Please write clearly in block capitals.

Centre number ☐☐☐☐☐ Candidate number ☐☐☐☐

Surname ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Forename(s) ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Candidate signature _____

AS
BIOLOGY

Paper 1

Specimen materials (set 2) 1 hour 30 minutes

Materials
For this paper you must have:
- a ruler with millimetre measurements
- a calculator, which you are expected to use where appropriate.

Instructions
- Use black ink or black ball-point pen.
- 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.
- 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.

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

0 1 . 1 The genetic code is **degenerate** and **non-overlapping**.

Explain the meaning of:

[2 marks]

Degenerate _____

_____

Non-overlapping _____

_____

Table 1 shows a short section of a messenger RNA (mRNA) molecule and the section of a polypeptide for which it codes.

Table 1

mRNA	G G G	G C U	U C A	C C G	G C A	A C G
Polypeptide	glycine	alanine	serine	proline	alanine	threonine

0 1 . 2 Name the bases represented in **Table 1** by:

[2 marks]

A _____

C _____

G _____

U _____

0 1 . 3 Use information in **Table 1** to give the sequence of bases in **DNA** that codes for serine.

[1 mark]

_____

5

0 2 . 1 Explain **two** ways in which the structure of fish gills is adapted for efficient gas exchange.

[2 marks]

1 _____

_____

2 _____

_____

0 2 . 2 Explain how the counter current mechanism in fish gills ensures the maximum amount of the oxygen passes into the blood flowing through the gills.

[3 marks]

_____

_____

_____

_____

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_____

_____

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_____

_____

5

Turn over for the next question

0 3 . 1 There are many different species of field mouse in Europe. Using a phylogenetic classification, all of these species have names that start with *Apodemus*.

What information does this give about field mice?

[2 marks]

The long-tailed field mouse, *Apodemus sylvaticus*, is a small mammal common in mainland Britain.

0 3 . 2 Complete **Table 2** to show the classification of the long-tailed field mouse.

[2 marks]

Table 2

Taxon	Name of Taxon
	Eukarya
Kingdom	Animalia
	Chordata
	Mammalia
Order	Rodentia
Family	Muridae

The St. Kilda field mouse lives only on one island off the coast of Scotland. It is very similar in appearance to the long-tailed field mouse but is larger and has lighter coloured fur.

Biologists wanted to find out if the St. Kilda field mouse and the long-tailed field mouse populations belonged to different species. They measured the length of the same features of a large number of individuals from the two populations.

The results are shown in **Table 3**.

Table 3

Population	Mean length (±SD) / mm	
	Head and body	Tail
St. Kilda field mouse	112.3 (±9.3)	105.5 (±8.4)
Long-tailed field mouse	95.2 (±8.2)	90.2 (±7.3)

0 3 . 3 Do the data in **Table 3** provide evidence that the two populations belong to different species? Use calculations of ratios to support your answer.

[3 marks]

0 3 . 4 Describe how breeding experiments could determine whether the two populations are from the same species.

[2 marks]

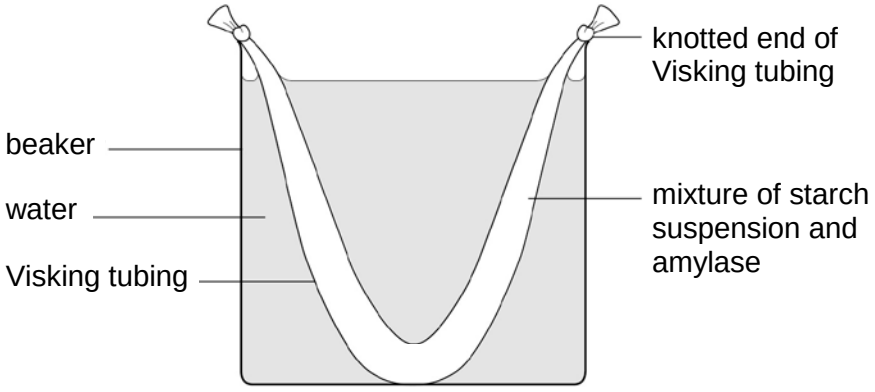
9

0 4 . 1 Cells lining the ileum of mammals absorb the monosaccharide glucose by co-transport with sodium ions. Explain how.

[3 marks]

A student set up the experiment shown in **Figure 1**.

Figure 1



The material from which Visking tubing is made is partially permeable.

After 15 minutes, the student removed samples from the liquid in the beaker and from the liquid inside the Visking tubing. She carried out biochemical tests on these samples. She drew **Table 4** to record her results.

0 4 . 2 Complete **Table 4** by placing a tick (✓) in each box that you expect to have shown a positive result.

[3 marks]

Table 4

Biochemical test	Liquid from beaker	Liquid inside Visking tubing
Biuret reagent		
Iodine in potassium iodide		
Benedict's solution		

0 4 . 3 Justify your answers to Question **04.2**.

[3 marks]

_____

_____

_____

_____

_____

_____

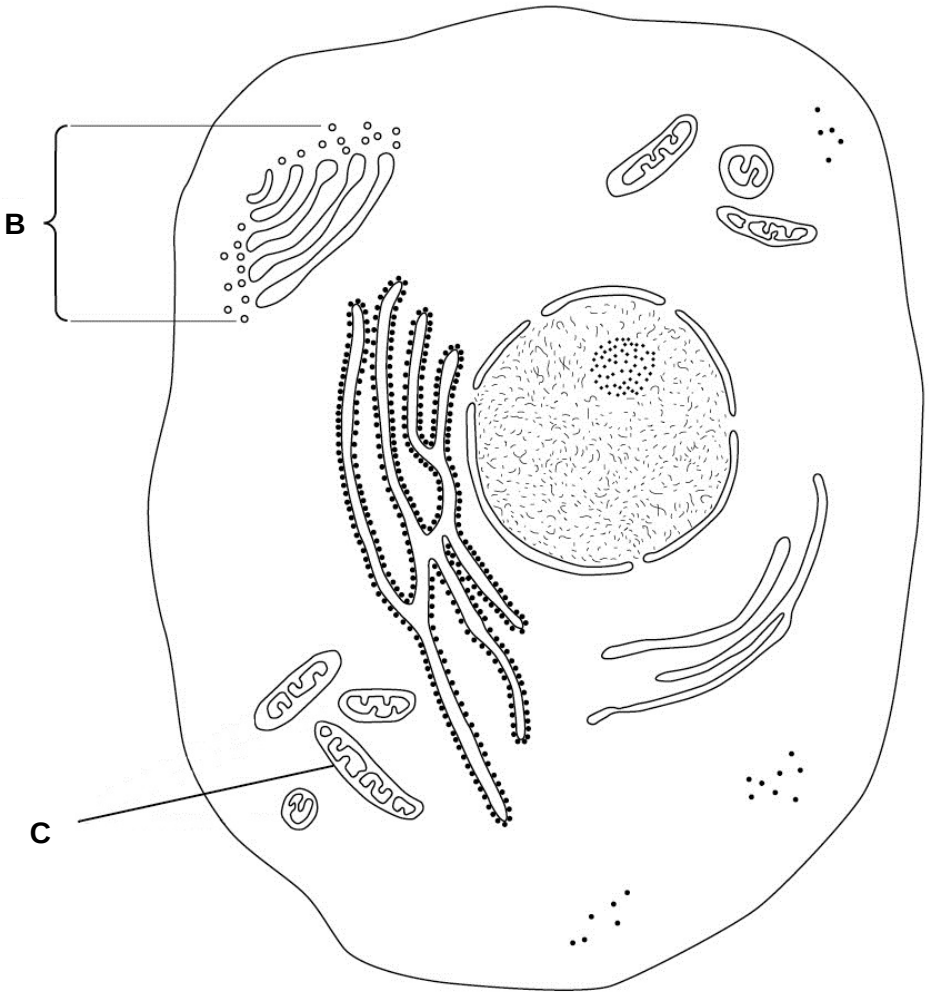
_____

9

Turn over for the next question

0 5 **Figure 2** is a diagram of an animal cell.

Figure 2



0 5 . 1 Name the organelles labelled:

[2 marks]

B _____

C _____

0 5 . 2 Name **two** structures present in plant cells that are **not** present in animal cells.

[1 mark]

1 _____

2 _____

A biologist prepared a sample of organelles labelled **C** from liver. He used the following method.

1. Added to the liver tissues an ice-cold, buffered solution with the same water potential as the liver tissue.
2. Mixed the liver and solution in a blender.
3. Filtered the mixture from the blender.
4. Spun the filtered liquid in a centrifuge at a low speed. A pellet appeared in the bottom of the centrifuge tube.
5. Poured off the liquid above the pellet into a second centrifuge tube and spun this at a higher speed to obtain the sample of organelles labelled **C**.

0 5 . 3 Explain why the solution the biologist used was ice-cold, buffered and the same water potential as the liver tissue (step 1).

[3 marks]

Ice-cold _____

_____

Buffered _____

_____

Same water potential _____

_____

0 5 . 4 Explain why the biologist used a blender and then filtered the mixture (steps 2 and 3).

[2 marks]

_____

_____

_____

_____

_____

0 5 . 5 Name the organelle that made up most of the first pellet after centrifuging at a low speed (step 4).

[1 mark]

_____

Question 5 continues on the next page

0 5 . 6 The second centrifuge tube was spun at a higher speed to obtain the sample of organelles labelled **C** in **Figure 2** (step 5).

Suggest why.

[1 mark]

10

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

0 6 Water and inorganic ions have important biological functions within cells.

0 6 . 1 Give **two** properties of water that are important in the cytoplasm of cells.
For each property of water, explain its importance in the cytoplasm.

[4 marks]

Property 1 _____

Biological importance within cells _____

_____

_____

Property 2 _____

Biological importance within cells _____

_____

_____

0 6 . 2 Other than sodium, name **one** inorganic ion and give **one** example of its biological importance in a cell.

[2 marks]

Name of inorganic ion _____

Biological importance _____

_____

_____

0 6 . 3 Compare and contrast the processes by which water and inorganic ions enter cells.

[3 marks]

9

Turn over for the next question

0 7 . 1 What is an antigen?

[2 marks]

0 7 . 2 What is an antibody?

[2 marks]

Poliomyelitis is an infection caused by a virus.

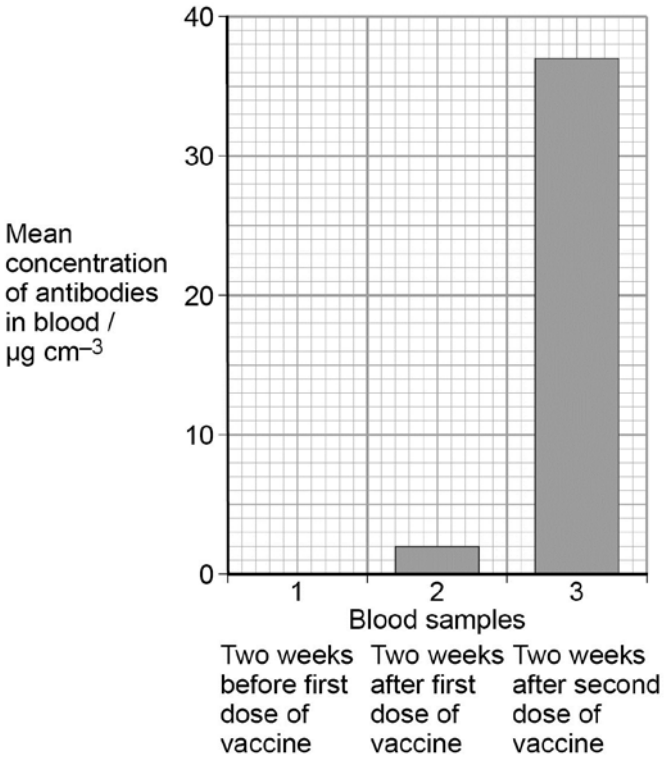
A doctor vaccinated a group of patients against poliomyelitis. He gave each patient two doses of vaccine, 3 months apart.

An immunologist tested three samples of blood from each of the patients:

- (sample 1) taken 2 weeks before the first dose of vaccine
- (sample 2) taken 2 weeks after the first dose of vaccine
- (sample 3) taken 2 weeks after the second dose of vaccine.

He measured the concentration of antibodies against the poliomyelitis virus in the patients' blood each time. The results are shown in **Figure 3**.

Figure 3



0 7 . 3 Calculate the percentage increase in the mean concentration of antibodies in blood between samples 2 and 3.

[1 mark]

Answer = _____ %

0 7 . 4 Explain the differences between the mean concentrations of antibodies in blood samples 1, 2 and 3.

[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

9

Turn over for the next question

0 8 A biochemist isolated a protease from a bacterium. He investigated the effect of temperature on the rate of hydrolysis of a protein by this protease. He measured the mass of protein hydrolysed in **5 minutes** at each temperature.

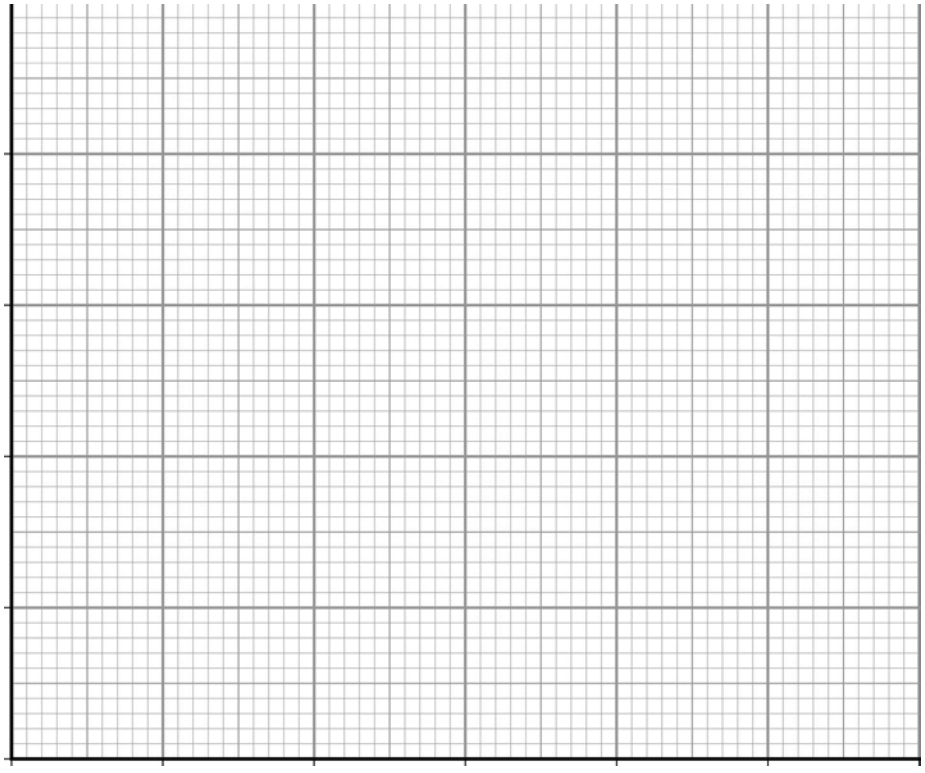
The results are shown in **Table 5**.

Table 5

Temperature / °C	Mass of protein hydrolysed / g	Rate of hydrolysis / .....
5	0.48	
10	1.11	
15	1.23	
20	1.05	
30	0.78	
45	0.12	

0 8 . 1 Process the data in **Table 5**. Plot the processed data on the graph paper.

[4 marks]



0 8 . 2 A student concluded from a graph of the data in **Table 5** that the bacterium lives at 15 °C.

Do the data support the student's conclusion? Give reasons for your answer.

[4 marks]

0 8 . 3 Suggest **two** variables the biochemist controlled when investigating the effect of temperature on the rate of breakdown of a protein by the protease.

[1 mark]

1 _____

2 _____

9

Turn over for the next question

0 9 Read the following passage.

Some insect species feed on the leaves of plants. These leaf-chewers bite off pieces of leaves. Other insect species feed on sap from phloem or xylem. These sap-feeders have sharp, piercing mouthparts that they insert directly into either xylem or phloem. Leaf-chewers and insects that feed on xylem sap are active feeders; this means they use their jaw muscles to obtain their food. In contrast, insects that feed on phloem sap are passive feeders; this means they do not use their jaw muscles to take up sap from phloem.

Feeding on phloem sap presents two problems. Firstly, phloem sap has a high sugar concentration. This could lead to a high pressure of liquid in the insect's gut because of water entering the gut from the insect's body tissues. A phloem-sap-feeder polymerises some of these sugars into polysaccharides which are passed out of its anus as 'honey dew'. The second problem is that phloem sap has a low concentration of amino acids. Phloem-sap-feeding insects rely on bacteria in their guts to produce amino acids. Each phloem-sap-feeding insect receives a few of these bacteria from its parent. This has resulted in a reduction in the genetic diversity of the bacteria found within these insects.

A scientist investigated the effect of three different insects on the growth of a plant called the goldenrod. He found that leaf-chewing insects and xylem-sap-feeding insects caused a much greater reduction in total leaf area than did phloem-sap-feeding insects.

Use the information from the passage and your own knowledge to answer the following questions.

0 9 . 1 Phloem-sap-feeders are passive feeders (lines 6–7).
Phloem-sap-feeders do not use their jaw muscles to take up sap from phloem.

Explain why they can take up sap without using their jaw muscles.

[3 marks]

0 9 . 2 A phloem-sap-feeder polymerises some of these sugars into polysaccharides (line 11). Suggest the advantage of this.

[2 marks]

0 9 . 3 Each phloem-sap-feeding insect receives a few of these bacteria from its parent (lines 14–15).

Suggest how this has caused a reduction in genetic diversity of the bacteria.

[2 marks]

0 9 . 4 A scientist found that leaf-chewers and xylem-sap-feeders had a greater effect on plant growth than phloem-sap-feeders (lines 19–21).

Other than environmental factors, give **two** features the scientist would have controlled in his experiment to ensure this conclusion was valid.

[2 marks]

1 _____

2 _____

Question 9 continues on the next page

0 9 . 5 The scientist used the reduction in total leaf area of the experimental plants as an indicator of plant growth.

Outline a method by which you could find the area of a plant leaf.

[1 mark]

_____

_____

_____

10

END OF QUESTIONS