Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

5538399305

BIOLOGY **9700/32**

Paper 3 Advanced Practical Skills 2 **May/June 2024**

2 hours

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

For Examiner's Use	
1	
2	
Total	

This document has **12** pages. Any blank pages are indicated.

1 Some fruits contain protease enzymes. These enzymes can denature the proteins in milk, causing the milk to clot.

You will investigate the effect of protease concentration on the time taken for milk to clot.

You will use your results to estimate the concentration of protease in a fruit extract.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
P	100% protease solution	none	50
M	milk	none	30
W	distilled water	none	100
U	fruit extract containing unknown protease concentration	none	20

If any solution comes into contact with your skin, wash off immediately under cold water.

It is recommended that you wear suitable eye protection.

You will need to make different concentrations of protease solution, using proportional dilution of the 100% protease solution, **P**.

You will need to prepare 10 cm^3 of each concentration, using **P** and **W**.

Table 1.2 shows how to prepare one of the concentrations of protease you will use.

Decide which other concentrations of protease you will use.

(a) (i) Complete Table 1.2 to show how you will prepare the concentrations of protease you will use.

Table 1.2

percentage concentration of protease	volume of P / cm^3	volume of W / cm^3
100	10.0	0.0

[2]

Carry out step 1 to step 8.

step 1 Stir the 100% protease solution, **P**. In the beakers provided, prepare the concentrations of protease as shown in Table 1.2.

step 2 Label test-tubes with the concentrations of protease stated in Table 1.2.

step 3 Put 2 cm^3 of milk, **M**, into each labelled test-tube.

step 4 Put 1 cm^3 of the 100% protease solution, **P**, into the appropriately labelled test-tube. Start timing.

step 5 Hold the test-tube at an angle and slowly rotate the test-tube as shown in Fig. 1.1. Hold a piece of black card behind the test-tube and observe the thin layer of milk on the side of the test-tube.

step 6 As soon as a number of small clots appear, stop timing and record the value in **(a)(ii)**. If there are no clots after 180 seconds, stop timing and record as 'more than 180'.

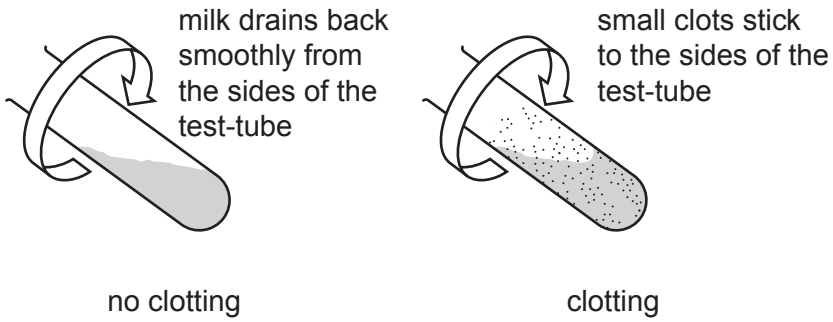

Fig. 1.1

step 7 Repeat step 4 to step 6 with each of the other concentrations of protease you prepared in step 1. Record your results in **(a)(ii)**.

step 8 Repeat step 2 to step 7 using clean test-tubes.

(ii) Record the **two** sets of results in an appropriate table.

[5]

(iii) Suggest **one** source of error in the procedure described in step 6 of this investigation.

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..... [1]

(iv) Suggest why the procedure was repeated.

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.....

..... [1]

(v) To estimate the concentration of protease in fruit extract **U**, you will need to test a sample of the extract.

State the volume of fruit extract **U** that you will use.

volume = …… cm^3 [1]

(vi) Record the time taken for clots to appear using fruit extract **U**.

time taken = ... [1]

(vii) Use your results from **(a)(ii)** and **(a)(vi)** to estimate the concentration of protease in fruit extract **U**.

concentration of protease in fruit extract **U** = ... % [1]

(viii) With reference to your estimate in **(a)(vii)**, suggest how you would modify this procedure to obtain a more accurate value for the concentration of protease in fruit extract **U**.

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.....

.....

..... [2]

(b) The effect of pH on the activity of the protease enzyme actinidin in fruit extract was investigated.

Table 1.3 shows the results of the investigation.

Table 1.3

pH	protease activity / μmol min^{-1} mg^{-1}
1.8	0.00
4.0	20.25
5.1	24.00
6.1	28.25
7.4	22.50
8.5	6.75

(i) Plot a graph of the data shown in Table 1.3 on the grid in Fig. 1.2.

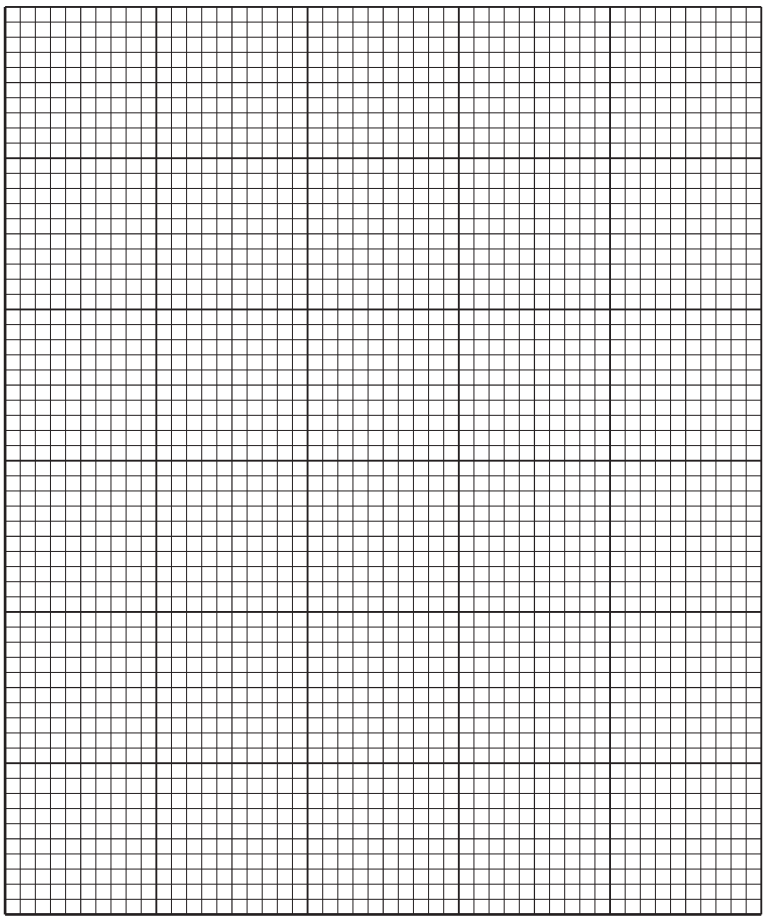

Fig. 1.2

[4]

(ii) Use the data in Table 1.3 and your graph in Fig. 1.2 to explain the effect of pH on the activity of protease.

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..... [3]

[Total: 21]

2 **K1** is a slide of a stained transverse section through a plant leaf.

(a) **(i)** Draw a large plan diagram of the region of the leaf on **K1** indicated by the shaded area in Fig. 2.1. Use a sharp pencil.

Use **one** ruled label line and label to identify a vascular bundle.

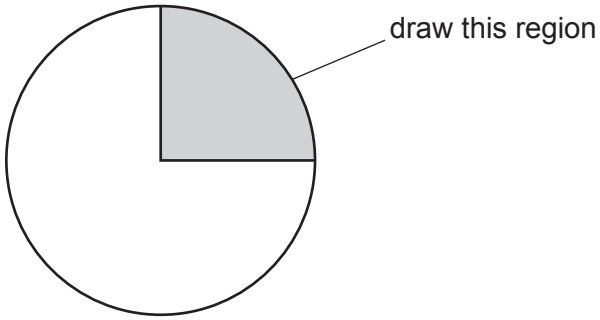

Fig. 2.1

[5]

(ii) Observe the trichomes on the leaf on **K1**.

Select a group of **four** adjacent cells that includes three epidermal cells **and** one trichome.

Each cell must touch at least **one** other cell.

- Make a large drawing of this group of **four** cells.
- Use **one** ruled label line and label to identify the cell wall of the trichome.

[5]

(iii) The presence of trichomes on **K1** suggests the leaf is from a plant that is a xerophyte.

State **one** other observable feature that suggests the leaf is from a plant that is a xerophyte.

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.....

..... [1]

(b) (i) Fig. 2.2 is a scanning electron micrograph of an open stoma.

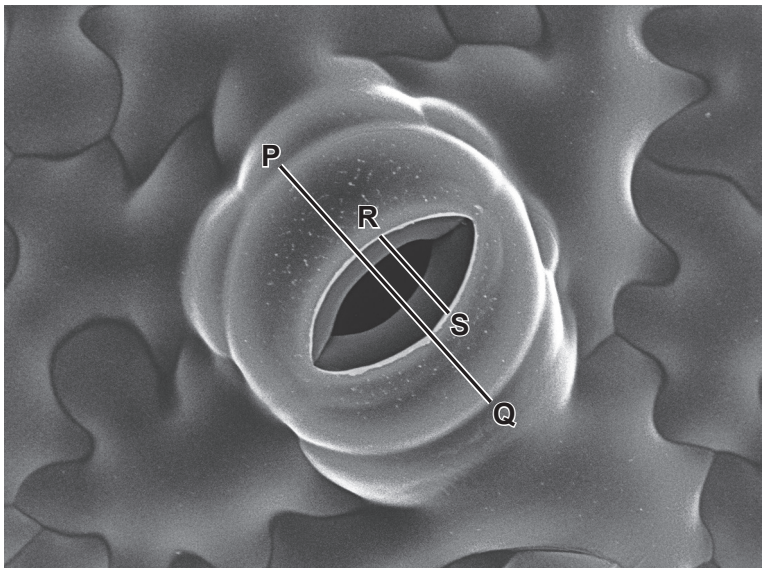

Fig. 2.2

Line **P**–**Q** represents the width of the paired guard cells that form the stoma.

Line **R**–**S** represents the width of the stoma.

Calculate the width of the stoma as a percentage of the width of line **P**–**Q**.

Show your working and give your answer to **two** significant figures.

answer = ... %

[4]

(ii) Fig. 2.3 and Fig. 2.4 are photomicrographs of the leaf surface from different plants.

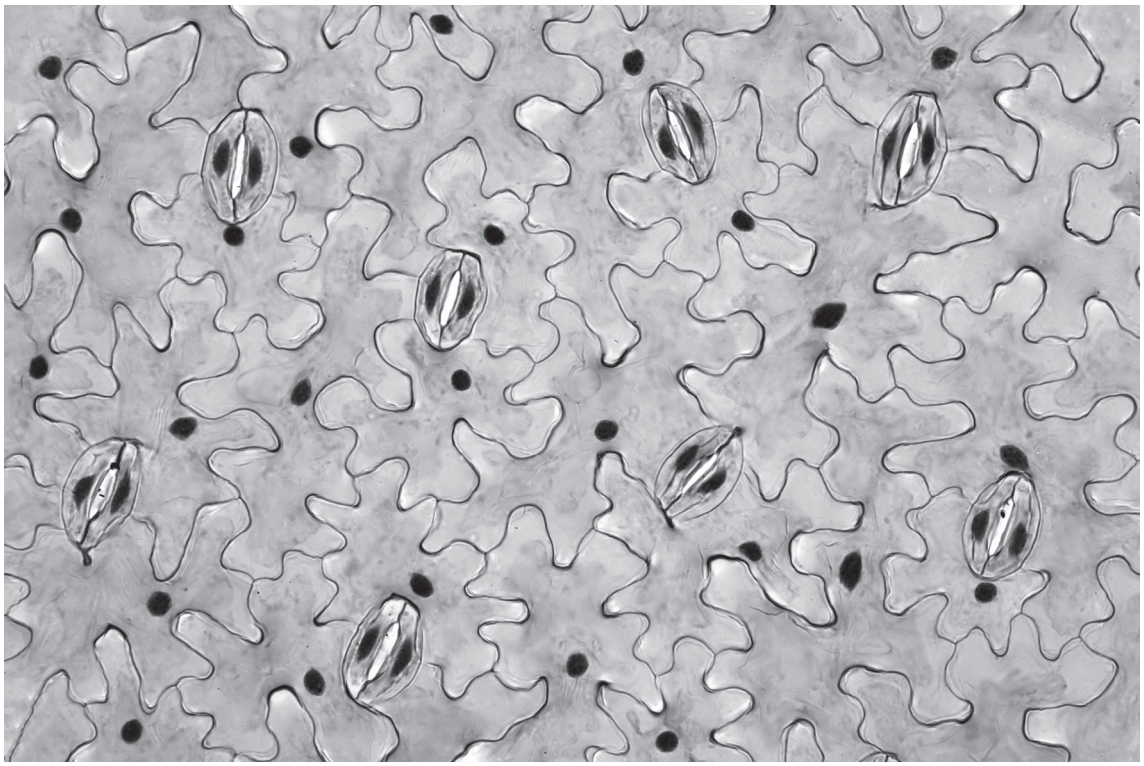

Fig. 2.3

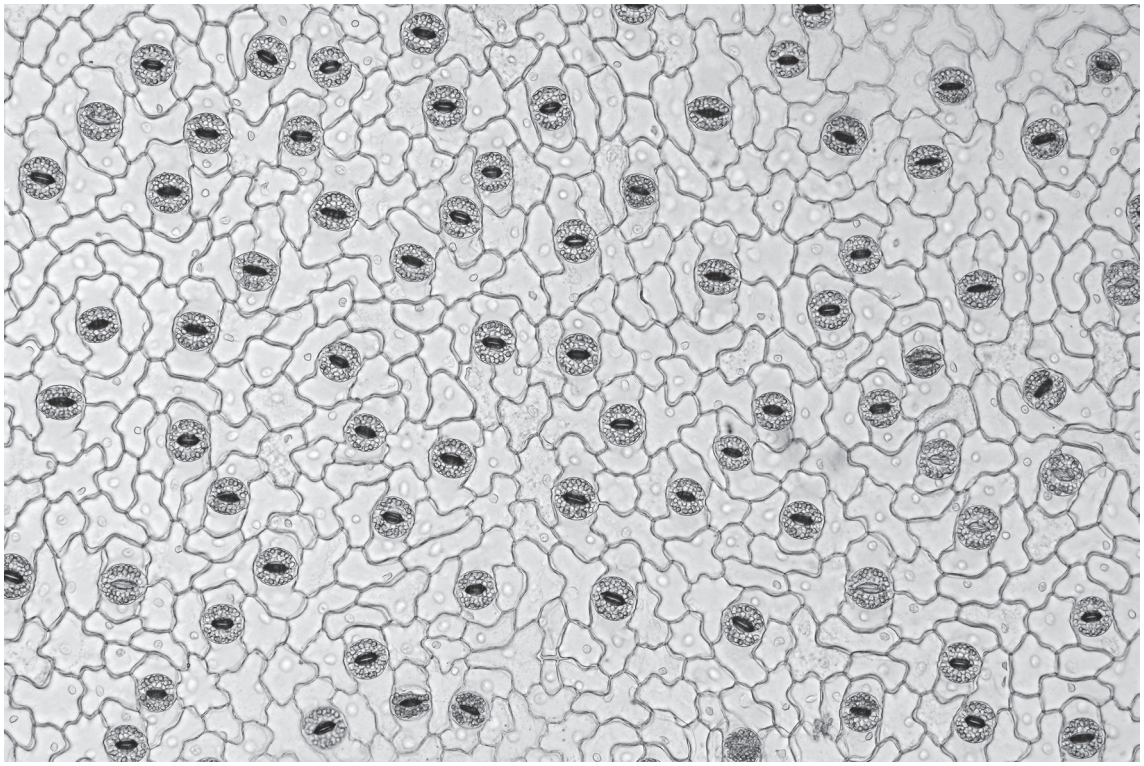

Fig. 2.4

Identify **three** observable features that are different between the leaf surface in Fig. 2.3 and the leaf surface in Fig. 2.4.

Record these **three** observable features in Table 2.1.

Table 2.1

feature	Fig. 2.3	Fig. 2.4
1		
2		
3		

[4]

[Total: 19]

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