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General Certificate of Education
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CANDIDATE NAME

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4591537489

BIOLOGY **9700/31**

Advanced Practical Skills 1 **October/November 2011**

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 Substrate **S** reacts with water as shown in the following equation:

substrate **S** + water $\longrightarrow$ product

Enzyme **E** catalyses this reaction.

You are provided with:

labelled	contents	hazard	percentage concentration	volume / cm^3
E	enzyme	irritant	–	20
S	substrate	irritant	0.1	20
P	phenolphthalein solution	irritant	–	20
W	distilled water	none	–	100

The product forms an alkaline solution which causes phenolphthalein to turn pink.
The first appearance of the pink colour will be used to indicate the end-point of the reaction.

You are required to investigate the independent variable, concentration of substrate solution, **S**.

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

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Fig. 1.1 shows how to make the first concentration of 0.05% substrate solution.

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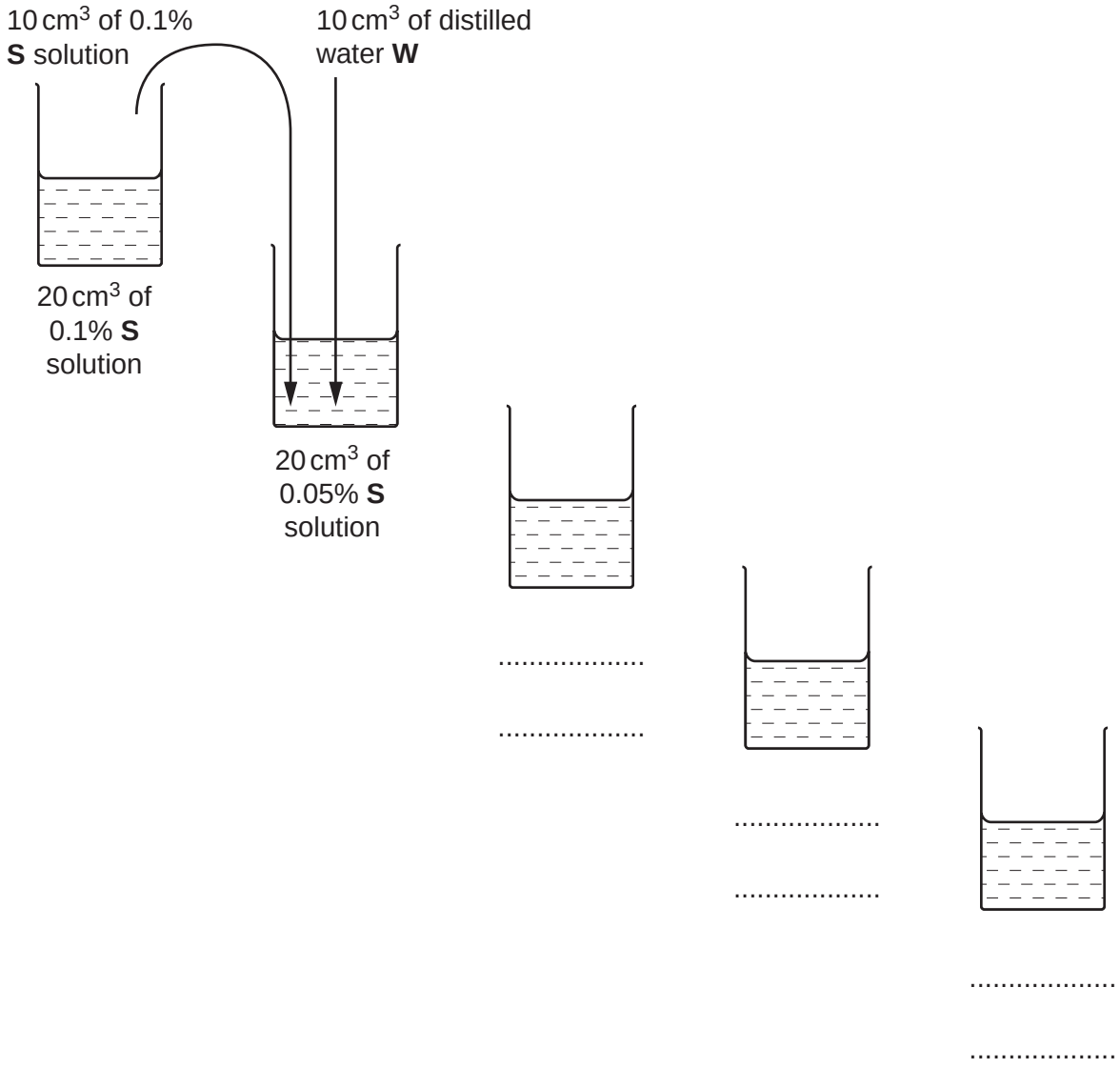


Fig. 1.1

(a) (i) Complete Fig. 1.1 to show how you will make **three** further concentrations of substrate solution, **S**. [3]

Proceed as follows:

For Examiner's Use

1. Prepare the concentrations of substrate solution as shown in Fig. 1.1, in the containers provided.

2. Put 2 cm^3 of 0.1% substrate solution, **S** into a labelled test-tube.

3. Put 0.5 cm^3 of phenolphthalein solution into the same test-tube.

4. Put 1 cm^3 of enzyme **E** into the same test-tube. Mix and start timing.

5. Record the time taken to reach the end-point of the reaction.

If the end-point is not reached at ten minutes, record 'more than 600' for that concentration.

6. Repeat steps 2 to 5 with each of the concentrations of substrate solution.

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

[5]

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(iii) State **one** variable which should have been controlled and how you could modify this procedure so that this variable would be controlled.

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.....

..... [1]

(iv) Describe **two** ways in which the accuracy of the results could be improved.

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..... [2]

A student investigated the effect of an inhibitor on an enzyme.
A strip of agar gel containing **the enzyme and its substrate** was produced. The enzyme breaks down (hydrolyses) the substrate to release a product which stains black when a dye is added.

Small drops (2μl) of different concentrations of the inhibitor were put onto the surface of the agar gel strip. After 10 minutes the agar gel strip was treated with the dye.

Fig. 1.2 shows a diagram of the strip of agar gel after adding the dye. This is not to scale.

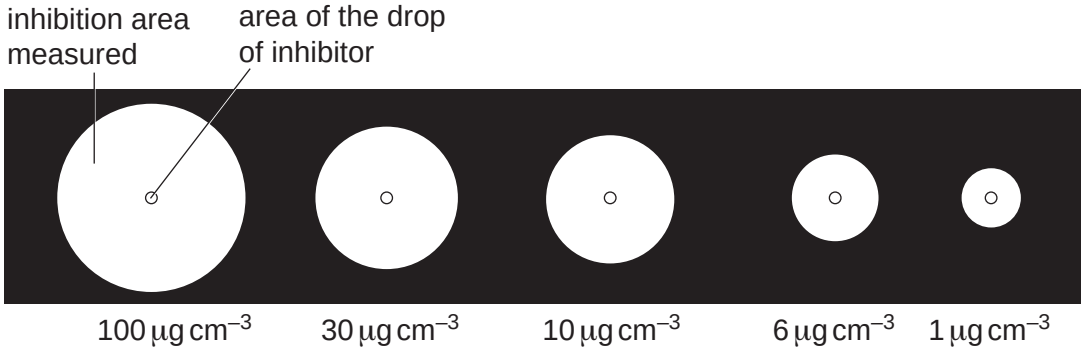


Fig. 1.2

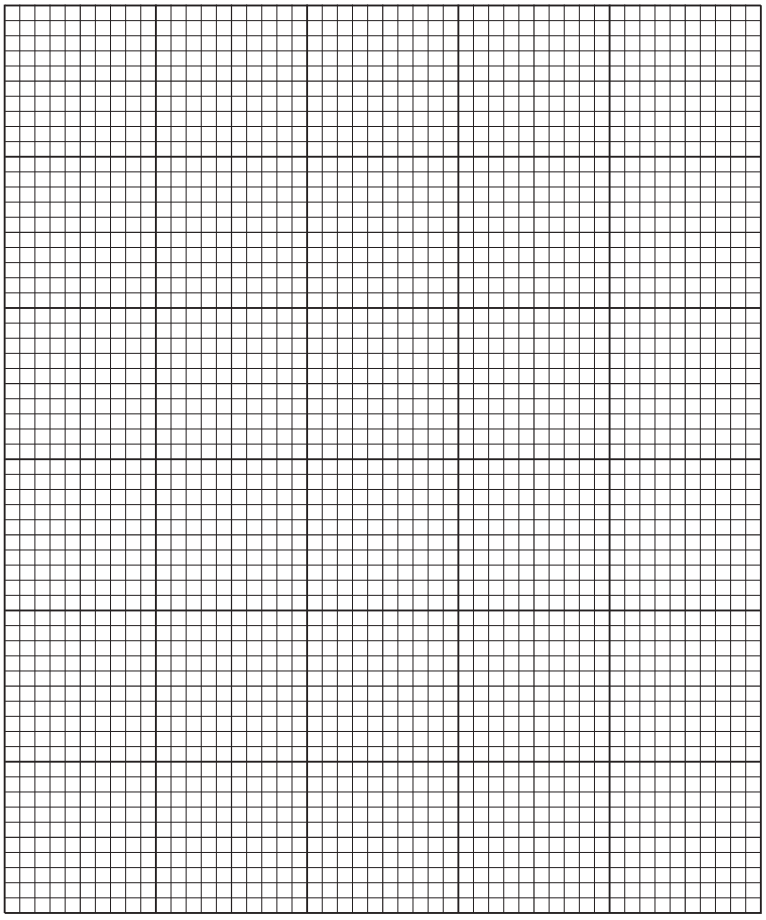
The student's results are shown in Table 1.1.

For Examiner's Use

Table 1.1

concentration of inhibitor / $\mu g\,cm^{-3}$	inhibition area / mm^2
1	30
6	50
10	70
30	106
100	120

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



[4]

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(ii) Estimate the concentration of inhibitor which would produce an inhibition area of 100 mm^2. Show on your graph where you obtained the estimate.

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concentration ..... $\mu g\,cm^{-3}$ [1]

(iii) Describe the trend shown in your graph.

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.....

.....[2]

(iv) Explain the effect of changing the concentration of the inhibitor.

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.....[2]

[Total: 20]

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

The genus of this plant is found in Europe, Asia, Africa and Australia.

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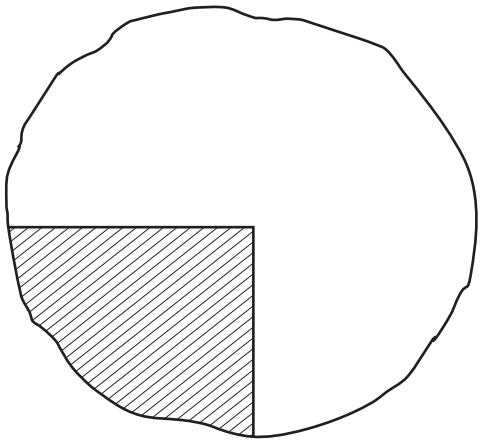


Fig. 2.1

(a) **(i)** Draw a large plan diagram of the part of the stem indicated by the shaded area in Fig. 2.1.

Label the epidermis.

[5]

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In this stem, crossing the air space, are chains of cells which are attached to the tissue surrounding the vascular bundle.

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Select a chain of cells which is attached by only **one** cell to the tissues surrounding the vascular bundle. The cells should have distinct cell walls and cell contents.

(ii) Make a large drawing of

- two adjacent (touching) chain cells and
- one cell that attaches these two cells to the tissue surrounding the vascular bundle.

There should be only one group of **three** cells in your drawing.
Label a cell wall.

[5]

(iii) Suggest **one** observable feature of **J1** which supports the conclusion that this is a stem from a plant living in water.

Suggest how this feature may help the plant to live in water.

.....

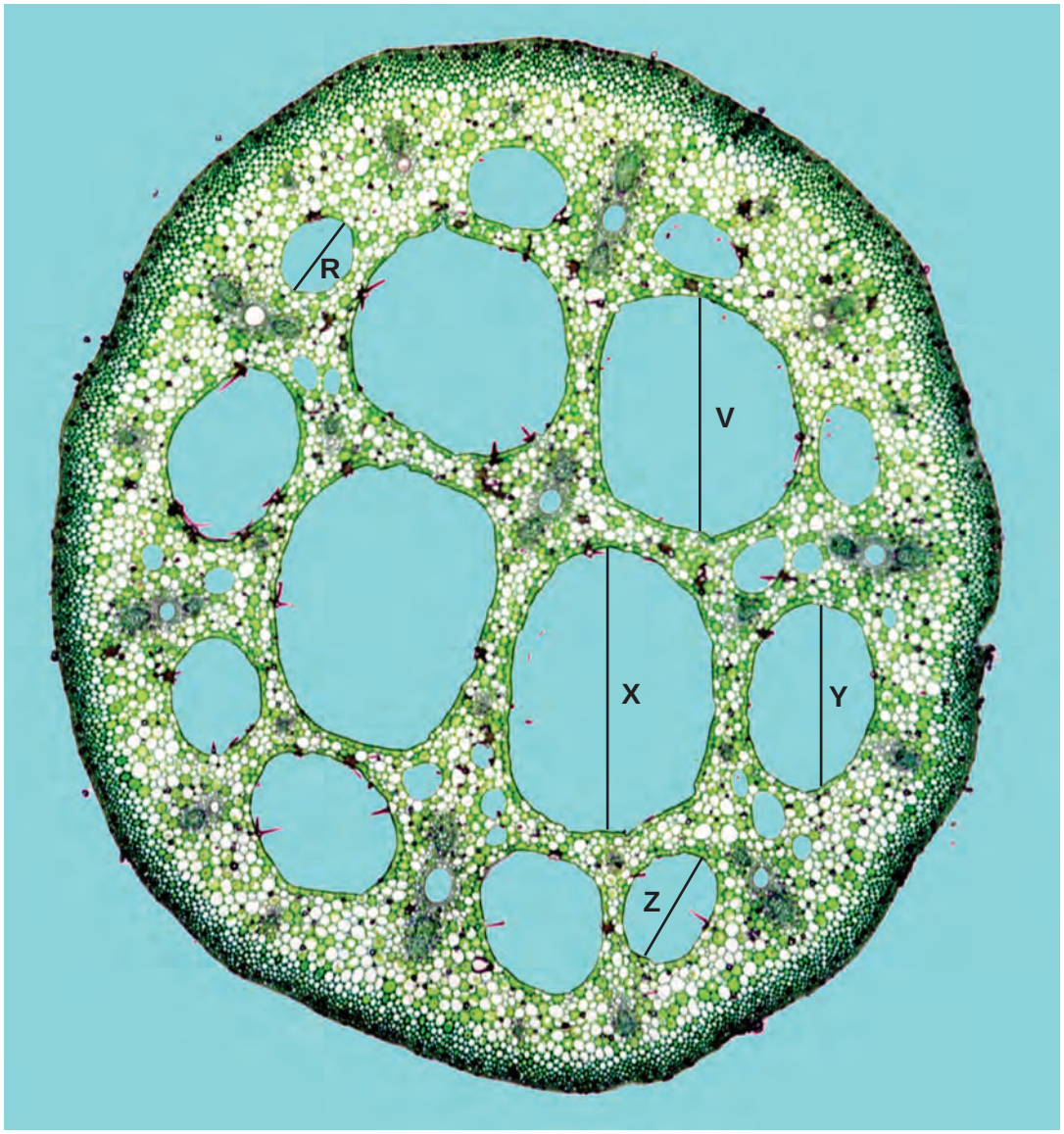
.....[1]

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Fig. 2.2 is a photomicrograph of a transverse section of a stem from a different plant species. The genus of this plant is found in Europe, North Africa and the Middle East.

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To find the mean length of an air space, a student measured five air spaces, as shown in Fig. 2.2.



magnification x 30

Fig. 2.2

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(b) (i) Use the magnification to calculate the mean actual length, in μm, of an air space using **R**, **V**, **X**, **Y** and **Z**.

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

..... μm [4]

(ii) Prepare the space below so that it is suitable for you to record **one** observable similarity and **two** observable differences between the specimen on **J1** and in Fig. 2.2.

Record your observations in the space you have prepared.

[5]

[Total: 20]

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4487941387

BIOLOGY **9700/33**

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1 Protein concentration may vary in samples of milk and 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 of milk.

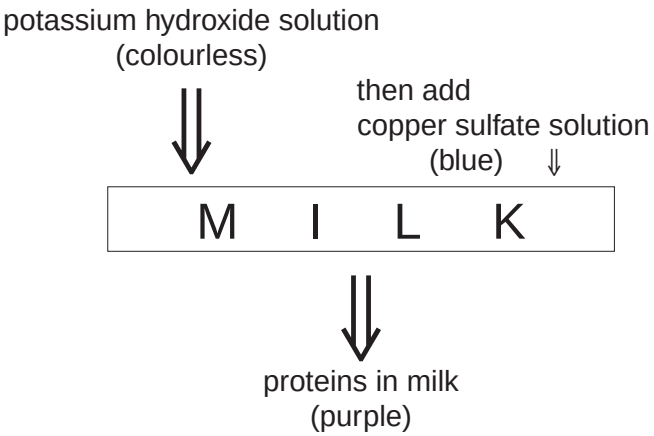


Fig. 1.1

You are provided with:

labelled	contents	hazard	percentage concentration	volume / cm^3
K	potassium hydroxide solution	harmful irritant corrosive	–	20
C	copper sulfate solution	harmful	–	20
M	milk for serial dilution	none	50	20
U	milk sample	none	unknown	10
W	distilled water	none	–	120

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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 then wash off with plenty of cold water.

You are required to estimate the protein concentration of a sample, **U**.

You are required to carry out a serial dilution of milk, **M**, to reduce the concentration of the milk by ten-fold between each successive dilution.

Fig. 1.2 shows how to make the first concentration of 5% of milk, **M**.

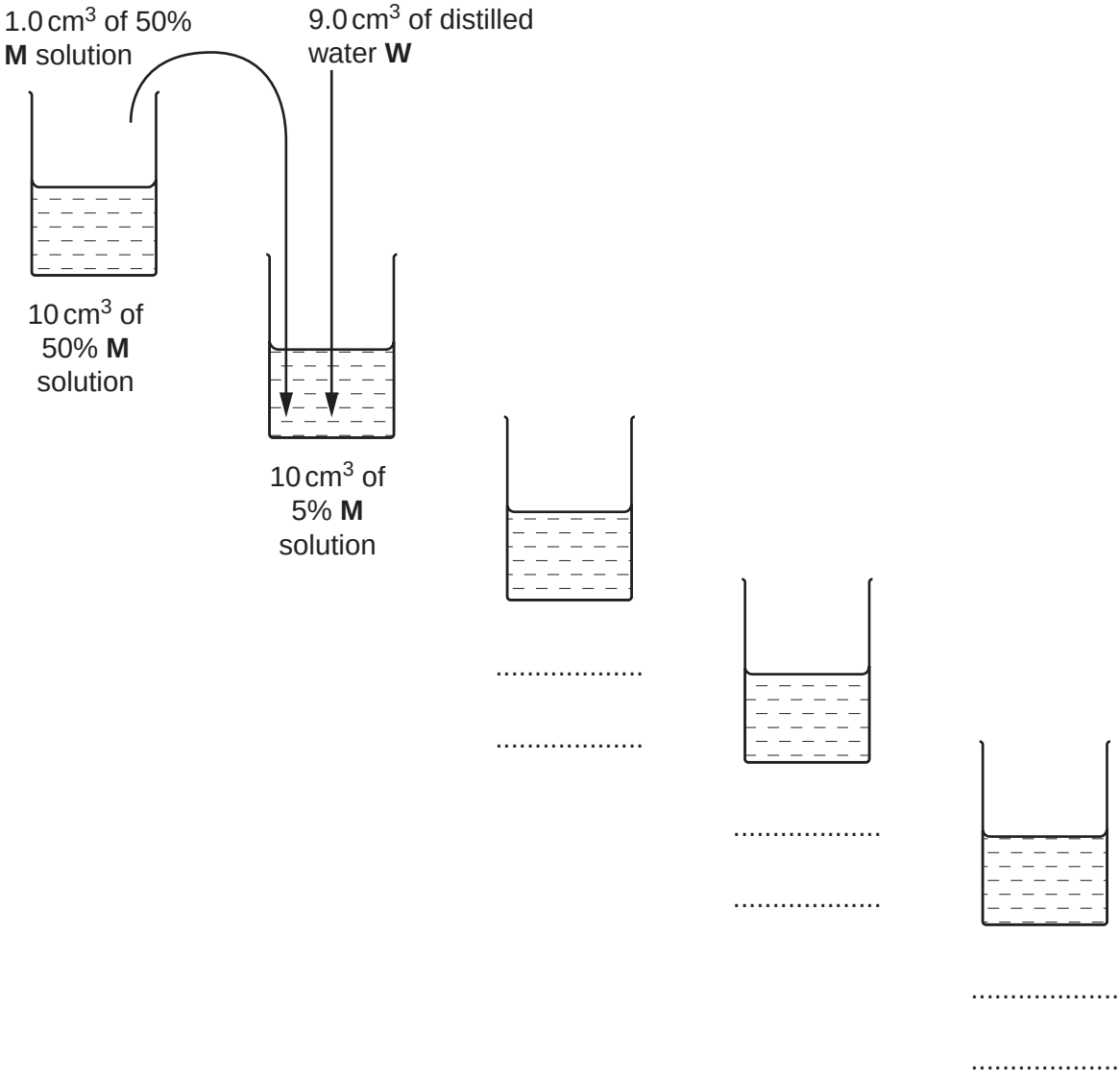


Fig. 1.2

(a) (i) Complete Fig. 1.2 to show how you will make **three** further concentrations of milk, **M**. [3]

A separate syringe must be used for the 50% sample of milk because it is so thick.

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A second syringe must be used for the other concentrations.

Proceed as follows:

1. Prepare the concentrations of milk as shown in Fig. 1.2, in the containers provided.

2. Label five test-tubes with the five concentrations of milk.

3. Put 1 cm^3 of each concentration into the labelled test-tubes.

4. Put 1 cm^3 of **U** into a test-tube, labelled **U**.

5. Put 1 cm^3 of **W** into a test-tube, labelled **W**.

6. Put 1 cm^3 of **K** into each test-tube. Shake gently to mix.

7. Put 1 cm^3 of **C** into each test-tube. Shake gently to mix.

8. Record your observations.

9. In the test-tube rack put the test-tubes in an order which will enable you to record each colour as a number using the scale below.

0 1 2 3 4 5 6 7 8 9 10

blue (no purple) — darkest purple

(ii) Prepare the space below and record your observations and the number using the scale opposite.

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[5]

(iii) Complete the diagram below to show the position of each of the concentrations of **M**.
Write the letter **U** to show where it fits in the series of concentrations.



The protein concentration of the 50% milk, **M** was 18 g 100 cm^{-3}.

Complete the following statement.

The protein concentration of the unknown milk sample, **U**, is between ..... g 100 cm^{-3} and ..... g 100 cm^{-3}. [2]

(iv) Suggest how you would modify this investigation to obtain a more accurate estimate of the protein concentration in milk sample **U**.

For Examiner's Use

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.....[3]

Fig. 1.3 shows the apparatus used by a student to investigate the action of a protein digesting enzyme (protease).

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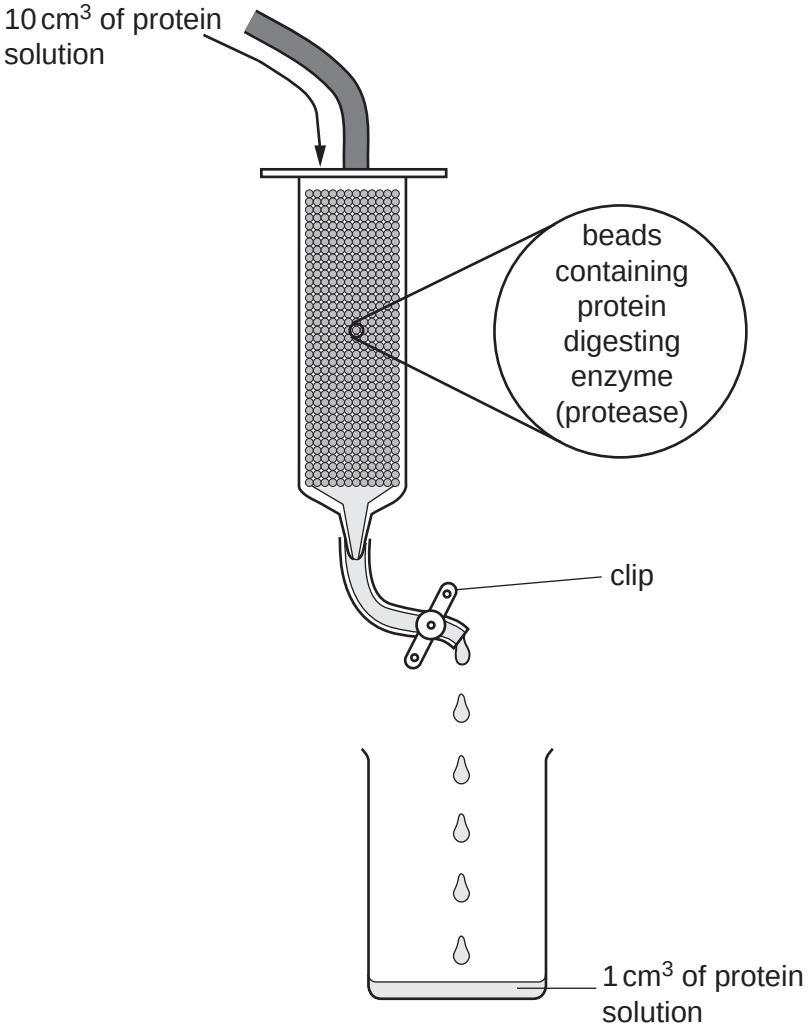


Fig. 1.3

A student poured 10 cm^3 of a solution containing 100 $mg\,dm^{-3}$ of protein into the syringe containing beads. The beads contain protease.

At first the clip was fully open and it took 6 seconds to collect a 1.0 cm^3 sample of the protein solution.

The student poured away the remaining protein solution, washed the beads and put them back into the syringe. The student repeated the procedure with fresh protein solution and slightly closed the clip so that it took 15 seconds to collect a 1.0 cm^3 sample of the protein solution.

This procedure was carried out three more times closing the clip more each time. The student measured the concentration of protein in each of the 1.0 cm^3 samples.

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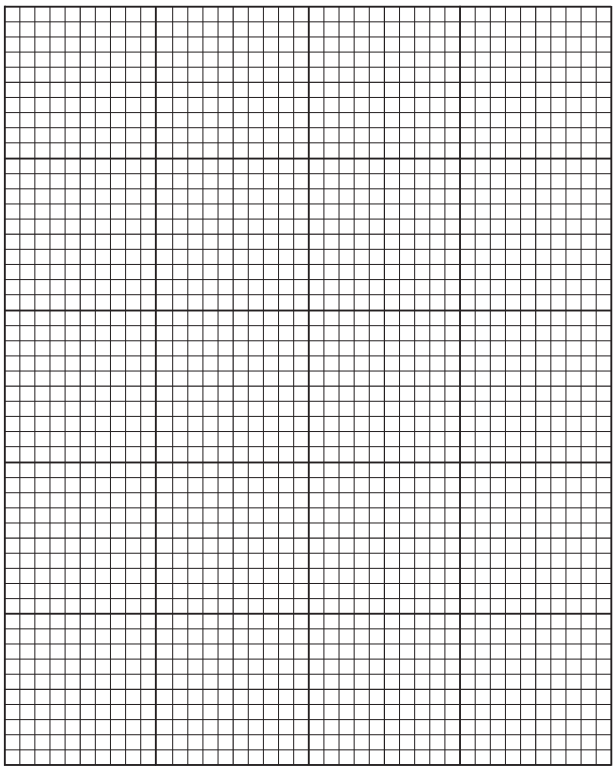
The results of the student's investigations are shown in Table 1.1.

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Table 1.1

time taken to collect 1.0 cm^3 sample of protein solution / s	concentration of protein in 1.0 cm^3 sample of protein solution / mg dm^{-3}
6	92
15	70
22	56
31	38
39	20

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



[4]

(ii) Describe and explain the trend in the results.

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..... [3]

(iii) Fig. 1.4a and Fig. 1.4b show the start and finish times for the student's second investigation.

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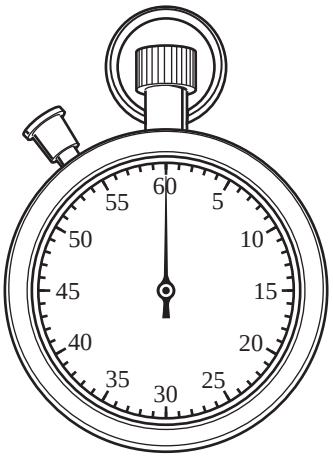


Fig. 1.4a

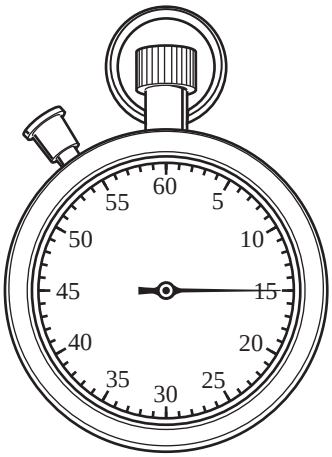


Fig. 1.4b

Use the information from Fig. 1.4a and Fig. 1.4b to calculate the percentage error of the time taken.

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percentage error .....[2]

[Total: 22]

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Question 2 starts on page 11

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2 **K1** is a stained transverse section through part of an organ from a mammal.

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Put the slide onto the microscope and move the slide to find the edge of the transverse section of the organ including the darkly stained layer.

Select a part of the section which clearly shows the edge and the darkly stained layer.

(a) Draw a large plan diagram which shows only the layers of the section visible without moving the slide to another field of view.

Use the letter **D**, with a label line, to show the position of the most darkly stained layer.

[5]

Fig. 2.1 is a photomicrograph of part of **K1**. The nuclei have been stained.

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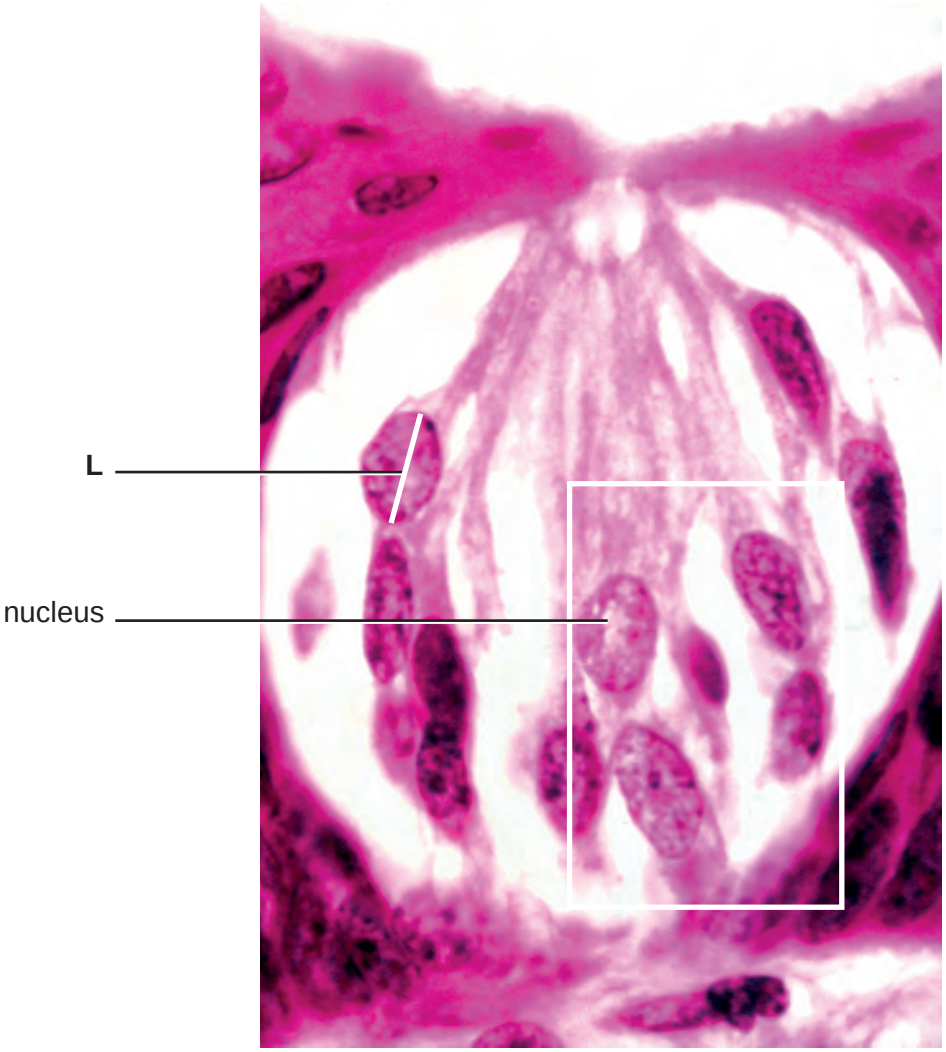


Fig. 2.1

(b) (i) Make a large drawing of all the whole nuclei shown within the area indicated on Fig. 2.1.

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Label one nucleolus.

[4]

(ii) Use the magnification to calculate the actual length of the line **L** in μm.

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

..... μm [3]

Fig. 2.2 and Fig. 2.3 are photomicrographs of transverse sections through the same organ as **K1** from different mammals.

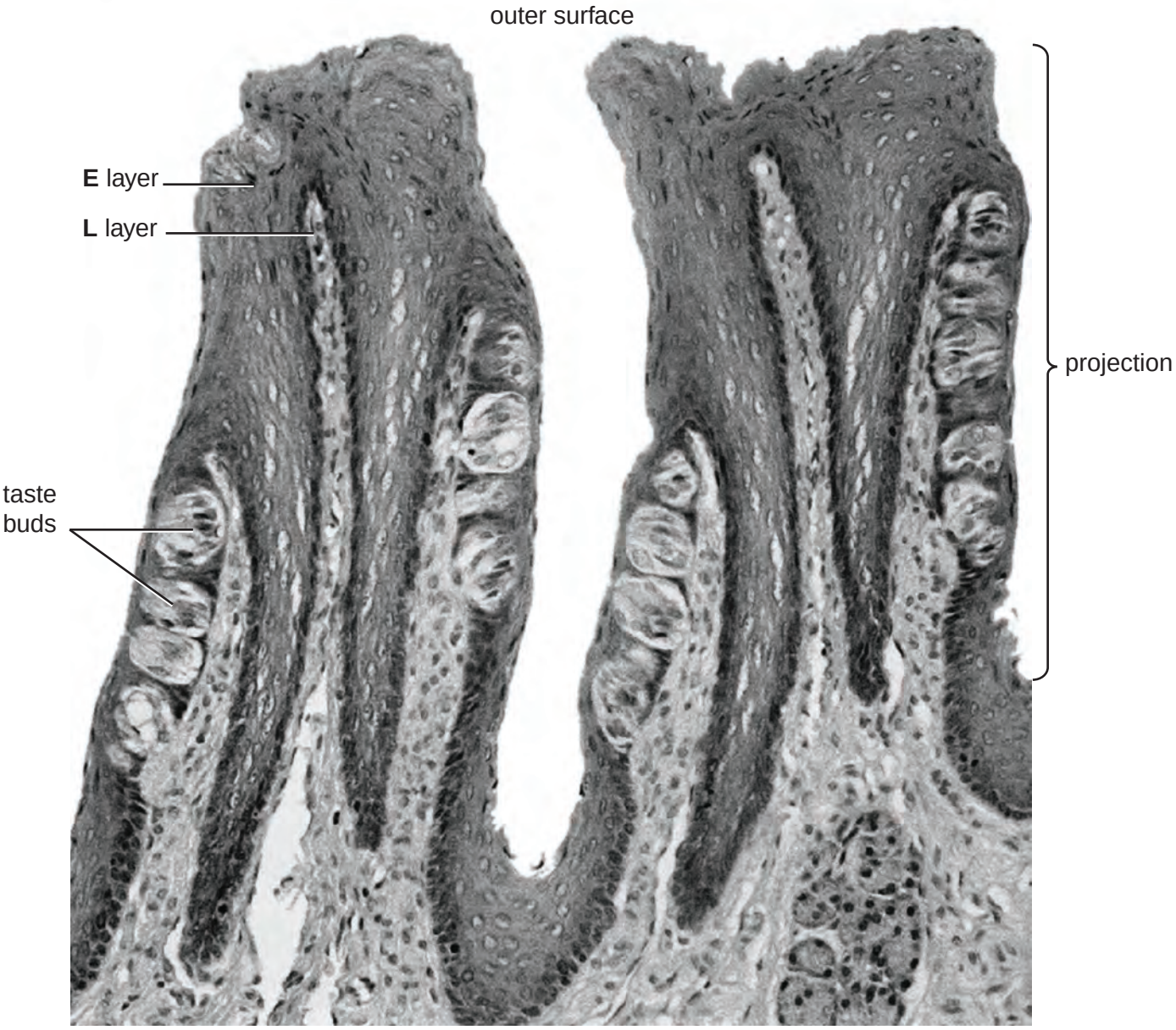
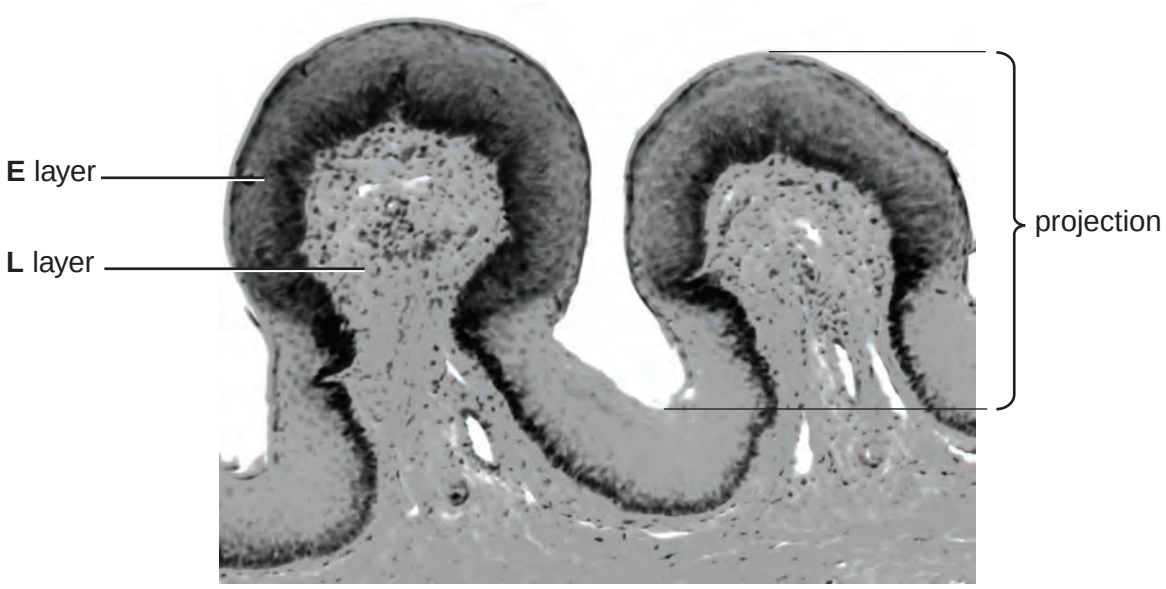


Fig. 2.2

For Examiner's Use



magnification x 100

Fig. 2.3

(c) (i) Prepare the space below so that it is suitable for you to record **three** observable differences between the specimens in Fig. 2.2 and Fig. 2.3.

Record your observations in the space you have prepared.

[5]

(ii) State one observable feature of Fig. 2.2 which supports the conclusion that this is part of an organ that may absorb molecules.

Suggest how this feature may increase the rate of absorption.

.....

..... [1]

[Total: 18]

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BIOLOGY **9700/34**

Advanced Practical Skills 2 **October/November 2011**

2 hours

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1 The blue-green agar blocks contain an indicator.

The investigation involves placing different sizes of agar blocks into dilute hydrochloric acid. As the acid moves (diffuses) into the agar blocks the indicator loses its blue-green colour.

You are required to investigate the independent variable, surface area to volume ratio of the agar blocks.

You are provided with:

labelled	contents	hazard	details
H	hydrochloric acid	irritant	enough to cover the blocks in the containers provided
A	agar block	irritant	one block containing an indicator

You must not touch the agar blocks with your hands. Use the blunt forceps and paper towel to handle the blocks.
If you get hydrochloric acid on your skin, wash off with cold water.

You are required to prepare four different sizes of agar blocks.

You will require **three** blocks of each size.

You are advised to read steps 1 to 6 before proceeding.

Proceed as follows:

1. Cut the agar block provided into blocks, each 1 cm × 1 cm × 1 cm. Cut the blocks on the white tile or chopping board provided.

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Fig. 1.1 shows how to obtain blocks with a different surface area compared with the blocks in step 1.

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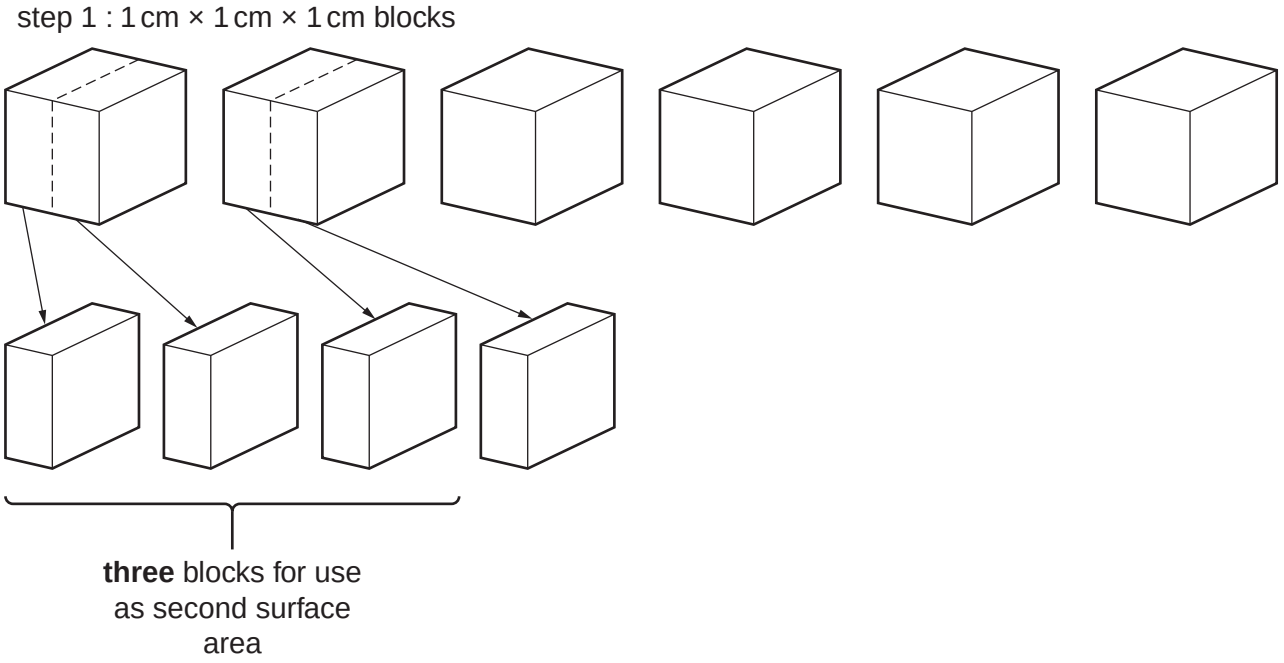


Fig. 1.1

2. Cut two of the 1 cm × 1 cm × 1 cm blocks as shown in Fig. 1.1 to obtain the blocks you need for the next surface area.

You may use the space on Fig. 1.1 to work out how to cut two further sizes of blocks with different surface areas.

3. Cut two further sizes of blocks with different surface areas. You will need **three** blocks of each of the four sizes of block.

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4. Put three of each size of block into the beaker or container using blunt forceps.

5. Put **H** into this beaker or container to cover the blocks and start timing.

6. Observe the blocks for the disappearance of the blue-green colour. This is the end-point of the reaction. As soon as you see the green colour disappear record the time taken for each block to reach the end-point. If any block remains blue-green at 15 minutes, record "**more than 15**".

The different sizes of agar blocks have different surface areas and volumes.

(a) (i) Complete Table 1.1.

Table 1.1

dimensions / cm	surface area / cm^2	volume / cm^3	surface area : volume ratio
1 × 1 × 1	6	1.0	6:1
1 × 1 × 0.5	4	0.5	8:1

[3]

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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 your investigation.

.....

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.....[2]

For Examiner's Use

A student investigated the effect of temperature on the rate of breathing in fish. Fish take water in through the mouth and force it over the gills when the mouth closes. Oxygen diffuses from the water into the gills. The gill cover opens to allow the water to leave as shown in Fig. 1.2.

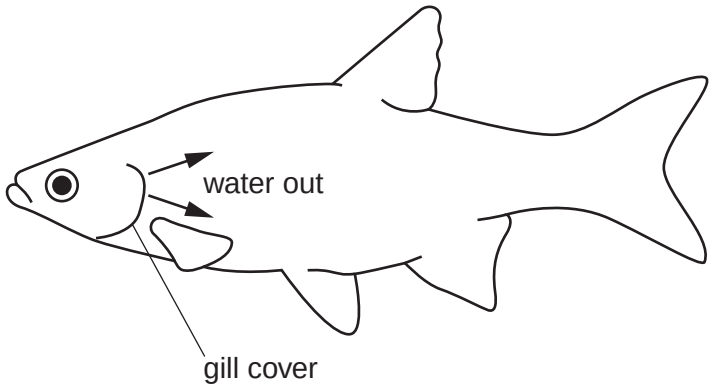


Fig. 1.2

A fish was placed in a bag partly filled with water. The bag, containing the fish, was placed in a large beaker containing water at 5 °C.

The number of times the gill cover opened in one minute was recorded. The bag containing the fish was removed and the temperature of the water in the beaker was raised to 10 °C.

A bag containing a different fish of the same species was then put into the beaker. The number of times the gill cover opened in one minute was counted.

This procedure was repeated using a different fish of the same species for each temperature as shown in Table 1.2. However, the student decided that the temperature would not be increased to above 25 °C as this might damage the fish.

(b) (i) Suggest how you might control **three** of the variables in the student's investigation.

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..... [3]

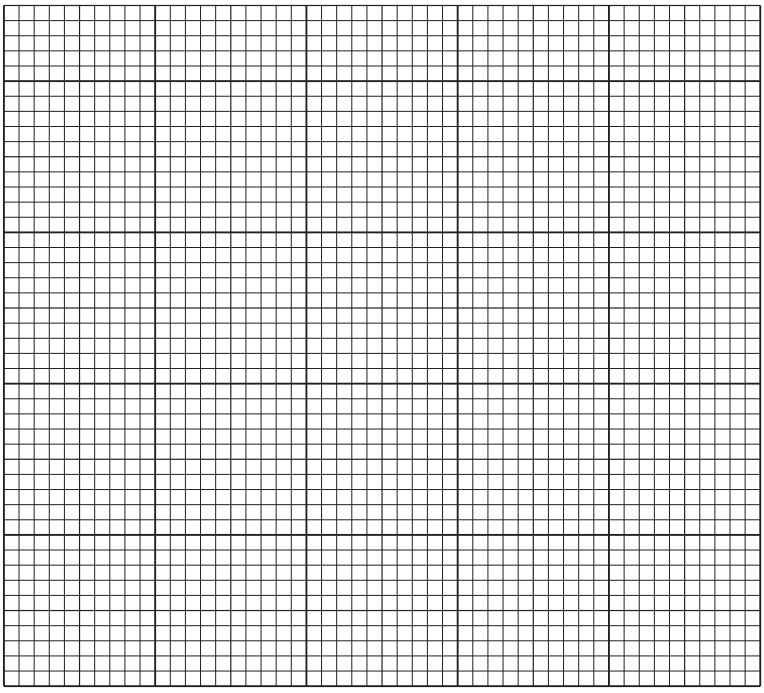
Table 1.2 shows the results of this investigation.

For Examiner's Use

Table 1.2

temperature / °C	rate of breathing / number min^{-1}
5	4
10	16
15	24
20	31
25	39

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



[4]

(iii) Describe and explain the effect of the temperature on the rate of breathing in this species of fish.

.....

.....

.....

.....

.....

.....[3]

[Total: 20]

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Question 2 starts on page 9

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2 **M1** is a slide of a stained transverse section showing part of a tube of a mammal from the gas exchange system.

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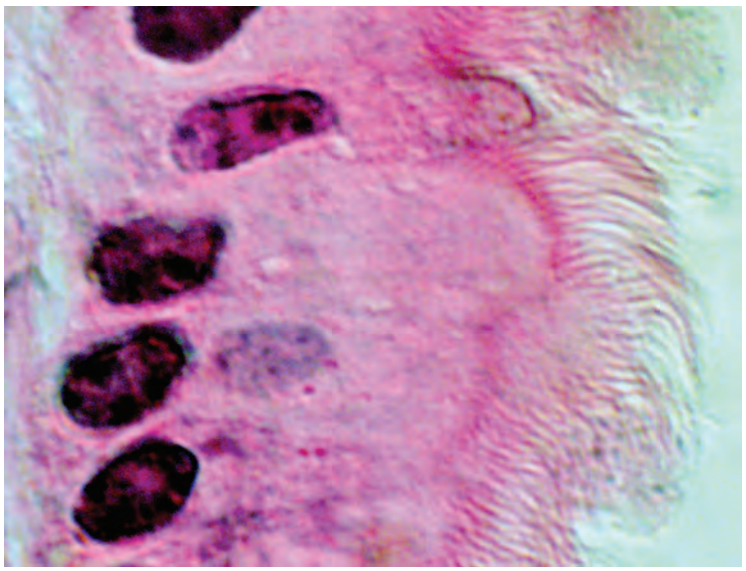
(a) **(i)** Draw a large plan diagram of the whole of the transverse section.

Label the cartilage.

[5]

Fig. 2.1 is a photomicrograph of the transverse section through part of another tube in the gas exchange system.

For Examiner's Use



magnification × 3300

Fig. 2.1

(ii) Make a large drawing of two adjacent (touching) whole cells and the contents inside the cells.

Label one epithelial cell and one nucleus.

[5]

(iii) State **one** observable feature which would enable these cells to move substances. Describe the use of this feature in the gas exchange system.

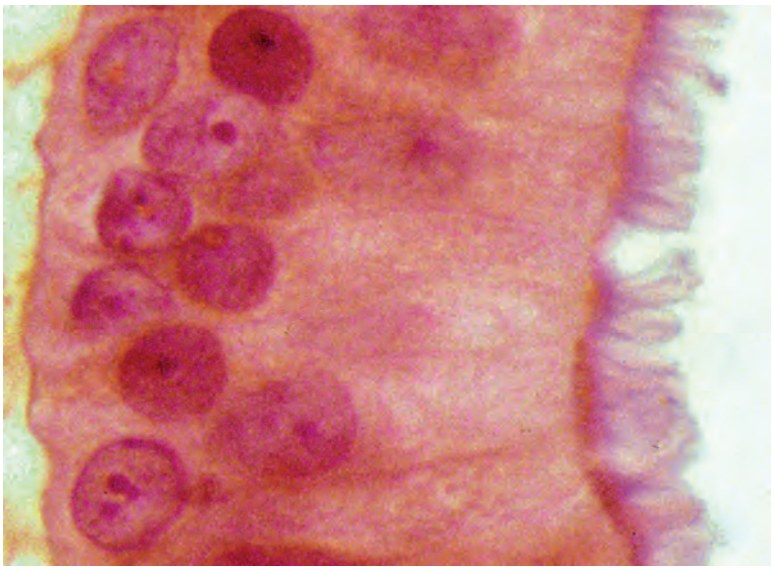
.....

..... [1]

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Fig. 2.2 is a photomicrograph of the transverse section through part of another tube of the gas exchange system.

For Examiner's Use



magnification × 3300

Fig. 2.2

(b) (i) Prepare the space below so that it is suitable for you to record **one** observable similarity and **two** observable differences between the specimens in Fig. 2.1 and in Fig. 2.2.

[5]

Question (b)(ii) is on page 12

(ii) Calculate the ratio of the mean length of the epithelial cell to the mean length of the cilia shown in Fig. 2.2.

For Examiner's Use

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

[4]

[Total: 20]

Copyright Acknowledgements:

Question 2, Fig 2.1 Science Photo Library
Question 2, Fig 2.2 Steve Gschmeissner/Science Photo Library

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7625209005

BIOLOGY **9700/35**

Advanced Practical Skills 1 **October/November 2011**

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.

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

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

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1	
2	
Total	

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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.
- Plan your use of **the time** to make sure that you finish all of the work that you would like to do.

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

1 Enzyme **E** catalyses the hydrolysis of sucrose to the reducing sugars, glucose and fructose.

Glucose and fructose can diffuse through a partially permeable (selectively-permeable) membrane.

The wall of Visking (dialysis) tubing is partially permeable.

A bag made of Visking tubing, containing enzyme **E** and sucrose solution, is placed into a large test-tube containing distilled water. The large test-tube is placed in a water-bath.

You are required to follow the time course of this enzyme-catalysed reaction by testing the distilled water surrounding the bag.

Samples of water around the bag are taken at intervals during 20 minutes and tested for reducing sugars using Benedict's solution.

You are provided with:

labelled	**contents**	**hazard**	**volume / cm^3**
E	invertase solution	irritant	15
S	sucrose solution	none	15
Benedict's solution	Benedict's solution	harmful irritant	60
W	distilled water	none	200

You are also provided with:

- **V**, one length of Visking (dialysis) tubing in distilled water.

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You will need to run the time course for the enzyme-catalysed reaction for 20 minutes.

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Fig. 1.1 shows the procedure for investigating the time course of the enzyme-catalysed reaction. The times you will use are 5 minutes, 10 minutes, 15 minutes and 20 minutes.

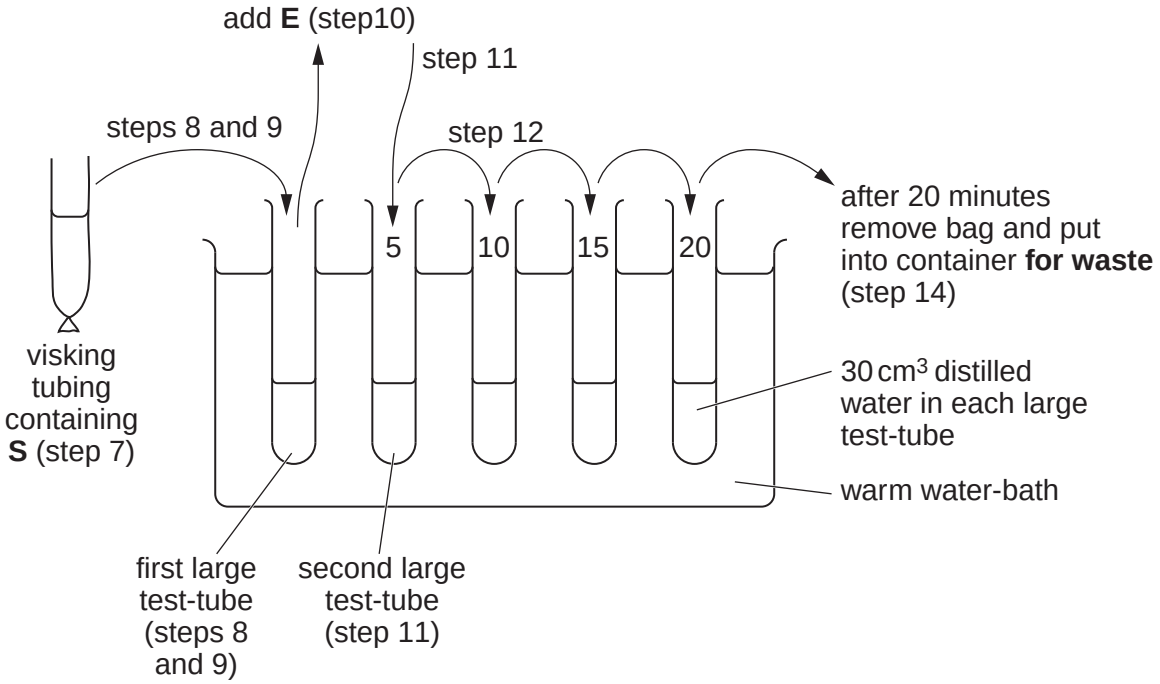


Fig. 1.1

You are advised to read steps 1 to 19 before proceeding.

Proceed as follows:

1. Label the large test-tubes with the times and put 30 cm^3 of distilled water into each one.

2. While you are doing steps 3 to 16 you will need to heat up the beaker of water labelled **for Benedict's test** so that it can be used later to carry out the Benedict's test.

   Decide on the temperature you plan to use for this water-bath.

   (i) State the temperature you have chosen in the space below.

   ..... °C [1]

3. Prepare a water-bath between 35 °C and 40 °C using the beaker of water labelled **for reaction**.

4. Put all the labelled large test-tubes into the water-bath labelled **for reaction**.

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

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

For Examiner's Use

7. Put 4 cm^3 of **S** into the open end of the bag.

8. Put the bag into the water in the first large unlabelled test-tube.

9. Allow 3 minutes for **S** in the bag to reach the same temperature as the distilled water surrounding the bag.

10. Put 4 cm^3 of enzyme **E** into the bag. You need to mix the enzyme with the substrate. Remove the bag, close the open end between your fingers. Holding both ends tightly, turn the bag upside down several times and this will mix the contents.

11. Put the bag back into the second large test-tube, labelled 5. Start timing the time course.

12. After 5 minutes remove the bag and contents and place it into the next large test-tube.

13. Repeat step 12 as shown in Fig. 1.1.

14. After 20 minutes, put your bag with its contents into the container labelled **for waste**.

15. At the end of the 20 minutes put the contents of each large test-tube into separate labelled small containers.

16. Test the contents of the small containers for reducing sugars using Benedict's solution. You will need to keep the volume of Benedict's solution the same for each test.

    Decide on the volume of sampling solution and Benedict's solution you plan to use for each test.

(ii) State the volume of sampling solution and Benedict's solution you have chosen.

volume of sampling solution .....

volume of Benedict's solution .....

[2]

17. In the small test-tubes, add the volumes of samples and Benedict's given in **(ii)**.

18. Put all the test-tubes into the water-bath **for Benedict's test** and immediately start timing.

19. Record the time for the change from blue to the first colour you see (ignore any further colour changes). If there is no colour change at 10 minutes, record "more than 600".

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

For Examiner's Use

[4]

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

.....

..... [1]

(v) Describe a suitable control for this investigation.

.....

..... [1]

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

.....

.....

.....

.....

..... [2]

A student investigated the effect of placing pieces of tissue from a potato in sucrose solutions of different concentrations.
At the start, each sample of potato tissue was weighed and the initial mass was recorded.
Then each sample of potato tissue was placed into a different concentration of sucrose solution.
After a set time the potato tissue was removed and the final mass of the potato tissue was recorded.
The change in mass and percentage change of mass for each sample of potato tissue was calculated.
The results of the student's investigation are shown in Table 1.1.

For Examiner's Use

Table 1.1

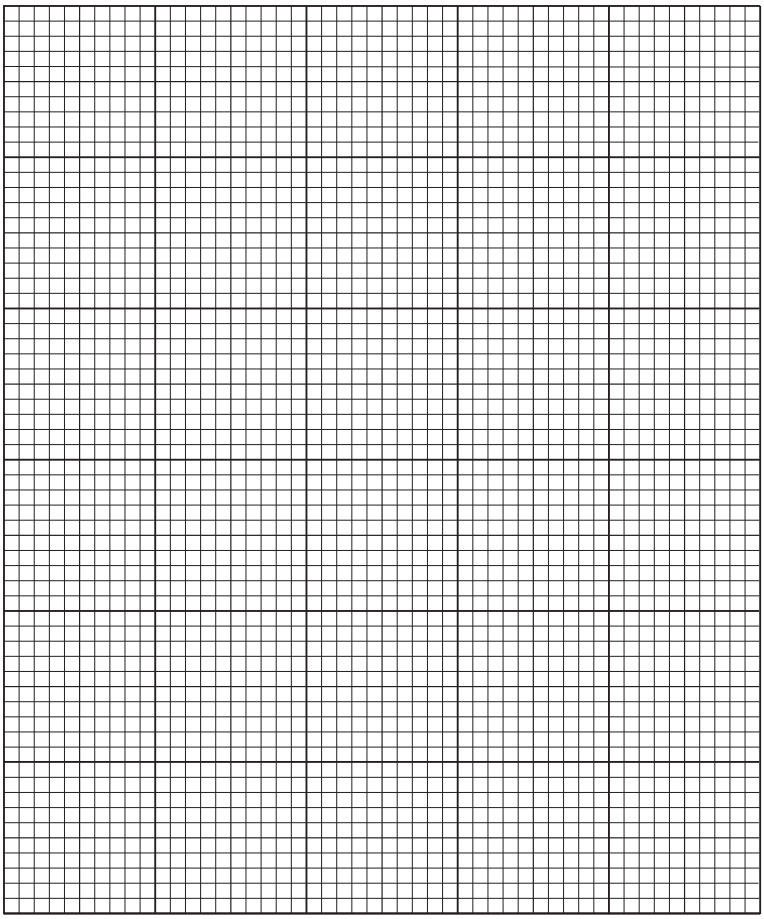
sucrose concentration / mol dm^{-3}	initial mass / g	final mass / g	change in mass / g	percentage change in mass
0.0	2.54	3.18	0.64	25.0
0.2	2.43	2.62	0.19	
0.4	2.40	2.45	0.05	2.0
0.6	2.71	2.30	−0.41	−15.0
0.8	2.44	2.49	0.05	2.0
1.0	2.58	1.80	−0.78	−30.0

(b) (i) Complete Table 1.1. [1]

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

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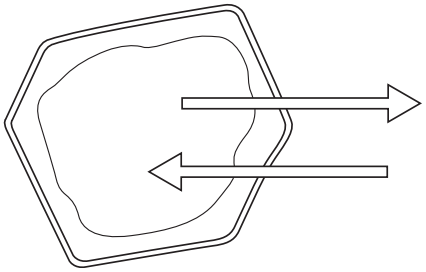
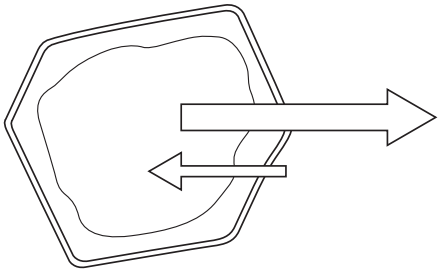
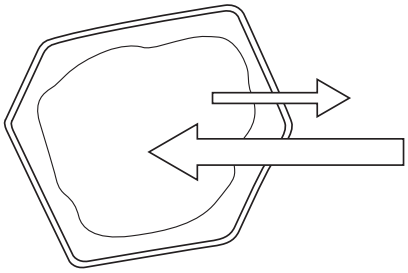
[4]

(iii) Draw a circle around the anomalous result on the graph. [1]

(iv) Complete Table 1.2 below.

For Examiner's Use

Table 1.2

diagrams of potato cells with arrows showing the direction and quantity of water movement	from your graph, state one example of a sucrose concentration where this water movement occurs **and** explain how you chose this example
Cell **A** 	example ..... explanation ....
Cell **B** 	example ..... explanation ....
Cell **C** 	example ..... explanation ....

[3]

(v) Explain, in terms of water potential, the movement of water in cell **A**.

.....

.....

.....

.....

.....

..... [2]

[Total: 22]

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2 **L1** is a slide of a stained transverse section through a plant leaf.
The plant belongs to a genus which grows widely especially in Chile and Argentina.

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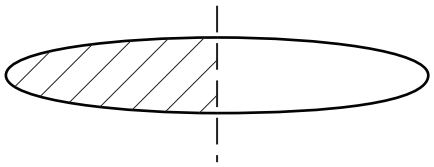


Fig. 2.1

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

Label the palisade mesophyll and the epidermis.

[6]

For Examiner's Use

(ii) Between the vascular bundles are openings (canals) surrounded by a wall of cells.

Make a large drawing of six adjacent (touching) cells making up this wall of cells (the inner wall of the canal).

Label with the letter **F** a stained feature inside one cell.

[6]

(iii) State one observable feature of the epidermis that supports the conclusion that this is a leaf from a plant growing in a dry habitat.

Suggest how this feature helps the plant to survive in a dry habitat.

.....

.....

..... [1]

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Fig. 2.2 is a photomicrograph of a transverse section through a leaf of a different plant species. This plant is native to Europe, North Africa and Asia but grows widely throughout the world.

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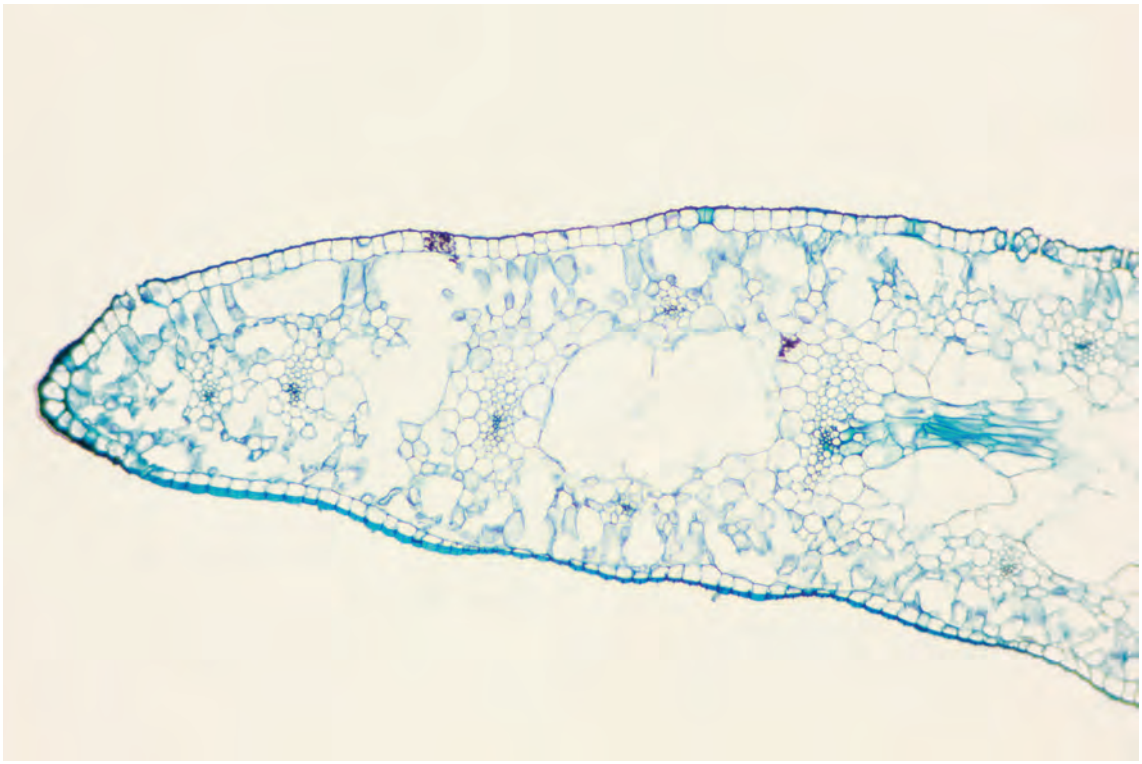


Fig. 2.2

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

Record your observations in the space you have prepared.

[5]

[Total: 18]

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Advanced Subsidiary Level and Advanced Level

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0011455449

BIOLOGY **9700/36**

Advanced Practical Skills 2 **October/November 2011**

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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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.
- 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 Enzyme **E** catalyses the hydrolysis of sucrose to glucose and fructose.

By adding enzyme **E** to different concentrations of sucrose the reducing sugars, glucose and fructose, will be formed. After a set time, the presence of reducing sugars can be determined by using Benedict's solution.

The end-point of this investigation is the time taken for the reducing sugars to change the colour of Benedict's solution from blue to the first colour you see (ignore any further colour changes).

You are required to find the sucrose concentration of a sample, **U**, by using the results of Benedict's tests on the reaction of enzyme **E** on different concentrations of sucrose.

You are provided with:

labelled	**contents**	**hazard**	**percentage concentration**	**volume / cm^3**
E	invertase solution	irritant	–	25
S	sucrose solution for serial dilution	none	10	25
U	sucrose solution	none	unknown	10
Benedict's solution	Benedict's solution	harmful irritant	–	60
W	distilled water	none	–	150

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

Fig. 1.1 shows how to make the first concentration of 5% sucrose solution.

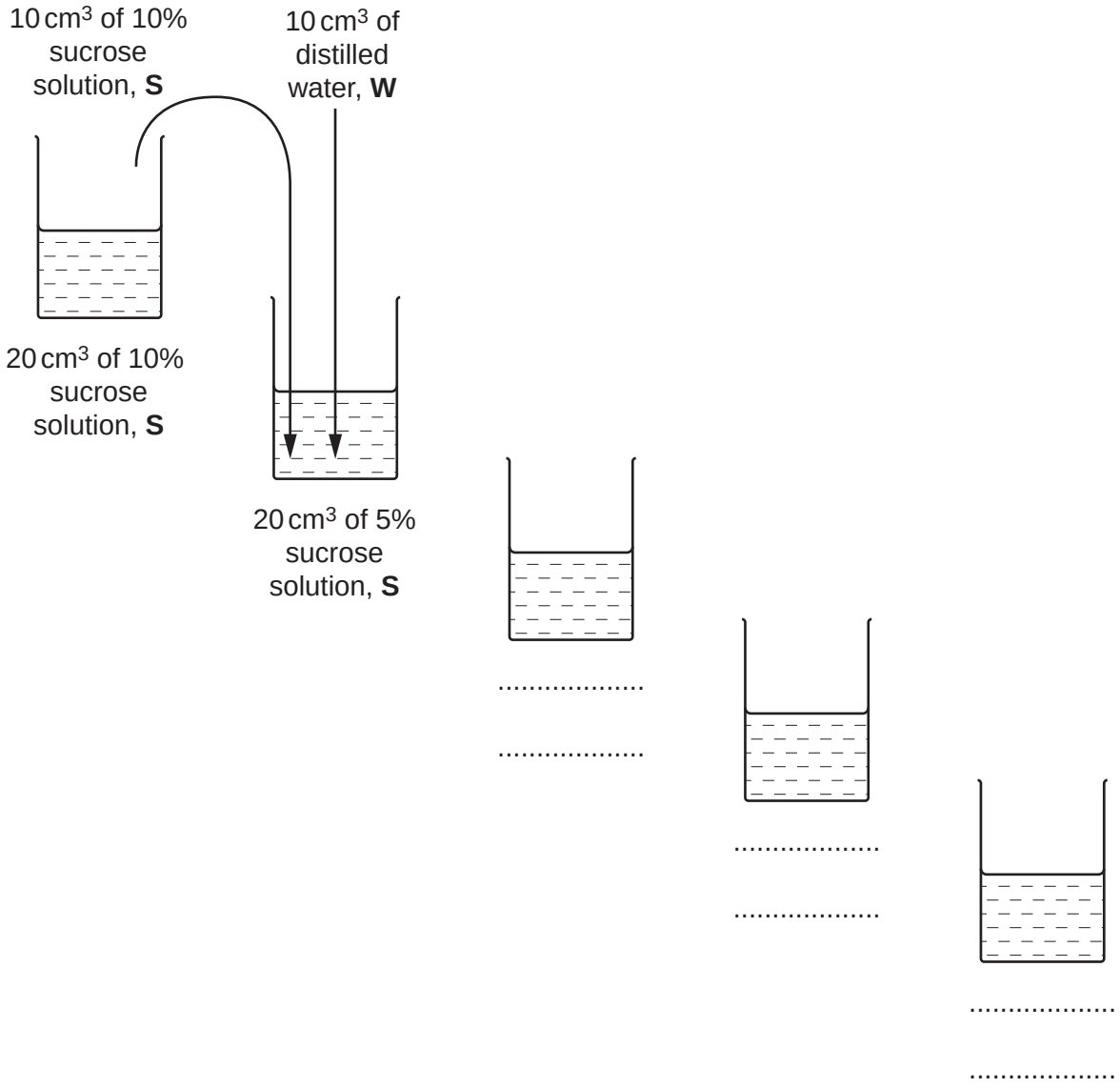


Fig. 1.1

(a) (i) Complete Fig. 1.1 to show how you will make **three** further concentrations of sucrose solution, **S**. [3]

As part of this investigation you are required to set up a suitable control.

(ii) Describe how you will set up this control using the apparatus provided.

.....

.....

..... [1]

You are advised to read steps 1 to 11 before proceeding.

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Proceed as follows:

1. Prepare the concentrations of sucrose solution as shown in Fig. 1.1, in the containers provided.

2. While you are doing steps 3 to 7 you will need to be heating up the water in the beaker labelled **for Benedict's test** to a temperature of more than 80 °C.

3. Put 2 cm^3 of the 10% sucrose solution, **S** into a labelled test-tube.

4. Put 2 cm^3 of **E** into the same test-tube.

5. Repeat steps 3 and 4 with each of the concentrations of sucrose and **U**.

6. Set up your control.

7. Put all the test-tubes into the water-bath labelled **for reaction**, between 35 °C and 40 °C, for 8 minutes.

8. After the test-tubes have been in the water-bath for 8 minutes, remove the test-tubes.

9. Put 4 cm^3 of Benedict's solution into each test-tube.

10. Put all the test-tubes into the water-bath at more than 80 °C and immediately start timing.

11. Record the time for the change from blue to the first colour you see (ignore any further colour changes). If there is no colour change after 10 minutes, record 'more than 600'.

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

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[4]

(iv) Using your results, complete the following statement.

The concentration of the unknown sucrose sample, **U**, is between .....% sucrose solution and .....% sucrose solution. [1]

(v) Suggest how you would modify this investigation to obtain a more accurate estimate of the sucrose concentration in sample **U**.

.....

.....

.....

.....

.....[2]

Peas are preserved by storing them in a freezer at low temperatures.
However, during storage peas lose some of their Vitamin C content.
The effect of temperature, on Vitamin C content, was investigated in peas at two temperatures, –12 °C and –6 °C.
The Vitamin C content of peas was measured before being placed in cold storage and then at 20 day intervals.

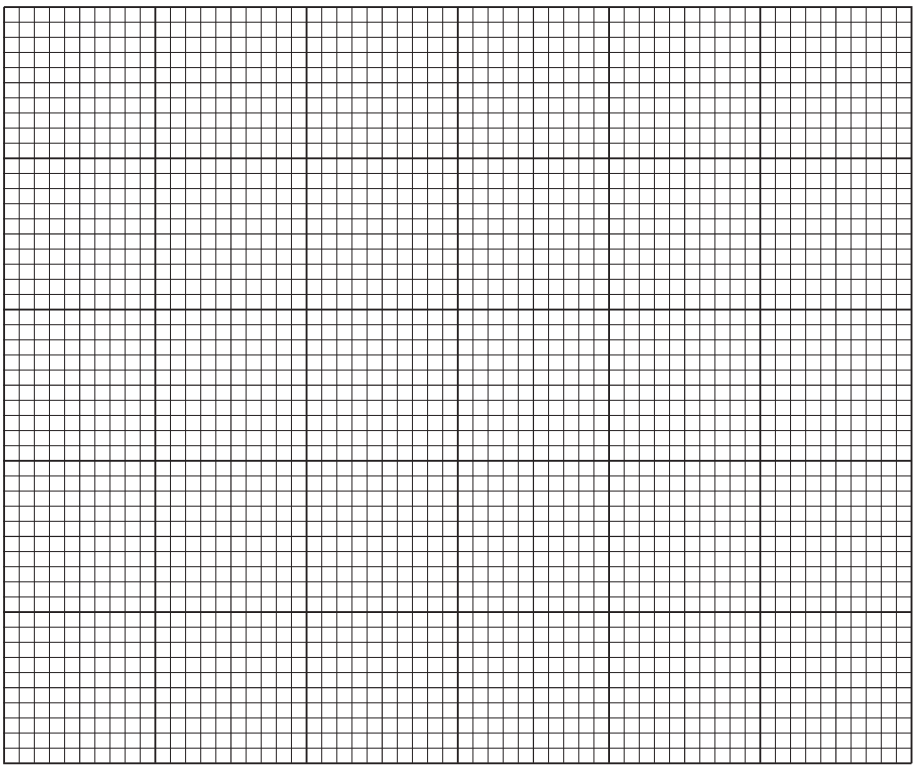
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The results are shown in Table 1.1.

Table 1.1

storage / days	percentage of Vitamin C content at –12 °C	percentage of Vitamin C content at –6 °C
0 (before freezing)	100	100
20	95	64
40	89	43
60	86	13

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



[4]

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(ii) A hypothesis was suggested that:

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Peas stored for 60 days at 10°C would contain no vitamin C.

State whether you support this hypothesis and use the results to explain the reasons for your answer.

.....

.....

.....

.....

.....

.....

.....

.....

.....[2]

(iii) Find the difference in Vitamin C content of peas at 26 days stored at the two different temperatures.

Show on your graph where you obtained the data.

.....% [2]

[Total: 19]

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

This plant genus is found in Africa, Asia, Australasia, Europe and North America.

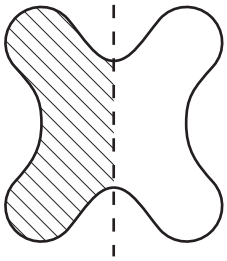


Fig. 2.1

(a) **(i)** Draw a large plan diagram of the part of the stem indicated by the shaded area in Fig. 2.1.

Label the xylem.

[6]

For Examiner's Use

Hair-like structures called trichomes are attached to the epidermal cells.

For Examiner's Use

Choose a whole trichome and its attached epidermal cells which can be clearly observed.

(ii) Make a large drawing of a whole trichome and five epidermal cells at the base of the trichome.

Label the trichome and one epidermal cell.

[6]

(iii) Suggest a possible function for the trichome on this stem.

.....[1]

Fig. 2.2 is a photomicrograph of a transverse section through a stem of a different plant species. This plant genus is found in Europe, Middle East and North Africa.

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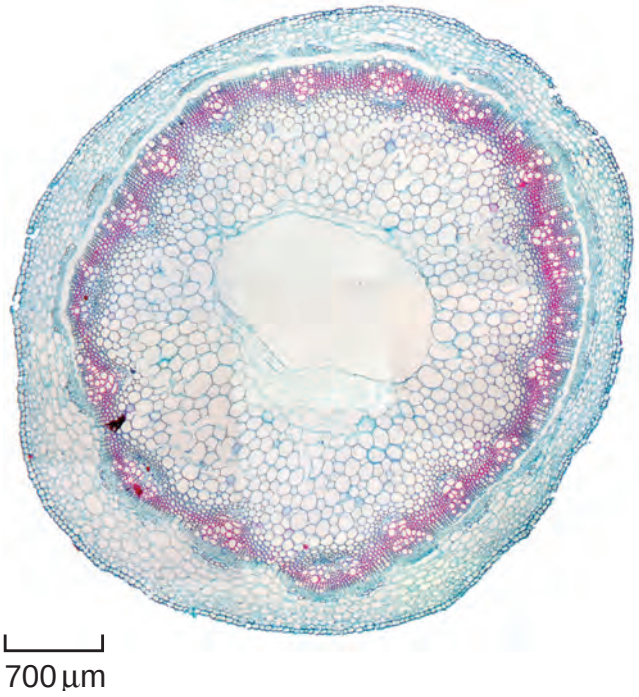


Fig. 2.2

(b) (i) Using the scale bar calculate the magnification of Fig. 2.2.

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

magnification x ..... [3]

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(ii) Prepare the space below so that it is suitable for you to record **three** observable differences between the specimens on **N1** and in Fig. 2.2.

Record the observations in the space you have prepared.

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[5]

[Total: 21]

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