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

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

8376729673

BIOLOGY **9700/31**

Advanced Practical Skills 1 **May/June 2012**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

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You are reminded that you have **only one hour** for each question in the practical examination.

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You should:

- Read carefully through **the whole** of Question 1 and Question 2.
- Plan your use of **the time** to make sure that you finish all the work that you would like to do.

You will **gain marks** for recording your results according to the instructions.

1 When onion cells are placed into a sodium chloride solution with a higher concentration than the cells, water leaves the vacuoles and the cells become plasmolysed.

You are provided with three samples of onion tissue, each soaked in a different concentration of sodium chloride solution, labelled **S1**, **S2** and **S3**.

The three concentrations of sodium chloride solution are 0.25 mol dm^{-3}, 0.50 mol dm^{-3} and 1.0 mol dm^{-3}.

The onion tissue in **S1** is in 1.00 mol dm^{-3} sodium chloride solution.

You are required to:

- observe and record the cells in **S1** and the effect of adding water, **W**, to these cells
- observe and record the onion cells to identify the concentration of the sodium chloride solutions, **S2** and **S3**.

You are advised to read steps 1 to 12 before proceeding.

Proceed as follows:

1. Label one **dry and clean** microscope slide **S1** and put the slide on a paper towel.
2. Put a few drops of the sodium chloride solution from **S1** onto the slide.
3. Remove a piece of the onion tissue from solution **S1** and, using forceps or fingers, peel off the inner concave epidermis as shown in Fig. 1.1.

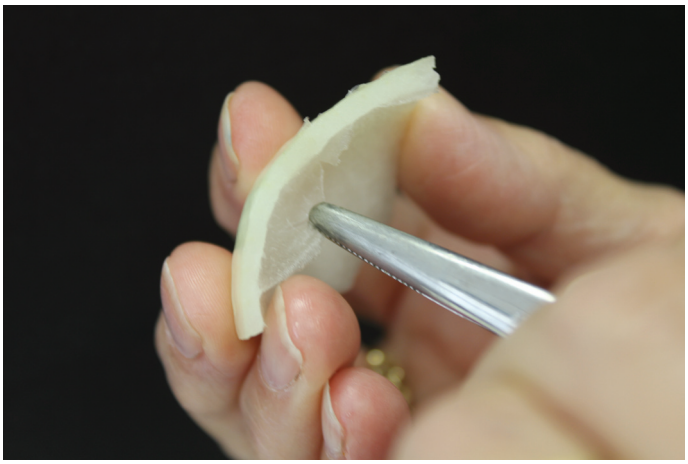


Fig. 1.1

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4. Cut one piece of the epidermis to fit under the coverslip. Replace the remaining epidermis into the solution in **S1**.

5. Place the epidermis into the sodium chloride solution on the slide as shown in Fig. 1.2. If the epidermis is folded, you may need to add more drops of sodium chloride solution so that it floats and uncurls. It is important to stop the epidermis from drying out.

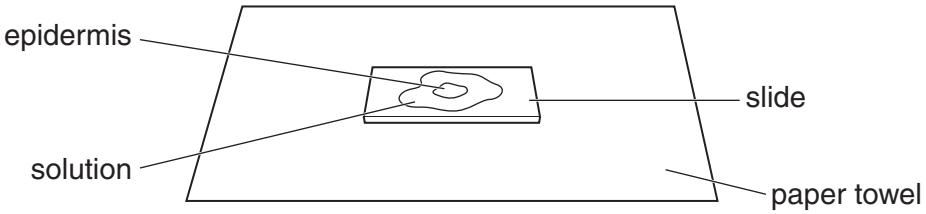


Fig. 1.2

6. Cover the epidermis on the slide with a coverslip and use a paper towel to remove any excess liquid that is outside the coverslip.

7. View the slide using the microscope. You may need to reduce the amount of light entering the microscope to observe the cells clearly.

(a) (i) Make a large drawing of two adjacent (touching) cells which show the effect of soaking the cells in the 1.00 mol dm^{-3} sodium chloride solution, **S1**.

Label a cell membrane.

[4]

(ii) Describe how you will obtain **quantitative** results to identify the concentration of the sodium chloride solutions, **S2** and **S3**, compared with **S1**.

For Examiner's Use

.....

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.....

..... [2]

(b) (i) Prepare the space below to record your quantitative results as you have described in **(a)(ii)**.

[5]

8. Record the result for **S1**.

9. Take the slide off the microscope and remove the coverslip.

10. Remove as much of the 1.00 mol dm^{-3} sodium chloride solution as you can and put a few drops of **W** onto the epidermis. Replace the coverslip and leave the slide until step 12.

11. Repeat steps 1 to 8 with **S2** and **S3** (note: you do not need to repeat **(a)(i)**).

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(ii) Identify the concentrations of sodium chloride solution in **S2** and **S3**. Complete the table.

solution	concentration of sodium chloride solution / mol dm^{-3}
S1	1.00
S2	
S3	

[1]

(iii) Describe how you identified the concentrations of sodium chloride.

.....

.....

.....

.....

..... [2]

12. Put the **S1** slide onto the microscope and select two adjacent cells to show the difference in the cells after adding the water compared with those drawn in **(a)(i)**.

(c) (i) Make a large labelled drawing of these two adjacent (touching) cells.

Label a cell wall.

[3]

For Examiner's Use

(ii) Use your knowledge and understanding of plasmolysis to explain how and why the cells changed when they were left in water.

.....

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.....

..... [2]

(d) Suggest how you would modify this investigation to find the **water potential** of the onion cells.

.....

.....

.....

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.....

.....

.....[3]

[Total: 22]

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2 You are required to investigate the effect of staining the tissues of sweet banana with iodine solution.

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You are provided with a piece of sweet banana.

Proceed as follows:

1. Cut a transverse (cross) section of the banana, approximately 5 mm thick, including the outer skin, as shown in Fig. 2.1.

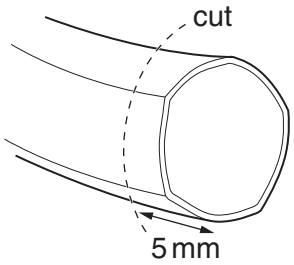


Fig. 2.1

(a) (i) Draw a large plan diagram of the transverse section.

[4]

2. Put two or three drops of iodine solution on the surface of the transverse section of the banana and spread out the iodine solution.

(ii) Observe the effect of iodine solution on the different tissues.

Annotate the diagram in **(a)(i)** to describe the effect of staining with iodine solution on the different tissues. [1]

(iii) Describe the pattern of staining that you observe.

.....

..... [1]

(b) (i) Calculate the ratio of the mean of the total width of the section to the mean width of the outer skin.

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You may lose marks if you do not show your working or if you do not use appropriate units.

[3]

(ii) State the value of the smallest division on the ruler used to measure the widths in **(b)(i)**. .....

State the actual error in measuring the widths in **(b)(i)**. ..... [1]

Table 2.1 shows some of the components in 100 g of plantain and sweet banana.

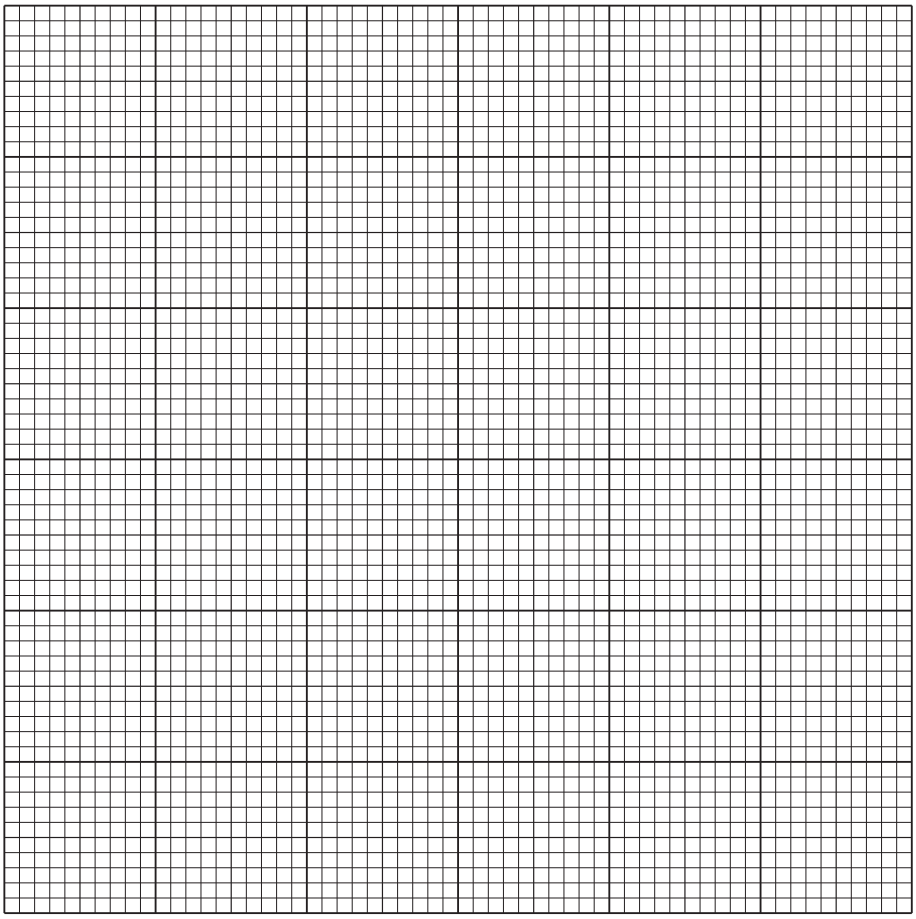
Table 2.1

component	percentage mass	
	plantain	**sweet banana**
fat	0.50	0.25
carbohydrate	28.00	19.50
protein	1.50	1.75
fibre and others	2.00	2.50

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(c) Plot a chart of the data in Table 2.1.

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[4]

The components in Table 2.1 make up a certain percentage of the total mass of the plantain and sweet banana. Water makes up the balance of the total mass.

(d) Calculate the difference in percentage water content between plantain and sweet banana.

You may lose marks if you do not show your working or if you do not use appropriate units.

..... % [4]

[Total: 18]

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

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7701667377

BIOLOGY **9700/32**

Advanced Practical Skills 2 **May/June 2012**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

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You will **gain marks** for recording your results according to the instructions.

1 Enzyme **E** catalyses the hydrolysis of starch. Starch can be found on the surface of some types of paper.

The end-point of this hydrolysis is the change of stained paper from blue/black to a light blue or white.

You are required to:

- make different concentrations of the enzyme solution, **E**
- investigate the effect of different concentrations of **E**, by finding the time taken for the blue/black colour of a square of paper to change to light blue or white.

You are provided with:

labelled	**contents**	**hazard**	**percentage concentration**	**volume /cm^3**
E	enzyme solution	irritant harmful	1.0	50
W	distilled water	none	–	50
iodine	iodine in potassium iodide solution	irritant harmful	diluted	–

(a) (i) Decide on the concentrations of **E** you will use in your investigation.

You will need to make up to 10 cm^3 of each **E** concentration.

Prepare the space provided on page 3 to show:

- the concentrations of **E**
- the volumes of **E**
- the volumes of **W**.

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Use this space:

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[3]

You are advised to read steps 1 to 12 before proceeding.

Proceed as follows:

1. Prepare the concentrations of enzyme solution as stated in **(a)(i)**.
2. Cut one piece of white paper 1 cm × 1 cm, from the grid on **page 15**.
3. Make a single cut, 1 cm long, in the end of a wooden splint as shown in Fig. 1.1.
4. Fit the piece of paper into the cut as shown in Fig. 1.2.

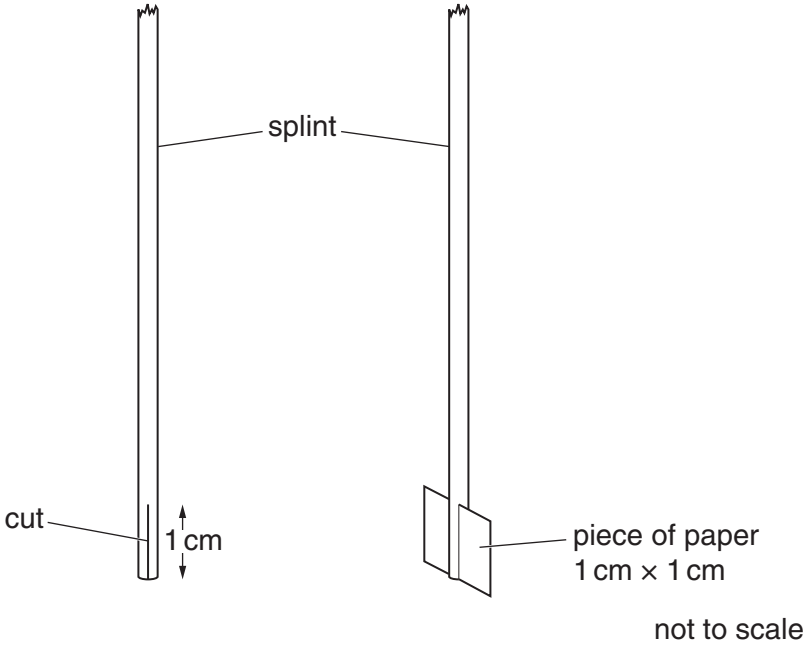


Fig. 1.1 **Fig. 1.2**

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5. Put the piece of paper into the **iodine** solution, as shown in Fig. 1.3, for at least 30 seconds so that the paper is evenly stained.

   This should be used as the colour standard.

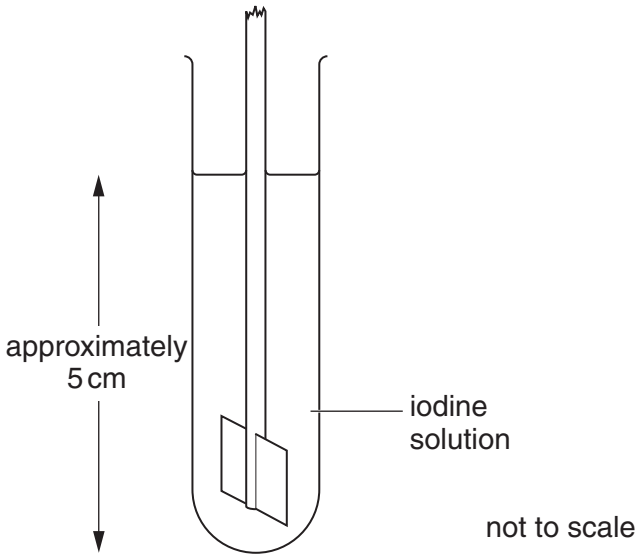


Fig. 1.3

6. Put one of the concentrations of **E** into a test-tube to a depth of 2 cm.

7. Repeat steps 2 to 5.

8. Put this splint and its piece of stained paper into the test-tube containing **E**, as shown in Fig. 1.4.

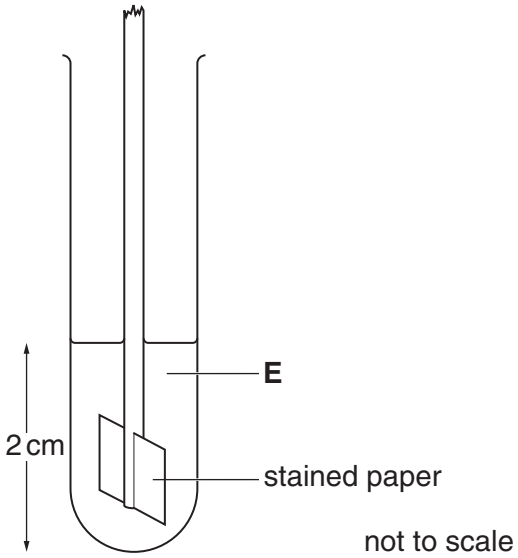


Fig. 1.4

9. Start timing.

10. Occasionally mix the contents by moving the test-tube.

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11. Record the time taken for the stained paper to reach the end-point.

    If the end-point is not reached at three minutes, stop timing. Record this as 'more than 180'.

12. Repeat steps 6 to 11 with each of the other concentrations of **E**.

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(ii) Prepare the space below and record your results.

[5]

(iii) Describe how you would set up a control using the apparatus provided.

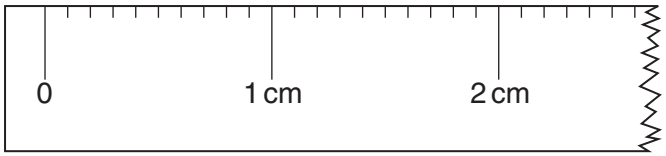
.....

.....

..... [1]

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(iv) Fig. 1.5 shows the ruler used by a student in step 6 to measure the depth of **E**.



magnification × 3

Fig. 1.5

State the degree of uncertainty of the measurements using this ruler.

..... [1]

(v) Identify **two** significant sources of error in your investigation.

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..... [2]

(vi) Suggest how you would make **two** improvements to this investigation.

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..... [2]

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Question 1 continues on page 8

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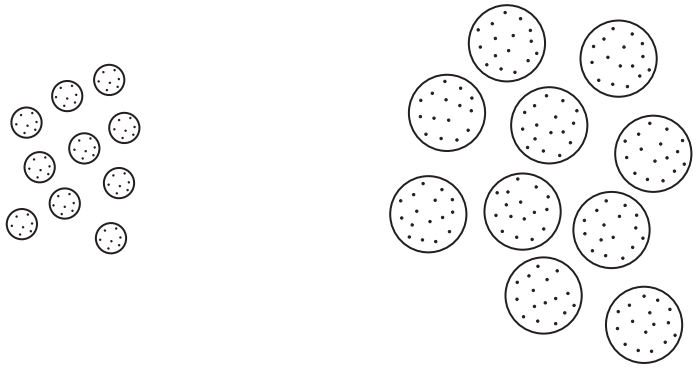
Lactase is an enzyme which catalyses the hydrolysis of lactose.

Lactase can be held on the surface of alginate beads (immobilised) and put into lactose solution.

A student investigated the effect of varying the size of alginate beads on the rate of reaction of lactase on lactose.

Other variables were considered and kept to a standard. There were 10 beads of each diameter.

Fig. 1.6 shows two of the sets of beads and the distribution of the lactase molecules.



not to scale

Fig. 1.6

The results of the student's investigation are shown in Table 1.1.

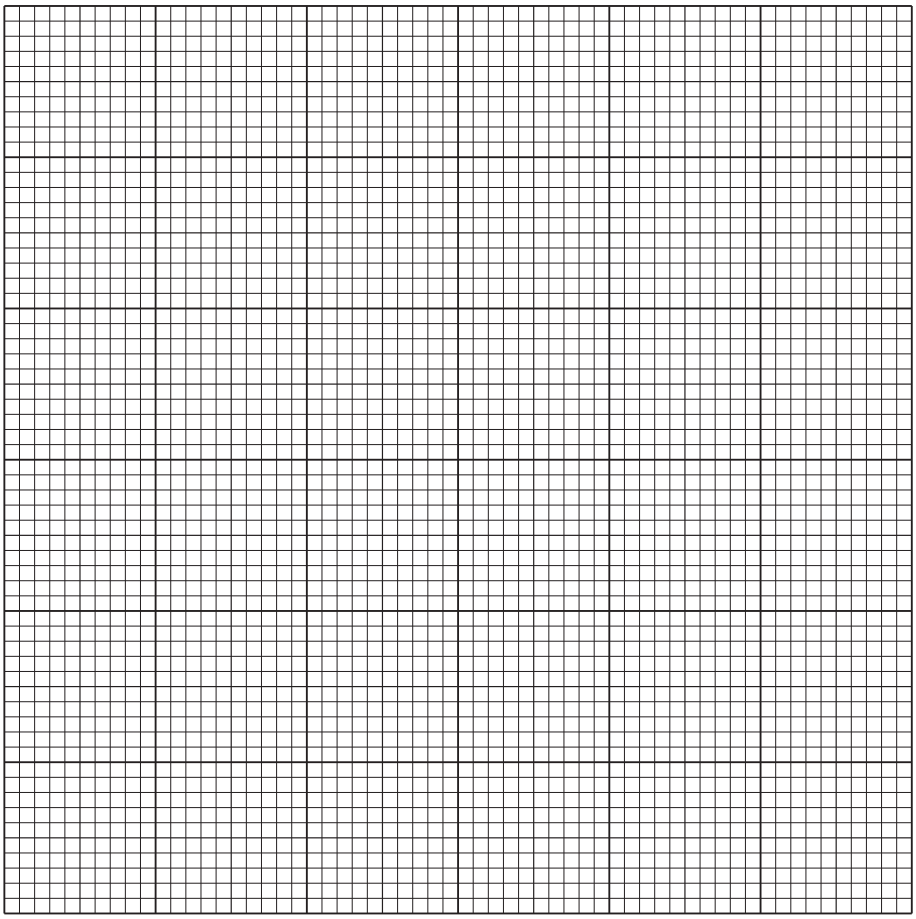
Table 1.1

bead diameter /mm	mass of product in a minute / mg min^{-1}
1.0	24.0
1.5	30.5
3.0	42.0
4.5	50.0
6.0	52.5

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(b) (i) Plot a graph of the data shown in Table 1.1.

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[4]

(ii) From your graph state the mass of product formed in a minute for immobilised lactase beads of 2 mm diameter.

..... [1]

(iii) Explain the effect of immobilised lactase bead diameter on the mass of product formed in a minute, using the data and Fig. 1.6.

.....

.....

.....

.....

..... [3]

[Total: 22]

2 **J1** is a slide of a stained transverse section through a mammalian lung.

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(a) Make a large drawing to show the walls of **two** whole alveoli.

Label a nucleus.

[5]

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Fig. 2.1 is a photomicrograph of a transverse section through an artery which shows the lumen partially blocked. A grid has been placed over the photomicrograph to help you answer **(b)(i)** and **(ii)**.

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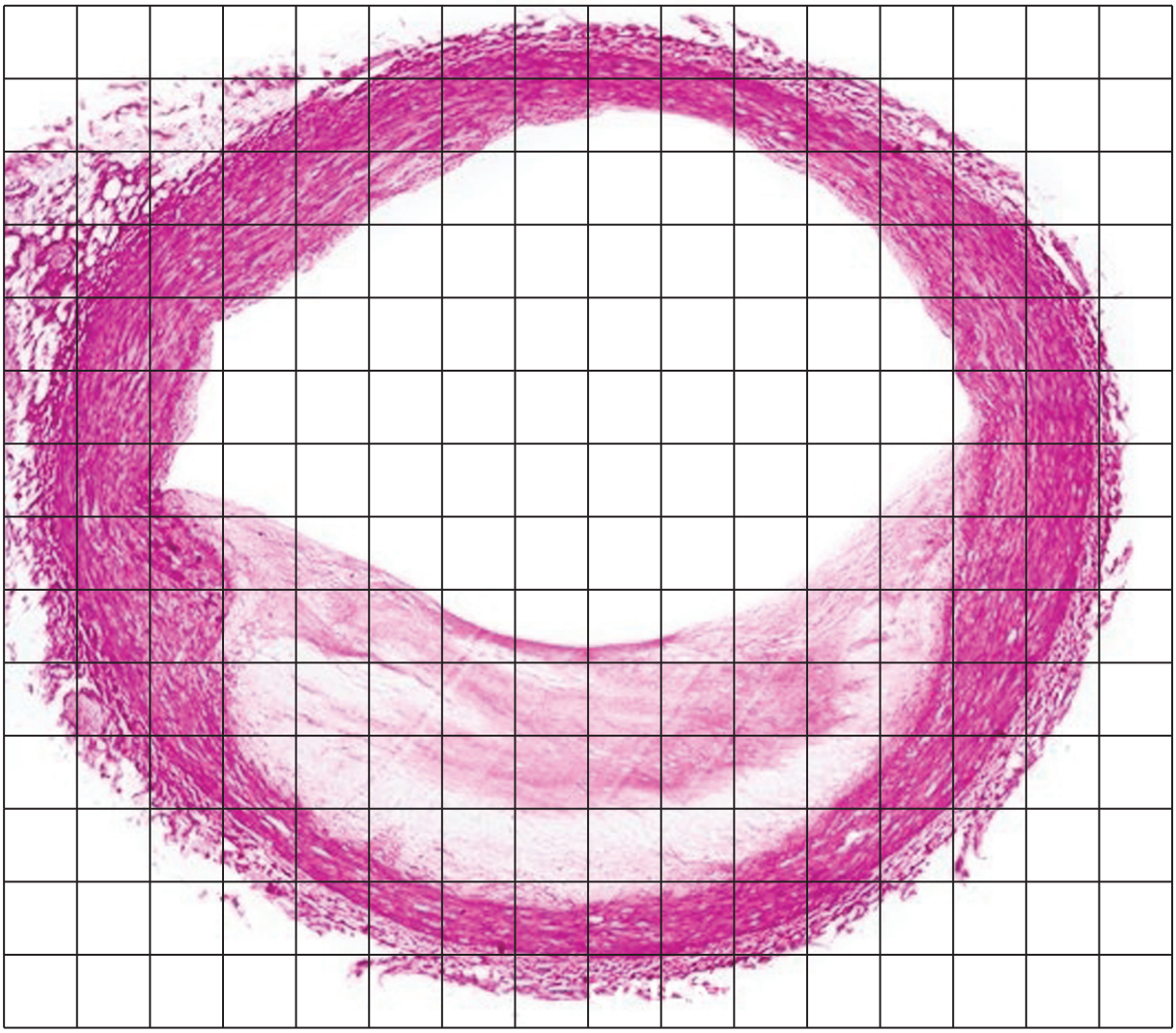


Fig. 2.1

(b) (i) Describe how you will use the grid to find the total area of the lumen and the area of the lumen that is blocked.

.....

.....

..... [1]

(ii) Calculate the percentage change in area of the lumen caused by the blockage.

You may lose marks if you do not show your working or if you do not use appropriate units.

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.....% [4]

Fig. 2.2 and Fig. 2.3 are photomicrographs of red blood cells from a fish species and a frog species respectively.

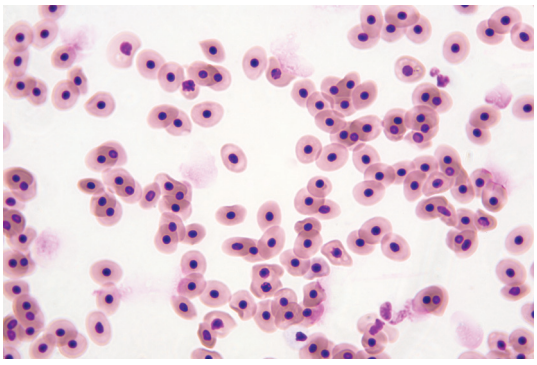
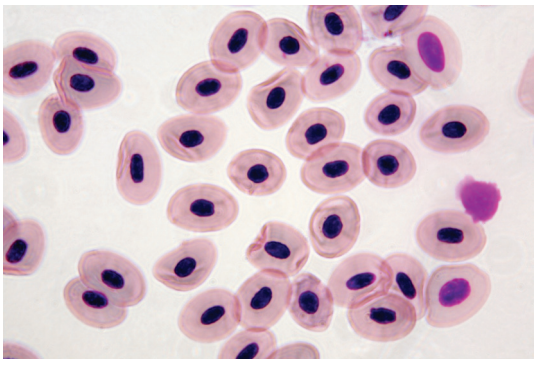


Fig. 2.2



magnification ×630 **Fig. 2.3**

(iii) Make a large drawing of two red blood cells from each species.

Label the cell membrane of one red blood cell.

Fish cells

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Frog cells

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[4]

(iv) Prepare the space below so that it is suitable for you to show the observable differences between the specimens in Fig. 2.2 and 2.3.

Record your observations in the space you have prepared.

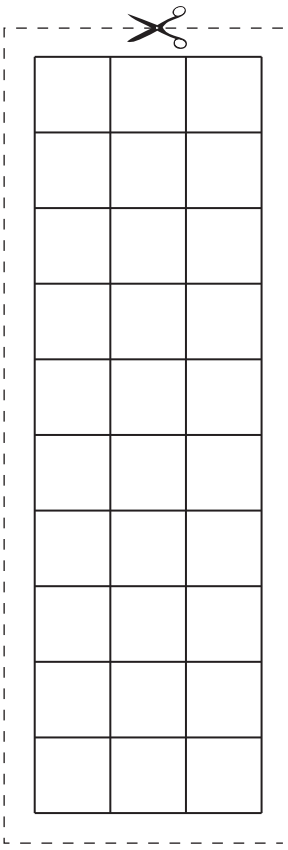
[4]

[Total: 18]

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Grid for use in Question 1:



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

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

6587875117

BIOLOGY **9700/33**

Advanced Practical Skills 1 **May/June 2012**

2 hours

Candidates answer on the Question Paper.

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1 When onion cells are placed into a sodium chloride solution with a higher concentration than the cells, water leaves the vacuoles and the cells become plasmolysed. In each concentration there will be cells which may show different states of plasmolysis.

You are provided with four samples of onion tissue, each soaked in a different concentration of sodium chloride solution, labelled **S1**, **S2**, **S3** and **S4**.

labelled	concentration of sodium chloride solution / mol dm^{-3}
S1	0.8
S2	0.4
S3	0.2
S4	unknown

You are required to:

- observe and record the cells at different states of plasmolysis in **S1**, **S2**, **S3** and **S4**
- use these results to answer **(a)(iii)** concerning the unknown concentration in **S4**.

Fig. 1.1 will help you decide on the state of plasmolysis of the onion cells.

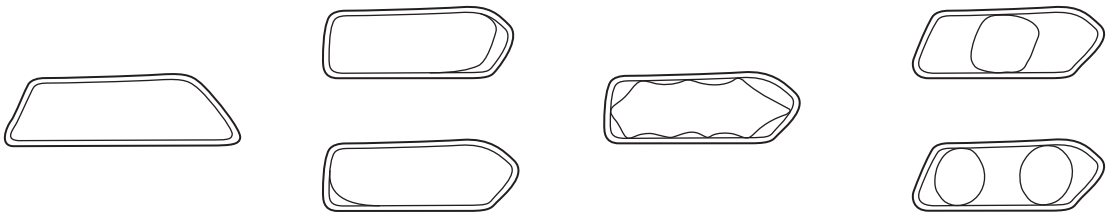


Fig. 1.1

You are advised to read steps 1 to 10 before proceeding.

Proceed as follows:

1. Label one **dry and clean** microscope slide **S1** and put the slide on a paper towel.
2. Put a few drops of the sodium chloride solution from **S1** onto the slide.

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3. Remove a piece of the onion tissue from solution **S1** and, using forceps or fingers, peel off the inner concave epidermis, as shown in Fig. 1.2.

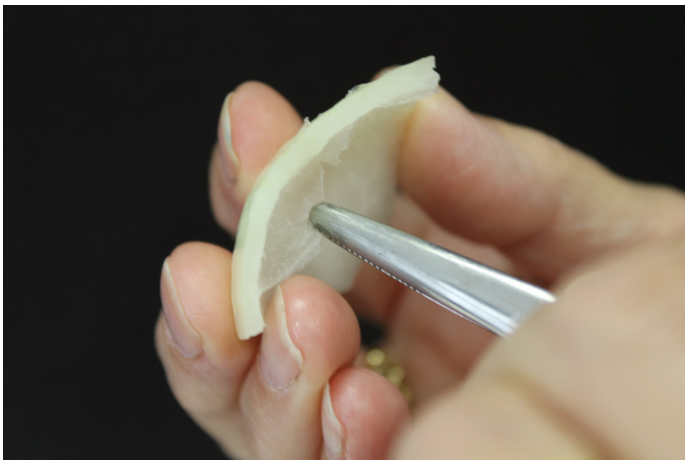


Fig. 1.2

4. Cut one piece of the epidermis that will fit under a coverslip. Replace the remaining epidermis into the solution in **S1**.

5. Place the epidermis in the sodium chloride solution on the slide as shown in Fig. 1.3. If the epidermis is folded, you may need to add more drops of sodium chloride solution so that it floats and uncurls. It is important to prevent the epidermis from drying out.

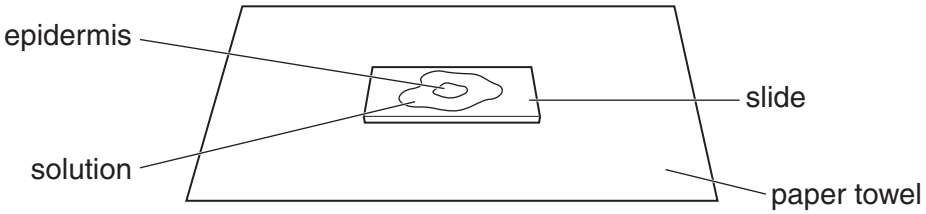


Fig. 1.3

6. Cover the epidermis on the slide with a coverslip and use a paper towel to remove any excess liquid that is outside the coverslip.

7. Observe the states of plasmolysis of the cells using the microscope.

8. You may need to reduce the amount of light entering the microscope to observe the cells clearly.

(a) (i) Describe how you will obtain accurate results to record the cells at different states of plasmolysis.

.....

.....

.....[1]

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(ii) Prepare the space below for recording your results.

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[4]

9. Record your results for **S1** as you have described in **(a)(i)**.

10. Repeat steps 1 to 9 with **S2**, **S3** and **S4**.

(iii) Use your results to complete the following statement.

The sodium chloride concentration of the unknown sample, **S4**, is between

..... mol dm^{-3} and ..... mol dm^{-3}. [1]

(iv) Identify **one** significant source of error in using Fig. 1.1 to obtain your results.

.....

.....

.....[1]

(v) Suggest how you would make **three** improvements to this investigation.

.....

.....

.....

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.....

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.....[3]

A student investigated the effect of different sodium chloride concentrations on red blood cells.
Red blood cells are destroyed (haemolysed) when placed in a sodium chloride solution with a lower concentration than the cells.

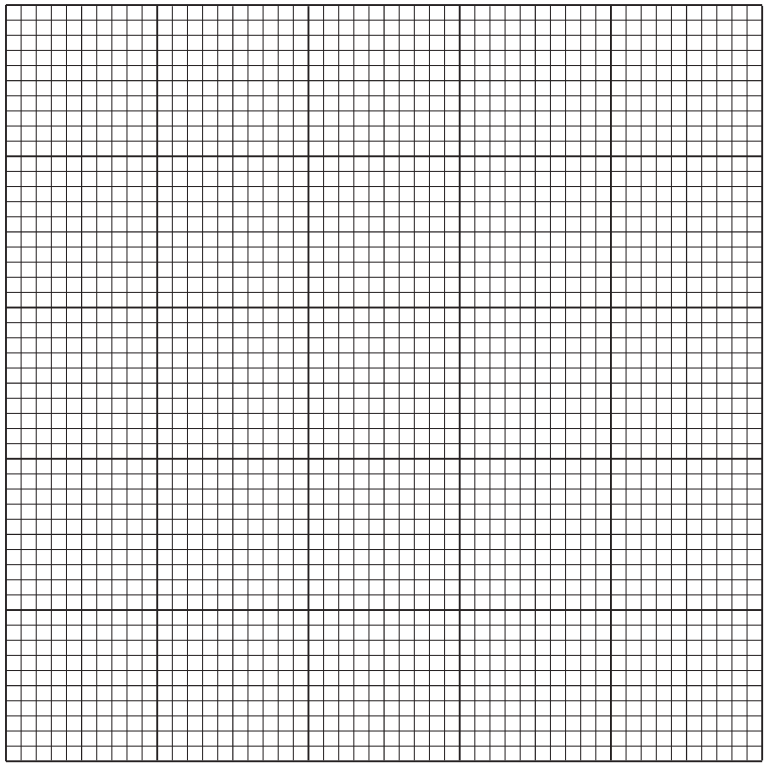
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The student's results are shown in Table 1.1.

Table 1.1

concentration of sodium chloride / × 10^{-2} mol dm^{-3}	percentage of red blood cells destroyed
5.5	100
6.0	96
6.5	74
7.0	31
7.5	10
8.0	0

(b) (i) Plot a graph of the data shown in Table 1.1.



[4]

(ii) State the sodium chloride concentration at which 50% of the red blood cells are destroyed.

Show on the graph how you obtained the concentration. [1]

Sodium chloride concentration .....[1]

(iii) Explain what is happening between the red blood cells and the external solutions when 0 and 100% of red blood cells are destroyed.

For Examiner's Use

0% red blood cells destroyed

.....

.....

.....

100% red blood cells destroyed

.....

.....

.....[3]

[Total: 19]

2 Cell surface membranes are made up of proteins and phospholipids. The phospholipids form a bilayer. Egg yolk is a source of protein and oil is a source of lipids. These can be used to investigate the effect of mixing egg yolk with oil and with water.

For Examiner's Use

You are required to observe the effect of:

- mixing oil and water
- adding egg yolk to oil
- mixing the egg yolk with oil and water.

You are provided with:

labelled	contents
Y	egg yolk (in a syringe)
O	oil
W	distilled water

You are advised to read steps 1 to 10 before proceeding.

Proceed as follows:

1. Label a test-tube, **P**, and half-fill with water.

2. Use a syringe to put 5 cm^3 of oil down the inside of test-tube **P** to form a layer on top of the water.

3. Repeat steps 1 and 2 with a test-tube, labelled **Q**.

4. As shown in Fig. 2.1, hold test-tube **P** near the top and rapidly move the test-tube five times to partly mix the oil and water.

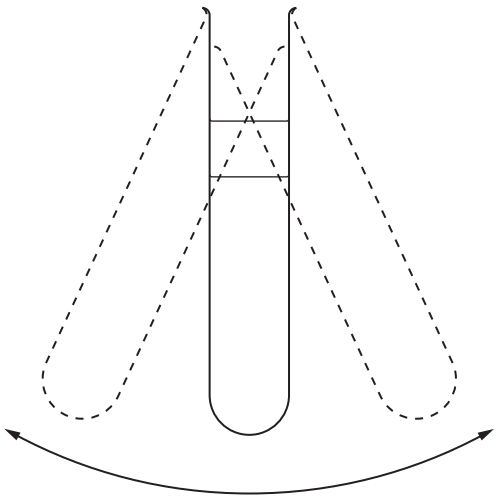


Fig. 2.1

5. Observe the contents of **P** and **Q**.

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(a) (i) Complete Fig. 2.2 to show your observations.

Label and annotate **P** and **Q** in Fig. 2.2 to describe your observations.

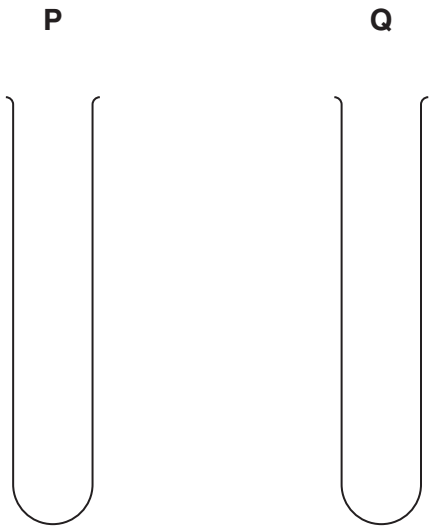


Fig. 2.2

[1]

6. Hold the syringe, labelled **Y**, in the test-tube, labelled **Q**, so that you can release one drop close to the surface of the oil.

7. Observe the contents of **Q**.

(ii) Complete Fig. 2.3 to show your observations.
Label and annotate **Q** in Fig. 2.3 to describe your observations.

Q (with egg yolk)

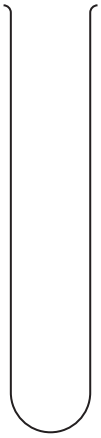


Fig. 2.3

[3]

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8. As shown in Fig. 2.4 put a bung in the test-tube labelled **Q**. Shake the test-tube vigorously to mix the oil and water thoroughly so that the egg yolk is broken up.

For Examiner's Use

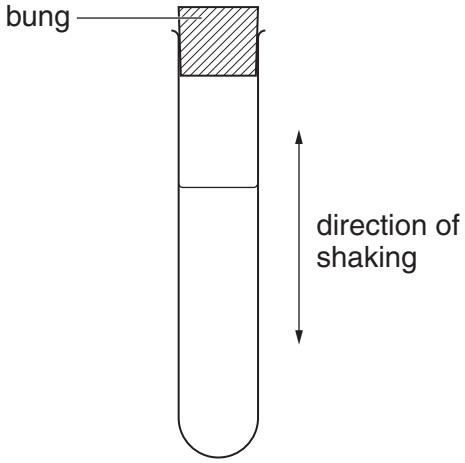


Fig. 2.4

9. As shown in Fig. 2.4 put a bung in the test-tube labelled **P**. Shake the test-tube vigorously to mix the oil and water.

10. After two minutes, observe the contents of **P** and **Q**.

(iii) Complete Fig. 2.5 to show your observations.
Label and annotate **P** and **Q** in Fig. 2.5 to describe your observations.

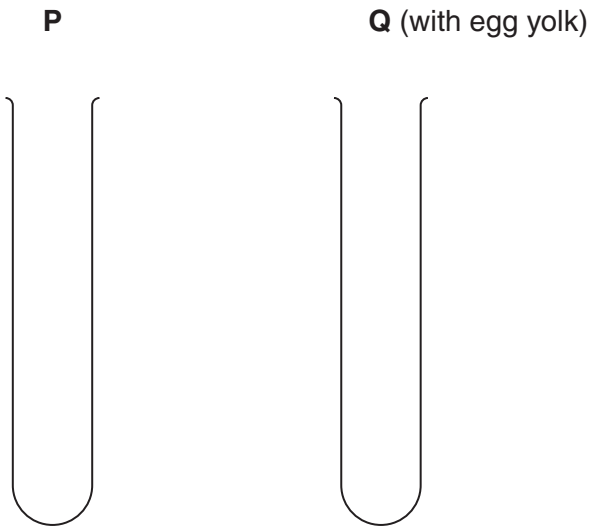
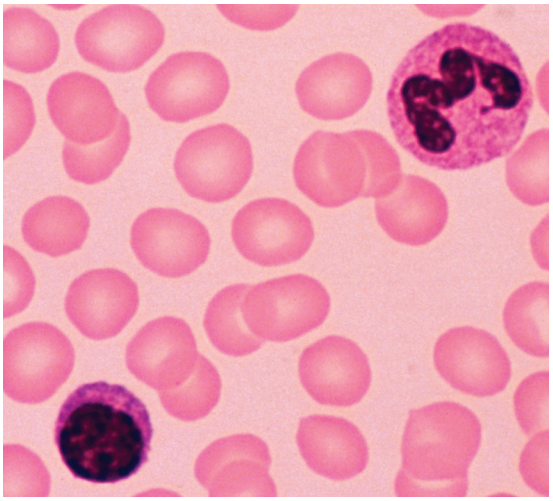


Fig. 2.5

[2]

Fig. 2.6 is a photomicrograph of normal human blood cells.

For Examiner's Use



magnification × 250

Fig. 2.6

(b) (i) Make a large drawing of three different types of blood cell.

Mark on the photomicrograph the cells that you have drawn.

[4]

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(ii) Prepare the space below so that it is suitable for you to show the observable differences between the red blood cells and the white blood cells shown in Fig. 2.6.

For Examiner's Use

Record your observations in the space you have prepared.

[5]

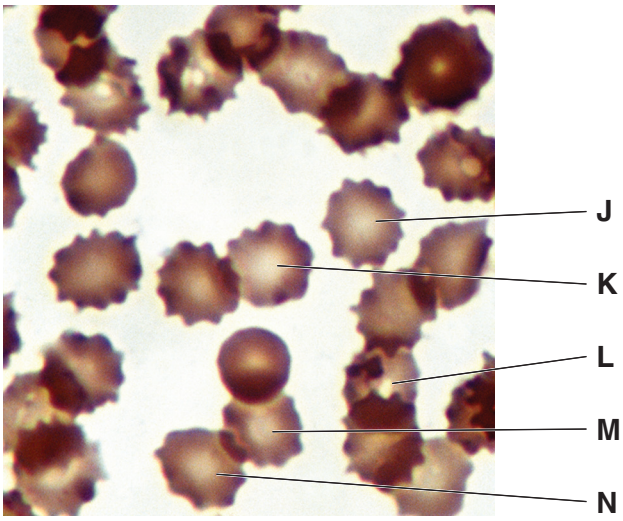
Question 2 continues on page 12

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[Turn over

Fig. 2.7 is a photomicrograph of human red blood cells that have lost water through their surface membrane causing them to change shape.

For Examiner's Use



magnification × 1430

Fig. 2.7

(iii) Use the magnification to calculate the **mean actual diameter**, in μm, of a crenated red blood cell using the labelled cells in Fig. 2.7.
Draw the red blood cell, labelled **J**, and show where you measured this cell.

You may lose marks if you do not show your working or if you do not use appropriate units.

..... μm [6]

[Total: 21]

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

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2235206891

BIOLOGY **9700/34**

Advanced Practical Skills 2 **May/June 2012**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

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Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black ink.
You may use a pencil for any diagrams, graphs or rough working.
Do **not** use red ink, staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

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.

For Examiner's Use	
1	
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You are reminded that you have **only one hour** for each question in the practical examination.

For Examiner's Use

You should:

- Read carefully through **the whole** of Question 1 and Question 2.
- Plan your use of **the time** to make sure that you finish all the work that you would like to do.

You will **gain marks** for recording your results according to the instructions.

1 Plant cells contain an enzyme, catalase, which catalyses the hydrolysis (breakdown) of hydrogen peroxide into oxygen and water. An extract of plant tissue contains catalase.

You are required to:

- make different concentrations of plant extract containing catalase
- investigate the effect of different concentrations of plant extract by finding the time taken for a square of filter paper, soaked in the plant extract, to rise in hydrogen peroxide solution.

You are provided with:

labelled	contents	hazard	volume /cm^3
H	hydrogen peroxide solution	harmful irritant	100
W	distilled water	none	80
P	100% plant extract solution	none	50

(a) (i) Decide on the concentrations of plant extract solution you will use in your investigation.

You will need to make up 10 cm^3 of each concentration of plant extract solution.

Prepare the space on page 3 to show:

- the concentration of **P**
- the volumes of **P**
- the volumes of **W**.

[3]

Use this space:

For Examiner's Use

You are advised to read steps 1 to 10 before proceeding.

Proceed as follows:

1. Prepare the concentrations of plant extract solution as stated in **(a)(i)**.

2. Put **H** into the test-tube, filling to within 2 cm from the top.

3. Cut squares of filter paper, 1 cm × 1 cm.

4. Use forceps to pick up one square of filter paper and dip the whole square into one of the concentrations of plant extract solution in its container.

5. Wipe the square against the inside of the container to remove excess plant extract solution from both sides of the square.

6. Hold the square so that the top of the square is level with the surface of **H** as shown in Fig. 1.1.

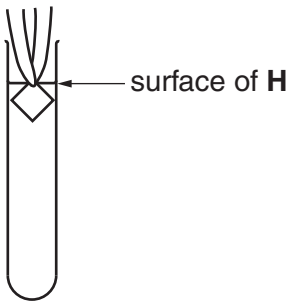


Fig. 1.1

7. Release the square (you may need to shake the forceps) and start timing.

8. Record the time taken for the square to return to the surface.
   If the time is more than three minutes, stop timing and record 'more than 180'.

9. Remove the square from the test-tube.

10. Repeat steps 4 to 9 with the other concentrations of plant extract.

(ii) Prepare the space below and record your results.

For Examiner's Use

[6]

(iii) Identify **three** significant sources of error in your investigation.

.....

.....

.....

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.....

.....

..... [3]

(iv) Suggest how you would make **three** improvements to this investigation.

.....

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..... [3]

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Catalase catalyses the hydrolysis of hydrogen peroxide into oxygen and water.

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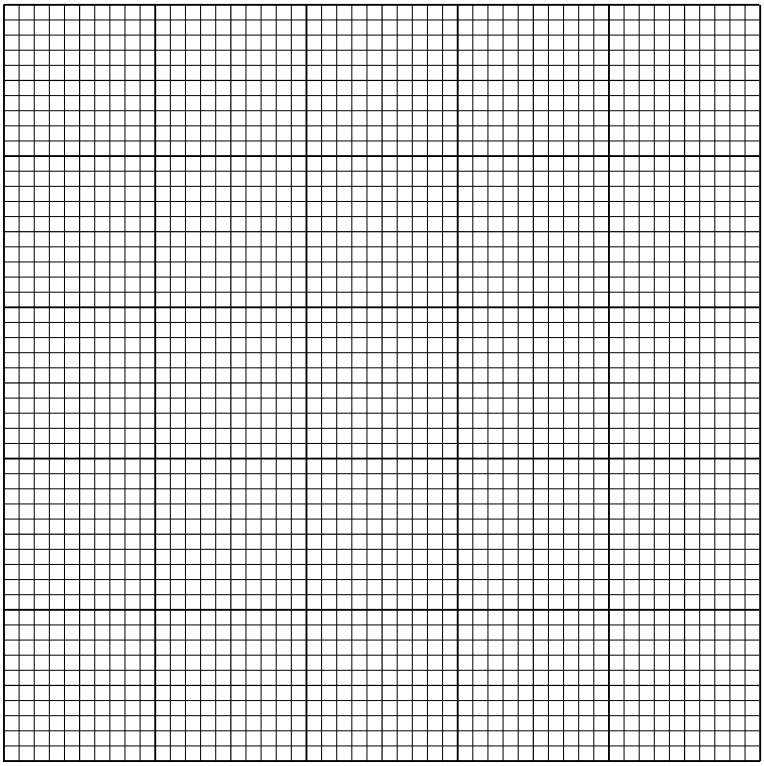
A student investigated the effect of changing the concentration of hydrogen peroxide solution on this hydrolysis.
For each concentration of hydrogen peroxide solution the time to collect 25 cm^3 of oxygen was recorded.

Table 1.1 shows the results of the student's investigation.

Table 1.1

percentage concentration of hydrogen peroxide	**time to collect 25 cm^3 of oxygen /s**
4	47
8	18
12	15
16	13
25	11

(b) (i) Plot a graph of the data shown in Table 1.1.



[4]

(ii) Explain the effect of changing the concentration of hydrogen peroxide.

For Examiner's Use

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 22]

2 **K1** is a slide showing transverse sections through blood vessels.

Select one large artery and one large vein.

(a) **(i)** Draw a large plan diagram of two different types of blood vessel on slide **K1**.

Label the muscle layer in the artery.

[5]

Fig. 2.1 is a photomicrograph of a transverse section through lung tissue.

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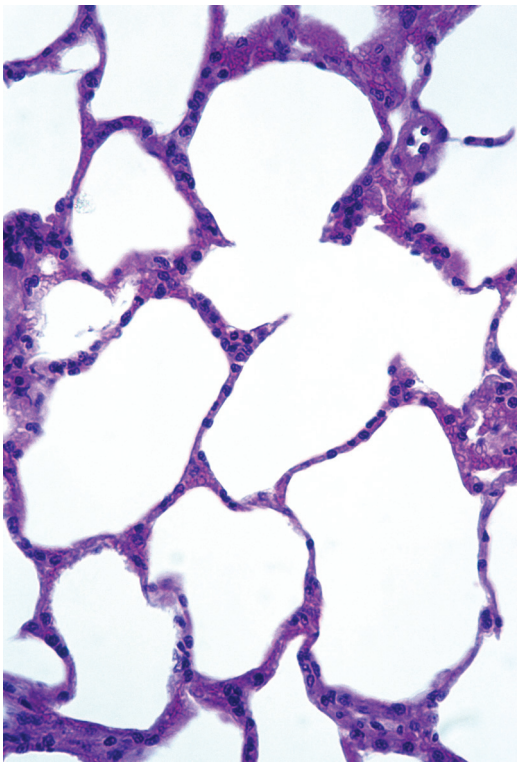


Fig. 2.1

(ii) Make a large drawing to show the walls of **two** whole alveoli that are touching each other.

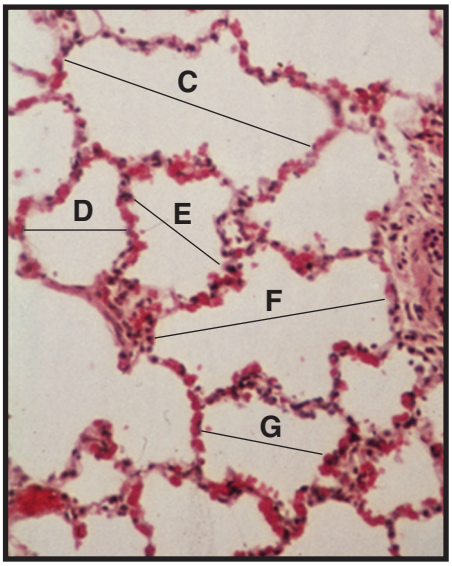
Label the gas exchange membrane.

[5]

Fig. 2.2 is a photomicrograph of a transverse section through healthy lung tissue.

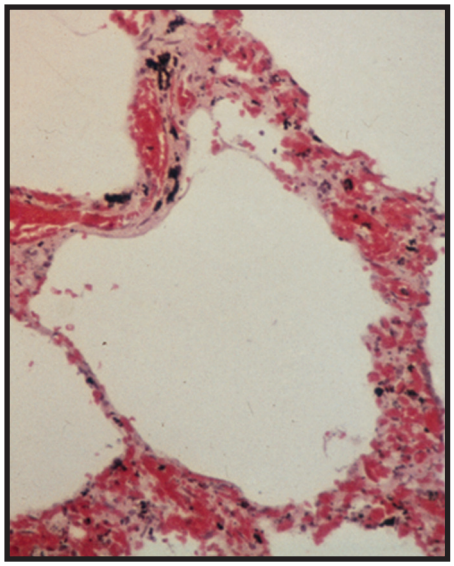
Fig. 2.3 is a photomicrograph of a transverse section through unhealthy lung tissue.

For Examiner's Use



magnification ×95

Fig. 2.2



magnification ×95

Fig. 2.3

To find the mean diameter of an alveolus in the healthy lung, a student measured five alveoli, as shown by the lines **C**, **D**, **E**, **F** and **G** in Fig. 2.2.

(iii) Use the magnification to calculate the mean actual diameter, in μm, of an alveolus using the lines **C**, **D**, **E**, **F** and **G**.

You may lose marks if you do not show your working or if you do not use appropriate units.

..... μm [3]

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(iv) Prepare the space below so that it is suitable for you to show the observable differences between the specimens in Fig. 2.2 and Fig. 2.3.

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Record your observations in the space you have prepared.

[5]

[Total: 18]

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General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CANDIDATE NAME

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7513769989

BIOLOGY **9700/35**

Advanced Practical Skills 1 **May/June 2012**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

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Write in dark blue or black ink.
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DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

You may lose marks if you do not show your working or if you do not use appropriate units.

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Total	

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You should:

- Read carefully through **the whole** of Question 1 and Question 2.
- Plan your use of **the time** to make sure that you finish all the work that you would like to do.

You will **gain marks** for recording your results according to the instructions.

1 When plant cells are placed into different concentrations of sodium chloride solution, water moves between the cells and the solutions. This will affect how much a piece of plant tissue can bend.

Fig. 1.1 shows how the angle of bend of a sample of plant tissue can be measured after you have pushed it until it will bend no further without breaking.

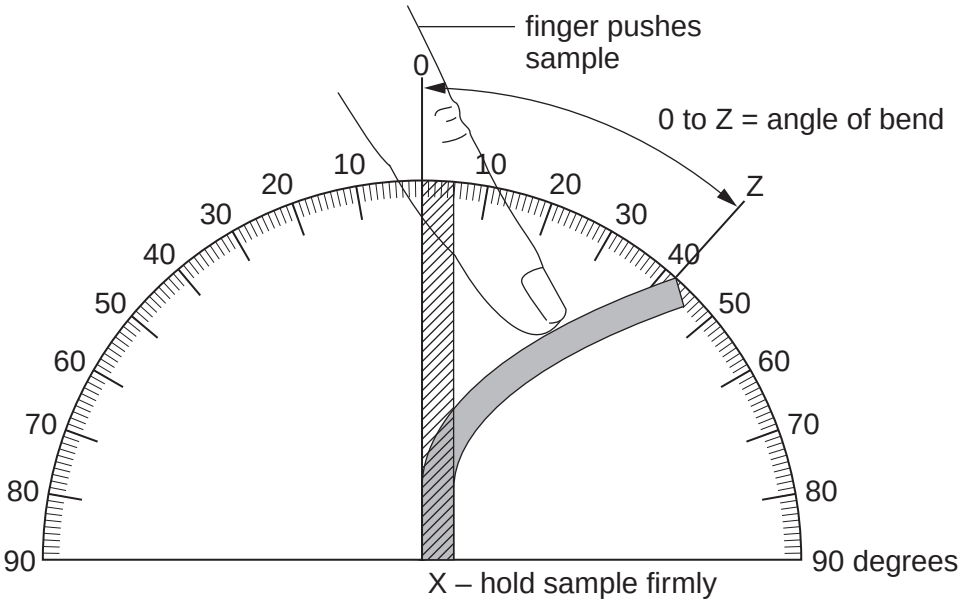


Fig. 1.1

You are provided with eight pieces of plant tissue, each soaked in a different concentration of sodium chloride solution labelled **P1**, **P2**, **P3** and **P4**.

P1, **P2** and **P3** each contain one of the concentrations of sodium chloride solution, 1.00 mol dm^{-3}, 0.50 mol dm^{-3} and 0.25 mol dm^{-3} but not necessarily in that order.

P4 has an unknown concentration of sodium chloride solution.

(a) (i) When samples of the plant tissue from each of the concentrations of sodium chloride solution are put into water, water will move.
Select the correct words from "**least**", "**most**", "**same**" to complete the sentence below.
You may use a word once, more than once or not at all.

The sample of plant tissue soaked in the highest concentration of sodium chloride solution will have the ..... bend at the start and when placed in water the bend will change the ..... . [1]

For Examiner's Use

You are required to:

- Observe and record the effect of putting samples of plant tissue from **P1**, **P2**, **P3** and **P4** into water, **W**, for different times up to 10 minutes.
- Use these results to answer **(b)(ii)** concerning the concentrations of the sodium chloride solutions, **P1**, **P2**, **P3** and **P4**.

The size of plant tissue is a variable which needs to be considered. Each piece of plant tissue should be a standard size.

(ii) Decide how you will make sure that the pieces of plant tissue are standard size.

State the size you will use.

.....

..... [1]

(iii) Describe how you will obtain accurate results to record the angle of bend of the plant samples.

..... [1]

You are advised to read steps 1 to 5 before proceeding.

(iv) To observe the effect of putting samples of plant tissue from **P1**, **P2**, **P3** and **P4** into **W** for different times up to 10 minutes you need to decide the times you will use.

State the times at which you will measure the angle of bend.

..... [1]

Proceed as follows:

1. Cut the pieces of plant tissue as stated in **(a)(ii)**.

2. Measure the angle of bend of the samples of plant tissue from **P1**, **P2**, **P3** and **P4** as shown in Fig. 1.1. Record your results in **(b)(i)**.

3. Put the samples from **P1**, **P2**, **P3** and **P4** into separate containers and add **W** to each container so that the samples are covered.

4. Start timing.

5. Measure the samples at each of the times that you decided in **(a)(iv)**.

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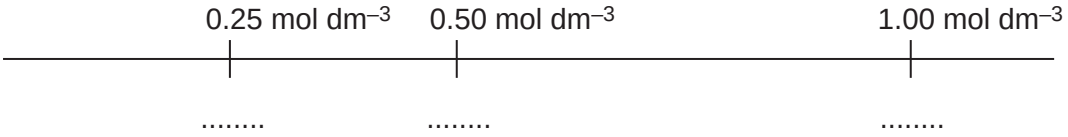
(b) (i) Prepare the space below and record your results.

For Examiner's Use

[7]

(ii) Use your results in **(b)(i)** to identify the concentrations of the sodium chloride solutions.

Complete the diagram below to show the position of each of the concentrations **P1**, **P2** and **P3**. Write "**P4**" where it fits in the series of sodium chloride concentrations.



[2]

(iii) Explain the effect of putting the plant tissue from **P1** into water, **W**.

.....

.....

.....

.....

.....[1]

(iv) Identify **two** significant errors in this investigation.

For Examiner's Use

.....

.....

.....

.....

.....[2]

(v) A protractor was used to measure the angle of bend.

State the value of the smallest division on the protractor. .....

State the actual error in using the protractor to measure the angle of bend.

.....[1]

(vi) Suggest how you would make this investigation as reliable as possible.

.....

.....

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.....[3]

[Total: 20]

For Examiner's Use

2 Iodine solution and methylene blue solution are used as stains for biological material.

You are required to:

- observe the effect of using the different stains, iodine solution and methylene blue solution, on thin sections of plant material, **S**
- record observations of the cells and their cell contents.

Iodine solution and methylene blue solution will stain your skin. Handle the stained plant material with forceps.

If any methylene blue comes into contact with your skin wash it off immediately with water.

1. Label two microscope slides, **S1** and **S2**.

2. Put **one or two drops** of iodine solution onto slide **S1** and **one or two drops** of methylene blue solution onto slide **S2**.

3. Cut two very thin sections of the plant material, **S**.

4. Put a thin section onto the drops of stain on each slide as shown in Fig. 2.1.

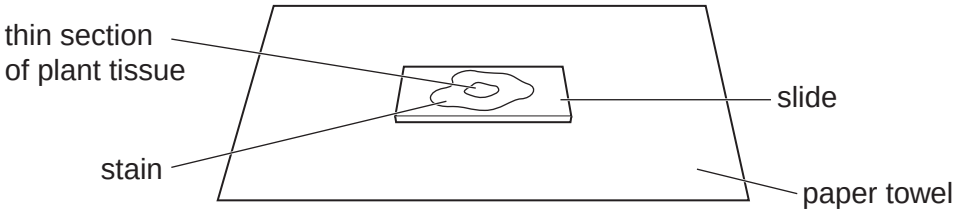


Fig. 2.1

5. Put a few more drops of iodine solution onto the plant section on **S1** and put a few more drops of methylene blue solution onto the plant section on **S2**. Make sure the iodine solution and the methylene blue solution cover each of the sections.

6. Place a coverslip onto each slide. The coverslip may not lie flat.

7. Use the paper towel to dry off any excess liquid around the coverslip.

8. View the slides using the microscope. Look for the thinnest part of the section, which may be at the edge, so that the cells and their contents can be observed.

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(a) From each slide **S1** and **S2**, make large labelled drawings of two adjacent (touching) cells and their cell contents.

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Label one starch grain.

Annotate your drawings to describe one observable difference between **S1** and **S2**.

[6]

Fig. 2.2 is a photomicrograph of a transverse section through the vascular tissue of a leaf. This plant is native to the Himalayan mountains.

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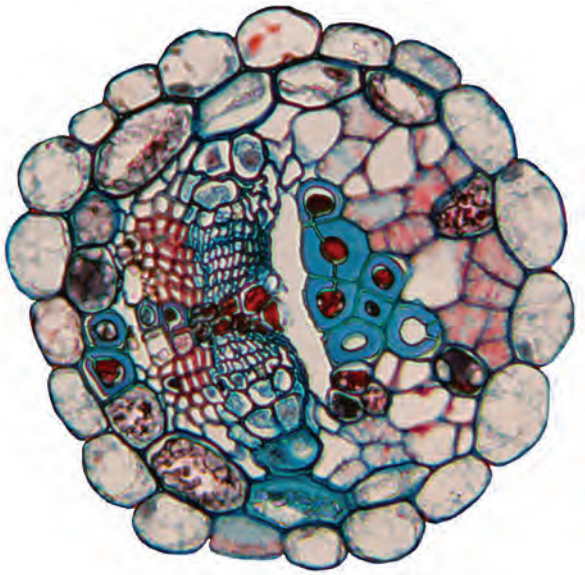


Fig. 2.2

(b) (i) Draw a large plan diagram of the tissues in the section shown in Fig. 2.2.

Label the xylem.

[6]

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(ii) In Fig. 2.2 there is an outer ring of cells.

Calculate the ratio of the mean length of these cells to the mean width of these cells.

You may lose marks if you do not show your working or if you do not use appropriate units.

For Examiner's Use

[2]

Question 2 continues on page 10

In an investigation the concentration of sugars in a plant were measured over 24 hours. For the first eight hours, the plant was in the dark, then it was placed in the light for the remaining 16 hours.

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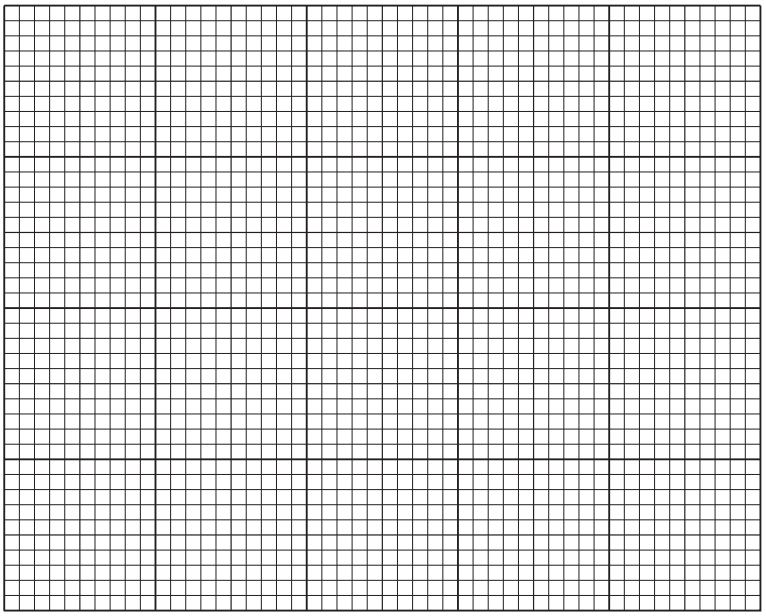
The concentrations of sugars were measured in samples taken from leaves and from phloem sieve tubes.

Table 2.1 shows the results of this investigation.

Table 2.1

time / hours	concentration of sugars / μmol	
	in leaves	in phloem sieve tubes
0	0.38	0.22
5	0.21	0.17
8	0.12	0.12
15	0.24	0.16
24	0.39	0.22

(c) (i) Plot a graph of the data shown in Table 2.1.



[4]

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(ii) Describe the trend for the concentration of sugars in the phloem. Suggest an explanation for the trend.

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.....[2]

[Total: 20]

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