Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

7732865742

BIOLOGY **9700/31**

Advanced Practical Skills 1 **May/June 2015**

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 an HB pencil for any diagrams or graphs.
Do **not** use staples, paper clips, 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.

For Examiner's Use	
1	
2	
Total	

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

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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 Starch is the substrate of enzyme **E**. When they are mixed, a reaction takes place and a biological molecule is produced, the product.

You are required to investigate the effect of enzyme **E** on starch.

You are provided with:

labelled	contents	hazard
S	1% starch solution	none
E	enzyme solution	harmful irritant
W	distilled water	none
iodine	iodide solution	harmful
Benedict's	Benedict's solution	harmful

Proceed as follows:

1. Set up a water-bath to heat to boiling (approximately 100 °C) ready for step 9.
2. Test a drop of solution **S** for starch and record your observations in **(a)(i)**.
3. Put 3 cm^3 of **S** into a test-tube.
4. Put 1 cm^3 of **E** into the same test-tube.
5. Shake the test-tube gently to mix the contents.
6. Leave the test-tube for 5 minutes, shaking it occasionally.
7. After 5 minutes, test a drop of the mixture from the test-tube for starch and record your observations in **(a)(i)**.

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

[3]

The rate at which enzyme **E** catalyses a reaction with **S** can be investigated by measuring the rate at which the products of the reaction are produced.

You are required to identify the type of biological molecule produced (the product) when **S** and **E** are mixed.

8. Put 4 cm^3 of **Benedict's** into the test-tube containing the mixture of **S** and **E**. This will inhibit enzyme **E**.

9. Put this test-tube into the boiling water-bath and immediately start timing.

(ii) Record the time taken for the first appearance of any colour change. If there is no colour change after 180 seconds remove the test-tube from the water-bath and record your result.

..... [1]

10. Turn off the Bunsen burner.

(iii) Explain the effect that enzyme **E** has on starch, using your observations from **(a)(i)** and the result from **(a)(ii)**.

..... [1]

(iv) Suggest the name of a biological molecule that could have been produced when **S** and enzyme **E** were mixed.

..... [1]

When carrying out a practical procedure, the hazards of the use of all the apparatus and all of the reagents need to be considered, then the **level** of risk needs to be assessed as low or medium or high.

(v) State the hazard with the greatest level of risk when carrying out steps 8 to 10.

State the level of risk of the procedure: low or medium or high.

hazard .....

level of risk .....

[1]

A student investigating the effect of enzyme **E** on starch suggested the hypothesis:

"lowering the concentration of starch below 1% will have no effect on the rate at which the product is produced."

You are required to investigate this hypothesis by:

- carrying out a **serial** dilution of **S**
- investigating the effects of different concentrations of starch solution on the rate at which the product is produced.

(b) (i) You are required to make a **serial** dilution of the 1% starch solution, **S**, which reduces the concentration of the starch solution **by half** between each successive dilution.

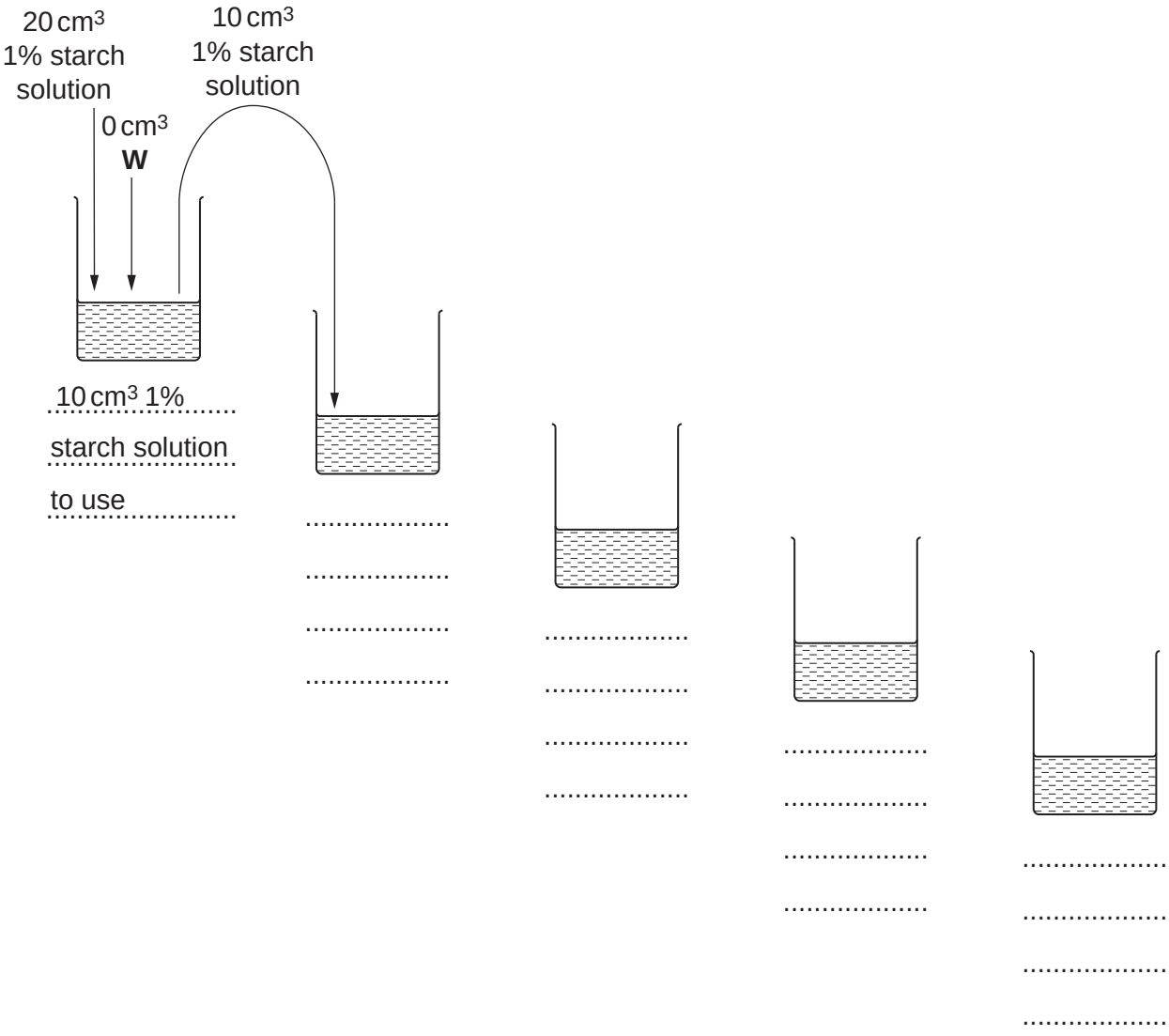
You will need to **prepare** 20 cm^3 of each concentration.

You should use the beakers shown in Fig. 1.1 to show how you will prepare the **serial** dilutions.

For **each beaker**, complete Fig. 1.1 to show how you will dilute the solution by:

- stating, under the beaker, the **concentration** and **volume** of the starch solution available for use in the investigation
- using one arrow, with a label above the beaker, to show the **concentration** and **volume** of starch solution added to prepare the concentration
- using another arrow, with a label above the beaker, to show the **volume** of **W** added to prepare the concentration.

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[3]

Fig. 1.1

Proceed as follows:

11. Prepare the concentrations of starch solution as stated in **(b)(i)**.

12. Label test-tubes with the concentrations of starch solution you have prepared.

13. Put 3 cm^3 of the **lowest** concentration of starch solution into the labelled test-tube.

14. Repeat step 13 with each of the other concentrations of starch solution.

15. Put 1 cm^3 of **E** into each of the test-tubes.

16. Shake each test-tube gently to mix the contents.

17. Leave the test-tubes for 5 minutes, shaking them occasionally. Relight the Bunsen burner to prepare a boiling water-bath ready for step 19.

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18. After five minutes, put 4 cm^3 of **Benedict's** into each of the test-tubes.

19. Put the test-tubes containing the two **lowest** concentrations of starch solution into the boiling water-bath and immediately start timing.

20. Record in **(b)(ii)** the time taken for the first appearance of any colour change.
If there is no colour change after 180 seconds, remove the test-tubes from the water-bath and record 'more than 180'.

21. Repeat steps 19 and 20 with the remaining test-tubes.

(ii) Prepare the space below and record your results, **including** the result from **(a)(ii)**.

[4]

(iii) Using your results, calculate the rate at which the product is produced when the concentration of starch is 1%.

..... s^{-1} [1]

The student's hypothesis stated that "lowering the concentration of starch below 1% will have no effect on the rate at which the product is produced".

(iv) State whether you support or reject this hypothesis. Explain how your results provide evidence for this decision.

support/reject .....

explanation .....

.....

.....

[2]

(c) (i) Identify **one** significant source of error in the procedure you carried out between steps 18 and 21.

.....

..... [1]

The student also stated that "the use of the syringe affected the accuracy of the serial dilutions produced."

(ii) State whether the error when using the syringe is systematic or random and give a reason for your answer.

systematic or random .....

reason .....

.....

[1]

Fruit juice **X** contains an inhibitor of enzyme **E**. Consider how you would modify the procedure you have just carried out to investigate the effect of the concentration of **X** on the activity of enzyme **E**.

(iii) Describe how the independent variable in the procedure you have just carried out would be standardised in the new investigation.

.....

Describe how the independent variable, concentration of **X**, will be investigated.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 22]

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You are required to use a sharp pencil for drawings and graphs.

2 **(a)** **J1** is a slide of a stained transverse section through a plant stem. This plant genus grows widely throughout the world.

You are not expected to be familiar with this specimen.

(i) Draw a large plan diagram of the quarter of the stem, as shown in Fig. 2.1.

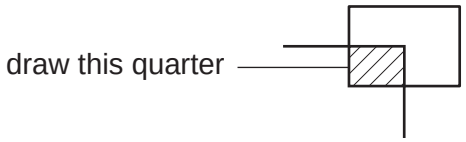


Fig. 2.1

Use **one** ruled label line and the letter **T** to identify the tissue which is made up of cells that are adapted for the transport of water.

[5]

(ii) Select one group of **four** cells from the tissue (cortex) between the epidermis and the vascular bundle. Each cell in the group should touch two of the other cells.

Make a large drawing of this group of **four** cells.

Use **one** ruled label line and label to identify **one** cell wall.

[4]

(b) Fig. 2.2 is a stained transverse section through part of the stem of a different plant species. You are not expected to be familiar with this specimen.

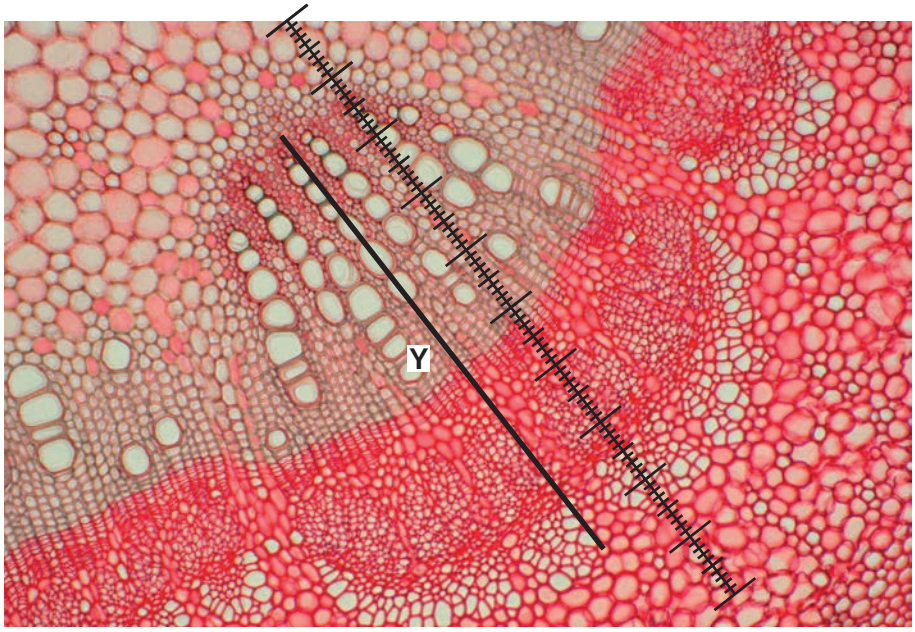


Fig. 2.2

A student calibrated the eyepiece graticule in a light microscope using a stage micrometer scale so that the actual length of the vascular bundle could be found.

The calibration was: one eyepiece graticule division equal to 11 μm.

Fig. 2.2 shows a photomicrograph taken using the same microscope with the same lenses as the student.

Use the calibration of the eyepiece graticule division and Fig. 2.2 to calculate the actual length of the vascular bundle, shown by line **Y**.

You may lose marks if you do not show all the steps in your working and do not use appropriate units.

actual length of the vascular bundle ..... [3]

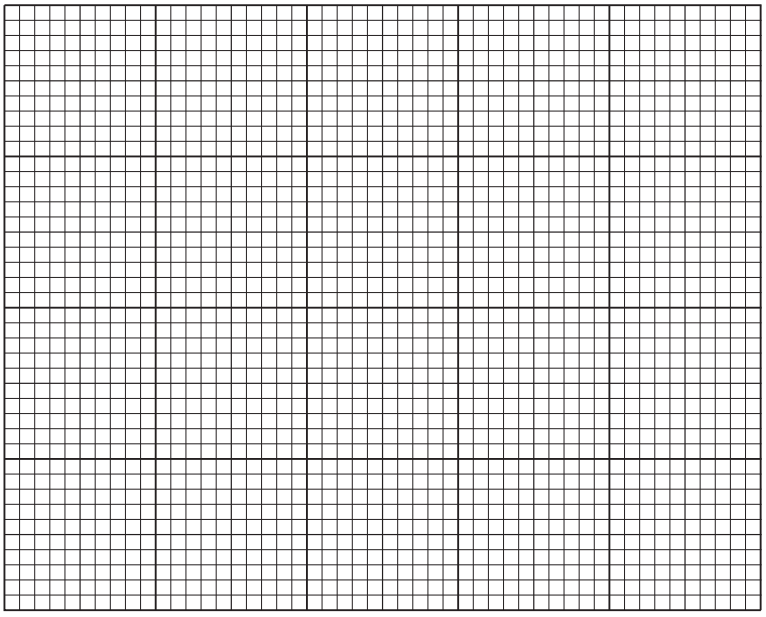
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(c) The plant in Fig. 2.2 produces fruit that are an important source of food for many animals in the ecosystem in which they grow.
A scientist carried out some tests to determine the mass of certain biological molecules found in one of these fruits. The total mass of the fruit was 35 g.
The results of the scientist's investigation are shown in Table 2.1.

Table 2.1

biological molecule found in the fruit	mass of biological molecule in the 35 g fruit / g
carbohydrate (C)	17.0
saturated fat (S)	0.2
unsaturated fat (U)	0.4
fibre (F)	2.4
protein (P)	1.2

(i) Plot a chart of the data shown in Table 2.1. [4]



(ii) Calculate the percentage of the fruit that is made up of fat.
You may lose marks if you do not show all the steps in your calculation and do not use appropriate units.

percentage ..... [2]

[Total: 18]

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