Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2022

Centre Number

Candidate Number

Biology

Assessment Unit AS 3
assessing
Practical Skills in AS Biology

[SBY31]

SBY31

FRIDAY 10 JUNE, AFTERNOON

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all seven** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 50.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
You are reminded of the need for good English and clear presentation in your answers.
Use accurate scientific terminology in all answers.

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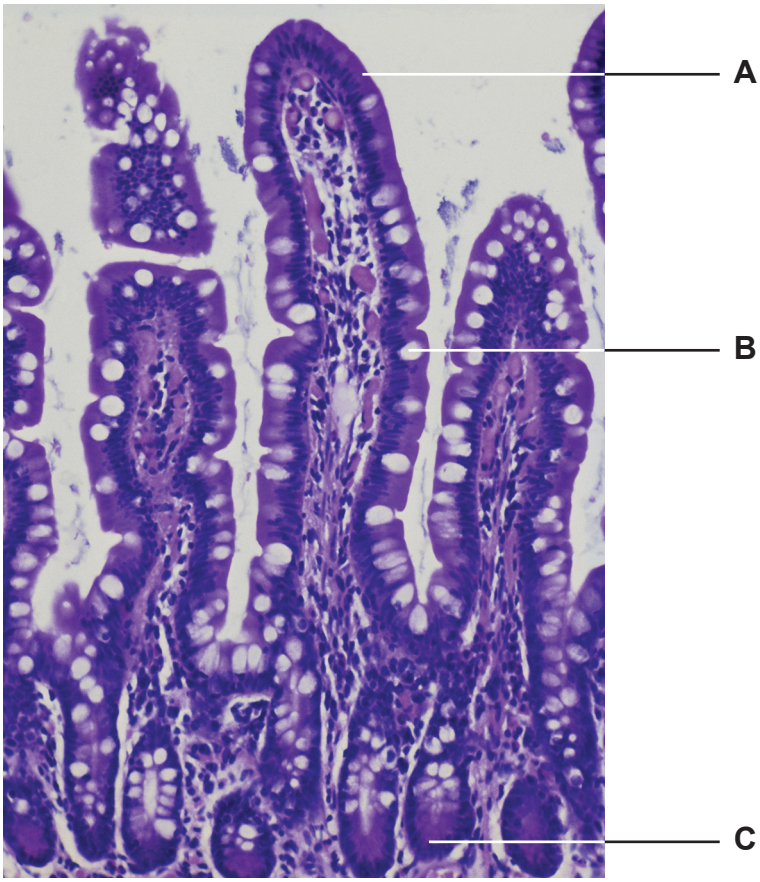
1 A photomicrograph of a transverse section through part of the ileum is shown below.



© Biophoto Associates / Science Photo Library

(a) Identify the cells located at **A**–**C**.

A _____

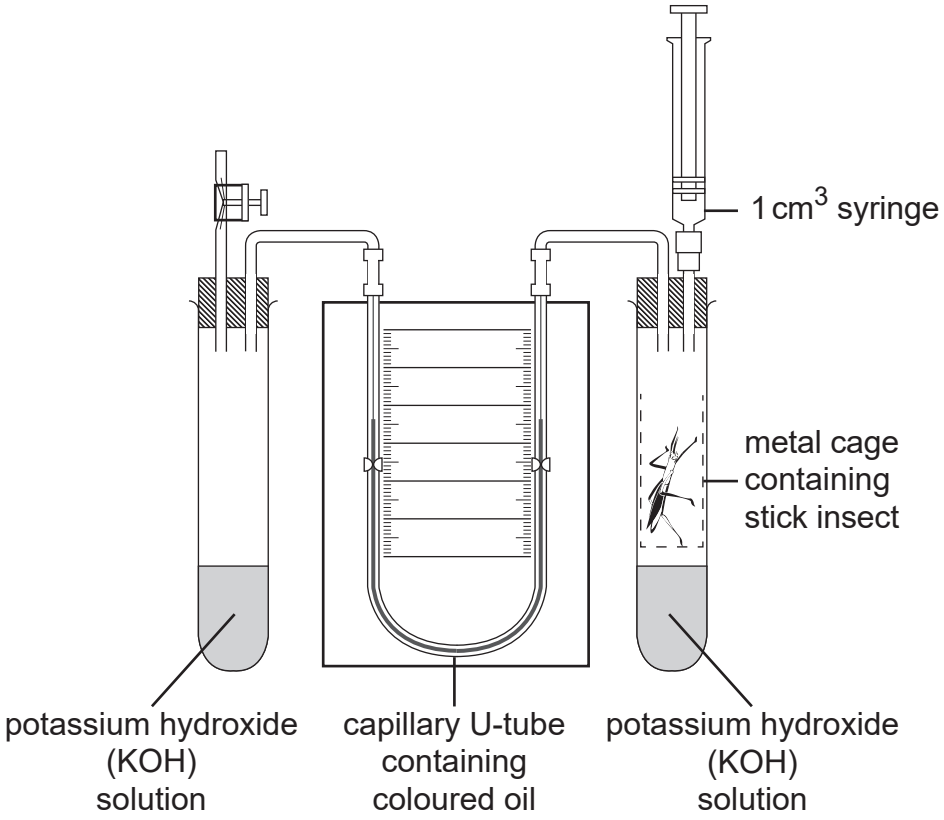
B _____

C _____ [3]

(b) Name the tissue **layer** of the ileum immediately below the layer shown in this photomicrograph.

_____ [1]

2 **(a)** The apparatus shown below can be used to measure the rate of oxygen uptake in small organisms such as stick insects.



(i) Name the apparatus shown.

_____ [1]

(ii) State the function of the potassium hydroxide in this investigation.

_____ [1]

(iii) State **one** precaution necessary when using this apparatus to ensure valid results.

_____

_____ [1]

[Turn over

(b) **(i)** Describe how you would use this apparatus to compare the rate of oxygen uptake in stick insects at 10°C and 25°C.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [3]

(ii) Predict the outcome of this investigation and suggest an explanation.

Prediction

_____

_____

Explanation

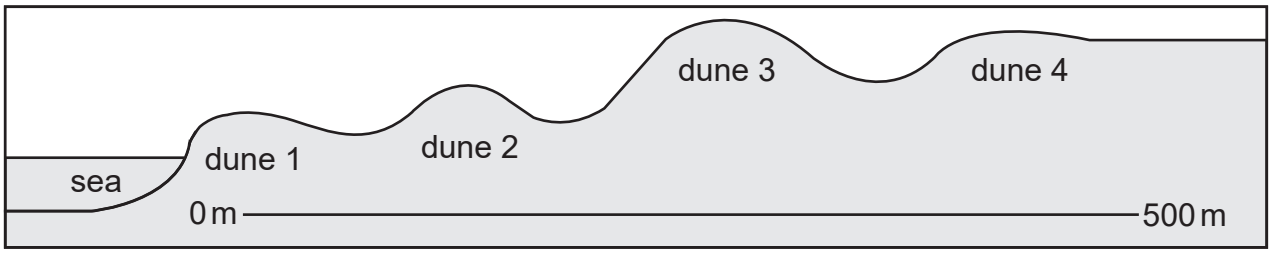
_____

_____

_____

_____ [3]

3 Sampling techniques can be used in a variety of ecological investigations. The distribution of plant species found on sand dune systems often shows a pattern, moving inland from the shore. The diagram below represents a typical sand dune system.



Source: Principal Examiner

(a) Describe a sampling method which could be used to investigate the pattern of plant species distribution, from dune 1 to dune 4.

[5]

[Turn over

In a separate investigation focusing on dune 4, the frequency of three plant species (**A**, **B** and **C**) was estimated.

Ten sample sites on dune 4 were used in this investigation. At each sample site, a pin frame with 20 pins was used. The number of pins touching each species (**A**, **B** and **C**) was recorded in the table below.

Species	**Number of pins touching species**									
A	0	1	1	2	3	3	1	0	2	0
B	14	5	0	8	11	6	0	10	4	8
C	9	8	3	1	5	2	1	1	0	2

The data was processed using the following formula to estimate percentage frequency.

$$\% \text{ frequency} = \frac{\text{total number of pins touching the species}}{\text{total number of pins in sample}} \times 100$$

(b) Use this formula to calculate the percentage frequency of species **B**.

(Show your working.)

_____% [2]

4 The photomicrograph below shows chromosomes during cell division.

© Dr. Juan F. Gimenez-Abian / Science Photo Library

(a) Identify the **type** of cell division taking place and give **two** pieces of evidence to support your answer.

Cell division _____

1. _____

_____

2. _____

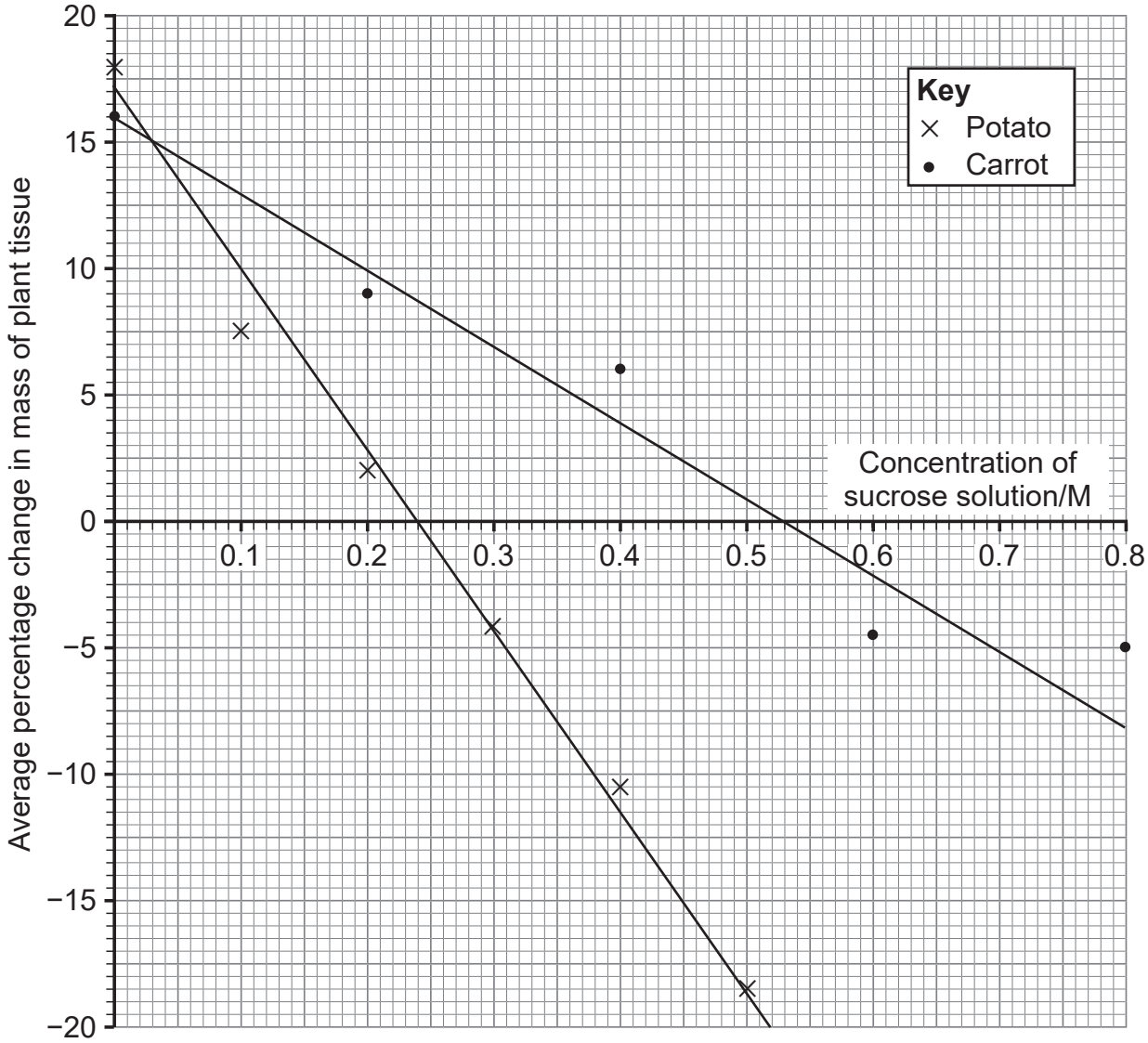
_____ [3]

(b) Name the **stage** of cell division in which chromosomes would appear as shown.

_____ [1]

5 **(a)** An investigation was carried out to determine the water potential of two plant tissues, potato and carrot. Potato cells store carbohydrate in the form of starch, while carrot cells store carbohydrate as sucrose.

Pieces of each plant tissue were weighed and placed into a range of sucrose solutions for 24 hours. They were then reweighed and the average percentage change in mass was calculated. The results are shown in the graph below.



(i) Describe precisely the trend shown for the potato tissue in sucrose solutions of 0 – 0.2 M.

_____

_____

_____ [1]

(ii) Explain the result for potato tissue at 0.4 M.

_____

_____

_____

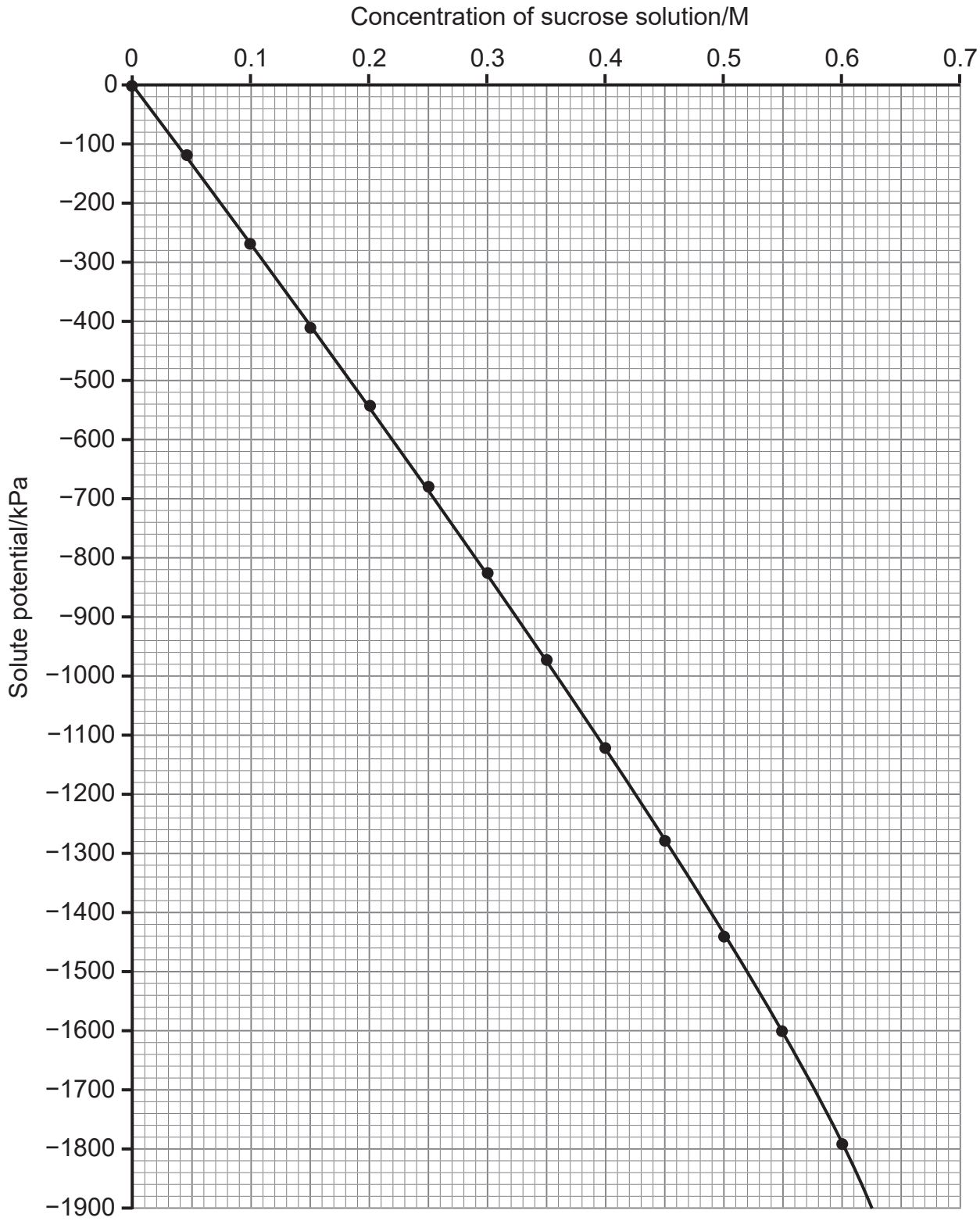
_____

_____

_____

_____ [2]

Below is a calibration graph which shows the relationship between concentration and solute potential of sucrose solution.



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(b) Using both graphs, determine the water potential (Ψ) of each tissue.

Ψ of potato _____ kPa

Ψ of carrot _____ kPa [2]

(c) Using the information provided, and your answers to **(b)** above, describe and explain the difference in the water potential of potato and carrot tissue.

_____

_____

_____

_____

_____

_____

_____

_____

_____ [3]

(d) Other than immersing all tissues for 24 hours, state **one other** variable that should be controlled to ensure the results are valid. Explain your answer.

Variable

_____

_____

Explanation

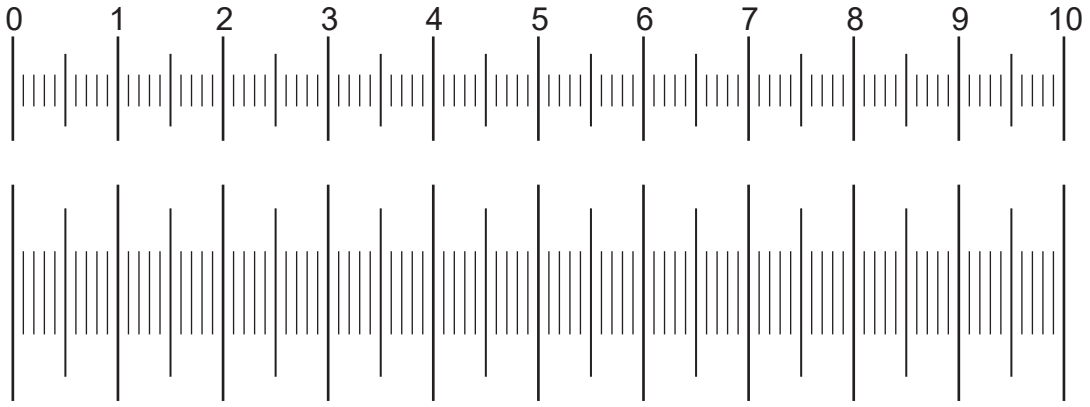
_____

_____

_____ [2]

6 Estimates of cell size can be made using a microscope, an eyepiece graticule and a stage micrometer. The eyepiece graticule is inserted into the microscope's eyepiece lens. This can then be calibrated by lining up a stage micrometer, as seen in the diagram below. This stage micrometer is 1 mm in length and is divided into 100 smaller divisions.

Eyepiece graticule



Stage micrometer

(a) When using the microscope, describe what you could do to confirm which scale is the stage micrometer.

_____

_____

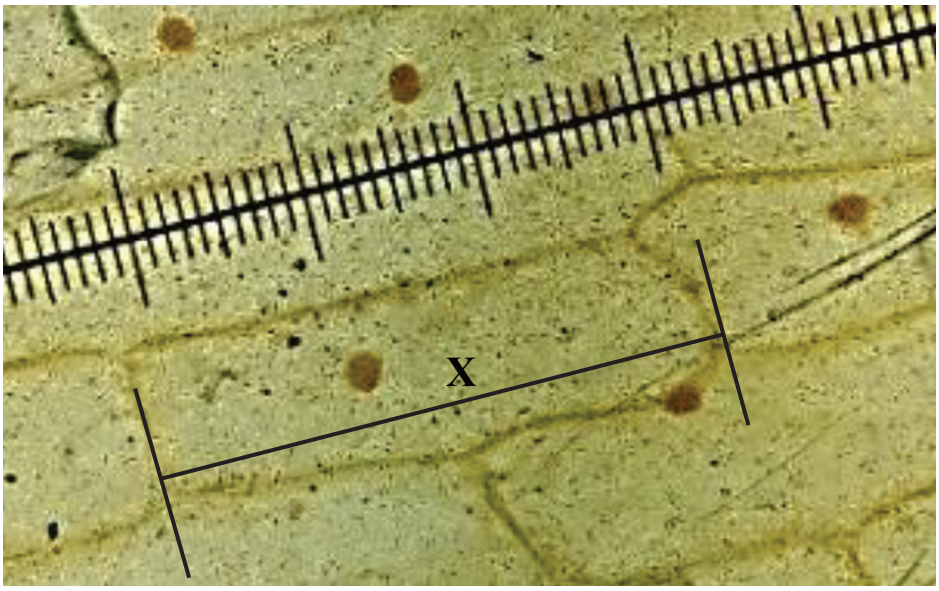
_____ [1]

(b) Using the stage micrometer, determine the size represented by each small division on the eyepiece graticule, as shown above.

_____ μm [1]

[Turn over

(c) The calibrated eyepiece graticule illustrated on the previous page was used to estimate the length of onion epidermal cells. The photomicrograph below is a view of onion epidermal tissue.



Source: Principal Examiner

(i) Use your answer to **(b)** and the line bars provided to estimate the length of an onion epidermal cell along the line **X**.

(Show your working.)

_____ µm [2]

(ii) Describe precisely how a reliable estimate of onion cell length in the epidermal tissue could be obtained.

_____

_____

_____ [1]

7 An investigation was carried out to determine the effect of pH on the action of the enzyme maltase on maltose.

Equal volumes of 1% maltase solution were added to each of five test tubes. A different pH buffer was then added to each test tube.

Equal volumes of 1% maltose solution were added to five additional test tubes. All test tubes were placed in a water bath at 35°C and allowed to equilibrate for five minutes.

After this time, the maltose was added to the test tubes of maltase and buffer and the time taken for complete hydrolysis of maltose at each pH was measured.

The rate of reaction of the enzyme was calculated using the following formula.

$$\text{rate of reaction} = \frac{1}{\text{time for complete hydrolysis}} \times 100$$

The results are shown in the table below.

pH	Time for complete hydrolysis/minutes	Rate of reaction/ arbitrary units
3	8.5	11.8
5	3.9	
7	1.8	55.6
9	6.4	
12	11.2	8.9

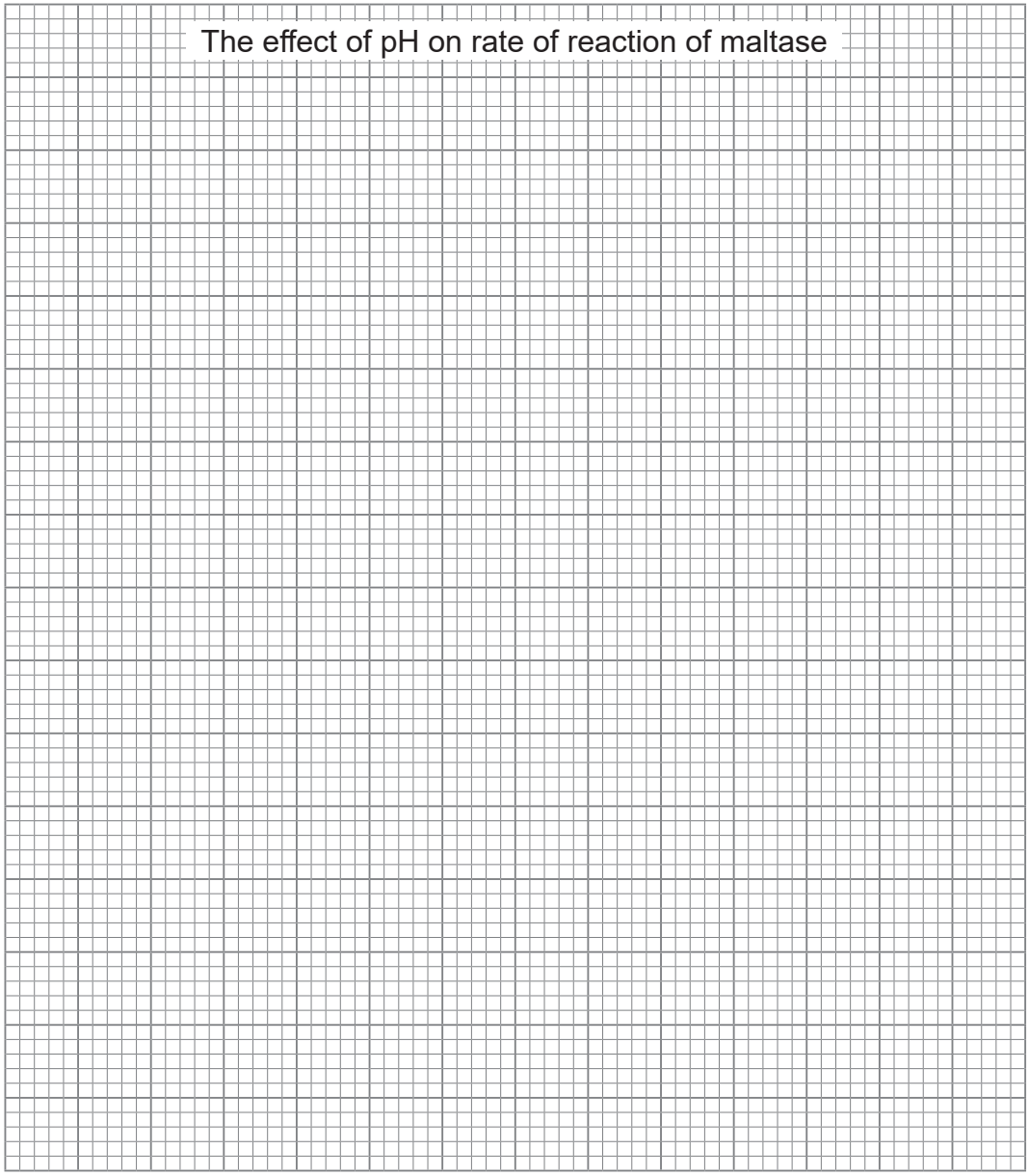
(a) (i) **Complete the table** by calculating the rate of reaction at pH 5 and pH 9. [2]

(ii) Identify the dependent variable in this investigation.

_____

_____ [1]

(b) Using an appropriate graphical technique, plot the data in the table to show the effect of **pH** on the **rate of reaction** of maltase. [3]



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(c) **(i)** Suggest the optimum pH of maltase, from the results of this investigation.

_____ [1]

(ii) Compare and contrast the effects of increasing acidity and alkalinity on the rate of reaction of maltase in this investigation.

Compare

_____

_____

_____

Contrast

_____

_____

_____ [2]

(d) The experiment was repeated using immobilised maltase. On your graph, sketch a line to show how the rates of reaction would be expected to differ. [2]

THIS IS THE END OF THE QUESTION PAPER

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For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
Total Marks	

Examiner Number

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