

Biology
PAPER 2
Foundation Tier

Total Marks

Friday 7 June 2024 – Afternoon

Time: 1 hour 45 minutes

In the boxes below, write your name, centre number and candidate number.

Surname					
Other names					
Centre Number					
Candidate Number					

YOU MUST HAVE

Ruler, calculator

YOU WILL BE GIVEN

Diagram Booklet

INSTRUCTIONS

Answer ALL questions.

Answer the questions in the spaces provided in this Question Paper or in the separate Diagram Booklet – there may be more space than you need.

INFORMATION

The total mark for this paper is 100.

The marks for EACH question are shown in brackets – use this as a guide as to how much time to spend on each question.

In questions marked with an **ASTERISK (*)**, marks will be awarded for your ability to structure your answer logically, showing how points that you make are related or follow on from each other where appropriate.

There may be spare copies of some diagrams.

ADVICE

Read each question carefully before you start to answer it.

Try to answer every question.

Check your answers if you have time at the end.

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

1 Scientists use microscopes to study cells.

Look at Figure 1 for Question 1 in the Diagram Booklet. It shows a light microscope.

(a) Look at the list of words for Question 1(a) in the Diagram Booklet.

Draw ONE straight line from each part of the microscope to its function.

(2 marks)

(b) Look at Figure 2 for Question 1(b) in the Diagram Booklet. It shows two images of bacteria.

Image A was taken through a light microscope.

Image B was taken using an electron microscope.

(continued on the next page)

1(b) continued.

- (i) Draw, in the space below, the bacterial cell labelled X.**

Label ONE part of the bacterial cell on your diagram.

(3 marks)

(continued on the next page)

Turn over

1(b) continued.

- (ii) State ONE advantage of using a light microscope and ONE advantage of using an electron microscope to study these bacterial cells.
(2 marks)**

Answer space continues on the next page.

A light microscope

1(b)(ii) continued.

An electron microscope

(Total for Question 1 = 7 marks)

2 Plants need light for photosynthesis.

(a) Part of the photosynthesis equation is shown below.

reactant A + water \longrightarrow glucose + product B

Which row in the table shows reactant A and product B?

(1 mark)

	reactant A	product B
<input type="checkbox"/> A	carbon dioxide	light
<input type="checkbox"/> B	light	oxygen
<input type="checkbox"/> C	oxygen	carbon dioxide
<input type="checkbox"/> D	carbon dioxide	oxygen

(b) Name the green chemical in chloroplasts that absorbs light.

(1 mark)

(continued on the next page)

Turn over

2 continued.

- (c) (i) Look at Figure 3 for Question 2(c)(i) in the Diagram Booklet.**

**Plan an experiment to investigate if plants grow faster when they receive more light.
Use the equipment shown in Figure 3.
(3 marks)**

(continued on the next page)

2(c) continued.

- (ii) State ONE factor that you would keep the same in this experiment.
(1 mark)**

(continued on the next page)

2(c) continued.

(iii) A plant was kept at a very high temperature of 60 °C

Explain the effect of this temperature on photosynthesis.

(2 marks)

(Total for Question 2 = 8 marks)

3 Look at Figure 4 for Question 3 in the Diagram Booklet. It shows a food chain in an oak woodland.

**(a) State what the arrows in the food chain represent.
(1 mark)**

(b) Look at the diagrams for Question 3(b) in the Diagram Booklet.

Which diagram represents the pyramid of biomass for this food chain?

(1 mark)

☐ **Diagram A**

☐ **Diagram B**

☐ **Diagram C**

☐ **Diagram D**

(continued on the next page)

3 continued.

(c) A robin in this woodland eats 6 g of food in a day.

The robin uses 15% of this food for growth.

**Calculate the mass of food that is used for growth.
(2 marks)**

_____ g

(continued on the next page)

3 continued.

(d) Temperatures in England have increased over the last 20 years.

**(i) State TWO human activities that have caused this temperature increase.
(2 marks)**

1 _____

2 _____

(continued on the next page)

Turn over

3(d) continued.

- (ii) Look again at Figure 4 for Question 3 in the Diagram Booklet. One new species of moth is now able to live in England because of the increased temperatures.**

This moth feeds on oak leaves.

Explain how these moths may affect the number of aphids in the food chain shown in Figure 4.

(2 marks)

(Total for Question 3 = 8 marks)

4 Endocrine glands produce hormones.

- (a) Look at Figure 5 for Question 4(a) in the Diagram Booklet.**

Draw TWO crosses on Figure 5 to show the position of the ovaries.

(1 mark)

- (b) Progesterone is produced in the ovaries.**

State ONE effect of progesterone on the uterus lining.

(1 mark)

(continued on the next page)

4 continued.

(c) Insulin is a hormone that controls blood glucose concentration.

**(i) Which endocrine gland produces insulin?
(1 mark)**

- ☐ **A thyroid**
- ☐ **B pancreas**
- ☐ **C adrenal**
- ☐ **D pituitary**

**(ii) State how insulin is transported from its endocrine gland to its target organs.
(1 mark)**

(continued on the next page)

4(c) continued.

**(iii) Name the main target organ for insulin.
(1 mark)**

(d) People with type 1 diabetes cannot produce insulin.

Look at Figure 6 for Question 4(d) in the Diagram Booklet. It shows the blood glucose concentration for a person with type 1 diabetes.

**(i) Describe the trend from midday to 1 pm.
(2 marks)**

(continued on the next page)

Turn over

4(d) continued.

- (ii) State what a person with type 1 diabetes could have done to cause the change in the blood glucose concentration from 1.05 pm to 1.30 pm.
(1 mark)**

(continued on the next page)

4 continued.

- (e) People with type 2 diabetes have cells that do not respond to insulin.**

**State TWO ways that people with type 2 diabetes can control their blood glucose concentration.
(2 marks)**

1 _____

2 _____

(Total for Question 4 = 10 marks)

5 Look at Figure 7 for Question 5 in the Diagram Booklet. It shows the structure of a leaf.

**(a) (i) Which layer has the highest number of chloroplasts per cell?
(1 mark)**

☐ **A layer E**

☐ **B layer F**

☐ **C layer G**

☐ **D layer H**

(ii) When iodine solution was put onto these cells, small parts of the cells became blue-black.

Name the substance stored in the parts of the cells that turned blue-black.

(1 mark)

(continued on the next page)

5(a) continued.

(iii) State how the guard cells control the amount of gas exchange that occurs through the stomata.

(1 mark)

(continued on the next page)

5 continued.

- (b) A scientist measured the thickness of the cuticle from the leaves of plants growing in soil that had a different percentage of water content.**

The scientist measured six plants at each percentage of water content.

Look at Figure 8 for Question 5(b) in the Diagram Booklet. It shows the results.

- (i) Calculate the mean thickness of cuticle for the plants growing in soil containing 15% water.**

**Give your answer to one decimal place.
(3 marks)**

_____ μm

(continued on the next page)

Turn over

5(b) continued.

- (ii) Explain why the thickness of the cuticle is different when a plant is grown in soil with a higher water content.
(2 marks)**

(continued on the next page)

5(b) continued.

- (iii) State ONE other way that the leaves of plants are adapted to help plants grow in soil with low water content.
(1 mark)**

(Total for Question 5 = 9 marks)

- 6 In humans, gas exchange occurs in the alveoli of the lungs.**

Look at Figure 9 for Question 6 in the Diagram Booklet. It shows the structure of an alveolus and its blood supply.

- (a) Which process moves carbon dioxide from the blood into the alveolus?**
(1 mark)

- ☐ **A diffusion**
- ☐ **B osmosis**
- ☐ **C active transport**
- ☐ **D transpiration**

- (b) State ONE adaptation of an alveolus that increases the rate of gas exchange.**
(1 mark)

(continued on the next page)

6 continued.

- (c) Describe how blood is moved from the heart to the lungs.
(2 marks)**

(continued on the next page)

6 continued.

(d) Look at Figure 10 for Question 6(d) in the Diagram Booklet. It shows the heart rate of a person before, during and after exercise.

(i) Describe the trend shown in Figure 10.

**Use data from Figure 10 to support
your answer.**

(2 marks)

(continued on the next page)

6(d) continued.

- (ii) Explain the trend shown in Figure 10 from 5 minutes to 25 minutes.
(2 marks)**

(continued on the next page)

6(d) continued.

(iii) The stroke volume is the volume of blood pumped during one beat of the heart.

At 25 minutes the stroke volume was 0.13 dm^3

Calculate the cardiac output of the heart of this person at 25 minutes.

Use the equation

cardiac output = stroke volume \times heart rate
(3 marks)

_____ dm^3 per minute

(Total for Question 6 = 11 marks)

Turn over

7 Look at Figure 11 for Question 7 in the Diagram Booklet. It shows the structure of a kidney nephron.

(a) Small soluble substances including glucose are forced out through small holes in the glomerulus into the Bowman's capsule.

**Which term describes this process?
(1 mark)**

- ☐ **A diffusion**
- ☐ **B osmosis**
- ☐ **C filtration**
- ☐ **D absorption**

(continued on the next page)

7 continued.

- (b) Explain why red blood cells do not move from blood in the glomerulus into the Bowman's capsule.
(2 marks)**

(continued on the next page)

7 continued.

- (c) (i) Describe what happens in the collecting duct to make the urine more concentrated.
(2 marks)**

- (ii) State where urine is stored before it leaves the body.
(1 mark)**

(continued on the next page)

7 continued.

***(d) Describe how you would use laboratory tests to show if a food contains glucose (a reducing sugar) and protein.**

Include in your answer:

- **how you would prepare the sample of food**
 - **how you would use Benedict's solution and Biuret solution**
 - **the results you would expect.**
- (6 marks)**

Answer space continues on the next page.

Turn over

7(d) continued.

[illegible]

(Total for Question 7 = 12 marks)

Turn over

8 (a) The heart pumps blood.

Explain why the wall of the left ventricle of the heart is thicker than the wall of the right ventricle of the heart.

(2 marks)

(continued on the next page)

8 continued.

- (b) A centrifuge can be used to separate the different parts of human blood.**

Look at Figure 12 for Question 8(b) in the Diagram Booklet. It shows blood separated into different parts.

- (i) Name part X.
(1 mark)**
-
-

- (ii) Which substance, needed for cellular respiration, is carried by red blood cells?
(1 mark)**

- ☐ **A carbon dioxide**
- ☐ **B urea**
- ☐ **C amino acids**
- ☐ **D oxygen**

(continued on the next page)

8(b) continued.

(iii) Name TWO types of white blood cell.
(2 marks)

1 _____

2 _____

(continued on the next page)

8 continued.

- (c) (i) When a person donates blood, 470 cm^3 of blood is removed from their body.

Red blood cells make up 44% by volume of the blood.

Calculate the volume of red blood cells in 470 cm^3 of donated blood.

Give your answer to the nearest whole number.
(3 marks)

_____ cm^3

(continued on the next page)

Turn over

8(c) continued.

- (ii) Before donating blood, a person has a small blood sample taken to check that the blood is healthy.**

State TWO precautions a doctor should take when collecting this sample.

(2 marks)

1 _____

2 _____

(Total for Question 8 = 11 marks)

9 (a) Look at Figure 13 for Question 9(a) in the Diagram Booklet. It shows a root hair cell from a plant.

**(i) Name the part labelled X.
(1 mark)**

**(ii) State ONE way that the structure of the root hair cell increases the volume of substances it absorbs.
(1 mark)**

(continued on the next page)

9(a) continued.

- (iii) Explain why root hair cells do not contain chloroplasts.
(3 marks)**

(continued on the next page)

9 continued.

(b) A student studied the water plant **Elodea**.

The student used a light microscope to observe the cells of the plant in tap water and in a **10%** salt solution.

Look at Figure 14 for Question 9(b) in the Diagram Booklet. It shows **Elodea** cells in tap water and in a **10%** salt solution.

Describe **TWO** ways that the **Elodea** cells in the **10%** salt solution are different from the **Elodea** cells in tap water.

(2 marks)

1 _____

2 _____

(continued on the next page)

Turn over

9 continued.

***(c) Look at Figure 15 for Question 9(c) in the Diagram Booklet. It shows the direction of water movement through a tree.**

Explain how water is moved from the soil, through the plant and into the air.

(6 marks)

Answer space continues on the next page.

Turn over

9(c) continued.

This image shows a blank 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.

(Total for Question 9 = 13 marks)

- 10 A student investigated the decomposition of two different types of leaf.**

The student placed 200 grams of holly leaves in a net bag.

The student placed 200 grams of oak leaves in another net bag.

The bags were left in a classroom.

The mass of the leaves in each bag was recorded every 10 days for 50 days.

- (a) State TWO variables that would need to be controlled in this investigation.
(2 marks)**

1 _____

2 _____

(continued on the next page)

10 continued.

(b) Look at Figure 16 for Question 10(b) in the Diagram Booklet. It shows the results of this investigation.

- (i) Calculate the rate of decomposition of holly leaves from 0 to 50 days.
(2 marks)**

_____ grams per day

(continued on the next page)

10(b) continued.

- (ii) Compare the trends shown in the data for holly leaves and oak leaves.
(2 marks)**

(continued on the next page)

10 continued.

- (c) Explain why it is important for the environment that dead leaves are decomposed.
(2 marks)**

- (d) Name ONE type of organism that decomposes leaves.
(1 mark)**

(continued on the next page)

Turn over

10 continued.

(e) Leaves are eaten by snails.

1 600 grams of leaves and 10 snails were kept in a container for one month.

A scientist measured the mass of the leaves and the mass of the snails at the start and end of one month.

Look at Figure 17 for Question 10(e) in the Diagram Booklet. It shows the results.

**Explain why the change in mass of the leaves is not the same as the change in mass of the snails.
(2 marks)**

(Total for Question 10 = 11 marks)

**TOTAL FOR PAPER = 100 MARKS
END OF PAPER**