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| Candidate surname | Other names |
|---|---|
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Centre Number | Candidate Number

# Pearson Edexcel International GCSE (9–1)

Friday 7 June 2024

Afternoon (Time: 1 hour 15 minutes)

Paper reference **4BI1/2B**

# Biology

**UNIT: 4BI1**
**PAPER: 2B**

You must have:
Calculator, ruler

Total Marks

## Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *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.*

## 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.

*Turn over* ▶

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**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 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

**Extinctions**

During the evolution of living organisms, most species have become extinct. Evolution by natural selection means that species constantly replace each other. The photograph shows the fossilised jaws of a shark called megalodon. Megalodon was a giant, predatory shark that became extinct 2.6 million years ago.



(Source: © CHRIS HELLIER / SCIENCE PHOTO LIBRARY)

Some scientists think megalodon was replaced by giant, predatory toothed whales. These whales were the ancestors of modern orcas. Any sharks that remained evolved to become smaller. As well as the steady loss of species over time, there have been mass extinction events. Approximately 250 million years ago 90% of all animals and plants became extinct. The cause of this mass extinction is not known, but one theory is that it was due to the eruptions of volcanoes. The volcanoes released sulfur dioxide, carbon dioxide and dust into the atmosphere. This caused populations of producer species to fall, atmospheric carbon dioxide levels to rise, and oxygen levels to fall.

Human activity is now causing another mass extinction. Some scientists estimate that approximately one million animal and plant species are at risk. To prevent species loss, cryozoos are being developed. Cryozoos are storage tanks containing samples of body cells from animals and are kept at a temperature of -170 °C. The cells are put in a salt and sugar solution and then frozen. If a species becomes extinct, the frozen cells can be used to clone new animals. The banteng is an endangered breed of cattle. Banteng body cells have been stored in a cryozoo. These cells have been used with eggs from another species to successfully produce a living banteng.

In the future we may be able to bring back extinct species such as mammoths by making clones using the remains of frozen mammoths. Scientists need to consider the advantages and disadvantages of bringing back extinct animals. Currently, the biodiversity of the world is different from the time when mammoths were alive. Many natural predators of mammoths are now extinct. Mammoths may have helped to keep methane-releasing soil frozen, reducing the release of the methane. Mammoths were also an important part of the nitrogen cycle and increased the nutrient content of low-nutrient Arctic soil.

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(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)**

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

(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)**

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

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

**(2)**

(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)**

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

**(2)**

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(ii) Describe how scientists could clone a banteng. (lines 18 to 20)

**(4)**

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

**(3)**

**(Total for Question 1 = 18 marks)**

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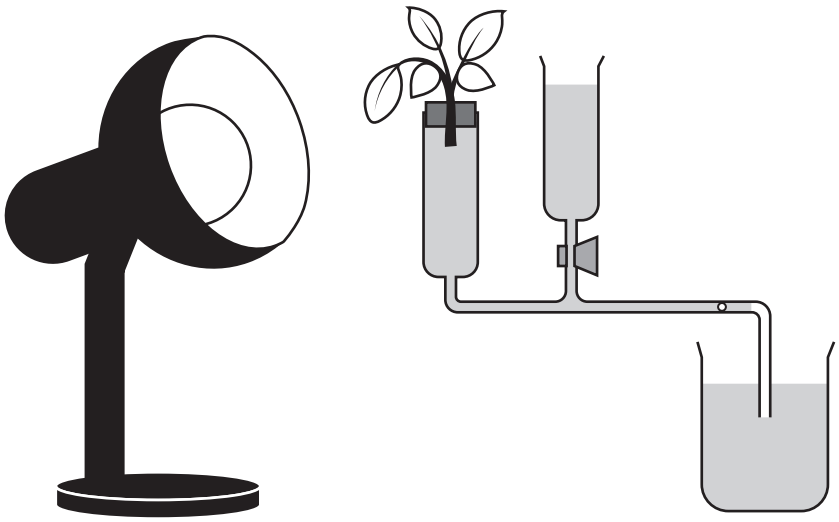
**2** Transpiration (water loss) is affected by several environmental factors.

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

The diagram 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)**

(ii) State the dependent variable in this investigation.

**(1)**

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

Table 1 shows their results.

| Light intensity in arbitrary units | Mean volume of water lost by shoot in 10 minutes in $mm^3$ |
|---|---|
| 0 | 2 |
| 5 | 8 |
| 10 | 12 |
| 15 | 12 |

**Table 1**

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

**(2)**

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

Table 2 shows the results for this desert plant.

| Light intensity in arbitrary units | Mean volume of water lost by shoot in 10 minutes in $mm^3$ |
|---|---|
| 0 | 6 |
| 5 | 4 |
| 10 | 0 |
| 15 | 0 |

**Table 2**

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)**

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**(Total for Question 2 = 10 marks)**

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

(a) Explain why athletes lose water during exercise.

**(2)**

(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

The table shows the scientist's results.

| Drink consumed by athlete | Volume of urine produced in $cm^3$ | Colour of urine |
|---|---|---|
| no drink | 100 | very dark yellow |
| pure water | 750 | very light yellow |
| isotonic drink | 500 | yellow |

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

**(3)**

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(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.

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**(Total for Question 3 = 7 marks)**

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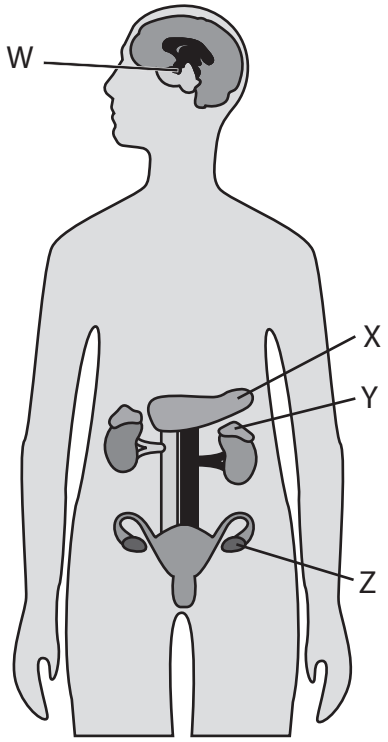
**4** The diagram shows four glands in the human body labelled W, X, Y and Z.




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

(i) Which labelled gland produces LH?

**(1)**

- ☒ A W
- ☒ **B** X
- ☒ **C** Y
- ☒ **D** Z

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

**(2)**

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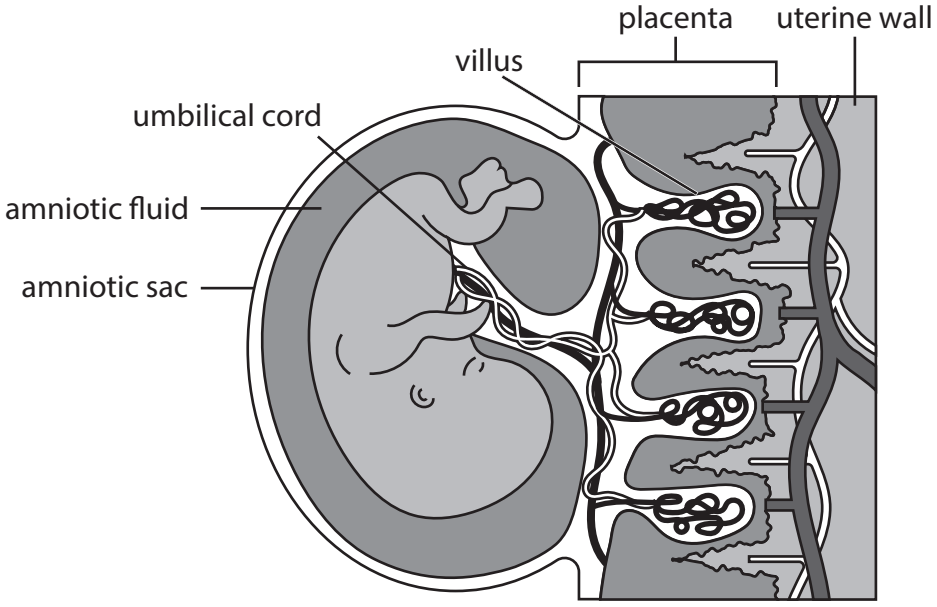
(b) The diagram shows a fetus developing in a uterus.




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

**(3)**

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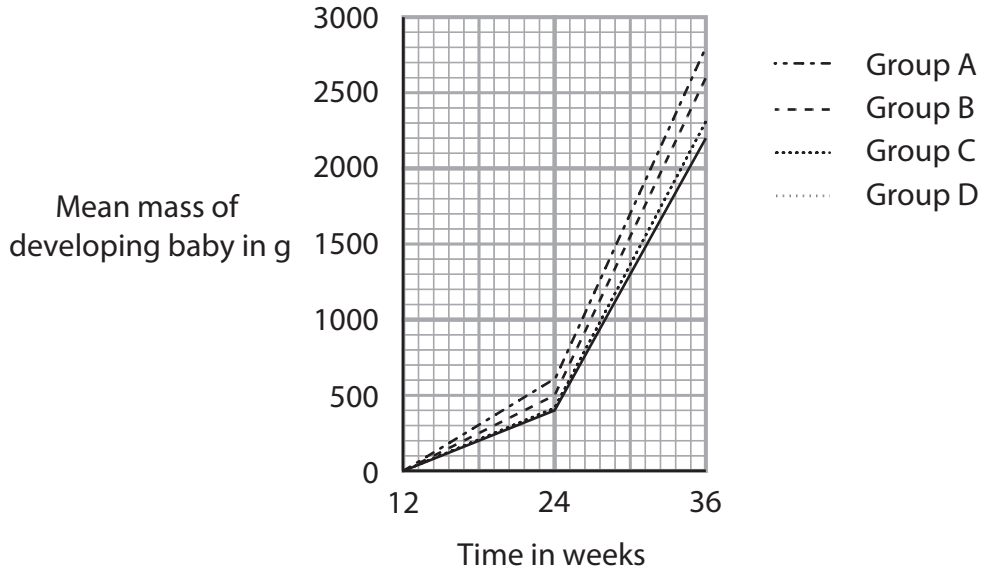
(c) Scientists investigated the effects of tobacco smoking and taking mineral ion supplements on the growth of developing babies during pregnancy.

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

The graph 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)**

percentage difference = .....%

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(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)**

**(Total for Question 4 = 13 marks)**

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**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)**

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

(ii) Which of these is the correct summary of the processes occurring during protein synthesis?

**(1)**

- ☒ A DNA —transcription→ RNA —translation→ protein
- ☒ **B** DNA —translation→ RNA —transcription→ protein
- ☒ **C** RNA —transcription→ DNA —translation→ protein
- ☒ **D** RNA —translation→ DNA —transcription→ protein

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(b) The table shows different mRNA codons for some amino acids.

| Codons | Amino acid |
|---|---|
| UUU, UUC | W |
| AUG | X |
| UGU, UGC | Y |

(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)**

number of other combinations = .....

(ii) 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)**

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(iii) State one way that the incidence of mutations can be increased.

**(1)**

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**(Total for Question 5 = 7 marks)**

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**6** The photograph shows a fish called tilapia. This type of fish is often grown in fish farms.



(Source: © DAVID NUNUK / SCIENCE PHOTO LIBRARY)

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

The table shows the percentage of the daily requirements for humans of three nutrients provided by a portion of tilapia.

| Nutrient group | Percentage of daily requirement provided by a portion of tilapia |
|---|---|
| lipids | 16 |
| protein | 38 |
| carbohydrate | 16 |

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

Give your answer in the form 1: n : 1

**(1)**

ratio = 1: ..... : 1

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

**(2)**

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(iii) Tilapia has high levels of protein.

State one function of protein in the human body.

**(1)**

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(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.

The table shows the scientists' results.

| Type of fish | Total starting mass of fish in g | Total mass of fish after seven months in g | Feed conversion index |
|---|---|---|---|
| non-GM | 1250 | 2830 | 1.9 |
| GM | 1250 | 3750 | 1.2 |

(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)**

mean rate of increase = ..... g per month

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(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)**

mass of protein pellets = ..... g

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

**(2)**

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(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)**

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(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.

Evaluate this conclusion.

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

**(5)**

**(Total for Question 6 = 15 marks)**

**TOTAL FOR PAPER = 70 MARKS**

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