Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE
NAME

CENTRE
NUMBER

CANDIDATE
NUMBER

COMBINED SCIENCE 0653/61

Paper 6 Alternative to Practical **May/June 2014**

1 hour

Candidates answer on the Question paper.

No Additional Materials are required.

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.

This document consists of **19** printed pages and **1** blank page.

International Examinations

[Turn over

1   A student is investigating the vitamin C content of a fruit juice.

DCPIP is a dark blue chemical that is decolourised by vitamin C. A solution containing a higher concentration of vitamin C will take fewer drops to decolourise DCPIP.

The student is provided with a set of four standard solutions of vitamin C and a fruit juice of unknown vitamin C content.
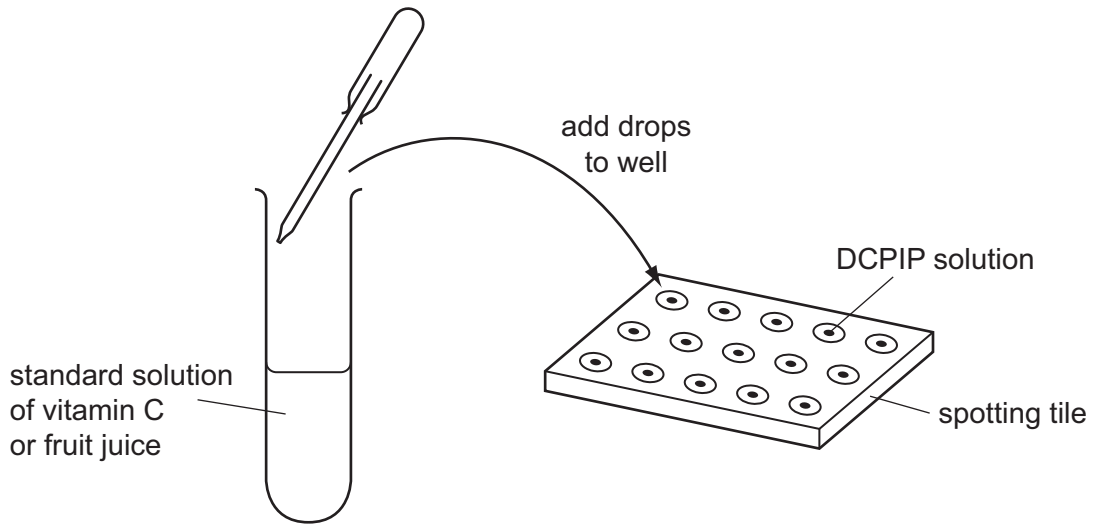

Fig. 1.1

- Using a dropping pipette, the student places two drops of DCPIP into each of five wells of a white spotting tile.

- She adds drops of the 0.25% vitamin C solution into one of the wells as shown in Fig. 1.1.

- She counts the number of drops needed to decolourise the DCPIP.

- She repeats the process for the remaining vitamin C solutions and the fruit juice.

- The results are shown in Table 1.1.

Table 1.1

concentration of vitamin C (%)	number of drops needed to decolourise DCPIP
0.25	20
0.50	17
0.75	10
1.00	5
fruit juice	12

(a) Plot a graph of vitamin C concentration on the horizontal axis against number of drops needed to decolourise DCPIP.

Draw the best fit straight line.
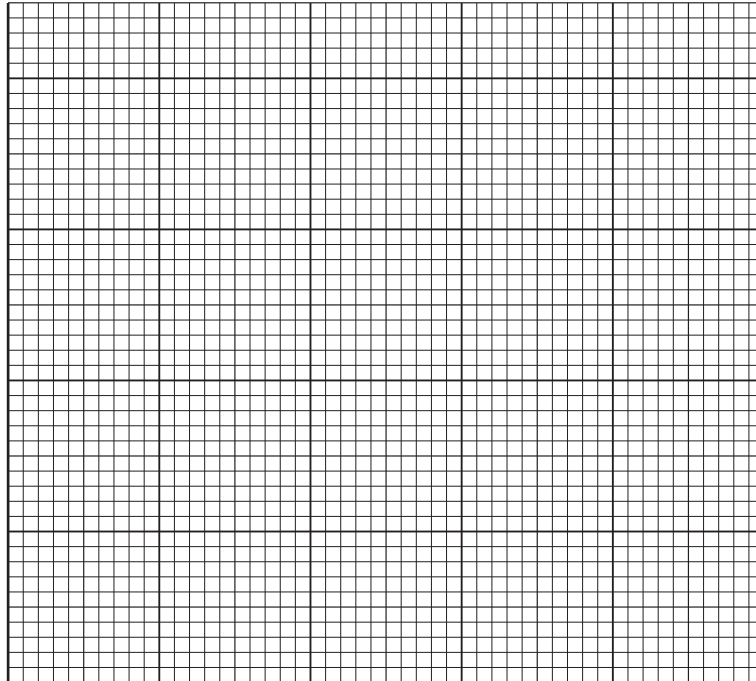
[3]

(b) Use your graph to estimate the concentration of the vitamin C content of the fruit juice and mark on the graph how you worked this out.

vitamin C content = ... %   [2]

(c) The student suggested that drops of distilled water are added to two drops of DCPIP in another well.

Give a reason why this further test should be used.

....

.... [1]

(d) Suggest **two** ways in which the experiment may be changed to give more accurate results.

1 ....

....

2 ....

....

[2]

(e) Suggest **one** way to improve the reliability of this experiment.

....

.... [1]

(f) Vitamin C is an important component of our diet. What are the consequences of a diet that lacks vitamin C?

.... [1]

Please turn over for Question 2.

 [Turn over

2 A student is investigating some reactions of sodium hydrogencarbonate, (NaHCO₃) and sodium carbonate, (Na₂CO₃). They are both white powders.

(a) She places some sodium hydrogencarbonate in a test-tube and attaches a delivery tube. She half fills a second test-tube with limewater and places the other end of the delivery tube into the limewater. She heats the first test-tube.

(i) Draw a labelled diagram of the apparatus.

[2]

(ii) She heats the test-tube of sodium hydrogencarbonate until there is no further change in the limewater. Carbon dioxide is given off.

Describe the **two** changes to the limewater.

....

....

.... [2]

(iii) The student also observes droplets of liquid in the delivery tube.

Describe a test that will show that these droplets are water.

....

.... [1]

(b) The student makes a solution of sodium hydrogencarbonate by dissolving some of it in distilled water.

She divides the solution into two test-tubes.

(i) To the first test-tube she adds a few drops of Universal (full range) Indicator solution. Sodium hydrogencarbonate solution is slightly alkaline.

Describe the colour change.

colour change .... to .... [1]

(ii) She adds a colourless liquid to the second test-tube. Bubbles of carbon dioxide are given off.

Suggest a name for the colourless liquid.

.... [1]

(c) She places some sodium carbonate in another test-tube and attaches a delivery tube. As in part **(a)** she half fills a second test-tube with limewater and places the other end of the delivery tube into the limewater.

She heats the test-tube containing sodium carbonate and records her observations.

(i) Suggest a difference between these observations and those made in **(a)(ii)**.

....

.... [1]

She makes a solution of sodium carbonate by dissolving some of it in distilled water.

She divides the solution into two test-tubes.

(ii) To the first test-tube she adds a few drops of Universal Indicator solution.

Sodium carbonate solution is more alkaline than sodium hydrogencarbonate.

How does the final colour of the Universal Indicator differ from the colour seen in **(b)(i)**?

....

.... [1]

(iii) To the second test-tube she adds an equal volume of copper(II) sulfate solution.

A blue precipitate is formed.

Suggest the name of this precipitate.

.... [1]

3 A student is finding the density of plasticine (modelling clay).

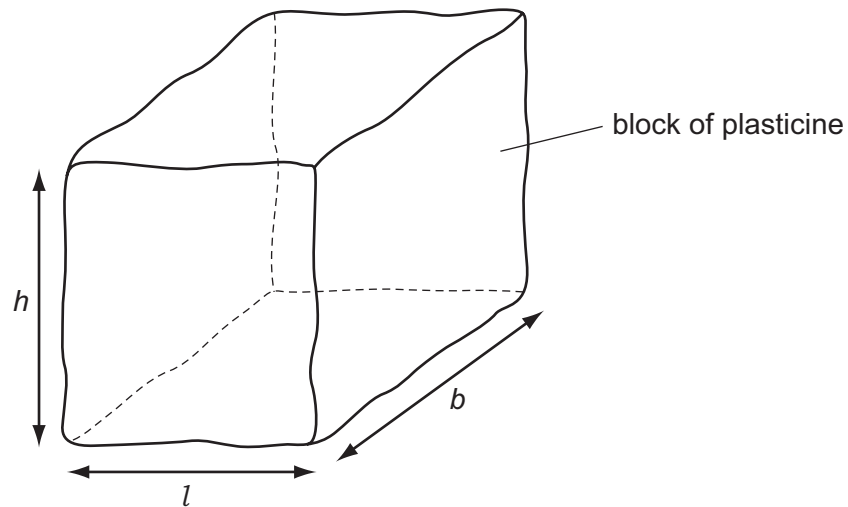**(a)** She moulds the piece of plasticine into a block as shown in Fig. 3.1.

block of plasticine

Fig. 3.1

(i) Measure the length, (*l*), breadth, (*b*), and height, (*h*), of the arrows in Fig. 3.1 to the nearest 0.1 cm and record your results below.

$l =$ .... cm

$b =$ .... cm

$h =$ .... cm   [3]

(ii) Calculate the volume of the block using the equation:

$$V = l \times b \times h$$

$V =$ .... cm^3 [1]

(b) The student sets up some apparatus as shown in Fig. 3.2.
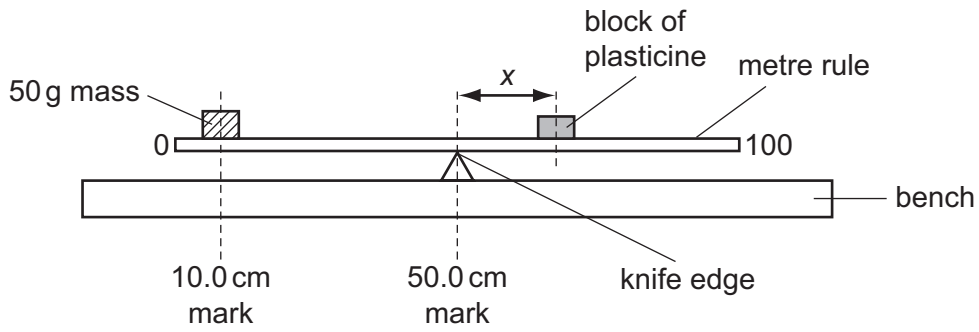
Fig. 3.2

A 50 g mass has been secured to the metre rule. Its position is fixed with its centre over the 10.0 cm mark.

She takes the block of plasticine and places it on the metre rule.

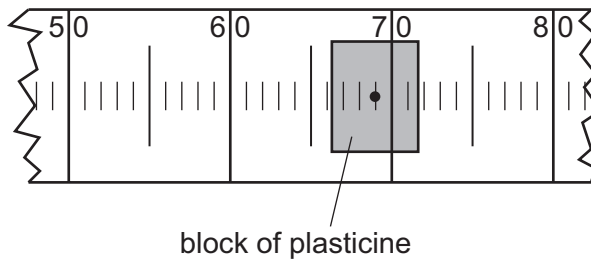She moves it until the rule is just balanced with the knife edge directly under the 50.0 cm mark.

block of plasticine

Fig. 3.3

(i) Use Fig. 3.3 to find the distance, x, between the centre of the plasticine and the 50 cm mark.

$x =$ .... cm   [1]

(ii) Calculate the mass, m, of the block of plasticine using the equation:

$$m = \frac{2000}{x}$$

$m=$ .... g   [1]

(iii) Calculate the density, d, of the plasticine using the equation:

$$d = \frac{m}{V}$$

$d =$ .... g / cm^3 [2]

       [Turn over

(c) Suggest **two** reasons why the data you have used to calculate the density of plasticine may be inaccurate.

reason 1 ....

....

reason 2 ....

.... [2]

Please turn over for Question 4.

 [Turn over

4 A student is studying cells using a light microscope.

She prepares cells from an onion and stains them using iodine solution.

Fig. 4.1 shows a group of onion cells as seen under the microscope.
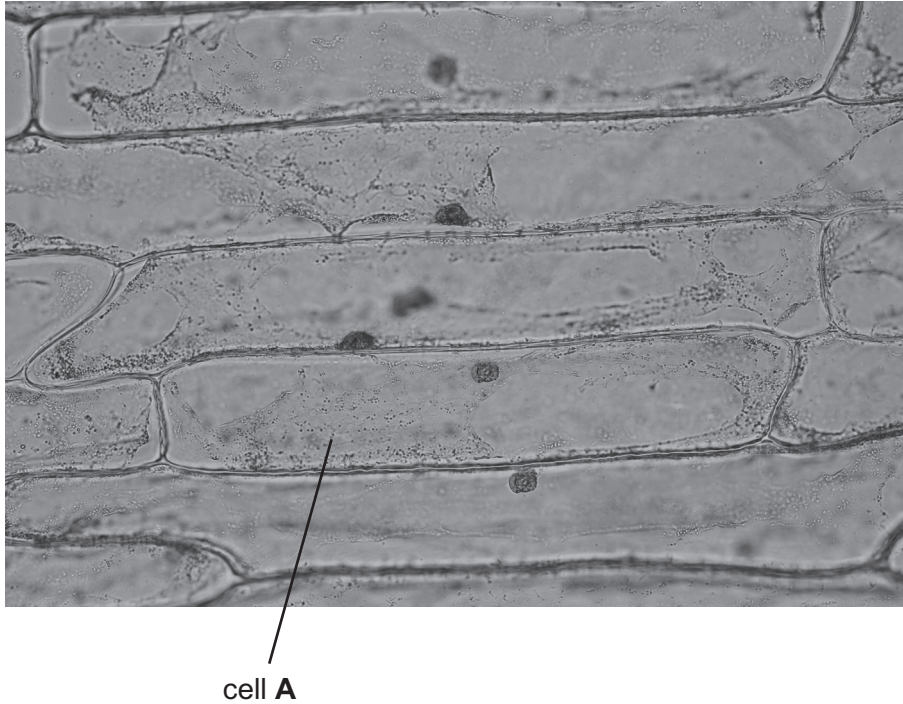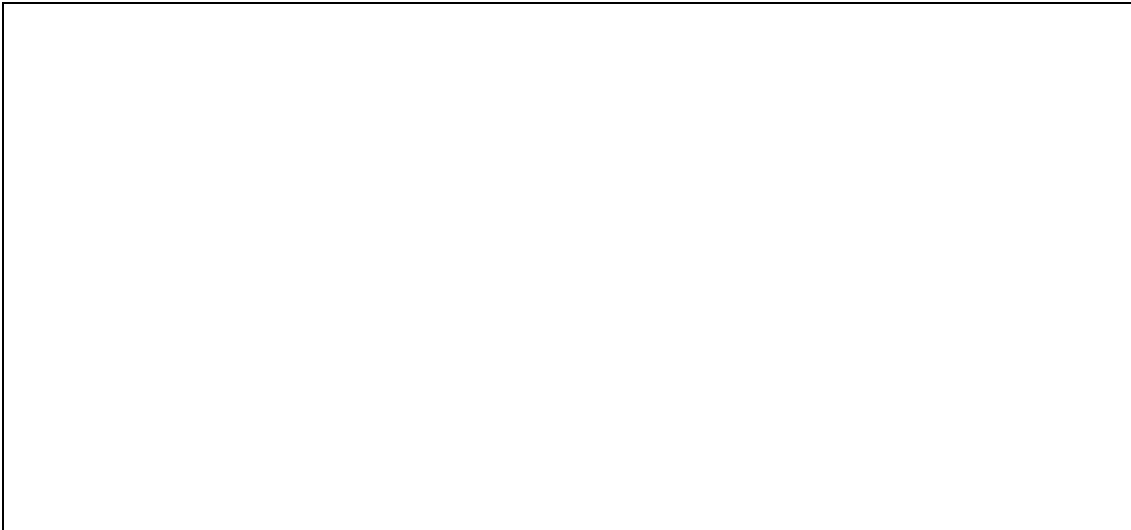

cell **A**

Fig. 4.1

(a) Make a large pencil drawing of cell **A** in the box provided. **Label** the nucleus and cell wall.

[3]

The student wants to measure the average length of these cells. She places a ruler with a millimetre scale on the stage of the microscope to find the diameter of the field of view. She looks down the microscope and sees the field of view shown in Fig. 4.2.
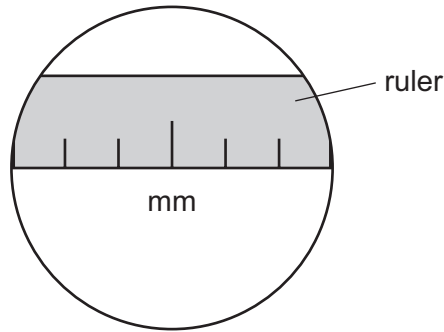

Fig. 4.2

(b) (i) Using the ruler in Fig. 4.2 state the width of the field of view of the microscope.

.... mm   [1]

(ii) She then replaces her slide and counts 15 cells across the field of view.

Calculate the average length of an onion cell using your answer from part **(b)(i)**.

Show your working.

average length of cell = ... mm   [1]

(iii) On your drawing in part **(a)** measure the length of cell **A** at the longest part.

length of cell **A** on the drawing = ... mm   [1]

(iv) Using the value for the average cell length from part **(b)(ii)** and the length of cell **A** on your drawing, calculate the magnification of your drawing.

magnification = ... [2]

(c) Name **one** structure normally present in a plant cell that is **not** visible in these onion cells.

.... [1]

(d) Another student uses a microscope to look at some cells in iodine solution. Some parts of the cell stain blue-black.

Explain this observation.

....

.... [1]

Please turn over for Question 5.

[Turn over

5 (a) A student is investigating how the temperature changes as a hot liquid cools.

He starts with some waxy solid in a test-tube and heats it until it melts.

He removes the heat and takes the temperature of the liquid as it cools.

He starts a stopclock and measures the temperature every minute for 10 minutes and records the values in Table 5.1.

Table 5.1

time / min	temperature / °C
0	
1	74
2	69
3	69
4	
5	55
6	42
7	32
8	28
9	22
10	

(i) Read the thermometers in Fig. 5.1 which show the temperatures at 0, 4 and 10 minutes.

Record the value in Table 5.1.   [3]

time = 0 min   time = 4 min   time = 10 min
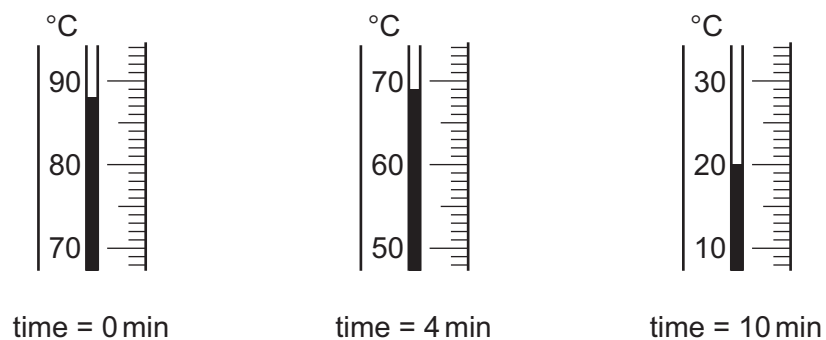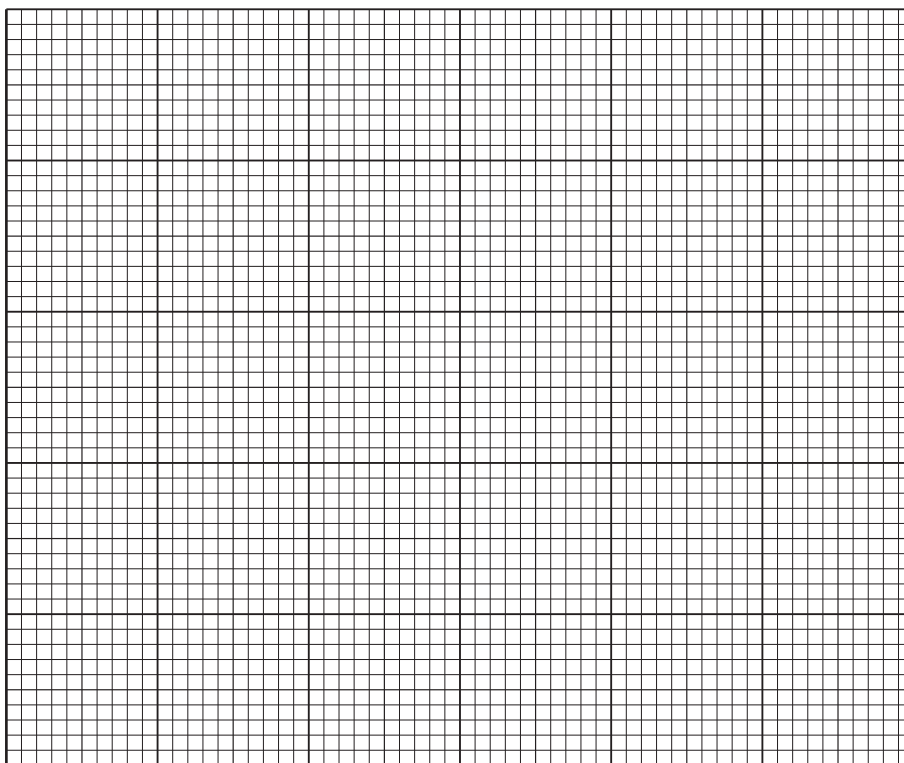
Fig. 5.1

(ii) Use the grid provided to plot a graph of temperature (vertical axis) against time. Draw the best fit smooth curve.

[3]

(iii) Use the graph to suggest a value for the melting point of the waxy solid.

.... °C   [1]

(b) Describe the movement and arrangement of the molecules of the substance at

time = 1 minute,

movement   ....

arrangement   ....

time = 7 minutes.

movement   ....

arrangement   ....

[3]

6 **(a)** A student is investigating how the length of a wire affects its electrical resistance.

    (i) Name a piece of apparatus that can be used to measure

        potential difference, ...

        current. .... [2]

    (ii) State the formula used to calculate the resistance of the wire using data obtained from these two pieces of apparatus.

        [1]

    (iii) Draw a circuit diagram to show how the student would carry out the investigation. Include the two pieces of apparatus you have named, the piece of wire and a power source.

        [4]

(b) (i) Use the axes in Fig. 6.1 to sketch the line you would expect if resistance is plotted against length.

resistance / ......

0

0   length of wire / cm
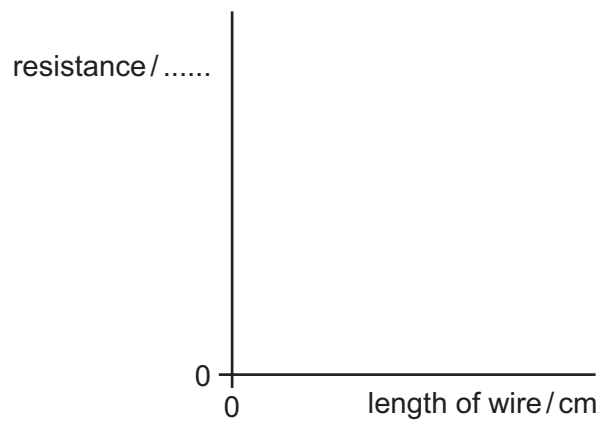
Fig. 6.1

[2]

(ii) State the unit for resistance.

unit = ...   [1]

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