cell.

.....[1]

(ii) Suggest why the vacuole in **K** is smaller than that in **L**.

.....

.....[1]

(iii) Region **S** contains salt solution. State what this indicates about the permeability of the cell wall.

.....

.....[1]

(c) (i) The list below shows three different values for water potential (Ψ) in plant cells. Underline the water potential (Ψ) which has the **lowest** value.

$\Psi = 0$ $\Psi = -1300\,kPa$ $\Psi = -1150\,kPa$ [1]

(ii) Fig. 6.2 is a diagram that shows four neighbouring spongy mesophyll cells from the leaf of a dicotyledonous plant. The water potential of the cytoplasm of the cells is shown in each case.

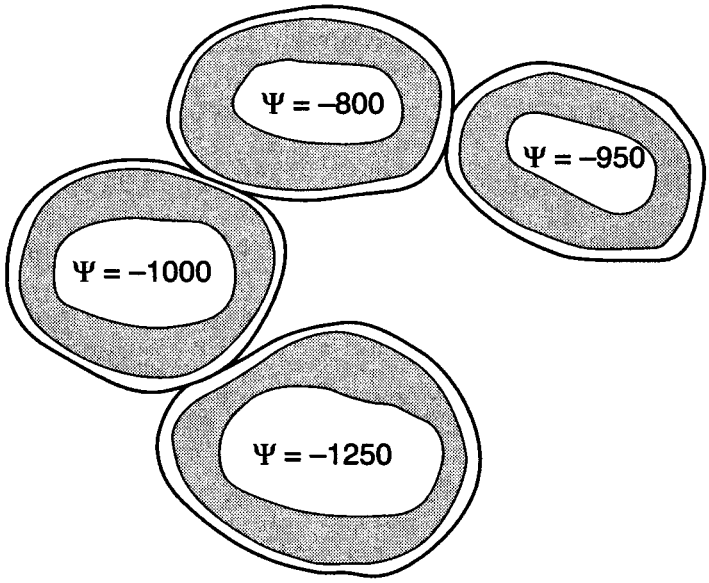

Fig. 6.2

Draw arrows on Fig. 6.2 to show the net flow of water between the cells. [3]

[Total: 13]

END OF QUESTION PAPER