Cambridge International AS & A Level

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Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5406497834

BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **May/June 2016**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

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Write in dark blue or black pen.
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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.

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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 Visking tubing, **V**, is selectively permeable, so that some biological molecules will diffuse through the wall of the tubing.

You are required to investigate the diffusion of reducing sugars into the water surrounding the Visking tubing.

Fig. 1.1 shows the apparatus you will set up for this investigation before the water has been added.

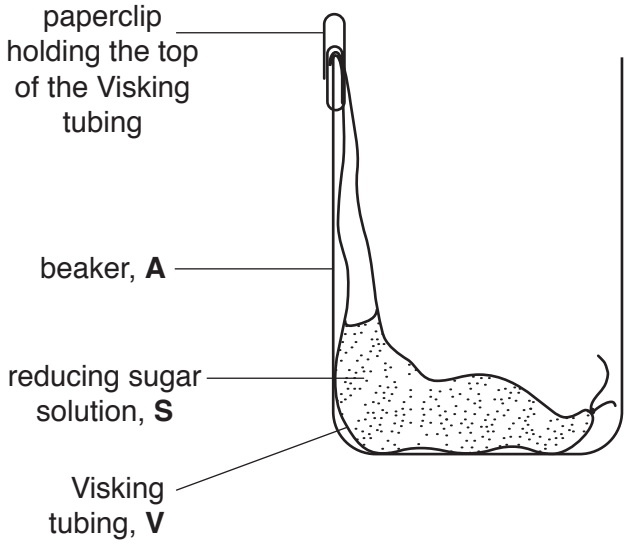


Fig. 1.1

(a) One sample of water surrounding the Visking tubing will be removed and tested using Benedict's solution, so you need to take this into account when you decide the volume of water to put into the beaker.

(i) Draw on Fig. 1.1 the level of water:

- before you remove the sample and label this level '**before**'
- after the volume of water needed for the test has been removed and label this level '**after**'. [2]

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You are provided with:

labelled	contents	hazard	volume/cm^3
S	20% reducing sugar solution	none	25

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

You are required to set up the apparatus as in Fig. 1.1, add the water and then remove a sample of this water (**U**) after 15 minutes.

Proceed as follows:

1. Set up a water-bath and heat to boiling ready for step 13.

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

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

4. Put 8 cm^3 of **S** into the open end of the Visking tubing.

5. Rinse the outside of the Visking tubing by dipping it into the water in the container labelled '**For washing**'.

6. Put the Visking tubing into the empty beaker, labelled **A**, as shown in Fig. 1.1.

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

8. Put water from the container labelled **V** into **A** to the level you decided in **(a)(i)** and start timing. Leave for 15 minutes.

While you are waiting continue with Question 1.

9. After 15 minutes, gently mix the water surrounding the Visking tubing.
   Remove 2 cm^3 of the water and put this sample into a test-tube and label this **U**.
   Stop timing.

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[Turn over

You are required to:

- prepare different concentrations of reducing sugar solution
- find, for each reducing sugar solution, the time taken for the **first** appearance of a colour change when heated with Benedict's solution
- estimate the concentration of the reducing sugar solution, **U**.

You are provided with:

labelled	contents	hazard	volume/cm^3
G	0.5% reducing sugar solution	none	60
W	distilled water	none	250
Benedict's	Benedict's solution	none	50

You are required to prepare different concentrations of reducing sugar solution using **G**.
You will need to **prepare** 10 cm^3 of each concentration.

(ii) Table 1.1 shows how to make up one of the concentrations of reducing sugar solution you will use.
Decide which concentrations of reducing sugar solution to prepare:
- using **simple** dilution
- using 0.5% reducing sugar solution, **G**.

Complete Table 1.1 to show how you will prepare the other concentrations.

Table 1.1

volume of 0.5% reducing sugar solution, **G** /cm^3	volume of distilled water, **W** /cm^3	final percentage concentration of reducing sugar solutions
10.0	0.0	0.5

[2]

10. Prepare the concentrations of reducing sugar solutions as shown in Table 1.1, in the beakers provided.

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11. Put 2 cm^3 of the **highest** percentage concentration of reducing sugar solution into a test-tube.

12. Put 3 cm^3 of Benedict's solution into the same test-tube.

13. Put this test-tube into the water-bath (prepared in step 1) and record the time taken for the first appearance of a colour change in **(a)(iii)**.
If there is no colour change after 120 seconds, stop timing and record the time as 'more than 120'.

14. Repeat step 11 to step 13 for each of the other concentrations you prepared in step 10.

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

[4]

You are required to use the same procedure to estimate the concentration of reducing sugar in the sample **U** (from step 9).

(iv) State which variable you will need to standardise when testing **U**.

.....[1]

15. Carry out the standardised test for the sample, **U**.

(v) Record the time taken for the first appearance of a colour change for **U**.

U ..... [1]

(vi) Use your results in **(a)(iii)** to estimate the percentage concentration of reducing sugar in **U**.

.....[1]

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[Turn over

(b) Reducing sugars are produced when an enzyme, **E**, hydrolyses sucrose. The reducing sugars change the colour of pink potassium manganate(VII) solution to a colourless end-point.

The rate of colour change depends on the concentration of the reducing sugar solution. The greater the reducing sugar concentration the faster the end-point is reached.

A student investigated the effect of the concentration of sucrose solution on the activity of enzyme, **E** by recording the time taken to decolourise potassium manganate(VII) solution.

All other variables were standardised.

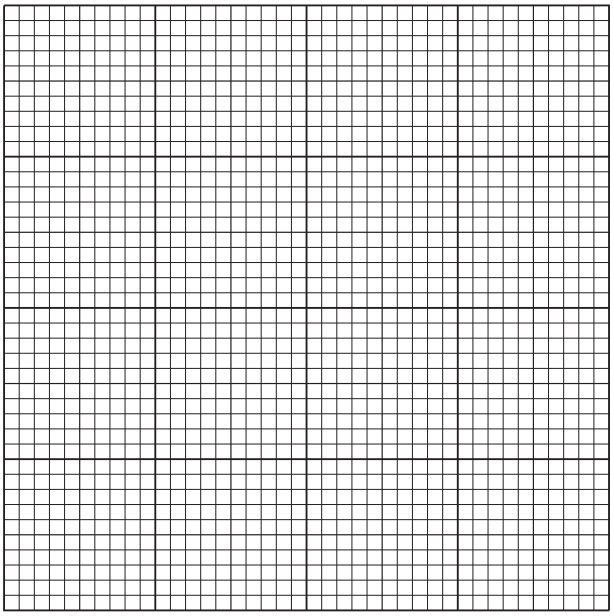
The results of the student's investigation are shown in Table 1.2.

Table 1.2

percentage concentration of sucrose solution	time to decolourise potassium manganate(VII) solution/s
0.5	158.0
1.0	84.0
1.5	74.0
2.0	32.0
2.5	22.0

You are required to use a sharp pencil for graphs.

(i) Plot a graph of the data shown in Table 1.2.



[4]

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(ii) Estimate the time to decolourise potassium manganate(VII) solution at 1.75% sucrose concentration.
Show on your graph how you obtained the time to decolourise potassium manganate(VII) solution.

time ..... [2]

(iii) Using the data in Table 1.2 and your graph, explain the relationship between the concentration of sucrose solution and the enzyme activity.

.....

.....

.....

.....

.....[2]

(iv) This student's procedure investigated the effect of sucrose concentration on the rate of enzyme activity.

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

Describe how sucrose concentration could be standardised.

.....

.....

Now consider how you could modify the student's procedure to investigate the effect of **pH** on the hydrolysis of sucrose.

Describe how this independent variable, **pH**, could be investigated.

.....

.....

.....

.....

.....[3]

[Total: 22]

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[Turn over

2 **J1** is a slide of a stained transverse section through a plant root.

You are not expected to be familiar with this specimen.

You are required to use a sharp pencil for drawings.

(a) **(i)** Draw a large plan diagram of half of the root as shown by the shaded area in Fig. 2.1.

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

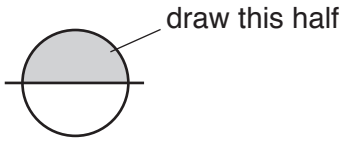


Fig. 2.1

You are expected to draw the correct shape and proportions of the different tissues.

[4]

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(ii) Observe the vascular tissue in the centre of the root on **J1**.
The vascular tissue is surrounded by a ring of cells.

Select **one** group of **four** adjacent (touching) cells from this ring of cells.
Each cell of the group must touch at least one of the other cells.

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

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

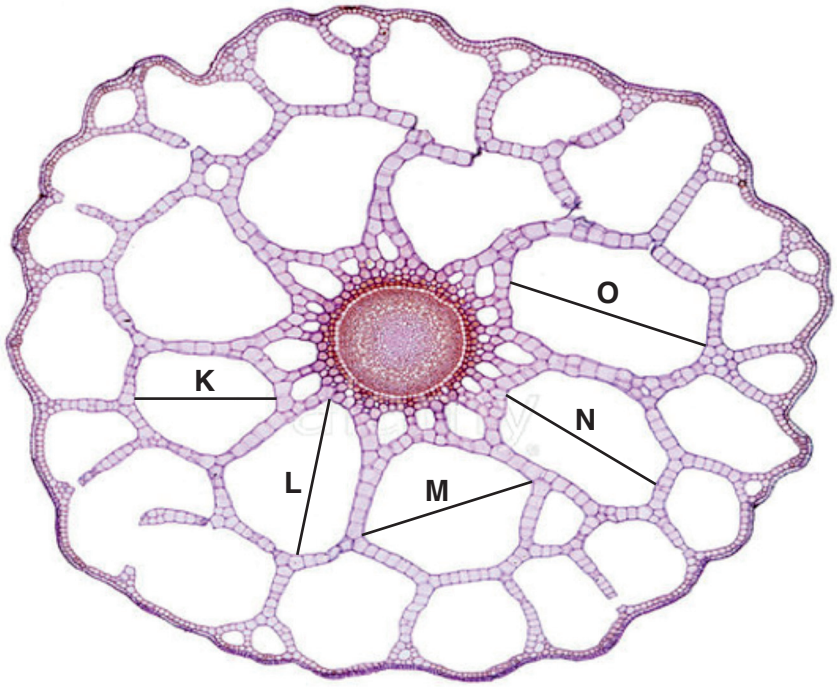
[5]

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[Turn over

(b) Fig. 2.2 is a photomicrograph of a stained transverse section through a plant stem of a different type of plant.

You are not expected to be familiar with this specimen.



magnification ×25

Fig. 2.2

(i) Use the magnification and the lines in Fig. 2.2 to find the actual diameter, in μm, of the air spaces labelled **K**, **L**, **M**, **N** and **O**.

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

K ..... μm, **L**..... μm, **M**..... μm, **N**..... μm, **O**..... μm [2]

(ii) Using the actual diameters calculated in **(b)(i)**, calculate the **mean** actual diameter of an air space.

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

mean actual diameter ..... [2]

(iii) A feature of the plant in Fig. 2.2 is the presence of air spaces in the plant stem.

Suggest a habitat where this plant might grow .....

Suggest how the air spaces adapt the plant to this habitat.

.....

.....[1]

(c) Prepare the space below so that it is suitable for you to record the observable differences between the root on **J1** and the stem in Fig. 2.2.

Record your observations in the space you have prepared.

[4]

[Total: 18]

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Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0723672802

BIOLOGY **9700/32**

Paper 3 Advanced Practical Skills 2 **May/June 2016**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

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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 Yeast cells use enzymes to hydrolyse (break down) glucose, releasing carbon dioxide.
The release of carbon dioxide can be used to measure the activity of yeast cells.

You are required to investigate the effect of temperature (independent variable) on the activity of a yeast cell suspension.

You are provided with:

labelled	contents	hazard	volume/cm^3
Y	yeast cell suspension with glucose added	none	100

(a) (i) You will need to test the activity of a yeast cell suspension at the temperature of the room.

Use the thermometer to measure the temperature of the room.

temperature ..... [1]

(ii) You will also need to test the activity of a yeast cell suspension at the maximum temperature of 60 °C.

State the **other** temperatures you will use in your investigation.

.....[1]

Proceed as follows:

Read step 1 to step 11.

1. Put 10 cm^3 of the yeast cell suspension, **Y**, into a test-tube labelled with the temperature of the room you recorded in **(a)(i)**.

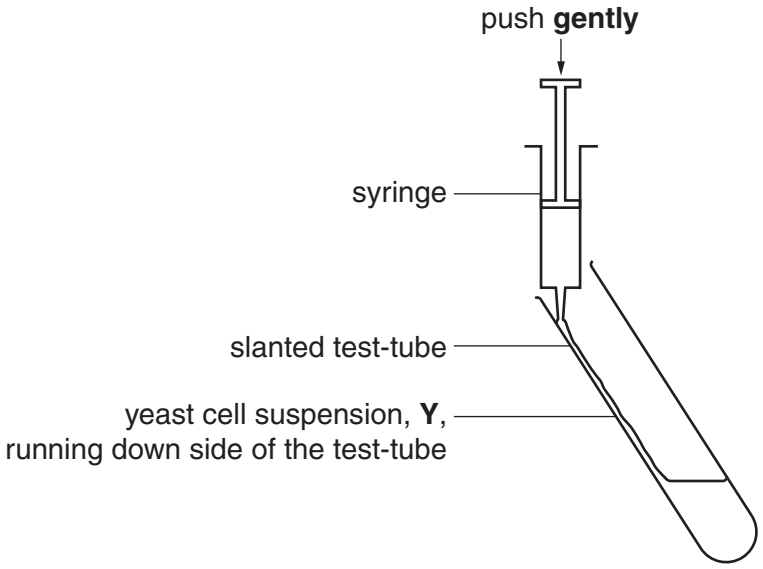


Fig. 1.1

2. Position the open end of the syringe so that it touches the side of the test-tube as shown in Fig. 1.1.

3. Gently press the plunger of the syringe so that the yeast cell suspension runs down the side of the test-tube to the bottom with as little foam as possible being formed.

4. Put this test-tube in the test-tube rack.

5. Repeat step 1 to step 4 for each of the other temperatures you will use in your investigation.

6. Label the beakers with the temperatures you will use in your investigation and set these up as water-baths ready for step 7.

7. Put the test-tube labelled 60 °C into the water-bath at that temperature.

8. Repeat step 7 for each of the labelled test-tubes.

9. Maintain the temperatures of the water-baths for 15 minutes.

10. After 15 minutes, stop timing, take the test-tubes out of each water-bath and put them in the test-tube rack.

11. Measure the height of the foam above the level of the yeast cell suspension in each of the test-tubes.

    Record your results in **(a)(iii)**.

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

[5]

(iv) Identify **two** significant sources of error in this investigation.

.....

.....

.....

.....

.....[2]

(v) Describe how you could set up a control for this investigation.

.....

.....

.....[1]

(vi) Explain how the temperature affected the enzymes in the yeast cell suspension.

.....

.....

.....

.....

.....[2]

(vii) This procedure investigated the effect of temperature on the activity of a yeast cell suspension.

To modify this procedure for investigating another variable, the independent variable (temperature), would need to be standardised.

Describe how the temperature could be standardised.

.....

.....

Now consider how you would modify this procedure to investigate the effect of **pH** on the activity of a yeast cell suspension.

Describe how this independent variable, **pH**, could be investigated.

.....

.....

.....

.....

.....[3]

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(b) A student investigated the effect of concentration of glucose solution on the activity of a yeast cell suspension. The volume of carbon dioxide released was measured.
All other variables were standardised.

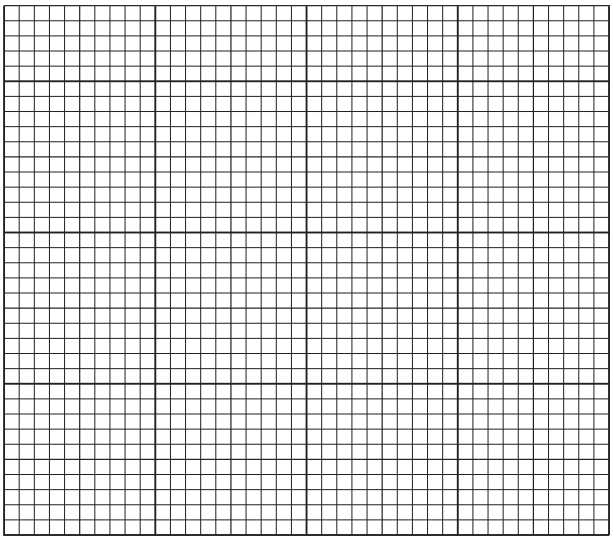
The results of the student's investigation are shown in Table 1.1.

Table 1.1

percentage concentration of glucose solution	volume of CO_2 released / cm^3
0.5	0.6
1.0	2.8
2.0	4.5
4.0	5.3
8.0	6.2

You are required to use a sharp pencil for graphs.

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



[4]

(ii) Use your graph to estimate the volume of CO_2 released at 3.5% concentration of glucose solution.

volume ..... cm^3 [1]

[Total: 20]

2 **M1** is a slide of a stained transverse section through a plant leaf.

You are not expected to be familiar with this specimen.

You are required to use a sharp pencil for drawings.

(a) **(i)** Draw a large plan diagram of the part of the leaf as shown by the shaded area in Fig. 2.1, to include observable features and **two** vascular bundles.

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

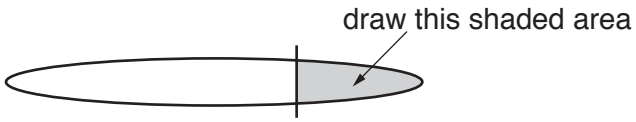


Fig. 2.1

You are expected to draw the correct shape and proportions of the different tissues.

[5]

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(ii) Within this leaf on **M1** canals are situated between the vascular bundles.
The canals are each made up of a circular group of cells surrounding a lumen.

Select one canal and observe the innermost ring of cells surrounding the lumen.

Select **one** group of **four** adjacent (touching) cells.
Each cell of the group must touch at least one other cell.

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

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

[5]

(b) Fig. 2.2 is a photomicrograph of a stained transverse section through a leaf from a different type of plant.
You are not expected to be familiar with this specimen.

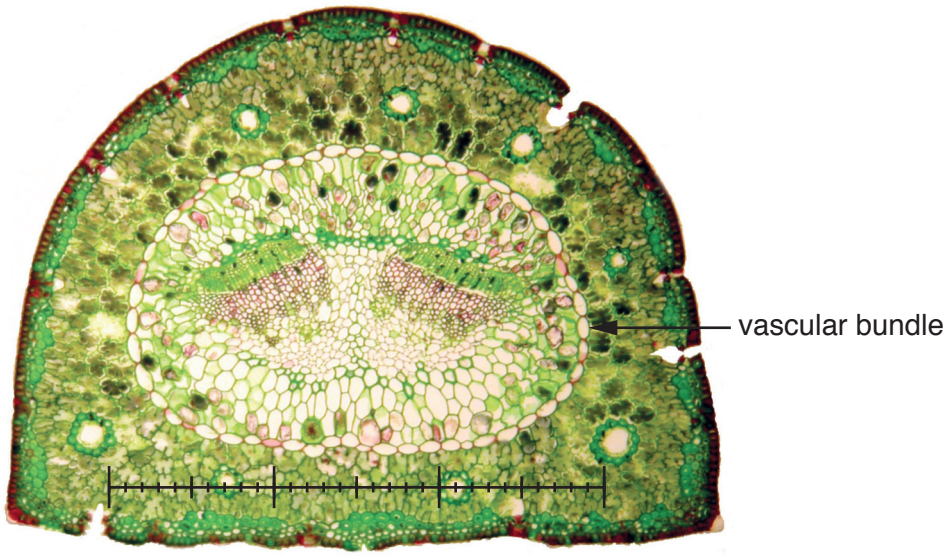


Fig. 2.2

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 unit equal to 29.5 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 and Fig. 2.2 to calculate the actual length of the vascular bundle.

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

[4]

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(c) (i) Prepare the space below so that it is suitable for you to record observable differences between the leaf on **M1** and the leaf in Fig. 2.2.

Record your observations in the space you have prepared.

[4]

(ii) The leaf on **M1** and the leaf in Fig. 2.2 both grow in dry habitats.

Suggest **one** observable feature shown by **both** the leaf on **M1** and the leaf in Fig. 2.2 which supports the conclusion that these plants grow in dry conditions.

Explain how **this** feature may help the plants grow in dry conditions.

feature .....

explanation .....[2]

[Total: 20]

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CANDIDATE NAME

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BIOLOGY **9700/33**

Paper 3 Advanced Practical Skills 1 **May/June 2016**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

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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 temperature (independent variable) on catalase in a plant extract solution.

You are provided with:

labelled	contents	hazard	volume/cm^3
P	plant extract solution	none	100
H	hydrogen peroxide solution	harmful irritant	100

You are advised to wear suitable eye protection, especially when using the hydrogen peroxide solution, **H**. If **H** comes into contact with your skin, wash off with cold water.

(a) When carrying out a practical procedure the hazards of using the solutions need to be considered. Then the level of risk needs to be assessed as low or medium or high.

State the hazard with the greatest level of risk when using the solutions then state the **level** of risk of the procedure: low or medium or high.

hazard .....

level of risk .....[1]

(b) You are required to keep a sample of 10 cm^3 of the solution in **P** to test at the temperature of the room.

Then heat the remaining solution in **P** and remove 10 cm^3 samples of the solution at different temperatures including a sample at the **maximum** temperature of 70 °C.

(i) Use the thermometer to measure the temperature of the room.

temperature .....[1]

(ii) You will need to test a sample of the solution in **P** which has been heated to 70 °C.

State the other temperatures at which you will remove each sample.

.....

.....[2]

Proceed as follows:

1. Put 10 cm^3 of the solution in **P** into a petri dish labelled with the temperature of the room you recorded in **(b)(i)**.

2. Gently heat the beaker labelled **P**, containing the remaining solution.

3. When the temperature of the solution in **P** reaches the lowest temperature stated in **(b)(ii)**, remove the Bunsen burner.

4. Remove 10 cm^3 of the solution in **P** and put it into a labelled petri dish.

5. Replace the Bunsen burner.

6. Repeat step 2 to step 5 for each of the temperatures stated in **(b)(ii)**.

7. When the solution reaches 70 °C, remove the last sample and put it into a labelled petri dish.

8. Turn off the Bunsen burner.

9. Leave the solutions to cool while you cut squares of filter paper, 1 cm × 1 cm. You will need to decide how many squares to cut to give you confidence in your results.

10. Put a mark on the test-tube 2 cm from the top.

11. Put **H** into the test-tube up to this mark.

12. Use forceps to pick up one square of filter paper and dip the whole square into the solution in the petri dish that is labelled with the temperature of the room.

13. Wipe the square against the petri dish to remove excess solution from both sides of the square.

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

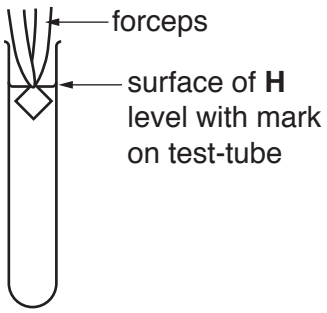


Fig. 1.1

15. Immediately release the square (you may need to shake the forceps) and start timing.

16. Measure the time taken for the square to return to the surface. Record the time in **(b)(iii)**.

    If the time is more than 120 seconds, stop timing and record ‘more than 120’.

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17. Remove the square from the test-tube.

*Note: if the square remains at the bottom of the test-tube, pour off **H** into the container labelled **H**. Use water in the beaker labelled 'for washing' to rinse out the square from the test-tube. Then repeat step 11.*

18. Repeat step 12 to step 17 with each of the samples removed at the different temperatures.

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

[6]

(iv) Identify **two** significant sources of error in this investigation.

.....

.....

.....

.....

.....[2]

(v) Explain how the enzyme catalase was affected by the change in temperature.

.....

.....

.....

.....

.....[2]

(vi) This procedure investigated the effect of temperature on the activity of catalase in the plant extract.

To modify this procedure for investigating another variable, the independent variable (temperature) would need to be standardised.

Describe how the temperature could be standardised.

.....

.....

Now consider how you could modify this procedure to investigate the effect of the **concentration of catalase** in the plant extract on the breakdown of hydrogen peroxide.

Describe how this independent variable, **concentration of catalase**, could be investigated.

.....

.....

.....

.....

.....[3]

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(c) A student investigated the activity of catalase in plant extracts from different species of plants, **R**, **S**, **T**, **U** and **V**, by measuring the initial rate of activity.

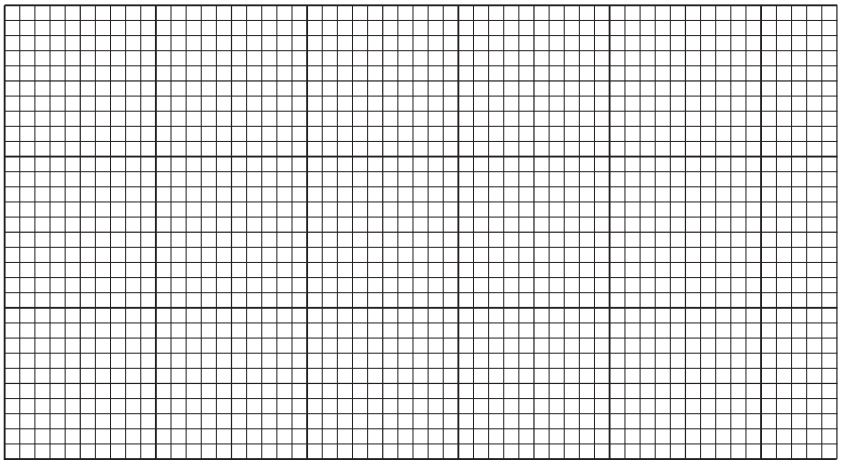
Table 1.1 shows the results for this investigation.

Table 1.1

different plant species	initial rate of activity of catalase / s^{-1}
R	0.0750
S	0.1275
T	0.0900
U	0.0325
V	0.0625

You are required to use a sharp pencil for charts.

Plot a chart of the data shown in Table 1.1.



[4]

[Total: 21]

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[Turn over

2 **K1** is a slide of a stained transverse section through a plant leaf.

You are not expected to be familiar with this specimen.

You are required to use a sharp pencil for drawings.

(a) **(i)** Draw a large plan diagram of the part of the leaf as shown by the shaded area in Fig. 2.1, to include observable features and **two** vascular bundles.

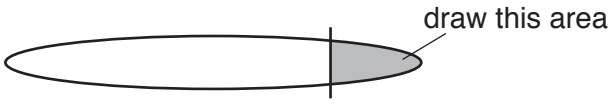


Fig. 2.1

You are expected to draw the correct shape and proportions of the different tissues.

[4]

(ii) Observe the epidermis in **K1**. These cells are not identical.

Select **one** group of **four** adjacent (touching) cells which show some of the differences between these cells.

Make a large drawing of this group of **four** cells.
Each cell of the group must touch at least one other cell.

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

[5]

(b) Fig. 2.2 is a photomicrograph of a stained transverse section through part of a leaf from a different type of plant.

You are not expected to be familiar with this specimen.

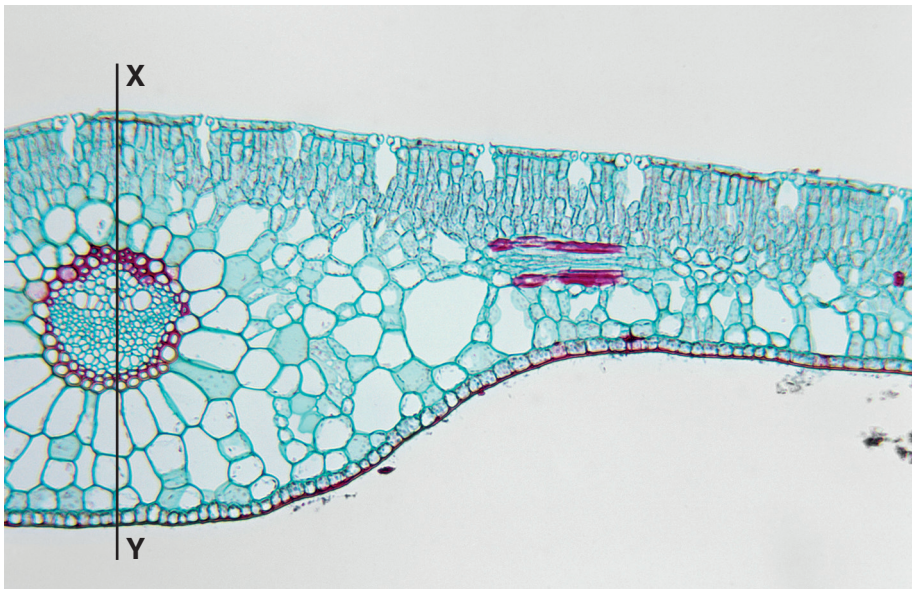


Fig. 2.2

(i) Use the line **X**–**Y** to determine the simplest ratio of the depth of the midrib to the diameter of the vascular bundle.

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

simplest ratio .....[5]

(ii) Suggest a habitat where this plant might grow and **one** observable feature, shown in Fig. 2.2, which adapts it to this habitat.

habitat .....

feature .....[1]

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

Record your observations in the space you have prepared.

[4]

[Total: 19]

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2615462080

BIOLOGY **9700/34**

Paper 3 Advanced Practical Skills 2 **May/June 2016**

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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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 hydrolysis (breakdown) of starch into glucose.

You are required to investigate the progress of this enzyme-catalysed reaction by **both**

- testing for the disappearance of starch
- testing for the appearance of glucose by finding the time taken for the decolourisation of potassium manganate(VII) solution.

To follow the progress of this reaction you will need to take samples from the reaction mixture at different times.

(a) (i) Decide how often you will take these samples including removing the last sample at 20 minutes.

State the times when you will remove the samples.

.....[1]

(ii) Decide how you will test a sample to show that the starch has disappeared.

State the reagent you will use .....

Describe how you will test each sample to show that the starch has disappeared and state the colour of any results you might collect.

test .....

.....

colour .....[1]

To test for the production of glucose, the change in the colour of potassium manganate(VII) solution is:

purple ⟶ colourless

Test-tube **Z** shows the colourless end-point.

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You are provided with:

labelled	contents	hazard	volume/cm^3
E	amylase solution	harmful irritant	10
S	starch solution	none	40
A	sulfuric acid	irritant	20
P	potassium manganate(VII) solution	harmful	20

You are advised to wear suitable eye protection, especially when using the amylase solution, **E** and the sulfuric acid, **A**. If **either E** or **A** come into contact with your skin, wash off with cold water. **P** may stain your skin.

(b) When carrying out a practical procedure the hazards of using the solutions need to be considered. Then the level of risk needs to be assessed as low or medium or high.

State the hazard with the greatest level of risk when using the solutions then state the **level** of risk of the procedure: low or medium or high.

hazard .....

level of risk .....[1]

Proceed as follows:

1. Label the test-tubes with the sampling times that you stated in **(a)(i)**.
2. Put 2.5 cm^3 of **A** into each test-tube.
3. Put 1 cm^3 of **P** into each test-tube and gently shake to mix with **A**.

(c) Temperature may affect the rate of an enzyme-catalysed reaction.

(i) Use the thermometer to measure the temperature of the room.

State the temperature of the room. ..... [1]

Read step 4 to step 9 and note that the timer should not be stopped until you have the last end-point recorded.

*The reaction will start as soon as **E** is added to **S**.*

4. Put 30 cm^3 of **S** into a beaker.
5. Put 4 cm^3 of **E** into the beaker containing **S**.
6. Immediately stir the mixture in the beaker and start the timer.

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7. At each of your sampling times:

   - test for the disappearance of starch as described in **(a)(ii)**
   - test for the appearance of glucose by removing 3 cm^3 of the mixture and putting it into the appropriately labelled test-tube, mixing well.

8. Record, in **(c)(ii)**, the time shown on the timer when the colourless end-point is reached (raw result). Do **not** stop the timer.

9. Repeat step 7 and step 8 for each of the times decided in **(a)(i)** until you have recorded the end-point for the last sample, removed at 20 minutes.

10. Calculate the time taken to reach **each** end-point (processed results).

(ii) Prepare the space below to record your results for:

- the test for starch
- the **raw** results for the appearance of glucose
- your **processed** results for the appearance of glucose.

[5]

(iii) Now measure the temperature of the room once again.

State the temperature of the room. .....

State the difference between this temperature and the temperature of the room you recorded in **(c)(i)**.

.....

State whether temperature was a significant error in this investigation.

.....[1]

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(iv) Explain how a temperature rise of 30 °C might have affected the mixture of starch and amylase.

.....

.....

.....

.....

.....

.....

.....[3]

(v) This procedure investigated the progress of the hydrolysis of starch by amylase.

To modify this procedure for investigating a different variable, the time for the hydrolysis would be standardised.

Consider how you could modify this procedure to investigate the effect of **pH** on the activity of amylase.

Describe how the independent variable, **pH**, could be investigated.

.....

.....

.....

.....

Describe how the dependent variable could be measured.

.....

.....

.....[3]

(d) A student investigated the effect of starch concentration on the initial rate of reaction of amylase.

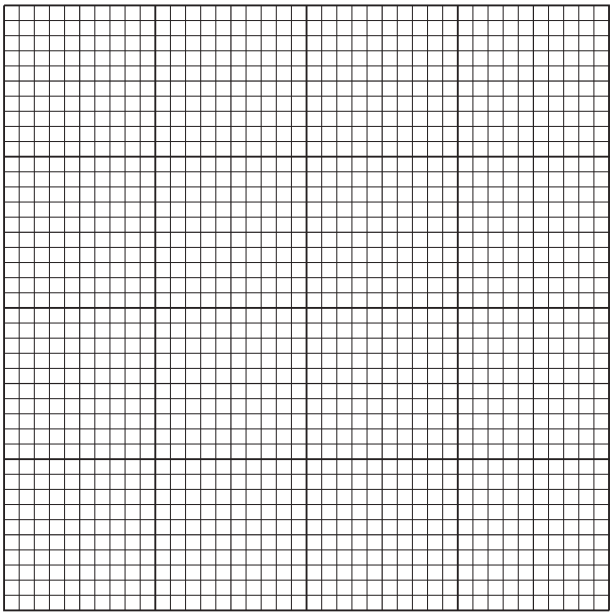
Table 1.1 shows the results for this investigation.

Table 1.1

percentage concentration of starch	initial rate of reaction of amylase /arbitrary units
0.00	0
0.50	100
1.25	215
1.75	285
2.50	340
3.25	340

You are required to use a sharp pencil for graphs.

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



[4]

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(ii) Use the graph to estimate the Michaelis-Menten constant (K_m).

Show your working on the graph and in the space below.

K_m .....[3]

[Total: 23]

2 **N1** is a slide of a stained transverse section through a plant stem.

You are not expected to be familiar with this specimen.

You are required to use a sharp pencil for drawings.

(a) **(i)** Select a field of view so that you can observe the epidermis and the vascular bundles.

Draw a large plan diagram of the different tissues in the field of view to show
- **two** of the large vascular bundles
- the epidermis
- any other observable tissues.

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

You are expected to draw the correct shape and proportions of the different tissues.

[5]

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(ii) Observe the cells in the centre of the stem (pith) in **N1**. These cells are not identical.

Select **one** group of **four** adjacent (touching) cells which show some of the differences between these cells.
Each cell of the group must touch at least **two** of the other cells.

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

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

[5]

(b) Fig. 2.1 is a photomicrograph of a stained transverse section through a root from a different type of plant.

You are not expected to be familiar with this specimen.

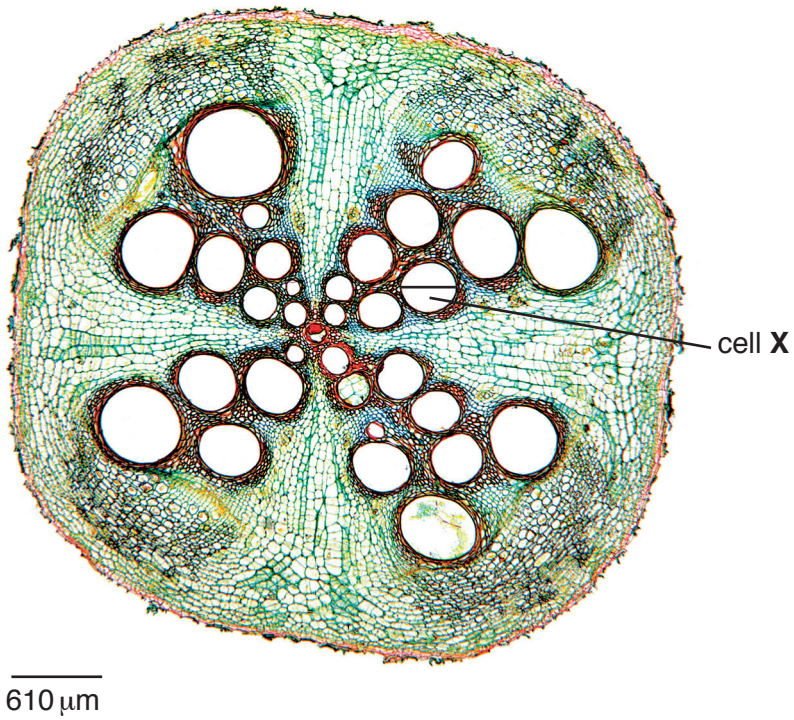


Fig. 2.1

(i) In Fig. 2.1 a line is drawn across the diameter of a cell, **X**.

Use this line and the scale bar to find the actual diameter of cell **X** in μm.

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

actual diameter ..... μm [3]

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(ii) Prepare the space below so that it is suitable for you to record the observable differences between the stem on **N1** and the root in Fig. 2.1.

Record your observations in the space you have prepared.

[4]

[Total: 17]

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7274025430

BIOLOGY **9700/35**

Paper 3 Advanced Practical Skills 1 **May/June 2016**

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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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 Glucose is an important substrate for cellular respiration. Glucose is absorbed into the blood from the small intestine and transported in the blood plasma to the body cells.

You are required to:

- prepare different concentrations of the glucose solution **G**
- carry out the Benedict's test on each of the concentrations of glucose solution you have prepared
- carry out the Benedict's test on the solution representing blood plasma **P**
- use the results of the Benedict's tests to estimate the concentration of glucose in **P**.

You are provided with:

labelled	contents	hazard	volume / cm^3
G	1% glucose solution	none	50
W	distilled water	none	70
P	unknown concentration of glucose	none	10
Benedict's	Benedict's solution	none	50

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

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

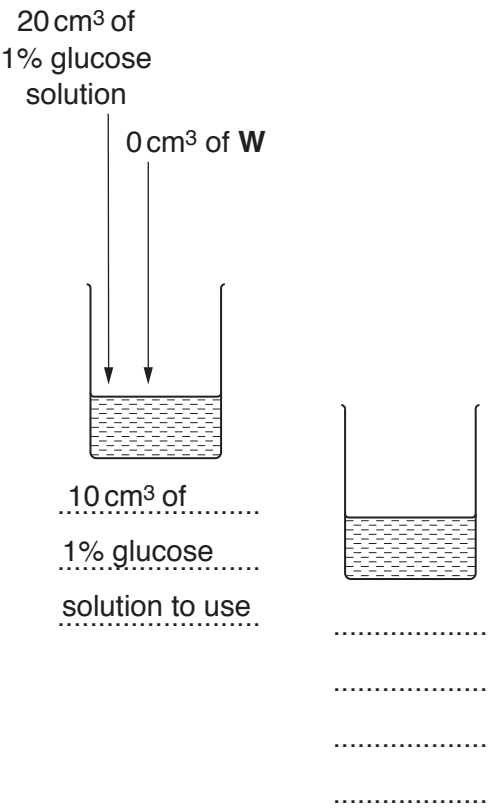
Fig. 1.1 shows the first two beakers you will use to make your serial dilution.

(i) Complete Fig. 1.1 by drawing the extra beakers you need for your serial dilution.

For each beaker:

- state, under the beaker, the **concentration** and **volume** of the glucose solution available for use in the investigation
- use one arrow, with a label above the beaker, to show the **concentration** and **volume** of glucose solution added to prepare the concentration
- use 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:

1. Set up a water-bath and heat to boiling ready for step 6.
2. Prepare the concentrations of glucose solution as shown in Fig. 1.1.
3. Put 2 cm^3 of 1% glucose solution into a test-tube.

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[Turn over

(ii) State the smallest division on the syringe you used in step 3.

.....

State the **actual** error when using this syringe.

.....[1]

Calculate the **percentage** error when using this syringe.

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

percentage error .....[1]

4. Put 2 cm^3 of Benedict's solution into the same test-tube as step 3.

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

Read step 6 to step 9 before proceeding.

You are required to:

- observe the contents of the test-tube continuously while the test-tube is heated for 60 seconds
- record the time taken for the **first** appearance of a colour change, if a colour change occurs during this 60 seconds
- record the colour **after** heating for 60 seconds.

6. Put this test-tube into the water-bath you prepared in step 1 and start timing.

7. Record the **time taken** for the first appearance of a colour change in Table 1.1.
*Do **not** stop the clock and continue heating until 60 seconds.*

If there is no colour change after 60 seconds record the time as 'more than 60'.

8. At 60 seconds remove the test-tube from the water-bath, gently shake, and record the **colour** of the Benedict's solution in Table 1.1.

9. Repeat step 3 to step 8 for each of the glucose solutions you prepared in step 2.

You are not required to repeat this experiment.

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(iii) Complete the column headings and record your results in Table 1.1.

Table 1.1

	time taken for the first appearance of a colour change /	colour of Benedict's at 60 seconds

[4]

(iv) Describe how you will standardise the Benedict's test in order to enable you to estimate the concentration of glucose in **P**.

.....

.....

.....

.....[2]

10. Repeat step 3 to step 8 using solution **P**.

(v) Record your results for solution **P**.

time taken for the first appearance of a colour change .....

colour of Benedict's at 60 seconds .....[1]

(vi) Estimate the concentration of glucose in **P**, using the colour of Benedict's at 60 seconds recorded in Table 1.1 and **(a)(v)**.

.....[1]

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(vii) Describe **one** improvement to allow a more accurate estimate of the concentration of glucose in **P** to be obtained using the **colour** of Benedict's at 60 seconds.

.....

.....

.....[1]

(viii) Describe how your results for the **time** taken for the first appearance of a colour change can be used to produce a more accurate estimate of the concentration of glucose in **P** than the one given in **(a)(vi)**.

.....

.....

.....

.....

.....[2]

(b) A scientist studied the change in the concentration of glucose in blood plasma after eating a meal containing carbohydrate. Samples of blood plasma were taken at regular intervals after eating the meal and the concentration of glucose in each sample was measured.

The results are shown in Table 1.2.

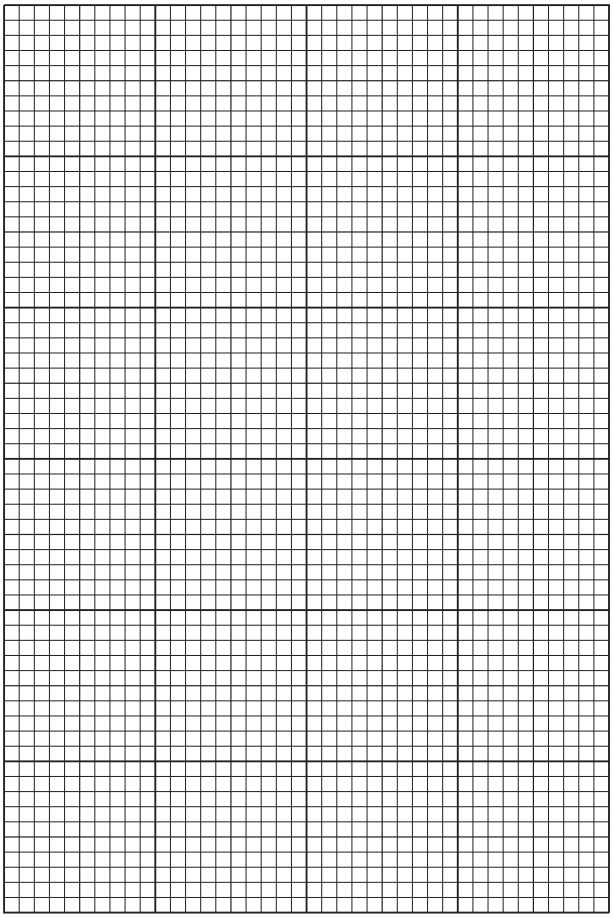
Table 1.2

time after eating the meal /minutes	**concentration of glucose in blood plasma /mmol dm^{-3}**
0	5.125
20	6.750
40	7.600
60	7.475
80	7.100

You are required to use a sharp pencil for graphs.

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(i) Plot a graph of the data shown in Table 1.2.



[4]

(ii) Calculate the percentage increase in concentration of glucose in the blood plasma between 0 minutes and 20 minutes after eating the meal.
You may lose marks if you do not show all your working.

percentage increase .....[1]

(iii) Use **one** label line and the label **X** to show on the graph where the rate of diffusion of glucose into the blood is most rapid. [1]

(iv) Suggest **one** reason for the concentration of glucose in blood plasma decreasing between 60 minutes and 80 minutes after eating the meal.

.....

.....

.....[1]

[Total: 23]

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[Turn over

2 **L1** is a slide of a stained transverse section through a plant organ.

You are not expected to be familiar with this specimen.

(a) An eyepiece graticule scale can be used to measure the layers of tissues and to help draw a plan diagram with the correct shape and proportions of the tissues, without needing to calibrate the eyepiece graticule scale.

You are required to use a sharp pencil for drawings.

(i) Draw a large plan diagram of part of the organ as shown by the shaded area in Fig. 2.1.

Use **one** ruled label line and the letter **Z** to identify the position of the tissue which prevents the flow of water through the apoplast pathway.

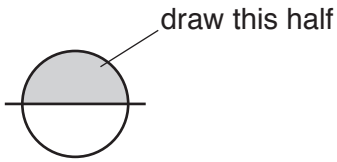


Fig. 2.1

[5]

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(ii) Identify the organ on **L1**. Describe **one** observable feature that supports your identification.

name of organ .....

feature .....[1]

(iii) Observe the organ on **L1** in the region between the epidermis and the vascular tissue (the cortex).

Select **one** group of **four** adjacent (touching) cells from the cortex.
Each cell of this group must touch at least **two** of the other cells.

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

Use **one** ruled label line and label to identify the cytoplasm in **one** of the cells.

[5]

(b) Fig. 2.2 is a photomicrograph of a stained transverse section through the same plant organ as on **L1**, but from a different plant.

You are not expected to be familiar with this specimen.

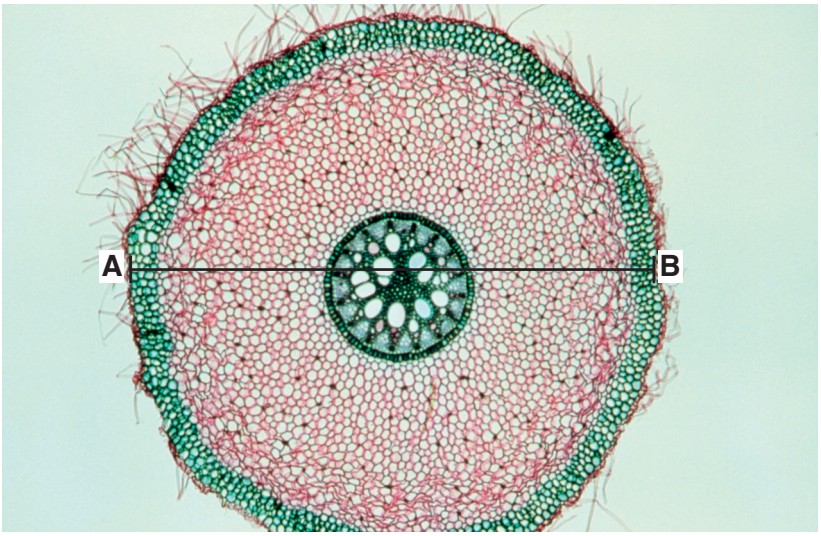


Fig. 2.2

The actual diameter of this organ along the line **A–B** is 3000 μm.

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

magnification .....[3]

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(c) Prepare the space below so that it is suitable for you to record the observable **similarities** between the plant organ on **L1** and that shown in Fig. 2.2.

Record your observations in the space you have prepared.

[3]

[Total: 17]

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