



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

CANDIDATE  
NAME

CENTRE  
NUMBER

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CANDIDATE  
NUMBER

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**BIOLOGY**

**9700/31**

Paper 31 Advanced Practical Skills

**October/November 2008**

**2 hours**

Candidates answer on the Question Paper.

Additional Materials: As listed in the confidential instructions

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.  
 Write in dark blue or black pen in the spaces provided on the Question Paper.  
 You may use a pencil for any diagrams, graphs or rough working.  
 Do not use staples, paper clips, highlighters, glue or correction fluid.  
 DO **NOT** WRITE IN ANY BARCODES.

Answer **both** questions.  
 The number of marks is given in brackets [ ] at the end of each question or part question.  
 You are advised to spend an hour on each question.  
 At the end of the examination, fasten all your work securely together.

For Examiner's Use	
1	
2	
<b>Total</b>	

This document consists of **10** printed pages and **2** blank pages.



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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1 You are required to investigate the effects of two solutions, **S1** and **S2**, on the cells of onion epidermal tissue.

- Solution **S1** is a  $1.0 \text{ mol dm}^{-3}$  solution of sucrose.
- Beaker **W** contains distilled water.
- Beaker **O** contains distilled water and two pieces of onion.

Use the distilled water in the beaker labelled **W** and solution **S1** to produce a  $0.5 \text{ mol dm}^{-3}$  solution of sucrose and label it as **S2**.

It is very important to stop the onion from drying out. Place a few drops of water on a microscope slide.

Remove one piece of onion from beaker **O** and using forceps or fingers peel off the inner concave epidermis as shown in Fig. 1.1. Pull the epidermis from the top of the piece towards the tip. Immediately place in distilled water on the microscope slide as shown in Fig. 1.1.

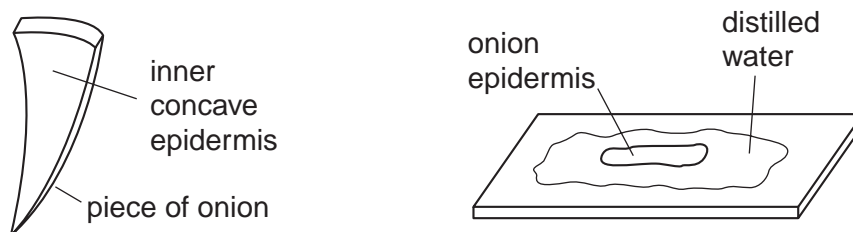


Fig. 1.1

Pour enough distilled water into the Petri dish to cover the base.

Using the scalpel carefully cut one piece of the epidermis approximately 5 mm by 5 mm and place into the distilled water in the Petri dish.

Use the second piece of onion if required.

Repeat until you have at least three small squares of epidermis floating in the Petri dish.

Mount one of the squares on a microscope slide in **distilled water**.

Cover with a cover slip and label the slide.

Repeat with two more squares of epidermis, mounting one in solution **S1** and another in solution **S2**.

Examine each of the slides using your microscope and carefully observe the state of the cells (**you may need to partially close the iris diaphragm or reduce the light intensity to increase the contrast**).

- (a) Estimate the degree of plasmolysis of five adjacent cells for slide **S1** first, using the reference diagrams in Fig. 1.2. Use the numbers given in Fig. 1.2 to make your estimate. Repeat with the slides for distilled water and **S2**.

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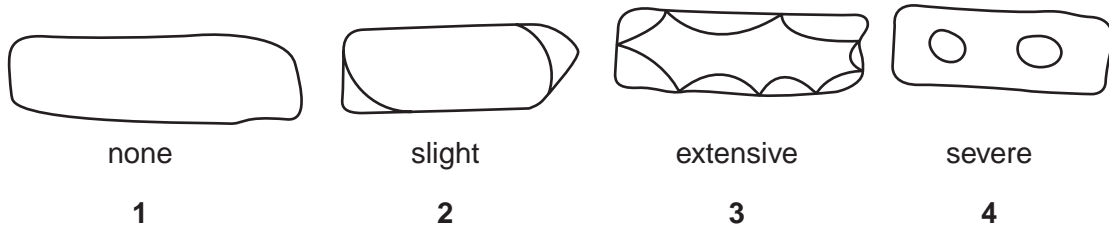


Fig. 1.2

- (i) Prepare and use the space below to present your observations from the slides made with **distilled water**, **S1** and **S2**, and a numerical estimate of the mean degree of plasmolysis for each of these solutions.

[6]

- (ii) Describe and explain your observations from the slides made with **distilled water**, **S1** and **S2**.

.....

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..... [3]

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

1. ....

.....

2. ....

..... [2]

**(iv)** Suggest how you would improve this experiment.

.....

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..... [3]

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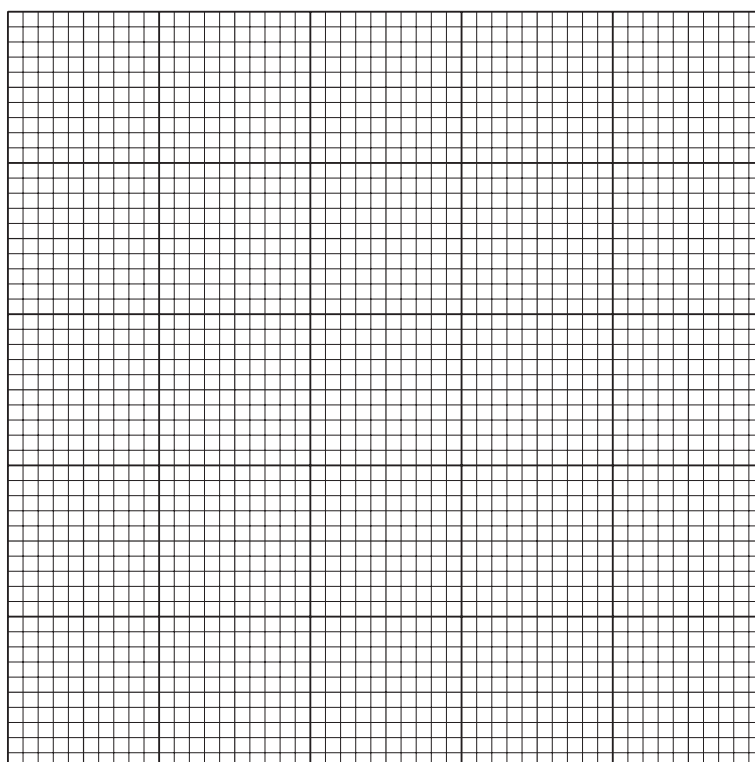
(b) In a similar investigation involving a range of different temperatures and 0.25 mol dm<sup>-3</sup> sucrose solution, a student obtained the results shown in Table 1.1.

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**Table 1.1**

	percentage plasmolysis of cells in 0.25 mol dm <sup>-3</sup> sucrose solution					
temperature °C	batch 1	batch 2	batch 3	batch 4	batch 5	mean
5	22	19	20	20	21	20
15	65	63	66	62	63	
25	79	74	76	78	75	76
35	83	85	86	45	87	
45	85	85	86	84	85	85
55	84	82	86	85	86	85

- (i) Complete Table 1.1 by calculating the missing values taking into account any anomalous values. [1]
- (ii) Plot a graph of temperature against the mean percentage plasmolysis of the cells.



[3]

- (iii) State the temperature at which 50% plasmolysis occurred.

..... [1]

(c) The student's hypothesis was:

**Percentage plasmolysis is proportional to temperature.**

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Draw an appropriate conclusion to the student's experiment.  
You should include in your conclusion whether the experimental data support the hypothesis and produce a revised hypothesis if necessary.

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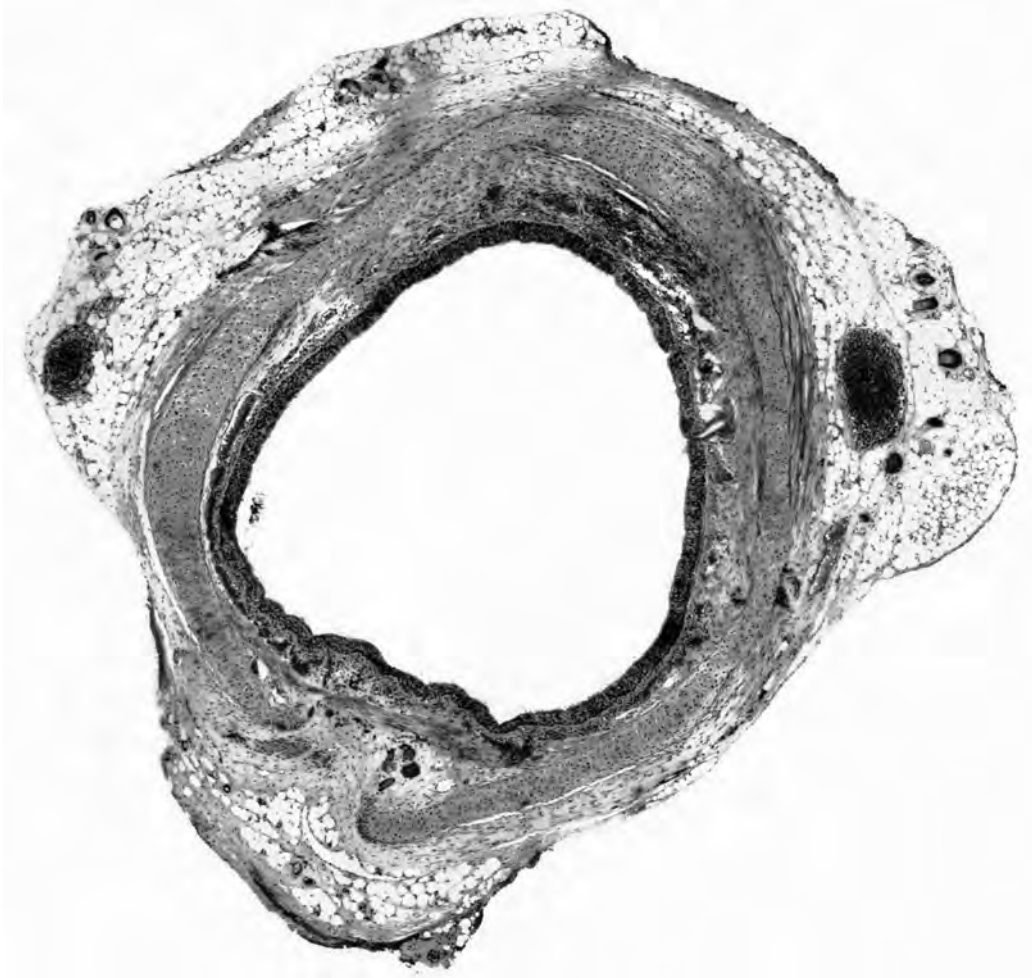
.....

..... [2]

[Total: 21]

- 2 Fig. 2.1 is a photomicrograph of a transverse section through a tubular structure from an animal.

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**Fig. 2.1**

- (a) (i) Draw a large low-power plan diagram of the specimen in photomicrograph Fig. 2.1.

[4]

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- (ii) Fig. 2.2 shows the same photomicrograph as Fig. 2.1 and includes the image of an eyepiece graticule.
- Fig. 2.3 shows a photomicrograph of a stage micrometer scale using the same lenses as Fig. 2.2 and includes an image of the same eye piece graticule.

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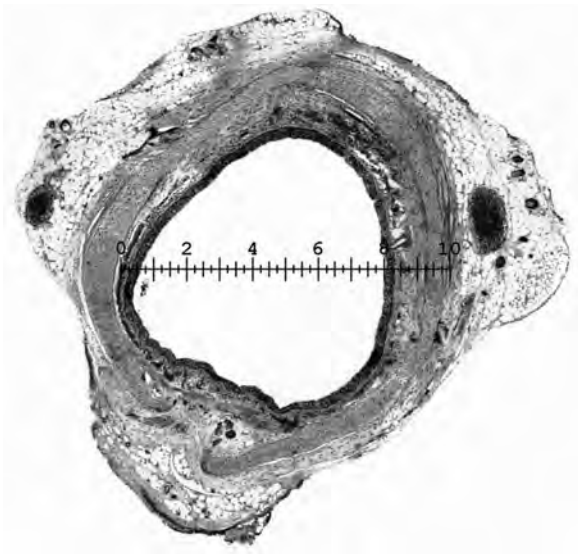


Fig. 2.2

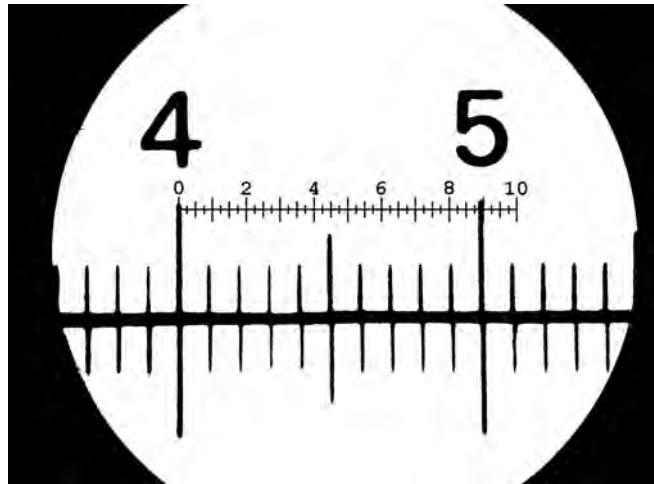


Fig. 2.3

Each division on the stage micrometer scale is 0.1 mm

Count the number of the eyepiece graticule units across the lumen of the structure in Fig. 2.2.

number of eyepiece graticule units .....

Count the number of eyepiece graticule units that match an exact number of stage micrometer scale divisions.

number of eyepiece graticule units .....

number of stage micrometer scale divisions .....

Use this information to calculate the actual width of the lumen in Fig. 2.2.

Show your working.

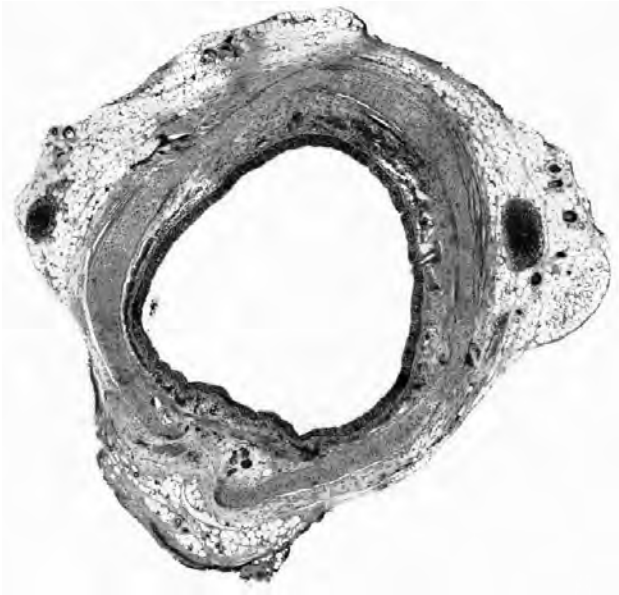
actual width of the lumen in Fig. 2.2. ....

[4]

(iii) Suggest how an error in measuring the width of the lumen could occur.

.....  
..... [1]

(b) Fig. 2.1 is repeated below. Fig. 2.4 shows another transverse section through a different tubular structure from the same organism at the same scale.



**Fig. 2.1 (repeated)**



**Fig. 2.4**

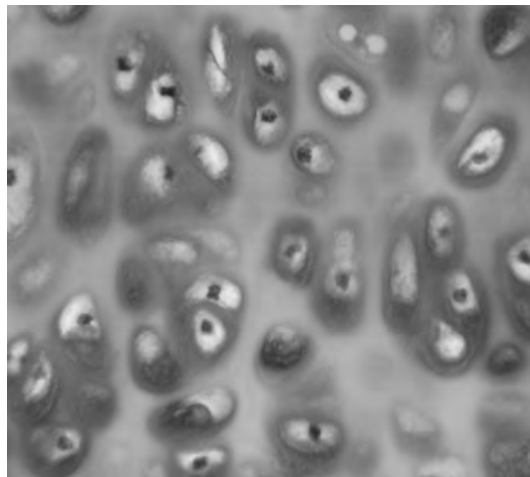
(i) Prepare the space below so that it is suitable for you to compare and contrast the specimens on Fig. 2.1 and Fig. 2.4 and then record your observations.

- (ii) Both the specimens on Fig. 2.1 and Fig. 2.4 are involved in the transport of substances.

State one observation that relates to this function.

.....  
.....  
..... [1]

- (c) Fig. 2.5 is a high power photomicrograph of part of the specimen shown in Fig. 2.1.



**Fig. 2.5**

In the space below make a labelled drawing of a group of five representative cells that are close together. On Fig. 2.5 draw a ring around the cells that you have drawn.

[4]

[Total: 19]

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