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

CANDIDATE NAME

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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	

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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**.

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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]

For Examiner's Use

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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]

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

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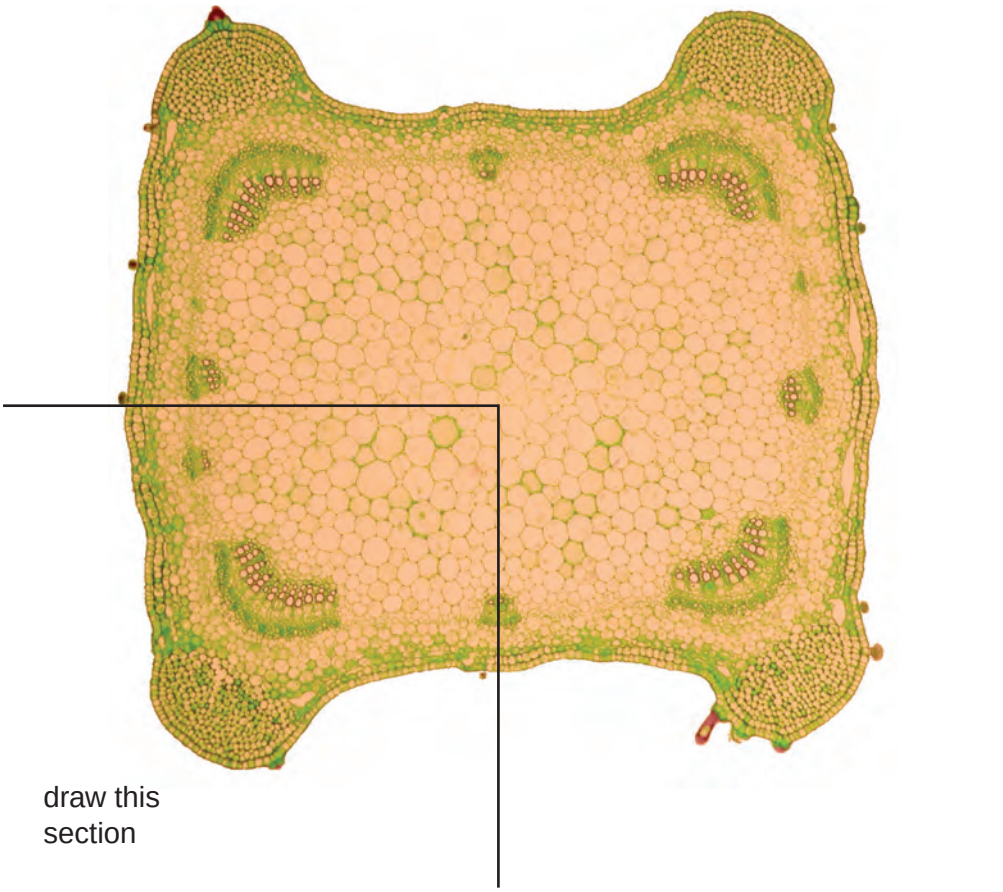


Fig. 2.1

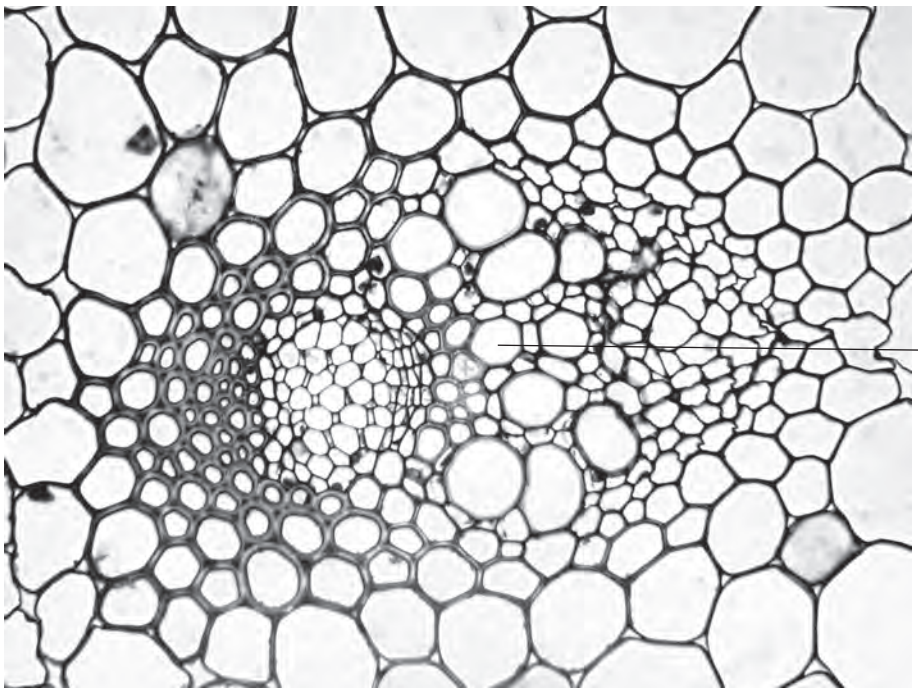
(a) Draw a large, labelled plan diagram of the part of the stem shown in Fig. 2.1.

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.

For Examiner's Use



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]

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

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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]

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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.

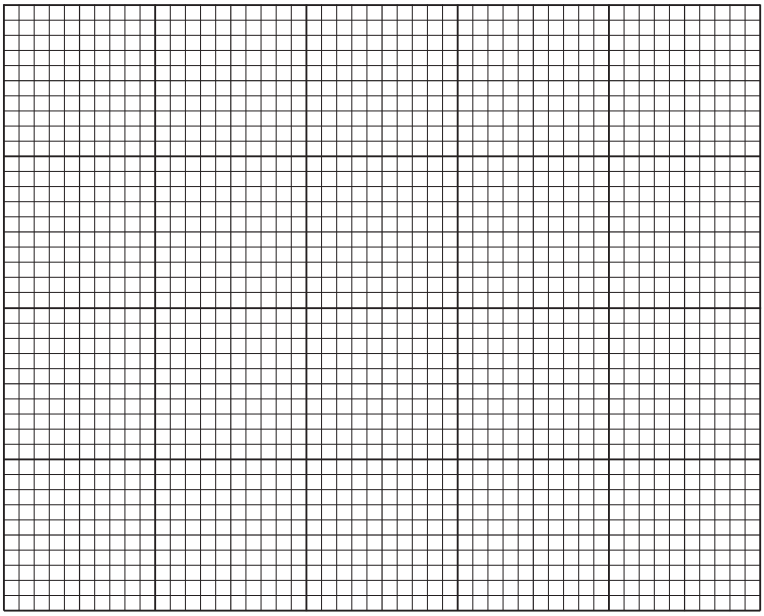
Show all the steps in your calculation.

Write your answer in Table 3.1. [2]

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(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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CANDIDATE NAME

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4114094444425

BIOLOGY **9700/32**

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

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions

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You are reminded that you have TWO hours to complete Questions 1, 2 and 3 in the practical examination.
Questions 1 and 3 use apparatus or a microscope. You should start with either Question 1 or 3. It is expected that Question 1 will take you approximately one hour. Question 3 should take you approximately 20 minutes.
Question 2 does not require apparatus or the use of a microscope, you should complete this question whenever you have spare time, most likely after you have completed Question 3.
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.

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1 You are required to identify four samples **S1**, **S2**, **S3** and **S4**.

One sample contains starch suspension which a person was about to eat.

One sample was taken from the mouth two minutes after being eaten.

One sample was taken from the stomach ten minutes after being eaten.

One sample was taken from the small intestine two hours after being eaten.

Starch is hydrolysed to glucose by enzymes in the mouth and small intestine. These enzymes are not active in the stomach. The starch suspension moves from the mouth to the stomach to the small intestine.

(a) (i) Suggest what happens to the concentrations of starch and glucose after the starch suspension has been eaten.

mouth .....

.....

stomach .....

.....

small intestine .....

..... [2]

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Using only the materials provided test the four samples **S1**, **S2**, **S3** and **S4**. You will need to consider carefully how you will carry out the tests so that you can determine the relative concentrations of starch and glucose.

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(ii) Prepare the space below and record:

- the tests you used
- the quantities of the samples and reagents
- and your results.

[7]

(iii) Using the information provided and your results, complete Table 1.1 below to identify the samples.

For Examiner's Use

Table 1.1

sample from	sample identified
starch about to be eaten	……
mouth	……
stomach	……
small intestine	……

[3]

(iv) Explain your answer to **(a)(iii)**.

.....

.....

.....

.....

.....

.....

..... [3]

(b) A student wanted to obtain a **quantitative** measurement of the glucose concentrations.

Suggest how the student could modify this investigation to obtain quantitative measurements of the glucose concentrations.

.....

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..... [3]

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A student investigated the effect of increasing the starch concentration on the time taken for 2 cm^3 of a 1% solution of amylase to hydrolyse the starch.

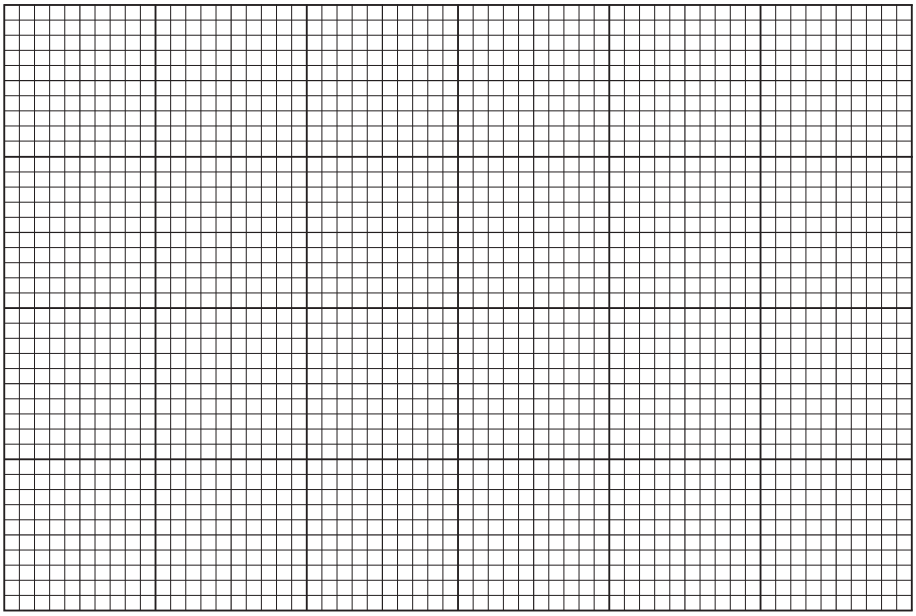
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The student's results are shown in Table 1.2.

Table 1.2

concentration of starch / g dm^{-3}	mean time taken for 1 cm^3 of starch to be hydrolysed / seconds
5	12
15	39
20	53
30	79

(c) (i) Plot a graph of these data shown in Table 1.2.



[4]

(ii) Use your graph to find the rate of hydrolysis by finding the gradient of the line.

Show on your graph where you took the readings to calculate the gradient. [1]

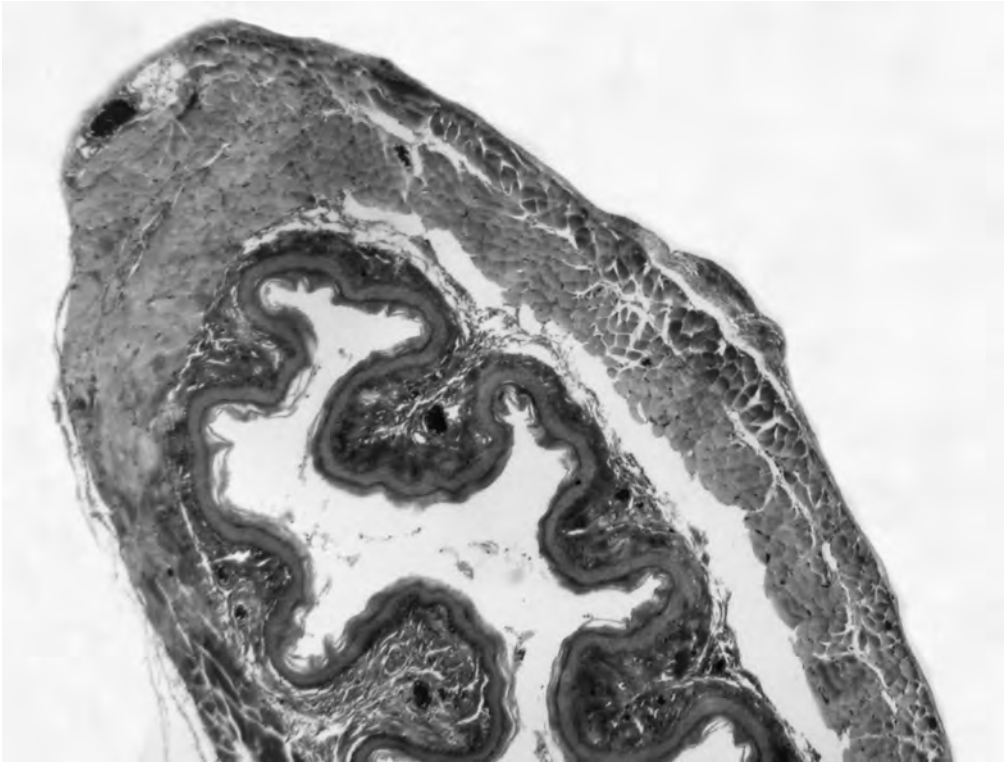
Show your working.

rate of hydrolysis ..... g dm^{-3} s^{-1} [1]

[Total: 24]

2 **(a)** Fig. 2.1 is a photomicrograph of a transverse section through a tubular organ of a mammal.

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magnification × 100

Fig. 2.1

Draw a large plan diagram of the section shown in Fig 2.1.

No labels are required.

[4]

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(b) Fig. 2.2 is a photomicrograph showing a high-power view of the surface of a leaf.

For Examiner's Use



magnification × 400

Fig. 2.2

(i) Make a large, labelled drawing to show two guard cells and the complete cells that surround them. Do **not** draw more than six cells in total.

Show on Fig. 2.2 the cells that you have drawn.

[5]

(ii) Calculate the actual length in micrometres (μm) of one of the guard cells.

Show all the steps in your calculation.

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..... μm [2]

[Total: 11]

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3 You are provided with two samples of plant material.

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A suspension of leaf cells in a dish, labelled **L**.

A piece of peeled potato tuber in a dish, labelled **P**.

1. Label four slides, two with **L** and two with **P**.

2. Using a pipette, place one drop of **L** on each of the two slides labelled **L**.

[H] 3. Add one drop of iodine solution to one of the slides labelled **L**.

4. Using a sharp blade or scalpel, cut the potato piece to show a fresh surface.

5. Carefully scrape off some potato cells from the fresh surface and smear them onto the middle of each of the two slides labelled **P**.

[H] 6. Add one drop of iodine solution to one of the slides labelled **P**.

7. Add a coverslip to each slide and use a paper towel to absorb the excess liquid.

8. Use your microscope to search each slide carefully and record the observations of the cells you can find.

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

[3]

(b) Explain your observations.

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.....

.....

.....

..... [2]

[Total: 5]

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2165956600

BIOLOGY **9700/33**

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

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 You are provided with five solutions **S1**, **S2**, **S3**, **S4** and **S5**.

These solutions contain starch or protein or reducing sugar in varying concentrations or any two of these or none of them.

Carry out tests, using only the reagents provided, to identify the contents of each of the solutions. Use your results to decide whether the concentration of each of the substances you identify is high or low.

You are required to identify two of the solutions, **S1** to **S5**, that could be mixed together to feed a young mammal.

The mixture needs to contain

- a high concentration of starch,
- a high concentration of protein and
- a low concentration of reducing sugar.

The mixture **must be made up from equal volumes of only two of the solutions, S1 to S5.**

You will need to consider carefully how you will carry out the tests so that you can determine the relative concentrations of the three substances.

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(a) (i) Complete the table below to show how you will carry out the tests on each solution.

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test for	method for test	expected results		
		negative	low concentration	high concentration
starch				
reducing sugar				
protein				

[4]

(ii) Prepare the space below and record your observations of the tests on all the solutions.

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[6]

(iii) Use your observations to state the **two** solutions that should be mixed in equal volumes to provide the correct mixture to feed the young mammal.

.....[1]

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QUESTION 1 CONTINUES ON PAGE 6 OVERLEAF

A student investigated the time taken for the complete digestion of starch by an enzyme found in the saliva of 25 individuals of a species of mammal.

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A sample of saliva was collected from each individual and mixed with 5 cm^3 of 1% starch suspension. Samples of the mixture were tested for the presence of starch.

The student recorded the time taken for the complete digestion of starch.

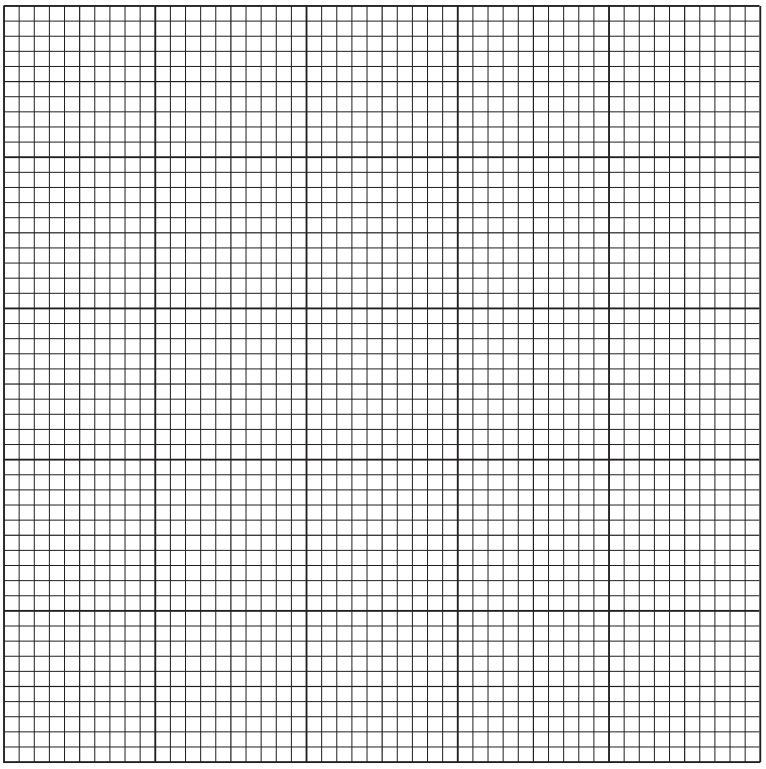
The investigation was repeated with the same individuals on the following day.

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

Table 1.1

time taken for complete digestion of starch / min	number of individuals	
	day 1	day 2
35	2	8
40	6	10
45	9	4
50	5	2
55	3	1

(b) (i) Plot these data shown in Table 1.1.



[4]

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(ii) Describe the patterns in the results.

For Examiner's Use

.....

.....

.....

.....

.....

.....

.....[3]

(iii) Suggest a reason for the difference between the results for day 1 and day 2.

.....

.....[1]

(iv) Suggest how you might control the variables in this investigation to compare a different species of mammal with the mammal studied.

.....

.....

.....

.....

.....

.....

.....[3]

[Total: 22]

2 **J1** is a slide of a stained transverse section of a leaf.

For Examiner's Use

You are not expected to have studied this leaf.

(a) **(i)** Draw a large low-power plan diagram of the midrib of the leaf as shown in the shaded area in Fig. 2.1.

Label the upper surface and one vascular bundle.

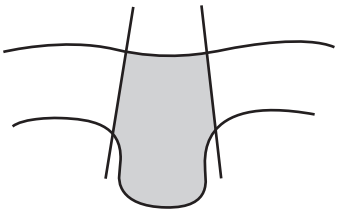


Fig. 2.1

[5]

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J1 is a leaf from a plant which grows in dry, sunny habitats.

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(ii) Describe **one** visible adaptation of this leaf and suggest a possible advantage to the plant.

.....

.....

.....

.....[2]

(iii) Using the eyepiece graticule and slide **J1**, find the ratio of the thickness of the midrib compared to the thickness of the lamina.
The position of the midrib and the lamina are shown in Fig. 2.2.

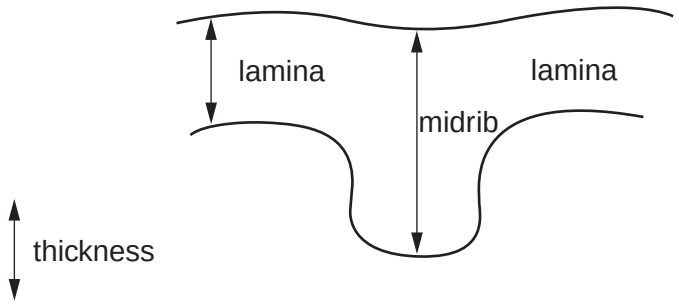


Fig. 2.2

You must show your measurements and all the steps in your calculation.

[3]

(b) (i) Make a large, high-power drawing of a group of three cells from the upper epidermis and the cells touching them.

Label a cell wall.

For Examiner's Use

[4]

(ii) Prepare the space below so that it is suitable for you to record the observable differences between the upper and lower epidermis of the leaf.

Record your observations in the space you have prepared.

[4]

[Total: 18]

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