Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4769128693

BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **May/June 2017**

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 **14** printed pages and **2** blank pages.

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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, think about 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 Some plant cells contain vitamin C (ascorbic acid), which has many functions for maintaining human health.
To find the best source of vitamin C may require estimating its concentration in plant extracts.

You are required to estimate the concentration of vitamin C in a solution of plant extract, **X**, using the indicator DCPIP.

DCPIP (blue) reacts with vitamin C in a sample and becomes colourless. The end-point is when the DCPIP remains blue, so all the vitamin C has reacted with DCPIP.

The greater the volume of DCPIP added to reach the end-point, the higher the concentration of vitamin C in the sample.

You are required to:

- prepare different concentrations of vitamin C solution, **V**, using a serial dilution of a 0.05% solution of **V**
- record the volume of DCPIP required to reach the end-point for each of the concentrations of **V**.

You are provided with:

labelled	contents	hazard	volume / cm^3
V	0.05% vitamin C solution	none	50
W	distilled water	none	100
X	unknown concentration of vitamin C in a plant extract	none	20
DCPIP	indicator	none	50

It is recommended that you wear suitable eye protection.

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(a) You are required to prepare a **serial** dilution of the 0.05% vitamin C solution, **V**, which reduces the concentration of **V** by **half** between each successive dilution.

You will need to prepare 10 cm^3 of each concentration.

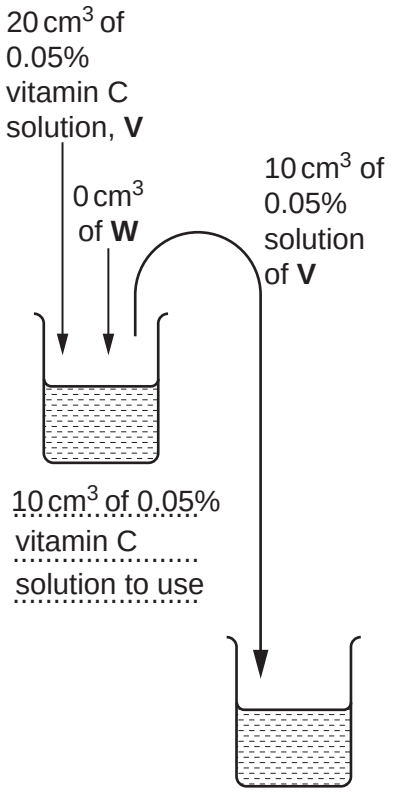
Fig. 1.1 shows the first two beakers you will use to make your serial dilution.

(i) Complete Fig. 1.1 by drawing as many extra beakers as you need for your serial dilution.

For each beaker:

- state, under the beaker, the **volume** and **concentration** of the solution available for use in the investigation
- use one arrow, with a label above the beaker, to show the **volume** and **concentration** of vitamin C 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.

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20 cm3 of 0.05% vitamin C solution, V
0 cm3 of W
10 cm3 of 0.05% solution of V
10 cm3 of 0.05% vitamin C solution to use

.....

.....

.....

[3]

Fig. 1.1

Proceed as follows:

1. Prepare the concentrations of vitamin C solution as decided in **(a)(i)** and Fig. 1.1.

You are required to find the volume of DCPIP needed to reach the end-point for each of the concentrations of vitamin C solution prepared in **(a)(i)**.

2. Put 3 cm^3 of the lowest concentration of vitamin C solution into a test-tube.

3. Put 5 cm^3 of DCPIP into the syringe, labelled **D**.

4. Wipe off any drops of DCPIP from the outside of the syringe with a paper towel.

5. Hold the syringe over the test-tube and push the plunger gently to release one or two drops of DCPIP as shown in Fig. 1.2.

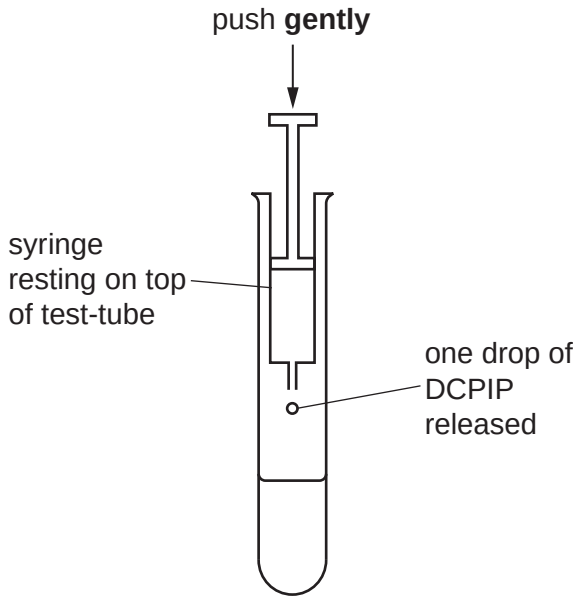


Fig. 1.2

6. Shake the test-tube to mix the contents.

7. Repeat step 5 and step 6 until the blue colour remains (does not disappear). This is the end-point.

8. Record in **(a)(ii)** the volume of DCPIP needed to reach the end-point.

   If the colour does not remain blue after adding 5 cm^3 of DCPIP, stop putting in DCPIP and record as 'more than 5'.

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9. Repeat step 2 to step 8 for each of the concentrations of vitamin C solution that you prepared in step 1.

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

[4]

(iii) Describe **one** significant source of error when carrying out steps 3 to 9.

.....

.....[1]

You are now required to estimate the concentration of vitamin C in a sample of plant extract, **X**, using DCPIP.

10. Repeat step 2 to step 8 with **X**. Record in **(a)(iv)** the volume of DCPIP needed to reach the end-point.

(iv) State the volume of DCPIP needed to reach the end-point for **X**. ..... cm^3 [1]

(v) Use your results in **(a)(ii)** and **(a)(iv)** to estimate the concentration of vitamin C in **X**.

.....[1]

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[Turn over

(vi) Describe how you could use this procedure to produce a more accurate estimate of the concentration of vitamin C in the sample of plant extract **X** than the one given in **(a)(v)**.

.....

.....

.....

.....

.....

.....

.....[3]

(b) Vitamin C is important in the human diet. It is essential for the growth and repair of tissues in the body.
Some vegetables contain vitamin C and can be eaten either uncooked (raw) or cooked.
A scientist carried out an investigation to determine the effect of heating on the vitamin C content of selected vegetables. The scientist measured the vitamin C content in 100 g of each food sample when raw and after boiling for 10 minutes.

All other variables were kept constant.

The results are shown in Table 1.1.

Table 1.1

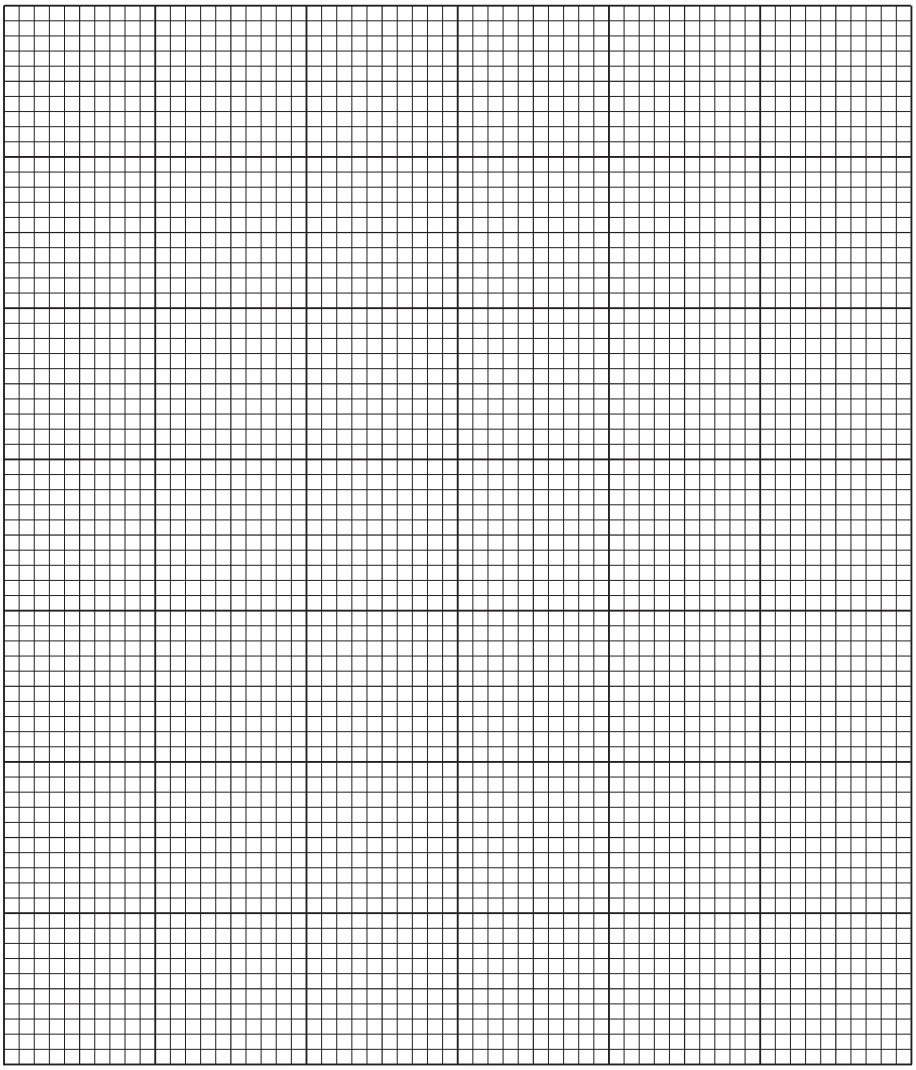
	vitamin C content / mg per 100 g	
vegetable	**raw**	**after boiling**
kale (K)	48	45
broccoli (B)	79	44
red pepper (R)	126	89

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Use a sharp pencil for charts.

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

Each pair of bars should be separated for each type of vegetable.



[4]

(ii) Calculate the percentage loss of vitamin C in broccoli as a result of boiling.

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

percentage loss = ...[2]

(iii) In raw vegetables vitamin C is contained within the cells of the tissues.
Suggest how boiling causes the loss of vitamin C in broccoli.

.....

.....

.....

.....

.....[2]

[Total: 21]

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

You are not expected to be familiar with this specimen.

(a) Observe the different tissues on **J1** and select a field of view that shows part of the epidermis and the vascular bundles.

Use a sharp pencil for drawing.

(i) Draw a large plan diagram from the selected field of view which shows:

- part of the epidermis
- only **two** smaller outer vascular bundles
- only **one** larger inner vascular bundle
- any other observable tissues.

You are expected to draw the correct shape and proportions of the different tissues.

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

[5]

(ii) Observe the cells of the epidermis on **J1**.

Select one group of **four** adjacent (touching) cells in the epidermis. Do **not** select guard cells in the epidermis. Each cell must touch at least one of the other cells.

Use the eyepiece graticule in the microscope to measure, as shown in Fig. 2.1:
- the total length of the four cells, **L**
- the depth of one of the cells, **T**.

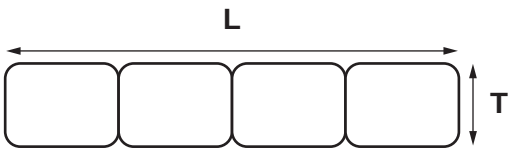


Fig. 2.1 (not drawn to scale)

L = ... eyepiece graticule units

T = ... eyepiece graticule units

[2]

(iii) Use the measurements from **(a)(ii)** to help you make a large drawing of this group of **four** cells on **J1**.

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

[5]

(iv) Suggest **one** observable feature of **J1** which supports the conclusion that this plant exchanges gases through its stem.

.....

.....

.....[1]

Fig. 2.2 is a photomicrograph of a stained transverse section through a different type of plant stem.

You are not expected to be familiar with this specimen.

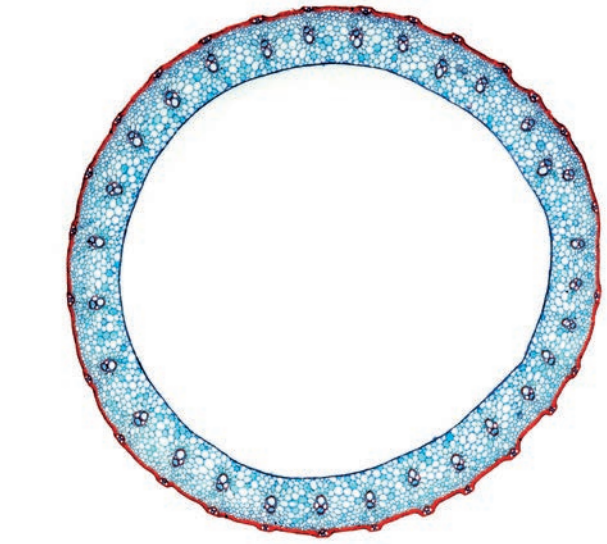


Fig. 2.2

(b) Calculate the magnification of Fig. 2.2 using the scale bar.

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

magnification × …….. [3]

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(c) Annotate Fig. 2.2 to describe **three** observable differences between the stem sections in Fig. 2.2 and on **J1** by:

- drawing label lines to **three** features in Fig. 2.2 that show these differences
- describing next to each line how each feature is different from the specimen **J1**.

[3]

[Total: 19]

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