Cambridge IGCSE

**Cambridge Assessment International Education**
Cambridge International General Certificate of Secondary Education

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**BIOLOGY** **0610/61**

Paper 6 Alternative to Practical **October/November 2019**

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

This document consists of **13** printed pages and **3** blank pages.

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

Some students investigated 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 a green leaf were dissolved in a solvent (**S1**). The solvent moved up the paper carrying the dissolved pigments different distances.

Step 1 The pigments from a green leaf were transferred to a strip of chromatography paper by pressing the leaf onto the paper using the edge of a metal disc. A green line was then visible on the paper as shown in Fig. 1.1.

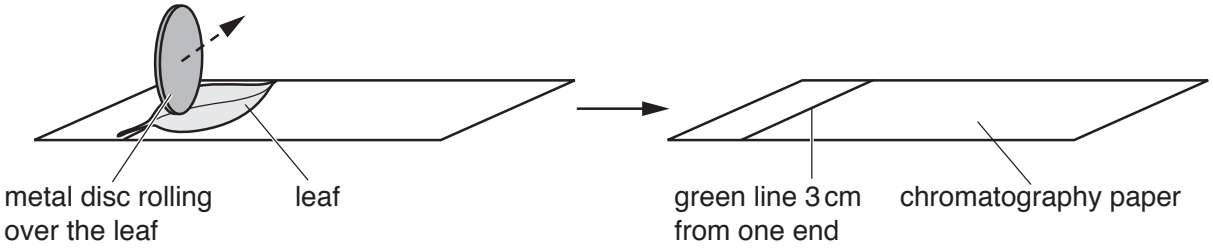


**Fig. 1.1**

Step 2 Solvent **S1** was poured into a test-tube to a depth of 2 cm.

Step 3 The strip of chromatography paper was lowered into the test-tube with the green line at the bottom so that part of the chromatography paper was in solvent **S1**. The green line remained above the level of solvent **S1** as shown in Fig. 1.2.

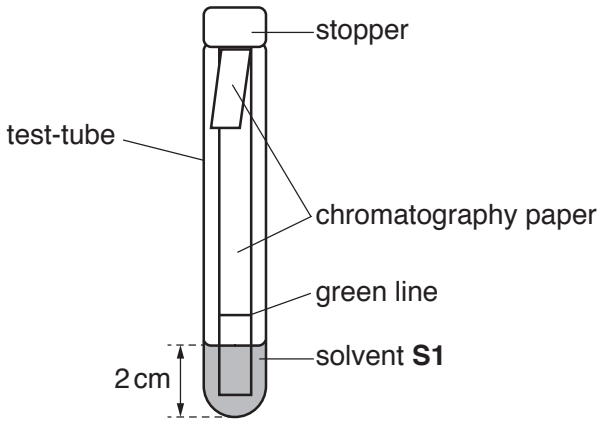


**Fig. 1.2**

Step 4 The free end of the chromatography paper was folded over the edge of the test-tube and a stopper was placed into the test-tube. The movement of solvent **S1** up the chromatography paper was observed for 15 minutes.

Step 5 After 15 minutes the strip of chromatography paper was removed from the test-tube.

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Step 6 The chromatography paper was placed on a paper towel and a pencil line was drawn across the paper to mark how far up the chromatography paper solvent **S1** had moved.

View solution

**(a)** Fig. 1.3 shows a diagram of the chromatography paper after it was dry.




**Fig. 1.3**

**(i)** State how many different pigments are visible on the chromatography paper in Fig. 1.3.

..... [1]

View solution

**(ii)** Suggest why it was important that the green line was kept above solvent **S1** in the test-tube in Fig. 1.2.

.....

.....

..... [1]

**(iii)** The students investigated the pigments in another type of green leaf using the same method.

View solution

State **two** variables that should be kept constant in this investigation.

1 .....

2 .....

[2]

**(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.

View solution

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

.....

..... [1]

**(ii)** A start line was drawn in pencil on a piece of chromatography paper. A small drop of the concentrated chlorophyll extract was placed on the start 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.

View solution

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

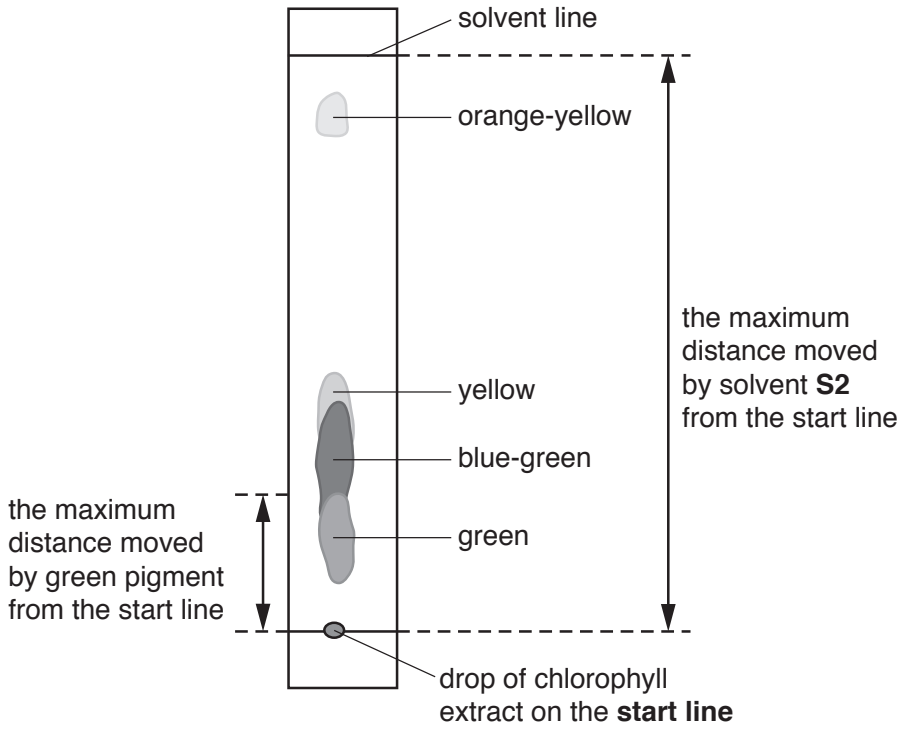


**Fig. 1.4**

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 chromatography paper 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.

View solution

[3]

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

View solution

pigment colour .....

explanation .....

.....

.....

[2]

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

View solution

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

1 .....

.....

.....

2 .....

.....

.....

[2]

**(d)** Chloroplasts can contain starch.

View solution

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

..... [1]

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

View solution

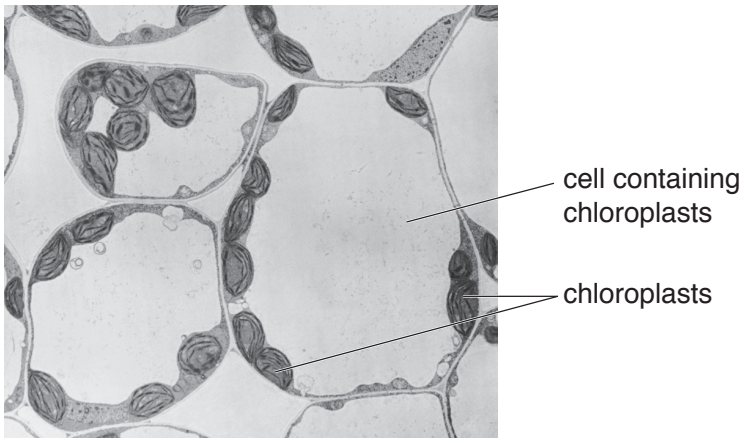


**Fig. 1.6**

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.

View solution

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]

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**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.

View solution

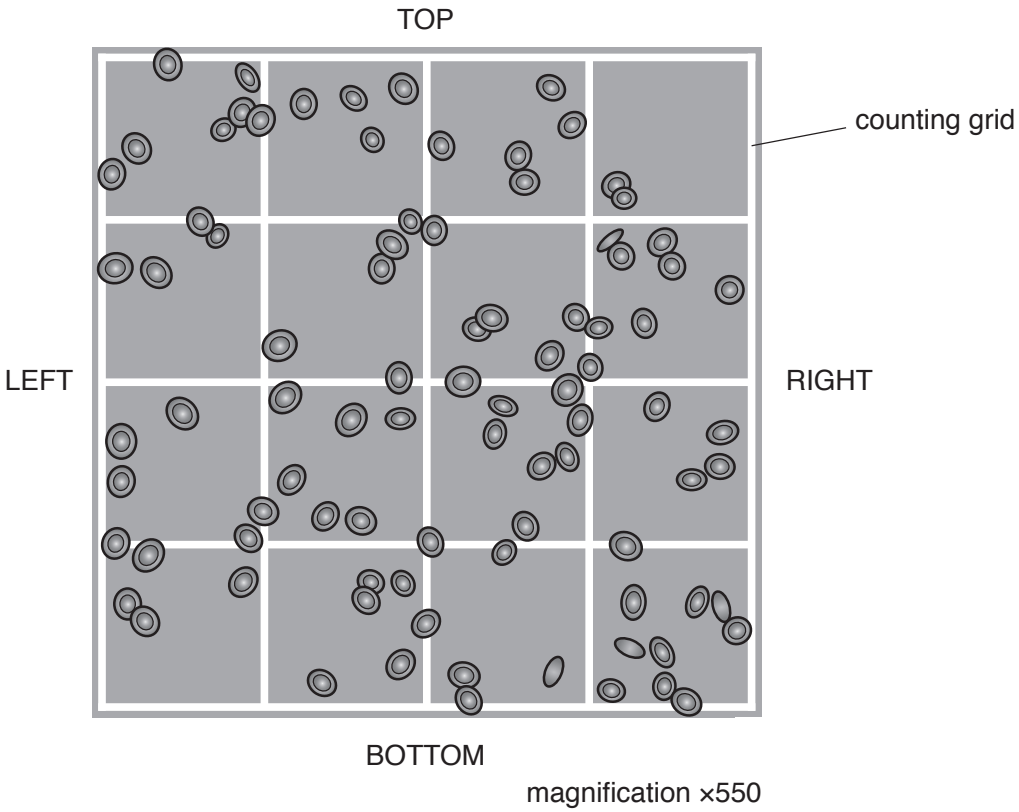


**Fig. 2.1**

**(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 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.

View solution

Calculate the volume of the counting grid.

..... $mm^3$ [1]

View solution

**(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]

View solution

**(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.

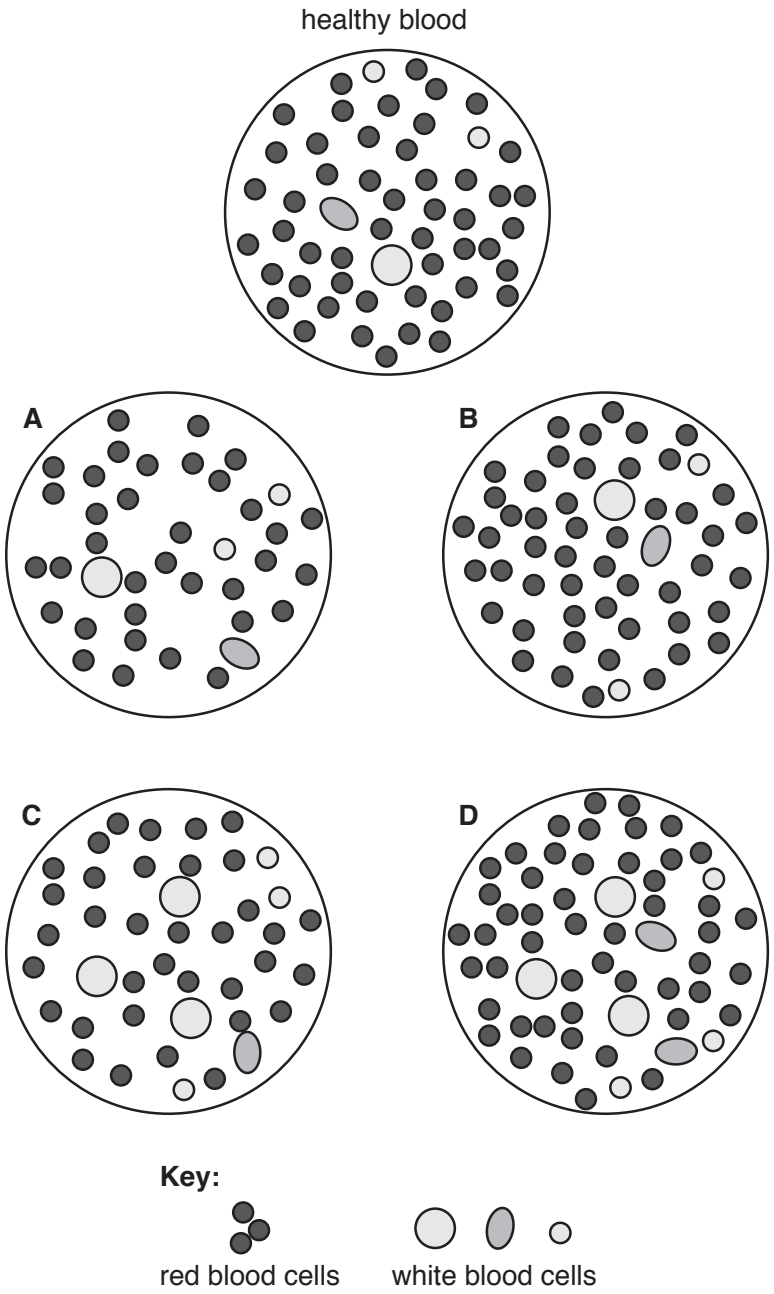


**Fig. 2.2**

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.

View solution

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.

View solution

.....

.....

.....

.....

..... [2]

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

View solution

.....

.....

.....

..... [1]

[Total: 13]

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