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

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

6611175037

BIOLOGY **9700/36**

Advanced Practical Skills 2 **October/November 2013**

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 ink.
You may use a pencil for any diagrams, graphs or rough working.
Do **not** use red ink, staples, paper clips, highlighters, glue or correction fluid.
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.

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1	
2	
Total	

This document consists of **11** printed pages and **1** blank page.

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You are reminded that you have **only one hour** for each question in the practical examination.

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You should:

- read carefully through **the whole** of question 1 and question 2
- then plan your use of **the time** to make sure that you finish all the work that you would like to do.

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

1 The enzyme amylase catalyses the hydrolysis (breakdown) of starch to a reducing sugar.

You are required to:

- identify which solution, **E1** or **E2** contains the highest enzyme concentration by estimating the concentration of reducing sugar produced by the action of **E1** and **E2** when breaking down starch
- prepare known concentrations of reducing sugar solutions to compare with the concentrations of reducing sugars produced by the action of **E1** and **E2**
- compare the concentrations of reducing sugars by using the Benedict's test.

For each of your Benedict's tests you need to standardise the:

- volume of Benedict's solution
- volume of the samples
- temperature of the water bath.

(a) (i) State the:

volume of Benedict's solution …… cm^3

volume of each of the samples to be tested …… cm^3

temperature of water bath …… °C. [1]

You are provided with:

labelled	**contents**	**hazard**	**volume / cm^3**
E1	amylase solution	harmful irritant	20
E2	amylase solution	harmful irritant	20
S	starch solution	none	50
G	0.4% reducing sugar solution	none	50
W	distilled water	none	100

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Read steps 1 to 6 before proceeding.

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Proceed as follows:

1. Put 1 cm^3 of **E1** and **E2** into separate beakers.
2. Put 10 cm^3 of **S** into each of the beakers with **E1** and **E2**. Mix well.
3. Leave the beakers for 15 minutes.

During the 15 minutes you are required to:
- set up a water bath ready for step 6 (on page 4)
- prepare the known concentrations of the reducing sugar solution.

4. Set up the water bath to heat to the temperature as decided in **(a)(i)**.

(ii) Decide which concentrations of the reducing sugar solution to make:

- using **serial dilution**
- using 20 cm^3 of the 0.4% reducing sugar solution, **G**, to start the **serial dilution**
- reducing the concentration by **half** between each concentration.

Complete Fig. 1.1 to show how you will make three further concentrations.

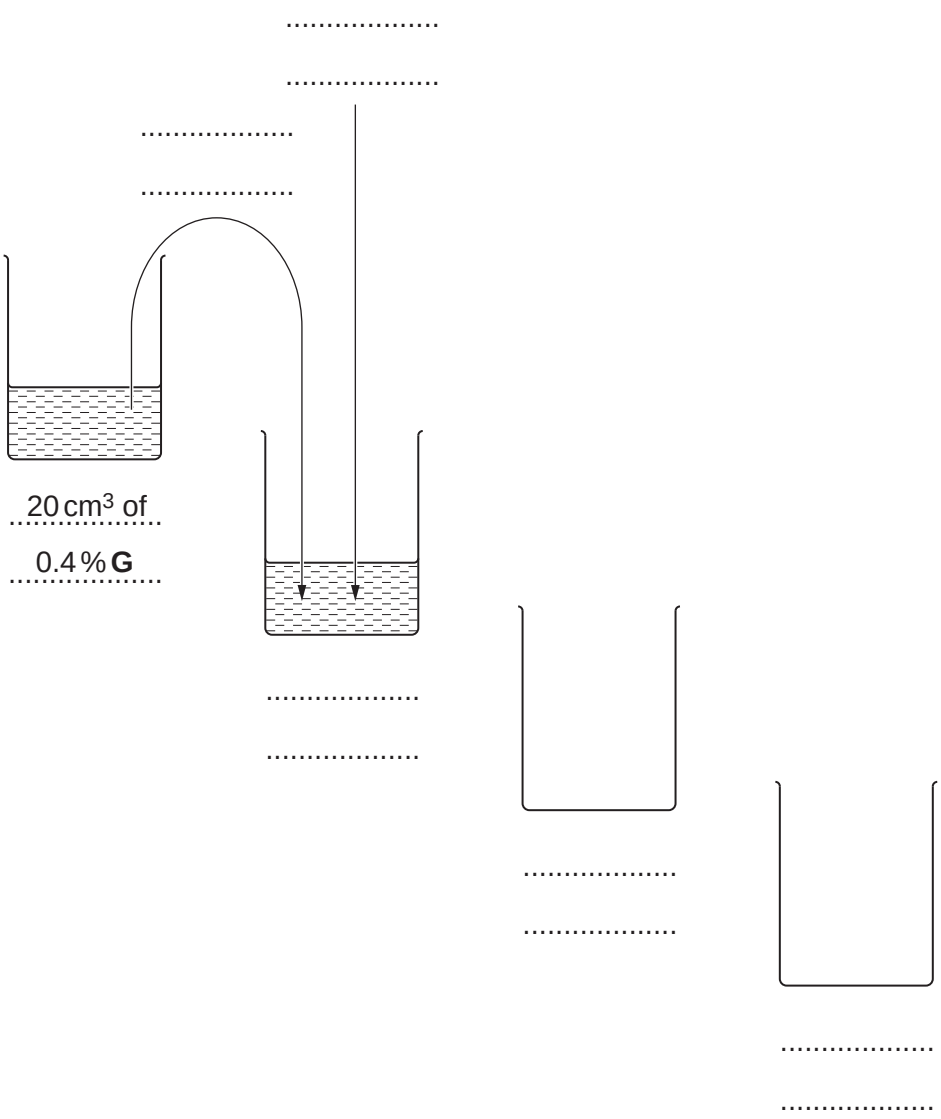


Fig. 1.1 [3]

5. Prepare all the concentrations of the reducing sugar solution, as in Fig. 1.1, in the containers provided.

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6. You are now required to test for the concentrations of reducing sugars by using the Benedict's test:

   - test each sample separately using the volumes decided in **(a)(i)**
   - record the time taken for the appearance of any colour change.
     If there is no colour change after 120 seconds record 'more than 120'.

(iii) Prepare the space below and record **only** your results for the known concentrations of reducing sugars.

[5]

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(iv) Using your results for **E1** and **E2** complete the following.

The time taken for the first colour change in **E1** was …… .

The time taken for the first colour change in **E2** was …… .

Using these two times, state which of these two solutions has the highest concentration of reducing sugars.

.....

Using the results from **(a)(iii)** estimate the concentration of reducing sugars in this solution.

.....[2]

(v) Describe how you would modify this investigation to follow the time course of the hydrolysis of starch by enzyme **E**, without the use of Benedict's solution.

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.....[3]

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[Turn over

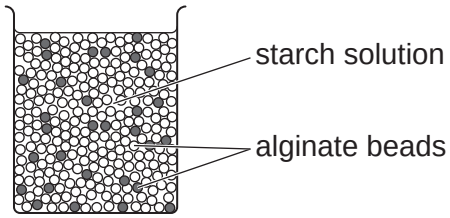
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(b) A student investigated the effect of iron sulfate on the rate of amylase activity, using immobilised amylase in alginate beads.

The student prepared two types of alginate beads containing amylase:

- **with** iron sulfate
- **without** iron sulfate.

The student mixed the two types of beads together in varying proportions, for example 30 beads with iron sulfate and 70 beads without iron sulfate (30% with iron sulfate) as shown in Fig. 1.2. The student put the beads into beakers containing starch solution.



Key:
● alginate beads with iron sulfate
○ alginate beads without iron sulfate

Fig. 1.2

Other variables were considered and kept to a standard.

The student measured the mass of reducing sugars produced by each mixture of beads in one minute.

The student's results are shown in Table 1.1.

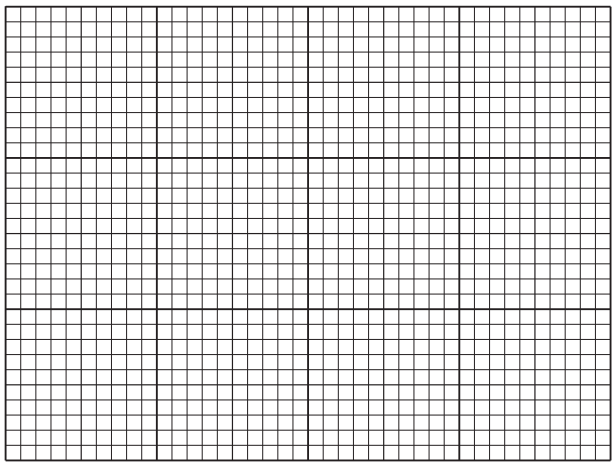
Table 1.1

percentage of beads with iron sulfate	**mass of reducing sugar produced / μmoles min^{-1}**
0	60
10	25
20	12
30	5
40	2

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

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[4]

(ii) Describe the trend shown by the data.

.....

.....[1]

(iii) Explain the reason for the difference in the results between 0 and 10 percentage of beads with iron sulfate.

.....

.....

.....

.....[2]

[Total: 21]

2 The eyepiece graticule scale in your microscope may be used to help draw a plan diagram, as in **(a)**, with the correct shape and proportions of the tissue, without needing to calibrate the eyepiece graticule scale.

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N1 is a slide of a stained transverse section through a tubular organ from an animal.

(a) Select a part of the wall of the organ which shows the highest number of different layers of tissues.
Draw a large plan diagram of a part of the wall of the organ to show the proportions of the different layers of tissues.

On your diagram, use a label line and label to show the lumen.

[5]

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Fig. 2.1 is a photomicrograph of cells from the same tubular organ as the specimen on slide N1.

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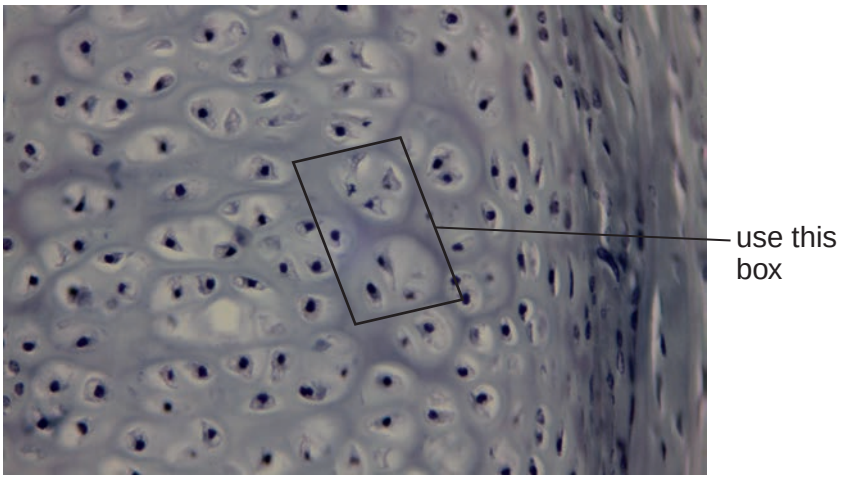


Fig. 2.1

(b) Make a large drawing of the whole cells shown in the box marked on Fig. 2.1.
The drawings should show any difference in size (linear magnification) observed between each cell.

On your drawing, use a label line and label to show one nucleus.

[5]

Fig. 2.2 is a photomicrograph of a stained transverse section through a different tubular organ of an animal.

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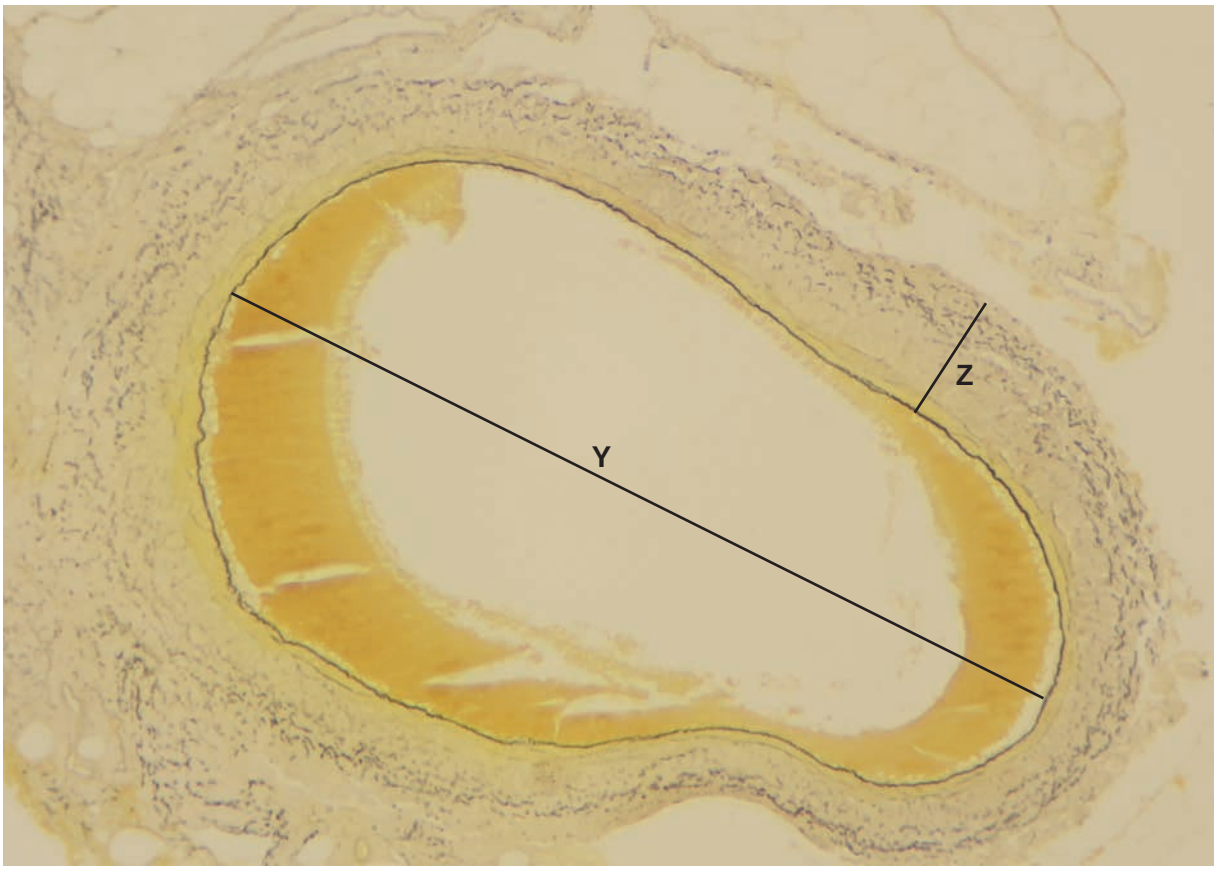


Fig. 2.2

(c) (i) Use the lines **Y** and **Z** shown on Fig. 2.2, to calculate the ratio of **Y** to **Z**.

You will lose marks if you do not show all the steps in finding the ratio.

ratio ..... [3]

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(ii) The tubular specimen shown in Fig. 2.2 transports blood at low pressure. Suggest **one** observable feature which supports this conclusion.

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.....

.....

..... [1]

(iii) Prepare the space below so that it is suitable for you to record the observable similarities and differences between the specimen on slide **N1** and that in Fig. 2.2.

Record your observations in the space you have prepared.

[5]

[Total: 19]

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