Cambridge International AS & A Level

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Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

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CANDIDATE NUMBER

7293927441

BIOLOGY **9700/31**

Advanced Practical Skills 1 **October/November 2014**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

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Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black 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.
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Before you proceed, read carefully through **the whole** of Question 1 and Question 2.

Plan the use of your **time** 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 An enzyme, **E**, catalyses the hydrolysis (breakdown) of triglycerides into fatty acids and glycerol.

The substrate for **E** will be the triglycerides present in milk, labelled **M**.

The end-point of this hydrolysis can be determined by using an indicator, **I**, which changes colour when the fatty acids are produced, as shown in Fig. 1.1.



end-point

Fig. 1.1

You are required to:

- prepare different concentrations of the enzyme solution, **E**
- investigate the effect of different concentrations of **E** (independent variable) on the hydrolysis of triglycerides in milk.

You are provided with:

labelled	contents	hazard	volume / cm^3
M	milk	none	40
W	distilled water	none	50
I	indicator solution	stains	30
A	solution of alkali	irritant	40
E	5% enzyme solution	irritant	50

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You are required to dilute the 5% enzyme solution, **E**, to provide a range of known concentrations using **simple** dilution.

Decide on the further concentrations of enzyme solution you will use in your investigation in addition to the 5% solution.

You will need to use 10 cm^3 of each enzyme solution.

(a) (i) Prepare the space below to show:

- the concentration of each **enzyme solution**
- the volumes of **E**
- the volumes of **W**.

[3]

(ii) Describe the expected trend in the time taken to reach the end-point as the concentration of enzyme solution increases.

.....

.....[1]

(iii) State **one** reason for the expected trend described in **(a)(ii)**.

.....

.....[1]

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(iv) As part of this investigation you are required to set up a control using the apparatus provided.

Describe how you will set up this control.

.....

.....

.....[1]

Read step 1 to step 10 before proceeding.

Proceed as follows:

1. Prepare **all** the concentrations of enzyme solutions you have listed in **(a)(i)** in the containers provided.

You are required to investigate the effect of different concentrations of enzyme solutions on the hydrolysis of triglycerides in milk. The appearance of fatty acids can be detected by using the indicator solution **I**.

2. Put 2 cm^3 of **M** into each of six separate test-tubes.

3. Put 2 cm^3 of **I** into each test-tube containing **M** and gently shake.

4. Put 3 cm^3 of **A** into each test-tube containing **M** and **I** and gently shake so that all the mixture turns orange.

Note that the mixtures might be different shades of orange.

The reaction will start as soon as you add enzyme solution, so read steps 5 to 10 before proceeding.

5. Set up your control as described in **(a)(iv)**.

6. Put 2 cm^3 of the lowest concentration of enzyme solution into one of the test-tubes from step 4 and mix well.

7. Repeat step 6 with **two** other concentrations of enzyme solution.

8. Start timing.

9. Record the time when each end-point (yellow) is reached, as shown in Fig. 1.1.

10. Repeat steps 6, 8 and 9 with the remaining concentrations of enzyme solution.

If the time taken to reach the end-point for any one concentration is longer than 300 seconds (5 minutes) **record** as ‘more than 300’.

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

[5]

(vi) Calculate the rate of hydrolysis for the 5% **E**.

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

(vii) Identify **one significant** source of error in measuring the dependent variable in the investigation you have just carried out.

.....

.....

.....[1]

(viii) You used a syringe to measure the volumes of **M**.

State the volume of the smallest division on the syringe .....

State the actual error of the syringe.

actual error .....
[1]

(b) Suggest how you would modify this investigation to obtain an accurate optimum temperature for the activity of **E**.

.....

.....

.....

.....

.....

.....

.....[3]

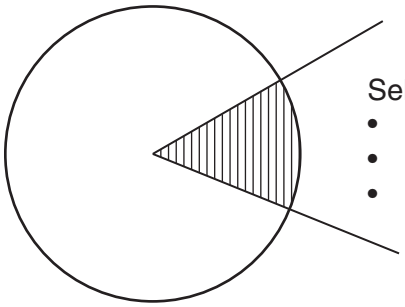
[Total: 17]

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Question 2 starts on page 8

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

2 **J1** is a slide of a stained transverse section through a plant stem.
This plant species grows widely including Europe, Asia and northwest Africa.
You are not expected to be familiar with this specimen.



Select four vascular bundles from the sector:
- one larger outer vascular bundle
- one smaller outer vascular bundle
- two inner vascular bundles.

Fig. 2.1

(a) **(i)** Draw a large plan diagram of the part of the specimen on **J1** indicated by the shaded sector in Fig. 2.1. Your plan diagram should include:

- the part of the specimen indicated by the shaded sector
- the four vascular bundles which you selected from the sector.

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

[4]

(ii) Observe the tissue in the central pith.

Select one group of three whole cells, which includes:

- one large cell
- two smaller cells which touch each other and also touch the large cell.

Make a large drawing of the group of cells which you have selected.

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

[5]

(b) Fig. 2.2 is a photomicrograph of a stained transverse section through a stem of a different plant species.
This plant species is found globally.

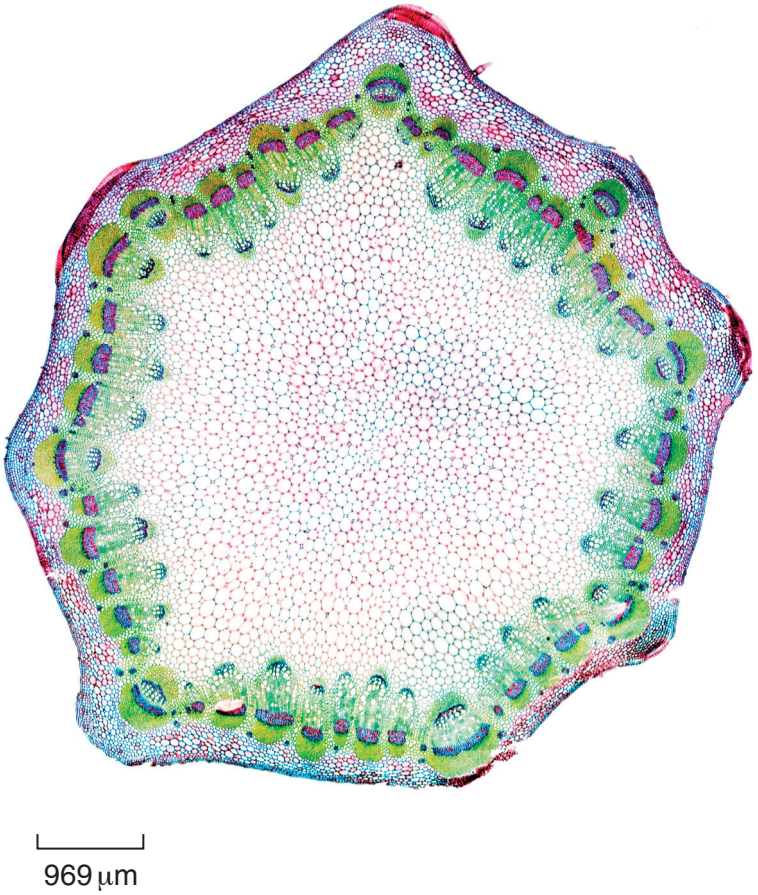


Fig. 2.2

(i) Calculate the magnification of Fig. 2.2 using the scale bar.
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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(ii) Prepare the space below so that it is suitable for you to show the observable differences between the specimens shown on **J1** and on Fig 2.2.

Record your observations in the space you have prepared.

[4]

(c) A student investigated the effect of different concentrations of sucrose solutions on 5 pieces of plant stem.

At the start, each piece of plant stem was cut along part of its length as shown in Fig. 2.3.

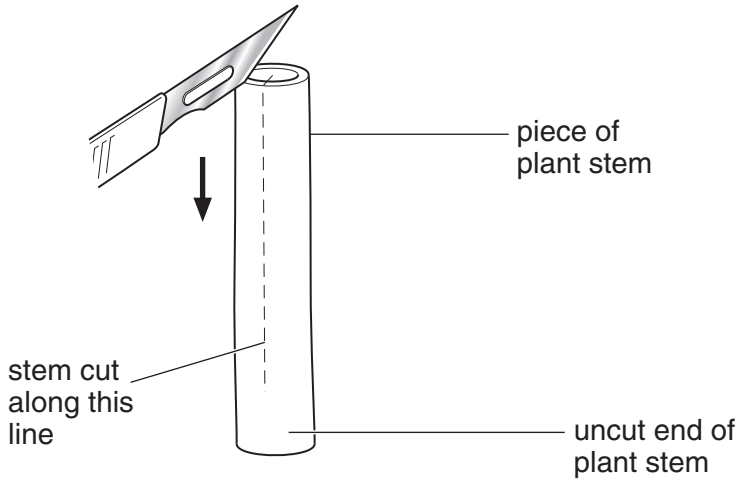


Fig. 2.3

Each piece of cut plant stem curved as shown in Fig. 2.4. The distance between the cut ends was 10 mm for each piece of plant stem.

Each piece of plant stem was placed in a separate dish as shown in Fig. 2.4 and covered with the same volume of one of the concentrations of sucrose solution. A different concentration of sucrose solution was used in each of the five dishes.

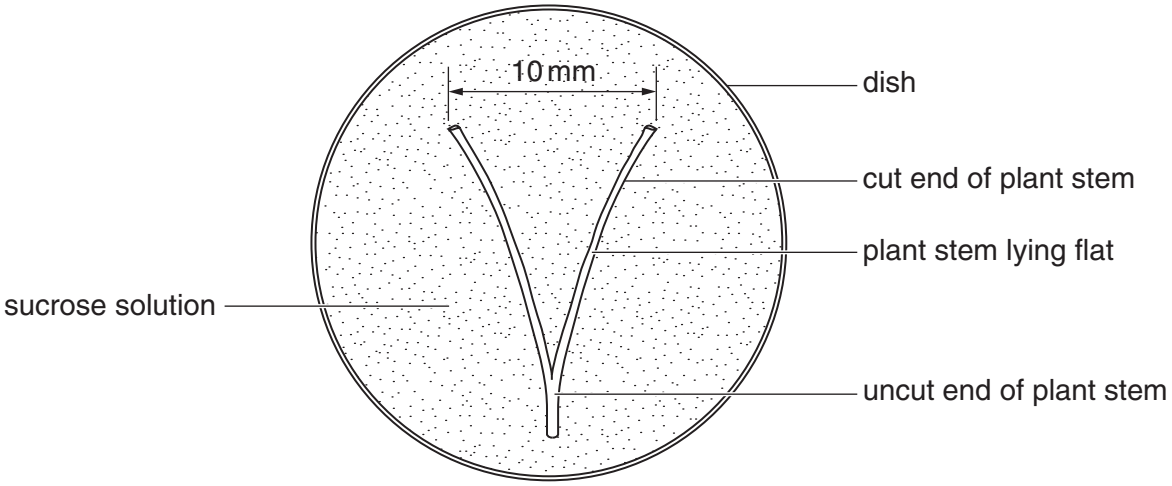


Fig. 2.4

After a set time the distance between the cut ends was measured for each piece of plant stem.

The student calculated the change in distance between the cut ends for each plant stem.

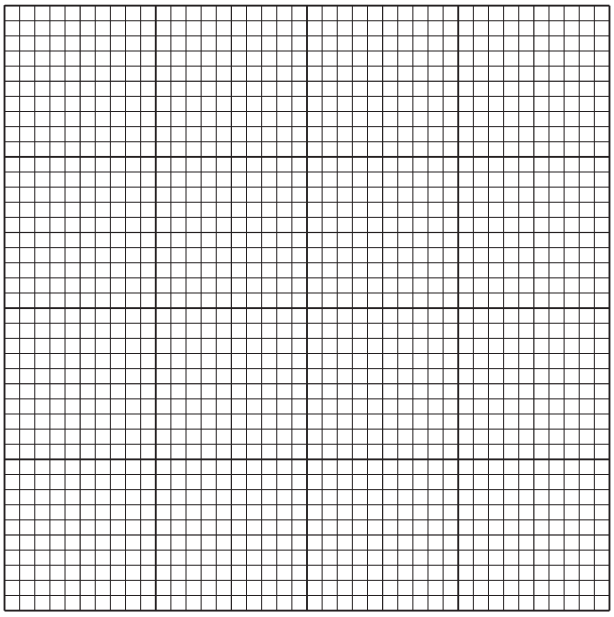
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The processed results of the student's investigation are shown in Table 2.1.

Table 2.1

sucrose concentration / mol dm^{-3}	change in distance between cut ends / mm
0.0	+3.8
0.2	+1.5
0.4	–1.0
0.6	–2.5
0.8	–3.8

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



[4]

(ii) Explain the trend shown in the graph.

.....

.....

.....

.....

.....

.....

.....[3]

[Total: 23]

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9809560772

BIOLOGY **9700/33**

Advanced Practical Skills 1 **October/November 2014**

2 hours

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1 Plants translocate sap through phloem sieve tubes. Scientists discovered that aphids feed by pushing their stylet into a single phloem sieve tube as shown in Fig. 1.1.

By using stylets it is possible for scientists to collect the sap from a single phloem sieve tube.

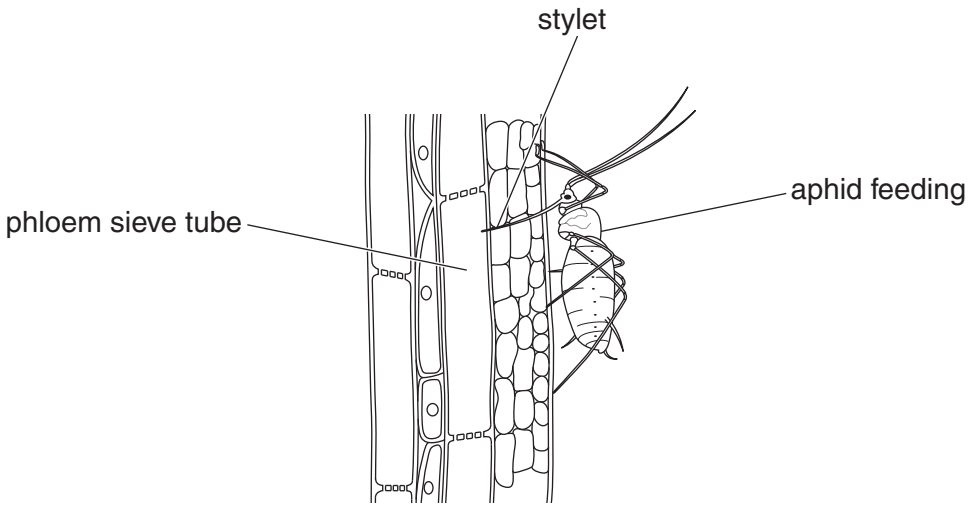


Fig. 1.1

You are required to estimate, as accurately as possible, the concentration of sucrose in a sample of sap, **P**, by:

- carrying out a trial using the concentrations of sucrose solutions **S1** and **S2**
- using the results of the trial to prepare further concentrations of sucrose solution
- obtaining more readings, so that you can estimate more accurately the concentration of sucrose in **P**.

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[Turn over

A drop or small volume of **P** is placed into a known concentration of sucrose solution.

Fig 1.2 shows how the drop or small volume of **P** is released.

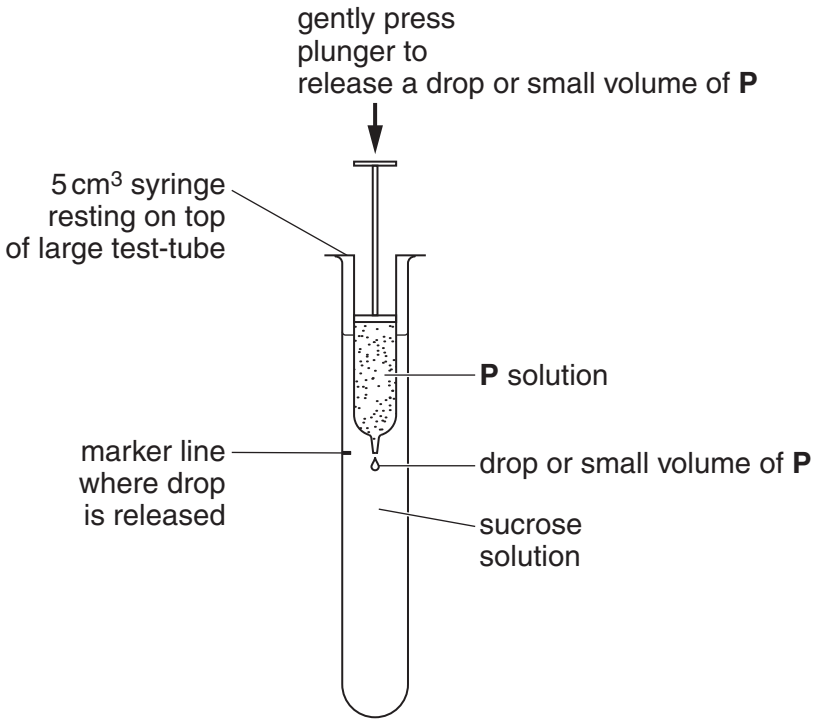


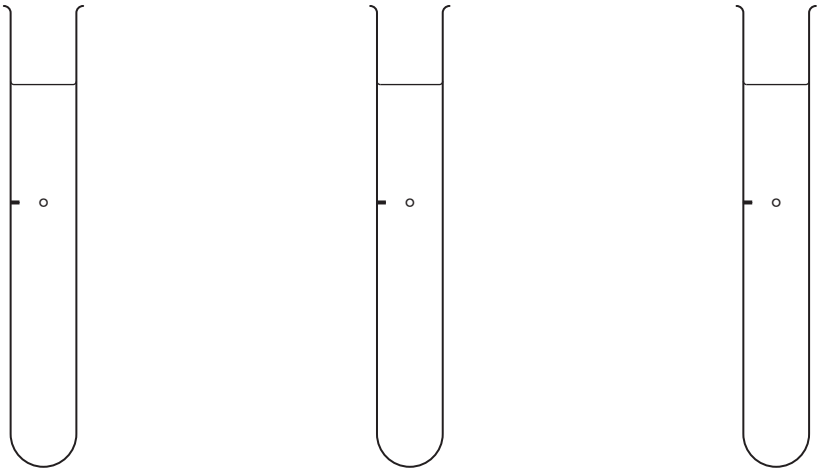
Fig. 1.2

Immediately the drop or small volume of **P** is released, the syringe is removed.

The drop of **P** may move up, move down or remain at the same level depending on the difference in the concentration between **P** and the sucrose solution.

(a) (i) Show clearly on the diagrams below, using the key, how you would expect to see the drop or small volume of **P** move if:

P is less concentrated than the sucrose solution	**P** is the same concentration the sucrose solution	**P** is more concentrated than the sucrose solution



Key:

↑ a drop or small volume of **P** moves up

↓ a drop or small volume of **P** moves down

→ a drop or small volume of **P** remains at same level

[1]

You are provided with:

labelled	**contents**	**hazard**	**volume /cm^3**
S1	0.10 mol dm^{-3} sucrose solution	none	200
S2	1.00 mol dm^{-3} sucrose solution	none	200
P	coloured sample of sap	none	20
W	distilled water	none	200

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[Turn over

Read step 1 to step 8 before proceeding.

Proceed as follows:

You are required to estimate the concentration of **P** using **S1** and **S2**.

1. Place the 5 cm^3 syringe on top of the large test-tube and use the marker pen to draw a line on the test-tube at the same height as the end of the syringe nozzle as shown in Fig. 1.2 (page 4).

2. Use the same syringe to suck up 4.0 cm^3 of **P**.

3. Put 35 cm^3 of **S1** into the test-tube.

4. As shown in Fig. 1.2, release one drop or a small volume of **P** and **remove** the syringe from the sucrose solution.

*Note: **P** may come out without pushing the plunger, observe and record the direction of movement.*

5. Immediately observe the movement of the drop or small volume of **P**.

6. Record your observations.

7. Wash out this test-tube.

8. Repeat steps 3 to 7 using **S2**.

(ii) Prepare the space below to record your observations.

[3]

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(iii) Complete the following by using one of the words '**more**' or '**less**'.

You may use each word once or more than once.

P is ..... concentrated than 0.1 mol dm^{-3} (**S1**).

P is ..... concentrated than 1.0 mol dm^{-3} (**S2**).

Use your results to estimate the concentration of sucrose in **P**.

estimate of concentration of sucrose in **P** .....[1]

(iv) State which solution, **S1** or **S2**, you will dilute to prepare further concentrations.

Use your results to explain the reason for your decision.

.....

.....[2]

You are required to prepare further concentrations of sucrose solution by **simple** dilution, using the solution stated in **(a)(iv)**.

Decide on the further concentrations of sucrose solution you will use in your investigation.

You will need 40 cm^3 of each sucrose solution.

(v) Prepare the space below to show:

- the concentration of each sucrose solution
- the volumes of sucrose solution
- the volumes of **W**.

[3]

9. Prepare **all** the concentrations of sucrose solution you have listed in **(a)(v)** in the containers provided.

10. Repeat steps 3 to 7 with each of the solutions.

(vi) Prepare the space below to record your observations.

[3]

(vii) Using these additional results from **(vi)** state a more accurate estimate of the concentration of sucrose in **P** than in **(iii)**.

.....[1]

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(viii) Describe **how** you would modify this procedure to investigate the concentration of sucrose in **P**, using Benedict's solution.

.....

.....

.....

.....

.....

.....

.....[3]

[Total: 17]

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

2 Plants translocate sap through phloem sieve tubes. Scientists discovered that aphids feed by pushing their stylet into a single phloem sieve tube as shown in Fig. 2.1.
By using stylets it is possible for scientists to collect the sap from a single phloem sieve tube.

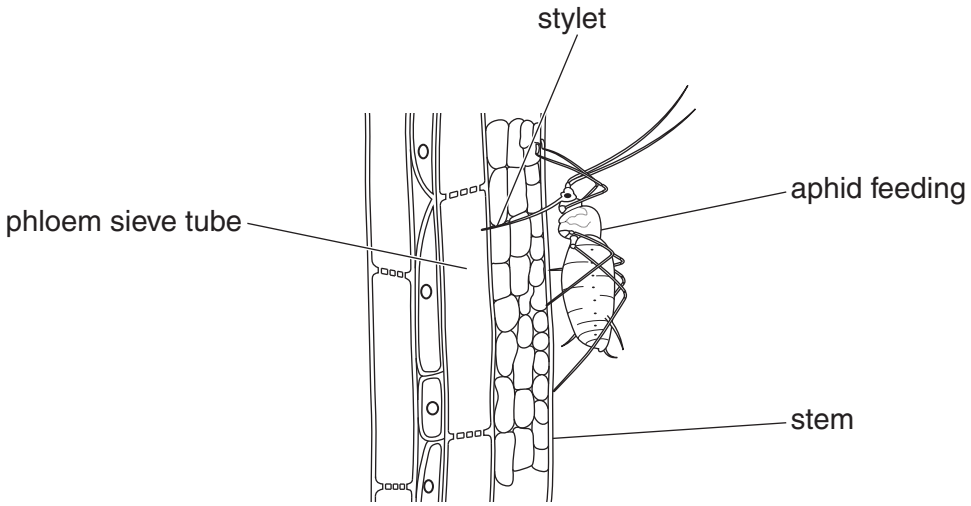


Fig. 2.1

Scientists have investigated the different rates of flow of sap in the stylets of aphids of different ages from hatching, **H**, up to the adult, **M**.

The results are shown in Table 2.1.

Table 2.1

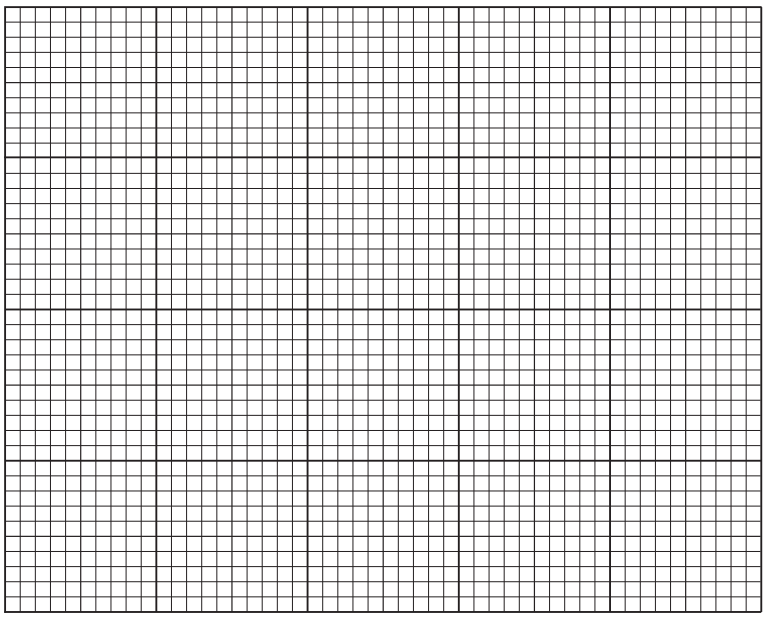
different ages of aphid	rate of flow of sap /μl h^{-1}			
	trial 1	**trial 2**	**trial 3**	**mean**
H	0.452	0.448	0.451	0.450
J	0.726	0.722	0.726	0.725
K	0.977	1.232	0.973	
L	1.401	1.601	1.399	1.400
M	1.978	1.975	1.972	1.975

(a) (i) Circle the two anomalous results in Table 2.1. [1]

(ii) Complete the table by calculating the missing mean value. [1]

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



[4]

(iv) Describe the relationship between the age of the aphid and the rate of flow of sap.

.....

.....

.....[1]

(v) Suggest **two** reasons which might explain the relationship described in **(iv)**.

.....

.....

.....

.....

.....[2]

(b) **K1** is a slide of a stained transverse section through a plant stem.
This plant species grows widely including Europe, Asia and North America.

You are not expected to be familiar with this specimen.

To help draw a plan diagram with the correct shape and proportions of the tissues, an eyepiece graticule can be used to measure the layers of tissues, without the need to calibrate the eyepiece graticule scale.

(i) Draw a large plan diagram of the part of the specimen on **K1** indicated by the shaded sector in Fig. 2.2.

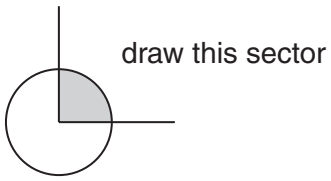


Fig. 2.2

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

[5]

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(ii) Observe the tissue between the xylem and the hollow centre of the specimen.

Select one group of three cells with:

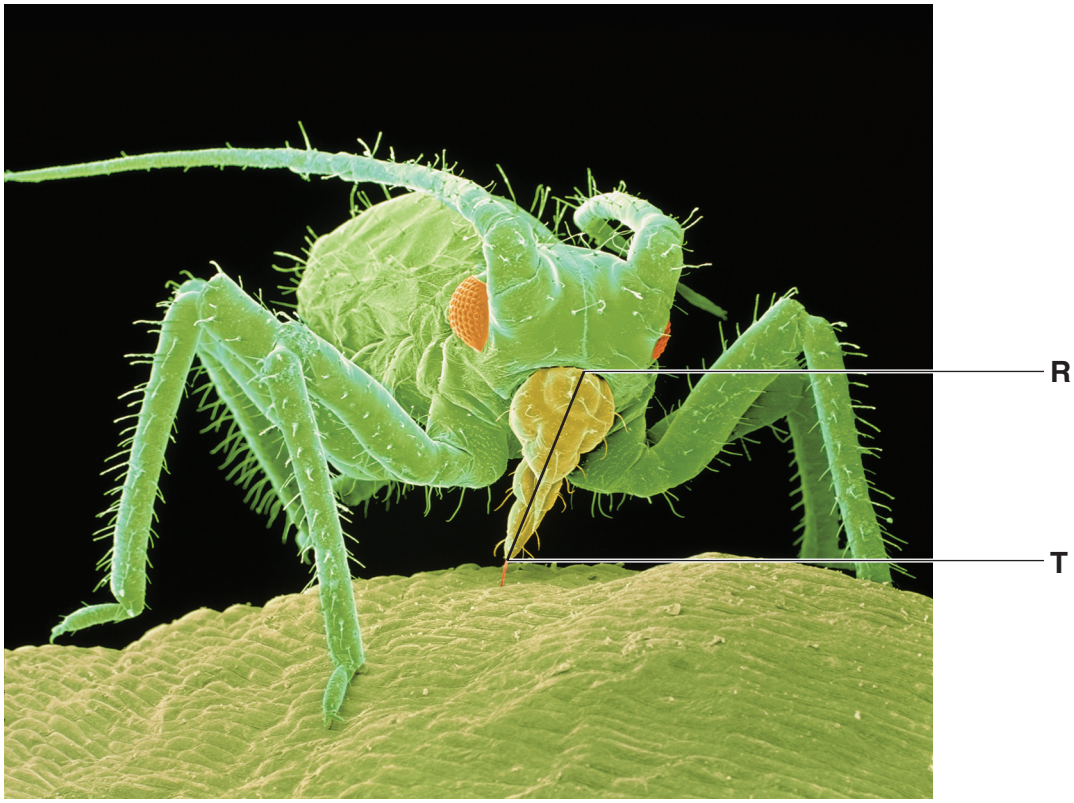
- one cell containing cell structures
- two cells which touch each other and also touch the cell which contains cell structures.

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

Use **one** ruled label line and label **D** to show **one** of the cell structures.

[5]

Fig. 2.3 is a photomicrograph of an aphid feeding on a plant.



magnification ×120

Fig. 2.3

(c) Calculate the actual length of the structure **R** to **T**, using the magnification, giving your answer in μm.

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

actual length ..... μm
[4]

[Total: 23]

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CANDIDATE NAME

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3056931141

BIOLOGY **9700/34**

Advanced Practical Skills 2 **October/November 2014**

2 hours

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1 Blood plasma contains the protein albumin. The concentration of albumin in a person's blood may be measured to identify health problems.

You are required to estimate, as accurately as possible, the concentration of albumin in a sample of blood plasma, **U**, by:

- carrying out a trial using the concentrations of albumin solutions **P1** and **P2**
- using the results of the trial prepare further concentrations of albumin solution
- obtaining more readings, so that you can estimate more accurately the concentration of albumin solution in **U**.

The albumin concentration can be measured by using potassium hydroxide solution and copper sulfate solution.

Fig. 1.1 shows the result of adding potassium hydroxide solution and copper sulfate solution to a sample containing albumin.

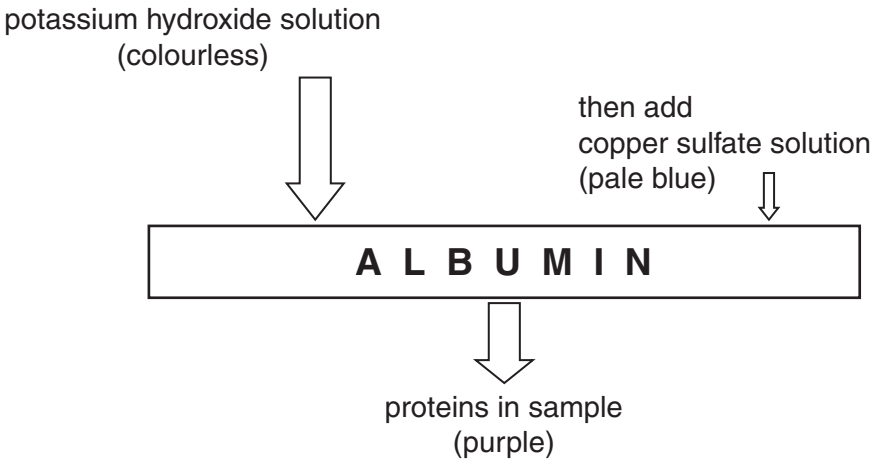


Fig. 1.1

You are provided with:

labelled	contents	hazard	volume/cm^3
K	potassium hydroxide solution	harmful irritant corrosive	20
C	copper sulfate solution	harmful	20
P1	0.8% albumin solution	none	40
P2	1.6% albumin solution	none	40
U	blood albumin sample	none	20
W	distilled water	none	120

You are advised to wear safety glasses or goggles, especially when using the potassium hydroxide, **K**. If potassium hydroxide, **K**, comes into contact with your skin, wash it off with plenty of cold water.

Question 1 continues on page 4

Read step 1 to step 6 before proceeding.

Proceed as follows:

You are required to estimate the concentration of **U** using **P1**, **P2** and **W**.

1. Put 1 cm^3 of the sample to be tested (for example, **P1**) into a test-tube.
2. Put 1 cm^3 of **K** into the same test-tube. Shake gently to mix.
3. Put 1 cm^3 of **C** into the same test-tube. Shake gently to mix.
4. Repeat steps 1 to 3 to test **P2**, **U** and **W**.
5. Record your **colour** observations.
6. In a test-tube rack put the test-tubes in an order which will enable you to record each colour as a **number** using the scale shown in Fig. 1.2. Use Fig. 1.3 to help you with the colours.

0 1 2 3 4 5 6 7 8 9 10

no purple — darkest purple

Fig. 1.2

Fig. 1.3 shows an example of no purple (0) and an example of darkest purple (10).

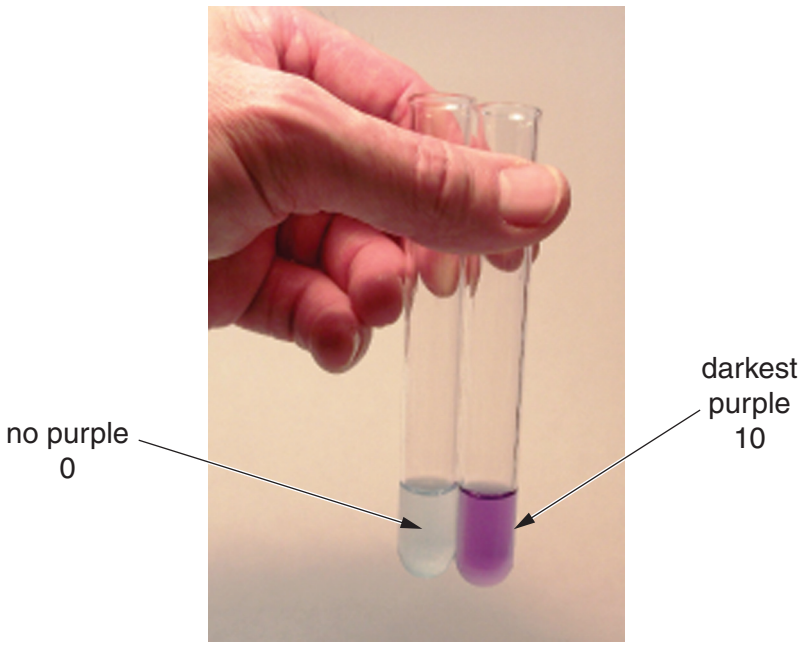


Fig. 1.3

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(a) (i) Prepare the space below to record your colour observations **and** the number using the scale shown in Fig. 1.2.

[4]

(ii) Complete the following by using one of the words '**more**' or '**less**'.

You may use each word once or more than once.

U is ..... concentrated than 0.8% (**P1**).

U is ..... concentrated than 1.6% (**P2**).

Use your results to estimate the concentration of albumin in **U**.

.....[1]

(iii) State which solution **P1** or **P2** you will dilute to prepare further concentrations.

Explain the reason for your decision.

.....

.....[2]

(iv) Complete Fig. 1.4 on page 6 to show how you will dilute the solution you decided on in **(iii)** to prepare a **serial** dilution.

You should use the two beakers shown in Fig. 1.4 and add as many extra beakers as you need to prepare a **serial** dilution.

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

For **each beaker**, complete Fig. 1.4 to show how you will dilute the solution you decided on in **(iii)** by:

- showing under each beaker the **concentration** and **volume** of the solution prepared in this beaker
- using one arrow, with a label above the beaker, to show the **concentration** and **volume** of albumin solution added
- using another arrow, with a label above the beaker, to show the **volume** of water added.

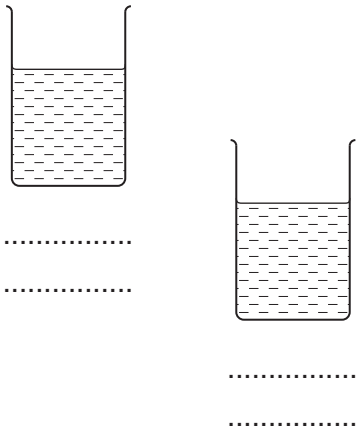


Fig. 1.4

[3]

7. Prepare **all** the concentrations of albumin solution, as shown in Fig. 1.4, in the containers provided.

8. Repeat steps 1 to 3 (page 4) with each of the solutions.

9. Repeat steps 5 and 6 (page 4).

(v) Prepare the space below to record your colour observations **and** the number using the scale shown in Fig. 1.2 (page 4).

[2]

(vi) Using these additional results from **(v)** state a more accurate estimate of the concentration of albumin in **U**.

.....[1]

(vii) Replicating the investigation would increase the confidence in the accuracy of your estimate.

Describe **one other** modification which would increase the confidence in your estimate.

.....

.....[1]

You are required to use a sharp pencil for charts.

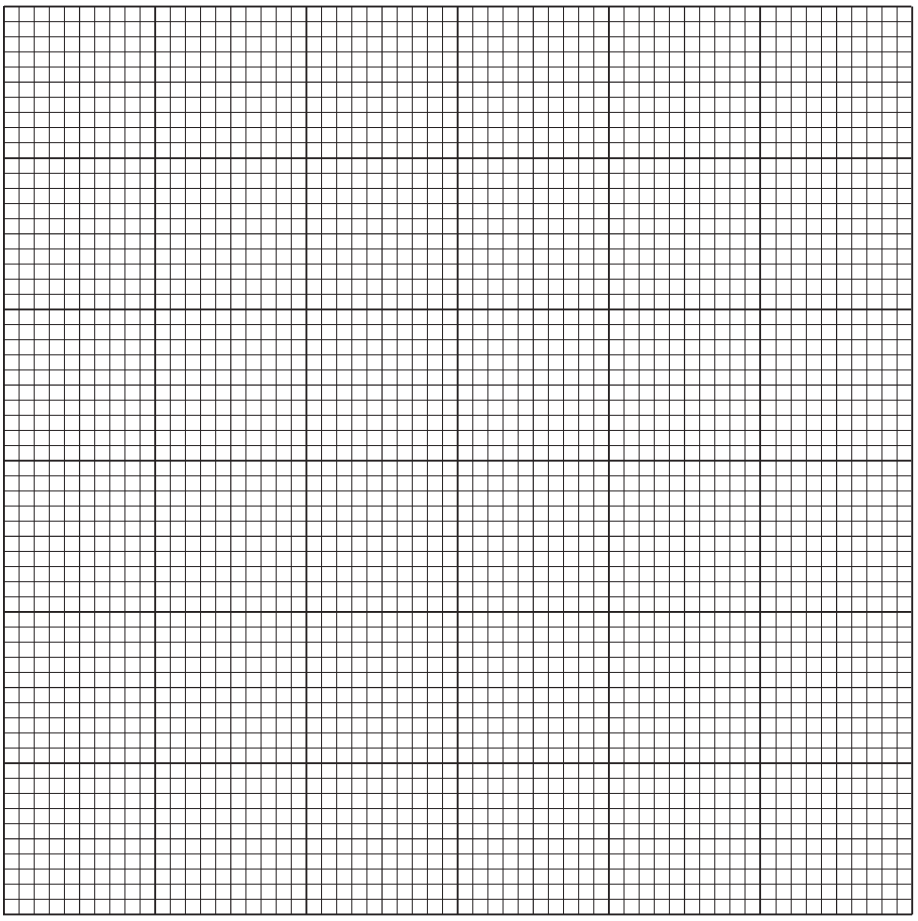
(b) Scientists have investigated the albumin concentration in the blood plasma of 166 people.

The results are shown in Table 1.1.

Table 1.1

albumin concentration in blood plasma /g per 100 cm^3	frequency /number of people
3.1 – 3.5	3
3.6 – 4.0	21
4.1 – 4.5	42
4.6 – 5.0	60
5.1 – 5.5	39
5.6 – 6.0	1

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



[4]

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(ii) Suggest **one** reason for the pattern of the results shown in the chart.

.....

.....[1]

(iii) The concentration of albumin in a person's blood may be measured to identify health problems. One of the reasons for a health problem is that blood albumin has a low solubility in water.

Suggest **one** health problem which may be caused by an albumin concentration of 5.6–6.0 g per 100 cm^3.

.....

.....

.....[1]

[Total: 20]

You are required to use a sharp pencil for drawings.

2 **L1** is a slide of a stained transverse section through a leaf.
This plant species grows widely including Europe, Africa and Asia.

You are not expected to be familiar with this specimen.

To help draw a plan diagram with the correct shape and proportions of the tissues, an eyepiece graticule can be used to measure the layers of tissues, without the need to calibrate the eyepiece graticule scale.

(a) **(i)** Draw a large plan diagram of the part of the specimen on **L1** indicated by the shaded sector in Fig. 2.1.

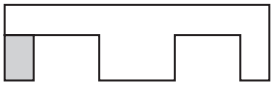


Fig. 2.1

On your diagram:

- ignore the trichomes (either attached or loose)
- use **one** ruled label line and label to show the palisade layer.

[5]

(ii) Select one whole trichome:

- made up of at least three cells
- attached to at least one epidermal cell.

Make a large drawing of this trichome attached to at least one epidermal cell.

Use **one** ruled label line and label to show **one** nucleus.

[4]

(b) Fig. 2.2 is a photomicrograph of a stained transverse section through another species of leaf.

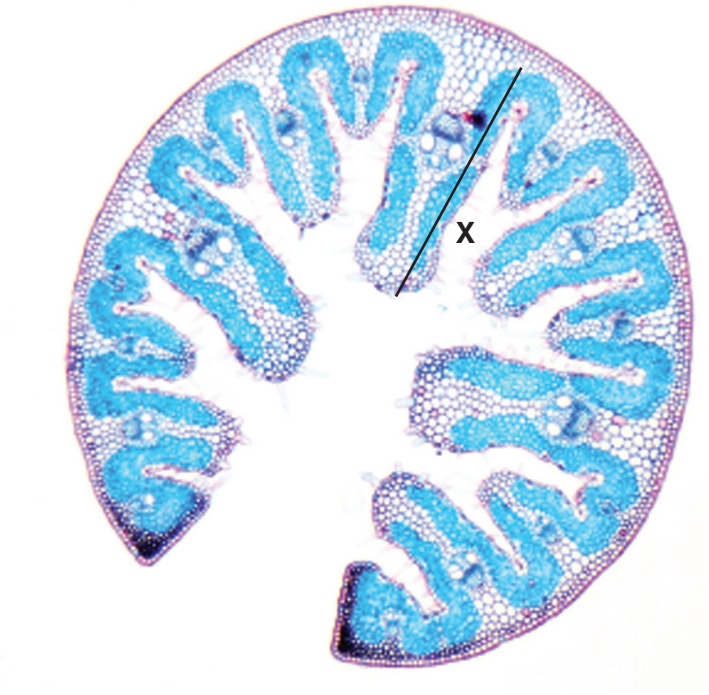


Fig. 2.2

(i) Prepare the space below so that it is suitable for you to show the observable differences between the specimens shown on **L1** and Fig. 2.2.

Record your observations in the space you have prepared.

[4]

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(ii) Calculate the actual length of the fold shown by line **X**, using the scale bar.

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

actual length .....[4]

(iii) Describe how you would obtain the **mean** maximum actual length of the folds in the specimen shown in Fig. 2.2.

.....

.....

.....

.....

.....[2]

(iv) Suggest **one** observable feature, other than trichomes, shown by **both** the specimen on **L1** and the specimen 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 by preventing water loss.

feature .....

explanation .....

.....[1]

[Total: 20]

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3095848871

BIOLOGY **9700/35**

Advanced Practical Skills 1 **October/November 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, graphs or rough working.
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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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 your **time** to make sure that you finish all the work that you would like to do.

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

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.

1 Enzymes in yeast cells catalyse the hydrolysis (breakdown) of glucose and release carbon dioxide and ethanol.

You are required to investigate the effect of different concentrations of yeast cell suspension, **Y** (independent variable), on the hydrolysis of glucose using methylene blue solution, **M**, by:

- preparing different concentrations of the yeast cell suspension, **Y**
- adding glucose solution, **G**, to activate the yeast cell suspension, **Y**, so that **M** changes colour from blue to blue/green as a result of the activity of the enzymes in the yeast cells.

You are provided with:

labelled	contents	hazard	volume /cm^3
Y	10% yeast cell suspension	none	100
G	glucose solution	none	80
W	distilled water	none	150
M	methylene blue solution	stains	20

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

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(a) (i) Complete Fig. 1.1 to show how you will dilute **Y** to prepare a **serial** dilution.

You should use the two beakers shown in Fig. 1.1 and add as many extra beakers as you need to prepare a **serial** dilution.

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

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

- showing under each beaker the **concentration** and **volume** of the suspension in this beaker
- using one arrow, with a label above the beaker, to show the **concentration** and **volume** of yeast cell suspension added
- using another arrow, with a label above the beaker, to show the **volume** of water added.

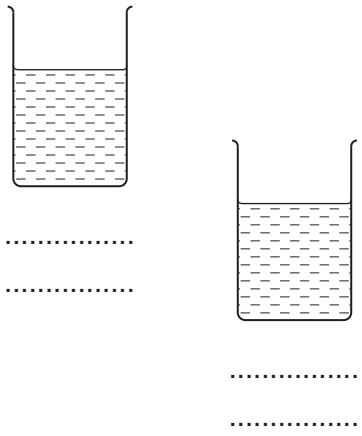


Fig. 1.1

[3]

1. Prepare **all** the concentrations of yeast cell suspension, as shown in Fig. 1.1 on page 3, in the containers provided.

You are required to put methylene blue solution with the yeast cell suspension and **G**.

When **G** is added to the yeast cell suspension the enzymes in the yeast cell suspension will start to catalyse the breakdown of glucose. Methylene blue solution changes colour as these enzymes become active as shown in Fig. 1.2.

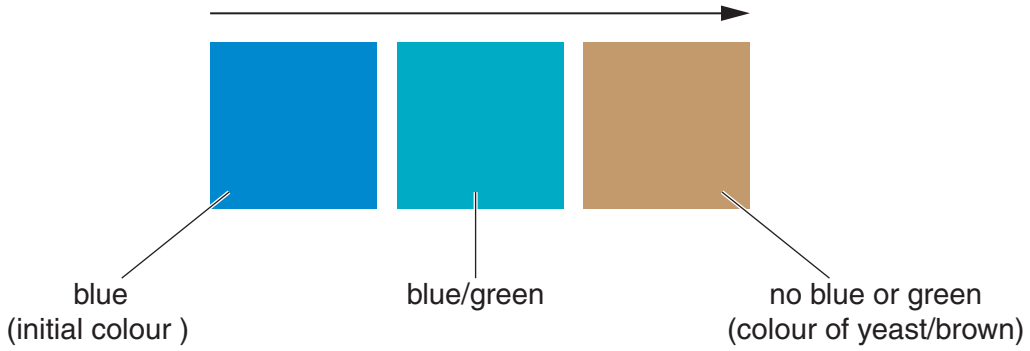


Fig. 1.2

5 minutes after adding **G** you are required to stop timing and record your observations of the concentrations of yeast cell suspension prepared in **(a)(i)**.

Read step 2 to step 9 before proceeding.

Proceed as follows:

2. In step 6 you will require a water-bath. Use the beaker or container provided to prepare a water-bath with warm water between 40 °C and 45 °C. You will need to add hot/cold water to maintain the temperature of the water-bath between 40 °C and 45 °C for steps 6 to 8.

3. Put 10 cm^3 of the 10% **Y** into your first test-tube.

4. Put 10 cm^3 of each of the other concentrations of yeast cell suspensions that you prepared in step 1 into separate test-tubes.

5. Put 1 cm^3 of **M** into each of the test-tubes.

Note that the contents of the test-tubes might be different shades of blue.

6. Put all the test-tubes into the water-bath between 40 °C and 45 °C and leave for two minutes.

You will start timing as soon as you add **G** (in step 7).

7. Leaving the test-tubes in the water-bath put 10 cm^3 of **G**, into each of the test-tubes and gently shake to mix the contents. Start timing.

   Do not shake the test-tubes again during the investigation.

8. After 5 minutes, stop timing and put the test-tubes in the test-tube rack in the order of the concentrations of yeast cell suspension.

9. Record your observations of each concentration of yeast cell suspension.

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(ii) Prepare the space below to record your observations.

[5]

(iii) You used syringes to measure the volumes of the yeast cell suspension.

State the volume of the smallest division on the syringe .....

State the actual error in using the syringe.

actual error .....
[1]

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

.....

.....

.....[1]

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

.....

.....

.....[1]

You are required to use a sharp pencil for graphs.

Lactose, a disaccharide sugar, is the main carbohydrate of milk.
Some people cannot breakdown lactose and scientists have investigated ways to remove lactose from milk.
One type of yeast was found to contain the enzyme, **E**, that breaks down (hydrolyses) lactose.

E can be held within (immobilised) alginate beads and put into milk.

As the milk comes into contact with the alginate beads, **E** hydrolyses the lactose.

Scientists have investigated the effect of keeping the alginate beads in contact with the milk for different lengths of time and the percentage hydrolysis of lactose was found.

The volumes and concentration of lactose and **E** were kept the same (standardised).

(b) (i) State **two other** variables that need to be standardised in this investigation.

Describe how you would standardise each of these variables.

.....

.....

.....

.....

.....

.....

.....[3]

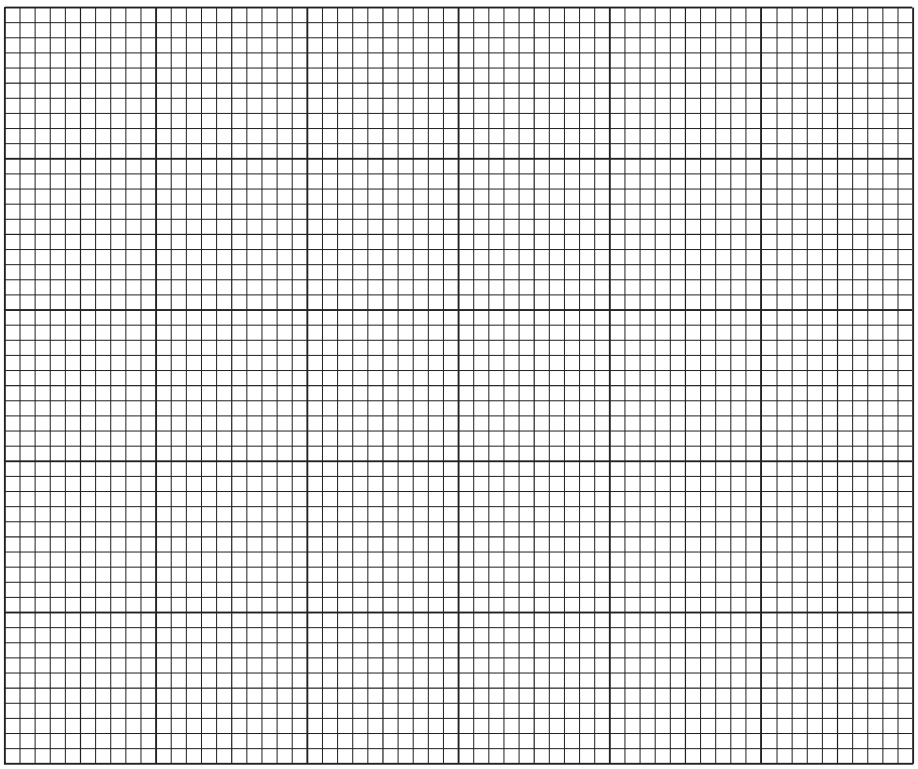
The results are shown in Table 1.1.

Table 1.1

time alginate beads in contact with milk /minutes	percentage hydrolysis of lactose
0	0
24	34
52	63
84	81
120	85

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



[4]

(iii) Using your graph state the percentage hydrolysis of lactose at 45 minutes.

.....%
[1]

(iv) Explain the reason for the difference in the results at 30 minutes and 70 minutes.

.....

.....

.....[1]

(v) Suggest a reason for the change in the trend after 90 minutes.

.....

.....

.....[1]

[Total: 21]

You are required to use a sharp pencil for drawings.

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

You are required to:

- observe the effect of using the different stains, iodine solution, **I**, and methylene blue solution, **M**, on thin sections of onion tissue, **S**
- observe and record the cells and their cell contents.

Iodine solution and **methylene blue** solution will stain your skin.

If any iodine solution or methylene blue solution comes into contact with your skin wash off immediately with water.

You are provided with:

- three pieces of onion tissue, in a dish labelled **S**
- iodine solution, **I**
- methylene blue solution, **M**
- distilled water, **DW**.

You are required to:

- prepare **three** microscope slides of onion tissue, one using iodine solution, **I**, one using methylene blue solution, **M**, and one using distilled water, **DW**
- use the microscope to observe the onion cells after **I**, **M** and **DW** have been added
- record your observations by using annotated drawings of **two** adjacent onion cells from each of the prepared slides.

Proceed as follows:

1. Label three dry and clean microscope slides, **I**, **M** and **DW** and put the slides on a paper towel.

2. Put a few drops of:

    - iodine solution onto slide **I**
    - methylene blue solution onto slide **M**
    - distilled water onto slide **DW**.

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3. Remove a piece of the onion tissue from **S** and, using forceps or fingers peel off the inner concave epidermis as shown in Fig. 2.1.

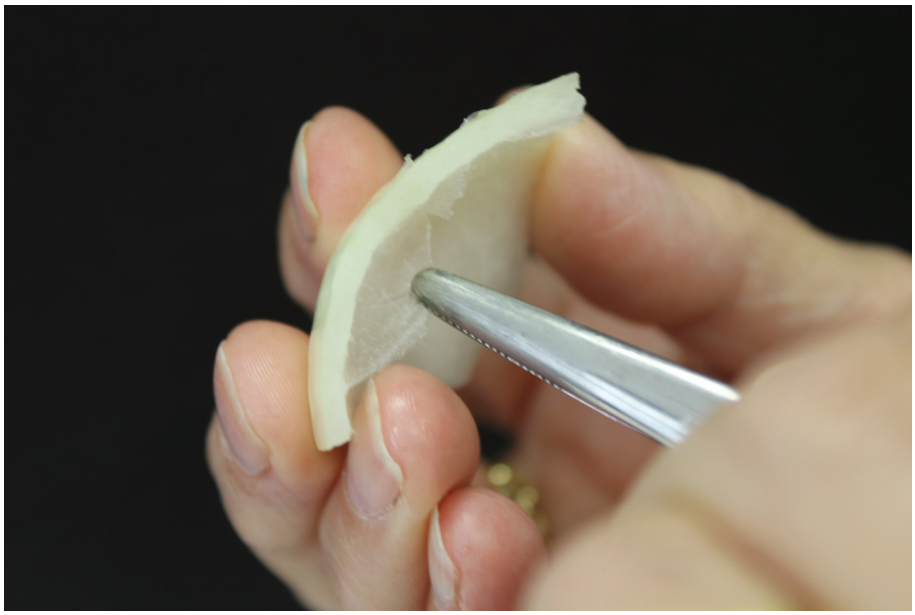


Fig. 2.1

4. Cut three pieces of the epidermis, each smaller than a coverslip.

5. Place one piece of the epidermis onto each of the slides as shown as Fig. 2.2.
If the epidermis is folded, you may need to add more drops of **I** or **M** or **DW** so that it floats or uncurls.

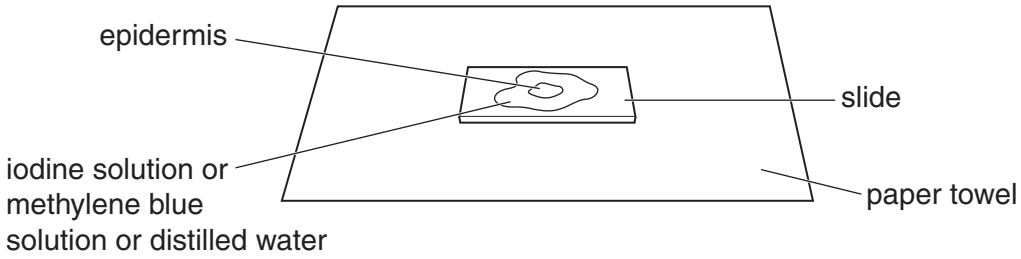


Fig. 2.2

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

7. View the slide using the microscope. Look for the thinnest part of the section so that the cells and their contents can be observed.

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

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(a) (i) Make a large drawing of **two** adjacent cells with any observable cell contents from each of:

- slide **I**
- slide **M**
- slide **DW**.

Use **one** ruled label line and label to show **one** nucleus on **one** of your drawings.

*cells from slide **I***

*cells from slide **M***

*cells from slide **DW***

[6]

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(ii) Describe **one** observable difference between the cells on slide **I** and the cells on slide **M**.

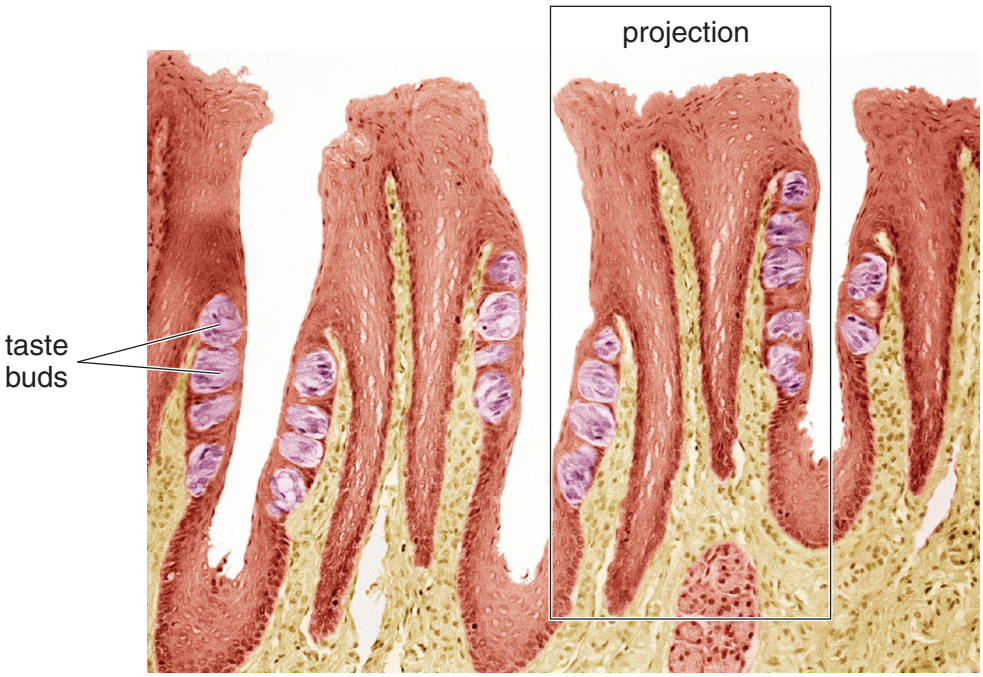
.....

.....[1]

Question 2 continues on page 12

(b) Fig. 2.3 is a photomicrograph of a stained transverse section through part of an organ from a mammal.

You are not expected to have studied this material.



magnification ×40

Fig. 2.3

(i) Suggest **one** observable feature shown by the specimen in Fig. 2.3 which supports the conclusion that this is part of an organ that may absorb molecules.

Explain how **this** feature may help the organ to increase the rate of absorption.

feature .....

explanation .....

[1]

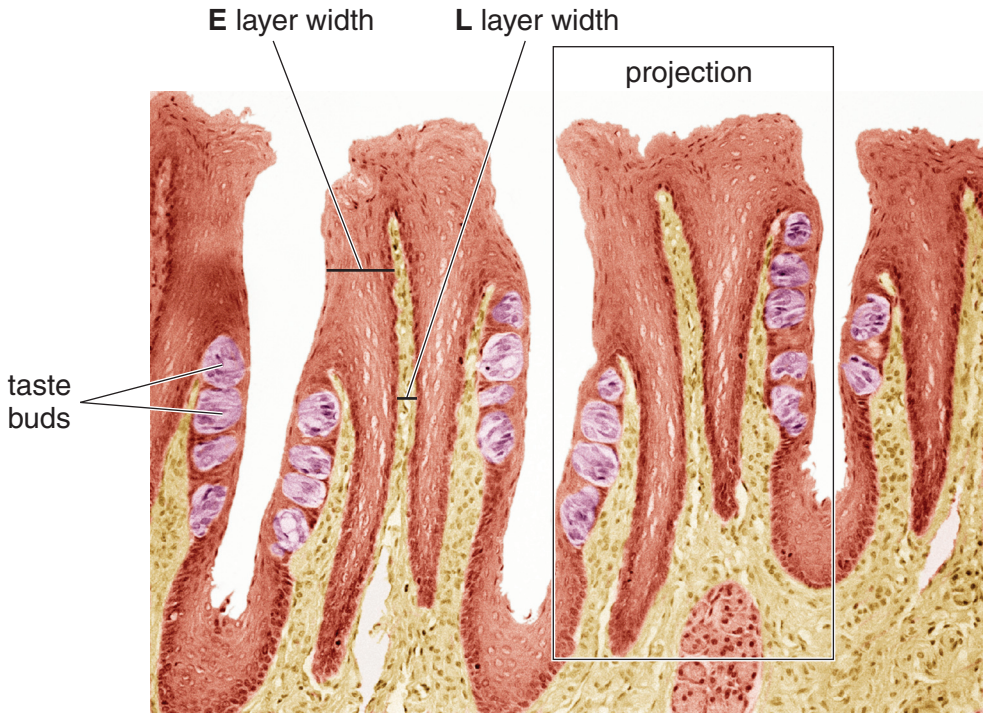
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(ii) Draw a large plan diagram of the projection shown in Fig. 2.3.

[4]

Question 2 continues on page 14

Fig. 2.3 is shown again here to help you to answer **(c)(i)**



(c) Fig. 2.4 is a photomicrograph of a stained transverse section through the same organ as Fig. 2.3 but from a different mammal.

You are not expected to have studied this material.

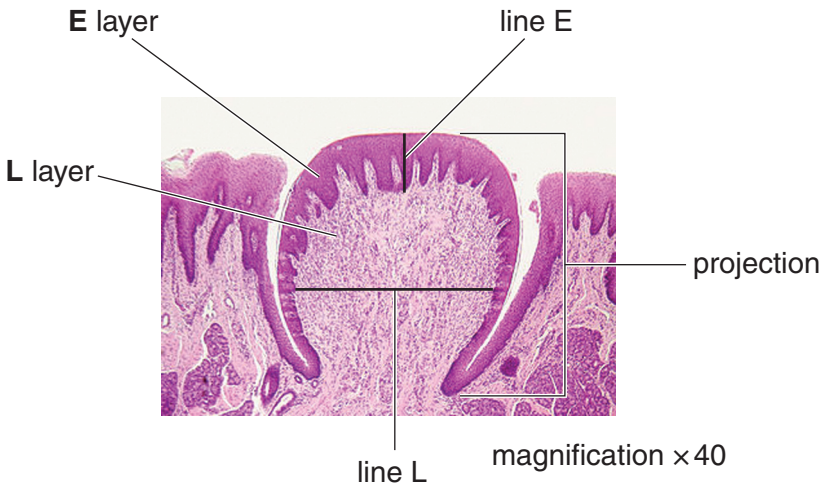


Fig. 2.4

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(i) Prepare the space below so that it is suitable for you to show the observable differences between the specimens in Fig. 2.3 and in Fig. 2.4.

Record your observations in the space you have prepared.

[4]

(ii) Calculate the ratio of the width of **L** (line L) to the width of **E** (line E) shown within the area indicated on Fig. 2.4.

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

ratio .....[3]

[Total: 19]

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Fig. 2.4 © WIM VAN EGMOND/VISUALS UNLIMITED, INC./SCIENCE PHOTO LIBRARY.

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2395543112

BIOLOGY **9700/36**

Advanced Practical Skills 2 **October/November 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, graphs or rough working.
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 your **time** to make sure that you finish all the work that you would like to do.

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

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.

1 An enzyme, **E**, catalyses the hydrolysis (breakdown) of triglycerides into fatty acids and glycerol.

The substrate for **E** will be the triglycerides present in milk, labelled **M**.

The end-point of this hydrolysis can be determined by using an indicator, **B**, which changes colour to yellow when the fatty acids are produced.

You are required to:

- prepare different concentrations of the enzyme solution, **E**
- investigate the effect of different concentrations of **E** (independent variable) on the hydrolysis of triglycerides in milk.

You are provided with:

labelled	contents	hazard	volume /cm^3
E	5% enzyme solution	irritant	40
W	distilled water	none	60
B	indicator solution	stains	20
M	milk	none	40
A	solution of alkali	irritant	40

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You are required to dilute the 5% enzyme solution, **E**, to provide a range of known concentrations using **simple** dilution.

Decide on the further concentrations of enzyme solution you will use in your investigation in addition to the 5% solution, **E**.

You will need to use 20 cm^3 of each enzyme solution.

(a) (i) Prepare the space below to show:

- the concentration of each enzyme solution
- the volumes of **E**
- the volumes of **W**.

[3]

Read step 1 to step 13 before proceeding.

Proceed as follows:

1. Prepare **all** the concentrations of enzyme solutions you have listed in **(a)(i)** in the containers provided.

You are required to investigate the effect of different concentrations of enzyme solutions on the hydrolysis of triglycerides in milk. The appearance of fatty acids can be detected using the indicator solution **B**.

Every 30 seconds, for a total of 180 seconds, a sample of milk will be removed from the test-tube and placed on a tile. You will need to have prepared this tile **before** you add the enzyme solutions.

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[Turn over

2. Wipe the tile clean with a damp paper towel and then dry the tile.
Label the tile as shown in Fig. 1.1. The numbers indicate the sampling times in seconds. Put two drops of indicator solution, **B**, on the tile above each sampling time, as shown in Fig. 1.1.

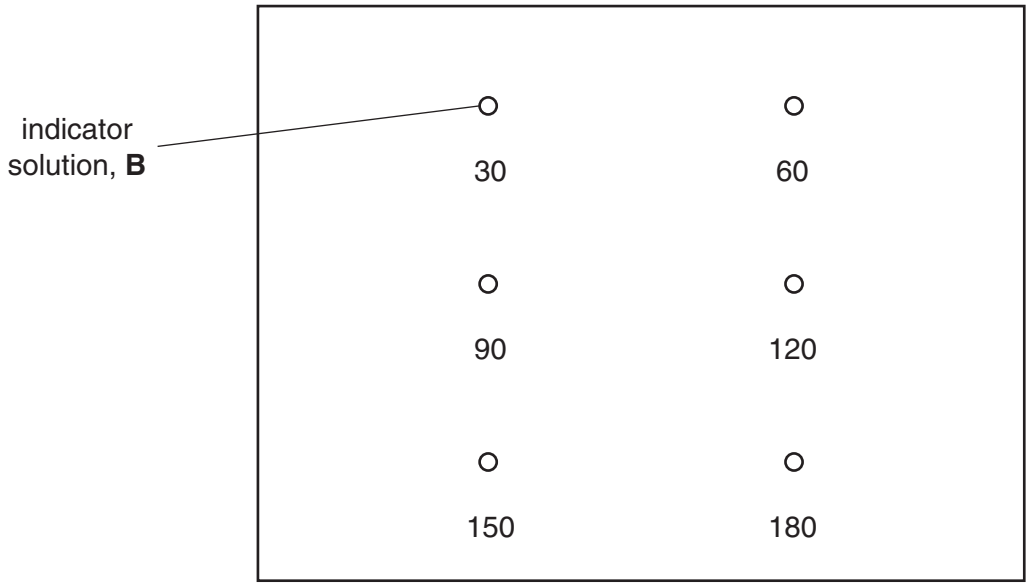


Fig. 1.1

3. Prepare a water-bath between 35 °C and 40 °C. You will need to add hot water/cold water to maintain the temperature of the water-bath between 35 °C and 40 °C for steps 7 to 12.

4. Put 2.5 cm^3 of **M** into a test-tube.

5. Put 2.5 cm^3 of **A** into the same test-tube.

6. Repeat steps 4 and 5 for each of the concentrations of enzyme solution you are going to investigate, including the 5% concentration, **E**.

7. Put all the test-tubes into the water-bath. Allow 2 minutes for the contents of the test-tubes to reach the same temperature as the water-bath.

The reaction will start as soon as you add the enzyme solutions so read steps 8 to 13 before proceeding.

8. Put 2.5 cm^3 of the 5% concentration, **E**, into one of the test-tubes, leaving the test-tube in the water-bath. Stir the contents of the test-tube and start timing.

9. After 30 seconds use the pipette to transfer two drops of the contents of the test-tube to the drop of **B**, labelled 30.

10. Repeat step 9, at 30 second intervals, until a drop changes to yellow (end-point).

11. Record the time taken to reach the end-point.

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If the drop at 180 seconds does not reach the end-point, record 'more than 180' as your result.

Once you have recorded a time for the end-point remove this test-tube from the water-bath and proceed to step 12.

12. Wipe the tile clean with a damp paper towel and then dry the tile.
    Label the tile again as shown in Fig. 1.1.

13. Repeat steps 8 to 12 with the remaining concentrations of enzyme solutions.

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

[5]

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

.....

.....

.....[1]

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

.....

.....

.....[1]

You are required to use a sharp pencil for graphs.

(b) A student investigated an enzyme which hydrolyses starch to glucose over a period of 20 minutes. The student measured the mass of glucose present at four minute intervals.

The volumes and concentrations of starch and enzyme were kept the same (standardised).

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

.....

.....

.....

.....

.....

.....

.....[3]

The results are shown in Table 1.1.

Table 1.1

time /min	mass of glucose /mg
4	1.90
8	3.15
12	3.90
16	4.00
20	4.05

(ii) Using the results in Table 1.1, calculate the rate of production of glucose between:

- 4 and 12 minutes

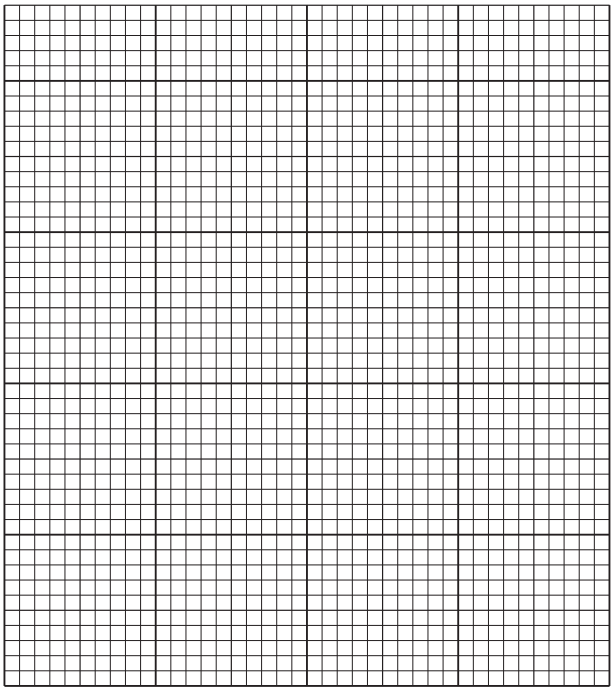
.....mg min^{-1}

- 12 and 20 minutes.

.....mg min^{-1}
[2]

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



[4]

(iv) Explain the reasons for the change in mass of glucose between:

- 0 and 12 minutes
- 12 and 20 minutes.

.....

.....

.....

.....

.....[2]

[Total: 21]

You are required to use a sharp pencil for drawings.

M1 is a slide of a stained transverse section through a plant root.
This plant species grows worldwide.
You are not expected to be familiar with this specimen.

2 *To help draw a plan diagram with the correct shape and proportions of the tissues, an eyepiece graticule can be used to measure the layers of tissues, without the need to calibrate the eyepiece graticule scale.*

(a) (i) Explain how **one** observable feature on **M1** identifies this specimen as a root.

.....

.....

.....[1]

(ii) Draw a large plan diagram of the part of the specimen on **M1** indicated by the shaded sector in Fig. 2.1.

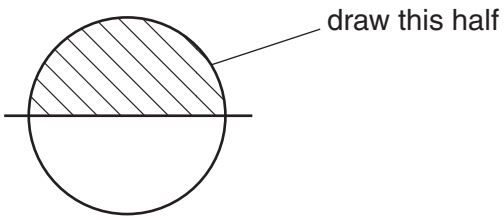


Fig. 2.1

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

[5]

(iii) Observe the xylem and the cortex of the specimen on **M1**.

Select:
- one group of **three** whole touching xylem vessels
- one group of **three** whole touching cortex cells.

Make a large drawing of each of these two groups of **three** cells.

Use **one** ruled label line and label to show **one** lumen on **one** of your drawings.

xylem vessels

cortex cells

[5]

Fig. 2.2 is a photomicrograph of part of a stained transverse section through a root of a different plant species. This plant species is found globally.

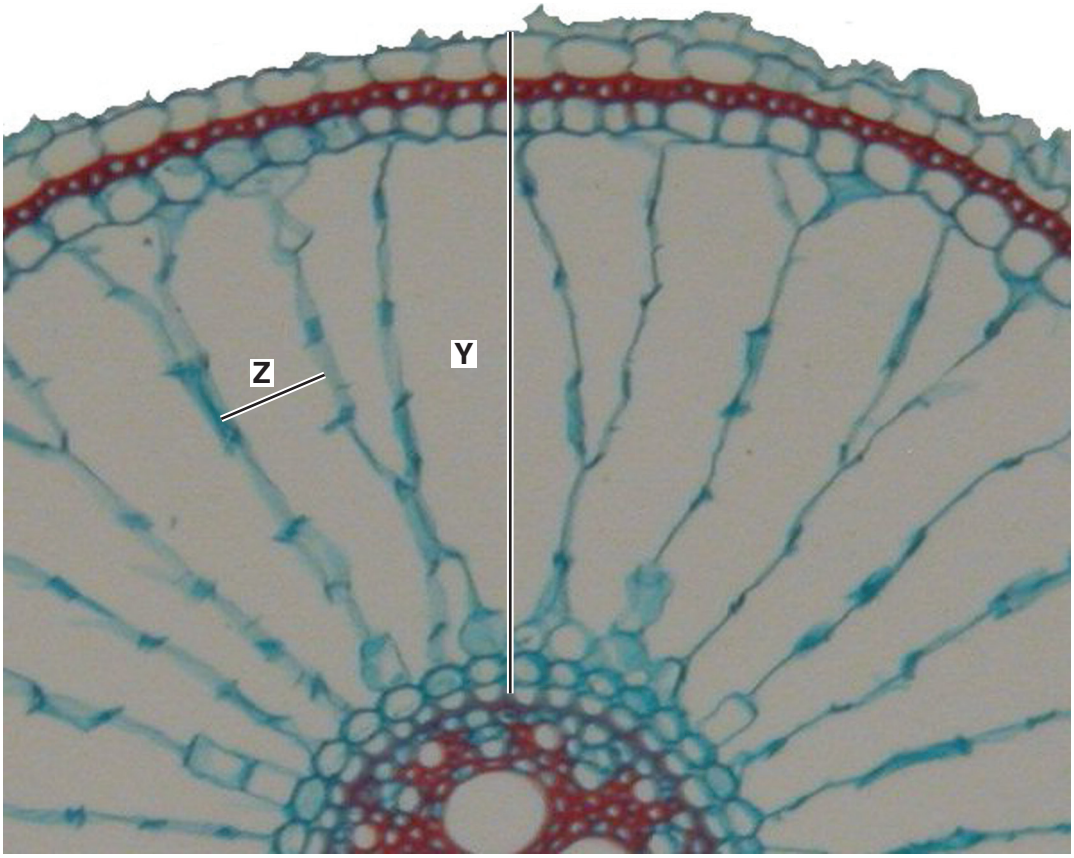


Fig. 2.2

(b) Use the lines **Y** and **Z** shown on Fig. 2.2 to calculate the ratio of **Y** to **Z**.

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

ratio .....[3]

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

Record your observations in the space you have prepared.

[5]

[Total: 19]

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