Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5196186566

BIOLOGY **9700/32**

Advanced Practical Skills 2 **May/June 2014**

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.
Do **not** use staples, paperclips, glue or correction fluid.
You may use an HB pencil for any diagrams or graphs.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

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	
Total	

This document consists of **13** printed pages and **3** blank pages.

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[Turn over

Before you proceed, read carefully through **the whole** of Question 1 and Question 2.

Plan the use of the two hours to make sure that you finish all the work that you would like to do.

If you have enough time, consider how you can improve the accuracy of your results, for example by obtaining one or more additional measurements.

You will **gain marks** for recording your results according to the instructions.

1 You are provided with a solution labelled, **E**, containing an enzyme which coagulates (clots) milk.

Calcium ions are required for this coagulation.

You are required to investigate the concentration of calcium ions (the independent variable), on the progress of this enzyme-catalysed coagulation.

When a mixture of milk, enzyme and calcium chloride is gently rotated the coagulation goes through the stages shown in Fig. 1.1.

Stage **3** is the end-point of the enzyme-catalysed coagulation.

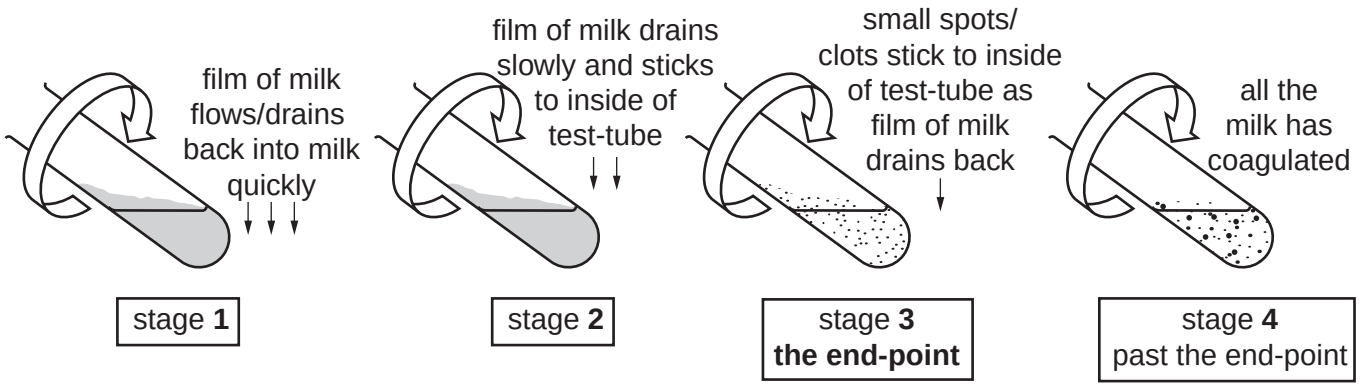


Fig. 1.1

You are provided with:

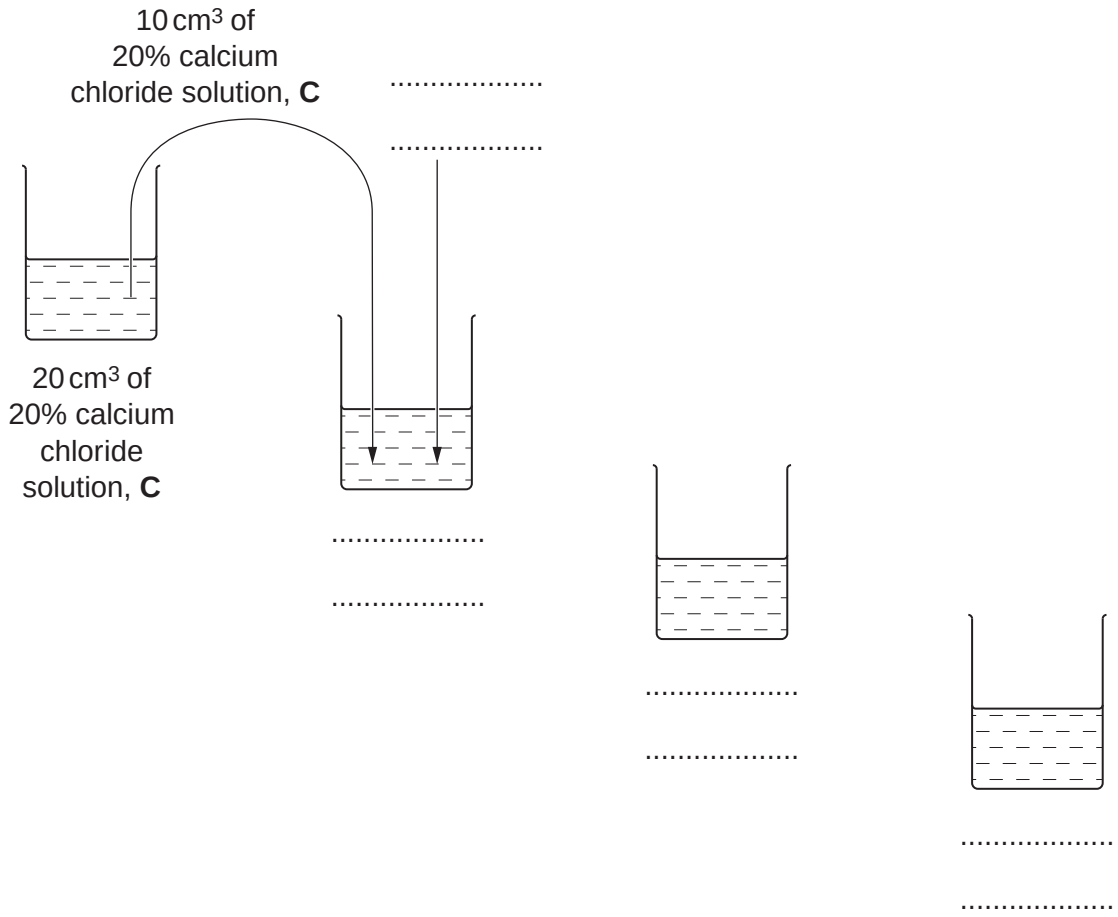
labelled	contents	hazard	volume /cm^3
C	20% calcium chloride solution	harmful irritant	50
W	distilled water	none	100
M	milk	none	100
E	1% enzyme solution	harmful irritant	20

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You are now required to carry out a serial dilution of calcium chloride solution, **C**, to reduce the concentration of **C**, by **half** between each successive dilution.

You will need 10 cm^3 of each calcium chloride solution.

(a) (i) Complete Fig. 1.2 to show how you will make **three** further concentrations of calcium chloride solution by serial dilution.



[3]

Fig. 1.2

Proceed as follows:

1. Prepare all the concentrations of calcium chloride solution as shown in Fig. 1.2 in the containers provided.

2. You are provided with a water-bath. Adjust the temperature to between 35 °C and 40 °C.
   You will need to maintain this temperature during steps 3 to 10.

3. Put 1 cm^3 of each of the four concentrations of calcium chloride solution into separate test-tubes.

4. Put 10 cm^3 of **M** into each test-tube.

5. Gently shake each of the test-tubes to mix **M** and calcium chloride solution.

6. Put the test-tubes into the water-bath and leave for at least three minutes.

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Read steps 7 to 11 before proceeding.

7. Remove the test-tube containing the mixture with the **highest** concentration of the calcium chloride solution from the water-bath.
   The process of coagulation will start when **E** is added to each test-tube.

   Put 1 cm^3 of solution **E**, so that it runs down the side of the test-tube to form a layer on the surface of the mixture as shown in Fig. 1.3.

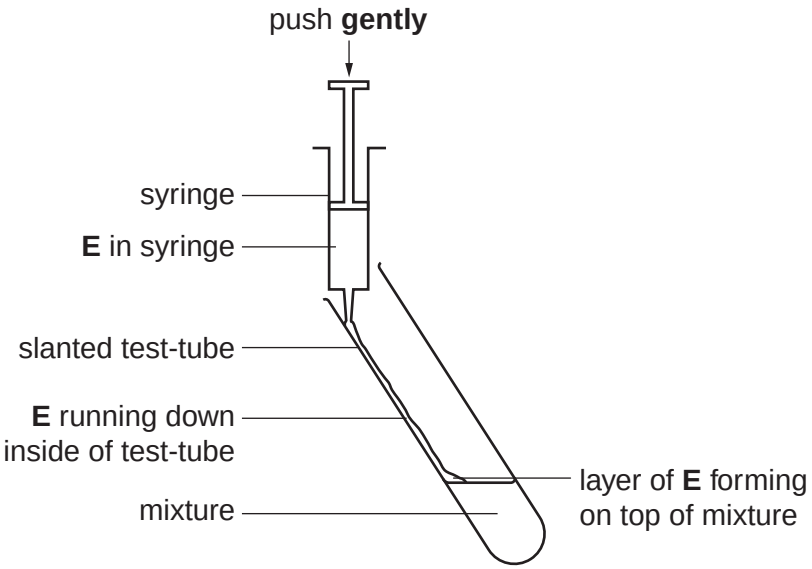


Fig. 1.3

8. Gently shake the test-tube to mix the solutions and **start timing**.

9. Gently rotate the test-tube, as shown in Fig. 1.1 on page 2, to form a film of milk on the inside of the test-tube.

10. Continue to rotate the test-tube whilst holding it over the black card on the table (see Fig. 1.4).

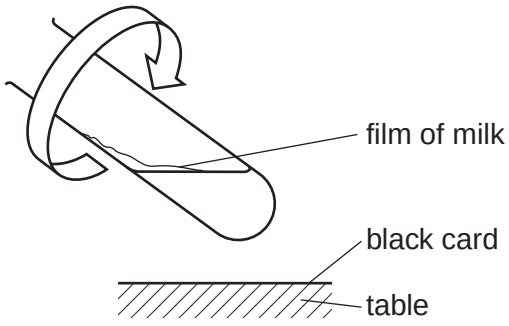


Fig. 1.4

Record the time to reach the end-point as shown in stage **3** in Fig. 1.1.
Ignore any small bubbles on the inside of the test-tube.
If the end-point has not been reached by 4 minutes, stop the experiment and record 'more than 240'.

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11. Repeat steps 7 to 10 using the other concentrations of calcium chloride solution.

(ii) Prepare the space below and record your results.

[5]

(iii) Identify **one** significant source of error in measuring the dependent variable in this investigation.

.....

.....

..... [1]

(iv) A systematic error occurs when apparatus with scales are used, since the scales may be slightly different.
For example, when measuring the same line, two rulers may give different lengths. However, as long as the same ruler is used for all the measurements, the trend is **not** affected because the error is consistent.

State **one** piece of apparatus used in this investigation that may have a systematic error. Suggest whether this affected your results and give a reason for your answer.

apparatus .....

reason .....

.....
[1]

(v) Describe a suitable control for this investigation.

.....

.....

..... [1]

In a similar investigation on the enzyme-catalysed coagulation of milk, a student studied the effect of heating solution **E** at 70 °C for different times.

After heating, the time to reach the end-point was recorded as in your investigation.
This was repeated for each of the different times.

(b) (i) State **two** variables that need to be kept the same (standardised) in this investigation. Describe how you would standardise each of these variables.

variable 1 .....

description .....

.....

variable 2 .....

description .....

.....
[2]

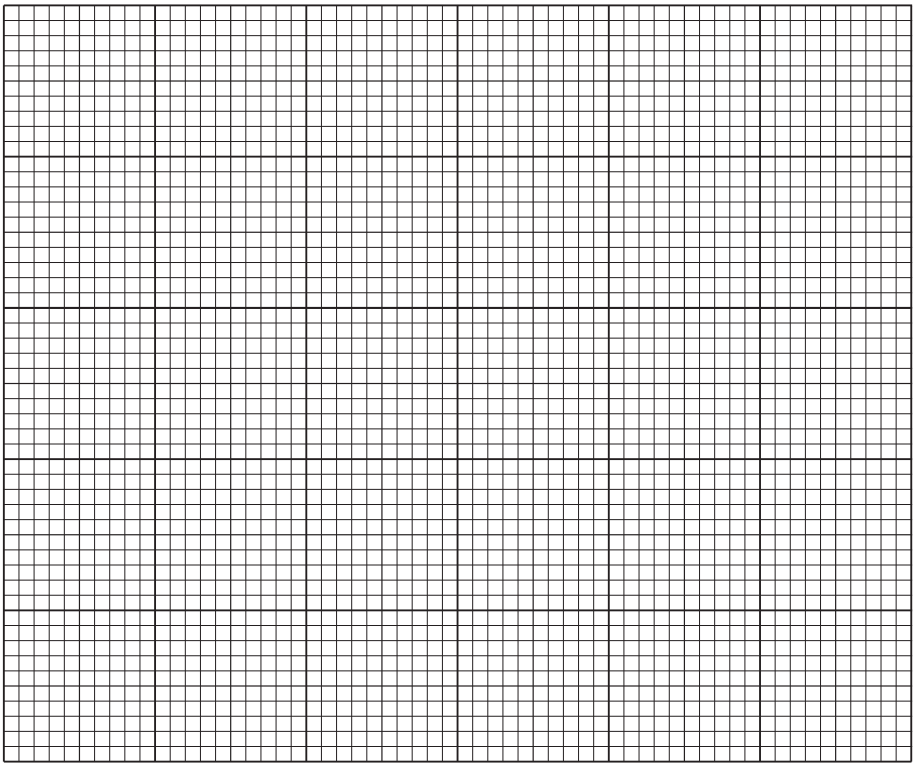
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The results of this investigation are shown in Table 1.1.

Table 1.1

time of heating solution E / s	time to reach the end-point / s
60	30
150	75
185	96
240	140
300	220

(ii) Plot a graph of the data shown in Table 1.1.



[4]

(iii) Explain the trend shown in your graph.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 20]

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Question 2 starts on page 10

2 The eyepiece graticule scale in your microscope may be used to measure the actual length of the layers of tissues or cells if the scale has been calibrated against a stage micrometer.

However, to help draw the correct shape and proportion of tissues, as in **(a)**, it is **not** necessary to calibrate the eyepiece graticule scale.

L1 is a stained, longitudinal section showing the tissues of a young root tip.

(a) Draw a large plan diagram of **L1**.

Use a ruled label line and a label to show the position of the area in which you can see cells showing stages of mitosis.

[5]

Fig. 2.1 is a photomicrograph of root cells.



Fig. 2.1

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(b) Make a large drawing of each of the **five** cells labelled **P**, **Q**, **R**, **S** and **T** on Fig. 2.1.

On your drawing use ruled label lines and labels to identify two **different** stages of mitosis.

Annotate **one** of the stages to describe **one** observable feature that supports your identification.

[6]

Fig. 2.2 is a photomicrograph of root cells from a different region of the root.

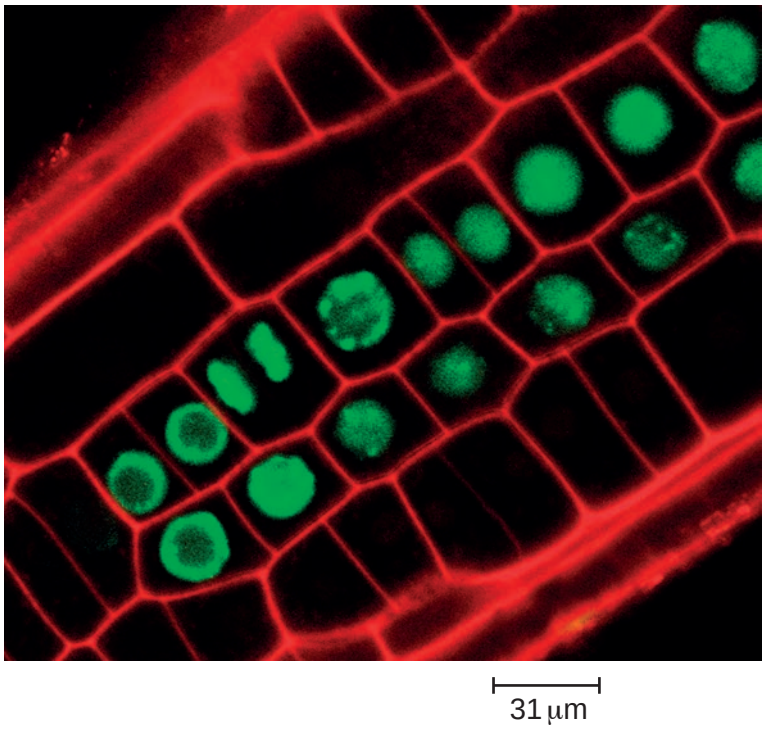


Fig. 2.2

(c) Use the scale bar below Fig. 2.2 to calculate the magnification of Fig. 2.2.

You may lose marks if you do not show your working or if you do not use appropriate units.

[4]

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Fig. 2.1 is shown again here to help you answer **(d)**.

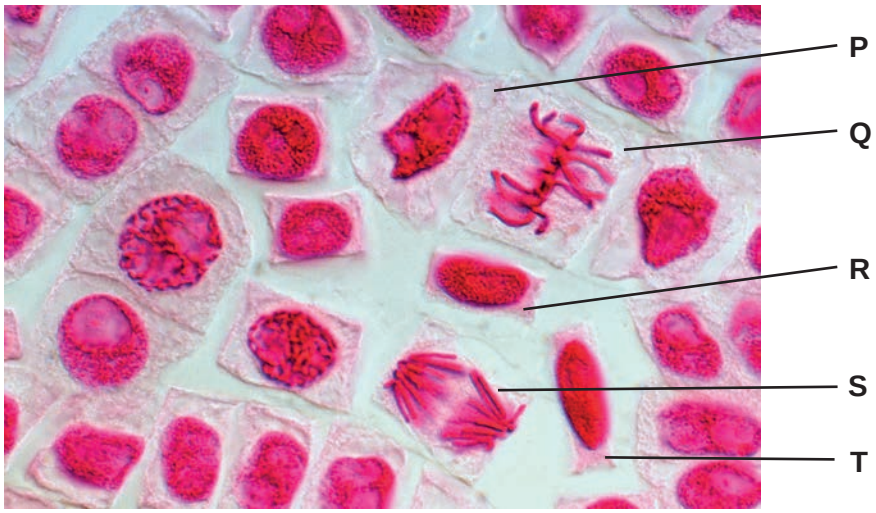


Fig. 2.1

(d) Prepare the space below so that it is suitable for you to record the observable differences, **other than** colour, between the specimens in Fig. 2.1 and in Fig. 2.2.
Record your observations in the space you have prepared.

[5]

[Total: 20]

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Fig. 2.2 © DR JOHN RUNIONS/SCIENCE PHOTO LIBRARY.

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