Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5176676854

BIOLOGY **0610/51**

Paper 5 Practical Test **October/November 2019**

1 hour 15 minutes

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 syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **14** printed pages and **2** blank pages.

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[Turn over

1 The leaves of plants contain green chlorophyll and other coloured pigments that are used in photosynthesis to trap light.

You are going to investigate the pigments present in a green leaf using chromatography. The process of chromatography separates the pigments. The more soluble the pigment the further it moves.

In this experiment the pigments in green leaves dissolve in a solvent (**S1**). The solvent moves up the paper carrying the pigments different distances.

You should use the safety equipment provided while you are carrying out the practical work.

Step 1 Use a ruler to draw a **pencil** line across the strip of chromatography paper 3 cm from one end.

Step 2 Place a leaf on top of the pencil line and transfer the pigment from the leaf onto the pencil line by rolling a metal disc over the leaf as shown in Fig. 1.1. You should see a faint green line on the chromatography paper.

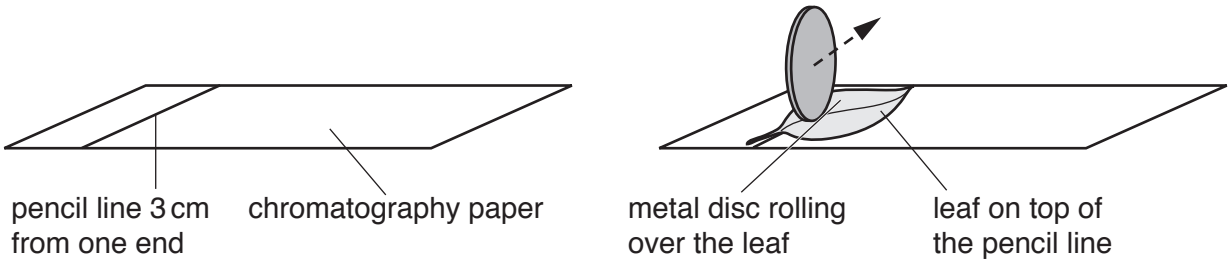


Fig. 1.1

Step 3 Move the leaf so that a different part of the leaf is over the line you have just made and repeat rolling the metal disc across the leaf along the pencil line. Repeat this step until you have a dark green line.

Step 4 Pour solvent **S1** into a test-tube to a depth of 2 cm. Put the lid back on the solvent container to prevent evaporation.

Step 5 Carefully lower the strip of chromatography paper into the test-tube with the green line at the bottom. Do **not** allow the green line to go below the level of solvent **S1** as shown in Fig. 1.2.

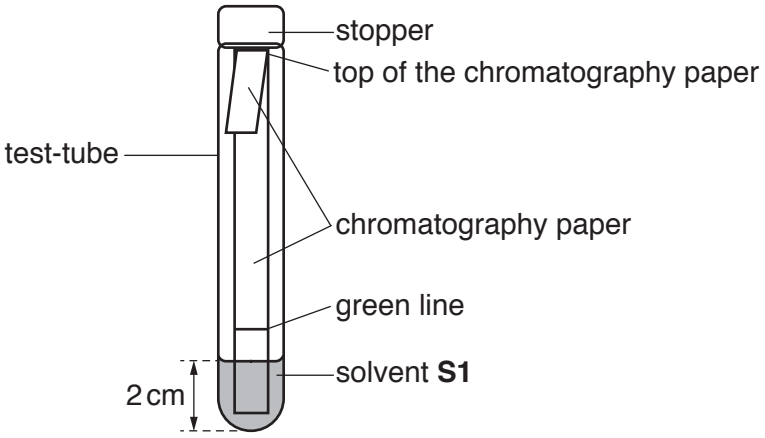


Fig. 1.2

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Step 6 Fold the free end of the chromatography paper over the edge of the outside of the test-tube and place a stopper in the test-tube.

Do not move the test-tube during steps 7 and 8.

Step 7 Start the stop-clock and observe the movement of solvent **S1** up the chromatography paper for one minute while it is inside the test-tube.

Step 8 Wait for five more minutes and then observe the movement of the solvent again while it is inside the test-tube. If the solvent is near the top of the chromatography paper move on to step 9. If it is not near the top of the chromatography paper wait for another five minutes and then move on to step 9.

Step 9 When the solvent is near the top of the chromatography paper (or you have waited for a total of 11 minutes) remove the stopper from the test-tube and lift out the strip of chromatography paper. Put the stopper back into the test-tube to prevent the solvent from evaporating.

Step 10 Place the chromatography paper on a paper towel and use the pencil to draw a line across the paper to mark how far up the chromatography paper solvent **S1** has reached. Leave the paper to dry for one minute.

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[Turn over

(a) (i) Use the adhesive tape to stick your completed chromatogram in the space in Fig. 1.3.

Observe the different pigment colours visible on your chromatogram.

Complete Fig. 1.3 by drawing the shape of each pigment colour visible in your chromatogram onto the diagram. Label all the visible pigment colours and the position reached by solvent **S1**.

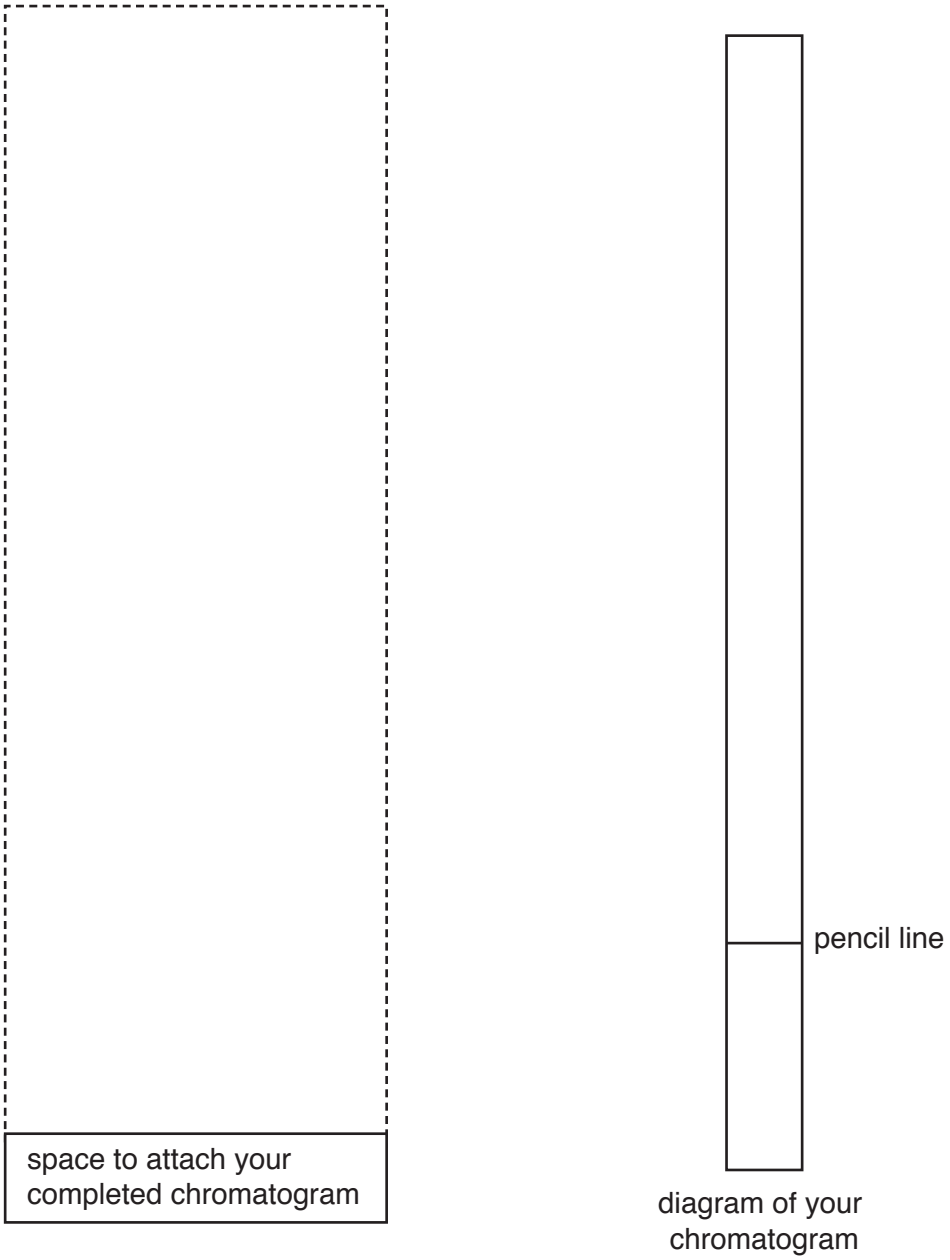


Fig. 1.3

[3]

(ii) Suggest why it is important that the green line was kept above solvent **S1**.

.....

.....

..... [1]

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(b) Some students used a different method to obtain the pigments from a leaf by cutting up the leaf and grinding it with ethanol. They filtered the mixture and obtained a chlorophyll extract which was then evaporated until only a small volume of extract remained. Ethanol is flammable.

(i) State **one** safety precaution that the students would take when evaporating substances containing ethanol.

.....

..... [1]

(ii) A chromatography paper was prepared in the same way as in step **1**. A small drop of the concentrated chlorophyll extract was placed on the pencil line and allowed to dry. The chromatography paper was then placed in a test-tube containing a different solvent (**S2**) and left for 10 minutes.

Fig. 1.4 shows the appearance of the chromatogram after it was removed from solvent **S2** and allowed to dry.

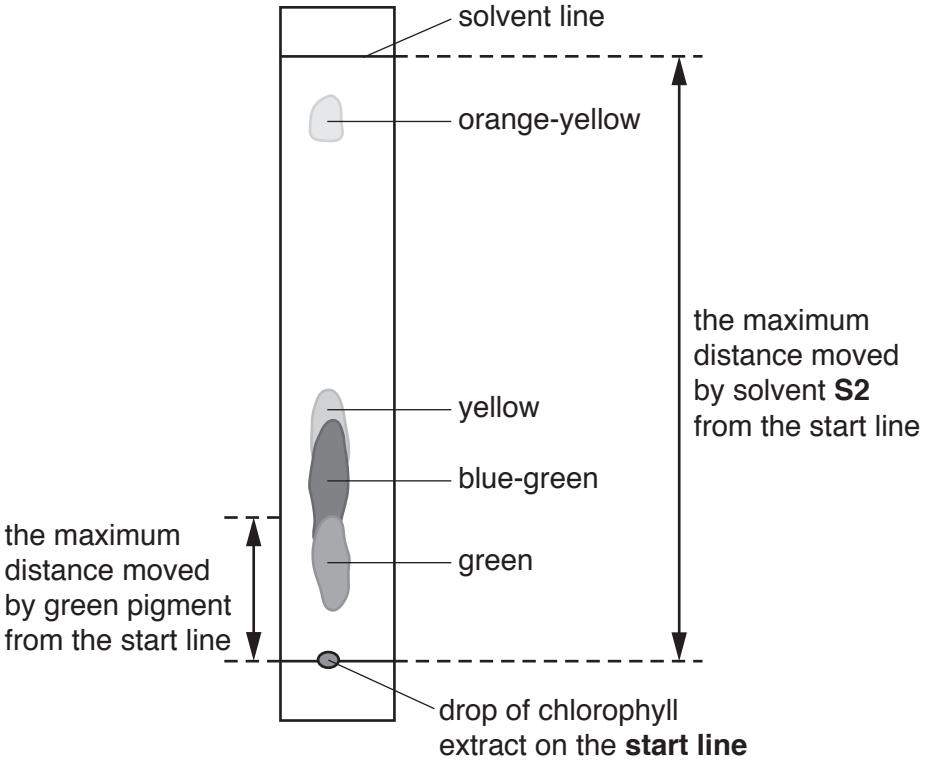


Fig. 1.4

The different pigments can be compared by calculating their Rf value.

$$\text{Rf value} = \frac{\text{the maximum distance moved by the pigment from the start line}}{\text{the maximum distance moved by the solvent from the start line}}$$

Fig. 1.4 shows where these distances were measured on the chromatogram for the green pigment.

The students calculated some of the Rf values. The results are shown in Fig. 1.5.

green 0.24 blue-green 0.40 yellow 0.45

Fig. 1.5

Calculate the Rf values for the **orange-yellow** pigment in Fig. 1.4.

Give your answer to two decimal places.

the maximum distance moved by the orange-yellow pigment from the start line

..... mm

the maximum distance moved by the solvent from the start line ..... mm

orange-yellow Rf value .....

[3]

(iii) Prepare a table and record the colours and Rf values of the four pigments.

[3]

(iv) Identify the pigment colour that is the least soluble and explain your choice.

pigment colour .....

explanation .....

.....

.....

[2]

(c) The method used to separate the leaf pigments in **1(b)** is different from the method you used in **1(a)**.

Describe **two** ways in which the method used in **1(b)** is an improvement to the method you used in **1(a)**.

1 .....

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2 .....

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[2]

(d) Chloroplasts can contain starch.

State the name of the substance that would be used to test for the presence of starch.

..... [1]

(e) Chloroplasts contain coloured pigments. Fig. 1.6 shows some of the cells from a leaf that contains chloroplasts.

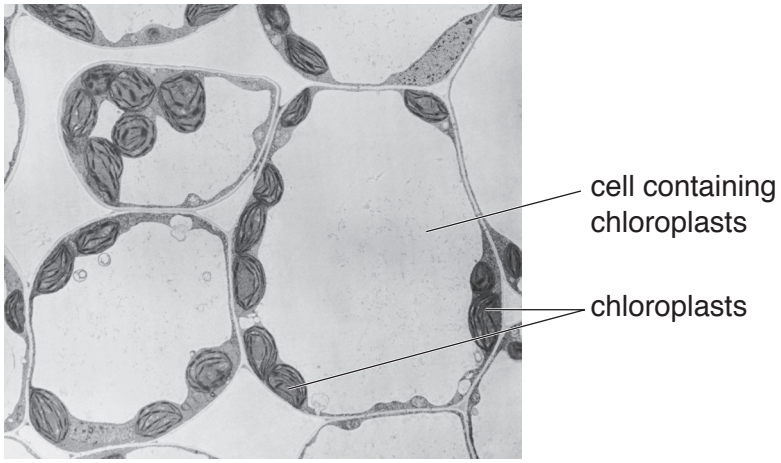


Fig. 1.6

Make a large drawing to show the three complete cells containing chloroplasts in Fig. 1.6.

Label **one** chloroplast on your drawing.

[5]

(f) Some plants have leaves that are not green. For example the plant may have red, purple or yellow leaves.

A student predicted that leaves of different colours would have different rates of photosynthesis.

Plan an investigation to find out if the student's prediction is correct.

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..... [6]

[Total: 27]

2 **(a)** Fig. 2.1 is a diagram of a sample of red blood cells on part of a counting grid. The blood has been diluted 200 times so that the cells can be counted more easily. A light microscope is used to view the counting grid.

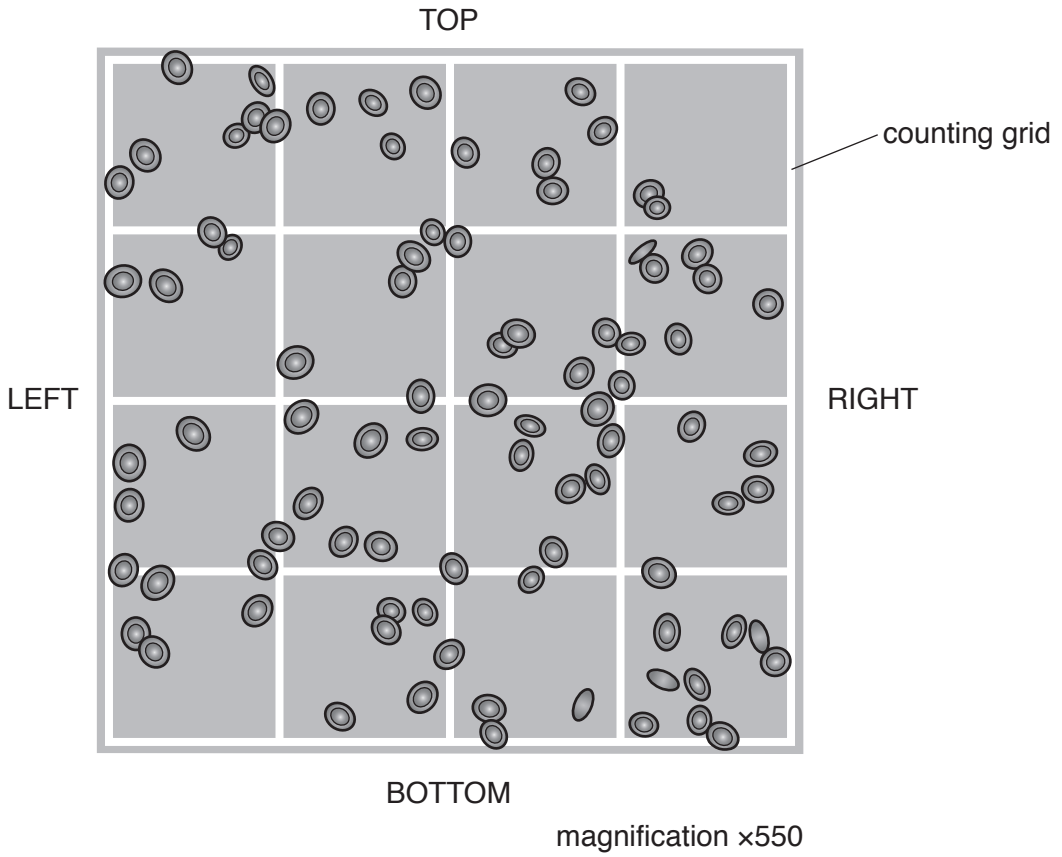


Fig. 2.1

(i) Scientists count the number of red blood cells to estimate the total number of red blood cells in the blood.

Cells that are touching the top and left side of the grid are counted.

Cells touching the bottom and right side of the grid are **not** counted.

State how many red blood cells would **not** be counted in the sample in Fig. 2.1.

..... [1]

(ii) The actual size of the counting grid in Fig. 2.1 is 0.20 mm × 0.20 mm. The depth of the counting grid is 0.10 mm.

Calculate the volume of the counting grid.

..... mm^3 [1]

(iii) A different sample of blood was also diluted 200 times.

The number of red blood cells inside the same size counting grid was 95.

Calculate the number of red blood cells per mm^3 of undiluted blood.

Use the formula:

$$\text{number of red blood cells per mm}^3 = \frac{\text{red blood cells counted} \times \text{dilution}}{\text{volume of the counting grid}}$$

Space for working.

number of red blood cells per mm^3 .....
[1]

(b) Table 2.1 describes the number of red blood cells and white blood cells in different blood samples.

Table 2.1

condition	number of red blood cells	number of white blood cells
healthy	normal	normal
anaemia	low	normal
leukaemia	low	high
infection	normal	high

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Fig. 2.2 shows drawings of blood samples.

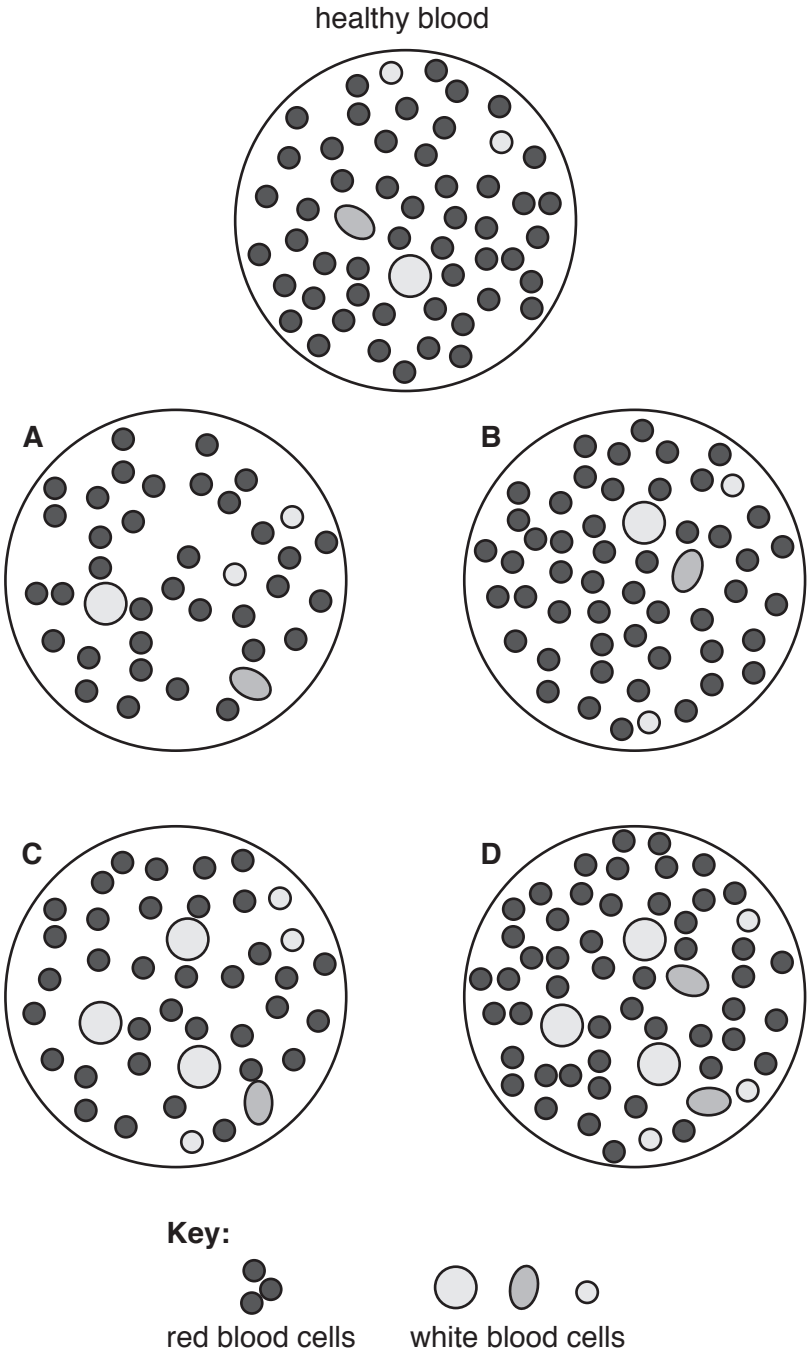


Fig. 2.2

State the letters in Fig. 2.2 which could represent these conditions:

infection .....

anaemia ..... .

[2]

(c) Anaemia can also be diagnosed by measuring the haemoglobin content of the blood. Samples of blood were collected from 1800 men and 2400 women.

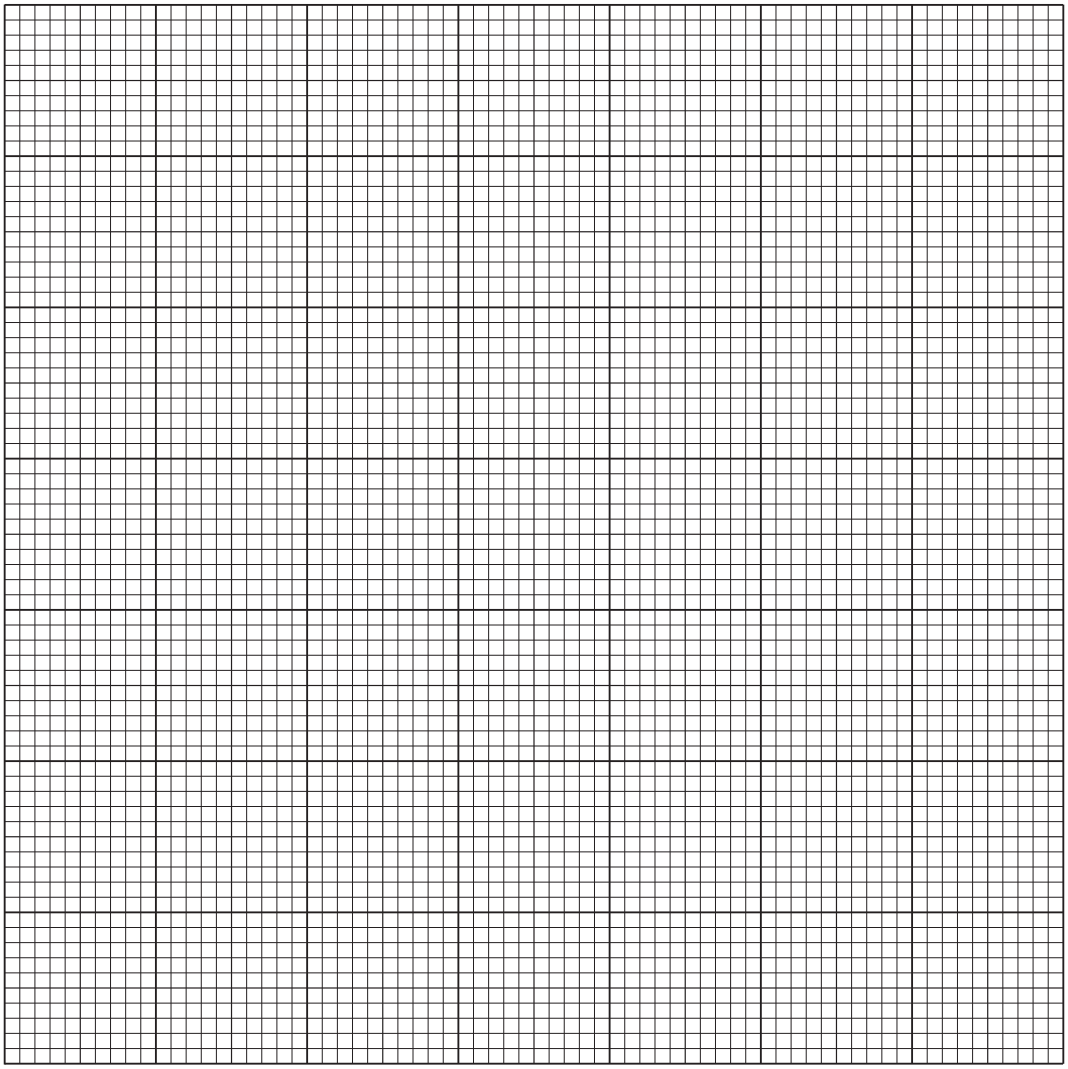
The haemoglobin content of their blood was measured and the percentage of people with anaemia was calculated.

Table 2.2 shows the percentage of men and women in the sample who have anaemia.

Table 2.2

age group	percentage with anaemia	
	men	women
65–74	7.0	8.5
75–84	16.5	11.0
85–94	26.0	20.5

(i) Plot a histogram to show the percentage of men and women with anaemia in each age group.



[5]

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(ii) Describe the trends shown by these data.

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..... [2]

(iii) Suggest why the data was reported as percentages rather than the actual numbers of men and women with anaemia.

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..... [1]

[Total: 13]

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