

GCSE Combined Science

Biology Paper 1

Higher Tier

In addition to this paper you should have:

- A ruler.
- A calculator.

Centre name				
Centre number				
Candidate number				

Time allowed:

- 1 hour 15 minutes

Surname
Other names
Candidate signature

Instructions to candidates

- Write your name and other details in the spaces provided above.
- Answer **all** questions in the spaces provided.
- Do all rough work on the paper.
- Cross out any work you do not want to be marked.

Information for candidates

- The marks available are given in brackets at the end of each question.
- There are 70 marks available for this paper.
- You are allowed to use a calculator.
- You should use good English and present your answers in a clear and organised way.
- For Questions 3, 5.5 and 7.2 ensure that your answers have a clear and logical structure, include the right scientific terms, spelt correctly and include detailed, relevant information.

Advice to candidates

- In calculations show clearly how you worked out your answers.

For examiner's use							
Q	Attempt N ^o			Q	Attempt N ^o		
	1	2	3		1	2	3
1				5			
2				6			
3				7			
4				8			
Total							

1 Cells are the basic working unit of life.

1.1 Which subcellular structures would be found in **both** plant and animal cells?
Tick **one** box.

- Mitochondria, permanent vacuole, cytoplasm, nucleus
- Cytoplasm, chloroplasts, cell membrane, mitochondria
- Nucleus, cell membrane, mitochondria, cytoplasm
- Cell membrane, cell wall, nucleus, mitochondria

[1 mark]

The human body contains many specialised cell types.
The structure of each cell type varies according to its function.

1.2 Some cells in the salivary glands continually make a protein-containing substance called mucus.

Suggest **one** type of subcellular structure that you would expect to find a lot of in these mucus-producing cells. Give a reason for your answer.

Subcellular structure:

Reason:

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[2 marks]

1.3 Cells in the muscles contain many mitochondria.

Suggest why it is an advantage for cells in the muscles to contain many mitochondria.

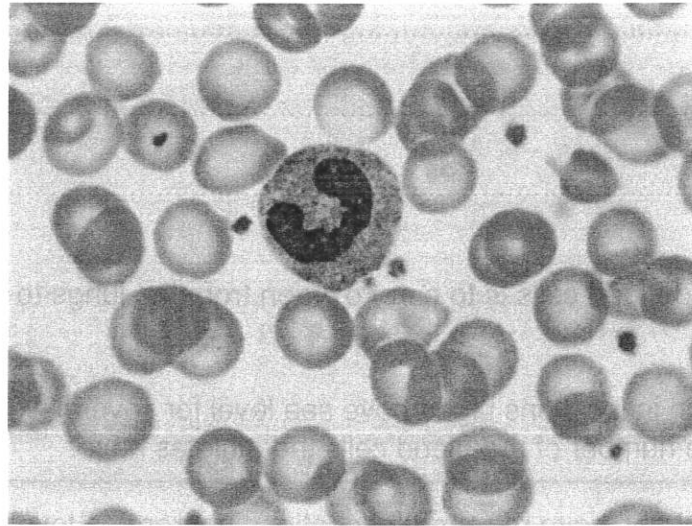
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[1 mark]

2 **Figure 1** shows a photograph of some human blood cells.

Figure 1



2.1 Which of the following statements about blood is correct?
Tick **one** box.

- Blood is a cell.
- Blood is a tissue.
- Blood is an organ.
- Blood is an organ system.

[1 mark]

2.2 Label a red blood cell and a white blood cell on **Figure 1**.

[1 mark]

2.3 Name **one** component of blood that is responsible for blood clotting.

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[1 mark]

Question 2 continues on the next page

Turn over ►

White blood cells help the body to fight infection.

2.4 Give **three** ways in which white blood cells are adapted to perform their function.

1.
2.
3.

[3 marks]

The function of red blood cells is to carry oxygen from the lungs to all cells in the body.

2.5 Some athletes train in locations high above sea level for several weeks before a race. This increases the number of red blood cells the athletes have.

Even once the athletes have returned to locations nearer sea level, their red blood cell count can remain high for many days.

Suggest how training in locations high above sea level might improve an athlete's performance in a race.

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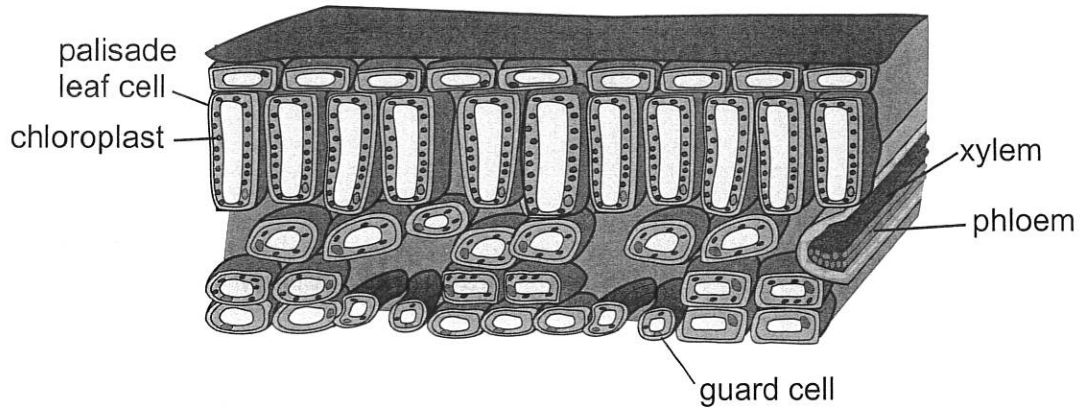
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[4 marks]

3 **Figure 2** shows a diagram of a leaf.

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Figure 2



Use **Figure 2** and your own knowledge to explain how the tissues in a leaf are adapted for photosynthesis.

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[6 marks]

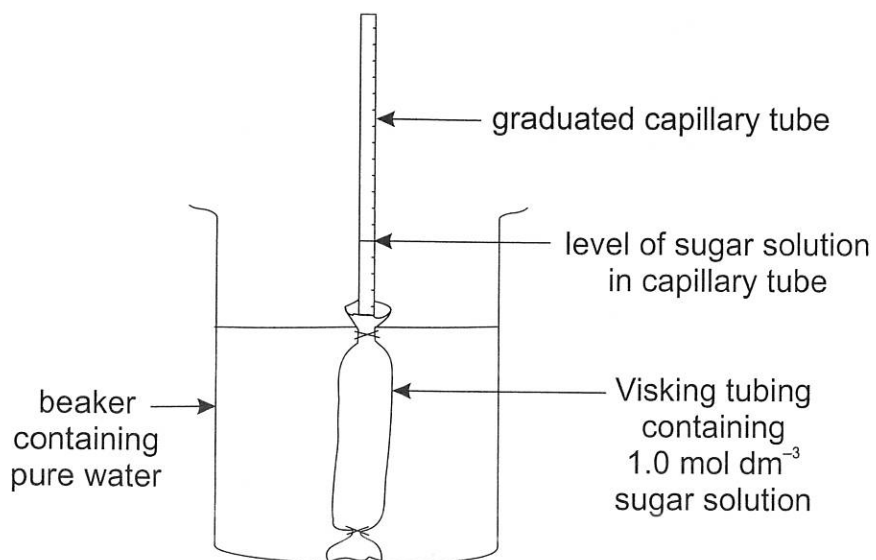
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- 4 A student is investigating osmosis using Visking tubing. Visking tubing is a partially permeable membrane. Water can pass through Visking tubing, but large sugar molecules cannot.

Figure 3 shows the student's apparatus at the start of her investigation.

Figure 3



The student leaves the apparatus for 30 minutes.

- 4.1 Suggest what will happen to the volume of the sugar solution inside the capillary tube during this time period. Explain your answer in terms of osmosis.

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[3 marks]

4.2 Suggest how the student could modify her experiment to investigate the effect of changing the concentration gradient on the rate of osmosis.

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[3 marks]

Turn over for the next question

Turn over ►

5 Figure 4 shows a dog.

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Figure 4



Respiration transfers energy from the dog's food to the cells in its body.

Some of the energy transferred by respiration is used to build up larger molecules from smaller molecules.

5.1 Describe which smaller molecules make up a lipid molecule.

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[2 marks]

5.2 Apart from building up larger molecules from smaller molecules, give **two** other examples of how a dog uses the energy transferred during respiration.

1.
2.
[2 marks]

Respiration can take place aerobically or anaerobically.

5.3 Compare aerobic and anaerobic respiration in animals.

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[3 marks]

Dog food contains a mix of essential nutrients, including protein.

- 5.4** A student prepared a sample of dog food for testing.
Describe how the student could test for the presence of proteins in the prepared sample.

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[2 marks]

- 5.5** Use your knowledge of digestive enzymes to explain how a dog may digest and absorb a meal containing proteins.

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[4 marks]

Turn over for the next question

Turn over ►

6 The enzyme amylase breaks down starch into simple sugars.

A student investigated the effect of pH on the rate at which amylase breaks down starch. This is the method she used:

1. Amylase and starch solution were added to six test tubes, each of which contained a different pH buffer solution.
2. Spotting tiles were prepared with 1 drop of iodine solution in each well.
3. Every 30 seconds, a sample of the amylase and starch solution was removed from the test tube and placed in a well on one of the spotting tiles.
4. The colour of the solution in the well was observed.
5. When all the starch had been broken down, the time was recorded.
6. The experiment was repeated three times for each of the six solutions.
7. A mean time and rate of reaction was calculated for each solution.

The results are shown in **Table 1**.

Table 1

pH of buffer solution	Time taken for starch to be broken down by amylase (s)				Mean rate of reaction (s ⁻¹)
	Repeat 1	Repeat 2	Repeat 3	Mean	
4	510	600	570	560	1.8
5	420	450	390	420	2.4
6	150	120	180	150	6.7
7	180	120	150	150	6.7
8	240	210	240	230	X
9	330	270	330	310	3.2

6.1 Explain how the student would have known when all the starch had been broken down by the amylase.

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[2 marks]

6.2 Calculate the value of **X** in **Table 1**.

Use the equation:

$$\text{rate of reaction} = \frac{1000}{\text{time}}$$

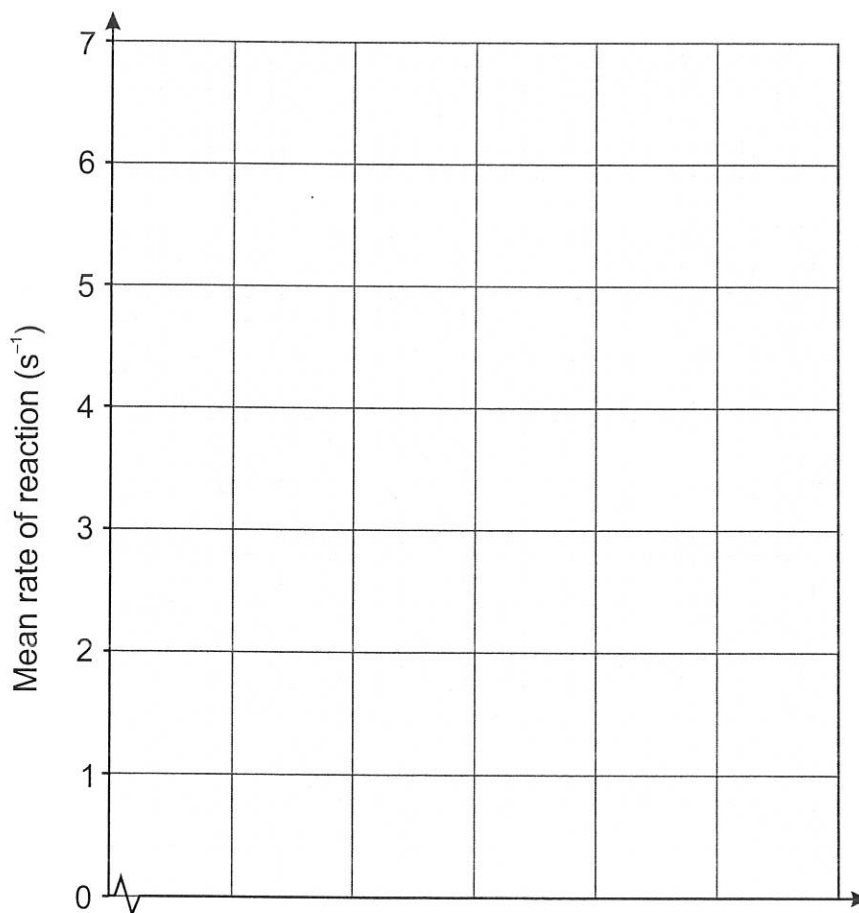
Give your answer to 2 significant figures.

X = s⁻¹
[1 mark]

6.3 Complete **Figure 5** using data from **Table 1** and your answer to 6.2.

- Complete the x-axis. Include a label and use a suitable scale.
- Plot the mean rate of reaction for each pH value.
- Join the points with straight lines.

Figure 5



[4 marks]

6.4 Use your graph in **Figure 5** to estimate the rate of reaction at **pH 5.5**.

Rate of reaction = s⁻¹
[1 mark]

Question 6 continues on the next page

Turn over ►

6.5 The results for the mean rate of reaction at pH 6 and 7 are the same.
Suggest how the experiment could be improved to determine the optimum pH
for amylase more accurately.

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[1 mark]

6.6 Give a conclusion that can be drawn from the results about the effect of pH on the
rate of amylase activity.

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[1 mark]

7 In 2015, there were approximately 438 000 deaths from malaria worldwide. Most deaths occurred among children living in sub-Saharan Africa.

7.1 Explain how malaria is spread from person to person.

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[3 marks]

A vaccine has been developed that provides some protection against malaria in young children. So far, it is the only vaccine available against the disease.

7.2 Explain what impact an anti-malaria vaccine might have on the number of cases of malaria in affected regions.

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[4 marks]

Turn over for the next question

Turn over ►

8 Plants lose water through the stomata in their leaves.

A student set up an experiment to show that more water is lost from the lower surface of a leaf than from the upper surface.

He used cobalt chloride paper in his experiment.
This paper is blue when it is dry and pink when it is wet.

This is the method he used:

1. He took a potted plant and taped a piece of dry cobalt chloride paper to the upper surface of one of the plant's leaves.
2. He taped a second piece of paper to the lower surface of the same leaf.
3. He left the plant for 5 minutes.
4. He observed the colour of the pieces of cobalt chloride paper.

The results of the experiment are shown in **Table 2**.

Table 2

	Colour of paper at start of experiment	Colour of paper after 5 minutes
Upper surface of leaf	blue	blue
Lower surface of leaf	blue	pink

8.1 Suggest an explanation for the results shown in **Table 2**.

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[3 marks]

8.2 The student repeated the experiment on a different day.
This time, neither piece of cobalt chloride paper turned pink after 5 minutes.
Suggest why the results of this experiment may be different on different days.

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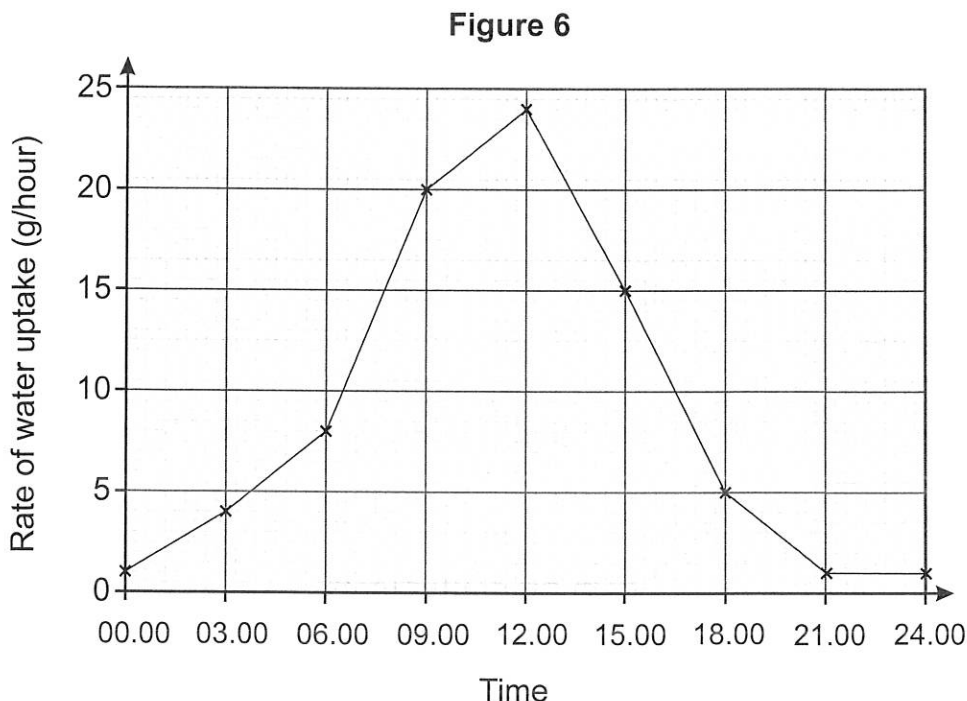
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[2 marks]

It is assumed that water loss from the leaves of a plant is directly proportional to water uptake from the roots.

An investigation was carried out to assess the rate of water uptake by a plant over a 24-hour period. The results are shown in **Figure 6**.



- 8.3** Use **Figure 6** to calculate the percentage increase in the rate of water uptake between 09.00 hours and 12.00 hours.

percentage increase = %
[2 marks]

Stomata are small. It is difficult to accurately measure their diameter unless they are fully open.

- 8.4** Use **Figure 6** to suggest what time of day it would be best to measure the diameter of stomata on leaves. Give a reason for your suggestion.

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[3 marks]

Question 8 continues on the next page

Turn over ►

8.5 Suggest an explanation for the changes in the rate of water uptake shown in **Figure 6**.

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[4 marks]

END OF QUESTIONS