

Biology

UNIT: 4BI1

Science (Double Award) 4SD0

PAPER: 1B

Total Marks

Friday 10 May 2024 – Morning

Time: 2 hours

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 110.

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.

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.

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 Look at the diagram for Question 1(a) in the Diagram Booklet. It shows part of a food web from an oak woodland.**

**(a) (i) Which is the producer in this food web?
(1 mark)**

- ☐ **A beetle**
- ☐ **B deer**
- ☐ **C oak tree**
- ☐ **D tick**

**(ii) On the blank page for Question 1(a)(ii) in the Diagram Booklet, draw a food chain, from this web, that includes the mouse and contains four trophic levels.
(2 marks)**

(continued on the next page)

1(a) continued.

**(iii) Which one of these organisms is in two different trophic levels in this food web?
(1 mark)**

- ☐ **A ant**
- ☐ **B blue jay**
- ☐ **C caterpillar**
- ☐ **D mouse**

(continued on the next page)

1 continued.

- (b) A tick is a small spider-like organism that bites and then takes in blood from the mammals as it feeds.**

Look at the diagram for Question 1(b) in the Diagram Booklet. It is a magnified image of a tick.

- (i) The actual length of the tick, as shown by line A–B, is 3·5 mm.**

Calculate the magnification of the image of the tick.

(2 marks)

magnification = \times _____

(continued on the next page)

1(b) continued.

- (ii) The tick absorbs substances from the mammal's blood it has taken in.**

Give the function of two named substances absorbed by the tick.

(4 marks)

Answer space continues on the next page.

substance 1

Turn over

1(b)(ii) continued.

substance 2

(continued on the next page)

1(b) continued.

(iii) Ticks can pass diseases between organisms.

**Suggest how ticks can pass diseases from
one organism to another.
(2 marks)**

(Total for Question 1 = 12 marks)

- 2 Look at the diagram for Question 2 in the Diagram Booklet. It shows a flower with some structures labelled.**

**(a) (i) Which structure is the style?
(1 mark)**

☐ A P

☐ B Q

☐ C S

☐ D T

**(ii) Which structure releases pollen?
(1 mark)**

☐ A P

☐ B R

☐ C T

☐ D U

(continued on the next page)

2(a) continued.

**(iii) On which structure do the pollen grains germinate?
(1 mark)**

☐ A P

☐ B R

☐ C S

☐ D U

(continued on the next page)

2 continued.

(b) This flower is insect-pollinated.

**Describe how structures P, R and T would be different in a wind-pollinated flower.
(3 marks)**

P _____

R _____

T _____

(continued on the next page)

2 continued.

(c) Flowering plants can reproduce asexually.

- (i) Give an example of a natural method of asexual reproduction in plants.
(1 mark)**

- (ii) Give an example of an artificial method of asexual reproduction in plants.
(1 mark)**

(continued on the next page)

2 continued.

- (d) Give three differences between asexual and sexual reproduction.
(3 marks)**

Answer space continues on the next page.

1 _____

2 _____

2(d) continued.

3 _____

(continued on the next page)

2 continued.

(e) A farmer has two varieties of a plant species.

One variety has a red flower colour and no scent.

The other variety has a white flower colour and a perfumed scent.

The farmer wants to produce a variety that has the red flower colour and the perfumed scent.

**Explain how the farmer could achieve this.
(3 marks)**

Answer space continues on the next page.

2(e) continued.

(Total for Question 2 = 14 marks)

- 3 The passage describes the process used to produce yoghurt.

Complete the passage by writing a suitable word or words in each blank space.

(7 marks)

Yoghurt is made by heating _____ to a high temperature.

This heating process is known as _____ .

This ensures that bacteria present in the liquid are _____ .

The liquid is then cooled to between 40°C and 46°C.

A type of bacteria called _____ is then added.

These bacteria use a sugar called _____ for _____ respiration.

The pH of the yoghurt decreases because this respiration produces a substance called _____ .

(Total for Question 3 = 7 marks)

- 4 Look at the diagram for Question 4 in the Diagram Booklet. A respirometer is a simple apparatus that can be used to measure the rate of respiration in small organisms.**

A student uses the respirometer to investigate the rate of respiration in some germinating seeds.

- (a) Give the balanced chemical symbol equation for aerobic respiration.
(2 marks)**

(continued on the next page)

4 continued.

- (b) The student measures the rate of respiration of 10 g of germinating seeds at 20 °C.**

They then repeat this with another sample of 10 g of germinating seeds at 30 °C.

The rate of respiration can be measured by recording the distance, in mm, the bubble of coloured liquid moves on the scale in one minute.

They measure the rate three times at each temperature.

(continued on the next page)

4(b) continued.

- (i) Explain why carbon dioxide needs to be absorbed by the soda lime when measuring the rate of aerobic respiration.
(2 marks)**

(continued on the next page)

4(b) continued.

- (ii) State how the student could have changed the temperature in this investigation.
(1 mark)**

(continued on the next page)

4 continued.

(c) Look at the table for Question 4(c) in the Diagram Booklet. It shows the student's results.

- (i) Calculate the mean distance moved by the bubble at 30 °C.
(2 marks)**

mean distance = _____ mm

(continued on the next page)

4(c) continued.

- (ii) Explain the effect of increasing the temperature on the movement of the bubble.
(3 marks)**

Answer space continues on the next page.

4(c)(ii) continued.

(Total for Question 4 = 10 marks)

5 (a) Increased release of greenhouse gases are a threat to many ecosystems.

**(i) Which of these are greenhouse gases?
(1 marks)**

- 1 CFCs**
- 2 methane**
- 3 oxygen**
- 4 water vapour**

- ☐ **A 1 and 2 only**
- ☐ **B 1, 2 and 3 only**
- ☐ **C 1, 2 and 4 only**
- ☐ **D all of them**

(continued on the next page)

5(a) continued.

- (ii) Explain what is meant by the term
greenhouse effect.
(2 marks)**

(continued on the next page)

5 continued.

(b) Look at the graph for Question 5(b) in the Diagram Booklet. It shows the mass of greenhouse gases emitted from four sources in the United Kingdom from 1990 to 2020.

- (i) Calculate the percentage of the total greenhouse gases emitted that came from energy production in 2020.
(3 marks)**

percentage = _____ %

(continued on the next page)

5(b) continued.

- (ii) Comment on the changes in the four sources of greenhouse gases from 1990 to 2020.**

Use the information in the graph and your own knowledge to support your answer.

(5 marks)

Answer space continues on the next page.

5(b)(ii) continued.

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(Total for Question 5 = 11 marks)

- 6 Look at the diagram for Question 6 in the Diagram Booklet. A student uses this apparatus to investigate the effect of light intensity on the rate of photosynthesis in pondweed.**

This is the student's method.

- **put a cut piece of pondweed in a beaker of water**
- **put a lamp 12 cm from the beaker**
- **count the number of bubbles of gas released from the cut end of the pondweed in one minute**
- **repeat this count for two more one-minute periods**

The student repeats the method, moving the lamp 2 cm nearer the beaker each time.

- (a) (i) Which gas is released by the plant during photosynthesis?
(1 mark)**

- ☐ **A carbon dioxide**
- ☐ **B oxygen**
- ☐ **C methane**
- ☐ **D nitrogen**

(continued on the next page)

Turn over

6(a) continued.

(ii) Which of these is the site of photosynthesis in a plant cell?
(1 mark)

- ☐ **A chloroplast**
- ☐ **B mitochondrion**
- ☐ **C nucleus**
- ☐ **D ribosome**

(iii) Give one abiotic variable the student should control in this investigation.
(1 mark)

(continued on the next page)

6 continued.

(b) Look at the table for Question 6(b) in the Diagram Booklet. It shows the student's results

(i) On the grid for Question 6(b)(i) in the Diagram Booklet, plot a line graph to show the relationship between the distance of the lamp from the beaker and the mean number of bubbles released.

Use a ruler to join your points with straight lines.

(5 marks)

(continued on the next page)

6(b) continued.

- (ii) Explain the effect of increasing the distance of the lamp from the beaker on the mean number of bubbles released per minute.
(3 marks)**

Answer space continues on the next page.

6(b)(ii) continued.

(Total for Question 6 = 11 marks)

- 7 (a) Human blood contains red blood cells and white blood cells.

Give three differences in structure between red blood cells and white blood cells.
(3 marks)

Answer space continues on the next page.

1 _____

2 _____

7(a) continued.

3 _____

(continued on the next page)

7 continued.

(b) Scientists collect data from men and women living at different altitudes.

The scientists determine

- **the mean mass of haemoglobin in one litre of blood**
- **the mean number of red blood cells in one litre of blood**

Look at the table for Question 7(b) in the Diagram Booklet. It gives the scientists' results.

(continued on the next page)

7(b) continued.

- (i) The blood volume of a woman living at an altitude of 1890 m is 4.3 litres.**

Calculate the total number of red blood cells in this person.

**Give your answer in standard form.
(3 marks)**

number of red blood cells = _____

(continued on the next page)

7(b) continued.

- (ii) Calculate the percentage difference in mean mass of haemoglobin in 1 litre of blood in men living at 2270 m compared with men living at sea level.
(2 marks)**

percentage difference = _____ %

(continued on the next page)

7(b) continued.

(iii) Discuss the relationship between altitude and mean mass of haemoglobin in 1 litre of blood and the number of red cells in 1 litre of blood in men and women.

**Use the data in the table and your own knowledge in your answer.
(5 marks)**

Answer space continues on the next 2 pages.

7(b)(iii) continued.

[illegible]

Turn over

7(b)(iii) continued.

(Total for Question 7 = 13 marks)

- 8 Cystic fibrosis (CF) is a condition that affects the mucus produced in the lungs and in other organs.

The condition is caused by a recessive allele.

- (a) State what is meant by a recessive allele.
(1 mark)

(continued on the next page)

8 continued.

(b) Look at the diagram for Question 8(b) in the Diagram Booklet. It shows a family pedigree.

Some people in the family have CF.

**(i) Use the pedigree to determine the genotypes of individuals A, B and C.
(3 marks)**

A _____

B _____

C _____

(continued on the next page)

8(b) continued.

(ii) Individuals E and F have a third child.

Draw a genetic diagram to show the genotypes of E and F, the gametes they produce and the possible genotypes and phenotypes of the offspring.

(3 marks)

(continued on the next page)

8 continued.

(c) The gene for cystic fibrosis affects many different body systems including the digestive system and the reproductive system.

(i) The mucus that is produced in the pancreas is much thicker and blocks the pancreatic duct.

Explain the effects this would have on human digestion.

(3 marks)

8(c) continued.

- (ii) Cystic fibrosis can result in the production of thick mucus which builds up in the cervix.**

Explain the effect this will have on reproduction.

(2 marks)

(Total for Question 8 = 12 marks)

9 Students investigate the effect of mineral ions on plant growth.

They use four solutions A, B, C and D.

- **A is a complete mineral solution that contains all of the mineral ions that a plant needs to grow normally**
- **B is a complete mineral solution without nitrate ions**
- **C is a complete mineral solution without magnesium ions**
- **D is a complete mineral solution without iron ions**

Look at Diagram 1 for Question 9 in the Diagram Booklet. The plant they use is duckweed, which grows on the surface of water.

(continued on the next page)

9 continued.

This is the students' method.

- **place each of the four solutions (A, B, C and D) into separate jars**
- **float five plants of duckweed in each jar**
- **use plants with the same number of leaves, are the same size and are healthy**
- **cover each jar with plastic film**

Look at Diagram 2 for Question 9 in the Diagram Booklet.

- **put the jars containing the plants in sunlight**
- **after four weeks count the total number of leaves in each jar**
- **make a note of the size and colour of the leaves in each jar**

(continued on the next page)

9 continued.

- (a) (i) State two variables the students kept constant in their experiment.
(2 marks)**

1 _____

2 _____

(continued on the next page)

9(a) continued.

- (ii) Explain why the students used complete mineral solution rather than distilled water to compare the effects of lacking a mineral ion. (2 marks)**

(continued on the next page)

9(a) continued.

**(iii) Explain why the jars are kept in sunlight.
(2 marks)**

**(iv) State the independent variable in
this investigation.
(1 mark)**

(continued on the next page)

9 continued.

(b) The students record the total number of leaves in each jar.

They classify the leaf size as large, medium and small.

They record leaf colour as how green the leaves were between 0 for white to 5 for dark green.

Look at the table for Question 9(b) in the Diagram Booklet. The students' results are shown.

(continued on the next page)

9(b) continued.

- (i) Some of the observations such as number of leaves are quantitative and some such as leaf size are qualitative.**

Give the difference between quantitative and qualitative results.

(1 mark)

(continued on the next page)

9(b) continued.

(ii) Comment on the students' results.

In your answer you should use data from the table and your own knowledge.

(6 marks)

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Turn over

9(b)(ii) continued.

[illegible]

(Total for Question 9 = 14 marks)

Turn over

- 10 Carbon dioxide can be added to a glasshouse to increase the yield of a crop plant.**

Design an investigation to find the carbon dioxide concentration needed for maximum crop yield.

Include experimental details in your answer and write in full sentences.

(6 marks)

Answer space continues on the next 2 pages.

10 continued.

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10 continued.

(Total for Question 10 = 6 marks)

TOTAL FOR PAPER = 110 MARKS
END OF PAPER