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CANDIDATE NAME

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7732865742

BIOLOGY **9700/31**

Advanced Practical Skills 1 **May/June 2015**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

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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.

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Before you proceed, read carefully through **the whole** of Question 1 and Question 2.

Plan the use of the two hours to make sure that you finish all the work that you would like to do.

If you have enough time, consider how you can improve the accuracy of your results, for example by obtaining one or more additional measurements.

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

1 Starch is the substrate of enzyme **E**. When they are mixed, a reaction takes place and a biological molecule is produced, the product.

You are required to investigate the effect of enzyme **E** on starch.

You are provided with:

labelled	contents	hazard
S	1% starch solution	none
E	enzyme solution	harmful irritant
W	distilled water	none
iodine	iodide solution	harmful
Benedict's	Benedict's solution	harmful

Proceed as follows:

1. Set up a water-bath to heat to boiling (approximately 100 °C) ready for step 9.
2. Test a drop of solution **S** for starch and record your observations in **(a)(i)**.
3. Put 3 cm^3 of **S** into a test-tube.
4. Put 1 cm^3 of **E** into the same test-tube.
5. Shake the test-tube gently to mix the contents.
6. Leave the test-tube for 5 minutes, shaking it occasionally.
7. After 5 minutes, test a drop of the mixture from the test-tube for starch and record your observations in **(a)(i)**.

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(a) (i) Prepare the space below and record your observations.

[3]

The rate at which enzyme **E** catalyses a reaction with **S** can be investigated by measuring the rate at which the products of the reaction are produced.

You are required to identify the type of biological molecule produced (the product) when **S** and **E** are mixed.

8. Put 4 cm^3 of **Benedict's** into the test-tube containing the mixture of **S** and **E**. This will inhibit enzyme **E**.

9. Put this test-tube into the boiling water-bath and immediately start timing.

(ii) Record the time taken for the first appearance of any colour change. If there is no colour change after 180 seconds remove the test-tube from the water-bath and record your result.

..... [1]

10. Turn off the Bunsen burner.

(iii) Explain the effect that enzyme **E** has on starch, using your observations from **(a)(i)** and the result from **(a)(ii)**.

..... [1]

(iv) Suggest the name of a biological molecule that could have been produced when **S** and enzyme **E** were mixed.

..... [1]

When carrying out a practical procedure, the hazards of the use of all the apparatus and all of the reagents need to be considered, then the **level** of risk needs to be assessed as low or medium or high.

(v) State the hazard with the greatest level of risk when carrying out steps 8 to 10.

State the level of risk of the procedure: low or medium or high.

hazard .....

level of risk .....

[1]

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[Turn over

A student investigating the effect of enzyme **E** on starch suggested the hypothesis:

"lowering the concentration of starch below 1% will have no effect on the rate at which the product is produced."

You are required to investigate this hypothesis by:

- carrying out a **serial** dilution of **S**
- investigating the effects of different concentrations of starch solution on the rate at which the product is produced.

(b) (i) You are required to make a **serial** dilution of the 1% starch solution, **S**, which reduces the concentration of the starch solution **by half** between each successive dilution.

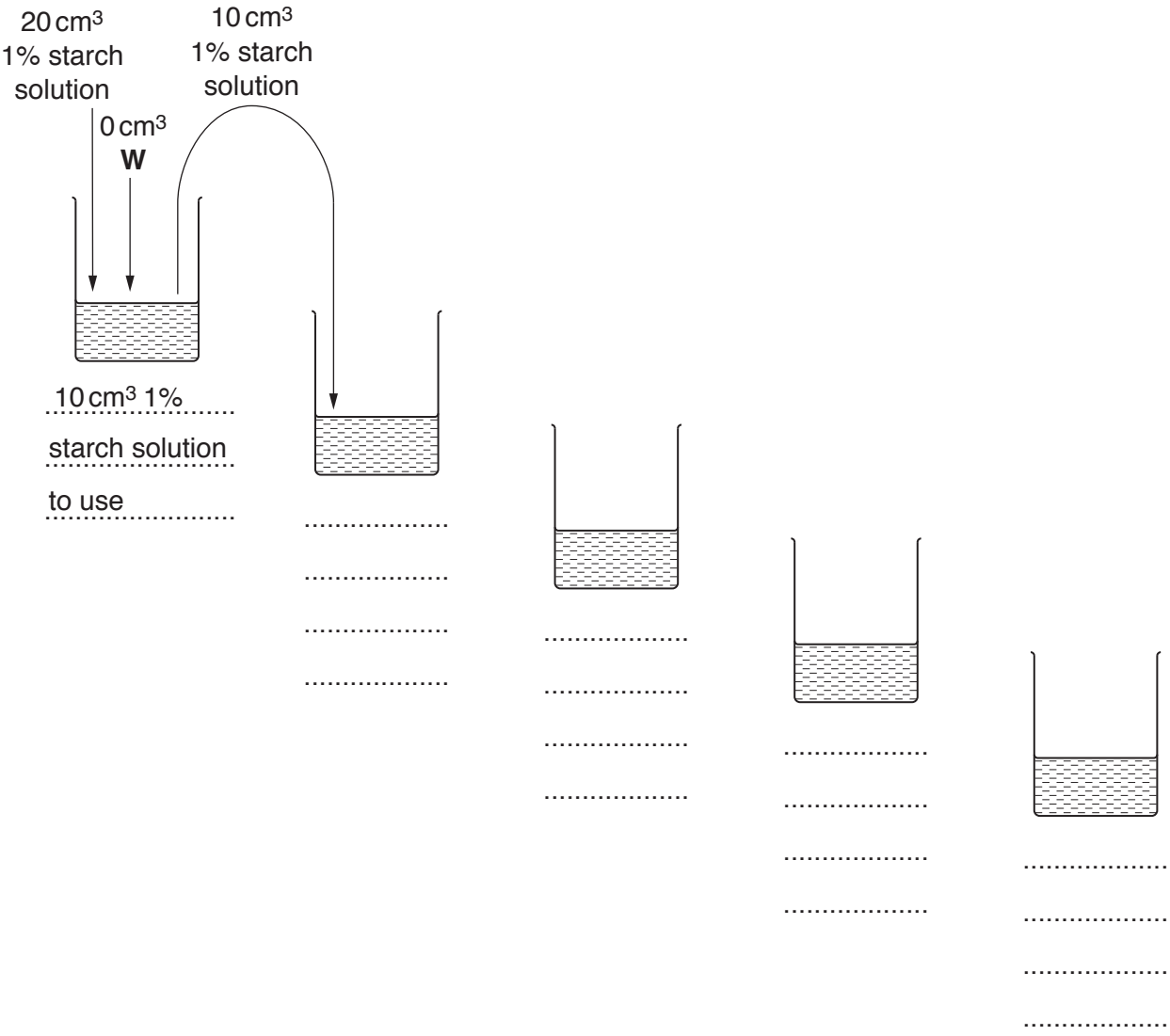
You will need to **prepare** 20 cm^3 of each concentration.

You should use the beakers shown in Fig. 1.1 to show how you will prepare the **serial** dilutions.

For **each beaker**, complete Fig. 1.1 to show how you will dilute the solution by:

- stating, under the beaker, the **concentration** and **volume** of the starch solution available for use in the investigation
- using one arrow, with a label above the beaker, to show the **concentration** and **volume** of starch solution added to prepare the concentration
- using another arrow, with a label above the beaker, to show the **volume** of **W** added to prepare the concentration.

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[3]

Fig. 1.1

Proceed as follows:

11. Prepare the concentrations of starch solution as stated in **(b)(i)**.

12. Label test-tubes with the concentrations of starch solution you have prepared.

13. Put 3 cm^3 of the **lowest** concentration of starch solution into the labelled test-tube.

14. Repeat step 13 with each of the other concentrations of starch solution.

15. Put 1 cm^3 of **E** into each of the test-tubes.

16. Shake each test-tube gently to mix the contents.

17. Leave the test-tubes for 5 minutes, shaking them occasionally. Relight the Bunsen burner to prepare a boiling water-bath ready for step 19.

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18. After five minutes, put 4 cm^3 of **Benedict's** into each of the test-tubes.

19. Put the test-tubes containing the two **lowest** concentrations of starch solution into the boiling water-bath and immediately start timing.

20. Record in **(b)(ii)** the time taken for the first appearance of any colour change.
If there is no colour change after 180 seconds, remove the test-tubes from the water-bath and record 'more than 180'.

21. Repeat steps 19 and 20 with the remaining test-tubes.

(ii) Prepare the space below and record your results, **including** the result from **(a)(ii)**.

[4]

(iii) Using your results, calculate the rate at which the product is produced when the concentration of starch is 1%.

..... s^{-1} [1]

The student's hypothesis stated that "lowering the concentration of starch below 1% will have no effect on the rate at which the product is produced".

(iv) State whether you support or reject this hypothesis. Explain how your results provide evidence for this decision.

support/reject .....

explanation .....

.....

.....

[2]

(c) (i) Identify **one** significant source of error in the procedure you carried out between steps 18 and 21.

.....

..... [1]

The student also stated that "the use of the syringe affected the accuracy of the serial dilutions produced."

(ii) State whether the error when using the syringe is systematic or random and give a reason for your answer.

systematic or random .....

reason .....

.....
[1]

Fruit juice **X** contains an inhibitor of enzyme **E**. Consider how you would modify the procedure you have just carried out to investigate the effect of the concentration of **X** on the activity of enzyme **E**.

(iii) Describe how the independent variable in the procedure you have just carried out would be standardised in the new investigation.

.....

Describe how the independent variable, concentration of **X**, will be investigated.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 22]

You are required to use a sharp pencil for drawings and graphs.

2 **(a)** **J1** is a slide of a stained transverse section through a plant stem. This plant genus grows widely throughout the world.

You are not expected to be familiar with this specimen.

(i) Draw a large plan diagram of the quarter of the stem, as shown in Fig. 2.1.

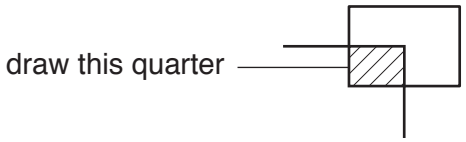


Fig. 2.1

Use **one** ruled label line and the letter **T** to identify the tissue which is made up of cells that are adapted for the transport of water.

[5]

(ii) Select one group of **four** cells from the tissue (cortex) between the epidermis and the vascular bundle. Each cell in the group should touch two of the other cells.

Make a large drawing of this group of **four** cells.

Use **one** ruled label line and label to identify **one** cell wall.

[4]

(b) Fig. 2.2 is a stained transverse section through part of the stem of a different plant species. You are not expected to be familiar with this specimen.

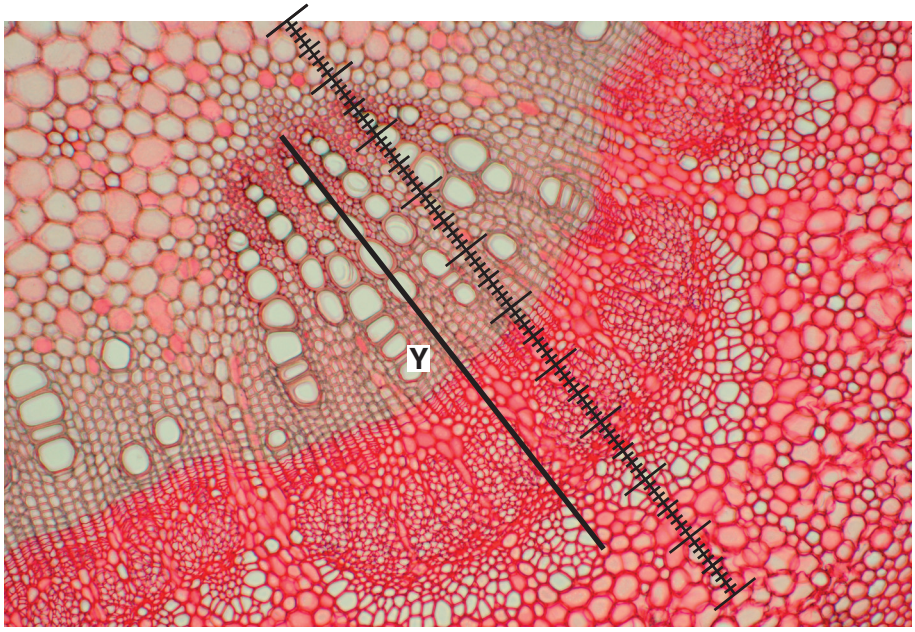


Fig. 2.2

A student calibrated the eyepiece graticule in a light microscope using a stage micrometer scale so that the actual length of the vascular bundle could be found.

The calibration was: one eyepiece graticule division equal to 11 μm.

Fig. 2.2 shows a photomicrograph taken using the same microscope with the same lenses as the student.

Use the calibration of the eyepiece graticule division and Fig. 2.2 to calculate the actual length of the vascular bundle, shown by line **Y**.

You may lose marks if you do not show all the steps in your working and do not use appropriate units.

actual length of the vascular bundle ..... [3]

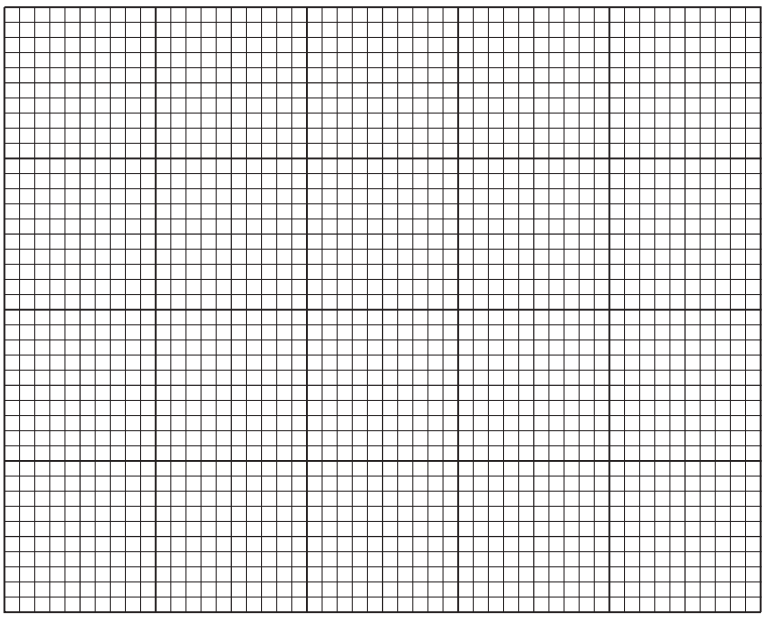
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(c) The plant in Fig. 2.2 produces fruit that are an important source of food for many animals in the ecosystem in which they grow.
A scientist carried out some tests to determine the mass of certain biological molecules found in one of these fruits. The total mass of the fruit was 35 g.
The results of the scientist's investigation are shown in Table 2.1.

Table 2.1

biological molecule found in the fruit	mass of biological molecule in the 35 g fruit / g
carbohydrate (C)	17.0
saturated fat (S)	0.2
unsaturated fat (U)	0.4
fibre (F)	2.4
protein (P)	1.2

(i) Plot a chart of the data shown in Table 2.1. [4]



(ii) Calculate the percentage of the fruit that is made up of fat.
You may lose marks if you do not show all the steps in your calculation and do not use appropriate units.

percentage ..... [2]

[Total: 18]

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Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0195201198

BIOLOGY **9700/32**

Advanced Practical Skills 2 **May/June 2015**

2 hours

Candidates answer on the Question Paper.

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Before you proceed, read carefully through **the whole** of Question 1 and Question 2.

Plan the use of the two hours to make sure that you finish all the work that you would like to do.

If you have enough time, consider how you can improve the accuracy of your results, for example by obtaining and recording one or more additional measurements.

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

1 Athletes who run long distances need to drink while they are running. Their drinks often contain carbohydrates to provide energy.

You are provided with four drinks: **D1**, **D2**, **D3** and **D4**.
Each drink contains **one** or **more** carbohydrates.

You are required to identify the carbohydrates in the drinks using the reagents provided.

(a) (i) Describe how you will use the reagent(s) to determine whether any of the drinks contain a polysaccharide.

.....

.....

..... [1]

Carry out the test you have described in **(a)(i)** on **D1**, **D2**, **D3** and **D4**.

(ii) Complete the table by using a tick (✓) to show the presence of a polysaccharide and a cross (✗) to show the absence of a polysaccharide, in any of **D1**, **D2**, **D3** and **D4**.

drink	presence (✓) or absence (✗) of polysaccharide
D1	
D2	
D3	
D4	

[1]

You are required to compare the quantity of reducing and non-reducing sugars in each of the drinks.

You will need to record the time taken for the first appearance of any colour change.
If no colour change occurs after 180 seconds (3 minutes), stop the experiment and record '**more than 180**'.

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(iii) Describe how you will use the reagent(s) to test for reducing and non-reducing sugars.

reducing sugar test: .....

.....

.....

.....

non-reducing sugar test: .....

.....

.....

.....

.....

[3]

When carrying out a practical procedure, the hazards of the use of all the apparatus and all of the reagents need to be considered, then the **level** of risk needs to be assessed as low or medium or high.

(iv) State the hazard with the greatest level of risk when testing for reducing and non-reducing sugar.
State the level of risk of the procedure: low or medium or high.

hazard .....

level of risk .....

[1]

Carry out the tests on **D1**, **D2**, **D3** and **D4**, as described in **(a)(iii)**, and record your results in **(a)(v)**.

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

[5]

The sugars in the drinks are sucrose and glucose.

(vi) Suggest which drink, **D1**, **D2**, **D3** or **D4**, would provide the athletes with the greatest quantity of glucose, and explain why you selected this drink.

.....

.....

..... [1]

(vii) A student wanted to investigate the concentration of **reducing sugar** in another drink, **D5**, used by athletes. Describe how the student could estimate the concentration of reducing sugar in drink **D5**.

.....

.....

.....

.....

.....

.....

..... [3]

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Question 1 continues on page 6

(b) The London Olympic Games of 2012 included races run over distances ranging from 100 m to 42 200 m (the Marathon).

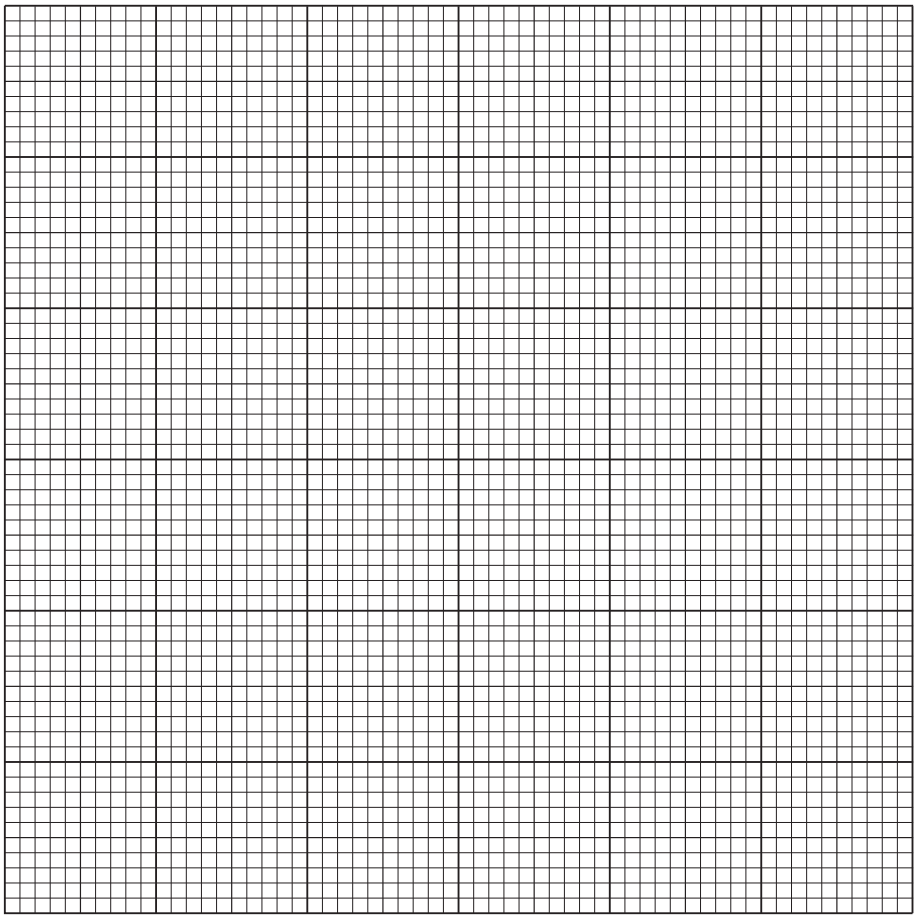
Table 1.1 shows the average speed of the winner of five of these races over different distances. Using $\log_{10}$ of the distance makes the numbers easier to plot on a graph.

Table 1.1

$\log_{10}$ distance / m	average speed / m s^{-1}
2.0	10.4
2.6	9.1
3.2	7.0
4.0	6.1
4.6	5.5

You are required to use a sharp pencil for graphs.

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



[4]

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(ii) Estimate the average speed for a race of distance $\log_{10} 3.5$ m.

..... [1]

(iii) Describe the trend shown by the data.

.....

.....

..... [1]

(iv) The winner of the Marathon race had trained at high altitude. Explain why this may have resulted in an increased average speed.

.....

.....

..... [1]

[Total: 22]

You are required to use a sharp pencil for drawings.

2 **(a)** **L1** is a slide of a stained transverse section through a plant stem. This plant species is a native of Europe and parts of Asia. You are not expected to be familiar with this specimen.

(i) Draw a large plan diagram of the quarter of the stem, as shown in Fig. 2.1.

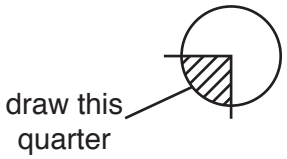


Fig. 2.1

Use **one** ruled label line and label to identify **one** vascular bundle.

[5]

(ii) Select one group of **four** cells from near the centre of the stem.
Each cell in the group should touch two of the other cells.

Make a large drawing of this group of **four** cells.

Use **one** ruled label line and label to identify **one** cell wall.

[5]

(b) Fig. 2.2 is a stained transverse section of an organ from a different plant species.
This plant species grows in Asia, Europe and North America.
You are not expected to be familiar with this specimen.

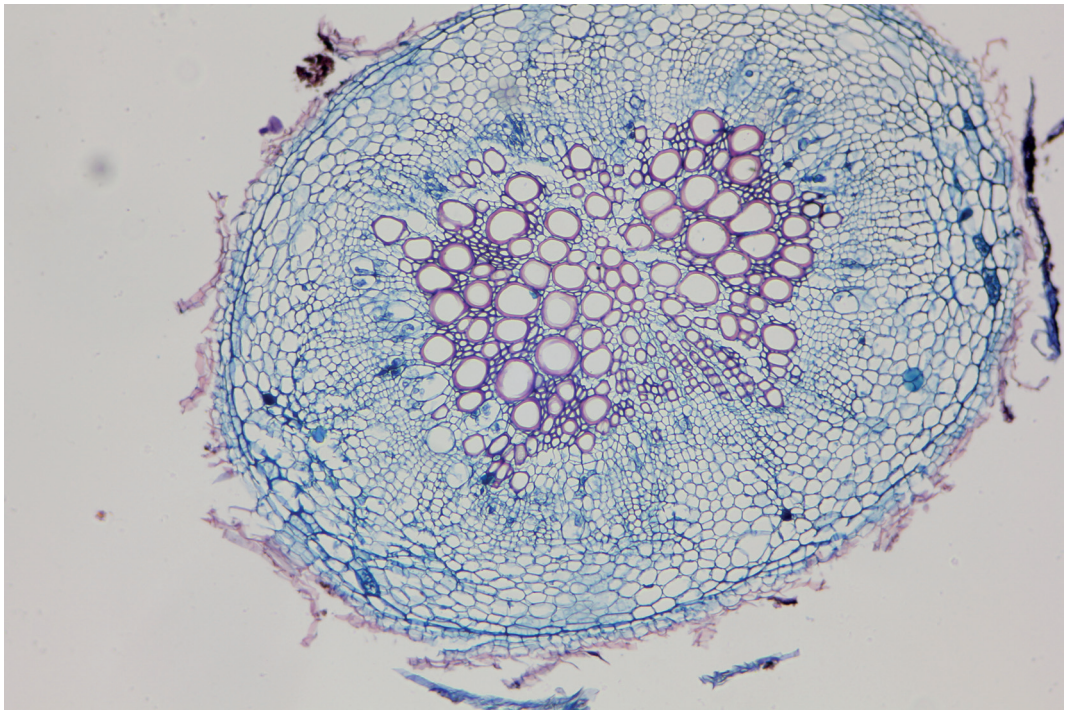


Fig. 2.2

Prepare the space below so that it is suitable for you to record observable differences between the specimen on slide **L1** and Fig. 2.2.

Record your observations in the space you have prepared.

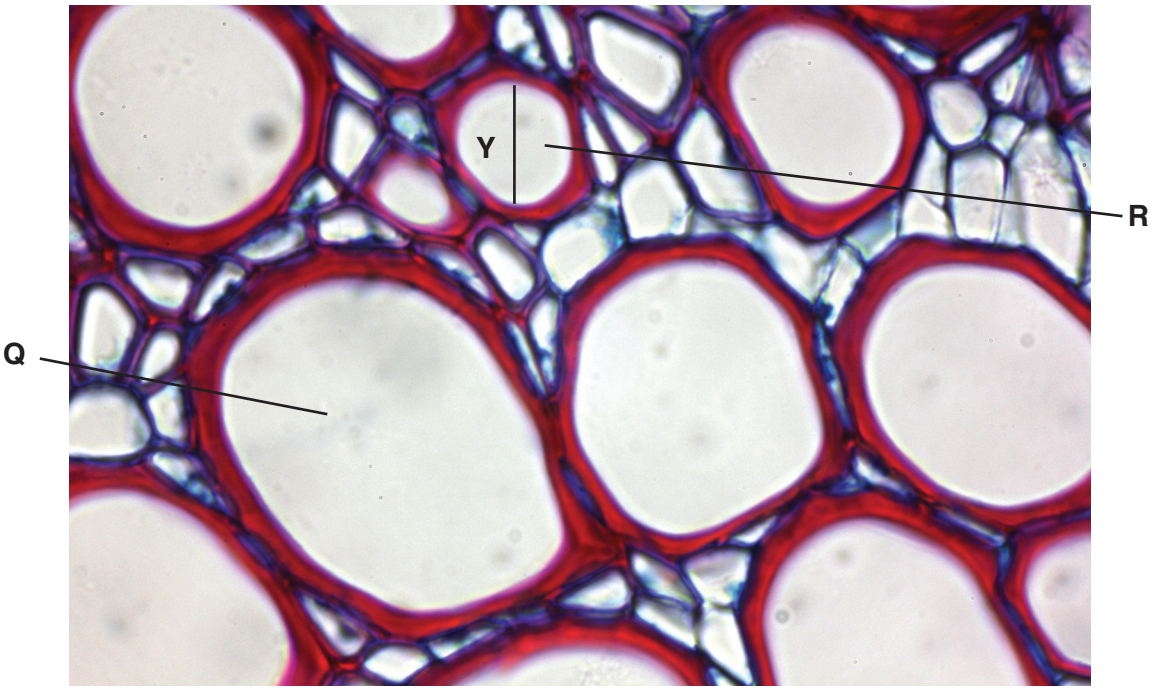
The differences should include:

- the vascular tissue
- one other tissue.

[4]

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(c) Fig. 2.3 is a high power view of part of the organ shown in Fig. 2.2.



magnification × 250

Fig. 2.3

(i) Calculate the **actual** widest diameter of the cell labelled **R** as shown by line **Y** in Fig. 2.3.

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

actual widest diameter ..... μm [2]

(ii) State **one** observable feature of cells **Q** and **R** shown on Fig. 2.3, and explain how this feature enables the cells to carry out their function.

.....

.....

..... [1]

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[Turn over

(iii) A student observed a different plant of the same species as shown in Fig. 2.3. The student determined the ratio of the diameter of one cell to the diameter of a smaller cell as 360 : 85.

However, a ratio may be simplified by dividing each side by the same number to give the smallest possible whole number on each side.

In this example, both sides of the ratio 360 : 85 are divisible by 5, so the simplest ratio for the diameters measured by the student is 72 : 17.

In Fig. 2.3, cell **Q** has an actual diameter of 200 μm. Determine the simplest ratio of the diameter of cell **Q** to the diameter of cell **R**.

ratio .....[1]

[Total: 18]

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CANDIDATE NAME

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CANDIDATE NUMBER

7894065152

BIOLOGY **9700/33**

Advanced Practical Skills 1 **May/June 2015**

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 When onion cells are placed into a solution, water will move depending on the water potential inside the cells and the water potential of the surrounding solution.

The water potential of a solution depends on both the concentration and the type of molecule dissolved.

You are required to:

- identify **S1**, **S2** and **S3** by carrying out tests for carbohydrates, using the reagents provided
- investigate the effect of water and each of the solutions **S1**, **S2** and **S3** on onion cells.

You are provided with:

labelled	contents	hazard
S1, **S2** and **S3**	see below	none
W	water with one piece of onion tissue	none

Each of **S1**, **S2** and **S3** contains a piece of onion tissue and one of the following:

- a mixture of sucrose solution and glucose solution
- sodium chloride solution
- starch solution.

By using **only two** of the biological molecule tests for carbohydrates, you should be able to identify the solutions, **S1**, **S2** and **S3**.

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(a) (i) Identify **S1**, **S2** and **S3** by carrying out tests using the apparatus and reagents provided. Decide which biological molecule to identify in the **first** test.

Complete the following:
First test: Test for .....

Describe how you will use the reagent(s) to carry out this test.

.....

.....

.....[1]

Carry out the **first test** and record your observations in **(a)(iii)**.

(ii) Decide which biological molecule to identify in the **second** test.

Complete the following:
Second test: Test for .....

Describe how you will use the reagent(s) to carry out this test.

.....

.....

.....[1]

Carry out the **second test** and record your observations in **(a)(iii)**.

(iii) Prepare the space below and record your observations for each test.

[3]

(iv) Complete the table to identify **S1**, **S2** and **S3**.

molecule(s)	**solution**
mixture of sucrose and glucose	
sodium chloride	
starch	

[1]

When carrying out a practical procedure, the hazards of the use of all the apparatus and all of the reagents need to be considered, then the level of risk needs to be assessed as low or medium or high.

(v) State the hazard with the greatest level of risk when using the apparatus and reagents to **test S1**, **S2** and **S3** for biological molecules.
State the level of risk of the procedure: low or medium or high.

hazard .....

level of risk .....

[1]

You are required to investigate the effect of water, **W**, and each of the solutions, **S1**, **S2** and **S3**, on the cells of the epidermis of onion.

(b) (i) Complete the sentence below by choosing from the following words:

enters **leaves** **plasmolysed** **turgid**

You may use each word once or more than once or not at all.

When onion cells are placed into a solution with a more negative water potential than the cells, water ..... the vacuoles and the cells become ..... .

[1]

You are required to investigate the effect of water and **each** of the solutions on the onion cells by:

- observing 10 cells in one field of view
- counting and recording the number of these cells which are plasmolysed
- making a drawing of one typical cell from each of **W** and **S1**.

Proceed as follows:

1. Label one **clean, dry** microscope slide '**W**' and put the slide on a paper towel.

2. Put a few drops of **W** onto the slide.

3. Remove a piece of the onion tissue from **W** and, using forceps or fingers, peel off the inner epidermis, as shown in Fig. 1.1.

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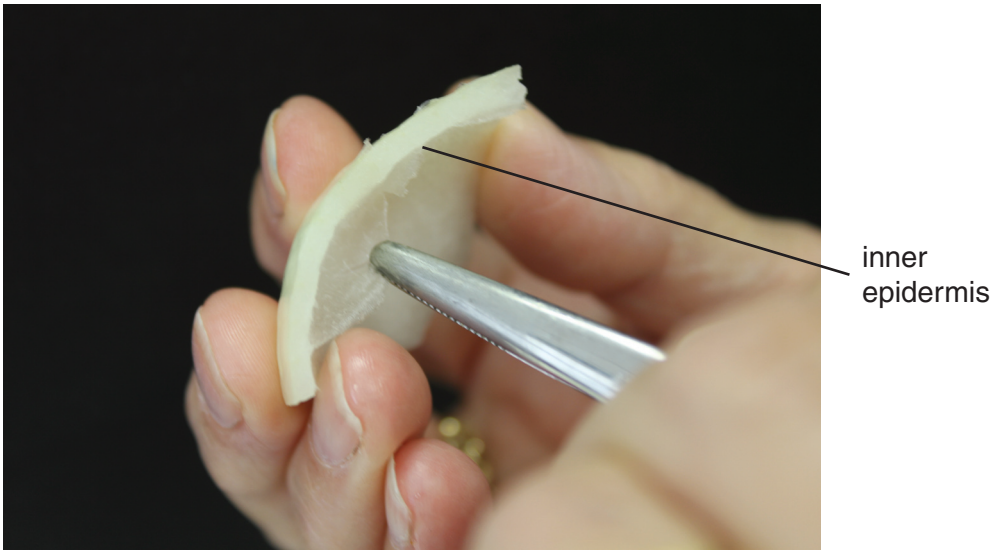


Fig. 1.1

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

5. Place the epidermis on the slide as shown in Fig. 1.2. If the epidermis is folded, you may need to add more drops of **W** so that it floats and uncurls.

6. It is important to prevent the epidermis from drying out so add more drops of **W** if needed.

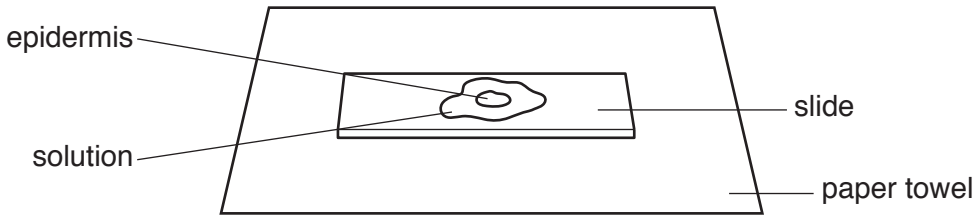


Fig. 1.2

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

8. Select an area of cells which show the effect of **W**. Observe 10 cells and record in **(b)(ii)** the number of these cells which show signs of plasmolysis.

9. Repeat step 8 for a different field of view.

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

10. Repeat steps 1 to 9 using the piece of onion from **S1** and mounting the piece of epidermis in the solution from **S1**.

11. Repeat steps 1 to 9 using the piece of onion from **S2** and then the piece of onion from **S3**.

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

[3]

(iii) Identify **one** significant error in measuring the dependent variable.

.....

.....[1]

You are required to use a sharp pencil for drawings.

(iv) Make a drawing of one cell from the epidermis in **W** and one cell from the epidermis in **S1**. The cells you choose must show the effect of **W** and **S1**.

Use **one** ruled label line and label to identify the cytoplasm in **each** cell.

*cell from epidermis in **W***

*cell from epidermis in **S1***

[4]

(v) Explain, using your knowledge of the movement of water, the effect of **S1** and **S3** on the cells of the epidermis.

S1

.....

.....

.....

S3

.....

.....

.....

[3]

[Total: 19]

2 **(a)** A student used a model to study the loss of water from stomata in leaves.

At the start of the investigation the model was set up as shown in Fig. 2.1.

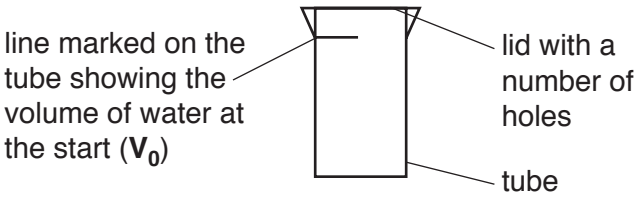


Fig. 2.1

The student investigated the effect that different numbers of holes in the lids had on the evaporation of water from the tube.

Each tube was set up with a lid with either 5 or 10 or 15 or 20 holes.

The tubes were left for 9 days and then the volume of the water remaining was marked with a second line on the tube. The volume of water at the start, $\mathbf{V_0}$, and the volume of water after 9 days, $\mathbf{V_9}$, were measured.

The volume of water lost by evaporation was calculated.

You are provided with four tubes labelled **1**, **2**, **3** and **4**. Each tube is marked with lines to show the volume of water at the start and after 9 days.

You are required to:

- measure the volume of water at the start of the investigation in each tube, $\mathbf{V_0}$
- measure the volume of water remaining in each tube after the 9 days, $\mathbf{V_9}$
- calculate the volume of water lost by evaporation in each tube (processed results).

(i) Describe how you will measure the volumes $\mathbf{V_0}$ and $\mathbf{V_9}$ (raw results) using the apparatus provided.

.....

.....

.....[1]

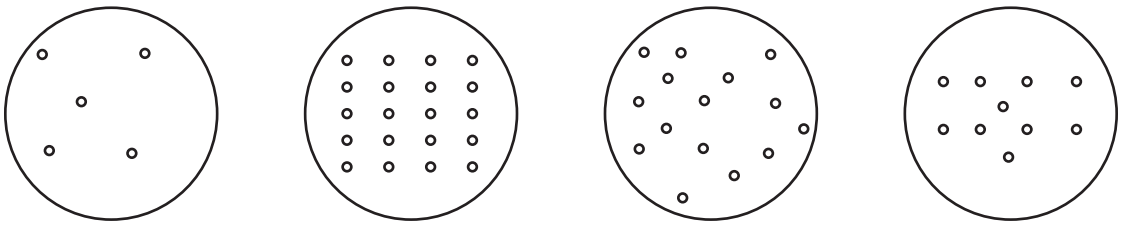
Carry out your method as described in **(a)(i)** for each of the four tubes and record your raw results and processed results in **(a)(ii)** on page 9.

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

[4]

Fig. 2.2 shows four lids labelled **P**, **Q**, **R** and **T**.



lid **P** lid **Q** lid **R** lid **T**

Fig. 2.2

(iii) Using your processed results, complete the table below to show which lid was used to cover which tube.

tube label	lid used to cover the tube
1	
2	
3	
4	

[1]

(iv) A control experiment is set up to make sure that the trend in the results is caused by the variable under investigation and not by some other variable.

Describe a control experiment for this investigation.

.....

.....[1]

(v) The student wanted to increase the rate of evaporation from the tubes, without removing the lid or altering the number or size of the holes.

Describe how the student could have changed the procedure to increase the rate of evaporation.

.....

.....

.....

.....[2]

A student investigated the relationship between the total circumference of the holes and rate of evaporation.

The student repeated the investigation with different lids with 0 or 5 or 10 or 20 holes. All the holes had the same diameter.

The student processed the results by calculating the total circumference of the holes and the rate of evaporation of water per day.

The processed results are shown in Table 2.1.

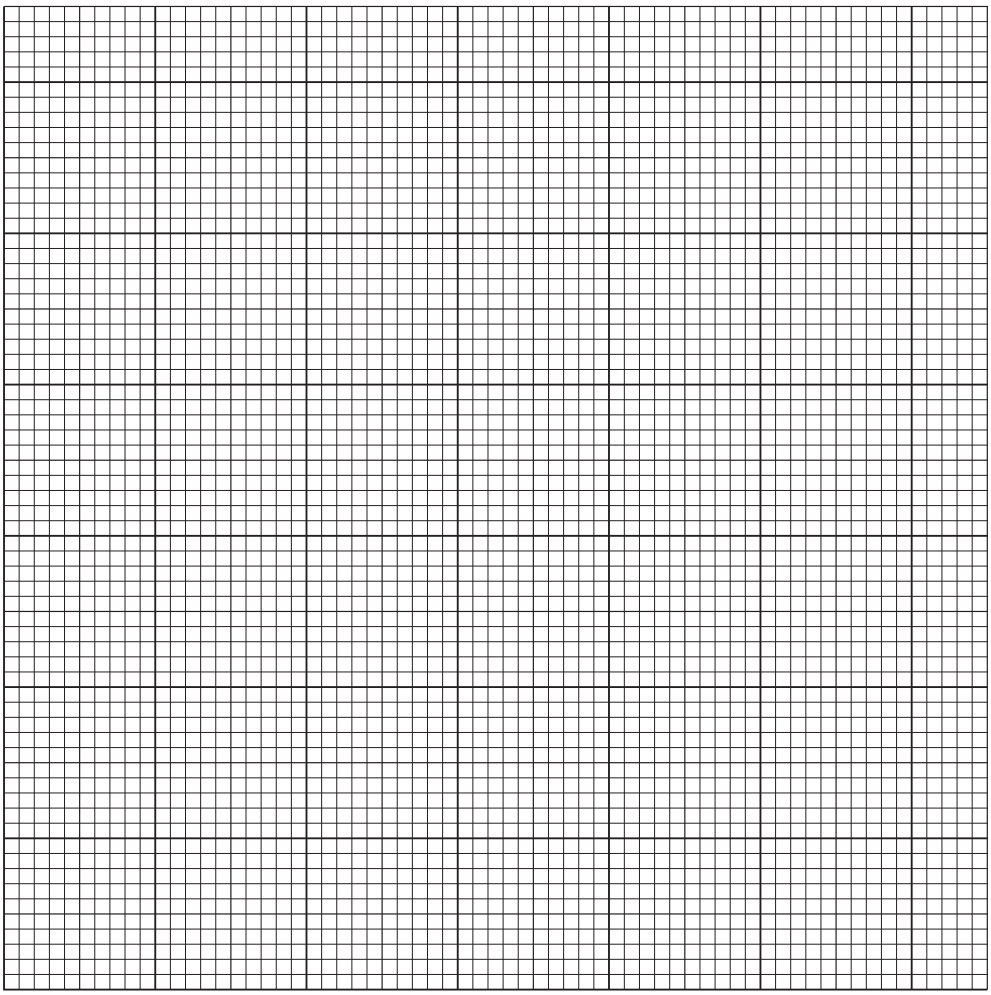
Table 2.1

total circumference of holes /mm	**rate of evaporation of water /cm^3 day^{-1}**
0.00	0.22
7.75	0.53
15.50	0.85
23.25	1.17
26.00	1.28

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You are required to use a sharp pencil for graphs.

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



[4]

(c) Fig. 2.3 is a stained transverse section through a plant stem.
You are not expected to be familiar with this specimen.

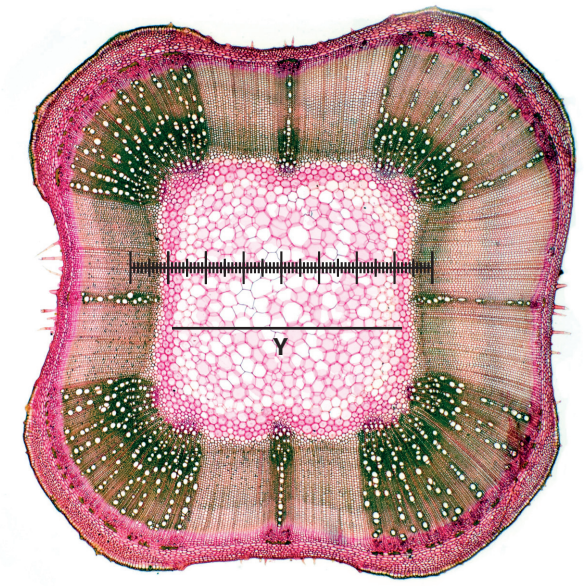


Fig. 2.3

Draw a large plan diagram of the quarter of the stem as shown in Fig. 2.4.

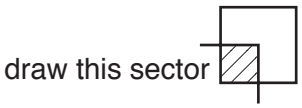


Fig. 2.4

[4]

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(d) A student calibrated the eyepiece graticule in a light microscope using a stage micrometer scale so that the actual length of the tissues could be found.

The calibration was: one eyepiece graticule division equal to 0.024 mm.

(i) The use of the unit mm is **not** the most appropriate unit for use with the light microscope.

State which unit is most appropriate for use with the light microscope and show how 0.024 mm is converted to this unit.

You may lose marks if you do not show your working.

unit .....[2]

(ii) Fig. 2.3 shows a photomicrograph taken using the same microscope with the same lenses as the student.

Use the calibration of the eyepiece graticule division from **(d)(i)** and Fig. 2.3 to calculate the actual total width of the pith, shown by line **Y**.

You may lose marks if you do not show all the steps in your calculation and do not use appropriate units.

actual total width .....
[2]

[Total: 21]

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Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5538403698

BIOLOGY **9700/34**

Advanced Practical Skills 2 **May/June 2015**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

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, paperclips, 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.

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1	
2	
Total	

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CAMBRIDGE International Examinations

Before you proceed, read carefully through **the whole** of Question 1 and Question 2.

Plan the use of the two hours to make sure that you finish all the work that you would like to do.

If you have enough time, consider how you can improve the accuracy of your results, for example by obtaining and recording one or more additional measurements.

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 investigate the effect of solution **X** on the activity of the catalase in a plant extract **P** by:

- preparing different concentrations of solution **X**
- investigating the effect of different concentrations of solution **X** by counting the number of bubbles of oxygen released in two minutes
- finding the rate of activity of the catalase by measuring the time taken to collect 2 cm^3 of the oxygen.

You are provided with:

labelled	contents	hazard	volume / cm^3
X	0.3% solution of **X**	harmful	20
W	distilled water	none	100
P	plant extract solution	none	90
H	hydrogen peroxide solution	harmful irritant	90
T	tap water	none	–

When carrying out a practical procedure, the hazards of the use of all the apparatus and all of the reagents need to be considered, then the **level** of risk needs to be assessed as low or medium or high.

(a) State the hazard with the greatest level of risk when using the apparatus and reagents in step 1 on page 4.
State the **level** of risk of the procedure: low or medium or high.

hazard .....

level of risk .....

[1]

(b) (i) You are required to make a **serial** dilution of the 0.3% solution of **X** which reduces the concentration of **X** by a **factor of 10** between each successive dilution.

You will need to prepare 10 cm^3 of each concentration of solution **X**.

You should use the beakers shown in Fig. 1.1 to show how you will prepare the **serial** dilutions.

You will need to use 9 cm^3 of each different concentration of **X** in the investigation.

For **each** beaker, complete Fig. 1.1 to show how you will dilute the solution by:

- stating, under the beaker, the **concentration** and **volume** of the solution available for use in the investigation
- using one arrow, with a label above the beaker, to show the **concentration** and **volume** of the solution **X** added to prepare the concentration
- using another arrow, with a label above the beaker, to show the **volume** of **W** added to prepare the concentration.

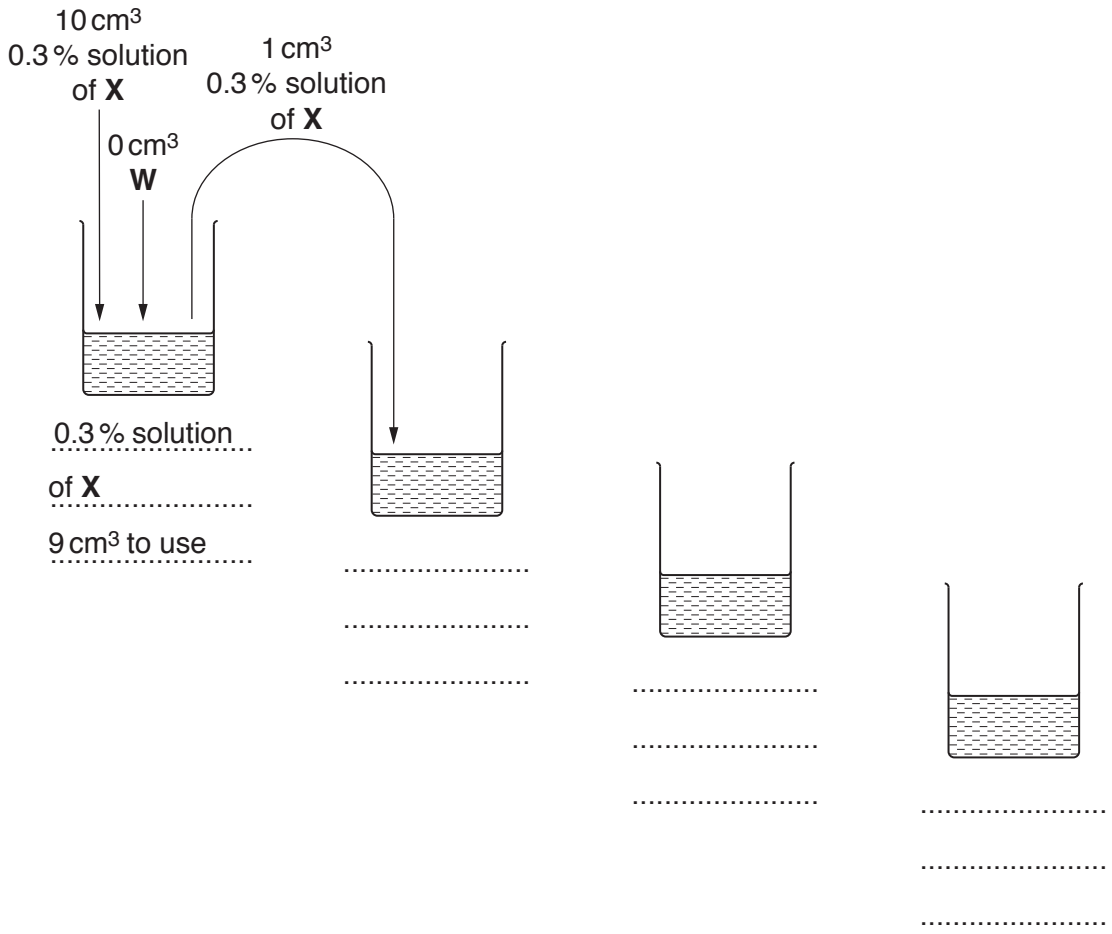


Fig. 1.1

[3]

You are required to investigate the effect of different concentrations of **X** on the activity of catalase by finding the number of bubbles of oxygen released in two minutes.

Proceed as follows:

1. Prepare the concentrations of **X** as shown in **(b)(i)**. *Note: syringe labelled **X** should be used for solution **X only**.*

2. Put 10 cm^3 of **P** into each of the concentrations of **X**, including 0.3% **X**. Shake gently to mix.

3. Put 20 cm^3 of **P** and 18 cm^3 of **W** into a separate beaker.

4. Leave for at least three minutes.

Read step 5 to step 13 before proceeding.

5. Put 10 cm^3 of **H** into each of five test-tubes.

6. Put 10 cm^3 of the mixture of **P** and **W** into one of the test-tubes.

7. Put the bung (with the delivery tube attached) into this test-tube.

8. Put the end of the delivery tube into the large beaker containing water labelled **T**.

9. Start timing and count the number of bubbles of oxygen released in 2 minutes.

10. Record the result in **(b)(ii)**.

Note: if no bubbles are released then make sure the bung is securely fitted into the test-tube. You may ask for petroleum jelly if necessary.

11. Put 10 cm^3 of the mixture of **P** with the **lowest** concentration of **X** into another test-tube containing **H**.

12. Repeat steps 7 to 10.

13. Repeat steps 11 and 12 with each of the other concentrations of **X**, including 0.3% **X**.

Consider how you will obtain results which are as accurate as possible.

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

[5]

You are required to find the rate of activity of the catalase by measuring the time taken to collect 2 cm^3 of oxygen produced by the hydrolysis of **H**.

You are going to collect the oxygen released by displacement of water as shown in Fig. 1.2.

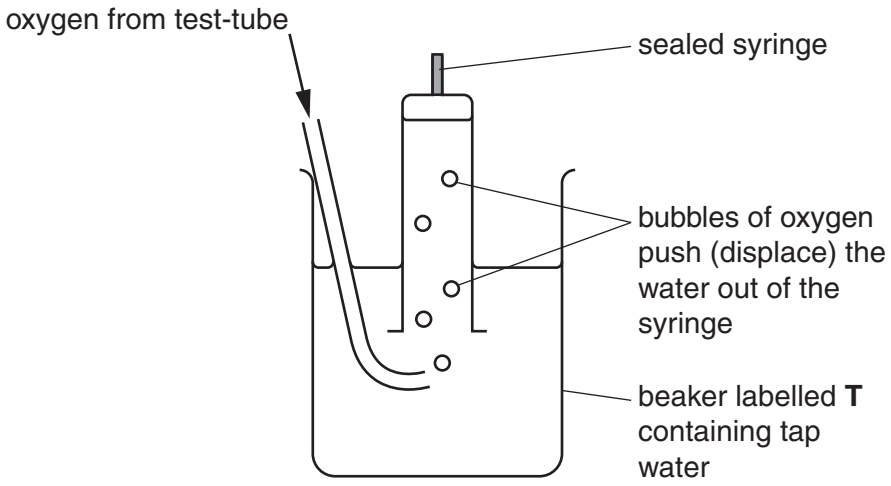


Fig. 1.2

The sealed syringe is full of water and is upside down over the end of the delivery tube.

You need to time how long it takes for the bubbles of oxygen to push (displace) 2 cm^3 of the water out of the syringe.

14. Put 5 cm^3 of **H** into a clean test-tube.

15. Put 10 cm^3 of the mixture of **P** and **W** into this test-tube.

16. Put the bung (with the delivery tube attached) into this test-tube.

17. Fill the sealed syringe with water from the beaker and turn it upside down keeping the open end of the syringe under the water as shown in Fig. 1.2.

18. Immediately put the end of the delivery tube into the beaker of water so that the bubbles of oxygen pass into the syringe.

19. Start timing.

(iii) Record the time for 2 cm^3 of oxygen to be collected.

time .....

Using your recorded time, calculate the rate of activity of the catalase in $cm^3\ s^{-1}$.

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

rate of activity ..... $cm^3\ s^{-1}$ [2]

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(iv) Using your knowledge of enzymes, suggest how solution **X** may be changing the activity of the catalase.

.....

.....

.....

.....

.....[2]

(v) Identify **one** significant source of error when using each of the two methods to measure the dependent variable.

one significant error in counting the number of bubbles

.....

.....

one significant error in measuring the displacement of water

.....

.....
[2]

(vi) This first procedure investigated the effect of the concentration of **X** on the activity of catalase in the plant extract.

To modify this procedure for investigating another variable, the independent variable (concentration of **X**) would need to be standardised.

Describe how the independent variable (concentration of **X**) will be standardised.

.....

.....

Consider how you would modify this procedure to investigate the effect of temperature on the activity of the catalase in the plant extract.

Describe how the independent variable, temperature, will be investigated.

.....

.....

.....

.....
[3]

[Total: 18]

2 In an investigation into the circulation of blood in giraffes, it has been found that as the length of the neck increases the thickness of the muscle wall of the left ventricle increases.

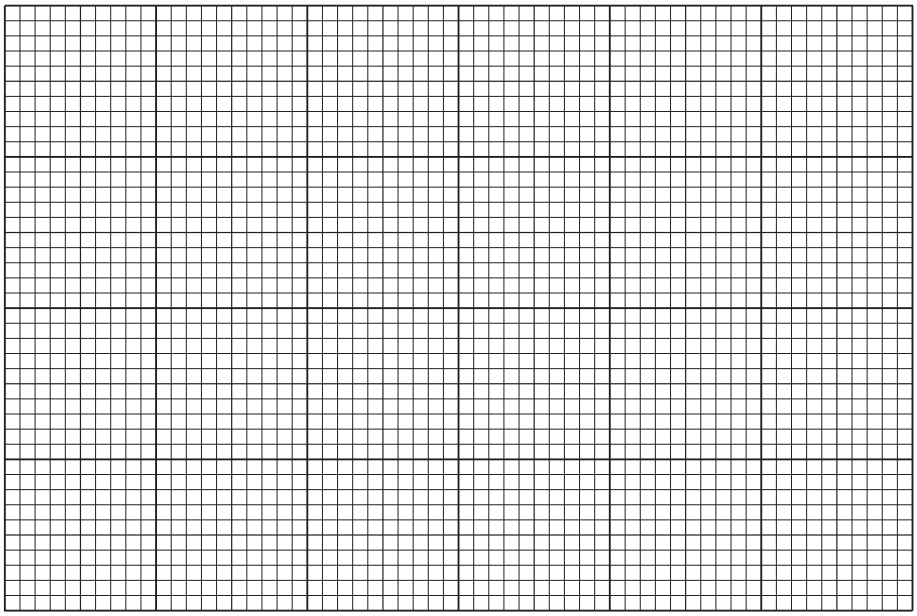
The results for five giraffes are shown in Table 2.1.

Table 2.1

length of neck /cm	**thickness of muscle wall in left ventricle /mm**
53.0	22.00
73.5	28.75
82.5	31.75
92.0	35.00
106.5	39.75

You are required to use a sharp pencil for graphs.

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



[4]

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(ii) A giraffe was found to have a neck length of 95.0 cm.

Using the graph, estimate the thickness of the muscle wall in the left ventricle.

.....mm [1]

(iii) Suggest **one** reason for the relationship shown in the graph.

.....

.....[1]

(b) Fig. 2.1 shows four photomicrographs of stained transverse sections through blood vessels, **Q**, **R**, **S** and **T**.

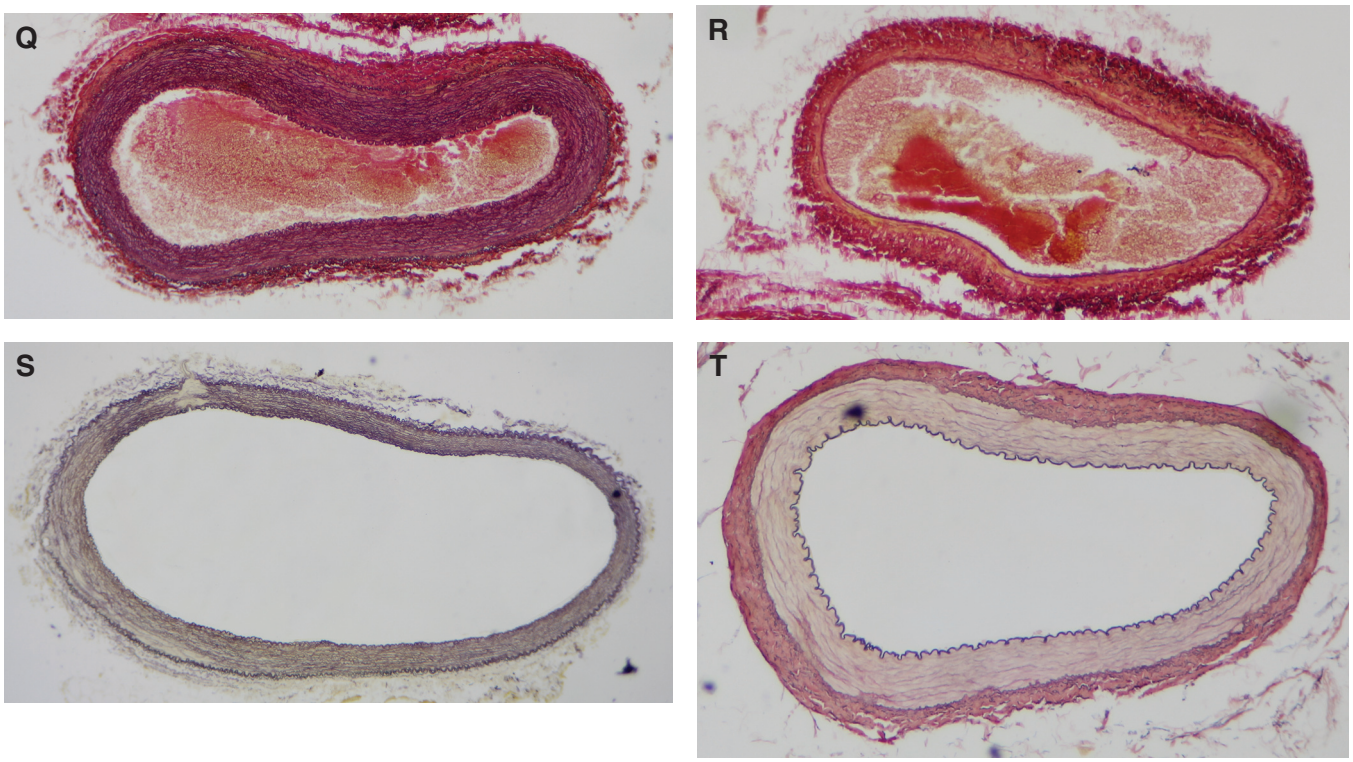


Fig. 2.1

(i) Choose **one** of the blood vessels shown in Fig. 2.1 which carries blood away from the heart.

State the blood vessel, **Q**, **R**, **S** or **T**, which you have chosen .....

Draw a large plan diagram of this blood vessel.

[5]

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A student observed a blood vessel from a **different** specimen. The student determined the ratio of the widest diameter of the blood vessel to the thickness of the blood vessel wall, using the actual measurements shown below.

widest diameter of the blood vessel = 1460 μm

thickness of the blood vessel wall = 75 μm

Ratio is 1460:75

However, a ratio may be simplified by dividing each side by the same number to give the smallest possible whole number on each side.

In this example, both sides of the ratio 1460:75 are divisible by 5, so the simplest ratio is 292:15.

(ii) Determine the simplest ratio of the **mean** diameter of the blood vessel **S** to the **mean** thickness of the wall of the blood vessel in Fig. 2.1.

On Fig. 2.1 show where you take your measurements.

You may lose marks if you do not show all the steps in your working.

ratio .....[4]

(c) **M1** is a slide of a stained transverse section through a plant stem.
This plant species grows throughout the world.

You are not expected to be familiar with this specimen.

(i) Observe one large vascular bundle. Select one group of **four** adjacent xylem vessel elements with at least two of the vessel elements touching.

Make a large drawing of this group of **four** xylem vessel elements.

Use **one** ruled label line and label to identify **one** lumen.

[5]

(ii) Describe **one** observable difference between the structure of the xylem vessel elements drawn in **(c)(i)** and the structure of the blood vessels in Fig. 2.1.

.....

.....[1]

(iii) Suggest **one** observable feature, shown by **both** the specimen on **M1** and Fig. 2.1, which supports the conclusion that these structures transport materials.

Explain how this feature may help the transport of materials in the vessel elements in **M1**.

feature .....

explanation .....

.....
[1]

[Total: 22]

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Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2827796115

BIOLOGY **9700/35**

Advanced Practical Skills 1 **May/June 2015**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

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, paperclips, 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.

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1	
2	
Total	

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UNIVERSITY of CAMBRIDGE International Examinations

[Turn over

Before you proceed, read carefully through **the whole** of Question 1 and Question 2.

Plan the use of the two hours to make sure that you finish all the work that you would like to do.

If you have enough time, consider how you can improve the accuracy of your results, for example by obtaining and recording one or more additional measurements.

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

1 The enzyme **E** catalyses the reaction of urea with water to form ammonium carbonate and carbon dioxide.

$$\text{urea} + \text{water} \longrightarrow \text{ammonium carbonate} + \text{carbon dioxide}$$

Aqueous ammonium carbonate produces ammonium ions. This forms an alkaline solution which causes red litmus paper to change to blue.
This colour change will be used to indicate the end-point of the reaction.
The end-point of the reaction is when **all of the surface** of the red litmus paper is blue.

You are required to:

- prepare different concentrations of the urea solution, **U**
- investigate the effect of different concentrations of **U** (independent variable) on the reaction of **U** with water, **W**.

You are provided with:

labelled	contents	hazard	volume / cm^3
U	5% urea solution	harmful irritant	50
W	distilled water	none	100
E	enzyme solution	harmful irritant	10

labelled	contents	hazard	quantity
R	red litmus paper	none	2 strips

When carrying out a practical procedure, the hazards of the use of all the apparatus and all of the reagents need to be considered, then the **level** of risk needs to be assessed as low or medium or high.

(a) State the hazard with the greatest level of risk when using the apparatus and reagents in step 1 on page 4.

State the level of risk of the procedure: low or medium or high.

hazard .....

level of risk .....

[1]

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(b) (i) You are required to make a **serial** dilution of the 5% urea solution, **U**, which reduces the concentration of the urea solution **by half** between each successive dilution.

You will need to **prepare** 40 cm^3 of each concentration.

You should use the beakers shown in Fig. 1.1 to show how you will prepare the **serial** dilutions.

For **each beaker**, complete Fig. 1.1 to show how you will dilute the solution by:

- stating, under the beaker, the **concentration** and **volume** of the urea solution available for use in the investigation
- using one arrow, with a label above the beaker, to show the **concentration** and **volume** of urea solution added to prepare the concentration
- using another arrow, with a label above the beaker, to show the **volume** of **W** added to prepare the concentration.

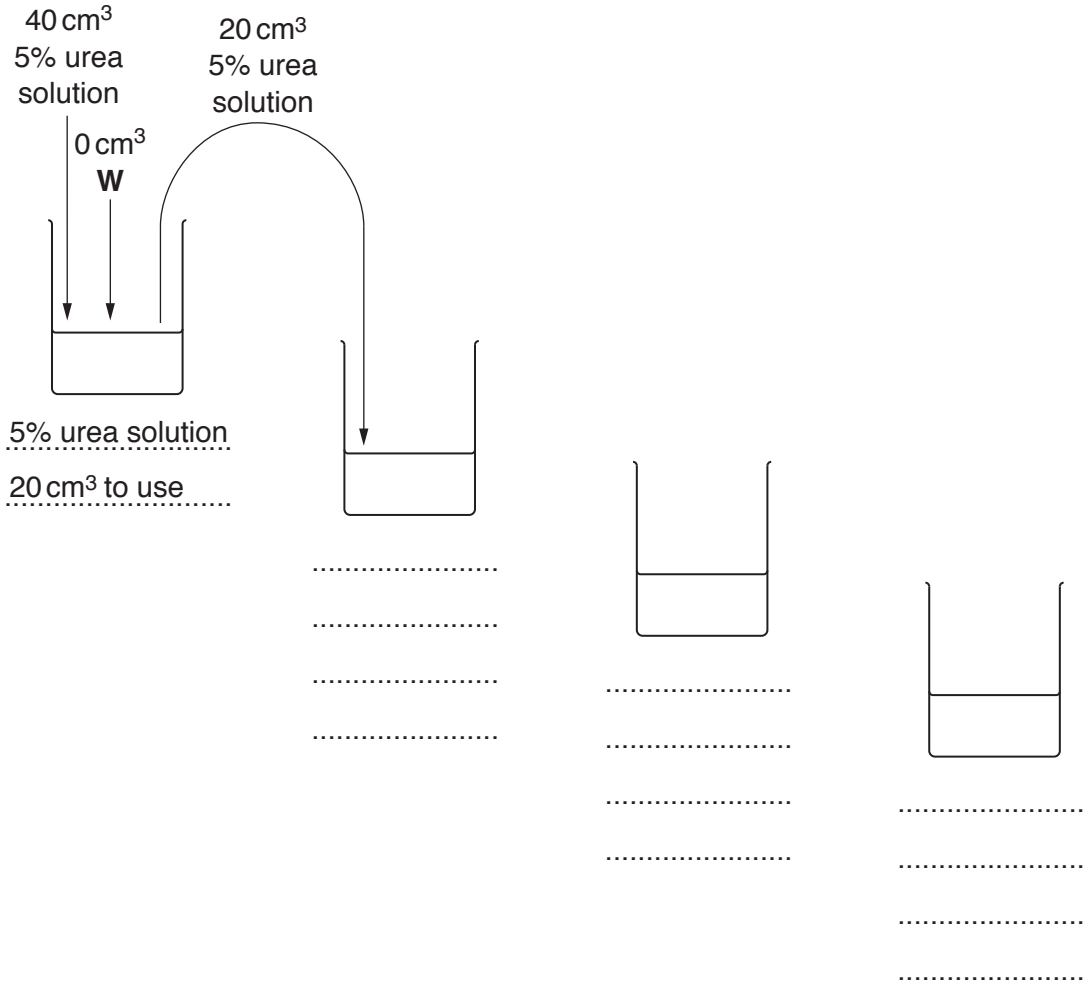


Fig. 1.1

[3]

Proceed as follows:

1. Prepare the concentrations of urea solution, as stated in **(b)(i)**.

2. Cut the red litmus paper into lengths of approximately 0.5 cm. Put one piece of litmus paper into the bottom of each of the four test-tubes.

3. Put 0.5 cm^3 of **E** into each test-tube.

4. Put 5 cm^3 of the **lowest** concentration of urea solution into one of these test-tubes and mix well. Immediately start timing.

5. During the investigation, shake the test-tube occasionally to mix the contents.

6. Record in **(b)(ii)** the time taken for **all of the surface** of the red litmus paper to change to blue (the end-point).
   If the piece of litmus paper does not reach the end-point after 180 seconds (3 minutes), stop the experiment and record '**more than 180**'.

7. Repeat steps 4 to 6 with the next lowest concentration of urea solution.

8. Repeat step 7 with the other concentrations of urea solution.

   You are now required to replicate the investigation.

9. Repeat steps 2 to 8.

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

[5]

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(iii) Significant sources of error may cause some of the raw data to be inaccurate, producing anomalous results.

- The end-point of this investigation was the change in colour of the red litmus paper. State how this might have caused the results to be inaccurate.

  .....

  .....

- Identify **one other** significant source of error for this investigation.

  .....

  .....

[2]

(iv) Describe **one** improvement to this investigation which would increase confidence in your results.

.....

.....[1]

(v) State **one** piece of apparatus used in this investigation that may have a systematic error.

.....[1]

(vi) When a student carried out this investigation, the red litmus paper changed to blue in a very short time. This made measuring the time inaccurate.

Describe **how** the student could change the procedure to increase the time taken to reach the end-point.

.....

.....

.....

.....

.....[2]

(c) The 'urea breath test' is used to detect human stomach infections caused by bacteria. If the bacteria are present in the stomach, an enzyme produced by the bacteria breaks down the urea to carbon dioxide. This carbon dioxide is absorbed from the stomach into the blood and travels to the lungs where it is released in the breath.

To test for the presence of the bacteria, the patient drinks a solution of urea containing ^{13}C, which is an isotope of carbon. The breath of the patient is then sampled at intervals for 110 minutes and analysed for the presence of $^{13}CO_2$ (carbon dioxide containing ^{13}C).

The results are shown in Table 1.1.

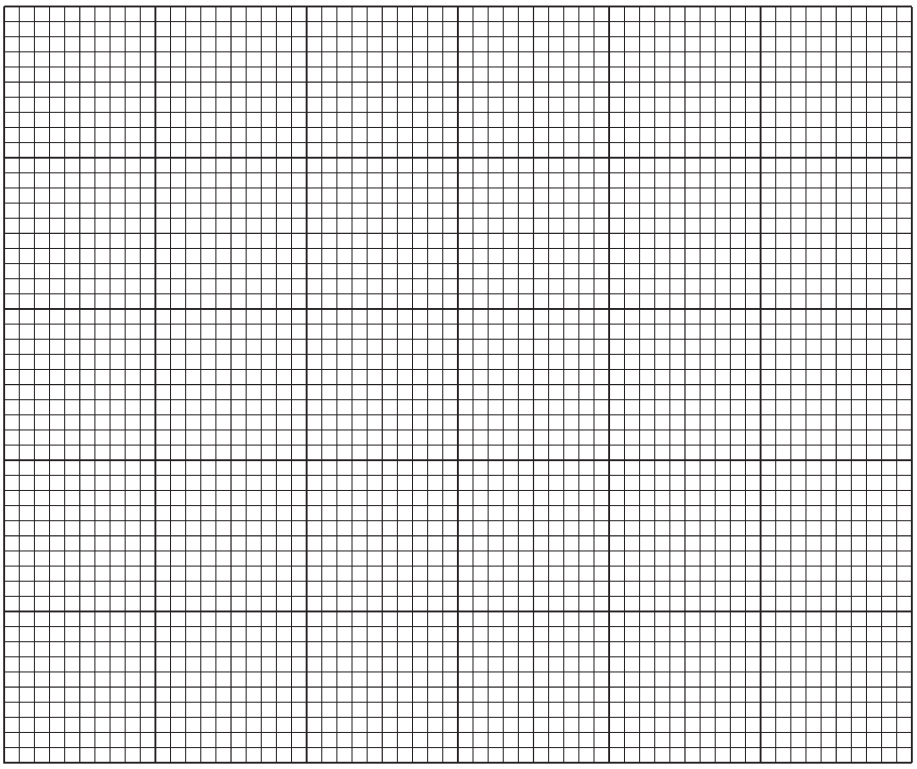
Table 1.1

time of sampling / minutes	$^{13}CO_2$ in the breath / arbitrary units
30	21.8
40	19.0
60	14.5
75	12.5
110	10.7

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You are required to use a sharp pencil for graphs.

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



[4]

(ii) Using your knowledge of enzymes, explain the trend shown in the data.

.....

.....

.....

.....

.....[2]

[Total: 21]

You are required to use a sharp pencil for drawings.

2 **(a)** **K1** is a slide of a stained transverse section through a plant stem. This plant genus grows in Europe, Africa and Asia.
You are not expected to be familiar with this specimen.

(i) Draw a large plan diagram of the half of the stem, as shown in Fig. 2.1.

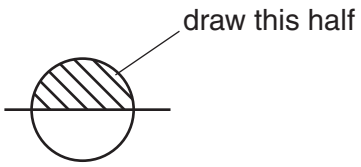


Fig. 2.1

Use **one** ruled label line and label to identify the pith.

[5]

(ii) Observe a corner or bulge of the stem.
Select and make a large drawing of:

- **two** whole, adjacent cells from the epidermis which touch each other
- **two** whole, adjacent cells from the cortex (the layer of tissue under the epidermis) which touch each other.

The drawings should show any difference in size (linear magnification) observed between each pair of cells.

Use **one** ruled label line and label to identify **one** cell wall.

cells from epidermis

cells from cortex

[5]

(b) Fig. 2.2 is a stained transverse section through the stem of a different plant species. This plant species grows throughout the world.

You are not expected to be familiar with this specimen.

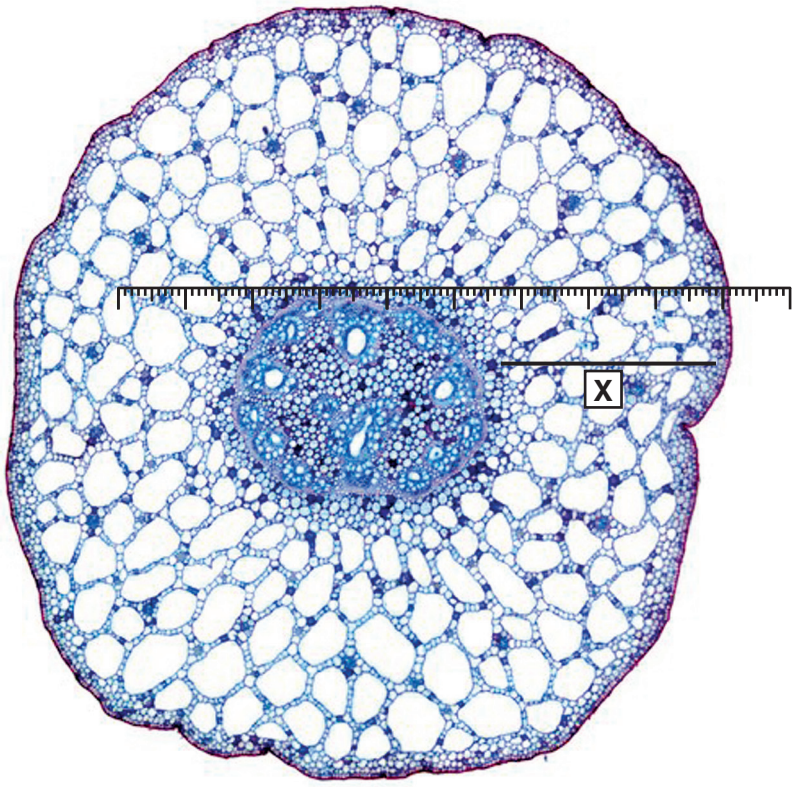


Fig. 2.2

A student calibrated the eyepiece graticule in a light microscope using a stage micrometer scale so that the actual length of specimens could be found.

The calibration was: one eyepiece graticule division equal to 0.028 mm.

(i) The use of the unit mm is **not** the most appropriate unit for use with the light microscope.

State which unit is the most appropriate for use with the light microscope and show how the value 0.028 mm is converted to this unit.

You may lose marks if you do not show your working.

unit .....[2]

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(ii) Fig. 2.2 shows a photomicrograph taken using the same microscope with the same lenses as the student.

Use the calibration of the eyepiece graticule division from **(b)(i)** and line **X** in Fig. 2.2 to calculate the actual total width of the tissue as shown by line **X**.

You may lose marks if you do not show all your working and do not use the appropriate units.

*actual width of the tissue shown by line **X*** .....[2]

(iii) Suggest **one** observable feature of the stem in Fig. 2.2 which supports the conclusion that this is from a plant growing in a freshwater pond.

Explain how this feature supports this conclusion.

feature .....

explanation .....

.....[1]

(c) Prepare the space below so that it is suitable for you to record observable differences between the specimen on **K1** and Fig. 2.2.

Record your observations in the space you have prepared.

[4]

[Total: 19]

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