

Biology
PAPER 2
Foundation Tier

Total Marks

Friday 9 June 2023 – 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.

There may be spare copies of some diagrams.

(continued on the next page)

INFORMATION continued.

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

Candidates may use a calculator.

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 Figure 1 from the Diagram Booklet shows a bird called an egret on the back of a buffalo.

(a) (i) The egret eats parasites that live on the skin of the buffalo.

Which term describes this relationship, where the buffalo and the egret both benefit?

(1 mark)

☐ **A eutrophication**

☐ **B mutualism**

☐ **C indigenous**

☐ **D biodiverse**

(continued on the next page)

1(a) continued.

(ii) The buffalo is part of the carbon cycle.

**Use words from below to complete
the sentences.**

(2 marks)

clean

decompose

energy

fertilise

glucose

water

The buffalo gains carbon from the

**_____ in the
plants that it eats.**

Bacteria will

**_____ the
waste from the buffalo.**

(continued on the next page)

Turn over

1(a) continued.

(iii) Figure 2 for Question 1(a)(iii) in the Diagram Booklet shows part of the carbon cycle.

Draw and label an arrow on Figure 2 to show the process plants use to make glucose from carbon dioxide.

(2 marks)

(b) Enzymes are used to digest proteins.

Figure 3 for Question 1(b) in the Diagram Booklet shows an enzyme and a protein.

Explain how boiling the enzyme stops the protein being digested.

(2 marks)

Answer space continues on the next page.

1(b) continued.

(Total for Question 1 = 7 marks)

- 2 In 2022, temperatures in England were higher than average.**

The increase in temperature is linked to global warming.

- (a) Which human activity is most likely to cause an increase in global warming?
(1 mark)**

- ☐ **A burning fossil fuels**
- ☐ **B insulating houses**
- ☐ **C using more solar panels**
- ☐ **D using nuclear power stations**

(continued on the next page)

2 continued.

(b) Figure 4 for Question 2(b) in the Diagram Booklet shows the rainfall for one area in England for part of 2022.

- (i) State TWO conclusions about the actual rainfall compared with the average rainfall shown in Figure 4.
(2 marks)**

1 _____

2 _____

(continued on the next page)

2(b) continued.

- (ii) The average potato yield for a field is 44 tonnes.**

The weather in 2022 meant that the actual yield for this field was one quarter lower than this average.

**Calculate the actual yield of potatoes for this field in 2022.
(2 marks)**

_____ tonnes

(continued on the next page)

2(b) continued.

- (iii) Food security occurs when all people are able to access enough safe and nutritious food to meet their requirements for a healthy life.**

**Explain how lower yields of potatoes and other crops could affect food security.
(3 marks)**

Answer space continues on the next page.

2(b)(iii) continued.

(Total for Question 2 = 8 marks)

3 Figure 5 for Question 3(a)(i) in the Diagram Booklet shows a diagram of the human blood system.

**(a) (i) Name blood vessel X.
(1 mark)**

**(ii) Which row of the table shows the width of the wall and blood pressure in blood vessel X?
(1 mark)**

	width of wall	blood pressure
<input type="checkbox"/> A	thick	high
<input type="checkbox"/> B	thick	low
<input type="checkbox"/> C	thin	high
<input type="checkbox"/> D	thin	low

(continued on the next page)

3 continued.

- (b) Figure 6 for Question 3(b) in the Diagram Booklet shows the pressure of blood flowing through the arteries, capillaries and veins of a person.**

Calculate the difference in blood pressure from the maximum in the arteries to the minimum in the veins.

(2 marks)

_____ kPa

(continued on the next page)

3 continued.

(c) Figure 7 for Question 3(c) in the Diagram Booklet shows a diagram of a vein with blood cells.

**(i) Identify structure Q.
(1 mark)**

**(ii) State the function of structure Q.
(1 mark)**

(continued on the next page)

3 continued.

- (d) Describe how the heart causes blood to move to the lungs.
(3 marks)**

(Total for Question 3 = 9 marks)

4 Hormones are chemicals produced in endocrine glands.

(a) Look at the diagram for Question 4(a) in the Diagram Booklet. Draw ONE straight line from each hormone to the endocrine gland that produces it.

(2 marks)

(continued on the next page)

4 continued.

(b) Figure 8 for Question 4(b) in the Diagram Booklet shows some of the changes that occur during the menstrual cycle.

(i) The level of oestrogen peaks on day 13.

State the effect on the follicle caused by the peak in oestrogen.

(1 mark)

(ii) Describe the effect of progesterone on the uterus lining from day 13 to day 21.

(2 marks)

4 continued.

- (c) The condom is an example of a barrier contraceptive.**

**State ONE advantage and ONE disadvantage of using this barrier method of contraception.
(2 marks)**

Advantage

Disadvantage

(continued on the next page)

4 continued.

- (d) The contraceptive pill is an example of a hormonal method of contraception.**

Explain ONE way that the contraceptive pill stops a woman from becoming pregnant.

(2 marks)

(Total for Question 4 = 9 marks)

5 Figure 9 for Question 5 in the Diagram Booklet shows a nephron from a kidney.

(a) The pressure of the liquid in the Bowman's capsule is 1.3 kPa.

The pressure of the liquid in the glomerulus is 5.6 times greater than the pressure in the Bowman's capsule.

(i) Calculate the pressure in the glomerulus.

Give your answer to one decimal place.
(2 marks)

_____ kPa

(continued on the next page)

5(a) continued.

- (ii) The higher pressure in the glomerulus forces some parts of the blood into the Bowman's capsule.

Which row of the table shows the parts of the blood that move into the Bowman's capsule?
(1 mark)

	blood cells	urea	water
<input type="checkbox"/> A	✓	✓	x
<input type="checkbox"/> B	x	✓	✓
<input type="checkbox"/> C	✓	x	x
<input type="checkbox"/> D	x	x	✓

(continued on the next page)

5 continued.

(b) A scientist investigated the concentration of glucose in liquids from three different parts of the nephron.

(i) Describe how the equipment shown in Figure 10 for Question 5(b) in the Diagram Booklet can be used to see if these liquids contain different concentrations of glucose. (4 marks)

5(b)(i) continued.

- (ii) Figure 11 for Question 5(b)(ii) in the Diagram Booklet shows the concentration of glucose in the three different parts of the nephron.**

**Explain ONE conclusion that can be made from the data in Figure 11.
(2 marks)**

(Total for Question 5 = 9 marks)

Turn over

6 In 2000, a council planted indigenous trees as part of a reforestation programme.

**(a) Why were indigenous trees used instead of non-indigenous trees?
(1 mark)**

☐ **A indigenous trees will bring in more pests**

☐ **B indigenous trees are less likely to survive**

☐ **C indigenous trees will support more native wildlife**

☐ **D indigenous trees will cause more damage to the soil**

(continued on the next page)

6 continued.

- (b) The animal biodiversity in this reforested area was measured from 2004 to 2017.**

Biodiversity is measured on a scale from 0 to 1.

0 = low biodiversity

1 = maximum biodiversity

Figure 12 for Question 6(b) in the Diagram Booklet shows the results.

- (i) Draw a straight line of best fit on Figure 12 to show the main trend in this data.
(1 mark)**
- (ii) Estimate the animal biodiversity of the reforested area in 2022.
(1 mark)**
-
-

(continued on the next page)

6 continued.

(c) (i) The data to calculate animal biodiversity was collected using the following method.

- **a 100 m² area was chosen**
- **three 1 m² quadrats were placed randomly on the ground**
- **animals inside the quadrat were counted**
- **the number of each species of animal was recorded**

**State TWO ways that the quality of the results from this method could be improved.
(2 marks)**

1 _____

2 _____

6(c) continued.

- (ii) State why point A on Figure 12 from the Diagram Booklet was ignored when considering the trend in animal biodiversity.
(1 mark)**

- (iii) The data shown in Figure 12 from the Diagram Booklet was collected during the summer.**

**Explain why animal biodiversity would be different if the data had been collected in the winter.
(2 marks)**

6 continued.

- (d) A scientist observes that trees at the edge of a forest shade part of a field.**

Describe how a belt transect could be used to see how light intensity affects the biodiversity of plants growing in the field.

(3 marks)

6(d) continued.

(Total for Question 6 = 11 marks)

- 7 (a) Figure 13 for Question 7(a) in the Diagram Booklet shows three organisms that live in pond water.

Oxygen diffuses across the cell membranes of these organisms.

- (i) Which row of the table shows the conditions needed for oxygen to diffuse from species A into the pond water?
(1 mark)

	concentration of oxygen in species A in parts per million	concentration of oxygen in pond water in parts per million
<input type="checkbox"/> A	10	10
<input type="checkbox"/> B	12	10
<input type="checkbox"/> C	10	12
<input type="checkbox"/> D	12	12

(continued on the next page)

7(a) continued.

- (ii) Species B has a surface area of $9\,000\,\mu\text{m}^2$ and a volume of $6\,000\,\mu\text{m}^3$.**

Calculate surface area to volume ratio for species B.

(2 marks)

ratio _____

(continued on the next page)

7(a) continued.

- (iii) The surface area to volume ratio for a cell of species A is 1 : 1.**

The surface area to volume ratio for each cell in species C is 1 : 4.

Explain how the different surface areas will affect the diffusion of oxygen out of the cells of species A and species C.

(2 marks)

7 continued.

- (b) Some species of algae that photosynthesise have vacuoles that are filled with gas.**

These vacuoles help the algae to float in water.

**State how these vacuoles help the algae survive.
(1 mark)**

(continued on the next page)

7 continued.

***(c) Figure 14 for Question 7(c) in the Diagram Booklet shows leaves on a branch of a tree.**

**Explain how leaves are adapted
for photosynthesis.
(6 marks)**

Answer space continues on the next page.

7(c) continued.

[illegible]

(Total for Question 7 = 12 marks)

- 8 People with diabetes cannot always control the concentration of glucose in their blood.**

(a) Two people eat identical meals.

One person has diabetes, the other person does not have diabetes.

Figure 15 for Question 8(a) in the Diagram Booklet shows the concentration of glucose in the blood of these two people after eating the meals.

- (i) Describe TWO differences in the concentration of glucose in the blood of the two people shown in Figure 15.
(2 marks)**

1 _____

2 _____

(continued on the next page)

8(a) continued.

- (ii) Calculate the maximum increase in the concentration of glucose in the blood of the person with diabetes.
(1 mark)**

_____ mmol per dm³

- (iii) Water moved out of the red blood cells of the person with diabetes when the concentration of glucose in the blood was above 15 mmol per dm³.**

**Explain why water moved out of the red blood cells of the person with diabetes.
(2 marks)**

(continued on the next page)

Turn over

8 continued.

(b) The pancreas produces a hormone that causes the concentration of glucose in the blood to decrease.

**(i) Name this hormone.
(1 mark)**

**(ii) State how this hormone is transported from the pancreas to its target organs.
(1 mark)**

(continued on the next page)

8(b) continued.

**(iii) Which is the target organ for the hormone that controls the concentration of glucose in the blood?
(1 mark)**

- ☐ **A kidney**
- ☐ **B pancreas**
- ☐ **C liver**
- ☐ **D lung**

(continued on the next page)

8 continued.

**(c) Explain how type 2 diabetes can be controlled.
(3 marks)**

(Total for Question 8 = 11 marks)

9 Respiration occurs in cells.

**(a) Why do cells respire?
 (1 mark)**

- ☐ **A to produce nitrogen**
- ☐ **B to release oxygen**
- ☐ **C to produce glucose**
- ☐ **D to release energy**

(continued on the next page)

9 continued.

(b) An athlete runs every day as part of their training.

- (i) Explain why the breathing rate of the athlete increases when running.
(2 marks)**

(continued on the next page)

9(b) continued.

- (ii) When the athlete is running, their muscle cells use both aerobic respiration and anaerobic respiration.**

**State TWO differences between aerobic respiration and anaerobic respiration.
(2 marks)**

1 _____

2 _____

(continued on the next page)

Turn over

9 continued.

- (c) Bromothymol blue (BTB) solution is an indicator of pH.**

Figure 16 for Question 9(c) in the Diagram Booklet shows the colour of BTB at different pH levels.

When air is passed through green BTB, for one minute, the solution stays green.

When a person breathes out through a straw into BTB for one minute the solution turns yellow.

- (i) Explain why the air breathed out turns the BTB solution yellow.
(2 marks)**

(continued on the next page)

Turn over

9(c) continued.

***(ii) Devise a plan, using green BTB solution, to investigate the amount of carbon dioxide in the air athletes breathe out after they have been running at different speeds.**

Include:

- **how you would use green BTB solution.**
 - **how you would control at least two variables.**
- (6 marks)**

Answer space continues on the next 2 pages.

9(c)(ii) continued.

[illegible]

Turn over

9(c)(ii) continued.

(Total for Question 9 = 13 marks)

- 10 (a) A student wanted to make a jacket to wear in cold weather.**

The student compared the insulation properties of wool as a natural material with polyester as a synthetic material.

Each material was wrapped around a beaker containing hot water as shown in Figure 17 for Question 10(a) in the Diagram Booklet.

The temperature was recorded every 2 minutes for 12 minutes.

- (i) Which part of the body controls the regulation of body temperature?
(1 mark)**

- ☐ **A kidney**
- ☐ **B pituitary gland**
- ☐ **C hypothalamus**
- ☐ **D pancreas**

(continued on the next page)

10(a) continued.

- (ii) State ONE variable that should be controlled in this investigation.
(1 mark)**

- (iii) Describe a control that could be used for this investigation.
(2 marks)**

(continued on the next page)

10 continued.

(b) The results for this investigation are shown in Figure 18 for Question 10(b) in the Diagram Booklet.

- (i) Compare and contrast the temperature changes for wool and polyester in this investigation.
(2 marks)**

- (ii) State ONE improvement to this investigation that would make the results more comparable.
(1 mark)**

10 continued.

- (c) (i) Wearing an insulated jacket may cause a person to sweat.**

**Explain how sweating helps to regulate temperature in humans.
(2 marks)**

(continued on the next page)

10(c) continued.

(ii) Sweat contains urea.

State where and how urea is produced in the human body.

(2 marks)

(Total for Question 10 = 11 marks)

TOTAL FOR PAPER = 100 MARKS
END OF PAPER