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General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CANDIDATE NAME

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5944630572

BIOLOGY **9700/31**

Advanced Practical Skills 1 **October/November 2010**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

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

1 Plant cells contain an enzyme, catalase, which catalyses the breakdown of hydrogen peroxide into oxygen and water.

When a piece of potato is dropped into hydrogen peroxide it will sink and then the production of oxygen causes the potato to rise. The more oxygen produced the less time it takes for the potato to rise.

You are required to investigate the independent variable, the surface area to volume ratio of pieces of potato, on the breakdown of hydrogen peroxide. The relationship of pieces of potato of different sizes to their surface area to volume ratio is shown in Fig. 1.1.

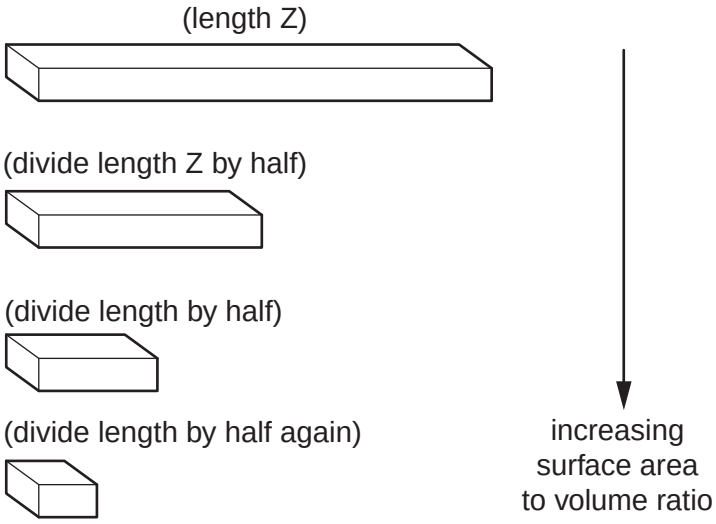


Fig. 1.1

You are provided with

labelled	contents	hazard	volume / cm^3
H	hydrogen peroxide	irritant oxidising substance	200 cm^3

labelled	contents	details	quantity
P	potato pieces	same cross-sectional area	4

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Proceed as follows:

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1. Prepare the pieces of potato as shown in Fig. 1.2.

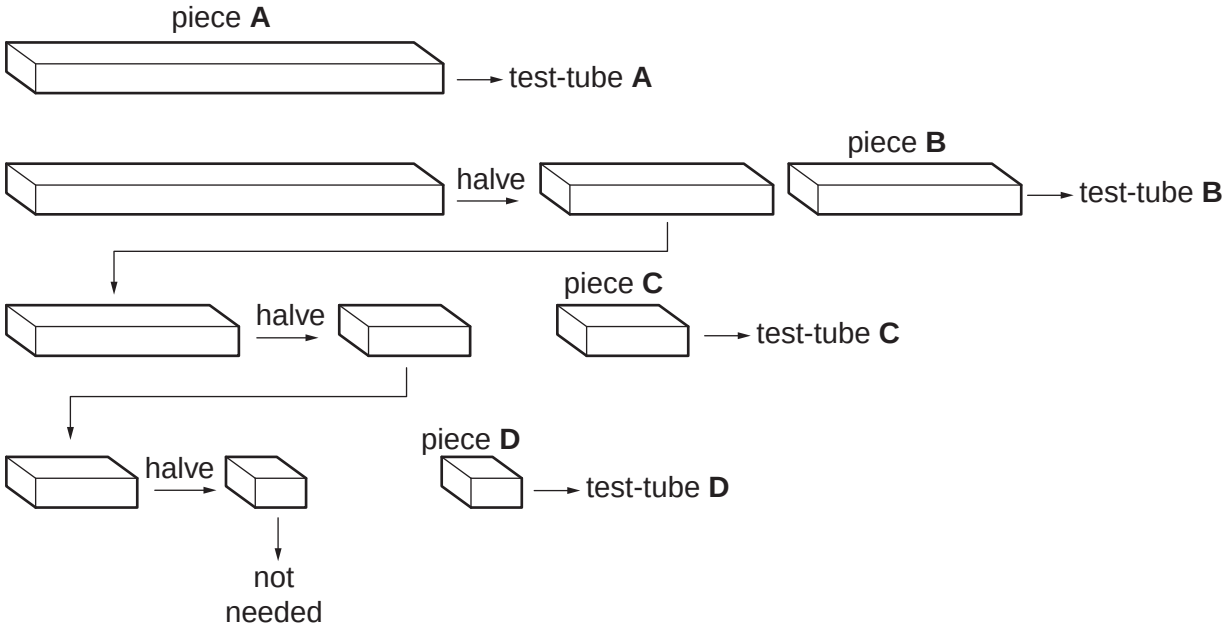


Fig. 1.2

2. Label four test-tubes **A**, **B**, **C** and **D**.

3. Put 25 cm^3 of **H** into test-tube **A**.

4. Put piece **A** onto a paper towel and gently remove any excess water.

5. Put piece **A** into test-tube **A**. Immediately start timing.

6. Record the time taken for piece **A** to rise to the surface.

   Do not touch the test-tube after you have started timing.

   If the piece of potato does not rise after 2 minutes stop timing and record 'more than 2 minutes'. Proceed to the next test.

7. Repeat steps 3 to 6 for one piece of **B**, one piece of **C** and one piece of **D**.

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

For Examiner's Use

[6]

(ii) Identify **two** significant sources of error in your investigation.

.....

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..... [2]

(iii) Suggest how you would make **three** improvements to this investigation.

For Examiner's Use

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..... [3]

A student investigated the effect of pH on the enzyme in potato tissue. The breakdown of hydrogen peroxide was measured by the release of oxygen.
Fig. 1.3 shows the apparatus used. The student recorded the time for the oxygen released to displace 10 cm^3 of water at five different pH values.

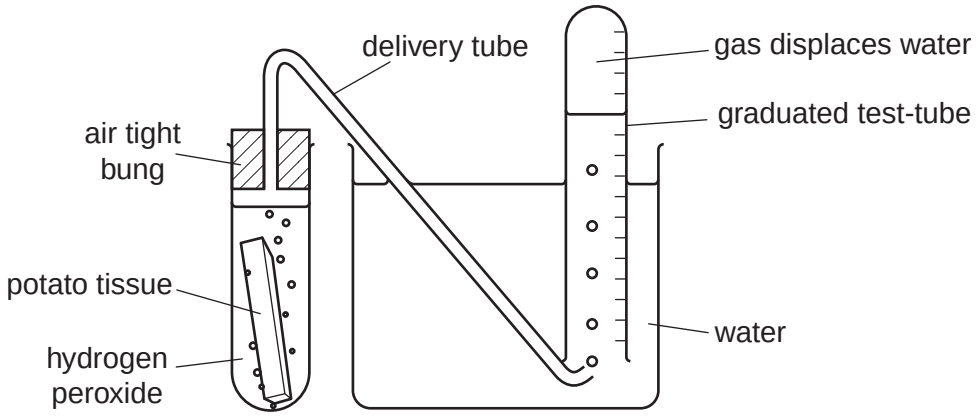


Fig. 1.3

The student's results are shown in Table 1.1.

For Examiner's Use

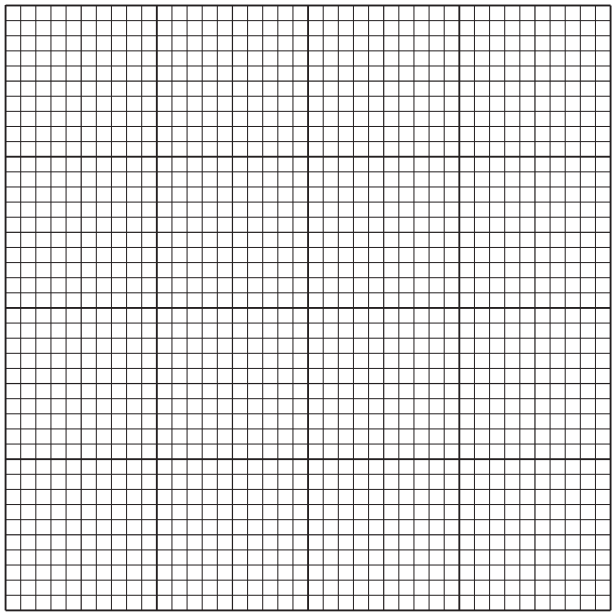
Table 1.1

pH	time to displace 10 cm^3 of water / s					
	trial 1	trial 2	trial 3	trial 4	trial 5	mean
5	17	14	16	14	15	15
6	8	5	15	6	5	6
7	2	10	3	3	4	3
8	8	6	6	17	7	
9	20	16	17	16	16	17

(b) (i) Three of the values in Table 1.1 are anomalous. Draw a circle around each of these values. [1]

(ii) Complete Table 1.1 by calculating the missing value. [1]

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



[4]

(iv) Explain the relationship between pH and the enzyme catalase shown in the data.

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..... [3]

[Total: 20]

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2 **J1** is a slide of a stained transverse section showing part of a lung of a mammal.

For Examiner's Use

(a) Make a large, high-power drawing to show details of five of the structures specialised for gas exchange (alveoli). The walls of one alveolus must be touching the walls of at least two other alveoli.

Label where gas exchange takes place.

[5]

Fig. 2.1 is a photomicrograph of a transverse section through a lung from a mammal. The outer layer of the bronchiole and the wall of the blood vessel are labelled.

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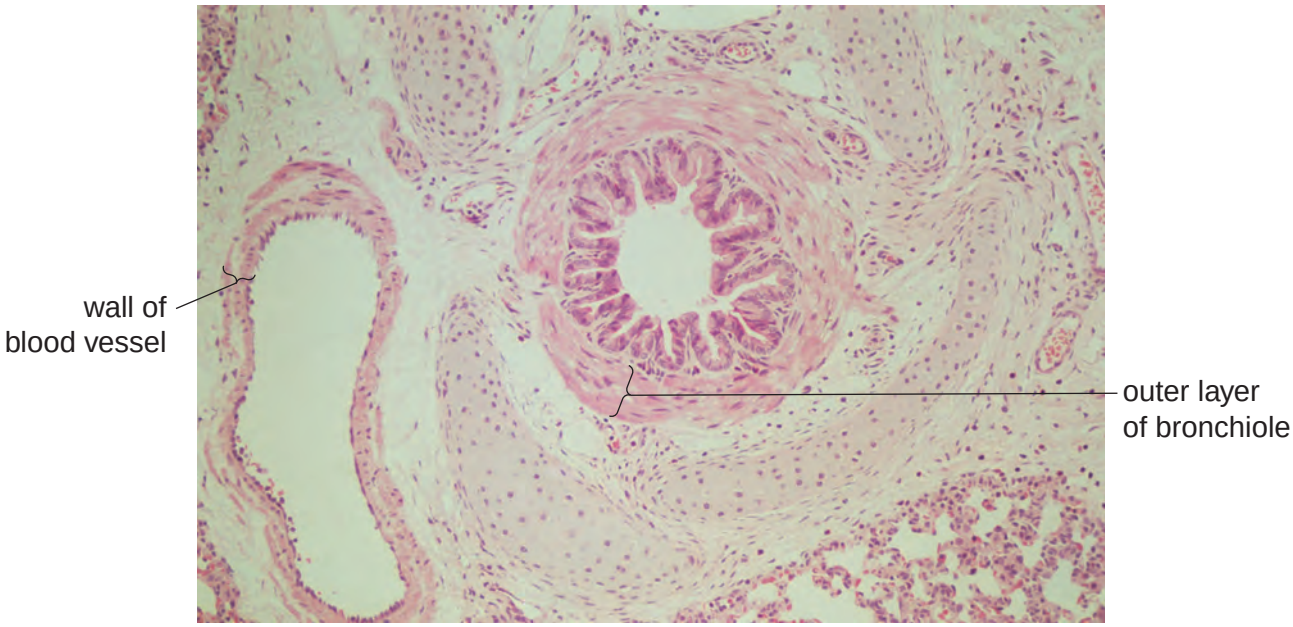


Fig. 2.1

(b) (i) Draw a large plan diagram of the bronchiole shown in Fig. 2.1.

Label the lumen.

[5]

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(ii) Calculate the ratio of the mean thickness of the outer layer of the bronchiole compared to the mean thickness of the wall of the blood vessel shown in Fig. 2.1.

Show clearly on Fig. 2.1 where you measured the thicknesses.

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

[4]

(iii) Prepare the space below so that it is suitable for you to compare the observable features of the bronchiole and blood vessel in the photomicrograph Fig. 2.1.

[6]

[Total: 20]

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3918523845

BIOLOGY **9700/33**

Advanced Practical Skills 1 **October/November 2010**

2 hours

Candidates answer on the Question Paper.

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Answer **both** questions.

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

1 When plant tissue is soaked in methylene blue the tissue takes up the stain and is coloured blue.

Copper sulfate solution affects the selective permeability of cell membranes.

You are provided with

labelled	contents	hazard	concentration / %	volume / cm^3
C	copper sulfate solution	harmful irritant	0.3	60
W	distilled water	none	–	100

labelled	contents	hazard	details	quantity
P	stained plant tissue	methylene blue will stain your skin	same cross-sectional area, stained with methylene blue and washed	5

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

It is recommended that you wear safety goggles/glasses.

You are required to investigate the effect of the independent variable, concentration of copper sulfate solution, on samples of plant tissue which have been soaked in methylene blue.

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(a) (i) Decide on the concentrations of copper sulfate solution you will use in your investigation.

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You will need 10 cm^3 of each concentration of copper sulfate solution.

Prepare the space below to show

- the concentrations of copper sulfate solution
- the volumes of copper sulfate solution
- the volumes of distilled water.

[3]

Make up the copper sulfate solutions that you have chosen in the containers provided.

Put 10 cm^3 of the appropriate concentration of copper sulfate solution into a labelled test-tube.

For Examiner's Use

You are provided with five pieces of plant tissue with the same cross-sectional area in a container of water, labelled **P**.

Proceed as follows:

(Always use blunt forceps when handling the plant tissue to avoid contact with the methylene blue).

1. Remove the pieces of plant tissue from the container, labelled **P**, and place them onto a white tile.

   You will need to prepare one sample of plant tissue to put into each of the concentrations of copper sulfate solution.

(ii) State which variable you will need to control when preparing the plant tissue samples.

.....[1]

(iii) Describe how you will control this variable and prepare the samples of plant tissue.

.....

.....[2]

2. Prepare the samples of plant tissue as you described in **(iii)**.

3. Empty the coloured water from the container, labelled **P**.

4. Place the samples back into the empty container, labelled **P**.

5. To remove excess methylene blue change the water five times, either using a syringe or by pouring off the water. Do not touch the plant tissue.

6. Remove the samples of plant tissue and add one sample of plant tissue to each test-tube of copper sulfate solution.

7. Immediately start timing.

8. Observe the test-tubes for 5 minutes and record your observations.

9. After five minutes, mix the contents of the test-tubes, by inserting a bung and inverting each test-tube.

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

For Examiner's Use

[5]

(v) Suggest how copper sulfate solution affects plant cell membranes.

.....

.....[1]

(vi) Identify **three** significant sources of error in your investigation.

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.....[3]

(vii) Suggest how you would make **three** improvements to this investigation.

For Examiner's Use

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.....[3]

[Total: 18]

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

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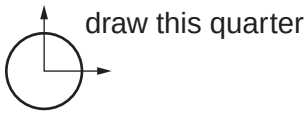


Fig. 2.1

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

Label the endodermis and the cortex.

[5]

(ii) Make a high-power drawing of one large xylem vessel and the single layer of cells touching a quarter of the vessel's circumference.

Labels are not required.

[5]

Fig. 2.2 is a photomicrograph of a transverse section through a quarter of a different organ from the same plant species.

For Examiner's Use

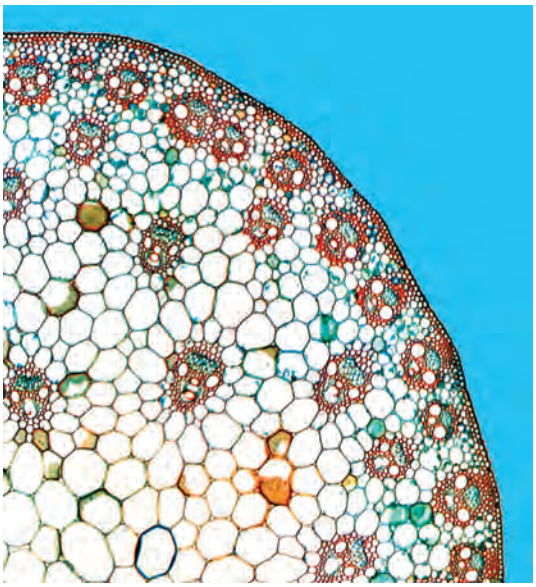


Fig. 2.2

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

Record your observations in the space you have prepared.

[4]

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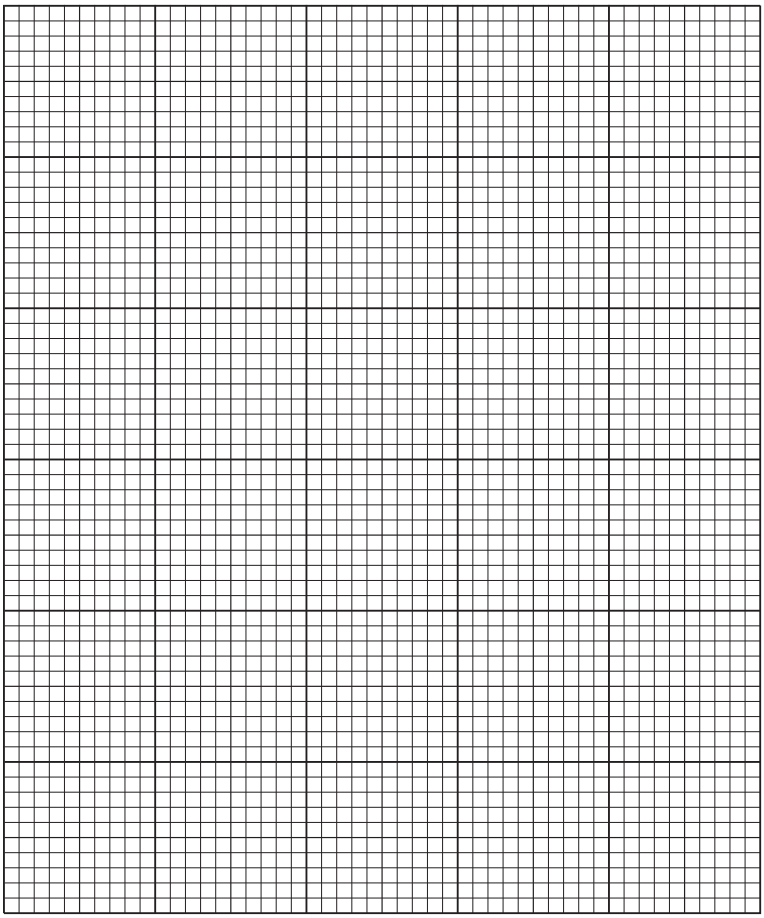
(c) (i) Table 2.1 shows the results of an investigation into the contents of phloem sieve tube elements.

For Examiner's Use

Table 2.1

contents	concentration in phloem sieve tube elements / $\mu g\,cm^{-3}$
sucrose	120
ammonium ions	45
calcium ions	85
magnesium ions	105
sodium ions	115

Plot a chart of the data shown in Table 2.1.



[4]

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(ii) The contents of the xylem vessels were also investigated and the concentration of calcium ions was found to be 190 $\mu g\,cm^{-3}$.

Use the result for the xylem vessels and the data from Table 2.1 to calculate the percentage difference between the concentration of calcium ions in the xylem vessels and the concentration of calcium ions in the phloem sieve tube elements.

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

[2]

(d) The investigation into xylem vessel contents also found that there was no sucrose present.

Suggest why there is 120 $\mu g\,cm^{-3}$ of sucrose in the phloem sieve tube elements.

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..... [2]

[Total: 22]

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2587516548

BIOLOGY **9700/34**

Advanced Practical Skills 2 **October/November 2010**

2 hours

Candidates answer on the Question Paper.

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

1 There are molecules on the surface of yeast cells which cause the cells to stick together. When a yeast suspension is placed in a test-tube some of the cells sink slowly to the bottom.

(a) (i) Show clearly **on Fig. 1.1** what you would expect the contents of the test-tube to look like after 10 minutes. You will gain marks for clear labels.

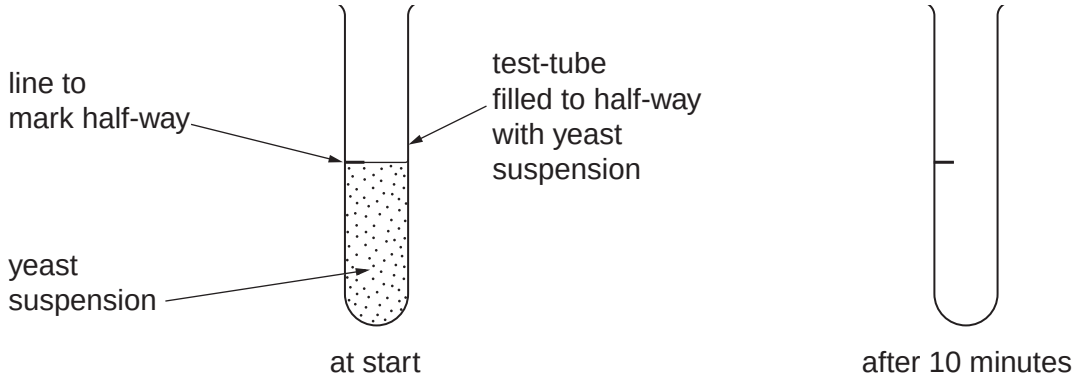


Fig. 1.1

[2]

You are required to investigate the effect of the independent variable, pH, on the sedimentation of a yeast cell suspension over a period of 10 minutes.

(ii) State the time intervals you will use and what you will use the graph paper scale to measure.

.....

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.....[2]

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You are provided with

labelled	contents	hazard	volume /cm^3
pH 3	buffer solution	irritant	30
pH 4	buffer solution	irritant	30
pH 5	buffer solution	irritant	30
pH 6	buffer solution	irritant	30
Y	yeast suspension	none	60
C	calcium chloride solution	irritant	15

Proceed as follows:

1. Label one test-tube for each pH.

2. Use the marker provided to mark a line half-way along the length of each test-tube as shown in Fig. 1.1.

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[Turn over

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You will need to put 1 cm^3 of **C** in each test-tube and then an equal volume of **Y** and each buffer solution so that the mixture will fill the test-tube to the half-way mark as shown in Fig. 1.2.

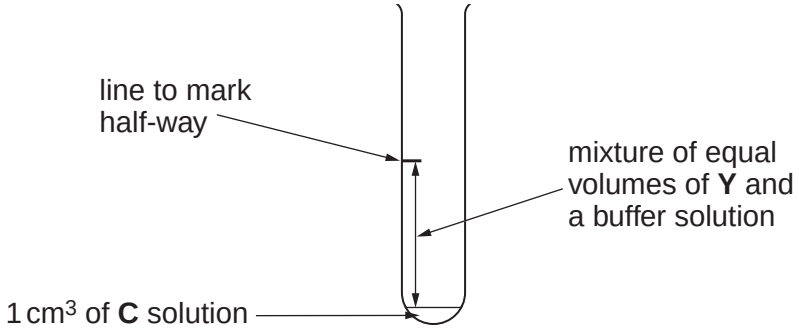


Fig. 1.2

(iii) Use the test-tube labelled **T** and the other apparatus provided and decide on the volume of **Y** and the volume of each buffer solution to use.

Describe all the steps you used to work out the volumes.

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.....

.....[1]

State the volume of **Y** and the volume of each buffer solution to use.

volume of **Y** .....

volume of each buffer solution .....

[1]

3. Put the volume of buffer solution labelled **pH 3**, stated in **(iii)**, into the test-tube labelled **pH 3**.

4. Put 1 cm^3 of **C** to the same test-tube.

5. Repeat steps 3 and 4 with each of the other buffer solutions **pH 4**, **pH 5** and **pH 6**.

6. Stir the yeast suspension **Y** with a glass rod.

7. Put the volume of **Y**, stated in **(iii)**, into each test-tube to make the total volume up to the half-way mark.

8. Put a bung or cork into the test-tube and invert the test-tube twice to mix well. Repeat with each test-tube.

9. Immediately start timing. At your selected times, record your observations. You may need to lift each test-tube to eye level to take each reading. Take care not to disturb the contents of the test-tube.

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

For Examiner's Use

[5]

(v) Use your results to state the effect of pH on the yeast suspension.

.....

.....

.....[1]

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

.....

.....

.....[1]

(vii) State the degree of uncertainty of using the graph paper scale as a measure.

.....[1]

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[Turn over

For Examiner's Use

(viii) Suggest how you could make this investigation

as accurate as possible,

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as reliable as possible.

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.....[3]

A yeast cell suspension can be used to produce ethanol for use as a fuel. The yeast cells are allowed to sediment out at the end of the process so that they can be reused. It has been found that calcium chloride affects the rate of sedimentation.

Table 1.1 shows the effect of adding calcium chloride to a yeast suspension.

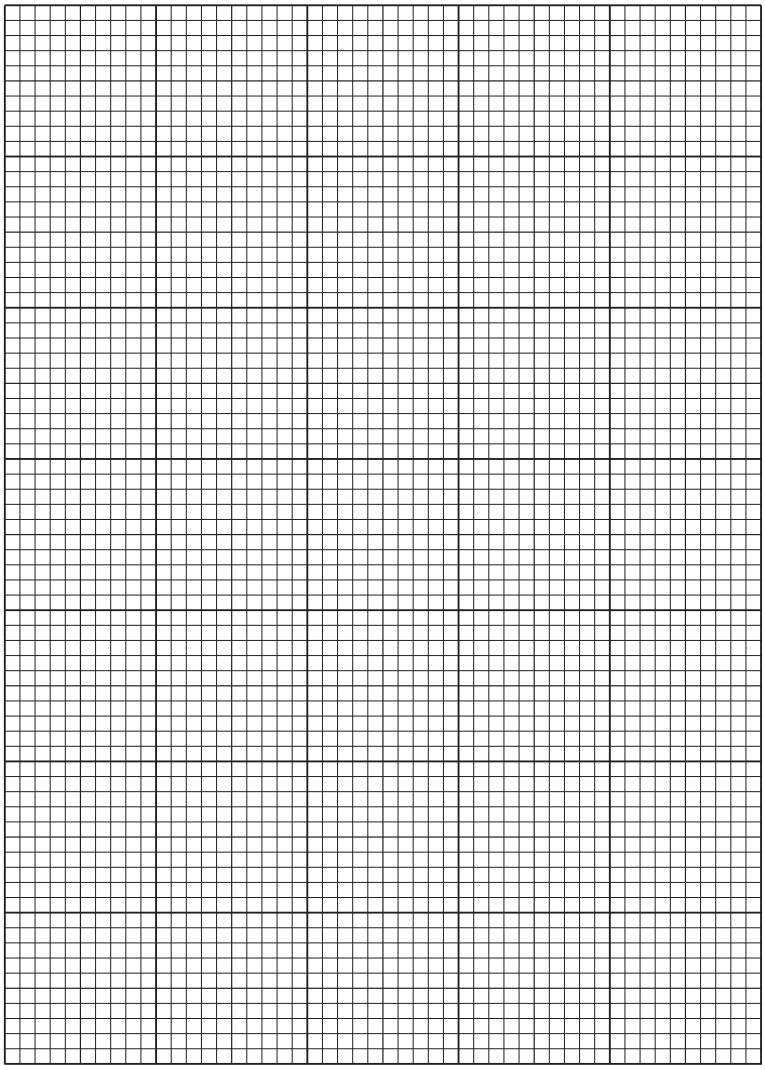
calcium chloride concentration / m mol	sedimentation time / min
0.00	85
0.25	140
0.40	69
0.50	50
0.75	12
1.00	12

Table 1.1

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

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[4]

(ii) State the concentration of calcium chloride required for the yeast to sediment out at 40 minutes.

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

concentration of calcium chloride required ..... m mol
[1]

[Total: 22]

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

For Examiner's Use

(a) **(i)** Select a large vascular bundle and draw a large plan diagram of the vascular bundle.

Label the xylem tissue.

[5]

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(ii) The epidermis has hair-like structures called trichomes.

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Make a high-power drawing of one trichome, made up of at least three cells, **and** one epidermal cell on each side touching the base of the trichome.

Label the trichome.

[5]

Fig. 2.1 is a photomicrograph of a stained transverse section of a different plant organ.

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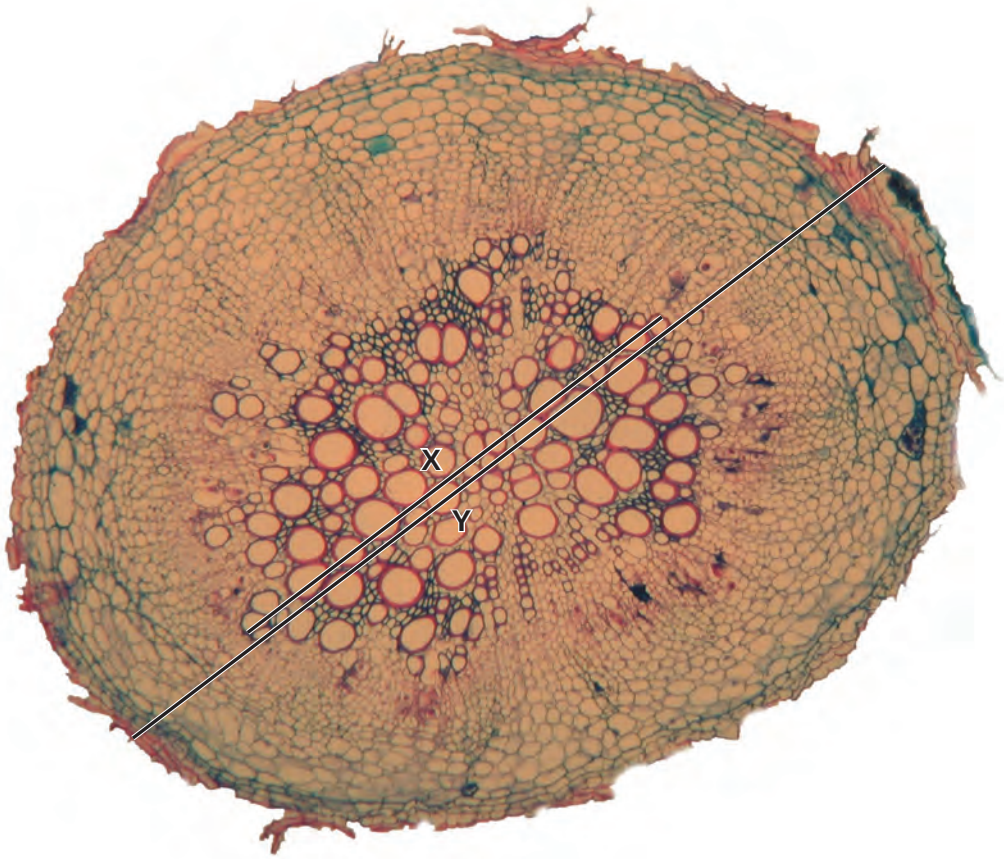


Fig. 2.1

(b) (i) Calculate the ratio of the total diameter of the plant organ labelled **Y** to the diameter of the vascular tissue labelled **X**.

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

[3]

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(ii) Prepare the space below so that it is suitable for you to describe the observable differences between **M1** and **Fig. 2.1**.

Record your observations in the space you have prepared.

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[5]

[Total: 18]

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0839973353

BIOLOGY **9700/35**

Advanced Practical Skills 1 **October/November 2010**

2 hours

Candidates answer on the Question Paper.

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

1 You are required to test known samples for the presence of ascorbic acid (vitamin C).

You are provided with

labelled	contents	hazard	volume / cm^3
A	0.1% ascorbic acid	irritant	100
W	distilled water	none	100
iodine	iodine in potassium iodide	irritant	40
S	starch	none	20
X	unknown sample	irritant	20
Y	unknown sample	irritant	20

To find the concentration of ascorbic acid in **A** and **W** you are required to find the volume of iodine added to the test samples until the end-point is reached.

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

To practise releasing drops from a small syringe:

1. Fill the syringe with 2 cm^3 distilled water.

2. Hold the syringe over an empty test-tube as shown in Fig. 1.1 and push the plunger **gently** to release one drop.

3. Repeat this until you can release one drop at a time.

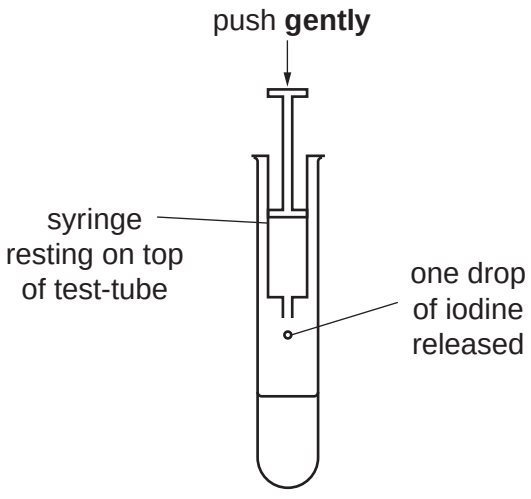


Fig. 1.1

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To find the concentration of ascorbic acid in **A** and **W** you will need to add drops of **iodine** until a blue colour appears which lasts for more than 10 seconds. This is the end-point.

You will be required to record the **volume** of **iodine** added.

Proceed as follows:

4. Put 1 cm^3 of **S** into a test-tube.
5. Add 5 cm^3 of the test sample (e.g. **A**) into the same test-tube.
6. Shake the test-tube gently to mix the contents.
7. Fill a small syringe with 2.0 cm^3 of **iodine**.
8. Wipe off any **iodine** from the outside of the syringe with a paper towel.
9. Add one drop of **iodine** to the mixture of **S** and **A** as shown in Fig. 1.1.
10. Mix gently and if there is no colour change add another drop.
11. When the blue colour first appears, wait 10 seconds to see if the end-point has been reached. If the blue colour disappears then add another drop.
12. Repeat steps 9 to 11 until the mixture stays blue for at least 10 seconds.
13. Record the **volume** of **iodine** added.
14. Repeat steps 4 to 13 with sample **W**.

volume of iodine added for sample

A .....

W .....

Proceed as follows to find the concentration of ascorbic acid in samples **X** and **Y**.

You will need to dilute the 0.10% ascorbic acid to provide a range of known concentrations.

You will need to make up 20 cm^3 of each concentration of ascorbic acid.

Table 1.1 shows how to make up two of the concentrations you should use.

Table 1.1

volume of ascorbic acid / cm^3	volume of distilled water / cm^3	concentration of ascorbic acid / %
20	0	0.10
16	4	0.08

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(i) Decide which other concentrations of ascorbic acid to make and complete Table 1.2, including the concentrations from Table 1.1.

Table 1.2

tube number	volume of ascorbic acid / cm^3	volume of distilled water / cm^3	concentration of ascorbic acid / %

[3]

Make up the concentrations of ascorbic acid you have chosen.

Repeat steps 4 to 13 with each of your concentrations of ascorbic acid and the two samples **X** and **Y**.

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[Turn over

(ii) Prepare the space below to show the concentration of ascorbic acid and record your results, including samples **X** and **Y**.

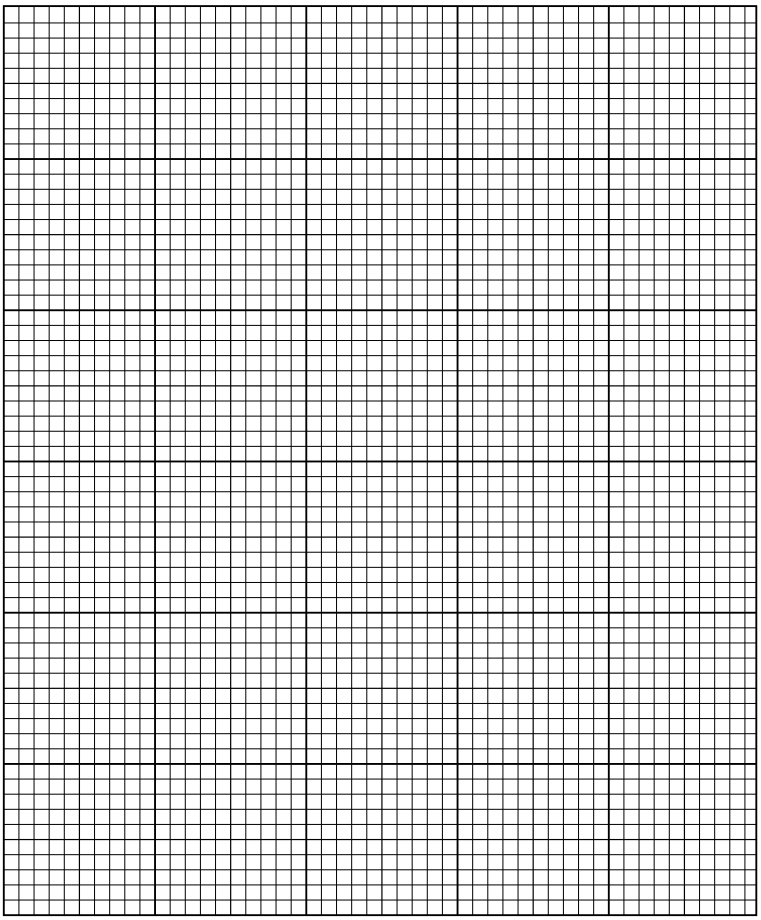
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[6]

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(iii) Plot a graph of the results.

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[4]

(iv) Use your graph to estimate the ascorbic acid concentration of sample **X**.

Show clearly on your graph how you obtained the ascorbic acid concentration. [1]

concentration of ascorbic acid in sample **X** ..... [2]

(v) Identify **two** significant sources of error when finding the concentration of ascorbic acid in sample **X**.

.....

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.....

..... [2]

(vi) Suggest how you would make **three** improvements to this investigation.

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..... [3]

[Total: 21]

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2 **L1** is a slide of a stained transverse section through a leaf-like structure.

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You are not expected to have studied this material.

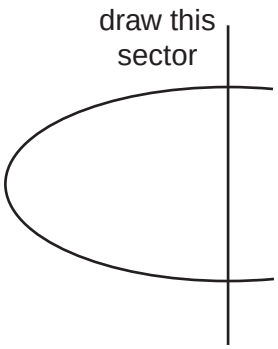


Fig. 2.1

(a) **(i)** Draw a large plan diagram of the sector shown in Fig. 2.1 to include the **outline** of two vascular bundles. No details of the internal tissues of the vascular bundles are required.

Label, with a **C**, the tissue containing chloroplasts.

[5]

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[Turn over

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(ii) Locate a large vascular bundle on **L1**. Using high-power, draw a large **plan** diagram to show one large vascular bundle in detail.

Label the phloem.

[5]

Fig. 2.2 is a photomicrograph of a transverse section of a leaf from a different plant species.

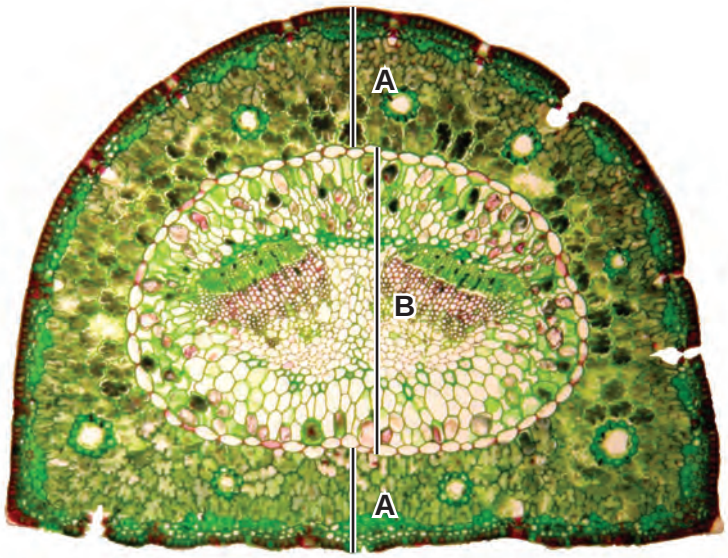


Fig. 2.2

(b) Calculate the ratio of the thickness of the layer labelled **B** compared to the total thickness of the layer labelled **A** as shown in Fig. 2.2.

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

[3]

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

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Record your observations in the space you have prepared.

[3]

(d) Describe how the observable features of the leaf section shown in Fig. 2.2 support the conclusion that this is a leaf from a plant growing in a dry habitat.

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..... [3]

[Total: 19]

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General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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1075918074

BIOLOGY **9700/36**

Advanced Practical Skills 2 **October/November 2010**

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

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

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1	
2	
Total	

This document consists of **9** printed pages and **3** blank pages.

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You are reminded that you have only one hour for each question in the practical examination. You should read carefully through the whole of each question and then plan your use of the time to make sure that you finish all of the work that you would like to do.

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

1 Solution **E** contains an enzyme which coagulates (clots) milk.

You are required to investigate the independent variable, temperature, on the progress of this enzyme-catalysed coagulation.

When a mixture of milk and enzyme is gently rotated the coagulation goes through the stages shown in Fig. 1.1. Stage **3** is the end-point of the enzyme-catalysed coagulation.

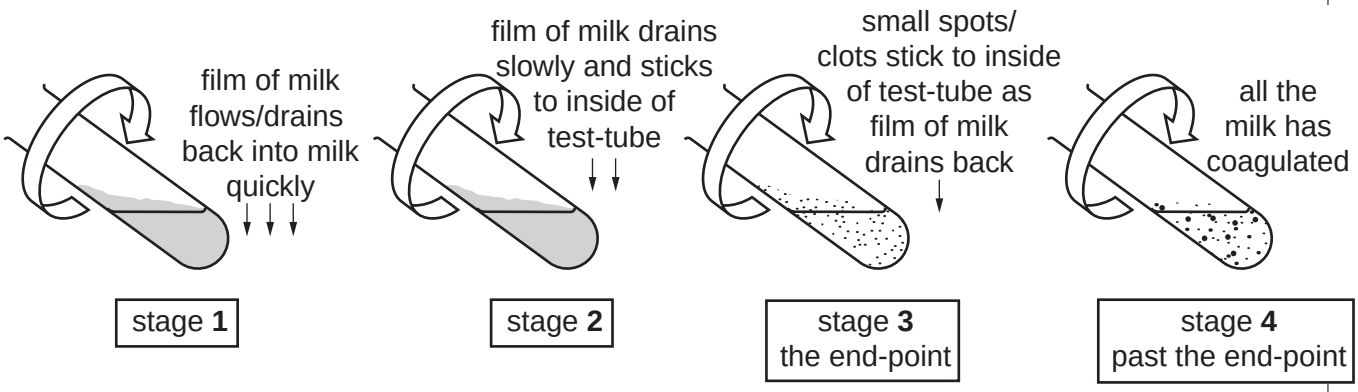


Fig. 1.1

You are provided with

labelled	contents	hazard	volume / cm^3
E	rennin solution	irritant	20
C	calcium chloride solution	irritant	20
M	milk	none	100

(a) (i) Decide on the temperatures you plan to use in the range (between) 25 °C to 45 °C.

Record the temperatures you have chosen in the space below.

.....

..... [2]

Proceed as follows:

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1. Label the test-tubes with the temperatures you have chosen.

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

3. Add 1 cm^3 of solution **C** to each test-tube.

4. Gently shake the test-tube to mix **M** and solution **C**.

5. Adjust the temperature of the water-bath you are provided with to your highest chosen temperature.

6. Record the actual temperature of the water-bath.

7. Put the test-tube, labelled with your highest temperature, into the water-bath and leave for three minutes.

8. Remove the test-tube from the water-bath and add 1 cm^3 of solution **E**, so that it runs down the side of the test-tube to form a layer on the surface of the milk as shown in Fig. 1.2.

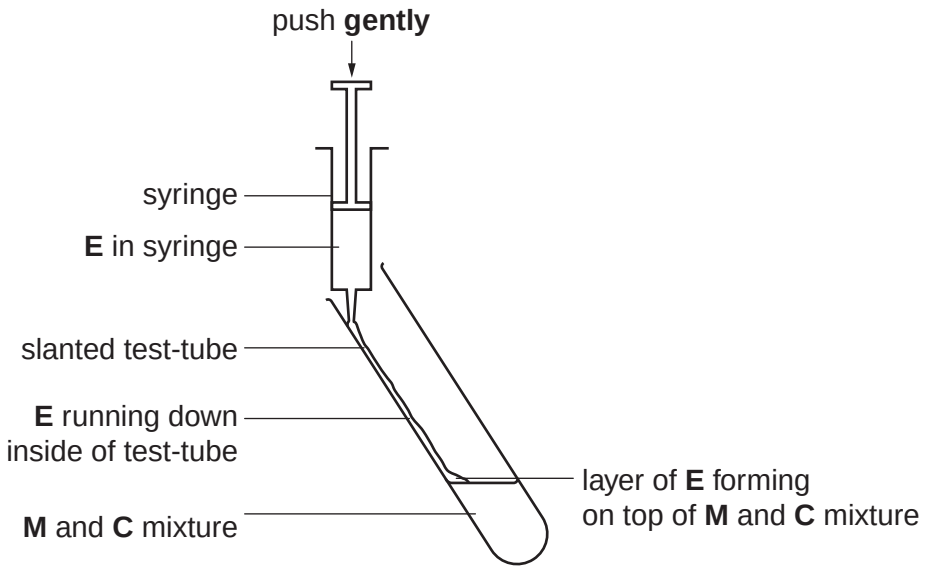


Fig. 1.2

9. Mix solution **E** with the milk by gently shaking the test-tube.

10. Start timing and gently rotate the test-tube as shown in Fig. 1.1 to form a film of milk on the inside of the test-tube. Continue to rotate the test-tube and record the time to reach the end-point as shown in stage **3** in Fig. 1.1. Ignore any small bubbles on the inside of the test-tube.

11. Adjust the water-bath to your next highest temperature.

12. Repeat steps 4 to 11.

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

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[4]

(iii) From your results, state the temperature at which the activity of the enzyme was **lowest**.

.....[1]

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

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.....[2]

(v) Describe a suitable control for this investigation.

.....

.....[1]

(vi) Suggest how you could make this investigation as reliable as possible.

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.....[1]

In a similar investigation a student studied the effect of the independent variable pH on the coagulation of milk.
The results are shown in Table 1.1.

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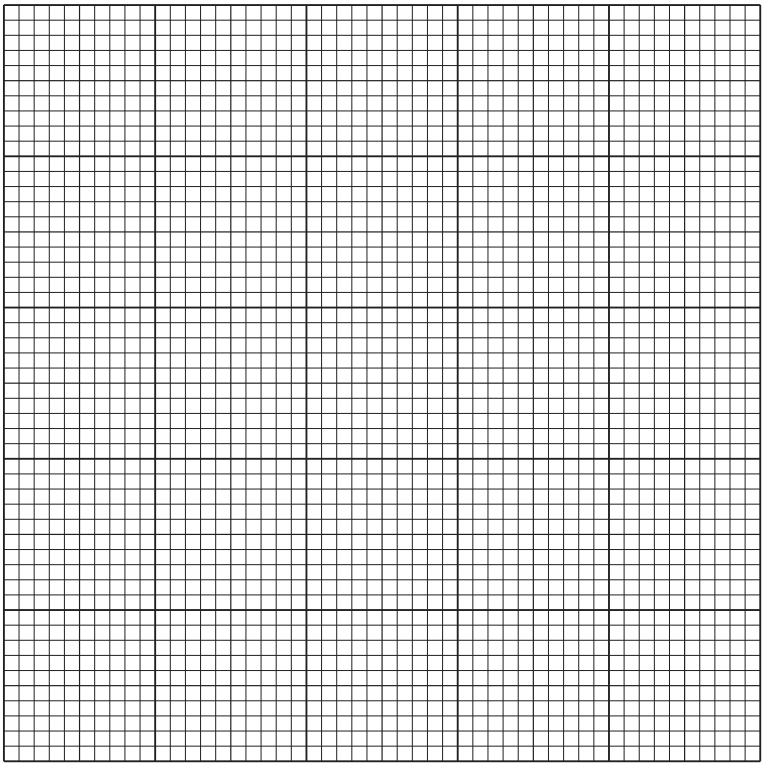
Table 1.1

	activity of milk clotting enzyme / arbitrary units					
pH of milk	**trial 1**	**trial 2**	**trial 3**	**trial 4**	**trial 5**	**mean**
6.02	8.8	8.7	8.9	8.2	8.7	
6.22	6.8	6.8	6.8	6.7	6.9	6.8
6.40	4.9	4.3	4.4	4.3	4.4	4.4
6.64	1.1	1.0	1.0	0.9	1.0	1.0
6.70	0.7	0.6	1.1	0.5	0.7	0.6

(b) (i) Three of the values in Table 1.1 are anomalous. Draw a circle around each of these values. [1]

(ii) Complete Table 1.1 by calculating the missing value. [1]

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



[4]

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(iv) Explain the relationship between pH and the enzyme shown in the data.

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.....[3]

[Total: 20]

2 **N1** is a stained transverse section through part of a tubular organ from an animal.

(a) **(i)** Draw a large plan diagram showing the features of the wall of the organ.

Label the position of the lumen.

[4]

(ii) Annotate (make notes with label lines) your diagram to show one difference between the outside layers and the inside layers. [1]

(b) (i) Fig. 2.1 is a photomicrograph of a stained transverse section through an organ from an animal. The tissue has been stained with special dyes to show the cells and nuclei.

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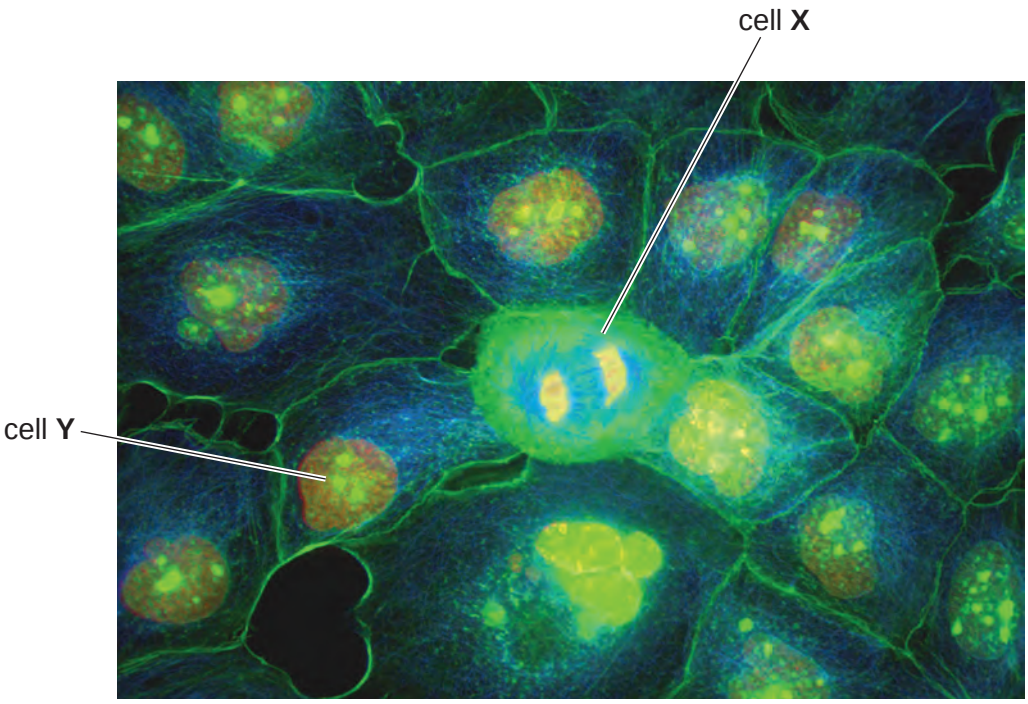


Fig. 2.1

The actual diameter of the nucleus in the cell labelled **Y** is 7.8 μm.

Use this information to calculate the actual mean diameter of the three largest nucleoli in cell **Y**.

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

mean diameter of nucleoli in cell **Y** ..... μm. [4]

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(ii) Suggest how you would make the measurement of each nucleolus more accurate.

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.....

..... [1]

(iii) Make a large drawing of the cell labelled **X** with three complete cells touching cell **X**.

[5]

(iv) Prepare the space below so that it is suitable for you to compare the cells labelled **X** and **Y**.

[5]

[Total: 20]

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Fig. 2.1 J. W. SHULER/SCIENCE PHOTO LIBRARY

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