Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/31**

Advanced Practical Skills 1 **October/November 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 **13** printed pages and **3** blank pages.

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 When plant tissue is soaked in methylene blue solution, the stain enters the tissue and colours it blue. This stained tissue can be used to investigate the effect of different solutions on the cells.

You are required to investigate the effect of different concentrations of sodium chloride solution (independent variable) on pieces of plant tissue which have been soaked in methylene blue solution.

You are provided with:

labelled	contents	hazard	volume / cm^3
S	10% sodium chloride solution	none	50
W	distilled water	none	200

labelled	contents	hazard	details	quantity
P	plant tissue stained with methylene blue	methylene blue will stain your skin	each piece has same cross-sectional area and is stained with methylene blue, then washed	5 pieces

If any methylene blue comes into contact with your skin wash it off immediately with water.

It is recommended that you wear safety goggles/glasses.

(a) You are required to make a serial dilution of the 10% sodium chloride solution, **S**, which reduces the concentration of the sodium chloride solution **by a factor of ten** between each successive dilution.

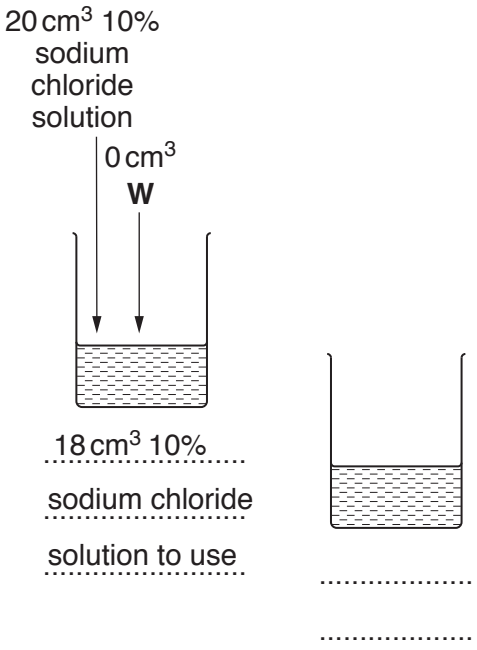
You will need to prepare 20 cm^3 of each concentration.

(i) Complete Fig. 1.1 to show how you will dilute the solution.

You should use the two beakers shown in Fig. 1.1 and draw as many extra beakers as you need to prepare sufficient concentrations for the investigation.

For each beaker:

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



[4]

Fig. 1.1

Proceed as follows:

Always use blunt forceps when handling the plant tissue to avoid contact with the methylene blue solution.

1. Prepare the concentrations of sodium chloride solution as stated in **(a)(i)** in the containers provided.

2. Remove the pieces of plant tissue from the container, labelled **P**, and place them onto a white tile.

3. Cut the ends off each piece of plant tissue.

4. Cut the plant tissue into **equal** lengths. These should be between 0.75 cm and 1 cm in length.

5. Any pieces of plant tissue which you do not need should be put into the beaker labelled '**For waste**'.

6. Empty the coloured water from the container labelled **P**.

7. Put all the pieces of plant tissue into the empty container labelled **P** and cover with tap water.

8. Change the tap water 5 times, either using a syringe or by pouring off the water. Do not touch the plant tissue.

9. Label test-tubes with the concentrations of sodium chloride solution you prepared in step 1.

10. Label a test-tube **W**.

(ii) The volume of solution surrounding the plant tissue in the test-tube is a variable that must be standardised.

One piece of plant tissue will be put into each test-tube with sodium chloride solution.

State the volume of solution that you will use in each test-tube. Explain why you have selected this volume.

volume .....

reason for selecting this volume .....

.....[1]

11. Put the volume of **W** stated in **(a)(ii)** into the test-tube labelled **W**.

12. For each of the concentrations of sodium chloride solution you prepared in step 1, put the volume stated in **(a)(ii)** into the test-tubes labelled in step 9.

13. Put one piece of plant tissue into each test-tube and leave for 10 minutes.

While you are waiting continue with Question 1.

After 10 minutes you will need to remove the plant tissue from each test-tube so that the colour of each solution can be recorded.

14. After 10 minutes, pour the solution **and** the piece of plant tissue from **one** of the test-tubes into the beaker labelled **R**.

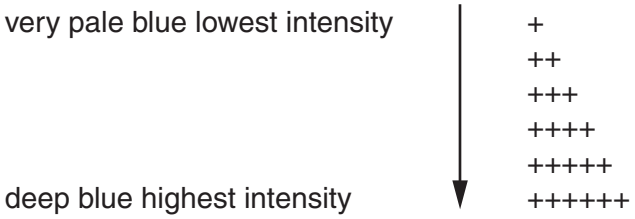
15. Put the piece of plant tissue into the container labelled **'For waste'**. Put the solution back into the test-tube.

16. Rinse beaker **R** with tap water.

17. Repeat step 14 to step 16 with each of the remaining test-tubes.

18. Put the test-tubes into the test-tube rack in the order of the intensity (quantity) of blue colour.

19. Observe the colour in the test-tubes and use the scale below to match each test-tube to an intensity of colour.



20. Record your observations in **(a)(iii)**.

(iii) Prepare the space below and record your observations.

[4]

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

(iv) State the hazard with the greatest level of risk when carrying out steps 2 to 8 on page 4. State the **level** of risk of the procedure: low or medium or high.

hazard .....

level of risk .....[1]

(v) The test-tube containing water and stained potato is a control experiment for this investigation.

Explain why it is necessary to collect this result.

.....

.....[1]

(vi) With reference to the experiment you have just carried out, explain why the use of a 1 cm^3 syringe that can measure to an accuracy of 0.01 cm^3 would **not** increase the accuracy of your results.

.....

.....[1]

(b) A scientist investigated the effect of concentration of sodium chloride solution on the increase in length of the roots of a fruit tree.

Nutrient solutions were prepared containing two different concentrations of sodium chloride solution, 1 mM and 25 mM.

10 young fruit trees were placed so that their roots were in 1 mM sodium chloride solution and another 10 young fruit trees were placed so that their roots were in 25 mM sodium chloride solution.

The root length of each of the trees was measured and the mean length of roots recorded at intervals over a period of 10 days.

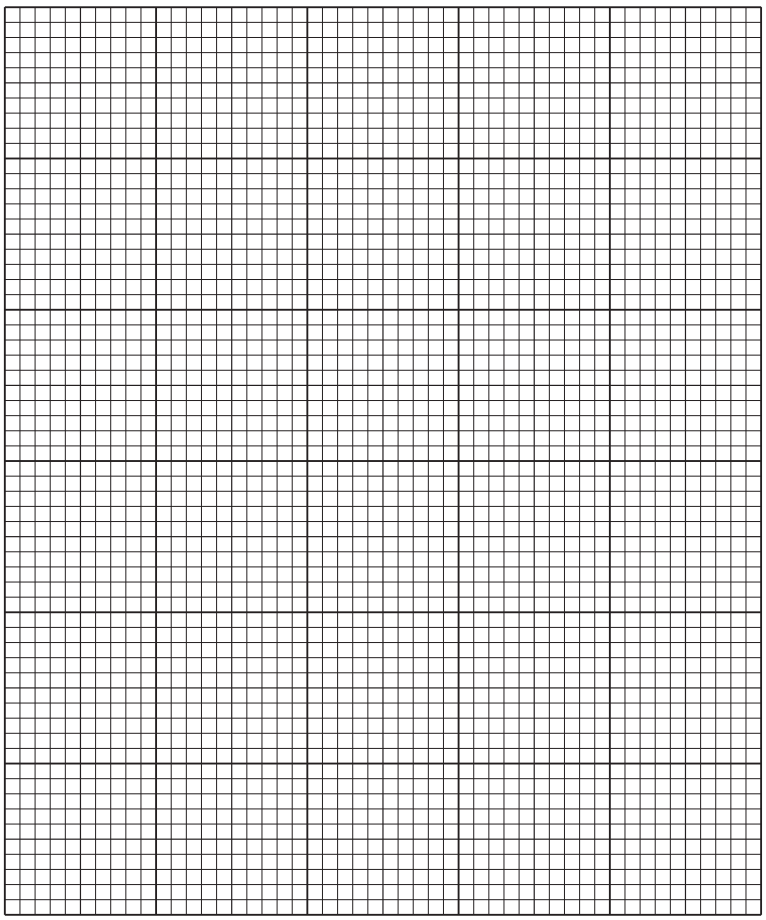
The results are shown in Table 1.1.

Table 1.1

time in sodium chloride solution/days	mean length of roots/mm	
	1 mM sodium chloride solution	25 mM sodium chloride solution
1	37.25	37.00
3	41.25	38.00
5	45.25	39.50
8	52.00	40.00
10	55.00	40.25

You are required to use a sharp pencil for graphs.

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



[4]

(ii) Using the data in Table 1.1, the rate at which root length increased between day 3 and day 5 for trees in 1 mM is calculated as 2.00 mm day^{-1}.

Use the data in Table 1.1 to calculate the rate at which root length increased between day 3 and day 5 for plants in 25 mM sodium chloride solution.

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

answer ..... mm day^{-1} [2]

[Turn over

(iii) The increase in length of the roots occurs due to an increase in cell numbers following mitosis. These cells then become longer as they take up water by osmosis.

Explain the difference in the rates between day 3 and day 5 for the two concentrations of sodium chloride solution.

.....

.....

.....

.....

.....[2]

(iv) This scientist investigated the effect of concentration of sodium chloride solution on the increase in length of the roots of a fruit tree.

Consider how you would modify this investigation to find the effect of **temperature** on the increase in length of the roots of a fruit tree in 1 mM sodium chloride solution.

Describe how the independent variable (temperature) will be investigated.

.....

.....

.....

.....

Describe how one other variable will be standardised.

.....

.....

.....[3]

[Total: 23]

Check that you have finished the whole of Question 1.

Question 2 starts on page 10

2 **J1** is a slide of a stained transverse section through a xerophytic plant leaf.

You are not expected to be familiar with this specimen.

You are required to use a sharp pencil for drawings.

(a) **(i)** Draw a large plan diagram of the part of the leaf indicated by the shaded area in Fig. 2.1.

Fig. 2.1

On your diagram use **one** ruled label line and label to identify **one** feature that adapts the plant to living in a dry habitat.

Annotate this label to explain **how** the feature you have identified adapts this plant to living in a dry habitat.

[5]

(ii) Select one group of **four** cells from the tissue below the vascular bundle found in the centre of the leaf. 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 the cytoplasm of one cell.

[5]

[Turn over

(b) Fig. 2.2 is a photomicrograph of a stained transverse section through a leaf of a different xerophytic plant species.

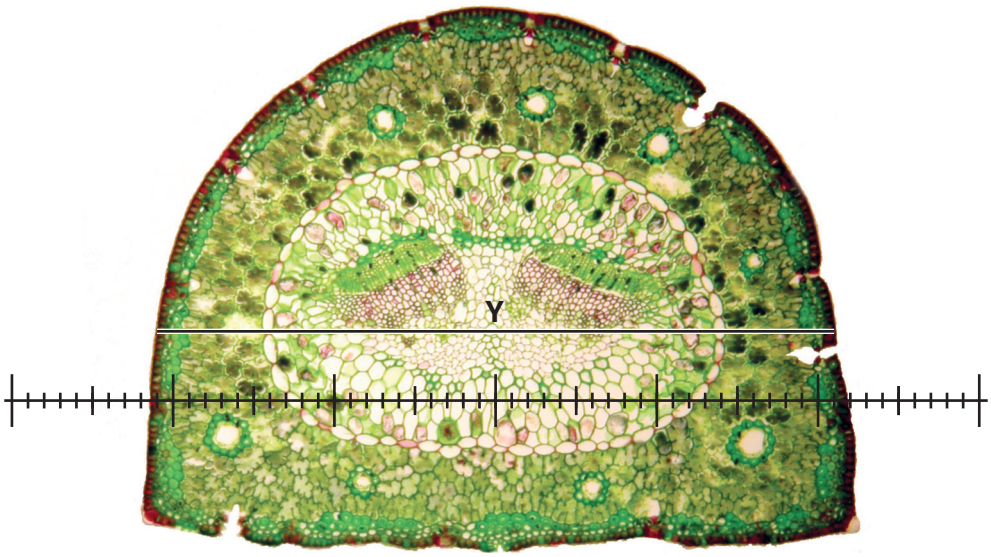


Fig. 2.2

(i) On Fig. 2.2, use a label line and the label '**X**' to suggest the position of the xylem tissue in the leaf. [1]

(ii) A student calibrated the eyepiece graticule in a light microscope using a stage micrometer scale so that the actual width of the leaf could be found.

The calibration was: one eyepiece graticule division equal to 0.012 mm.
This is converted to one eyepiece graticule division equal to 12 μm, which is the most appropriate units for use with the light microscope.

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

Use the calibration of the eyepiece graticule division and Fig. 2.2 to calculate the actual width of the leaf, as shown by line **Y**.

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

..... μm [3]

(c) The leaf on slide **J1** and the leaf in Fig. 2.2 are adapted to living in dry conditions.

Prepare the space below so that it is suitable for you to record observable differences in xerophytic adaptations between these two specimens.

Record your observations in the space you have prepared.

[3]

[Total: 17]

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