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

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

9236558690

BIOLOGY **9700/31**

Advanced Practical Skills 1 **October/November 2013**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

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Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black ink.
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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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You are reminded that you have **only one hour** for each question in the practical examination.

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You should:

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

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

1 Agar pieces can be used to investigate diffusion.

You are required to investigate the effect of ascorbic acid (independent variable) diffusing into stained agar pieces.

As ascorbic acid, **A**, diffuses into the stained agar piece it causes the piece to decolourise (lose its blue colour).

You are provided with:

labelled	contents	hazard	volume / cm^3
A	0.10% ascorbic acid	irritant	100
W	distilled water	none	100

labelled	contents	hazard	size
U	agar block containing a blue stain	none	at least 60 mm × 40 mm

Read steps 1–6 before proceeding.

Proceed as follows:

1. You are required to dilute the 0.10% ascorbic acid, **A**, to provide a range of known concentrations using **simple dilution**.

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(a) (i) Decide which concentrations of ascorbic acid to make, then complete Table 1.1.

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- The difference between each concentration should be 0.02%.
- You will need to make up 20 cm^3 of each concentration.

Table 1.1

volume of ascorbic acid / cm^3	volume of distilled water / cm^3	percentage concentration of ascorbic acid
20	0	0.10

[3]

2. Prepare all the concentrations of ascorbic acid as in Table 1.1 in the beakers or containers provided.

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[Turn over

You will need to cut the agar block, **U**, into smaller pieces as shown in Fig. 1.1.
To avoid staining your skin, try not to touch the agar.
You may use the blunt forceps and paper towels to handle the agar.

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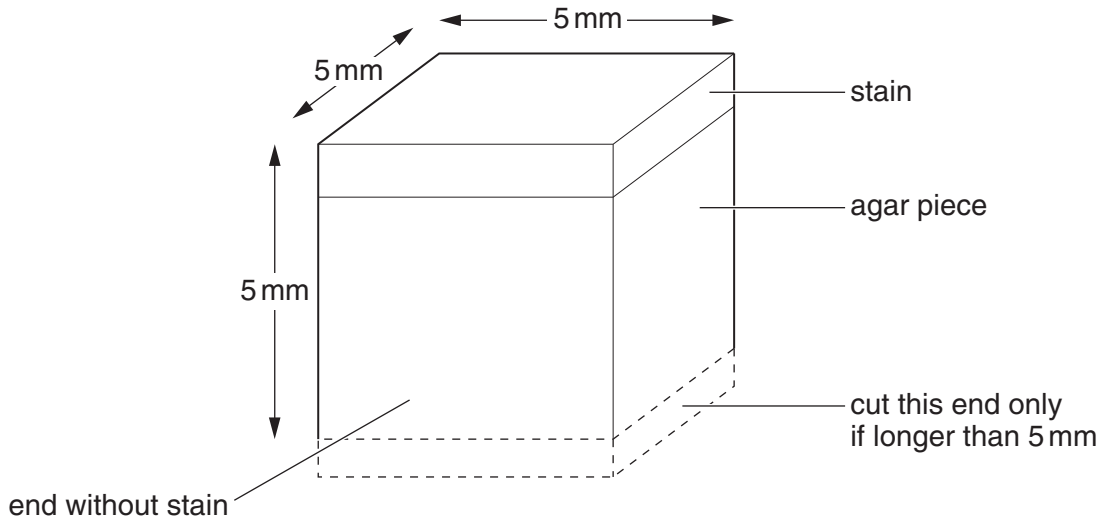


Fig. 1.1

3. Place the agar block onto a damp paper towel and cut the block into identical pieces of 5 mm × 5 mm × 5 mm as shown in Fig. 1.1.
You will need to consider the number of pieces needed for each concentration of ascorbic acid you have stated in Table 1.1 on page 3.

   Fig. 1.1 shows the measurement of the agar pieces that you need.

4. Put the prepared agar pieces into each of the concentrations of ascorbic acid. Immediately start timing.

5. Gently stir the contents of each beaker or container at regular intervals.

6. Record the time taken for the pieces to decolourise.
After 15 minutes, if any agar piece has not decolourised, **stop timing**, and record 'more than 900'.

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

For Examiner's Use

[5]

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

.....

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.....

.....[2]

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

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.....[3]

A student investigated measuring the concentration of ascorbic acid in different solutions by using a colour change with an indicator.
The greater the volume of indicator added the greater the concentration of ascorbic acid in the solution.

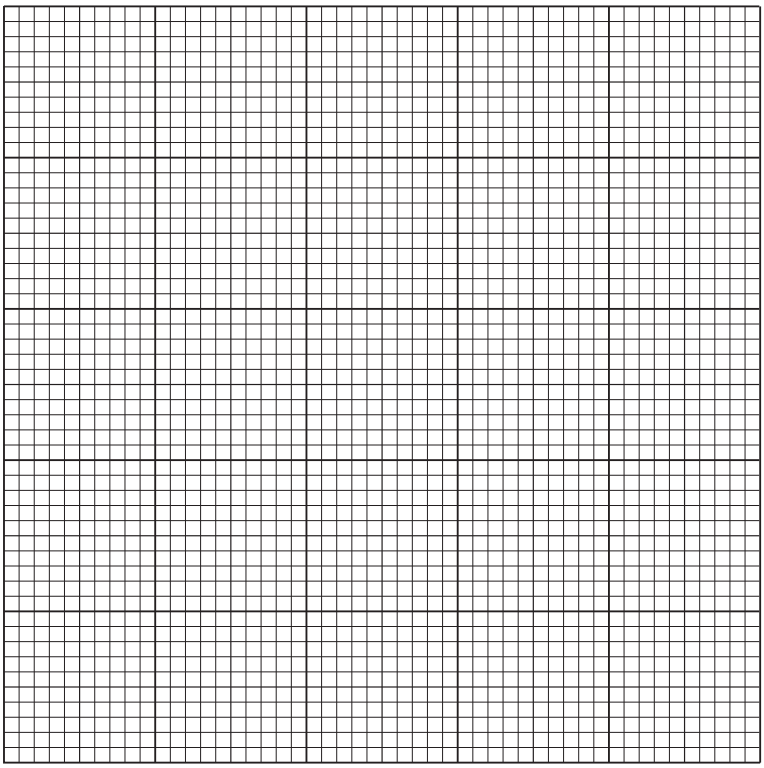
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The student's results are shown in Table 1. 3.

Table 1.3

percentage concentration of ascorbic acid	volume of indicator / cm^3
0.10	0.25
0.30	0.75
0.60	1.45
0.70	1.75
1.00	2.50

(b) (i) Plot a graph of the data shown in Table 1.3.



[4]

(ii) Use your graph to estimate the concentration of ascorbic acid present in a solution that required 0.875 cm^3 of indicator.

Show clearly on your graph how you obtained the ascorbic acid concentration.

concentration of ascorbic acid .....[2]

[Total: 19]

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2 **J1** is a slide of a transverse section through a tubular organ which is involved in transport.

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(a) (i) Draw a large plan diagram of the part of the tube on **J1** indicated by the shaded sector in Fig. 2.1.

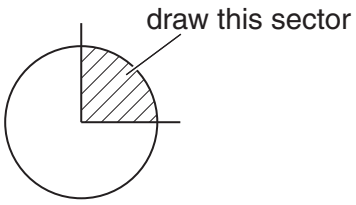


Fig. 2.1

On your diagram, use a label line and label to show the muscle tissue.

[5]

(ii) State **one** observable feature of the tube on **J1** which supports the conclusion that the tube is involved in transport.
Explain how this feature supports the conclusion.

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.....

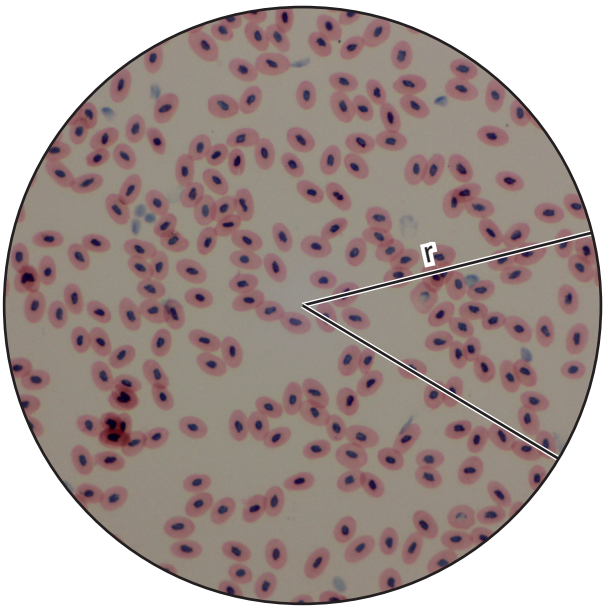
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.....[2]

Fig. 2.2 is a photomicrograph of blood cells in a field of view.

For Examiner's Use



magnification x 200

Fig. 2.2

Fig. 2.2 shows many blood cells. There are too many red blood cells to count, so the technique of sampling may be used to estimate the number of red blood cells in the field of view.

A sample should be counted in a known smaller area and then the result multiplied to obtain an estimate of the number of red blood cells in the whole field of view.

For example, if the number of red blood cells is counted in an eighth of the area of the field of view then this number would be multiplied by 8 to obtain the total number in the area of the field of view.

(b) (i) Count and record the **sample number** of red blood cells in the eighth of the area of the field of view.

- Mark clearly **on Fig. 2.2** each of the red blood cells counted.
- Estimate the number of red blood cells in the whole field of view.

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

number of red blood cells in the field of view ..... [2]

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To find the area of the field of view you need to calculate the **actual length** of line **r**, the radius of the circle, in mm.

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(ii) Use the magnification on Fig. 2.2 to calculate the **actual length** of line **r** in mm.

actual length ..... mm

Use the actual length of line **r** to calculate the area of the field of view using the formula for the area of a circle:

area of a circle πr^2
$\pi = 3.14$
r = radius of field of view

area of field of view ..... mm^2 [2]

(iii) Calculate the number of red blood cells per mm^2 using your answers in **(b)(i)** and **(b)(ii)**.

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

number of red blood cells ..... mm^{-2} [2]

A group of people climbed a mountain. They started at sea level (0.0 km) and reached a height of 6 km above sea level in 60 days.

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The average number of red blood cells per cm^3 of blood was calculated for the group of people at the start of the climb and at 20 day intervals.

The data is shown in Table 2.1.

Table 2.1

days	height above sea level /km	average number of red blood cells for the group / millions per cm^3
0	0.0	4.7
20	3.0	5.5
40	4.5	6.3
60	6.0	6.5

(iv) Describe the trend in the average number of red blood cells with height above sea level and explain the advantages of this trend.

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.....[3]

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Fig. 2.3 is a photomicrograph of blood from a different organism.

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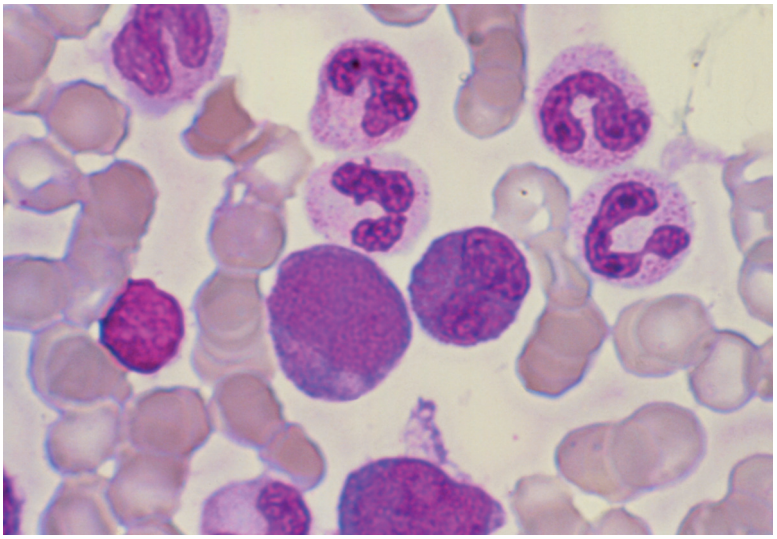


Fig. 2.3

(c) Make a drawing of white blood cells as observed in Fig. 2.3 made up of:

- **two** cells of one type of white blood cell
- **two** cells of a different type of white blood cell.

The drawings should show any differences in size (linear magnification) observed between each type of cell.

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

[5]

[Total: 21]

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Question 2 Fig. 2.3 © BIOPHOTO ASSOCIATES/SCIENCE PHOTO LIBRARY.

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7459711852

BIOLOGY **9700/33**

Advanced Practical Skills 1 **October/November 2013**

2 hours

Candidates answer on the Question Paper.

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1 Lipase is an enzyme which catalyses the hydrolysis (breakdown) of triglycerides into fatty acids and glycerol.

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

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

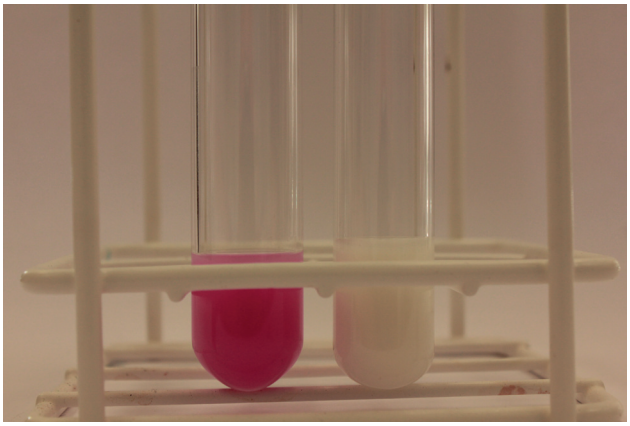


Fig. 1.1

You are required to investigate the effect of substrate concentration in **M** (independent variable) on the lipase-catalysed reaction.

You are provided with:

labelled	contents	hazard	volume / cm^3
M	milk	none	70
W	distilled water	none	100
A	alkali solution	irritant	100
P	indicator solution	flammable	10
E	lipase solution	irritant	20

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Proceed as follows:

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You may assume that the triglyceride content of the milk, **M**, is 5%.
You are required to dilute this 5% milk, **M**, to provide a range of known concentrations of triglycerides using **simple dilution**.

(a) (i) Decide which three further concentrations of triglycerides to make, then complete Table 1.1.

- The difference between each concentration should be 1%.
- You will need to make up 20 cm^3 of each concentration.

Table 1.1

volume of milk solution / cm^3	**volume of distilled water / cm^3**	**percentage concentration of triglycerides in milk**
20	0	5

[2]

(ii) State the concentration of triglycerides which you would expect to reach the end-point (pink to white) in the shortest time.

.....[1]

1. Prepare **all** the concentrations of triglycerides as in Table 1.1 in the containers provided.

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2. Put 20 cm^3 of **A** into each of the concentrations which you prepared in step 1 and mix well.
3. Put 3 cm^3 of each mixture, as made in Step 2, into separate test-tubes.
4. Put five drops of **P** into each of the test-tubes and gently shake so that all the mixture turns pink. (Note that each of the concentrations might not be the same shade of pink).
5. Set up a water-bath and adjust the temperature of the water to between 45 °C and 50 °C. You will need to add hot water/cold water to maintain the temperature of the water-bath between 45 °C and 50 °C for steps 6 to 9.
6. Put the test-tubes from Step 4 into the water-bath for five minutes.
7. Put 3 cm^3 of **M** in a test-tube to act as a standard to help you recognise the end-point. Put this test-tube in the water-bath.

When you start the timer after adding **E** to the first test-tube in Step 8, you must **not** stop the timer at any of the end-points, just record the time.

The reaction will start as soon as you add **E***, so read steps 8 to 13 before proceeding.*

Continue as follows:

8. Put 2 cm^3 of **E** into the test-tube containing the **lowest** concentration of triglycerides and mix well, then return it to the water-bath.
9. Start timing and record start time on Fig. 1.2.
10. Immediately, put 2 cm^3 of **E** into the next test-tube containing next highest concentration of triglycerides and mix well, then return it to the water-bath.
11. Record start time on Fig. 1.2.
12. Immediately repeat steps 10 and 11 for the remaining concentrations.
13. Observe the four test-tubes and record the time on Fig. 1.2 when each end-point is reached. This is your raw data.

Using the colour of ***M*** *may help you recognise the end-point.*

If the time taken to reach the end-point for any one concentration is longer than 5 minutes record 'more than 300'.

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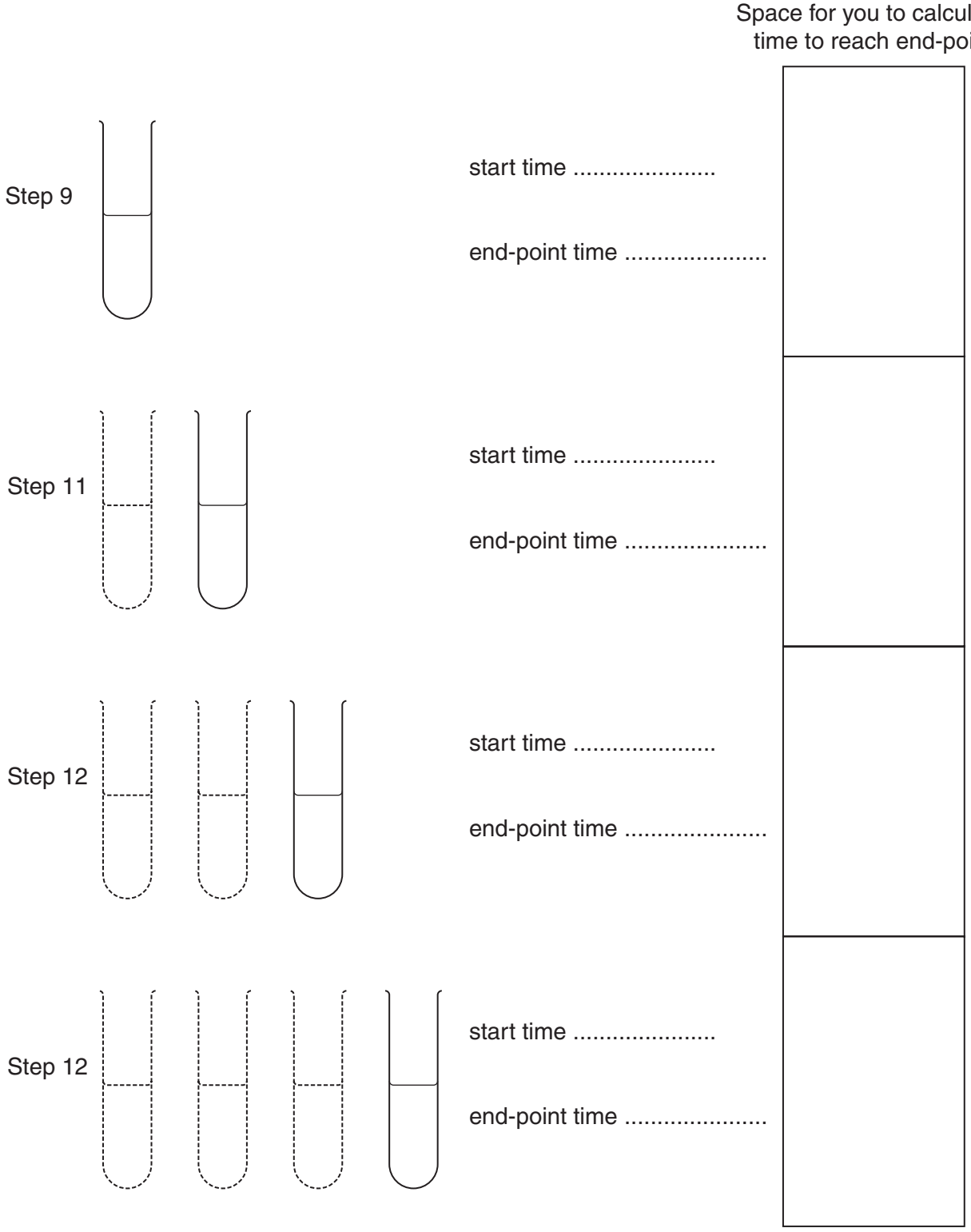


Fig. 1.2

From your timer readings you will be required to calculate the time taken to reach the end-point in each test-tube.

14. Process your raw data to find the time taken to reach the end-point for each concentration (these are your **processed** results).

    If you have time check your results.

    (iii) Prepare the space below to record your **processed** results.

[5]

    (iv) Calculate the rate of lipase activity for the 5% concentration of triglycerides.

..... [1]

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(v) Describe how you could set up a control for this investigation using the apparatus provided.

For Examiner's Use

.....

.....

.....[1]

(vi) Identify **one** significant source of error in this investigation.

.....

.....

.....[1]

Some scientists investigated the effect of the triglycerides in different types of milk (independent variable) on the time taken to reach the end-point. They used the same method as in your investigation.

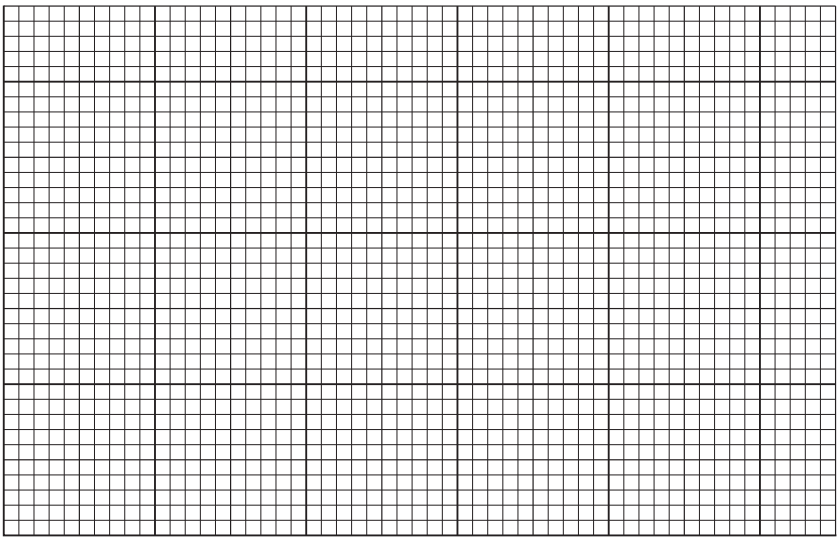
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The results are shown in Table 1.2.

Table 1.2

type of milk	time taken to reach the endpoint /s
full fat (F)	130
evaporated (V)	120
low fat (L)	215
condensed (C)	150
dried (D)	265

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



[4]

(ii) Suggest **one** reason for the difference in the time taken to reach the end-point between evaporated milk (V) and dried milk (D).

.....

.....

.....[1]

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A student carried out an investigation into the effect of immobilised lipase on the hydrolysis of triglycerides in milk. The student used the apparatus in Fig. 1.3.

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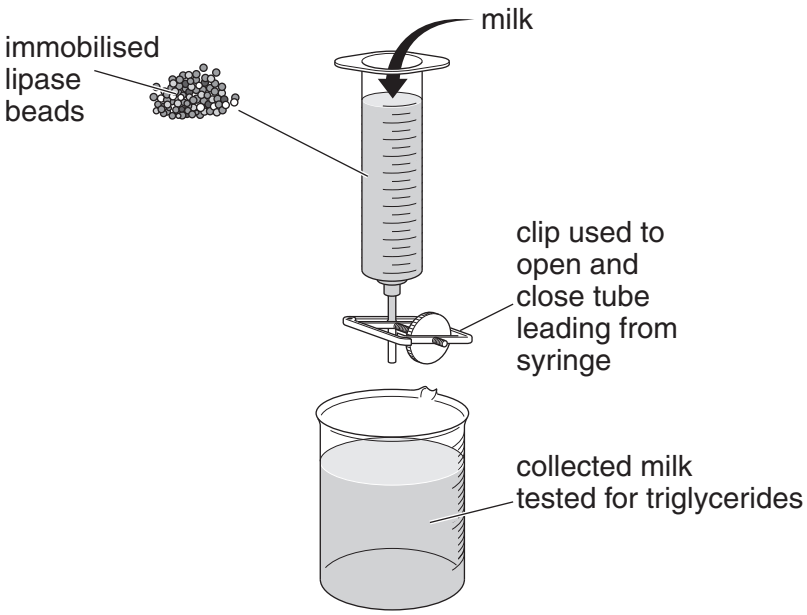


Fig. 1.3

(c) Identify **two** variables that the student would need to standardise to compare the activity of different concentrations of lipase immobilised in alginate beads.

Describe how **one** of these variables would be standardised.

.....

.....

.....

.....

.....[2]

[Total: 18]

2 **K1** is a slide of a transverse section through a plant leaf. This plant grows in the Mediterranean region.

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(a) (i) Draw a large plan diagram of the part of the leaf indicated by the shaded sector in Fig. 2.1.

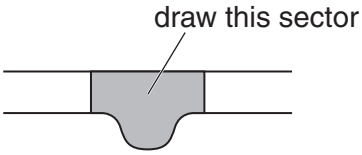


Fig. 2.1

On your diagram, use a ruled label line and label to show an epidermis.

[4]

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(ii) Find an area on the specimen in **K1** showing a group of four xylem vessels. Choose one group of four whole xylem vessels.

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Make a drawing of this group, as observed on the specimen on **K1**.

On your drawing, use a label line and label to show one lumen.

[5]

Question 2 continues on page 13

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Fig. 2.2 shows a photomicrograph of a stage micrometer viewed through a microscope.

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The smallest measurement on this stage micrometer is 0.1 mm.

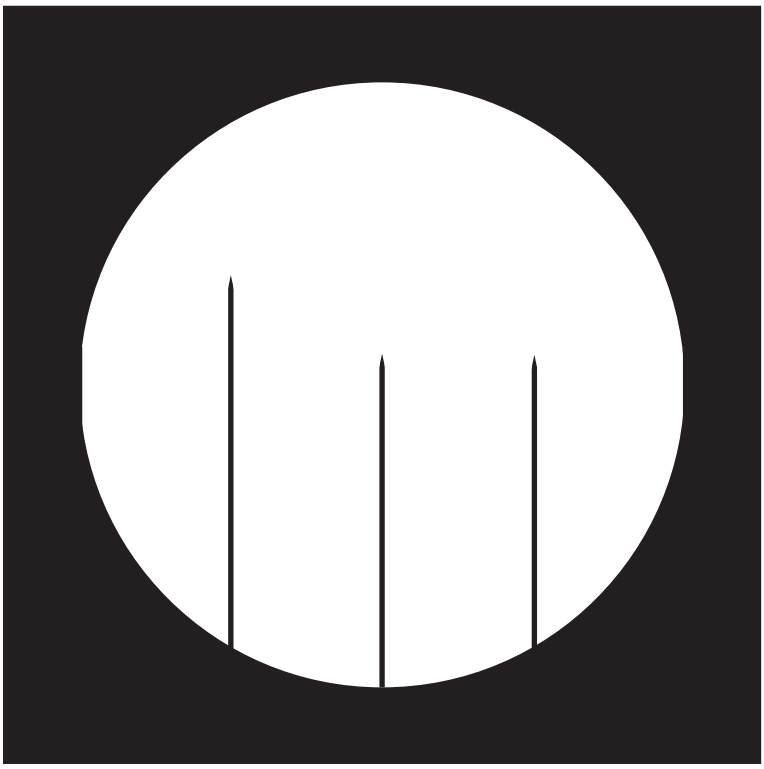


Fig. 2.2

You are required to:
- find the area of the field of view, using Fig. 2.2
- count the number of chloroplasts in a quarter of the field of view, using Fig. 2.3 (on page 14)
- calculate the number of chloroplasts per mm^2.

(b) (i) Calculate the area of the field of view, using:

- the formula for the area of a circle πr^2
- $\pi = 3.14$
- r = radius of the field of view.

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

area of field of view ..... mm^2 [2]

Fig. 2.3 is a photomicrograph showing leaf cells, with the same field of view as in Fig. 2.2.

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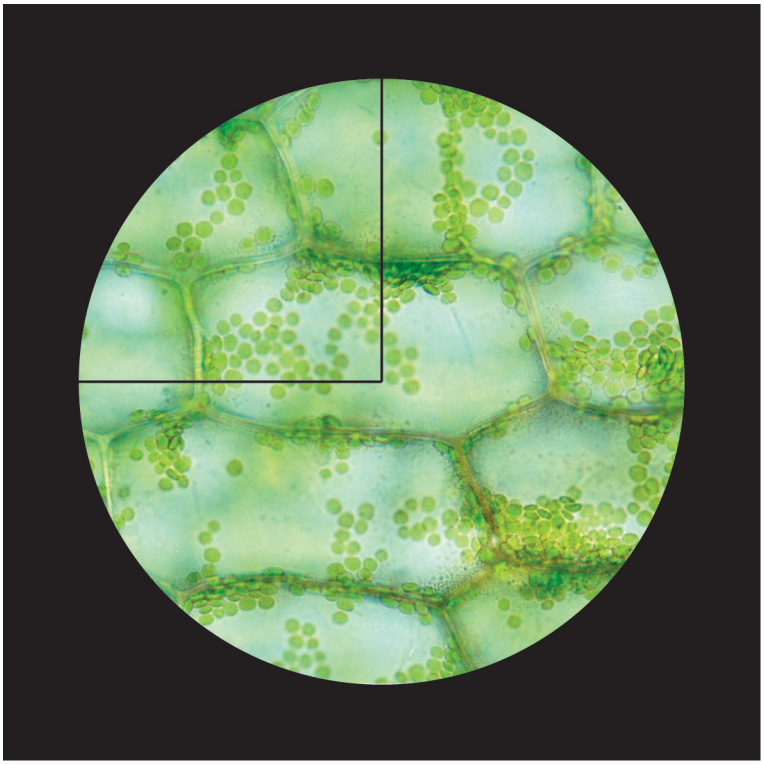


Fig. 2.3

Fig. 2.3 shows chloroplasts in leaf cells. There are too many chloroplasts to count, so the technique of sampling may be used to estimate the number of chloroplasts in the field of view.

A sample should be counted in a known smaller portion and then the result multiplied to obtain an estimate of the number of chloroplasts in the whole field of view.

For example, if the number of chloroplasts is counted in a quarter of the field of view then this number would be multiplied by 4 to obtain the estimate of the total number in the field of view.

(ii) Count and record the **sample number** of chloroplasts in the quarter of the field of view.

- Mark clearly **on Fig. 2.3** each of the chloroplasts counted.
- Estimate the total number in the whole field of view.

Calculate the number of chloroplasts per mm^2.

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

number of chloroplasts ..... mm^{-2} [4]

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Fig. 2.4 is a photomicrograph of a one-celled organism which lives in fresh-water. You are not expected to have studied this organism. The organism has engulfed some green algae (**R**) which it uses for food.

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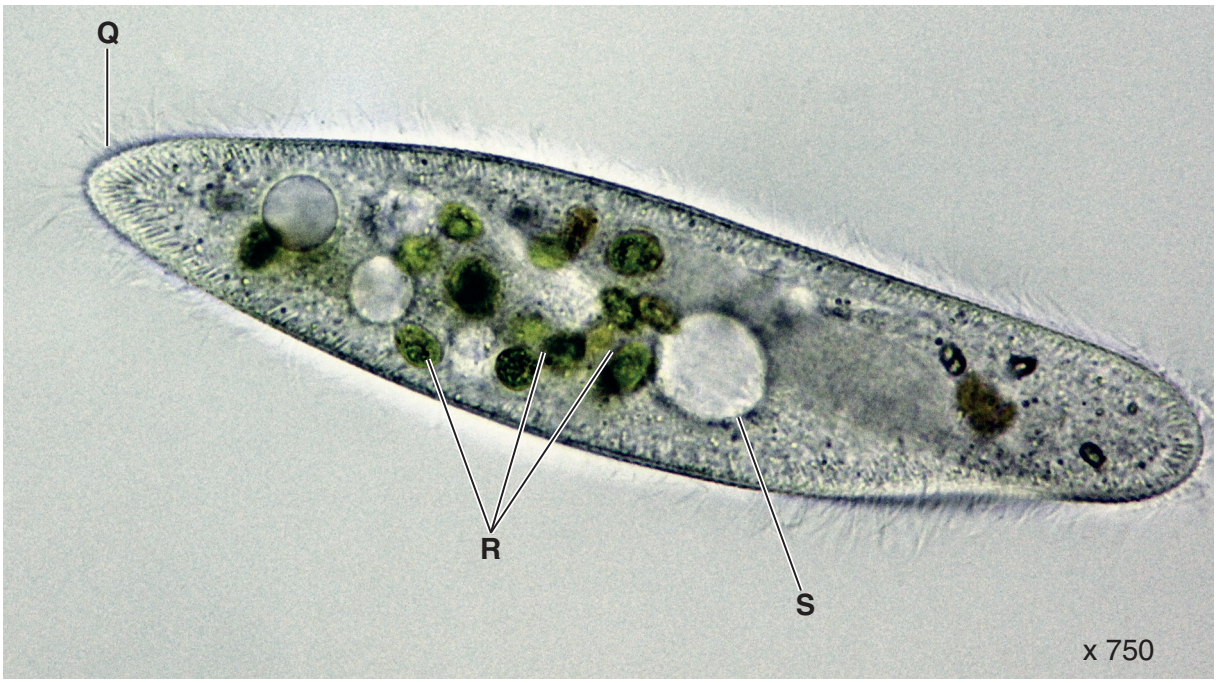


Fig. 2.4

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

To help you some of the structures on Fig. 2.4 have been labelled with letters.

Record your observations in the space you have prepared.

[5]

Question 2(c)(ii) starts on page 16

The organism you have observed in Fig. 2.4 is part of a food web.

For Examiner's Use

(ii) State the trophic level of the organism in Fig. 2.4.

.....

Describe one **observable** feature of the specimen in Fig. 2.4 which supports this conclusion.

.....

.....

.....[2]

[Total: 22]

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CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8599584199

BIOLOGY **9700/34**

Advanced Practical Skills 2 **October/November 2013**

2 hours

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1 You are provided with an extract from plant cells, which contains a mixture of biological molecules.
This extract may contain any of the biological molecules, for example lipids, proteins or types of carbohydrates.

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

You are required to investigate the diffusion of biological molecule(s) into the water surrounding the Visking tubing.

(a) (i) State which biological molecule(s) might **diffuse** through the wall of the Visking tubing.

.....[1]

You are provided with:

labelled	contents	hazard	volume / cm^3
P	solution of plant extract	none	15
W	distilled water	none	100

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

Fig. 1.1 shows the set-up of the apparatus.

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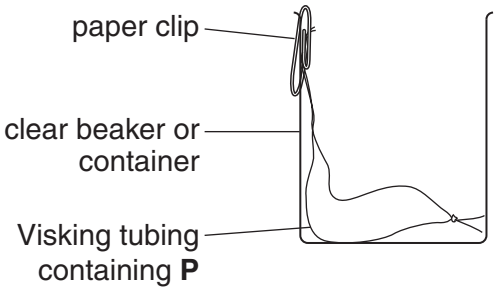


Fig. 1.1

You must now read up to the end of step 11 before proceeding.

Samples of the water surrounding the Visking tubing will be removed at 5 minute intervals for 15 minutes.

To compare the diffusion of any single biological molecule at each 5 minute interval the test for the biological molecule needs to be standardised.
For example, if you carried out the test for reducing sugars:

- one standardised variable is the volume of sample removed from water, e.g. 2 cm^3
- the dependent variable is measuring the time taken for the first colour change to appear.

(ii) State the **other** variables which would need to be standardised for the reducing sugars test, using only the reagents and apparatus provided.

Describe how you will standardise each variable.

.....

.....

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.....[3]

Samples of water surrounding the Visking tubing will be removed for testing at 5 minute intervals for 15 minutes. Therefore, you need to take this into account when you decide the volume of water to put into the container.

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Decide:

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- the test (or tests) you will carry out on the water
- the volume of the water you will need to sample for the test (or tests) at each time interval.

*You may find it helpful to calculate the **total** volume of water needed for all the tests.*

(iii) Draw **on Fig. 1.1** (on page 4) the level of the water:

- before you remove any samples (label this 'before')
- after the total volume of water needed to sample for all the tests has been removed (label this 'after'). [2]

Proceed as follows:

1. Tie a knot in the Visking tubing as close as possible to one end so that it seals the end.
2. To open the other end, wet the Visking tubing and rub the tubing gently between your fingers.
3. Put 5 cm^3 of **P** into the open end of the Visking tubing.
4. Rinse the outside of the Visking tubing by dipping it into the water in the container labelled **V**.
5. Put the Visking tubing into a small beaker or container as shown in Fig. 1.1.
6. Make sure the open end of the Visking tubing is held in place by a paperclip.

You will start timing as soon as you add **W**.

Read steps 7 to 11 before proceeding.

7. Put **W** into the small beaker to the level you decided in **(iii)**.
8. Immediately start timing and remove the first sample of water into a separate container to keep for the tests.
9. After 5 minutes, remove the next sample into a different container.
10. Repeat step 9 for two more samples.
11. Use the reagents and apparatus provided to identify the biological molecule(s) that you decided in **(a)(i)** may be present in the samples.

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[Turn over

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

For Examiner's Use

[5]

(v) Use the results from **(iv)** to complete the hypothesis:

The Visking tubing allows …… to diffuse into the surrounding water. [1]

(vi) Explain how the results support your hypothesis.

.....

.....

.....[1]

(vii) Predict the trend in the results if the time was extended from 15 minutes to 30 minutes.

For Examiner's Use

.....

.....[1]

(viii) Suggest how you would modify this investigation to investigate the **concentration** of reducing sugars in **P**.

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.....[3]

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[Turn over

Some scientists investigated the total sugar content of plant extracts from different types of fruit.

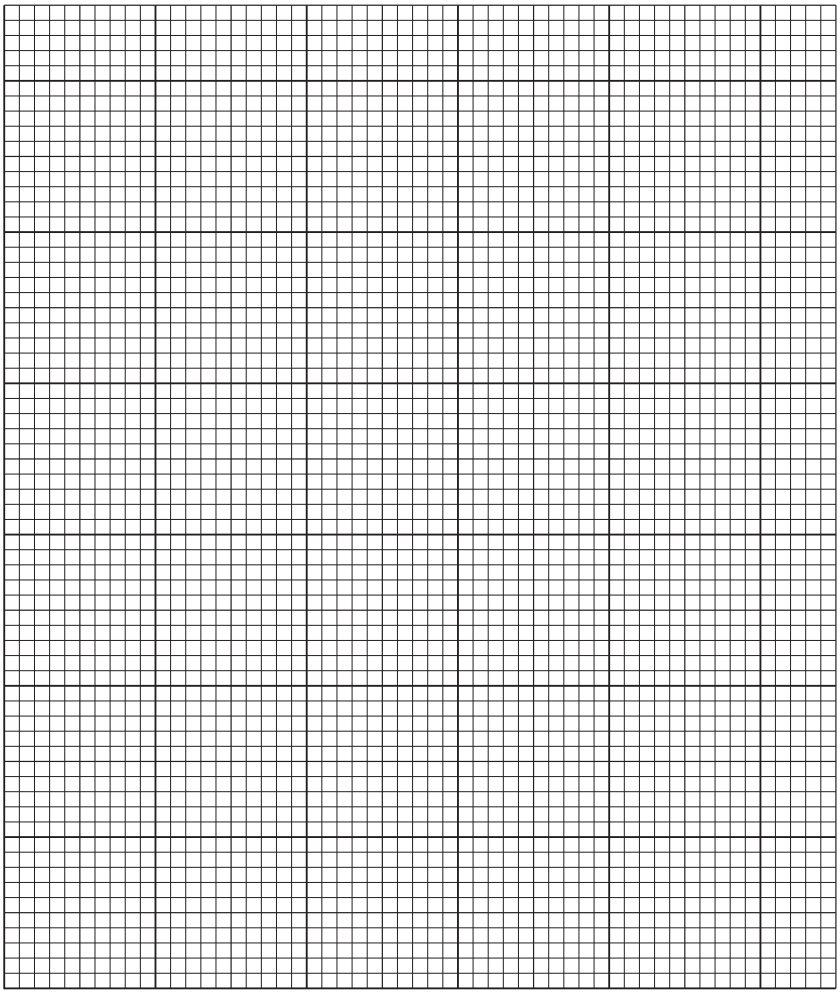
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The results are shown in Table 1.1.

Table 1.1

type of fruit	percentage of sugars
avocado (A)	0.6
banana (B)	12.2
kiwi (K)	8.0
lemon (L)	2.5
melon (M)	5.9

(b) Plot a chart of the data shown in Table 1.1. [4]



[Total: 21]

2 The eyepiece graticule scale in your microscope may be used to help draw a plan diagram, as in **(a)**, with the correct shape and proportions of the tissues, without needing to calibrate the eyepiece graticule scale.

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M1 is a slide of a stained transverse section through part of a tubular organ from an animal.

(a) Select a part of the wall of the organ which shows the highest number of different layers of tissues.

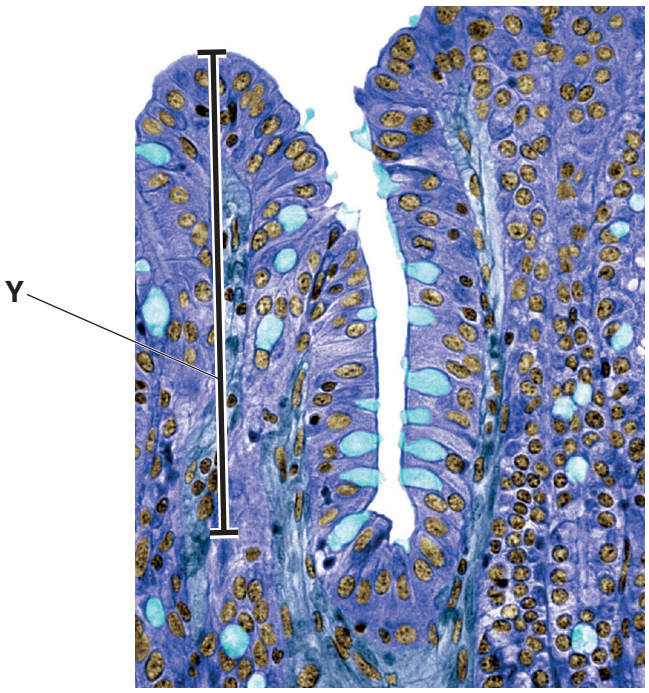
Draw a large plan diagram of this part of the wall to show the proportions of the different layers of tissues. The outermost layer is **smooth** and this should be drawn at the top of your diagram.

Annotate (make a note with a label line) your diagram to show one **other** difference between the layers making up the wall.

[4]

Fig. 2.1 is a photomicrograph of a stained transverse section through part of a different tubular organ from the same animal.

For Examiner's Use



magnification × 310

Fig. 2.1

(b) (i) Use the magnification to calculate the **actual length** of line **Y** in μm.

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

actual length .....μm [4]

(ii) State **one** observable feature in Fig. 2.1 which supports the conclusion that substances are absorbed by the tubular organ.

Explain how this feature would increase the rate of absorption.

.....

.....[1]

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(iii) Prepare the space below so that it is suitable for you to record the observable differences between the specimen on slide **M1** and that shown in Fig. 2.1.

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Record your observations in the space you have prepared.

[4]

Fig. 2.2 is a photomicrograph showing some cells from the lining of a different part of the same tubular organ shown in Fig. 2.1.

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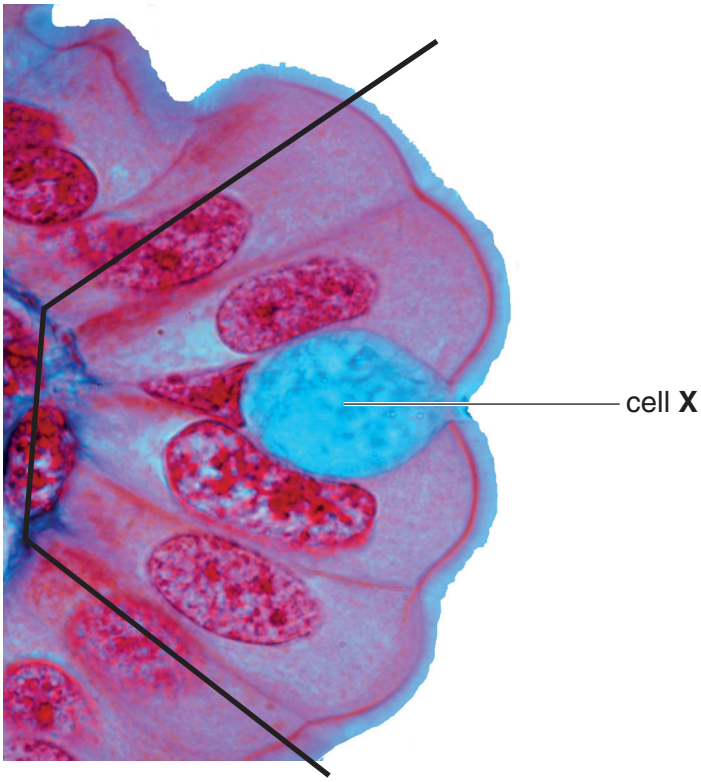


Fig. 2.2

(c) (i) Similar cells to cell **X** are found in Fig. 2.1 (on page 10).

On Fig. 2.1 (on page 10), use a label line and label to identify one cell which may be the same type as cell **X**. [1]

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(ii) Make a large drawing of the **whole** cells shown in the sector marked on Fig. 2.2 (on page 12).

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

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[5]

[Total: 19]

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

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6457084426

BIOLOGY **9700/35**

Advanced Practical Skills 1 **October/November 2013**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

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

For Examiner's Use	
1	
2	
Total	

This document consists of **15** printed pages and **1** blank page.

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

For Examiner's Use

You should:

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

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

1 Plant cells contain enzymes which catalyse some of their metabolic reactions. Some of these enzymes catalyse the release of oxygen from hydrogen peroxide solution. A plant extract solution can be produced which will contain these enzymes.

You are required to investigate the effect of hydrogen peroxide (independent variable) when mixed with a plant extract solution.

You are provided with:

labelled	contents	hazard	volume / cm^3
P	plant extract solution	none	15
H	6% hydrogen peroxide solution	irritant harmful	50
W	distilled water	none	100
D	liquid detergent	none	15

Proceed as follows:

You are required to change the concentration of the hydrogen peroxide solution (the independent variable).

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(a) (i) Decide which concentrations of hydrogen peroxide to make:

- using **serial dilution**,
- using 40 cm^3 6% hydrogen peroxide solution, **H**, to start the **serial dilution**,
- reducing the concentration by **half** between each concentration.

Complete Fig. 1.1 to show how you will make **three** further concentrations.

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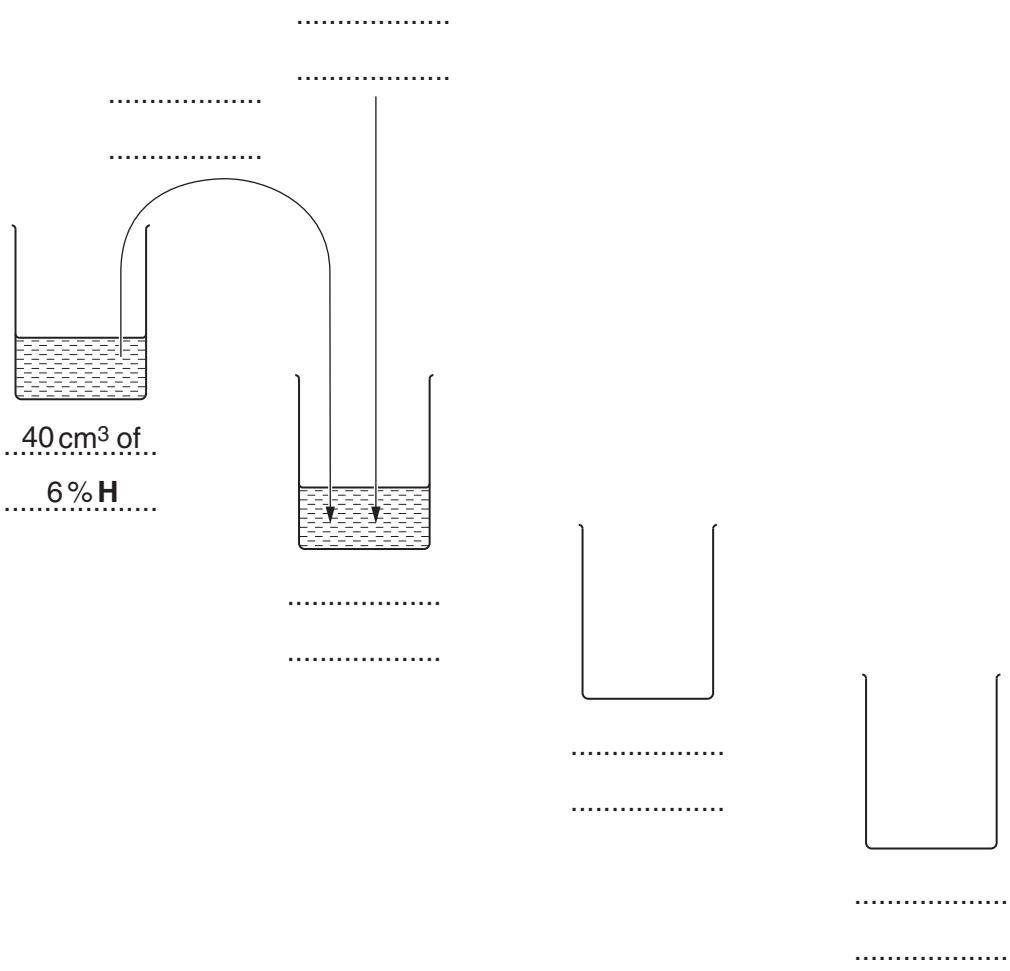


Fig. 1.1

[3]

1. Prepare all the concentrations of hydrogen peroxide, as in **Fig. 1.1**, in the containers provided.

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When detergent is mixed with **H** and then **P** (containing the enzyme), oxygen is released and the bubbles form a foam on top of the mixture.

You are required to measure the release of oxygen by measuring the total height of the mixture and the foam **and** the height to where the mixture meets the foam, as shown in Fig. 1.2.

You are provided with a graph paper scale on a piece of card. Fig. 1.2 shows how to use the graph paper scale to measure the total height of the mixture and foam **and** the height to where the mixture meets the foam.

2. Fold the graph paper scale along one of the thicker lines and label this line 0 as shown in Fig. 1.2.
You may find it useful to label each 10 mm as shown on Fig. 1.2.

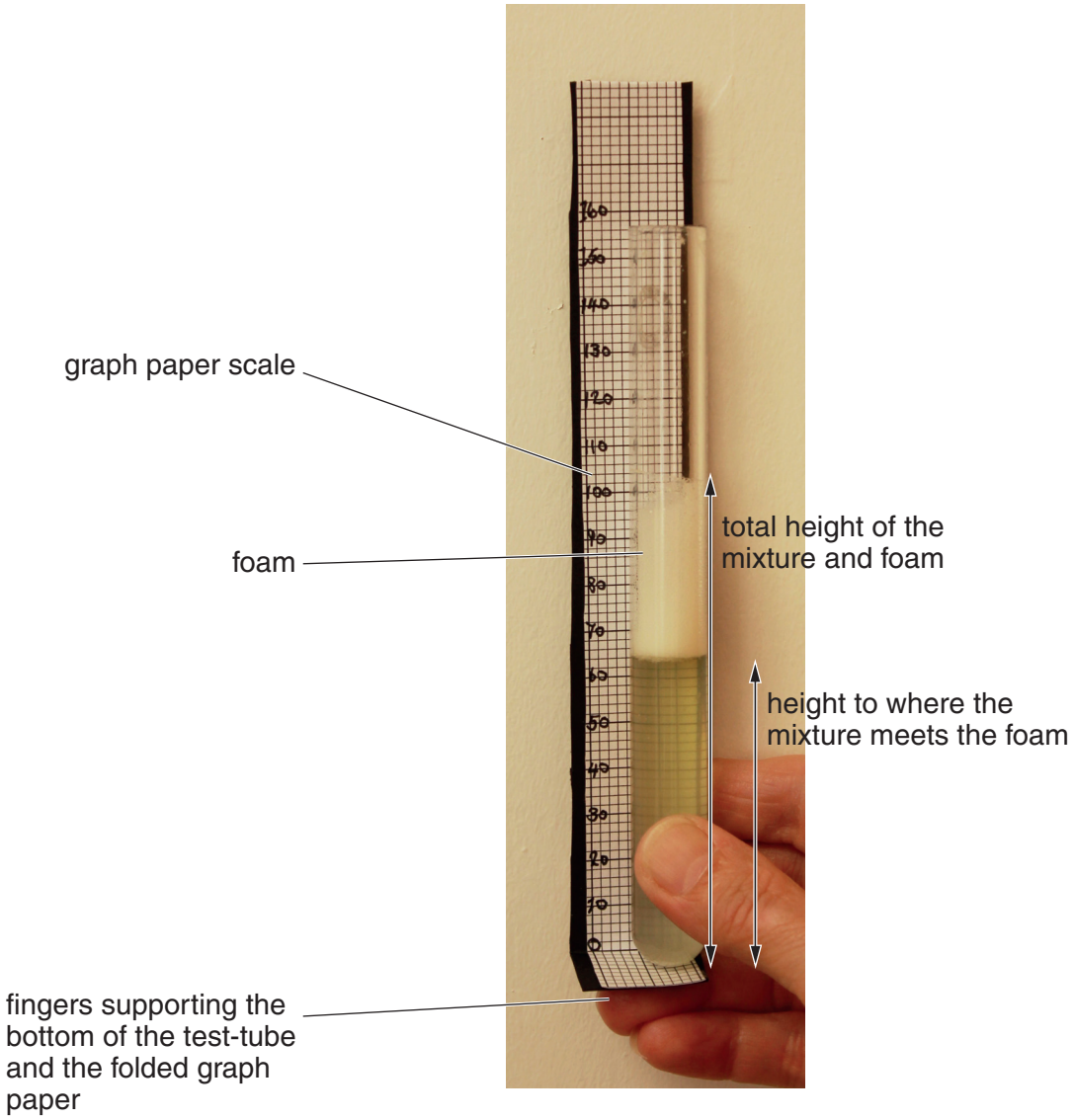


Fig. 1.2

For Examiner's Use

3. Put 5 cm^3 of the 6% concentration of **H** into a test-tube.

4. Put 4 or 5 drops of **D** into the same test-tube.
So that **D** does not come into contact with the wall of the test-tube, you should release the drops close to the top of **H**.

5. As shown in Fig. 1.3, stir **H** and **D** until mixed together.

The reaction will start as soon as you put **P** into the mixture of **H** and **D**.

Read steps 6 to 9, before proceeding.

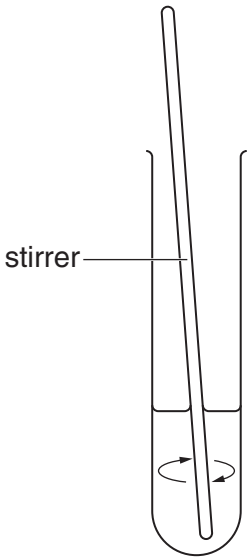


Fig. 1.3

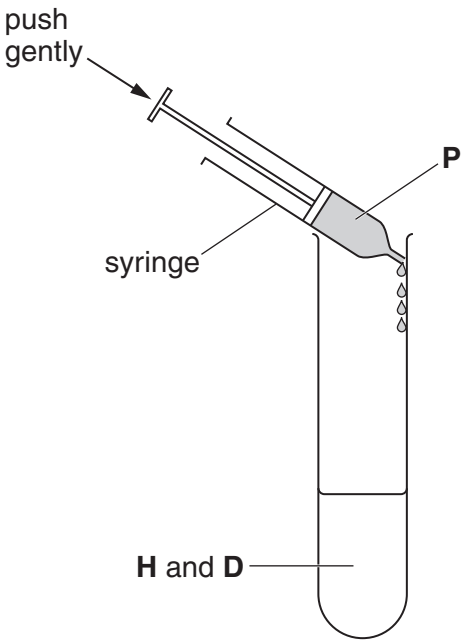


Fig. 1.4

6. As shown in Fig. 1.4, put 1 cm^3 of **P** into the same test-tube and stir as before. Immediately start timing.

7. Hold the test-tube as shown in Fig. 1.2.

   Every 60 seconds until 180 seconds, record the:

   - total height of the mixture and foam
   - height of the mixture where it meets the foam.

If the foam reaches the top of the test-tube before 180 seconds:

- stop timing
- record 'total height to the top of test-tube'
- record the height of the mixture where it meets the foam.

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To process your results you may find it helpful to record your raw measurements on Fig. 1.5.

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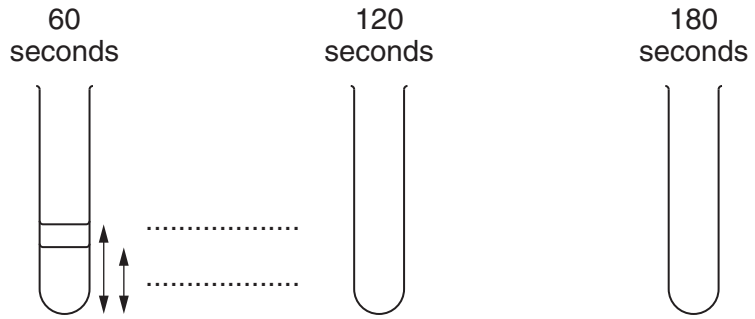


Fig. 1.5

8. Repeat steps 3 to 7 with each of the remaining concentrations.

9. Process your raw results to find the height of the foam. If you have time, check your results.

   You may use the space below to record your raw measurements.

(ii) Prepare the space below to record, for **each** concentration, the **processed** results **only** for the maximum height of foam.

For Examiner's Use

[5]

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

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.....[2]

For Examiner's Use

(iv) Describe **how** you would modify this procedure to investigate the effect of copper sulfate concentrations on the enzyme in the plant extract solution.

.....

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.....[3]

(b) Some scientists investigated the effect of copper sulfate solution on the release of oxygen from hydrogen peroxide solution, in the presence of a plant extract.

All the variables were standardised.

They set up two test-tubes:

- one with 1 cm^3 of distilled water, hydrogen peroxide and plant extract
- one with 1 cm^3 of copper sulfate solution, hydrogen peroxide and plant extract.

The number of bubbles of oxygen released in each 60 seconds for 300 seconds were recorded.

The results are shown in Table 1.1.

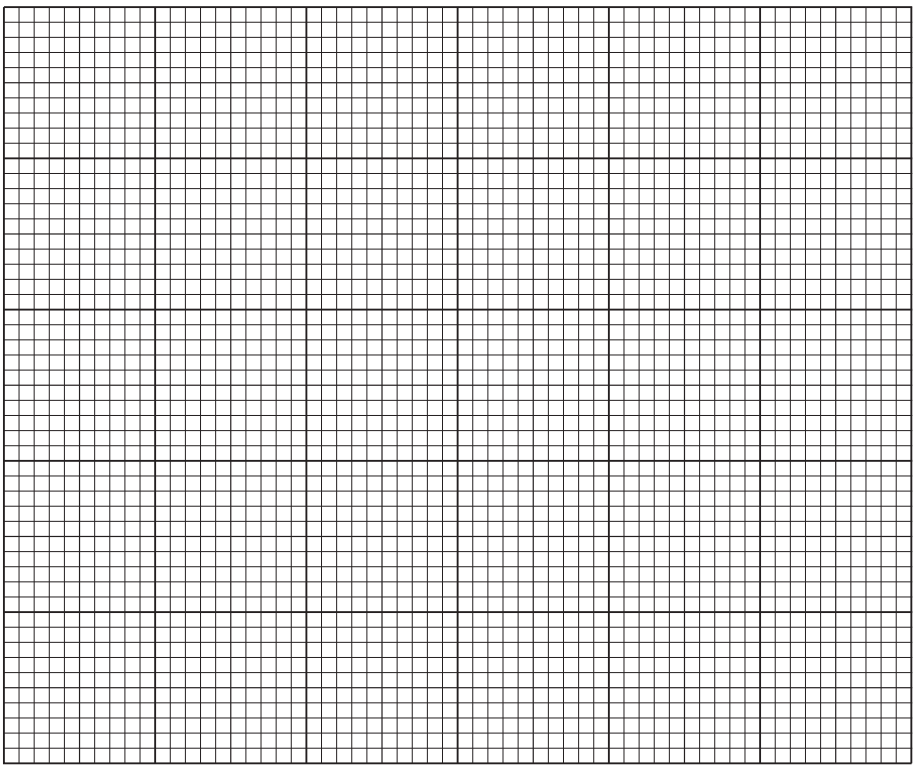
Table 1.1

time / s	number of bubbles of oxygen released	
	with 1 cm^3 of distilled water	with 1 cm^3 of copper sulfate solution
60	99	69
120	96	4
180	65	0
240	34	0
300	4	0

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

For Examiner's Use



[4]

(ii) Explain the effect of the copper sulfate solution on the enzymes in the plant extract.

.....

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.....

.....[3]

[Total: 20]

Question 2 starts on page 11

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2 **L1** is a slide of a transverse section through a plant leaf. This plant species grows widely including tropical, sub-tropical and temperate regions.

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

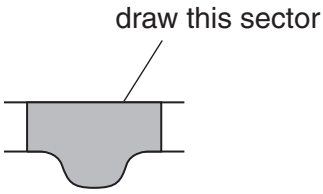


Fig. 2.1

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

[5]

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[Turn over

(ii) Make a drawing of **one** group of adjacent (touching) cells, as observed on the specimen on **L1**, made up of:

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- three epidermal cells
- three of the palisade cells touching these epidermal cells.

On your drawing use a label line and label to show one palisade cell.

[5]

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Fig. 2.2 shows a stage micrometer viewed through a microscope with an eyepiece graticule scale.

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The smallest measurement on this stage micrometer is 0.1 mm.

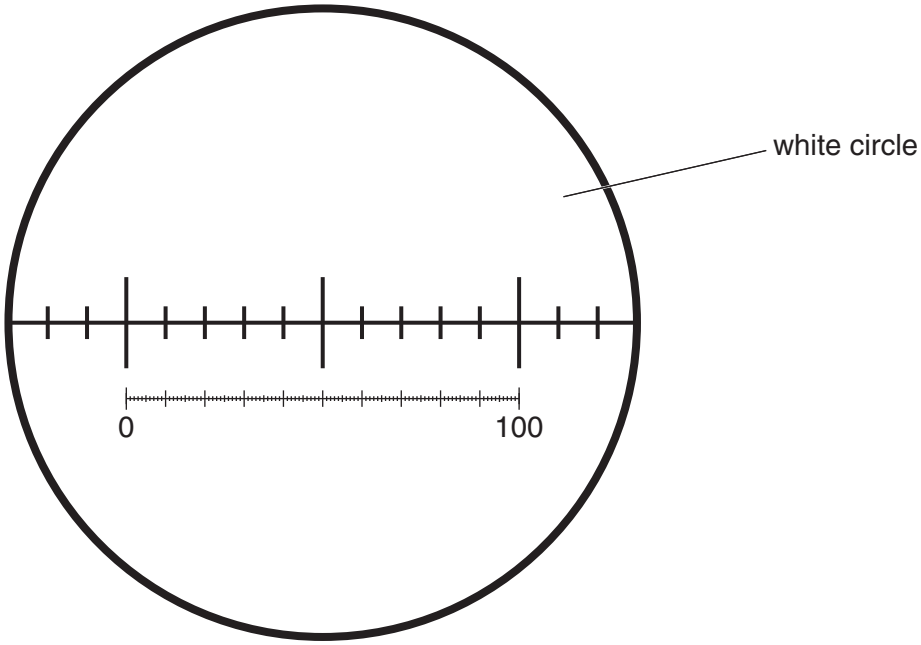


Fig. 2.2

You are required to:

- find the area of the field of view, using Fig. 2.2
- count the number of stomata in a quarter of the field of view, using Fig. 2.3 (on page 14)
- calculate the number of stomata per mm^2.

(b) (i) Calculate the area of the field of view, using:

- the formula for the area of a circle πr^2
- $\pi = 3.14$
- r = radius of the field of view.

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

area of field of view ..... mm^2 [2]

Fig. 2.3 is a photomicrograph of the lower surface of a leaf, with the same field of view as in Fig. 2.2.

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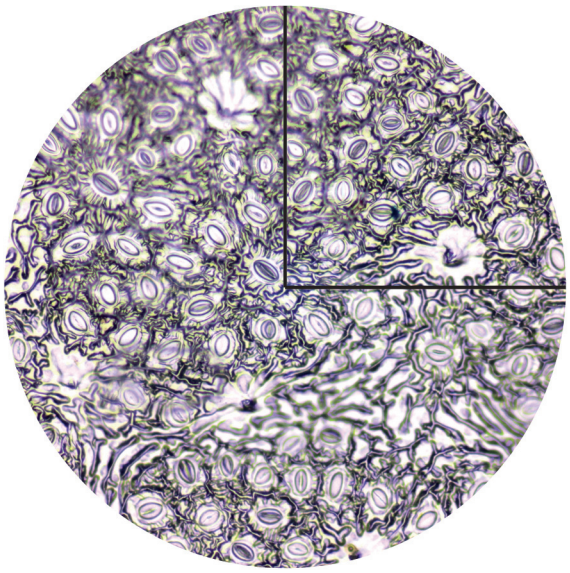


Fig. 2.3

Fig. 2.3 shows stomata on a leaf surface. There are too many stomata to count so the technique of sampling may be used to estimate the number of stomata in the field of view.

A sample should be counted in a known smaller portion and then the result multiplied to obtain an estimate of the number of stomata in the whole field of view.

For example, if the number of stomata is counted in a quarter of the field of view then this number would be multiplied by 4 to obtain the estimate of the total number in the field of view.

(ii) Count and record the **sample number** of stomata in the quarter of the field of view shown in Fig. 2.3.

- Mark clearly **on Fig. 2.3** each of the stomata counted.
- Estimate the total number in the whole field of view.

Calculate the number of stomata per mm^2.

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

number of stomata ..... mm^{-2} [4]

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Fig. 2.4 is a photomicrograph of the lower surface of a different leaf, with the same field of view (using the same lenses) as Fig. 2.3.

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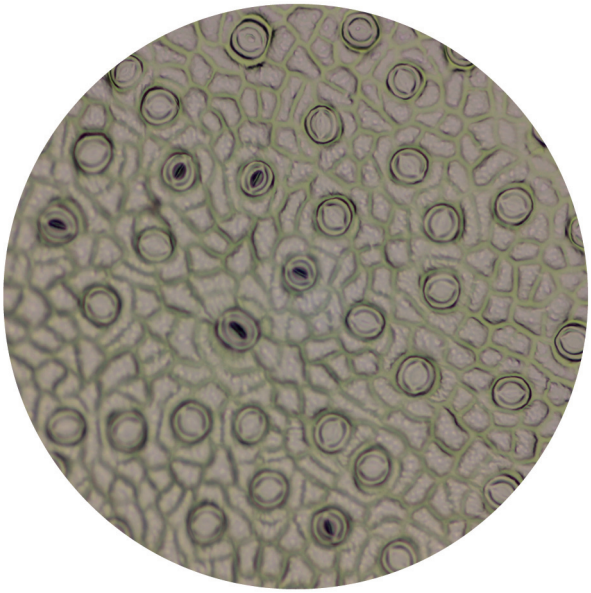


Fig. 2.4

(c) Prepare the space below so that it is suitable for you to record the observable differences between the surface of each leaf shown in Fig. 2.3 and Fig. 2.4.

Record your observations in the space you have prepared.

[4]

[Total: 20]

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

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6611175037

BIOLOGY **9700/36**

Advanced Practical Skills 2 **October/November 2013**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black ink.
You may use a pencil for any diagrams, graphs or rough working.
Do **not** use red ink, staples, paper clips, highlighters, 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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You are reminded that you have **only one hour** for each question in the practical examination.

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You should:

- read carefully through **the whole** of question 1 and question 2
- then plan your use of **the time** to make sure that you finish all the work that you would like to do.

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

1 The enzyme amylase catalyses the hydrolysis (breakdown) of starch to a reducing sugar.

You are required to:

- identify which solution, **E1** or **E2** contains the highest enzyme concentration by estimating the concentration of reducing sugar produced by the action of **E1** and **E2** when breaking down starch
- prepare known concentrations of reducing sugar solutions to compare with the concentrations of reducing sugars produced by the action of **E1** and **E2**
- compare the concentrations of reducing sugars by using the Benedict's test.

For each of your Benedict's tests you need to standardise the:

- volume of Benedict's solution
- volume of the samples
- temperature of the water bath.

(a) (i) State the:

volume of Benedict's solution …… cm^3

volume of each of the samples to be tested …… cm^3

temperature of water bath …… °C. [1]

You are provided with:

labelled	contents	hazard	volume / cm^3
E1	amylase solution	harmful irritant	20
E2	amylase solution	harmful irritant	20
S	starch solution	none	50
G	0.4% reducing sugar solution	none	50
W	distilled water	none	100

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Read steps 1 to 6 before proceeding.

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Proceed as follows:

1. Put 1 cm^3 of **E1** and **E2** into separate beakers.
2. Put 10 cm^3 of **S** into each of the beakers with **E1** and **E2**. Mix well.
3. Leave the beakers for 15 minutes.

During the 15 minutes you are required to:
- set up a water bath ready for step 6 (on page 4)
- prepare the known concentrations of the reducing sugar solution.

4. Set up the water bath to heat to the temperature as decided in **(a)(i)**.

(ii) Decide which concentrations of the reducing sugar solution to make:

- using **serial dilution**
- using 20 cm^3 of the 0.4% reducing sugar solution, **G**, to start the **serial dilution**
- reducing the concentration by **half** between each concentration.

Complete Fig. 1.1 to show how you will make three further concentrations.

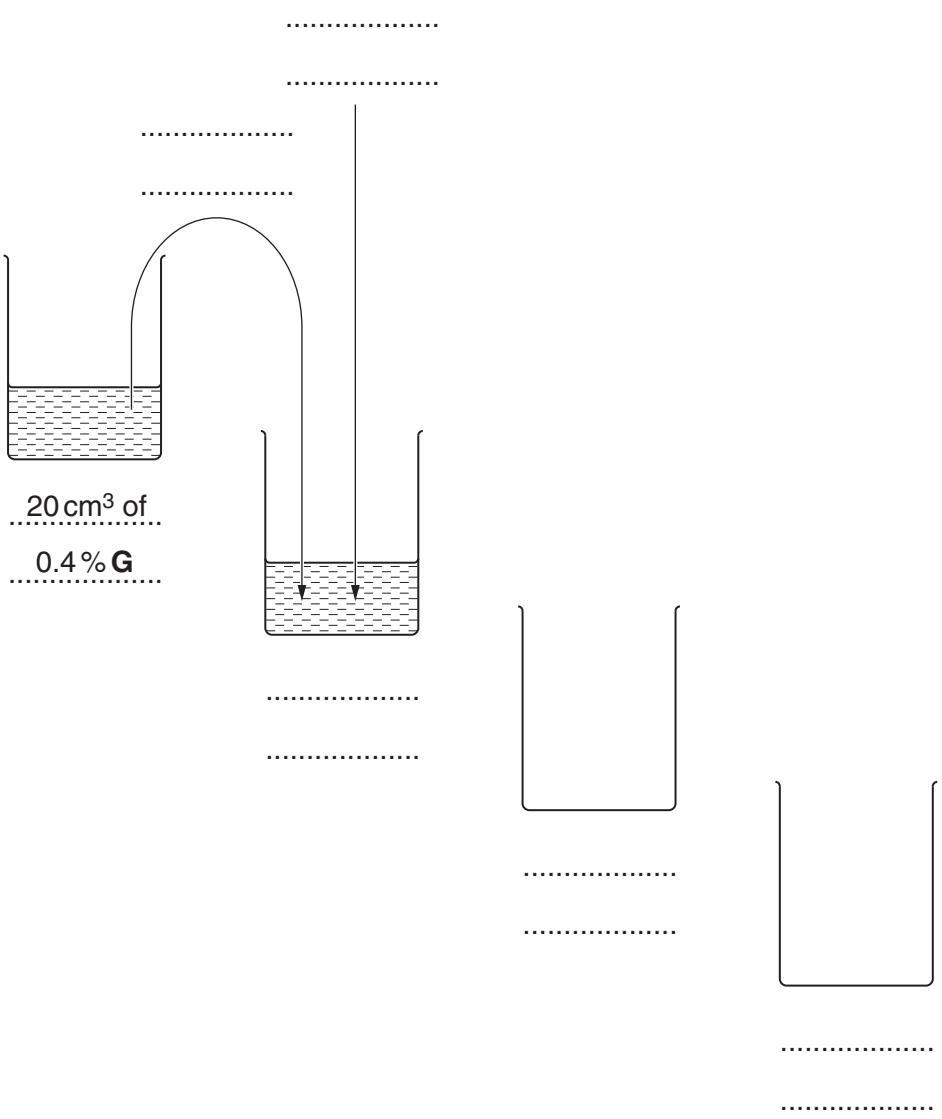


Fig. 1.1 [3]

5. Prepare all the concentrations of the reducing sugar solution, as in Fig. 1.1, in the containers provided.

For Examiner's Use

6. You are now required to test for the concentrations of reducing sugars by using the Benedict's test:

   - test each sample separately using the volumes decided in **(a)(i)**
   - record the time taken for the appearance of any colour change.
     If there is no colour change after 120 seconds record 'more than 120'.

(iii) Prepare the space below and record **only** your results for the known concentrations of reducing sugars.

[5]

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(iv) Using your results for **E1** and **E2** complete the following.

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The time taken for the first colour change in **E1** was …… .

The time taken for the first colour change in **E2** was …… .

Using these two times, state which of these two solutions has the highest concentration of reducing sugars.

.....

Using the results from **(a)(iii)** estimate the concentration of reducing sugars in this solution.

.....[2]

(v) Describe how you would modify this investigation to follow the time course of the hydrolysis of starch by enzyme **E**, without the use of Benedict's solution.

.....

.....

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.....

.....

.....[3]

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[Turn over

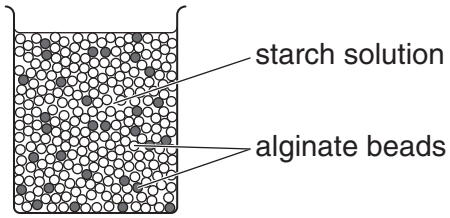
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(b) A student investigated the effect of iron sulfate on the rate of amylase activity, using immobilised amylase in alginate beads.

The student prepared two types of alginate beads containing amylase:

- **with** iron sulfate
- **without** iron sulfate.

The student mixed the two types of beads together in varying proportions, for example 30 beads with iron sulfate and 70 beads without iron sulfate (30% with iron sulfate) as shown in Fig. 1.2. The student put the beads into beakers containing starch solution.



Key:
● alginate beads with iron sulfate
○ alginate beads without iron sulfate

Fig. 1.2

Other variables were considered and kept to a standard.

The student measured the mass of reducing sugars produced by each mixture of beads in one minute.

The student's results are shown in Table 1.1.

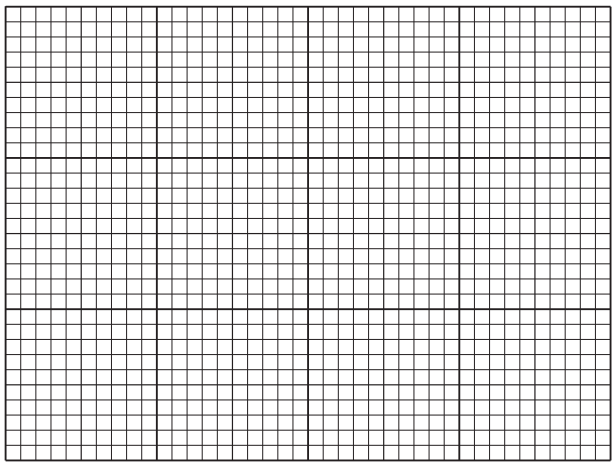
Table 1.1

percentage of beads with iron sulfate	mass of reducing sugar produced / μmoles min^{-1}
0	60
10	25
20	12
30	5
40	2

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

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[4]

(ii) Describe the trend shown by the data.

.....

.....[1]

(iii) Explain the reason for the difference in the results between 0 and 10 percentage of beads with iron sulfate.

.....

.....

.....

.....[2]

[Total: 21]

For Examiner's Use

2 The eyepiece graticule scale in your microscope may be used to help draw a plan diagram, as in **(a)**, with the correct shape and proportions of the tissue, without needing to calibrate the eyepiece graticule scale.

N1 is a slide of a stained transverse section through a tubular organ from an animal.

(a) Select a part of the wall of the organ which shows the highest number of different layers of tissues.
Draw a large plan diagram of a part of the wall of the organ to show the proportions of the different layers of tissues.

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

[5]

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Fig. 2.1 is a photomicrograph of cells from the same tubular organ as the specimen on slide N1.

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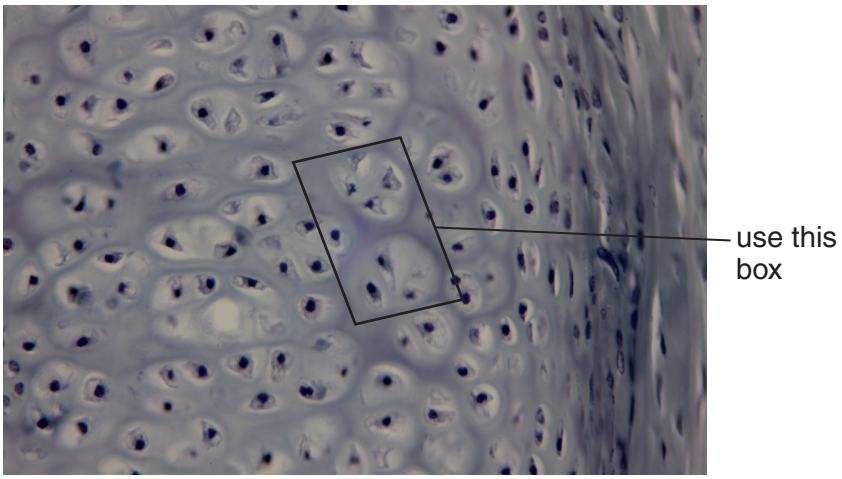


Fig. 2.1

(b) Make a large drawing of the whole cells shown in the box marked on Fig. 2.1.
The drawings should show any difference in size (linear magnification) observed between each cell.

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

[5]

Fig. 2.2 is a photomicrograph of a stained transverse section through a different tubular organ of an animal.

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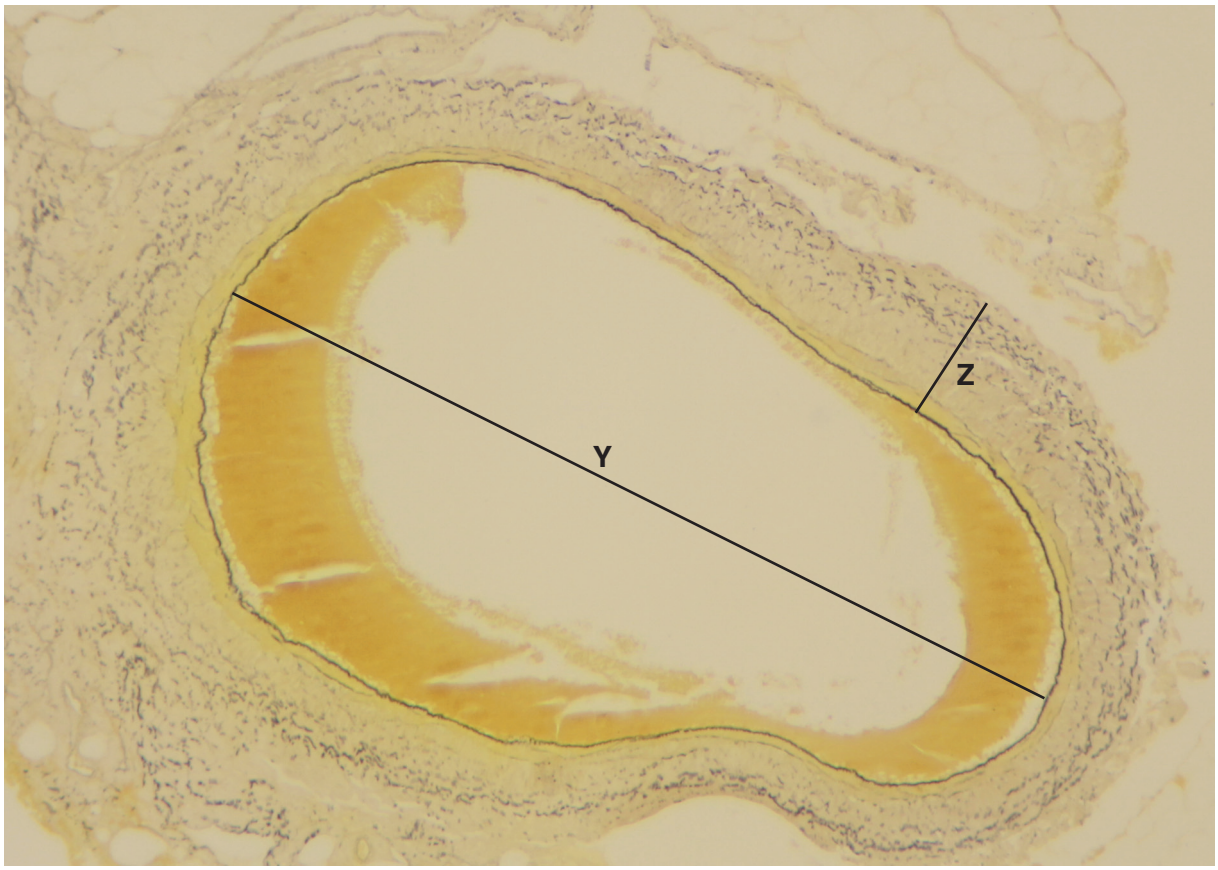


Fig. 2.2

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

You will lose marks if you do not show all the steps in finding the ratio.

ratio ..... [3]

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(ii) The tubular specimen shown in Fig. 2.2 transports blood at low pressure. Suggest **one** observable feature which supports this conclusion.

For Examiner's Use

.....

.....

.....[1]

(iii) Prepare the space below so that it is suitable for you to record the observable similarities and differences between the specimen on slide **N1** and that in Fig. 2.2.

Record your observations in the space you have prepared.

[5]

[Total: 19]

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