

Biology
UNIT: 4BI1
PAPER: 2B

Total Marks

Friday 7 June 2024 – Afternoon

Time: 1 hour 15 minutes

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

Surname					
Other names					
Centre Number					
Candidate Number					

YOU MUST HAVE

Calculator, ruler

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 70.

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 ☒.

EXTINCTIONS

- 1 Look at the image and read the passage for Question 1 in the Diagram Booklet. Use the information in the passage and your own knowledge to answer the questions that follow.**

(a) Megalodon was an animal.

Which of these features does megalodon share with the fungus yeast?

- 1 nuclei present in cells**
 - 2 nervous coordination**
 - 3 stores carbohydrate as glycogen**
- (1 mark)**

- ☐ **A 1 and 2 only**
- ☐ **B 1 and 3 only**
- ☐ **C 2 and 3 only**
- ☐ **D 1, 2 and 3**

1 continued.

- (b) Scientists think that the giant, predatory toothed whales that replaced the extinct megalodon consumed the same sources of food.**

**Explain how the evolution of giant, predatory toothed whales may have caused the extinction of megalodon. (lines 5 to 7)
(3 marks)**

(continued on the next page)

1 continued.

- (c) (i) Volcanoes release sulfur dioxide into the atmosphere.**

**Describe the biological consequences of sulfur dioxide release. (lines 10 to 12)
(2 marks)**

(continued on the next page)

1(c) continued.

- (ii) The release of large amounts of dust into the atmosphere reduced light intensity.**

Explain why this would cause a loss of food chains. (lines 9 to 11)

(3 marks)

(continued on the next page)

1 continued.

- (d) (i) Explain why the cells in cryozoos are put in salt and sugar solution rather than pure water.
(lines 16 to 18)
(2 marks)**

(continued on the next page)

1(d) continued.

- (ii) Describe how scientists could clone a
banteng. (lines 18 to 20)
(4 marks)**

(continued on the next page)

1 continued.

- (e) Explain why releasing cloned mammoths could have negative and positive effects on Arctic biodiversity. (lines 22 to 28)
(3 marks)**

(Total for Question 1 = 18 marks)

Turn over

- 2 Transpiration (water loss) is affected by several environmental factors.**

A student investigates the effect of light intensity on water loss from a plant shoot.

Look at the diagram for Question 2 in the Diagram Booklet. It shows some of the apparatus the student uses.

The student predicts that water loss from a plant shoot will increase as light intensity increases.

- (a) (i) Describe how to set up and use the student's apparatus to test this prediction.
(4 marks)**

Answer space continues on the next page.

2(a)(i) continued.

**(ii) State the dependent variable in
this investigation.
(1 mark)**

(continued on the next page)

2 continued.

- (b) Another student uses the apparatus to collect and process the data.**

Look at Table 1 for Question 2(b)(i) in the Diagram Booklet. It shows their results.

- (i) Explain why light intensity changes the mean volume of water lost by the shoot.
(2 marks)**

(continued on the next page)

2(b) continued.

- (ii) The student repeats the experiment with a plant that is adapted to live in desert environments.**

Look at Table 2 for Question 2(b)(ii) in the Diagram Booklet. It shows the results for this desert plant.

The desert plant has adaptations to survive in desert environments where not much water is available.

**Explain why the results for this desert plant, in table 2, are different from the results in table 1.
(3 marks)**

Answer space continues on the next page.

Turn over

2(b)(ii) continued.

(Total for Question 2 = 10 marks)

3 Isotonic drinks are often used to rehydrate athletes after exercise.

**(a) Explain why athletes lose water during exercise.
(2 marks)**

(continued on the next page)

3 continued.

(b) Isotonic drinks contain salt and sugar solutions that are the same concentration as normal blood plasma.

A scientist uses this method to investigate how well an isotonic drink rehydrates athletes.

- **three athletes exercise for one hour**
- **one athlete has no drink**
- **the second athlete drinks 1000 cm^3 of pure water**
- **the third athlete drinks 1000 cm^3 of isotonic drink**
- **the volume and colour of urine produced by each athlete are measured one hour later**

(continued on the next page)

3(b) continued.

Look at the table for Question 3(b)(i) in the Diagram Booklet. It shows the scientist's results.

- (i) Explain the results shown in the table for the athlete who consumed no drink.
(3 marks)**

(continued on the next page)

3(b) continued.

- (ii) Explain the differences in urine volume and urine colour produced by the athlete who consumed the isotonic drink and the athlete who consumed pure water.
(2 marks)**

(Total for Question 3 = 7 marks)

- 4 Look at the diagram for Question 4(a)(i) in the Diagram Booklet. It shows four glands in the human body labelled **W**, **X**, **Y** and **Z**.

(a) LH is a hormone involved in the menstrual cycle.

- (i) Which labelled gland produces LH?
(1 mark)

☐ A W

☐ B X

☐ C Y

☐ D Z

- (ii) Describe the functions of LH during the menstrual cycle.
(2 marks)

Answer space continues on the next page.

4(a)(ii) continued.

(b) Look at the diagram for Question 4(b) in the Diagram Booklet. It shows a fetus developing in a uterus.

Explain how the amniotic fluid and placenta enable the safe growth of the fetus.

(3 marks)

Answer space continues on the next page.

4(b) continued.

(c) Scientists investigated the effects of tobacco smoking and taking mineral ion supplements on the growth of developing babies during pregnancy.

The scientists looked at four groups of mothers.

- GROUP A non-smokers taking mineral ion supplements**
- GROUP B non-smokers not taking mineral ion supplements**
- GROUP C smokers taking mineral ion supplements**
- GROUP D smokers not taking mineral ion supplements**

(continued on the next page)

4(c) continued.

Look at the graph for Question 4(c)(i) in the Diagram Booklet. It shows the mean masses of developing babies at **12 weeks** of pregnancy at **24 weeks** of pregnancy and at birth (**36 weeks**).

- (i) Calculate the percentage difference at **36 weeks** of the mean mass of babies from mothers in group **A** compared with the mean mass of babies from mothers in group **D**.

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

percentage difference = _____%

4(c) continued.

- (ii) Comment on the effect of smoking and the effect of taking mineral ion supplements on the growth of babies.**

Use the graph and your own knowledge to help your answer.

(4 marks)

Answer space continues on the next page.

4(c)(ii) continued.

(Total for Question 4 = 13 marks)

- 5 The sequence of bases on one strand of a section of DNA is

TAC CGT AAT TAT

- (a) (i) Which of these is the complementary sequence of DNA on the other strand of the double helix?

(1 mark)

- ☐ A ATG GCA TTA ATA
- ☐ B AUG GCA UUA AUA
- ☐ C CGT TAC GGC CGC
- ☐ D CGU UAC GGC CGC

- (ii) Look at the diagrams for Question 5(a)(ii) in the Diagram Booklet. Which of these is the correct summary of the processes occurring during protein synthesis?

(1 mark)

- ☐ A
- ☐ B
- ☐ C
- ☐ D

(continued on the next page)

Turn over

5 continued.

(b) Look at the table for Question 5(b)(i) in the Diagram Booklet. It shows different mRNA codons for some amino acids.

(i) UUU-AUG-UGU is one combination of codons that codes for the sequence of amino acids W-X-Y.

**Give the number of OTHER combinations that code for the same amino acid sequence.
(1 mark)**

number of other combinations = _____

5(b) continued.

- (ii) Look again at the table for Question 5(b)(i) in the Diagram Booklet. Explain why most genetic mutations have no effect on the phenotype of an organism.**

Use the information in the table and your own knowledge in your answer.

(3 marks)

(continued on the next page)

5(b) continued.

- (iii) State one way that the incidence of mutations can be increased.
(1 mark)**

(Total for Question 5 = 7 marks)

- 6 Look at the photograph for Question 6(a) in the Diagram Booklet. It shows a fish called tilapia. This type of fish is often grown in fish farms.**

(a) Tilapia are a good source of nutrients for humans.

Look at the table for Question 6(a)(i) in the Diagram Booklet. It shows the percentage of the daily requirements for humans of three nutrients provided by a portion of tilapia.

- (i) Use the table to determine the ratio of lipid to protein to carbohydrate.**

**Give your answer in the form 1: n : 1
(1 mark)**

ratio = 1: _____: 1

(continued on the next page)

6(a) continued.

- (ii) Describe how to test a sample of tilapia to show the presence of lipid.
(2 marks)**

- (iii) Tilapia has high levels of protein.**

**State one function of protein in the human body.
(1 mark)**

(continued on the next page)

6 continued.

- (b) Scientists have produced genetically modified (GM) tilapia that grow faster.**

Scientists investigate the growth of these GM tilapia compared with non-genetically modified (non-GM) tilapia.

This is the scientists' method.

- set up two equally sized tanks containing water**
- put non-GM tilapia into one tank**
- put an equal mass of GM tilapia into the second tank**
- feed the fish in each tank the same mass of protein pellets**

The mass of each type of fish was measured at the start of the investigation and after seven months.

A measure called the feed conversion index was also calculated for each type of fish.

(continued on the next page)

6(b) continued.

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

- (i) The mean rate of increase in mass of the non-GM tilapia during the seven months is **226 g** per month.**

Calculate the mean rate of increase in mass, in g per month, of the GM tilapia.

**Give your answer to three significant figures.
(2 marks)**

mean rate of increase = _____ g per month

6(b) continued.

- (ii) The feed conversion index is a measure of the mass of protein pellets used compared with the increase in mass of tilapia.

It is calculated using this formula.

$$\text{feed conversion index} = \frac{\text{total mass of protein pellets used}}{\text{increase in mass of tilapia}}$$

Use the information in the table to calculate the mass of protein pellets given to the non-GM tilapia.

(1 mark)

mass of protein pellets = _____ g

(continued on the next page)

6(b) continued.

- (iii) Suggest why the GM tilapia have a lower feed conversion index than the non-GM tilapia.
(2 marks)**

- (iv) Both groups of fish were fed the same mass of pellets and placed into the same sized tanks of water.**

**Give ONE other abiotic factor that the scientists should keep constant.
(1 mark)**

(continued on the next page)

Turn over

6(b) continued.

- (v) The scientists conclude that farming GM tilapia is better for the environment than farming non-GM tilapia. This is because the GM tilapia would result in less nitrate in the water and cause less spread of disease.**

Look again at the table for Question 6(b)(i) in the Diagram Booklet. Evaluate this conclusion.

Use the information in the table and your own knowledge in your answer.

(5 marks)

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Turn over

6(b)(v) continued.

[illegible]

Turn over

6(b)(v) 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 6 = 15 marks)

TOTAL FOR PAPER = 70 MARKS

END OF PAPER