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

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

4546753867

BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills **October/November 2009**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use 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 **all** questions.
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	
3	
Total	

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

You are reminded that you have TWO hours to complete Questions 1, 2 and 3.
You may start with either Question 1 or Question 3, which require the use of apparatus or a microscope.
At the start of the second hour you should begin the work for the other question, either 1 or 3.
Question 2 does not require any apparatus or the use of a microscope, you should plan your work so that you complete this question whenever you have spare time.
It is anticipated that each question will take you approximately 40 minutes.
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.
You will gain marks for recording your results according to the instructions.

For Examiner's Use

1 You are required to estimate the concentration of sugar in an extract from the phloem of a flowering plant.

You are provided with:

- $2\,cm^3$ of a solution extracted from phloem in a test-tube, labelled **P**
- a range of sucrose solutions of known concentration in beakers, labelled **W** to **Z**, as shown in Table 1.1

[H] • $20\,cm^3$ of Benedict's solution, labelled **B**

[H] • $20\,cm^3$ of dilute hydrochloric acid, labelled **H**

- $50\,cm^3$ of sodium hydrogen carbonate solution, labelled **S**.

Table 1.1 shows the concentration of sucrose in each beaker.

Table 1.1

beaker	sucrose concentration / g 100 cm^{-3}
W	5.00
X	2.50
Y	1.00
Z	0.25

1. Set up a water-bath with hot water. The water-bath should not be more than one third full. Heat the water until it boils.

While you are waiting for the water to boil, carry on to instructions 2 to 5 and prepare the space at (a)(i) to record your results.

2. Label four test-tubes, **W** to **Z**.

3. Use the large syringe to add $2\,cm^3$ of:

- solution **W** to test-tube **W**
- solution **X** to test-tube **X**
- solution **Y** to test-tube **Y**
- solution **Z** to test-tube **Z**.

4. Use the small syringe to add 1 cm^3 of dilute hydrochloric acid to tubes **W**, **X**, **Y**, **Z** and **P**.

5. Gently shake each test-tube.

6. When the water is boiling, place all the test-tubes into the water-bath and leave them in the boiling water for **three** minutes.

7. After this time, remove the test-tubes from the water-bath using a test-tube holder and place them in the test-tube rack.

8. Use the large syringe to add 5 cm^3 of sodium hydrogen carbonate solution to each test-tube. The mixture will fizz and rise up the test-tube.

9. Make sure that the temperature of the water-bath is between 80 °C and 90 °C.

10. When the fizzing stops, use the small syringe to add 1 cm^3 of Benedict's solution to test-tube **W** and place the test-tube in the hot water-bath. Immediately start timing.

11. Observe the test-tube very carefully for the first sign of a colour change. As soon as you see this, record the time taken for the colour to change.

12. Remove the test-tube from the water-bath and put it in the test-tube rack.

13. Repeat steps 9 to 12 for test-tubes **X**, **Y**, **Z** and **P**.

(a) **(i)** Prepare and use the space below to record all your results.

[6]

(ii) Use your results to estimate the concentration of sugar in **P**.

.....

..... [2]

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(b) You used syringes to measure the volumes of the solutions used.

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

State the degree of uncertainty in using the small syringe to measure the volumes ..... [1]

(c) **(i)** Identify a significant source of error in estimating the sugar concentration in **P**.

.....

..... [1]

(ii) Suggest how you would improve the investigation.

.....

.....

.....

.....

.....

..... [3]

(d) A student obtained another sample from the phloem and tested it using the same method. The concentration of sugar was higher than you found.

Suggest one reason why the concentration of sugar in the phloem is not always the same.

.....

..... [1]

[Total: 14]

2 Fig. 2.1 is a photomicrograph of part of a transverse section of a stem of a flowering plant.

For Examiner's Use

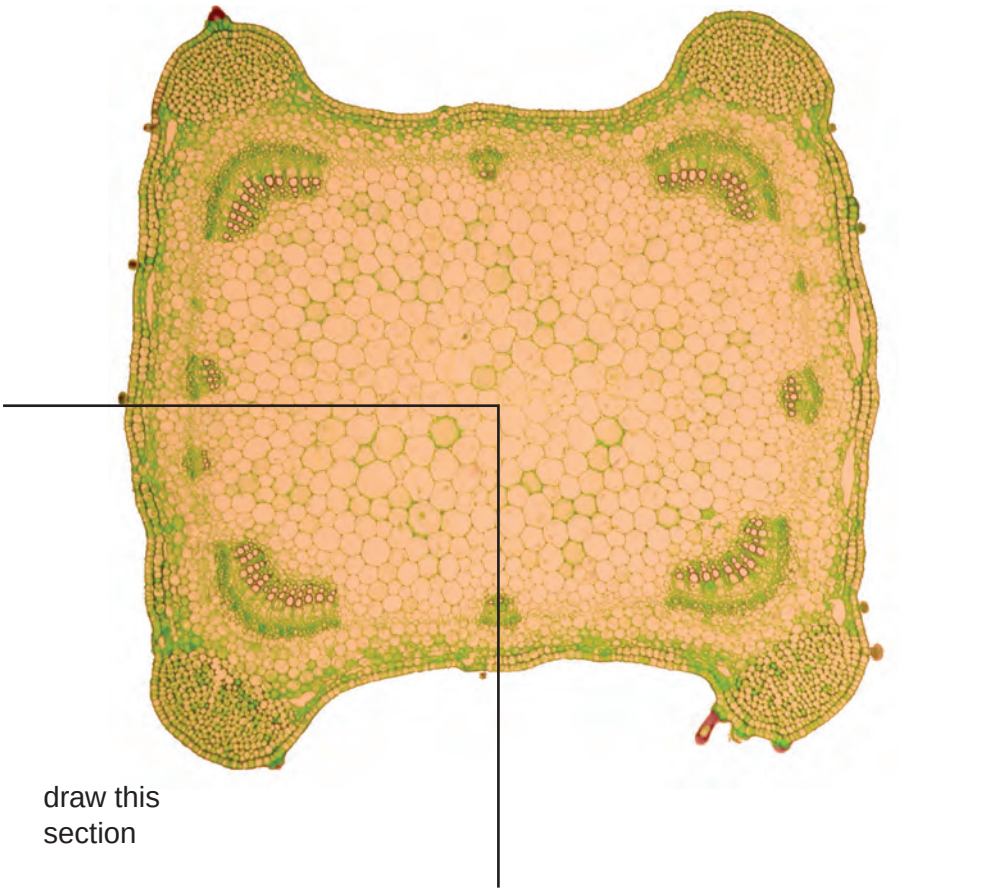


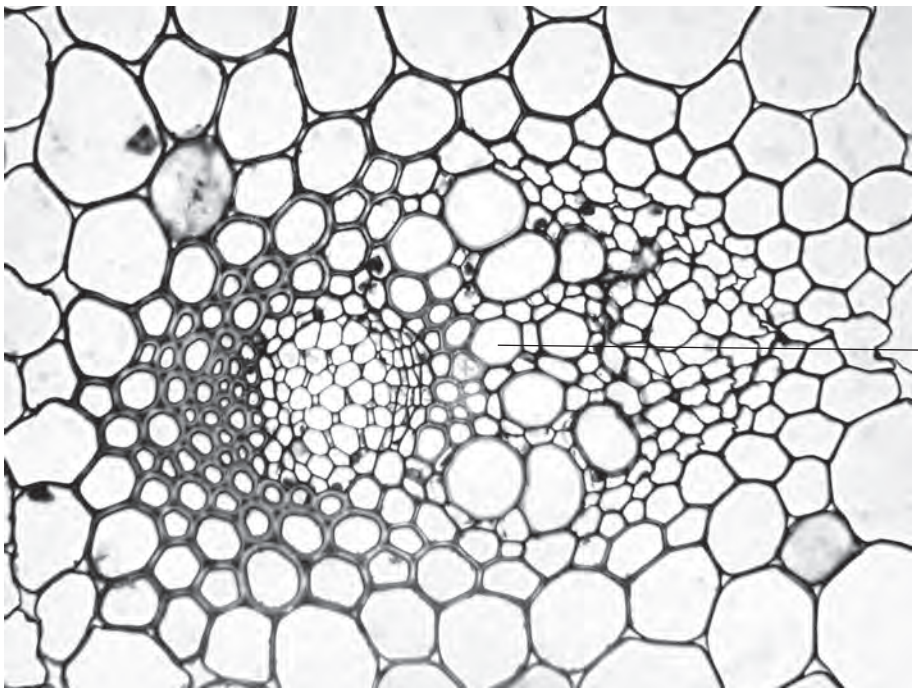
Fig. 2.1

(a) Draw a large, labelled plan diagram of the part of the stem shown in Fig. 2.1.

On your diagram add **two** annotations to describe the **visible** appearance of two tissues in Fig. 2.1.

[6]

Fig. 2.2 is a photomicrograph of part of a stem of a different flowering plant viewed under high-power.



magnification × 400

Fig. 2.2

(b) Using Fig. 2.2 make a large drawing of cell **X** and all the cells that are touching it. Start with the phloem and include a companion cell.

Label cell **X** on your drawing.

[6]

[Total: 12]

3 Methylene blue stains dead cells but is decolourized by living cells so they will appear white or clear.

For Examiner's Use

You are required to observe the colour of methylene blue when added to

- boiled yeast, **A1**
- yeast in a high concentration of sodium chloride solution, **A2**
- yeast in a glucose solution, **A3**.

1. Label three microscope slides **A1**, **A2** and **A3**.
2. Place **one drop** of **A1** onto slide **A1** and add **one drop** of methylene blue.
3. Use a glass rod to mix carefully.
4. Leave for five minutes.
5. Repeat steps 2 to 4 with solutions **A2** and **A3.**
6. Add a coverslip to each slide.
7. Use the paper towel to dry off any liquid around the coverslip.
8. View the slides using the microscope.

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

[2]

(ii) Explain the appearance of the yeast cells in **A1** and **A3**.

.....

..... [1]

In a similar investigation, a student recorded the activity of yeast cells in a glucose solution to which different concentrations of sodium chloride had been added. The student counted the number of bubbles of carbon dioxide released in three minutes.

The student's results are shown in Table 3.1.

Table 3.1

sodium chloride concentration / %	activity of yeast cells / number of carbon dioxide bubbles released in three minutes			mean activity of yeast / number of bubbles min^{-1}
	trial 1	trial 2	trial 3	
0.0	165	154	150	52
1.0	174	165	159	55
1.5	177	180	168	
3.0	98	97	94	32
5.0	39	48	45	15

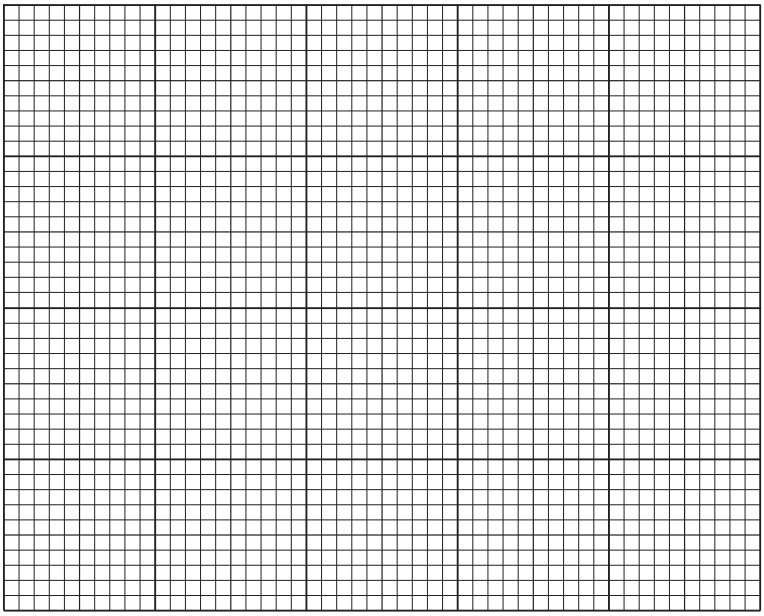
(b) (i) Complete Table 3.1 by calculating the missing value for the mean activity of yeast.

Show all the steps in your calculation.

Write your answer in Table 3.1. [2]

(ii) Plot a graph of these data shown in Table 3.1.

For Examiner's Use



[4]

(iii) Describe the results shown in your graph.

.....

.....

.....

..... [2]

(iv) From your graph estimate the mean activity of yeast in a 2.0% sodium chloride solution.

..... [1]

(v) Explain the difference in the activity between

0.0% and 1.5% sodium chloride solution

.....

.....

3.0% and 5.0% sodium chloride solution.

.....

..... [2]

[Total: 14]

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