

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

INTERNATIONAL A-LEVEL BIOLOGY (9610)

Unit 5 Synoptic Paper

Tuesday 9 June 2026

08:00 UK Time

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- a ruler with millimetre measurements
- a scientific calculator, which you are expected to use where appropriate.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	



J U N 2 6 B L 0 5 0 1

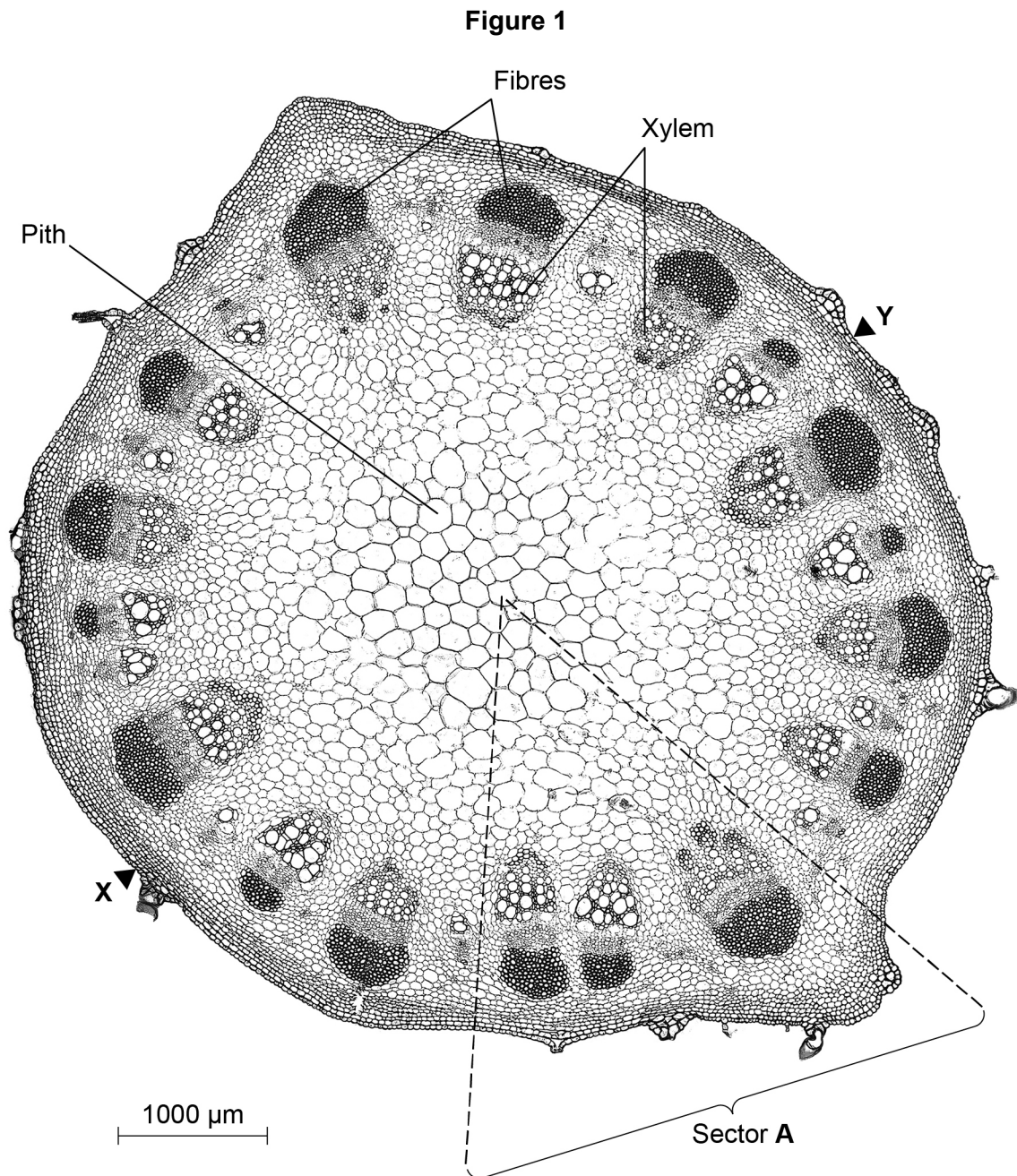
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BL05

Answer **all** questions in the spaces provided.

0 1

Figure 1 shows a transverse section (TS) of the stem of a dicotyledonous plant as seen using an optical microscope.



0 1 . 1

Draw a tissue map of sector **A** shown in **Figure 1**.**[3 marks]**

0 1 . 2

Calculate the actual diameter of the stem in **Figure 1** between point **X** and point **Y**.Give your answer in micrometres (μm).**[3 marks]**Diameter of stem = _____ μm

0 1 . 3

Describe how the distribution of the xylem in **Figure 1** is different from the distribution of the xylem in the root of a dicotyledonous plant.**[1 mark]**

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12

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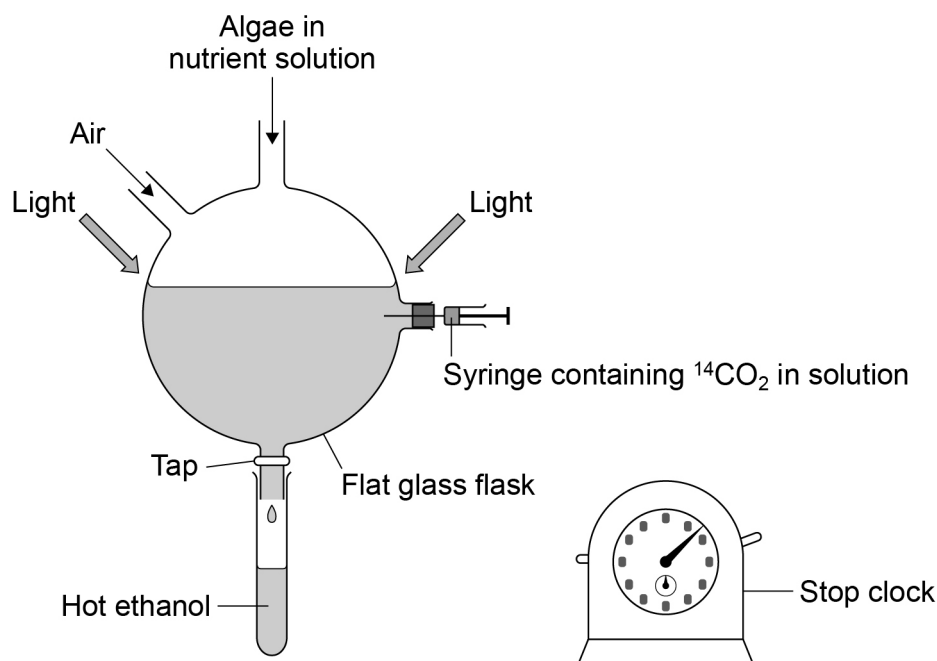
0 5

0 2

Algae are single-celled organisms. In the 1940s, Melvin Calvin and other scientists investigated photosynthesis in algae. The scientists discovered the metabolic pathway for changing carbon from carbon dioxide into various organic chemical compounds using radioactive carbon dioxide ($^{14}\text{CO}_2$).

Figure 2 shows the apparatus the scientists used.

Figure 2



The scientists:

- inject $^{14}\text{CO}_2$ into the flask from the syringe and immediately start the stop clock
- use the tap to take a sample from the flask into a test tube of hot ethanol at 5 seconds
- take more samples at 10, 15, 20, 25 and 30 seconds into separate test tubes
- allow most of the ethanol to evaporate from each sample
- analyse the samples using paper chromatography.

0	2	.	1
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Give **two** reasons why the scientists use single-celled algae in the investigation.

[2 marks]

1 _____

2 _____

0	2	.	2
---	---	---	---

Give **two** reasons why each sample is put **immediately** into hot ethanol.

[2 marks]

1 _____

2 _____

Question 2 continues on the next page

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0 2 . 3

The scientists take samples from the flask at intervals of **only** 5 seconds.

Explain how taking samples at **5-second** intervals helps the scientists to work out a metabolic pathway for photosynthesis.

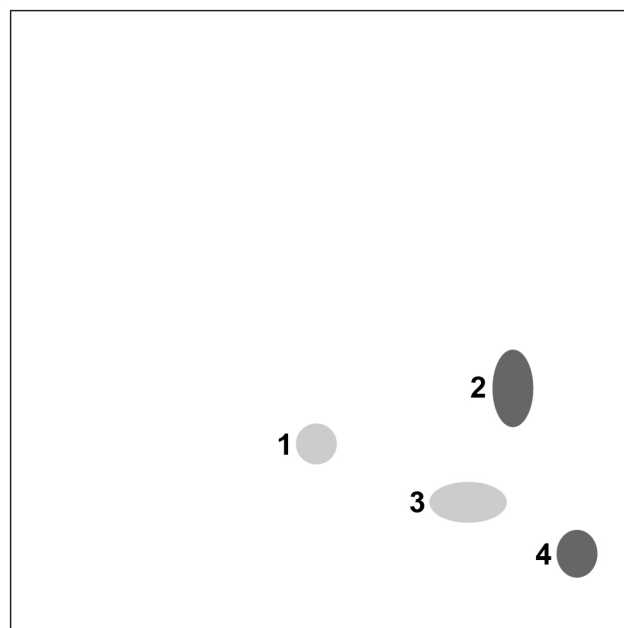
[3 marks]

The scientists analyse each sample using paper chromatography.

After the chromatography, the chromatography paper is left in contact with photographic film for 2 weeks.

Figure 3 shows the results for the sample taken at 5 seconds.

Figure 3



[6 marks]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

[1 mark]

0 2 . 6 The next step in the scientists' investigation is to identify compounds **1** to **4**.

The scientists know of several compounds that might be formed in photosynthesis.

Suggest how the scientists could use paper chromatography to identify compounds **1** to **4**.

[2 marks]

16



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0 3

If a coronary artery is blocked by atheroma, blood cannot reach part of the wall of the heart. This could cause a myocardial infarction.

0 3

1

Describe how an atheroma is formed.

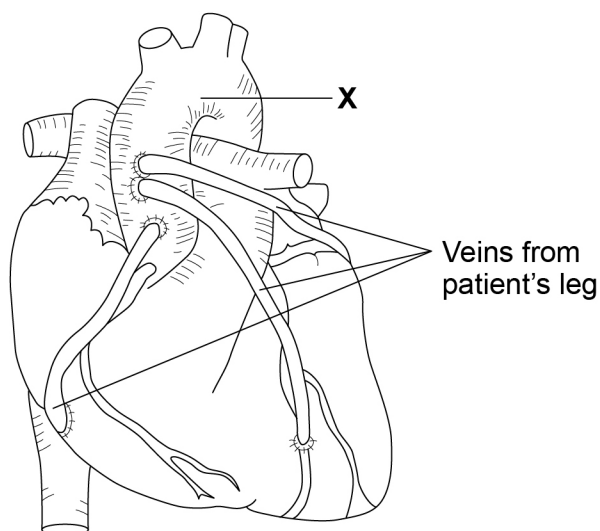
[2 marks]

A patient has three blocked coronary arteries.

The patient has an operation on their heart called a triple coronary bypass.

Figure 4 shows the patient's heart after the operation.

Figure 4



The veins are joined to blood vessel **X**.

0 3

2

Name blood vessel **X**.

[1 mark]



0 3 . 3

Why are the veins in **Figure 4** taken from the patient's body and **not** from the body of another person?

[1 mark]

0 3 . 4

Explain how the operation would help to reduce the risk of a myocardial infarction.

[2 marks]

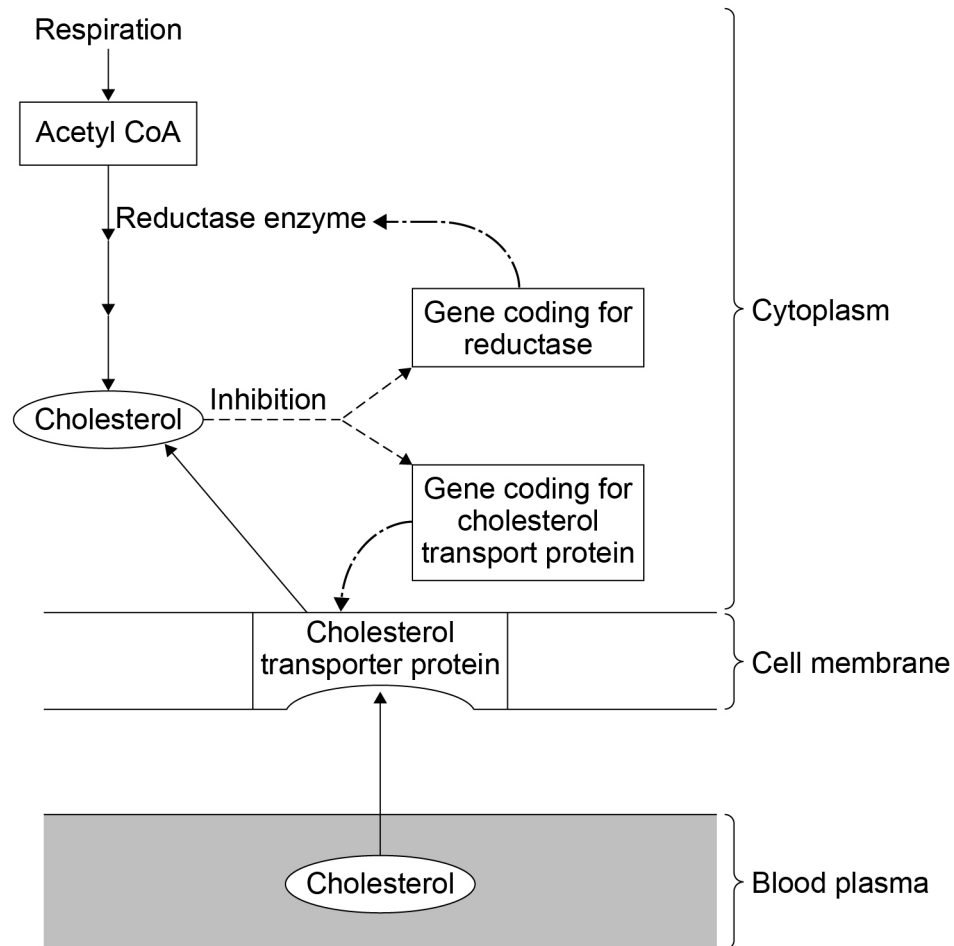
Question 3 continues on the next page

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A diet high in cholesterol and saturated fat is a risk factor for atheroma formation in the coronary arteries.

Figure 5 shows the mechanisms for controlling cholesterol synthesis and cholesterol uptake by a liver cell.

Figure 5



Statins are drugs used for lowering the concentration of cholesterol in blood plasma.

Statins inhibit the reductase enzyme needed for cholesterol synthesis in liver cells.

0 3 . 5 Explain how statins lower the concentration of cholesterol in blood plasma.

Use information from **Figure 5**.

[3 marks]

9

Turn over for the next question

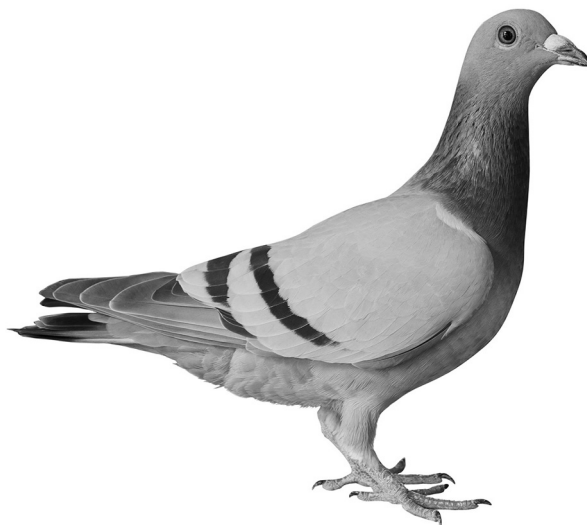
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0 4

Figure 6 shows a domestic pigeon.

Figure 6



The feathers on the body of the pigeon can be one of three colours, determined by three alleles, **Re**, **BI** and **Br**:

Re codes for red feathers

BI codes for blue feathers

Br codes for brown feathers.

The **Re** allele is dominant to **BI** and to **Br**.

The **BI** allele is dominant to **Br**.

In pigeons, sex is determined by the chromosomes **Z** and **W**.

Males have the sex chromosomes **ZZ**.

Females have the sex chromosomes **ZW**.

The gene for feather colour is **only** on the **Z** chromosome.

Use the following symbols to answer the questions:

Z^{Re} = a **Z** chromosome carrying the allele for red feathers

Z^{BI} = a **Z** chromosome carrying the allele for blue feathers

Z^{Br} = a **Z** chromosome carrying the allele for brown feathers

W = a **W** chromosome.



0 4 . 1

A person who breeds pigeons (a pigeon breeder) crosses a red male pigeon with a blue female pigeon.

The offspring are:

- red males and females
- blue males
- brown females.

Complete the genetic diagram to explain this.

[2 marks]

Parental phenotypes	Red male	Blue female
Parental genotypes	_____	_____
Gametes	_____	_____

Offspring genotypes _____

Offspring phenotypes _____

Question 4 continues on the next page

Turn over ►



In a second investigation, the breeder uses a different red male pigeon.

The breeder crosses this red male pigeon several times with blue female pigeons.

The offspring are:

- 7 red pigeons, both males and females
- 13 blue pigeons, both males and females.

0 4 . 2

Give the genotype of the red male parent in this second investigation.

[1 mark]

The breeder expected equal numbers of red and blue pigeons in the offspring.

A statistical test gives a probability, $P = 0.18$

0 4 . 3

Name the statistical test the breeder uses.

[1 mark]

0 4 . 4

Explain what the breeder can conclude from the result, $P = 0.18$

Use the terms **significant**, **chance** and **null hypothesis** in your answer.

[3 marks]



The breeder has:

Describe a breeding programme the breeder could use to get a stock of pure-breeding (homozygous) red pigeons.

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0	5
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There are about 5 million red blood cells in every mm³ of human blood.

Red blood cells contain the protein haemoglobin.

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Haemoglobin contains the elements carbon, hydrogen, oxygen and sulfur.

Name **two** other elements found in haemoglobin.

[2 marks]

1 _____

2 _____

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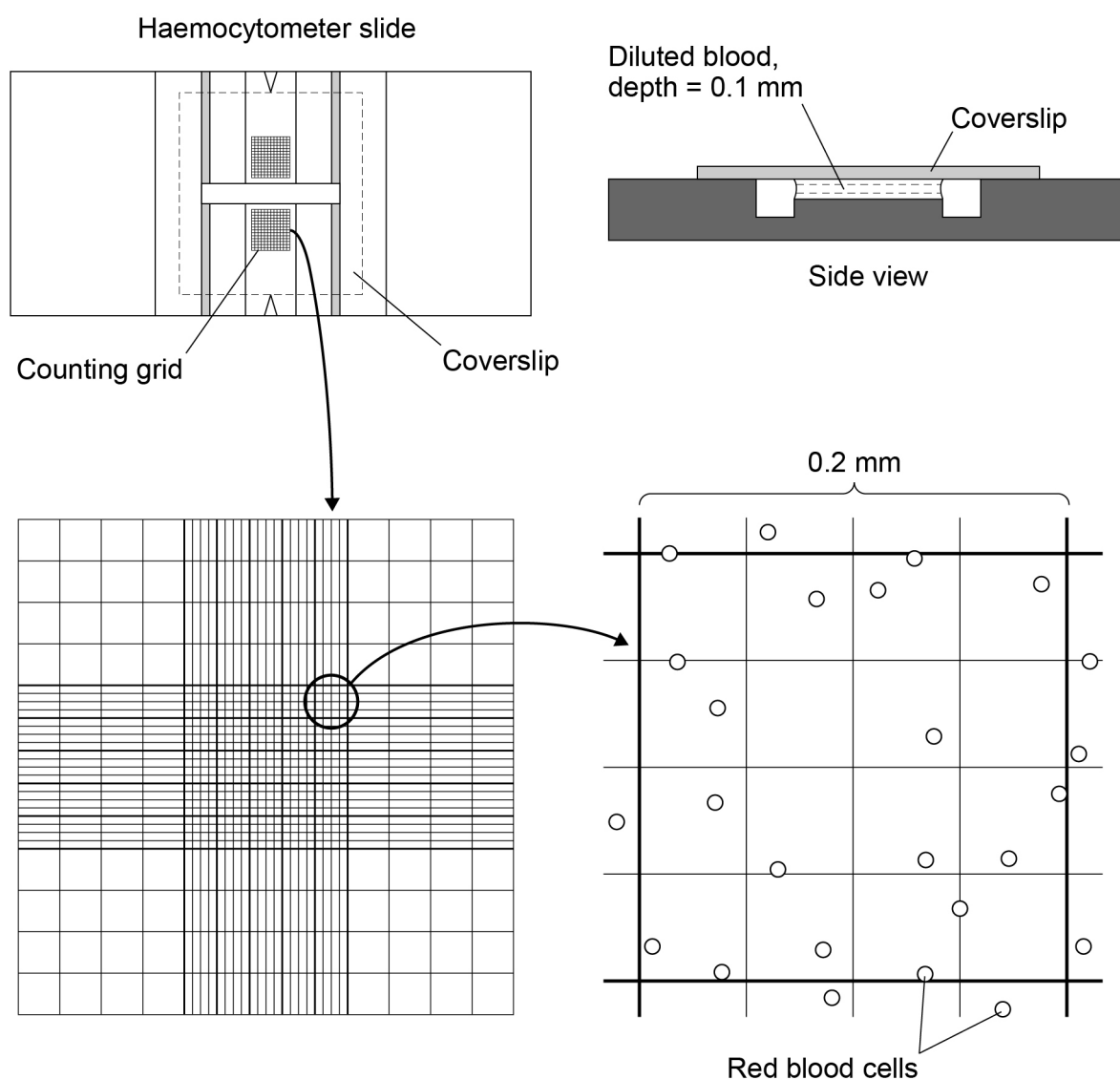
A woman is feeling ill and visits her doctor. The woman has difficulty breathing during exercise and feels tired after any exercise.

The doctor takes a sample of the woman's blood.

The doctor:

- dilutes 1.0 mm^3 blood to a volume of 1000 mm^3 with sodium chloride solution
- puts a drop of the diluted blood on the counting grid of a haemocytometer slide, as shown in **Figure 7**
- puts a coverslip on top to give a depth of 0.1 mm of diluted blood
- puts the haemocytometer slide on the stage of a microscope
- counts the number of red blood cells in a $0.2 \text{ mm} \times 0.2 \text{ mm}$ square on the slide.

Figure 7



0 5 . 2

Use the following procedure to count the number of red blood cells in the $0.2 \text{ mm} \times 0.2 \text{ mm}$ square in **Figure 7**:

- count **all** cells that are completely within the $0.2 \text{ mm} \times 0.2 \text{ mm}$ square
- count cells that are touching the left side and the lower side of the square
- do **not** count cells that are touching the right side or the upper side of the square.

[1 mark]

Number of red blood cells in the $0.2 \text{ mm} \times 0.2 \text{ mm}$ square = _____

0 5 . 3

Use your answer to Question **05.2** to estimate the number of red blood cells in 1.0 mm^3 of **undiluted** blood.

Give your answer in standard form.

[2 marks]

Number of red blood cells in 1.0 mm^3 of undiluted blood = _____

0 5 . 4

How could the doctor make the estimate of the number of red blood cells in 1.0 mm^3 of the woman's undiluted blood more valid?

[1 mark]

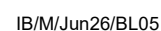


Environmental factors, such as temperature, the concentrations of oxygen and carbon dioxide, pH and food availability, may change.

Homeostasis involves physiological control systems that maintain the internal environment within restricted limits.

Use examples to support your answer.

[6 marks]

[illegible]

Design an experiment to compare the optimum temperature of amylase from a human and amylase from a plant.

[illegible]

Turn over ►



Describe how changes in environmental temperature affect processes in plants.

[illegible]

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[illegible]

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