Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/35**

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, paperclips, 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 **12** printed pages.

UNIVERSITY of CAMBRIDGE International Examinations

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 and recording one or more additional measurements.

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

1 The enzyme **E** catalyses the reaction of urea with water to form ammonium carbonate and carbon dioxide.

$$\text{urea} + \text{water} \rightarrow \text{ammonium carbonate} + \text{carbon dioxide}$$

Aqueous ammonium carbonate produces ammonium ions. This forms an alkaline solution which causes red litmus paper to change to blue.
This colour change will be used to indicate the end-point of the reaction.
The end-point of the reaction is when **all of the surface** of the red litmus paper is blue.

You are required to:

- prepare different concentrations of the urea solution, **U**
- investigate the effect of different concentrations of **U** (independent variable) on the reaction of **U** with water, **W**.

You are provided with:

labelled	contents	hazard	volume / cm^3
U	5% urea solution	harmful irritant	50
W	distilled water	none	100
E	enzyme solution	harmful irritant	10

labelled	contents	hazard	quantity
R	red litmus paper	none	2 strips

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.

(a) State the hazard with the greatest level of risk when using the apparatus and reagents in step 1 on page 4.

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

hazard .....

level of risk .....

[1]

(b) (i) You are required to make a **serial** dilution of the 5% urea solution, **U**, which reduces the concentration of the urea solution **by half** between each successive dilution.

You will need to **prepare** 40 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 urea solution available for use in the investigation
- using one arrow, with a label above the beaker, to show the **concentration** and **volume** of urea 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.

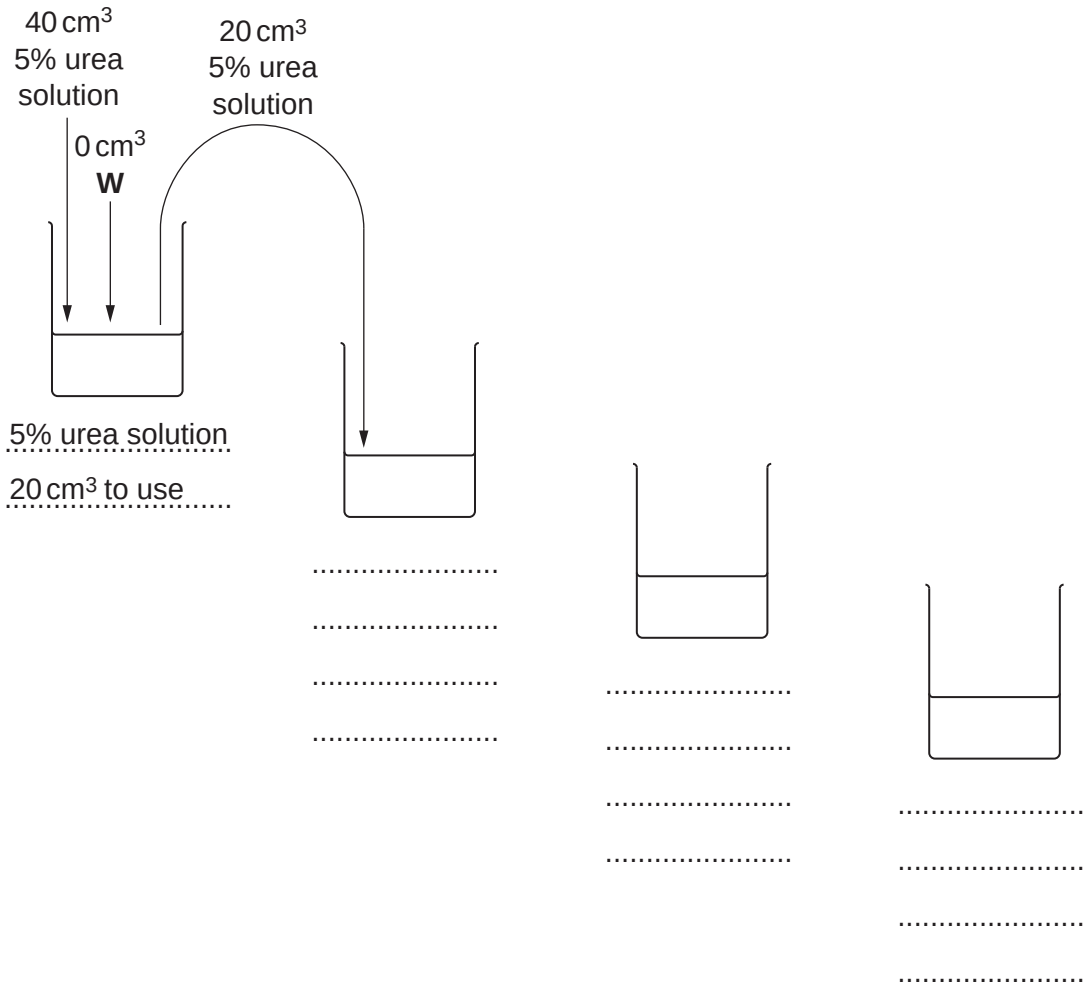


Fig. 1.1

[3]

Proceed as follows:

1. Prepare the concentrations of urea solution, as stated in **(b)(i)**.

2. Cut the red litmus paper into lengths of approximately 0.5 cm. Put one piece of litmus paper into the bottom of each of the four test-tubes.

3. Put 0.5 cm^3 of **E** into each test-tube.

4. Put 5 cm^3 of the **lowest** concentration of urea solution into one of these test-tubes and mix well. Immediately start timing.

5. During the investigation, shake the test-tube occasionally to mix the contents.

6. Record in **(b)(ii)** the time taken for **all of the surface** of the red litmus paper to change to blue (the end-point).
   If the piece of litmus paper does not reach the end-point after 180 seconds (3 minutes), stop the experiment and record '**more than 180**'.

7. Repeat steps 4 to 6 with the next lowest concentration of urea solution.

8. Repeat step 7 with the other concentrations of urea solution.

   You are now required to replicate the investigation.

9. Repeat steps 2 to 8.

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

[5]

(iii) Significant sources of error may cause some of the raw data to be inaccurate, producing anomalous results.

- The end-point of this investigation was the change in colour of the red litmus paper. State how this might have caused the results to be inaccurate.

  .....

  .....

- Identify **one other** significant source of error for this investigation.

  .....

  .....

[2]

(iv) Describe **one** improvement to this investigation which would increase confidence in your results.

.....

.....[1]

(v) State **one** piece of apparatus used in this investigation that may have a systematic error.

.....[1]

(vi) When a student carried out this investigation, the red litmus paper changed to blue in a very short time. This made measuring the time inaccurate.

Describe **how** the student could change the procedure to increase the time taken to reach the end-point.

.....

.....

.....

.....

.....[2]

(c) The 'urea breath test' is used to detect human stomach infections caused by bacteria. If the bacteria are present in the stomach, an enzyme produced by the bacteria breaks down the urea to carbon dioxide. This carbon dioxide is absorbed from the stomach into the blood and travels to the lungs where it is released in the breath.

To test for the presence of the bacteria, the patient drinks a solution of urea containing ^{13}C, which is an isotope of carbon. The breath of the patient is then sampled at intervals for 110 minutes and analysed for the presence of $^{13}CO_2$ (carbon dioxide containing ^{13}C).

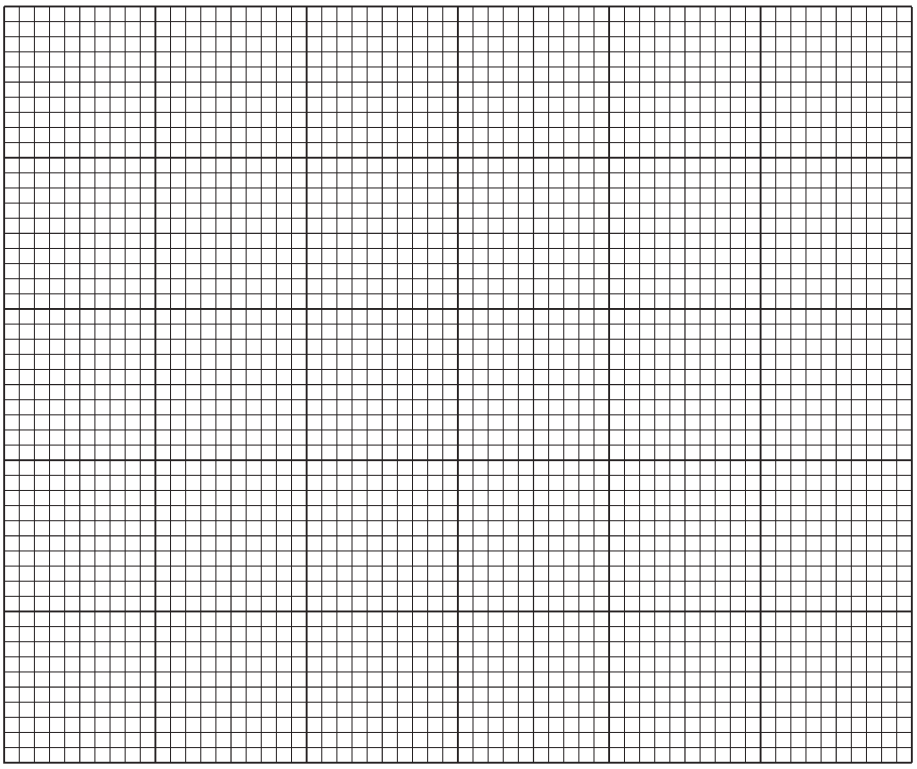
The results are shown in Table 1.1.

Table 1.1

time of sampling / minutes	**$^{13}CO_2$ in the breath / arbitrary units**
30	21.8
40	19.0
60	14.5
75	12.5
110	10.7

You are required to use a sharp pencil for graphs.

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



[4]

(ii) Using your knowledge of enzymes, explain the trend shown in the data.

.....

.....

.....

.....

.....[2]

[Total: 21]

You are required to use a sharp pencil for drawings.

2 **(a)** **K1** is a slide of a stained transverse section through a plant stem. This plant genus grows in Europe, Africa and Asia.
You are not expected to be familiar with this specimen.

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

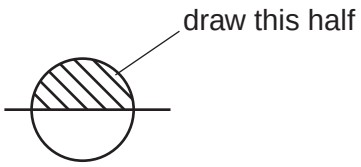


Fig. 2.1

Use **one** ruled label line and label to identify the pith.

[5]

(ii) Observe a corner or bulge of the stem.
Select and make a large drawing of:

- **two** whole, adjacent cells from the epidermis which touch each other
- **two** whole, adjacent cells from the cortex (the layer of tissue under the epidermis) which touch each other.

The drawings should show any difference in size (linear magnification) observed between each pair of cells.

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

cells from epidermis

cells from cortex

[5]

(b) Fig. 2.2 is a stained transverse section through the stem of a different plant species. This plant species grows throughout the world.

You are not expected to be familiar with this specimen.

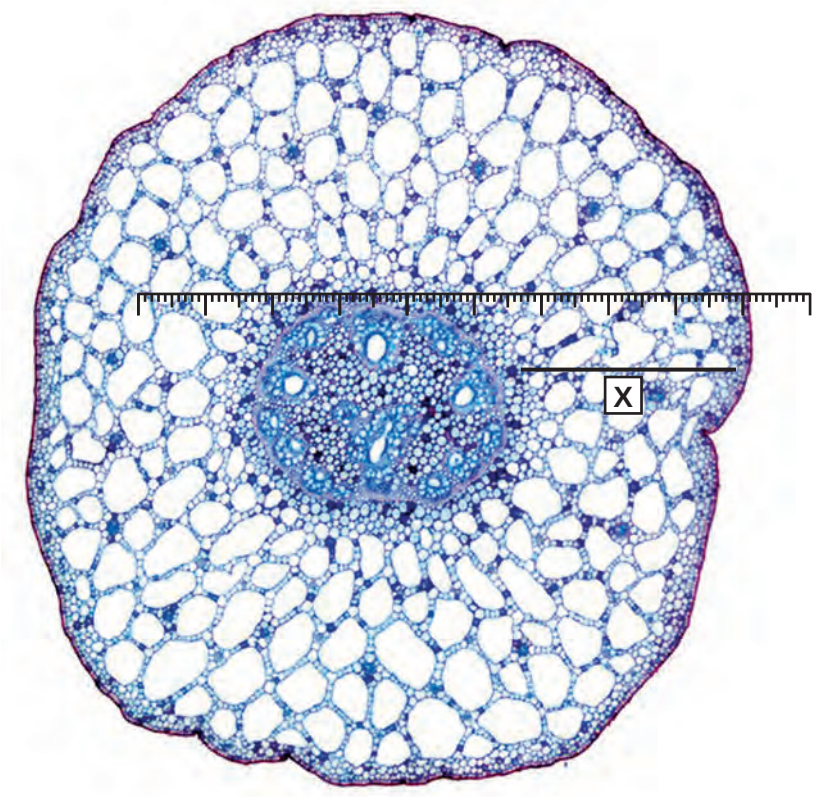


Fig. 2.2

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

The calibration was: one eyepiece graticule division equal to 0.028 mm.

(i) The use of the unit mm is **not** the most appropriate unit for use with the light microscope.

State which unit is the most appropriate for use with the light microscope and show how the value 0.028 mm is converted to this unit.

You may lose marks if you do not show your working.

unit .....[2]

(ii) 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 from **(b)(i)** and line **X** in Fig. 2.2 to calculate the actual total width of the tissue as shown by line **X**.

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

*actual width of the tissue shown by line **X*** .....[2]

(iii) Suggest **one** observable feature of the stem in Fig. 2.2 which supports the conclusion that this is from a plant growing in a freshwater pond.

Explain how this feature supports this conclusion.

feature .....

explanation .....

.....[1]

(c) Prepare the space below so that it is suitable for you to record observable differences between the specimen on **K1** and Fig. 2.2.

Record your observations in the space you have prepared.

[4]

[Total: 19]