Cambridge International AS & A Level

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Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

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7723508459

BIOLOGY **9700/31**

Advanced Practical Skills 1 **May/June 2014**

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, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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1	
2	
Total	

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[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 Benedict's test can be used to detect the presence of reducing sugars such as glucose. A solution to be tested is mixed with Benedict's solution, heated and the time taken to the first appearance of a colour change recorded.

A student suggested the hypothesis:

> "the time taken for the Benedict's solution to show the first appearance of a colour change will decrease as the temperature increases."

You are required to investigate the effect of different temperatures (the independent variable) when carrying out the Benedict's test.

You are provided with:

labelled	**contents**	**hazard**	**volume /cm^3**
G	4% glucose solution	none	60
Benedict's solution	Benedict's solution	harmful irritant	80

You must now read up to the end of step 4 before proceeding.

You will need to standardise the Benedict's test to compare the time taken to the first appearance of a colour change at four different temperatures, 70 °C, 80 °C, 90 °C and 100 °C.

Use 4 cm^3 of **G** for each temperature tested.

(a) (i) Decide the volume of Benedict's solution you will use for each test.

Complete the table to show the volume of Benedict's solution you will use.

solution	**volume /cm^3**
Benedict's	
G	4

[1]

Proceed as follows;

1. Set up a water-bath and maintain it at the first temperature of 70 °C.

2. Test 4 cm^3 of **G** with Benedict's solution using the volume you decided in **(a)(i)**.
   Start timing when the test-tube is placed into the water-bath and record the time taken for the first appearance of a colour change at the **top** of the mixture in the test-tube.
   If no colour change occurs after 4 minutes, stop the experiment and record 'more than 240'.

3. Immediately pour the contents of the test-tube into the container labelled 'for waste'. Fill the test-tube with water from the container labelled 'for washing'. Empty the contents of the test-tube into the container labelled 'for waste'.

4. Repeat steps 1 to 3 with the other temperatures of the water-bath, 80 °C, 90 °C and 100 °C.

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

[2]

The student's hypothesis was:

"the time taken for the Benedict's solution to show the first appearance of a colour change will decrease as the temperature increases."

(iii) State whether your results support this hypothesis.

.....

Use your results to explain your answer.

.....

.....

.....

.....

[2]

You are required to:

- select **one** temperature from 70 °C, 80 °C, 90 °C or 100 °C to carry out the Benedict's test
- make different concentrations of glucose from the solution **G**
- estimate the glucose concentrations of solutions **S1** and **S2** at the selected temperature.

You are provided with:

labelled	contents	hazard	percentage concentration	volume /cm^3
S1	glucose solution	none	unknown	15
S2	glucose solution	none	unknown	15
W	distilled water	none	–	100

To compare the concentrations of glucose you will need to standardise the temperature using your results from **(a)(ii)**.

(iv) State the temperature you will use.
State a reason for the temperature you have chosen.

temperature .....

reason .....

.....
[1]

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You are now required to carry out a serial dilution of glucose solution, **G**, to reduce the concentration of **G** by **half** between each successive dilution.

You will need 15 cm^3 of each glucose concentration.

Fig. 1.1 shows how to make the first concentration of 2% glucose solution.

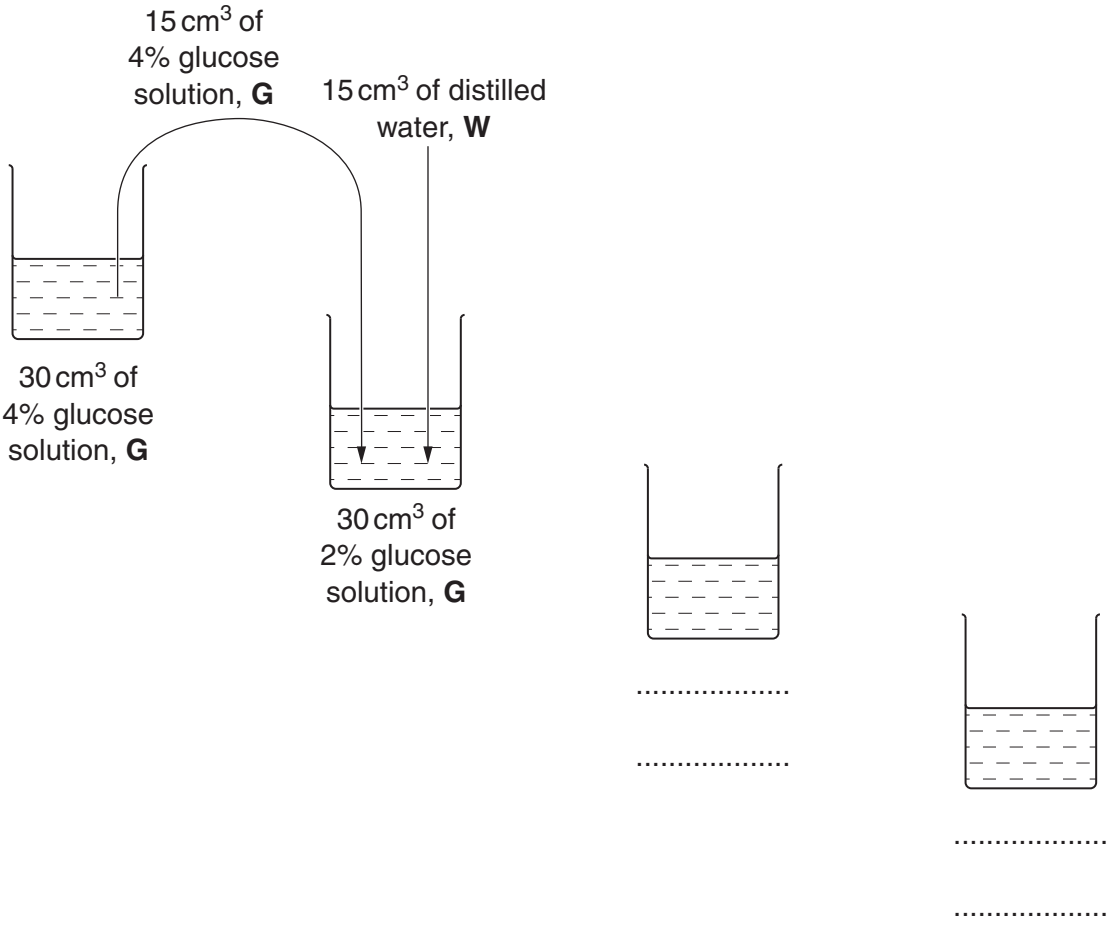


Fig. 1.1

(v) Complete Fig. 1.1 to show how you will make **two** further concentrations of **G**. [2]

You will need to test the different concentrations of glucose, as well as **S1** and **S2**, with Benedict's solution.

(vi) Decide the volumes of solutions you will use in your investigation.

Complete the table.

solution	volume/cm^3
Benedict's	
glucose solutions	
S1	
S2	

[1]

Proceed as follows:

5. Prepare all the concentrations of glucose solution as shown in Fig. 1.1 in the containers provided.

6. Set up a water-bath and maintain it at the temperature you decided in **(a)(iv)**.

7. Test the four concentrations of glucose solution and **S1** and **S2** to compare the concentration of glucose.

8. Record your results in **(vii)** on page 7.

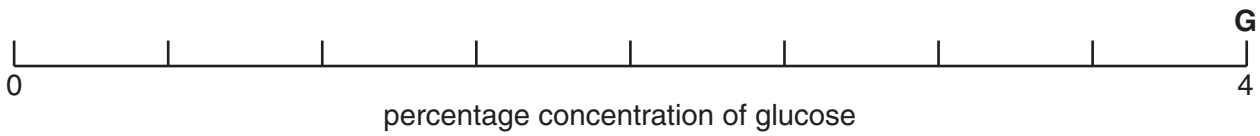
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(vii) Prepare the space below and record your results.

[3]

(viii) Complete Fig. 1.2 below to show:

- each percentage concentration of glucose solution (the concentration of **G** is shown)
- where the samples **S1** and **S2** fit in the series of concentrations.



[2]

Fig. 1.2

(ix) Describe **three** modifications to this investigation which would improve the confidence in your results.

.....

.....

.....

.....

.....

.....

.....

.....

..... [3]

(x) A systematic error occurs when apparatus with scales are used, since the scales may be slightly different.
For example, when measuring the same line, two rulers may give different lengths. However, as long as the same ruler is used for all the measurements, the trend is **not** affected because the error is consistent.

State **one** piece of apparatus used in this investigation that may have a systematic error. Suggest whether this affected your results and give a reason for your answer.

apparatus .....

reason .....

.....
[1]

[Total: 18]

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Question 2 starts on page 10

2 **(a)** The eyepiece graticule scale in your microscope may be used to measure the actual length of the layers of tissues or cells, if the scale has been calibrated against a stage micrometer.

However, to help draw the correct shape and proportions of tissues or cells, as in **(a)(i)** and **(a)(ii)**, it is **not** necessary to calibrate the eyepiece graticule scale.

J1 is a stained transverse section through a plant leaf.

This plant species grows in sub-tropical and temperate regions.
You are not expected to have studied this leaf.

(i) Draw a large plan diagram of the mid-rib of the leaf on **J1**. The mid-rib is shown by the shaded area in Fig. 2.1.

On your diagram, use a ruled label line and label to show the xylem.

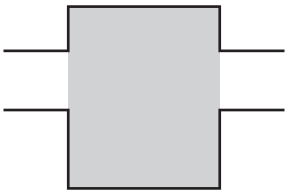


Fig. 2.1

[4]

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(ii) Within the vascular bundles the xylem is made up of chains of vessel elements (arranged in lines).

Select **two** different chains of xylem vessel elements.

Make a large drawing of **three** complete adjacent (touching) xylem vessel elements from **each** of these two selected chains.

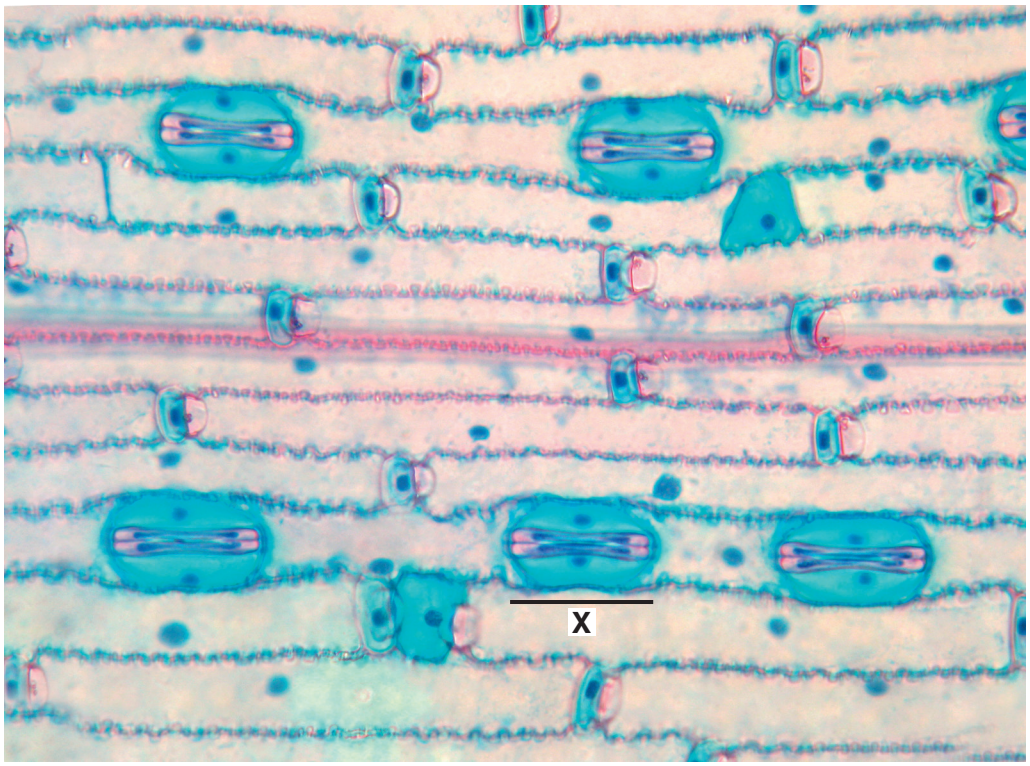
On your drawing use a ruled label line and label to **one** lumen.

first chain

second chain

[5]

(b) Fig. 2.2 is a photomicrograph of the surface of a plant leaf showing stomata. This plant species grows throughout the world's temperate regions.



magnification ×230

Fig. 2.2

(i) Use the magnification on Fig. 2.2 to calculate the actual length, in μm, of line **X**.

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

..... μm [4]

(ii) State **one** observable feature of the leaf surface, shown in Fig. 2.2, that supports the conclusion that water loss was being reduced in this leaf.

Explain how this feature reduces water loss.

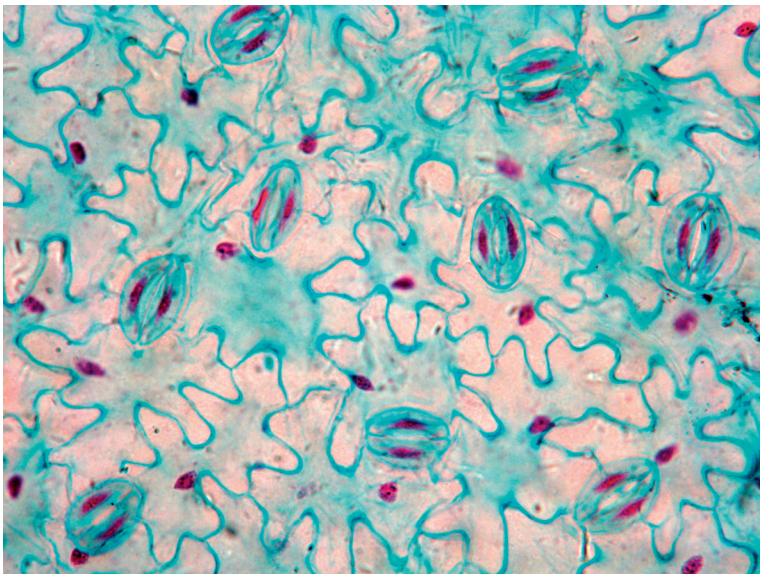
feature .....

explanation .....

[1]

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Fig. 2.3 is a photomicrograph of a stained surface of another leaf showing stomata. This plant species is native to North Africa and South-west Asia.



magnification ×230

Fig. 2.3

(c) Prepare the space below so that it is suitable for you to record the observable differences between the specimens shown in Fig. 2.2 and in Fig. 2.3. Record your observations in the space you have prepared.

[4]

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[Turn over

Rising concentrations of carbon dioxide in the atmosphere have been recorded by scientists for over one hundred years and can be used to predict future increases.

Scientists have studied the effect of carbon dioxide on the number of stomata per mm^2 on the upper and lower epidermis of leaves of one species of plant.

A large sample of plants was grown in air containing one of each of the following concentrations of carbon dioxide:

- $380\,\mu mol\,mol^{-1}$ (the concentration measured in the atmosphere now)
- $560\,\mu mol\,mol^{-1}$ (the predicted concentration in the atmosphere 50 years in the future)
- $800\,\mu mol\,mol^{-1}$ (the predicted concentration in the atmosphere 100 years in the future).

All other variables were standardised.

After a set time the number of stomata per mm^2 on the upper and lower epidermis of the leaves was found and the mean number of stomata per mm^2 was calculated.

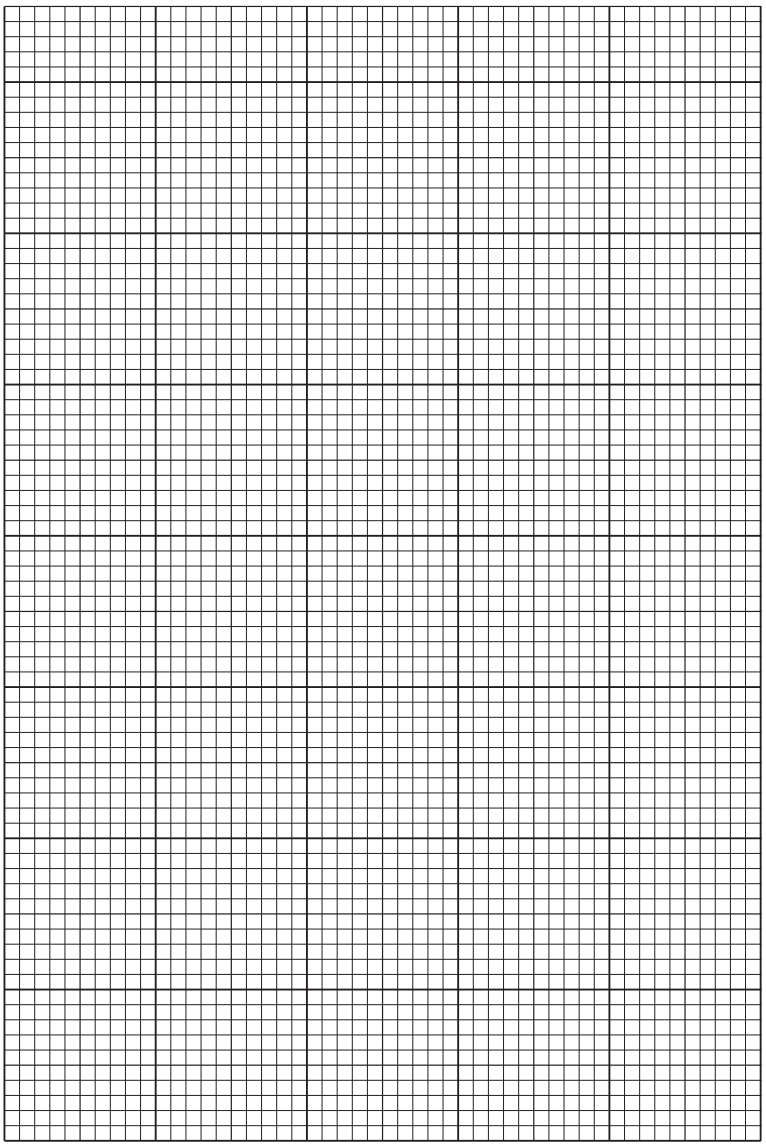
The results are shown in Table 2.1.

Table 2.1

concentration of CO_2 / $\mu mol\,mol^{-1}$	**mean number of stomata / mm^2**	
	upper epidermis (U)	**lower epidermis (L)**
380	2	104
560	3	121
800	8	142

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(d) Plot a **chart** of the data shown in Table 2.1.



[4]

[Total: 22]

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Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5196185666

BIOLOGY **9700/32**

Advanced Practical Skills 2 **May/June 2014**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

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[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 one or more additional measurements.

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

1 You are provided with a solution labelled, **E**, containing an enzyme which coagulates (clots) milk.

Calcium ions are required for this coagulation.

You are required to investigate the concentration of calcium ions (the independent variable), on the progress of this enzyme-catalysed coagulation.

When a mixture of milk, enzyme and calcium chloride is gently rotated the coagulation goes through the stages shown in Fig. 1.1.

Stage **3** is the end-point of the enzyme-catalysed coagulation.

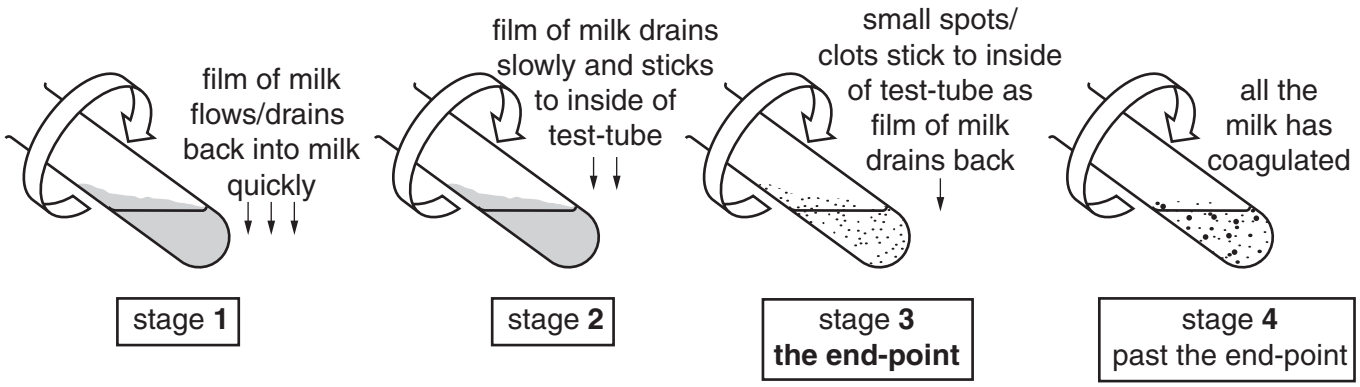


Fig. 1.1

You are provided with:

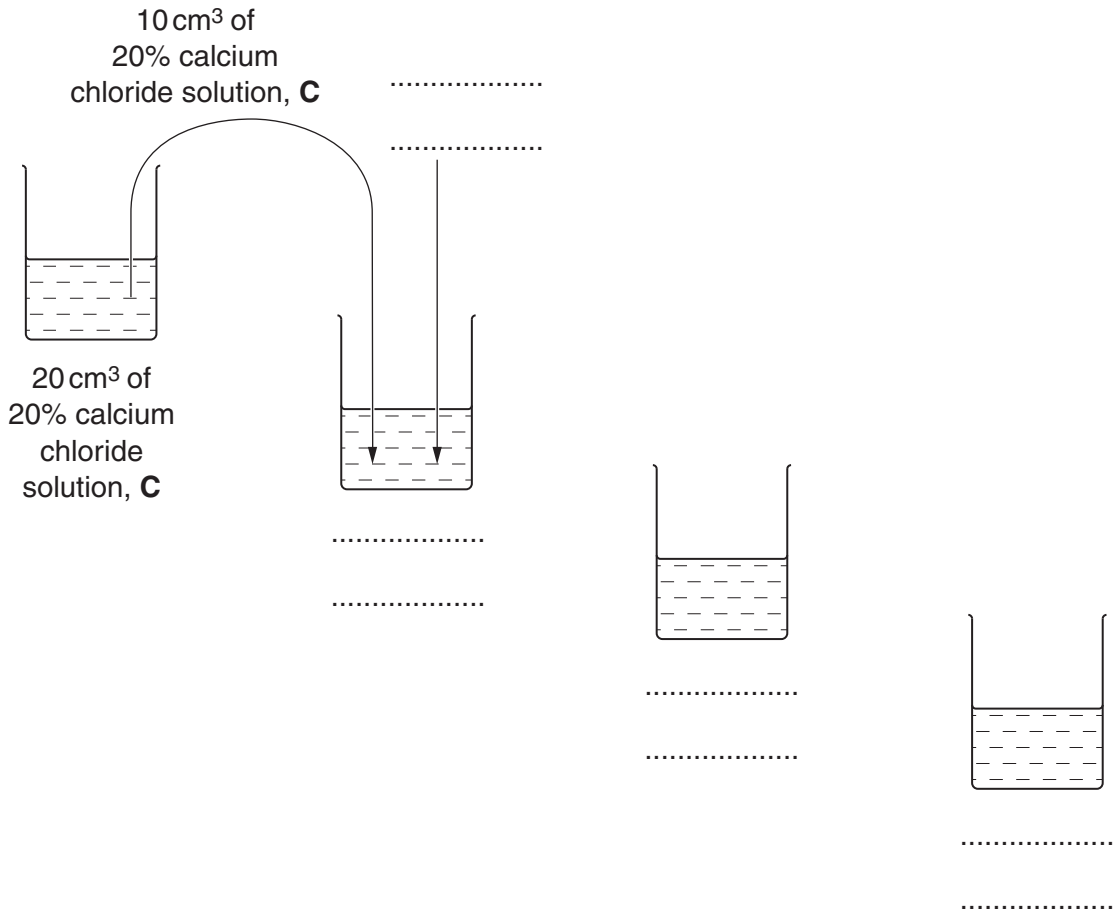
labelled	contents	hazard	volume /cm^3
C	20% calcium chloride solution	harmful irritant	50
W	distilled water	none	100
M	milk	none	100
E	1% enzyme solution	harmful irritant	20

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You are now required to carry out a serial dilution of calcium chloride solution, **C**, to reduce the concentration of **C**, by **half** between each successive dilution.

You will need 10 cm^3 of each calcium chloride solution.

(a) (i) Complete Fig. 1.2 to show how you will make **three** further concentrations of calcium chloride solution by serial dilution.



[3]

Fig. 1.2

Proceed as follows:

1. Prepare all the concentrations of calcium chloride solution as shown in Fig. 1.2 in the containers provided.

2. You are provided with a water-bath. Adjust the temperature to between 35 °C and 40 °C. You will need to maintain this temperature during steps 3 to 10.

3. Put 1 cm^3 of each of the four concentrations of calcium chloride solution into separate test-tubes.

4. Put 10 cm^3 of **M** into each test-tube.

5. Gently shake each of the test-tubes to mix **M** and calcium chloride solution.

6. Put the test-tubes into the water-bath and leave for at least three minutes.

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Read steps 7 to 11 before proceeding.

7. Remove the test-tube containing the mixture with the **highest** concentration of the calcium chloride solution from the water-bath.
   The process of coagulation will start when **E** is added to each test-tube.

   Put 1 cm^3 of solution **E**, so that it runs down the side of the test-tube to form a layer on the surface of the mixture as shown in Fig. 1.3.

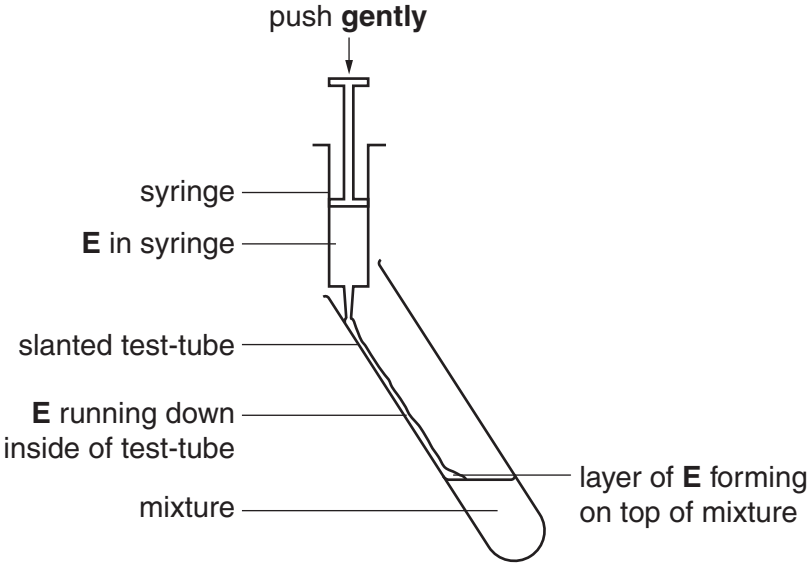


Fig. 1.3

8. Gently shake the test-tube to mix the solutions and **start timing**.

9. Gently rotate the test-tube, as shown in Fig. 1.1 on page 2, to form a film of milk on the inside of the test-tube.

10. Continue to rotate the test-tube whilst holding it over the black card on the table (see Fig. 1.4).

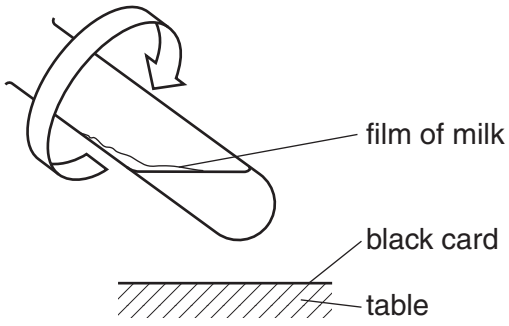


Fig. 1.4

Record the time to reach the end-point as shown in stage **3** in Fig. 1.1.
Ignore any small bubbles on the inside of the test-tube.
If the end-point has not been reached by 4 minutes, stop the experiment and record 'more than 240'.

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11. Repeat steps 7 to 10 using the other concentrations of calcium chloride solution.

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

[5]

(iii) Identify **one** significant source of error in measuring the dependent variable in this investigation.

.....

.....

..... [1]

(iv) A systematic error occurs when apparatus with scales are used, since the scales may be slightly different.
For example, when measuring the same line, two rulers may give different lengths. However, as long as the same ruler is used for all the measurements, the trend is **not** affected because the error is consistent.

State **one** piece of apparatus used in this investigation that may have a systematic error. Suggest whether this affected your results and give a reason for your answer.

apparatus .....

reason .....

.....
[1]

(v) Describe a suitable control for this investigation.

.....

.....

..... [1]

In a similar investigation on the enzyme-catalysed coagulation of milk, a student studied the effect of heating solution **E** at 70 °C for different times.

After heating, the time to reach the end-point was recorded as in your investigation.
This was repeated for each of the different times.

(b) (i) State **two** variables that need to be kept the same (standardised) in this investigation. Describe how you would standardise each of these variables.

variable 1 .....

description .....

.....

variable 2 .....

description .....

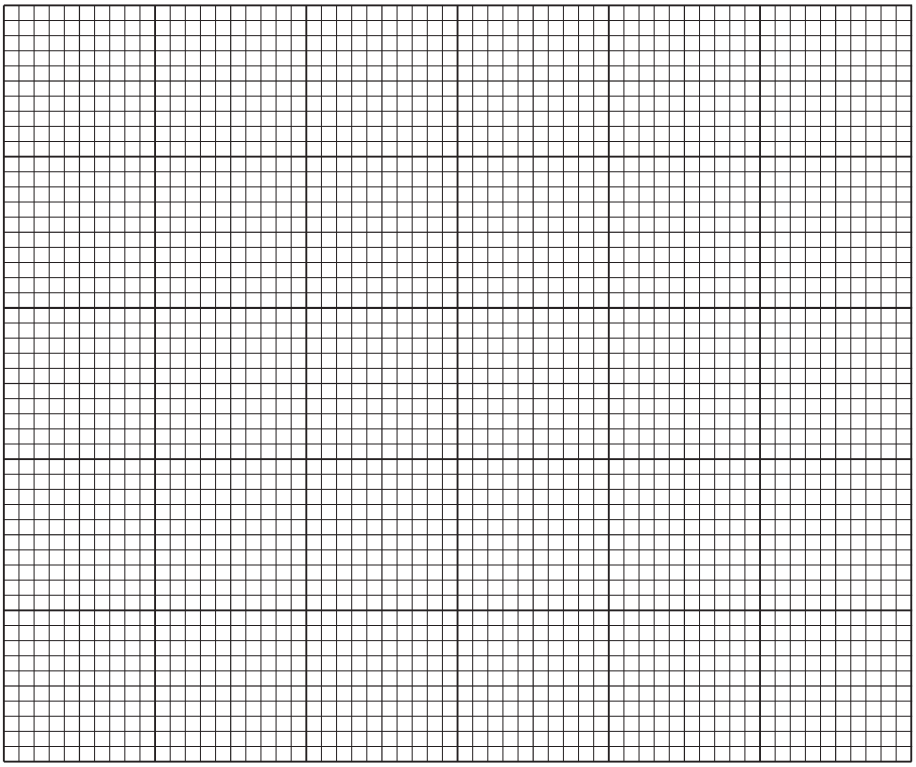
.....
[2]

The results of this investigation are shown in Table 1.1.

Table 1.1

time of heating solution E /s	time to reach the end-point /s
60	30
150	75
185	96
240	140
300	220

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



[4]

(iii) Explain the trend shown in your graph.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 20]

Question 2 starts on page 10

2 The eyepiece graticule scale in your microscope may be used to measure the actual length of the layers of tissues or cells if the scale has been calibrated against a stage micrometer.

However, to help draw the correct shape and proportion of tissues, as in **(a)**, it is **not** necessary to calibrate the eyepiece graticule scale.

L1 is a stained, longitudinal section showing the tissues of a young root tip.

(a) Draw a large plan diagram of **L1**.

Use a ruled label line and a label to show the position of the area in which you can see cells showing stages of mitosis.

[5]

Fig. 2.1 is a photomicrograph of root cells.

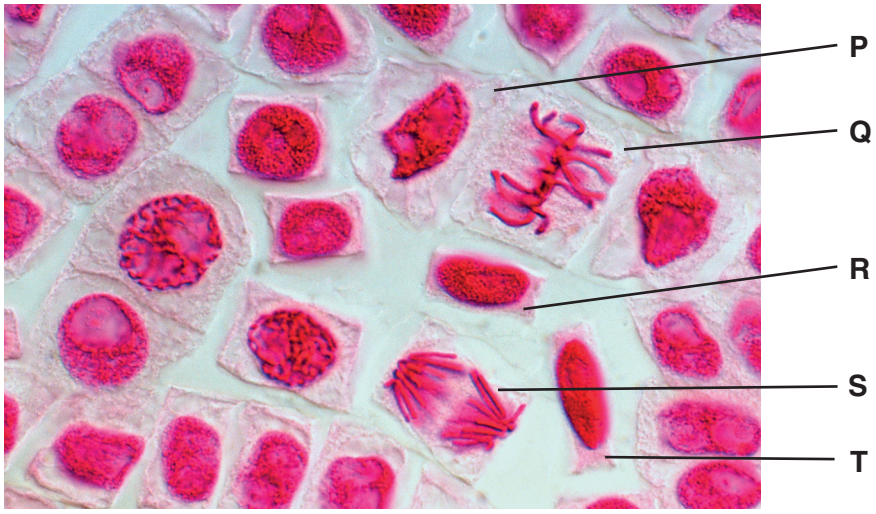


Fig. 2.1

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(b) Make a large drawing of each of the **five** cells labelled **P**, **Q**, **R**, **S** and **T** on Fig. 2.1.

On your drawing use ruled label lines and labels to identify two **different** stages of mitosis.

Annotate **one** of the stages to describe **one** observable feature that supports your identification.

[6]

Fig. 2.2 is a photomicrograph of root cells from a different region of the root.

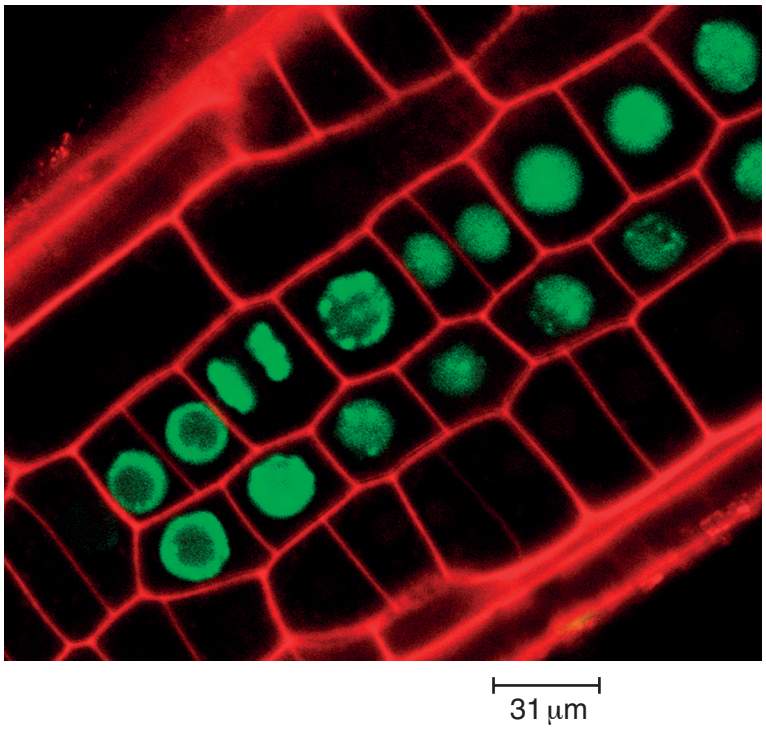


Fig. 2.2

(c) Use the scale bar below Fig. 2.2 to calculate the magnification of Fig. 2.2.

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[4]

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Fig. 2.1 is shown again here to help you answer **(d)**.

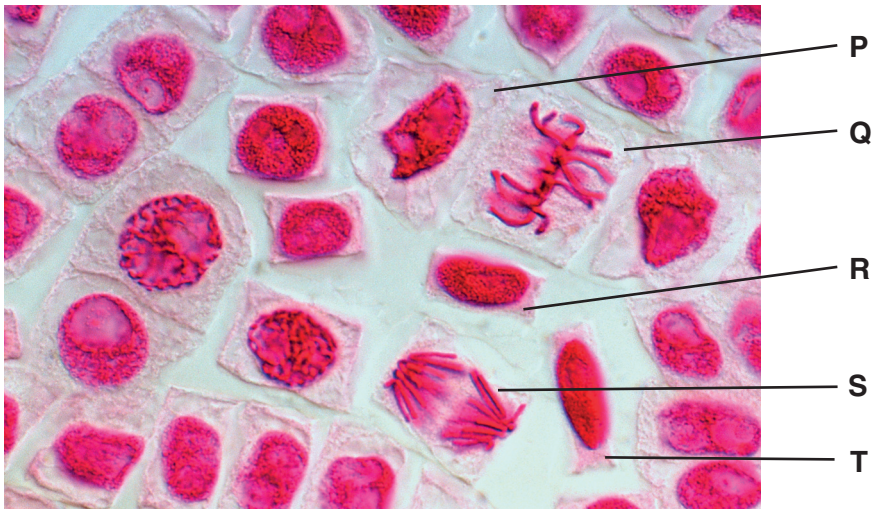


Fig. 2.1

(d) Prepare the space below so that it is suitable for you to record the observable differences, **other than** colour, between the specimens in Fig. 2.1 and in Fig. 2.2.
Record your observations in the space you have prepared.

[5]

[Total: 20]

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CANDIDATE NAME

CENTRE NUMBER

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4088133241

BIOLOGY **9700/33**

Advanced Practical Skills 1 **May/June 2014**

2 hours

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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 You are provided with a blue solution, labelled **C**, which is alkaline.

C is blue because it contains an indicator.

Carbon dioxide reacts with **C** when bubbled into it. When enough carbon dioxide reacts with **C**, the indicator will change from blue to yellow (even if the solution is cloudy). This is the end-point.

Hydrochloric acid, **H**, can also turn indicator **C** clear. If only a small volume of carbon dioxide is bubbled into **C** then the indicator will remain blue. Hydrochloric acid, **H**, can then be added slowly until the indicator turns from blue to yellow.
The **volume** of **H** is then recorded.

The greater the volume of **H** that needs to be added to reach the end-point, the less carbon dioxide has reacted with **C**.

You are provided with:

labelled	**contents**	**hazard**	**volume /cm^3**
Y	yeast cell suspension	none	50
C	alkaline solution (blue)	irritant	70
H	hydrochloric acid	irritant	30

You are now required to find the volume of **H** needed to reach the end-point, when **no** carbon dioxide has been bubbled into **C**.

When no carbon dioxide has been bubbled into **C**, the greatest volume of **H** will need to be added to get the end-point.

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Proceed as follows:

1. Put 5 cm^3 of **C** into a test-tube.

2. Use a syringe, containing 2 cm^3 of **H**, to put drops of **H** into **C** as shown in Fig. 1.1.
Mix well as you add **H**, until the end-point is reached. You may need to fill the syringe again.

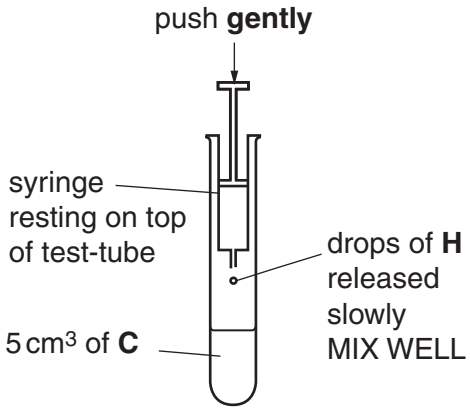


Fig. 1.1

(a) (i) Record the volume of **H** needed to reach the end-point.

volume of **H** ..... [1]

Yeast cells release carbon dioxide from some of their metabolic reactions.

A student investigated the release of carbon dioxide from a yeast cell suspension, using the apparatus shown in Fig. 1.2.

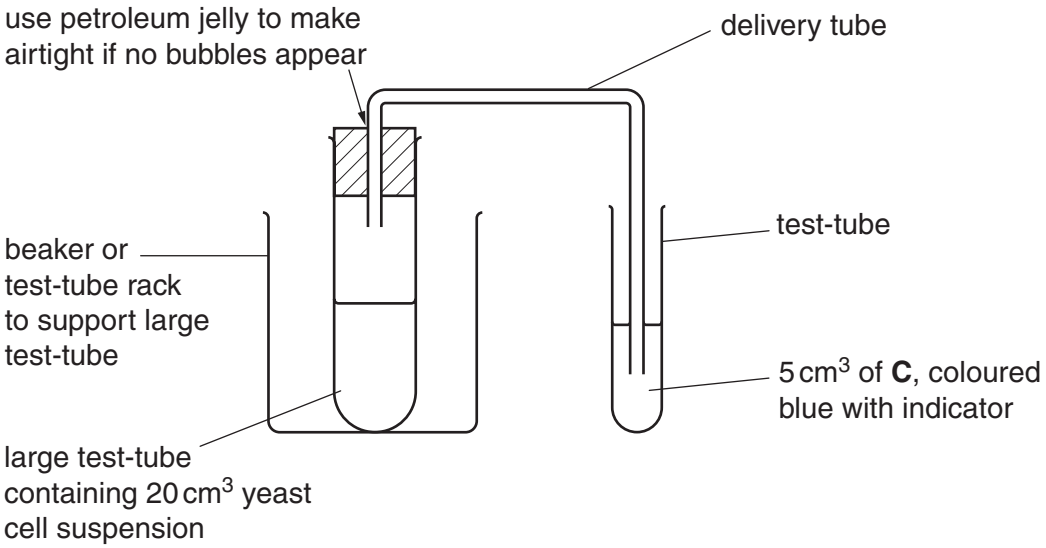


Fig. 1.2

The student set up this apparatus and left it for 10 minutes.

The student observed that during the 10 minutes the bubbles of carbon dioxide were not released at a constant rate.

You are required to investigate the release of carbon dioxide bubbles during 10 minutes using apparatus set up as in Fig. 1.2.

You will move the delivery tube to different test-tubes containing **C**, at different times during 10 minutes.

(ii) Decide the length of time you will leave the delivery tube in each test-tube containing **C**. State the length of time.

time ..... [1]

(iii) State **one** significant source of error that may occur when the delivery tube is moved from one test-tube to the next.

Describe how you will reduce this error.

source of error .....

description .....

.....

.....
[2]

Read steps **3** to **11** before proceeding:

3. Put 5 cm^3 of **C** into a test-tube. Repeat for the number of test-tubes you need to use for your times in **(a)(ii)**.

4. Remove **Y** by placing the nozzle of a large syringe below any froth on the surface.

5. Put 20 cm^3 of **Y** into the large test-tube.

6. Put the bung containing the delivery tube into the large test-tube. It **must** be airtight.

7. Hold the large test-tube as shown in Fig. 1.3.

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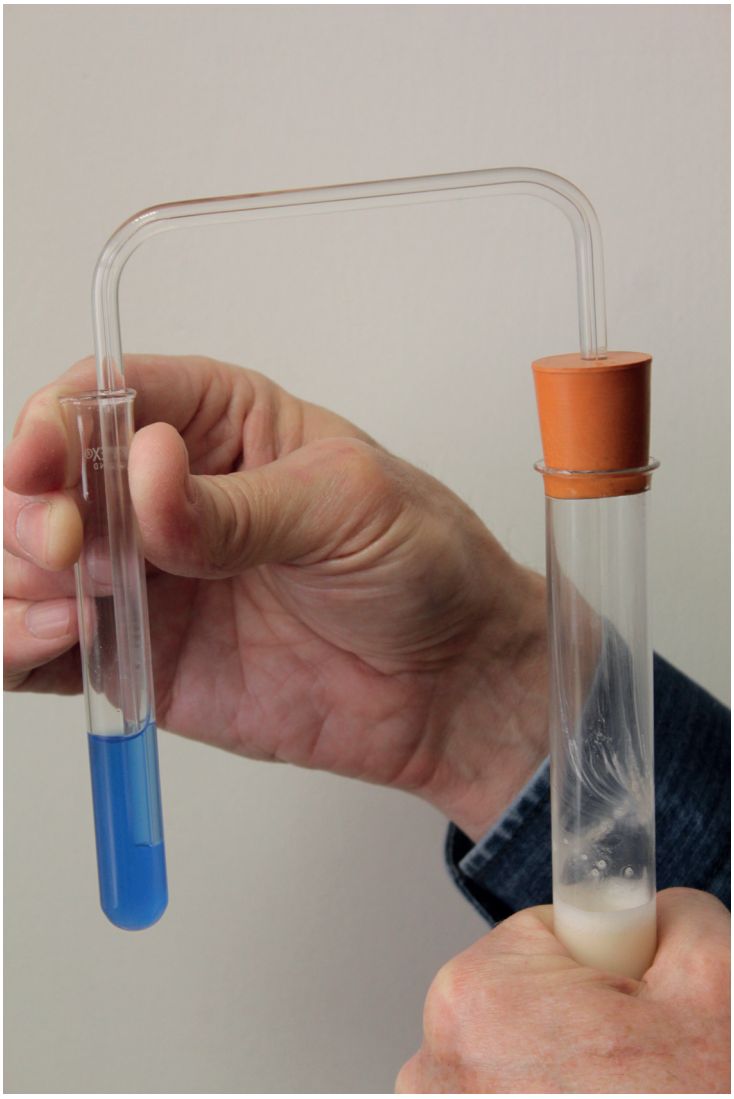


Fig. 1.3

8. Put the end of the delivery tube into the first test-tube containing **C**. Immediately start timing.

9. After the time you decided in **(a)(ii)**, move the delivery tube to the next test-tube containing **C**.

10. Repeat step 9 for all the test-tubes which you set up in step 3.

11. After removing the delivery tube from the last test-tube, repeat step 2 with any of the test-tubes where there is still a blue colour.
    Record your results in **(a)(iv)** on page 6.
    For any test-tubes where **C** is yellow (even if the solution is cloudy) record '0'.

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[Turn over

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

[5]

(v) Identify **one** significant source of error in measuring the dependent variable in this investigation.

.....

.....

..... [1]

(vi) A systematic error occurs when apparatus with scales are used, since the scales may be slightly different.
For example, when measuring the same line, two rulers may give different lengths. However, as long as the same ruler is used for all the measurements, the trend is **not** affected because the error is consistent.

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

Suggest whether this affected your results and give a reason for your answer.

apparatus .....

reason .....

.....
[1]

(b) Increasing concentrations of carbon dioxide in the atmosphere have been recorded by scientists for over one hundred years and can be used to predict future increases.

Scientists have studied the effect of carbon dioxide on the leaf area of two different types of plants, **R** and **T**, after 60 days.

A large sample of each type of plant was grown in air containing one of the following concentrations of carbon dioxide:

- $280\,\mu mol\,mol^{-1}$ (the concentration measured in the atmosphere around the year 1900)
- $380\,\mu mol\,mol^{-1}$ (the concentration measured in the atmosphere now)
- $719\,\mu mol\,mol^{-1}$ (the concentration which is predicted in the atmosphere for the year 2100).

All other variables were standardised.

On day 60 the mean leaf area per plant was calculated.

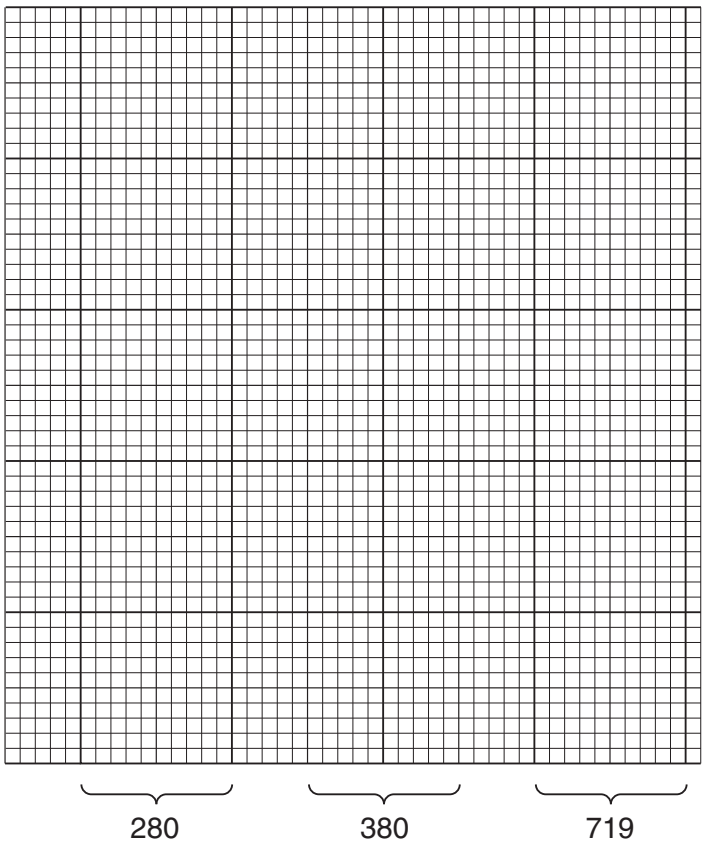
The results are shown in Table 1.1.

Table 1.1

concentration of CO_2 / $\mu mol\,mol^{-1}$	**mean leaf area / $cm^2\,plant^{-1} \times 10^3$**	
	plant R	**plant T**
280	1.00	1.50
380	2.55	3.35
719	4.20	3.90

(i) Complete Fig. 1.4 by plotting a chart of the data in Table 1.1.

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[3]

Fig. 1.4

(ii) Describe the trends shown on the chart for **R** and **T**.

.....

.....

.....

.....

..... [2]

(iii) Suggest how the differences in the leaf area in plant **R** may affect transport in this plant.

.....

.....

.....

.....

.....

.....

..... [2]

Fig. 1.5 is a photomicrograph of a stained transverse section through part of a plant leaf. This plant species is native to part of Asia.

You are not expected to have studied this leaf.



Fig. 1.5

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(c) Draw a large plan diagram of the part of the leaf shown in Fig. 1.5.

On your diagram, use a ruled label line and label to show the vascular bundle.

[4]

[Total: 22]

2 Methylene blue stains dead cells blue.
Living cells are **not** stained blue so they will appear white or clear.

You are provided with:
- methylene blue solution, **M**, (handle carefully as it will stain your skin)
- suspensions of yeast cells, labelled **S1**, **S2** and **S3**.

Each suspension, **S1**, **S2** and **S3** has been heated for ten minutes at 45 °C or 80 °C or 100 °C.

You are required to:
- use the microscope to observe the colour of the yeast cells from **S1**, **S2** and **S3**, after **M** has been added
- record your observations by using annotated drawings of three yeast cells from each of **S1**, **S2** and **S3**
- identify the temperature at which each of **S1**, **S2** and **S3** was heated.

1. Label three microscope slides **S1**, **S2** and **S3**.

2. Place **one drop** of **S1** onto slide **S1** and add **one drop** of **M**. Mix carefully using a glass rod. (If **M** comes into contact with your skin rinse with cold water.)

3. Repeat step 2 with **S2** and **S3**.

4. Leave for five minutes.

5. Add a coverslip to each slide.

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

7. Use the microscope to observe the yeast cells on each slide, then select cells which you can draw and annotate to describe the effect of the methylene blue, **M**.

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

- making drawings of **three** cells from **each** of the slides in the boxes provided
- annotating your drawings to describe the effect of methylene blue, **M** on the cells.

S1

S2

S3

[4]

(ii) Use your observations to identify the temperature that was used to heat each of the suspensions **S1**, **S2** and **S3**.
Complete the table.

suspension	temperature / °C
S1	
S2	
S3	

[1]

(iii) Explain how you identified the yeast cells that had been heated at 100 °C.

.....

.....[1]

(iv) A student was provided with a suspension of yeast cells which had been heated at a temperature between 45 °C and 80 °C.

Describe how you could modify this investigation to provide **quantitative** measurements that can be used to estimate this temperature.

.....

.....

.....

.....

.....

.....

..... [3]

Fig. 2.1 is a photomicrograph of yeast cells.

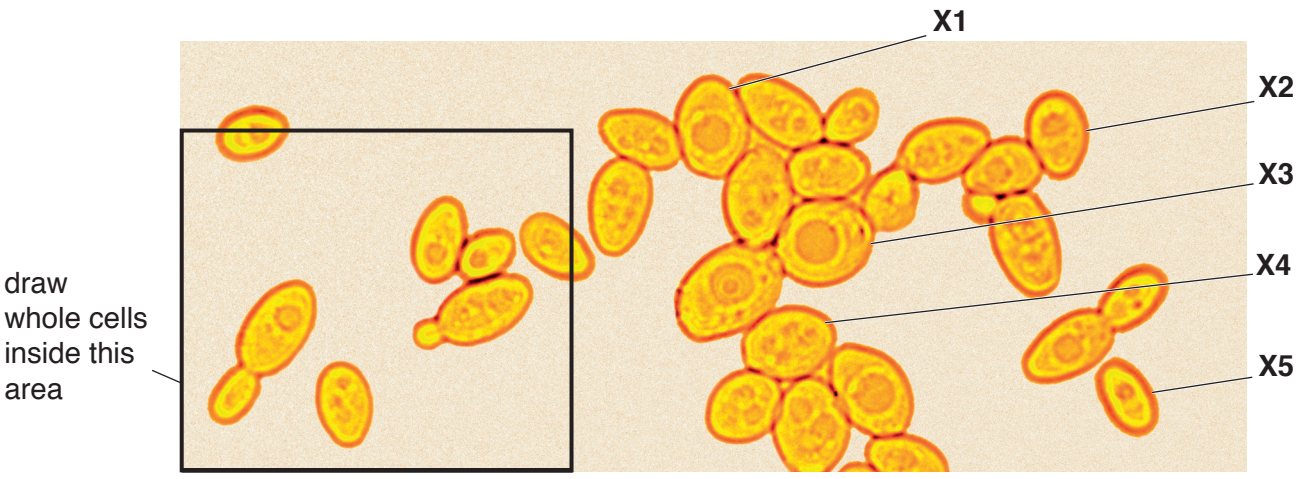


Fig. 2.1

(b) (i) Make a large drawing of the whole cells shown in the area on Fig. 2.1.

On your drawing, use a label line and label to show one observable feature of these cells which identify them as being similar to animal cells.

[5]

(ii) Use the magnification to calculate the mean maximum actual length, in μm, of yeast cells, **X1**, **X2**, **X3**, **X4** and **X5**.

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

..... μm [4]

[Total: 18]

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7008871349

BIOLOGY **9700/34**

Advanced Practical Skills 2 **May/June 2014**

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 ink.
You may use a pencil for any diagrams, graphs or rough working.
Do **not** use red ink, 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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Total	

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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 Many plant cells contain a water soluble molecule called ascorbic acid, which has many functions to help the plant survive.

You are provided with an extract from plant cells, **P**, which contains ascorbic acid.

Visking tubing, **V**, is selectively permeable, similar to a cell surface membrane, so that some biological molecules will diffuse through the wall of the tubing.

You are required to investigate the diffusion of ascorbic acid from **P** into the water surrounding the Visking tubing over a period of 15 minutes.

Fig. 1.1 shows the apparatus before the water was added.

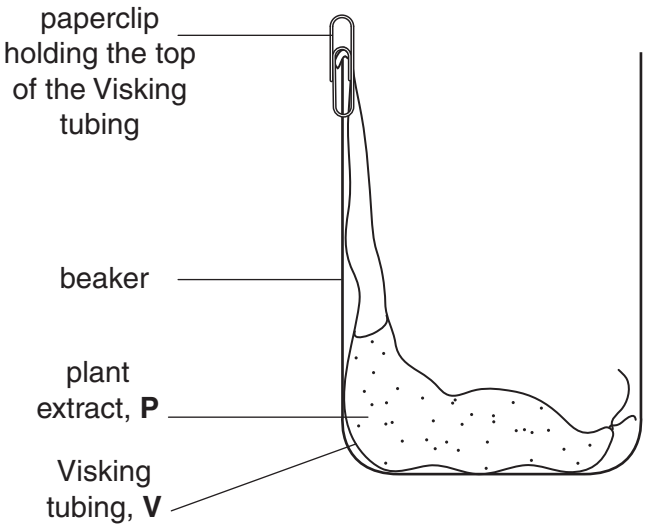


Fig. 1.1

(a) (i) Water is added to the beaker in Fig. 1.1.
Describe the expected trend in the concentration of ascorbic acid in the water over a period of 15 minutes.

..... [1]

You are provided with:

labelled	contents	hazard	volume /cm^3
A	sample of water removed after 15 minutes	irritant	15
P	plant extract containing ascorbic acid	irritant	15
W	distilled water	none	100
I	iodine in potassium iodide solution	irritant	20
S	starch	none	20

labelled	details
V	15 cm length of Visking tubing in a beaker containing water

You must now read up to the end of step 23 before proceeding.

To compare the concentration of ascorbic acid in the samples you are required to find the **volume** of iodine solution, **I**, added to each sample until the end-point is reached.

The drops of **I** will be added one at a time using a small syringe.

To practise releasing drops from a small syringe:

1. Fill the syringe with 2 cm^3 of **I**.

2. Hold the syringe over an **empty** test-tube and push the plunger **gently** to release one drop at a time, as shown in Fig. 1.2.

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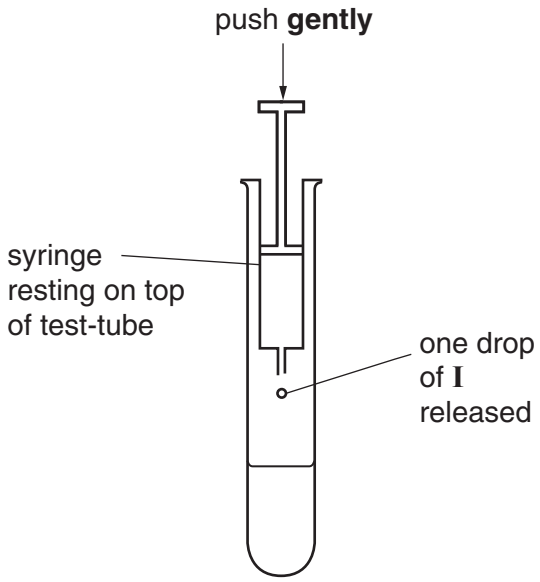


Fig. 1.2

To compare the concentration of ascorbic acid in the samples you will need to add drops of **I** until a blue colour appears. When this blue colour lasts for more than 10 seconds, this is the end-point and the **volume of I** that has been added should be recorded.

The apparatus in Fig. 1.1 was set-up and water was added and left for 15 minutes.
Sample **A** was removed from the water in the beaker.

You are required to find the volume of **I** needed to reach the end-point for sample **A**.

Proceed as follows:

3. Put 1 cm^3 of **S** into a test-tube.

4. Put 3 cm^3 of the sample (e.g. **A**) into the same test-tube.

5. Shake the test-tube gently to mix the contents.

6. Fill the syringe, labelled **I**, with 2 cm^3 of **I**.

7. Wipe off any drops of **I** from the outside of the syringe with a paper towel.

8. Add **one** drop of **I** to the mixture in the test-tube as shown in Fig. 1.2.

9. Mix gently and if there is no colour change add another drop.

10. Continue adding drops, one at a time, until the blue colour appears.
    Wait 10 seconds to see if the end-point has been reached. If the blue colour disappears then add another drop.

11. Repeat step 10 until the mixture stays blue for at least 10 seconds.

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(ii) Record the **volume of I** needed to reach the end-point.

volume ..... [1]

You are required to:

- set up Visking tubing containing **P** as in Fig. 1.3
- decide the level of water to put into the beaker
- remove samples of the water surrounding the Visking tubing at **5 minute intervals** for 15 minutes
- compare the ascorbic acid concentrations in the samples.

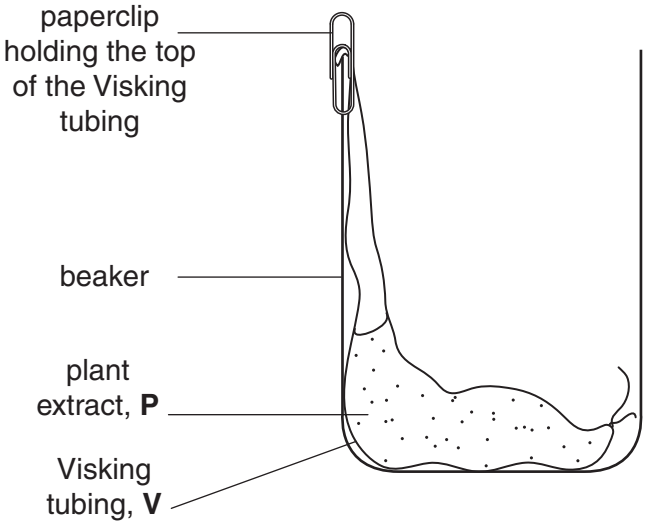


Fig. 1.3

Samples of water surrounding the Visking tubing will be removed for testing, so you need to take this into account when you decide the level of water to put into the beaker.

(iii) Draw **on Fig. 1.3** the level of the water

- before you remove any samples (label 'before'),
- after the total volume of water needed for all the tests has been removed (label 'after').

[2]

(iv) In order to compare the ascorbic acid concentrations, state **one** variable which you will need to standardise when finding the volume of **I** added to each sample.

Describe how you will standardise this variable.

variable .....

description .....

.....

[1]

Proceed as follows:

12. Put **S**, as in step 3, into the four test-tubes you will require in order to test the samples of water.

13. Tie a knot in the Visking tubing as close as possible to one end so that it seals the end.

14. To open the other end, wet the Visking tubing and rub the tubing gently between your fingers.

15. Put 6 cm^3 of **P** into the open end of the Visking tubing.

16. Rinse the outside of the Visking tubing by dipping it into the water in the container labelled **V**.

17. Put the Visking tubing into an empty beaker as shown in Fig. 1.3.

18. Make sure the open end of the Visking tubing is held in place by a paperclip.

You will start timing as soon as you add **W** (**steps 19 and 20**).

You should read steps 19 to 23 before proceeding.

19. Put **W** into the beaker to the level you decided in **(iii)**.

20. Immediately start timing and remove the first sample of water (as in **step 4**) and put into a prepared test-tube (as in **step 12**).

21. Test the sample as in **steps 5 to 11**.

22. After 5 minutes, gently mix the water surrounding the Visking tubing and then remove the next sample, put it into a different (prepared) test-tube and repeat **steps 5 to 11**.

23. Repeat **step 22** for two more samples.

Record your results in **(a)(v)** on page 8.

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[Turn over

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

[5]

(vi) Describe how the results support your expected trend as stated in **(a)(i)**.

.....

.....

..... [1]

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This investigation provides results to compare the concentration of ascorbic acid in the samples.

(vii) If you had been provided with 1.0% ascorbic acid solution, suggest how you would modify this investigation to find the **percentage concentration** of ascorbic acid in the water after 15 minutes.

.....

.....

.....

.....

.....

.....

..... [2]

(viii) A systematic error occurs when apparatus with scales are used, since the scales may be slightly different.
For example, when measuring the same line, two rulers may give different lengths. However, as long as the same ruler is used for all the measurements, the trend is **not** affected because the error is consistent.

State **one** piece of apparatus used in this investigation that may have a systematic error. Suggest whether this affected your results and give a reason for your answer.

apparatus .....

reason .....

.....
[1]

(b) Iodine solution (iodine in potassium iodide solution) turns blue-black when starch is present in plant tissues.

However, as ascorbic acid is also found in plant tissues, some scientists investigated the effect of testing for starch with iodine solution when there was ascorbic acid present.

The concentration of ascorbic acid was $0.0001\,mol\,dm^{-3}$ and the concentration of starch solution was standardised.

The percentage of starch which reacted with the iodine solution was measured.

The results are shown in Table 1.1.

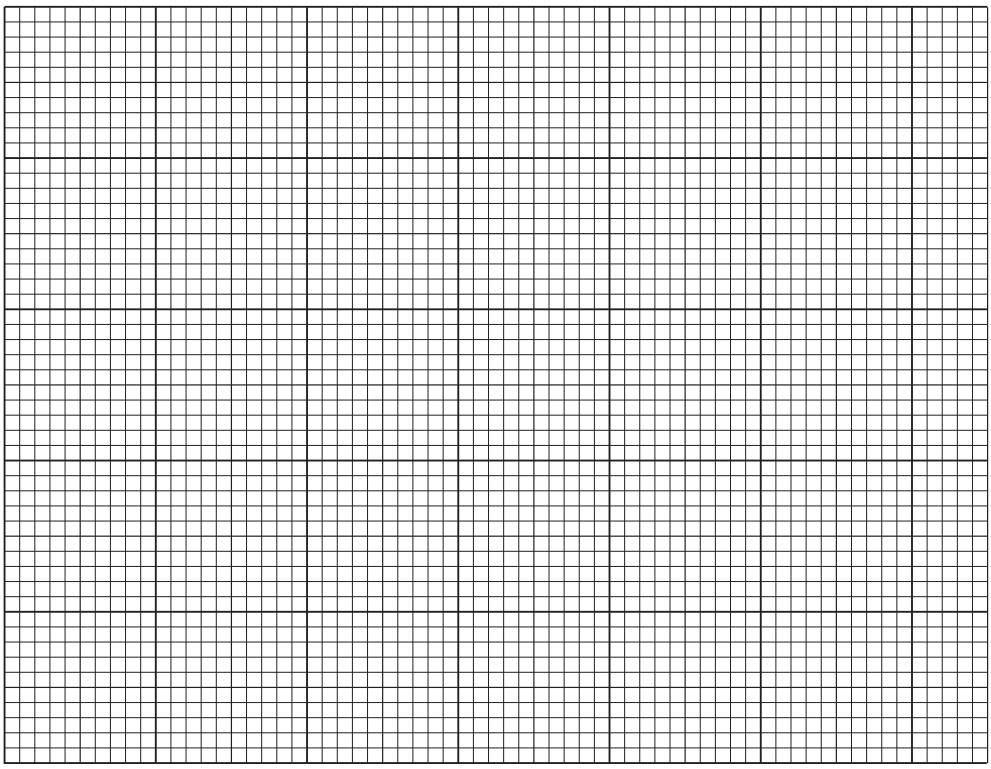
Table 1.1

volume of iodine solution /cm^3	percentage of starch which reacted with iodine solution
0.0	0.0
0.5	2.0
1.5	5.0
2.0	36.0
2.5	68.0

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

*You will need to consider the answer to **(b)(ii)** before you plot your graph.*



[4]

(ii) Estimate the volume of iodine solution needed for 100% of the starch to be reacted. Show on your graph how you obtained the volume of iodine solution.

volume of iodine solution ..... cm^3 [1]

(iii) Explain how the presence of ascorbic acid may affect the use of iodine solution as a test for the presence of starch in different plant tissues.

.....

.....

.....

.....

..... [2]

(iv) A plant tissue contains 0.0001 mol dm^{-3} ascorbic acid and starch.
Suggest how you would make sure that the iodine test showed the presence of all the starch (100%).

.....

.....

..... [1]

[Total: 22]

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2 The eyepiece graticule scale in your microscope may be used to measure the actual length of the layers of tissues or cells, if the scale has been calibrated against a stage micrometer.

However, to help draw the correct shape and proportions of tissues or cells, as in **(a)(i)**, it is **not** necessary to calibrate the eyepiece graticule scale.

(a) **M1** is a stained transverse section showing the tissues where there is gas exchange in a mammal.

(i) Make a large drawing to show the details of **three** whole structures which are specialised for gas exchange (alveoli). The walls of one alveolus must be touching the walls of the other two alveoli.

On your drawing, use a ruled label line and label to show **one** nucleus.

[4]

(ii) On your drawing, use a ruled label line and label to show where gas exchange takes place. [1]

(iii) State **one observable** feature, shown in your drawing, that supports the conclusion that gas exchange is a function of this tissue.

Explain how this feature enables gas exchange to take place.

feature .....

explanation .....

.....

[2]

(b) Fig. 2.1 is a photomicrograph of a stained transverse section through the tissues in a leaf where gas exchange takes place. This plant species is native to South America.

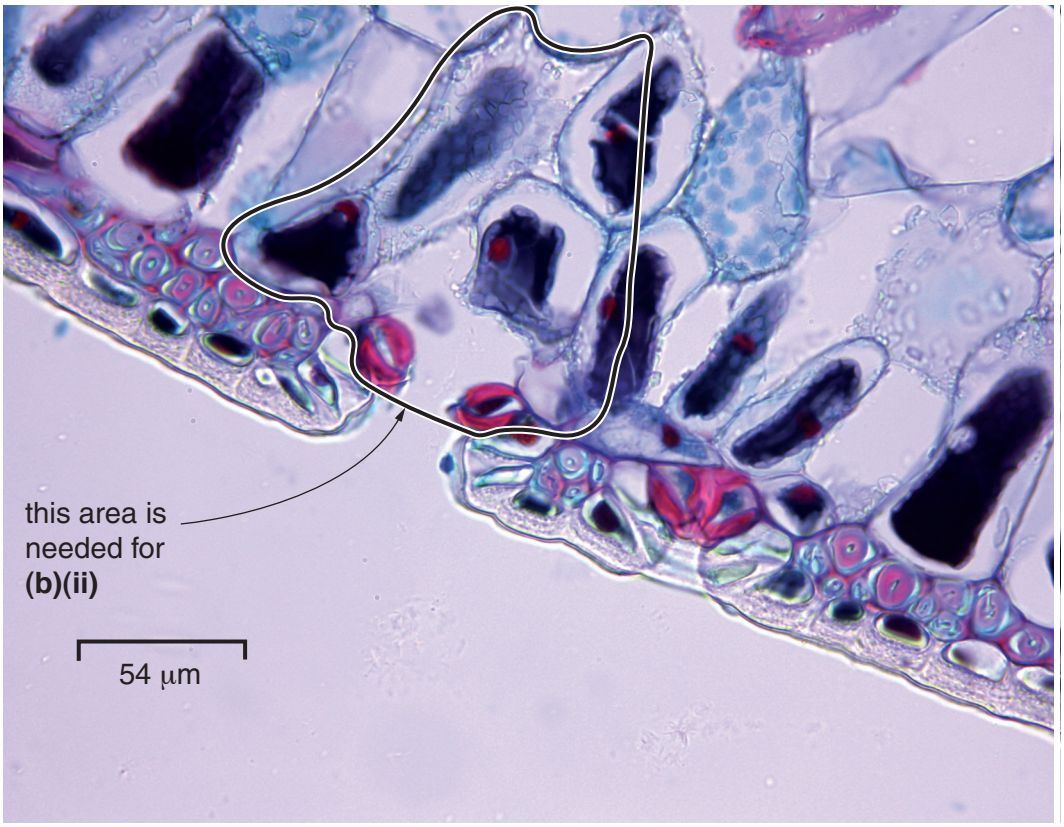


Fig. 2.1

(i) Use a ruled label line and the label **Z on Fig. 2.1** to show **one** observable feature which has reduced transpiration.
Explain how this feature has decreased the rate of transpiration.

.....

..... [2]

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(ii) Make a large drawing of the whole cells shown **inside** the area shown by the line on Fig. 2.1.

On your drawing, use a ruled label line and label to **one** guard cell.

[5]

(iii) Calculate the magnification of Fig. 2.1 using the scale bar.

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

magnification × ..... [4]

[Total: 18]

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3870282862

BIOLOGY **9700/35**

Advanced Practical Skills 1 **May/June 2014**

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 ink.
You may use a pencil for any diagrams, graphs or rough working.
Do **not** use red ink, staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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Total	

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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 During the summer, certain plants translocate sucrose from the leaves to the roots to be stored as starch.
In the spring, this starch is hydrolysed to produce glucose which will provide energy for new growth.

You are provided with three samples, **S1**, **S2** and **S3** from plant root extracts, removed at different times of the year:

- the middle of winter, when there was no plant growth
- the beginning of spring, when plant growth begins
- the middle of spring, during active growth.

(a) (i) These extracts were tested for starch. Predict the colour that was observed and complete the table.

time of year extract was taken	predicted colour
middle of winter	
beginning of spring	
middle of spring	

[1]

You are required to:

- compare the concentrations of starch in the samples **S1**, **S2** and **S3**
- identify the time of year when each extract was taken.

You are provided with:

labelled	hazard	volume/cm^3
S1	none	20
S2	none	20
S3	none	20

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(ii) State the reagent you will use to compare the concentrations of starch **and** describe how you will standardise the starch test for each sample.

reagent .....

description .....

.....

.....[2]

Proceed as follows:

- Carry out the starch test as described in **(a)(ii)**.

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

[3]

(iv) Complete the table to match the samples **S1**, **S2** and **S3** with the time of year that each extract was taken from the root.

time of year extract was taken	sample
middle of winter	
beginning of spring	
middle of spring	

[1]

You are required to estimate the concentration of glucose in **S3** using **G1** and **G2**.

You are provided with:

labelled	hazard	percentage concentration of glucose	volume/cm^3
G1	none	0.1	20
G2	none	1.0	20

Proceed as follows:

1. Carry out tests to compare the **concentration** of glucose in **S3**, **G1** and **G2** using the apparatus and reagents provided.

   You will need to record the **time taken** for the first appearance of a colour change at the **top** of the mixture of the sample with the selected reagent(s).
   If no colour change occurs after 5 minutes, stop the experiment and record 'more than 300'.

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

[3]

(vi) Use the results you obtained to estimate the concentration of glucose found in **S3**.

.....

.....[1]

(vii) Suggest how you would modify this investigation to obtain a more accurate estimate of the glucose concentration in **S3**.

.....

.....

.....

.....

.....

.....

.....[3]

(viii) A systematic error occurs when apparatus with scales are used, since the scales may be slightly different.
For example, when measuring the same line, two rulers may give different lengths. However, as long as the same ruler is used for all the measurements, the trend is **not** affected because the error is consistent.

State **one** piece of apparatus used in this investigation that may have a systematic error. Suggest whether this affected your results and give a reason for your answer.

apparatus .....

effect and reason .....

.....[1]

(b) Certain plants translocate sucrose from the leaves to the roots to be stored as sucrose rather than as starch. These roots can be harvested and kept in storage until they are sold. However, water loss during storage reduces their value.

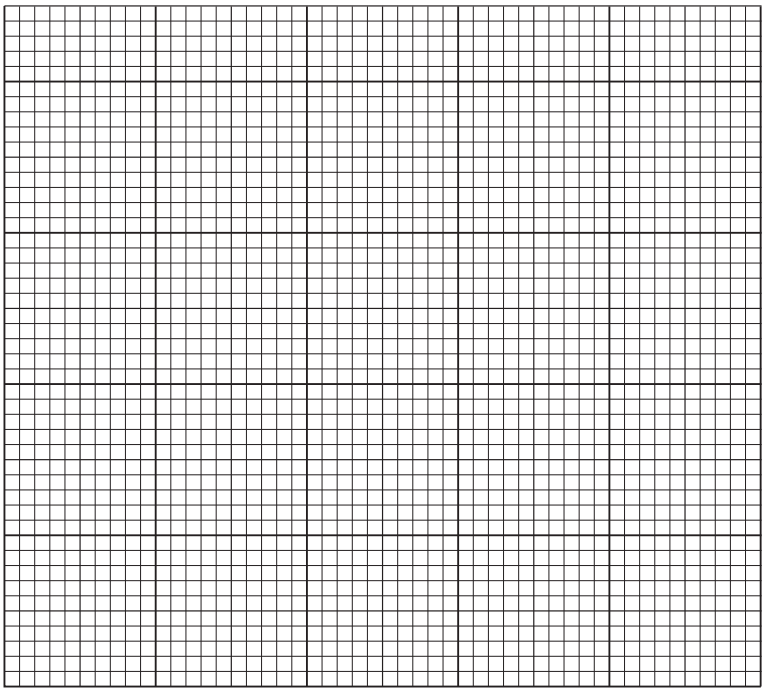
A scientist investigated how water loss from these roots was affected by the time in storage. Constant temperature and humidity were maintained during storage.
Ten roots were weighed at five day intervals. The mean percentage change in water content was calculated. It was found that all the roots had lost water.

The results are shown in Table 1.1.

Table 1.1

time in storage/days	mean percentage change in water content
5	–6.25
10	–11.00
15	–15.50
20	–17.25
25	–17.50

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



[4]

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(ii) Ten roots were stored for 5 days, and another ten roots were stored for 20 days. Pieces of root from the sample at 5 days and from the sample at 20 days were removed, weighed and soaked in dilute sucrose solution for 24 hours. The pieces were then reweighed.

State which sample would have the highest percentage gain in mass after soaking in the dilute sucrose solution.

Explain your answer using your knowledge of water potential.

sample .....

explanation .....

.....

.....

.....[2]

[Total: 21]

2 The eyepiece graticule scale in your microscope may be used to measure the actual length of the layers of tissue or cells, if the scale has been calibrated against a stage micrometer.

However, to help draw the correct shape and proportion of tissues, as in **(a)**, it is **not** necessary to calibrate the eyepiece graticule scale.

K1 and **K2** are slides showing stained transverse sections through blood vessels.

(a) Draw large plan diagrams of **two** different **types** of blood vessel shown in **K1** and **K2**.

On your diagram, use ruled label lines and labels to describe (annotate) **one** observable difference in the layer lining the inside of each vessel.

[5]

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Fig. 2.1 is a photomicrograph of blood cells taken from a person suffering from cancer affecting the white blood cells.

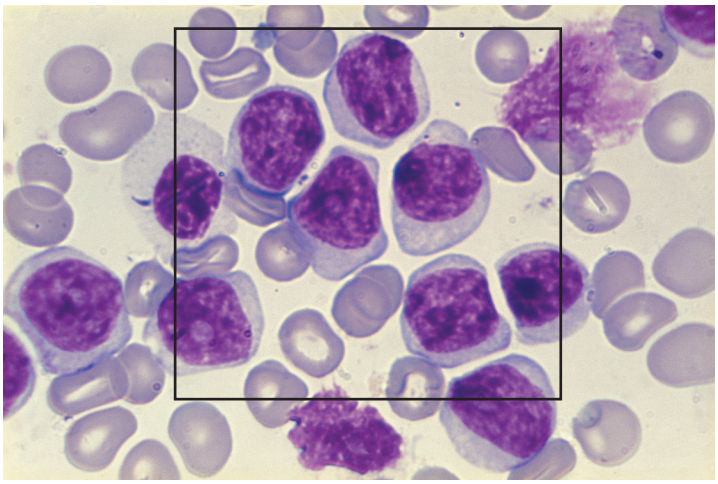


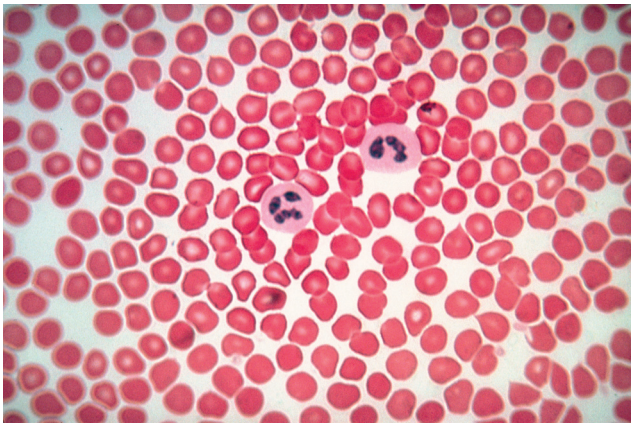
Fig. 2.1

(b) Make a large drawing of **five** whole white blood cells in the area shown on Fig. 2.1.

Use ruled label lines and labels to **one** cell you have drawn to identify **three** cell structures that can also be found in plant cells.

[5]

(c) Fig. 2.2 is a photomicrograph showing blood cells from a healthy person.



magnification x500

Fig. 2.2

(i) To diagnose cancer of the white blood cells a sample of blood is taken and a total blood cell count is carried out on the sample.

State **one** difference, **other than size**, between the blood shown in Fig. 2.1 and that in Fig. 2.2 that indicates that the person is suffering from cancer which affects the white blood cells.

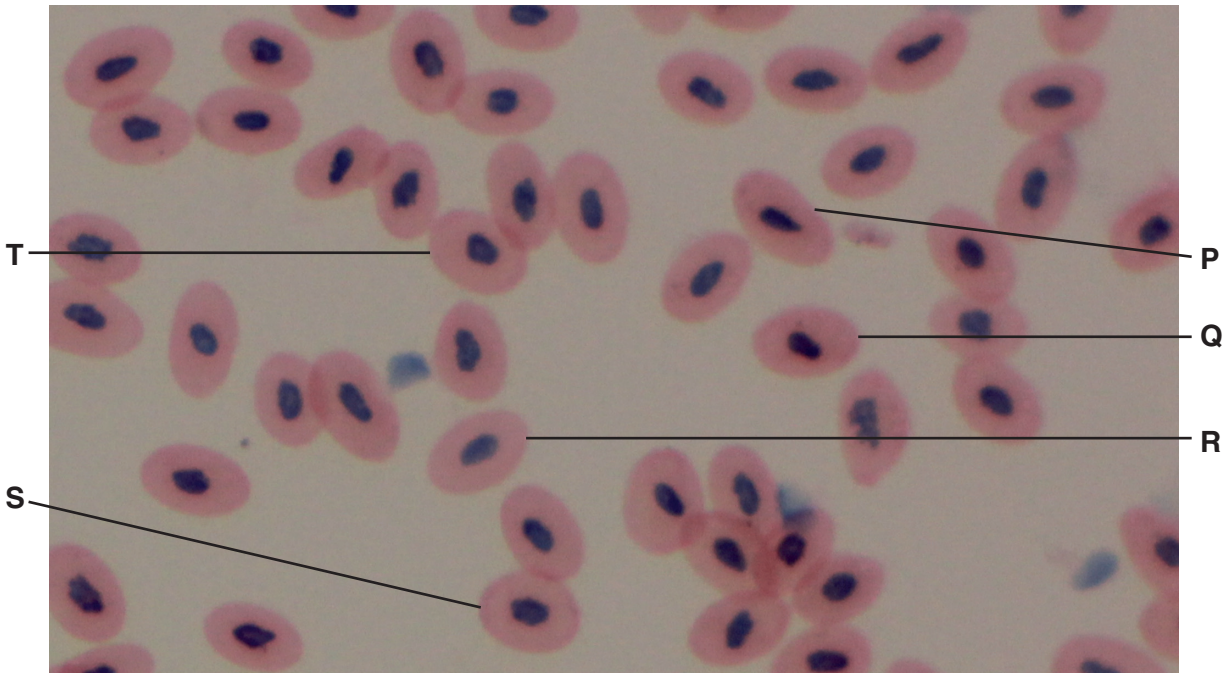
Explain the reason for this difference.

difference .....

explanation .....

.....[2]

Fig. 2.3 is a photomicrograph of blood cells from a different species of animal.



magnification x500

Fig. 2.3

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(ii) A student measured the **longest** length of five red blood cells **P**, **Q**, **R**, **S** and **T** shown in Fig. 2.3 and found the mean actual length of the red blood cells.

Use the magnification to calculate the mean actual length, in μm, of the red blood cells using the five **labelled** red blood cells in Fig. 2.3.

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

mean actual length .....μm [4]

(d) Prepare the space below so that it is suitable for you to record the observable differences between the red blood cells in Fig. 2.2 and Fig. 2.3.

Record your observations in the space you have prepared.

[3]

[Total: 19]

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Fig. 2.2 © ERIC GRAVE/SCIENCE PHOTO LIBRARY.

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