

Biology
Unit: 4BI1
Science (Double Award) 4SD0
Paper: 1B

Total Marks

Time: 2 hours plus your additional time allowance

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 – there may be more space than you need.

Show all the steps in any calculations and state the units.

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 ☐.

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.

ADVICE

Read each question carefully before you start to answer it.

Write your answers neatly and in good English.

Try to answer every question.

Check your answers if you have time at the end.

Good luck with your examination.

Answer ALL questions.

- 1 Look at the table for Question 1(a) in the Diagram Booklet. It lists values that can be obtained in practical investigations.**

- (a) Complete the table by naming pieces of laboratory apparatus that can be used to help obtain these values.**

**The first one has been done for you.
(4 marks)**

(continued on the next page)

1 continued.

- (b) Look at the diagram for Question 1(b) in the Diagram Booklet. It shows a red blood cell viewed through a microscope.**

The actual width of this red blood cell is 8 μm .

The magnification of this red blood cell can be calculated using this formula.

$$\text{magnification} = \frac{\text{width of cell in drawing}}{\text{actual width of cell}}$$

**Calculate the magnification of this red blood cell.
(2 marks)**

magnification = _____

(Total for Question 1 = 6 marks)

2 Look at the diagram for Question 2 in the Diagram Booklet. It shows the human heart with four blood vessels labelled A, B, C and D.

**(a) (i) Which blood vessel brings oxygenated blood to the heart?
(1 mark)**

☐ A

☐ B

☐ C

☐ D

**(ii) Which blood vessel contains blood at the highest pressure?
(1 mark)**

☐ A

☐ B

☐ C

☐ D

(continued on the next page)

Turn over

2 continued.

- (b) (i) Draw a label line on the diagram to show the position of a semi-lunar valve.
(1 mark)**
- (ii) Describe the function of the semi-lunar valves.
(2 marks)**

(continued on the next page)

2 continued.

(c) In the heart of a foetus, the two upper chambers (atria) are linked by a hole so that blood can pass between them.

**(i) Explain why this hole is normally closed before the baby is born.
(2 marks)**

(continued on the next page)

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2 continued.

**(ii) Sometimes the hole does not close.
Explain what effect this will have on the baby.
(3 marks)**

[illegible]

(Total for Question 2 = 10 marks)

Turn over

3 A student investigates factors that affect photosynthesis.

(a) In his first experiment, the student uses this method to investigate the effect of light on photosynthesis.

- **place a plant in the dark for 24 hours**
- **cover part of leaf X with black paper**
- **place the plant in the light for 24 hours**

Look at the diagram for Question 3(a) in the Diagram Booklet. It shows the plant in the light.

Describe how the student tests leaf X to show the effect of light on photosynthesis.

(4 marks)

3 continued.

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3 continued.

(b) In his second experiment, the student uses a water plant to investigate the effect of carbon dioxide concentration on the rate of photosynthesis.

He does the experiment at two different light intensities.

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

**(i) Explain the student's results.
(4 marks)**

3 continued.

**(ii) Describe how the student could change the light intensity in this investigation.
(1 mark)**

(continued on the next page)

3 continued.

**(iii) Give the dependent variable in this investigation.
(1 mark)**

**(iv) Give one way in which the student could control the biotic variable in this investigation.
(1 mark)**

(Total for Question 3 = 11 marks)

4 Look at the diagram for Question 4(a) in the Diagram Booklet. It shows a yeast cell.

**(a) (i) Which row of the table is correct for this yeast cell?
(1 mark)**

	Substance in cell wall	Substance stored in cytoplasm
<input type="checkbox"/> A	cellulose	glycogen
<input type="checkbox"/> B	cellulose	starch
<input type="checkbox"/> C	chitin	glycogen
<input type="checkbox"/> D	chitin	starch

**(ii) Which type of organism is a yeast cell?
(1 mark)**

☐ **A a bacterium**

☐ **B a fungus**

☐ **C a plant**

☐ **D a protocist**

(continued on the next page)

Turn over

4 continued.

(b) Biofuel is made from ethanol.

Scientists use genetically modified (GM) yeast to produce biofuel.

The GM yeast contains an enzyme that digests plant cell walls to produce glucose.

The yeast uses the glucose in respiration to produce ethanol.

**(i) Which of these equations shows the respiration in the yeast?
(1 mark)**

☐ **A glucose \longrightarrow ethanol**

☐ **B glucose \longrightarrow ethanol + carbon dioxide**

☐ **C glucose + oxygen \longrightarrow ethanol**

☐ **D glucose + oxygen \longrightarrow ethanol + carbon dioxide**

(continued on the next page)

4 continued.

- (ii) Name an enzyme used by scientists to genetically modify the yeast.
(1 mark)**

- (iii) The GM yeast is a recombinant strain.**

**State what is meant by the term
RECOMBINANT.
(1 mark)**

(continued on the next page)

4 continued.

- (iv) Suggest why biofuel produced using glucose from plants could reduce global warming.
(2 marks)**

(continued on the next page)

4 continued.

(c) Look at the graph for Question 4(c) in the Diagram Booklet. It shows the mass of ethanol produced by GM yeast and by normal yeast over a period of 3 days.

**(i) Calculate the percentage increase in the mass of ethanol produced by GM yeast compared to normal yeast after 1 day.
(2 marks)**

percentage increase = _____ %

(continued on the next page)

4 continued.

- (ii) Give two reasons why the rate of ethanol production decreases after 1 day.
(2 marks)**

1 _____

2 _____

(Total for Question 4 = 11 marks)

5 Weeds are plants that compete with crop plants.

A scientist investigates the use of two different ways of reducing the population of weeds.

This is her method.

- **use chemical control in one field by spraying herbicides, a type of pesticide, that kill the weeds**
- **use biological control in another field by releasing insects that eat the weeds**
- **measure the mean (average) number of weeds in each field once a month from February to August**

Look at the table for Question 5 in the Diagram Booklet. It shows the scientist's results.

- (a) Describe a method to measure the mean number of weeds per m^2 in each field.**
(3 marks)

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Turn over

5 continued.

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5 continued.

- (b) The scientist concludes that biological control is a better way of controlling weeds than chemical control.**

Discuss this conclusion.

**Use data from the table and your own knowledge to support your answer.
(5 marks)**

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(Total for Question 5 = 8 marks)

Turn over

6 A student studies the organisms in a pond community.

(a) Which of these is the correct description of a community?

(1 mark)

- ☐ **A the living organisms together with their non-living environment**
- ☐ **B the area where organisms live**
- ☐ **C the organisms of all species in a habitat**
- ☐ **D the organisms of one species in a habitat**

(continued on the next page)

6 continued.

- (b) Look at the table for Question 6(b) in the Diagram Booklet. It shows the number of organisms per m^2 at different trophic levels in a pond community.**

It also shows the total biomass of these organisms per m^2 .

- (i) Calculate the mean mass in g of a single primary consumer.
(3 marks)**

Give your answer in standard form.

mean mass = _____ g

(continued on the next page)

6 continued.

(ii) Look at the grid for Question 6(b)(ii) in the Diagram Booklet. Use this grid to draw a pyramid of biomass for the pond community. (2 marks)

(c) The number of secondary consumers is low because energy transfer is not 100% efficient.

(i) Explain why egestion is one reason why energy transfer is not 100% efficient. (2 marks)

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6 continued.

- (ii) Give two other reasons why energy transfer is not 100% efficient.
(2 marks)**

1 _____

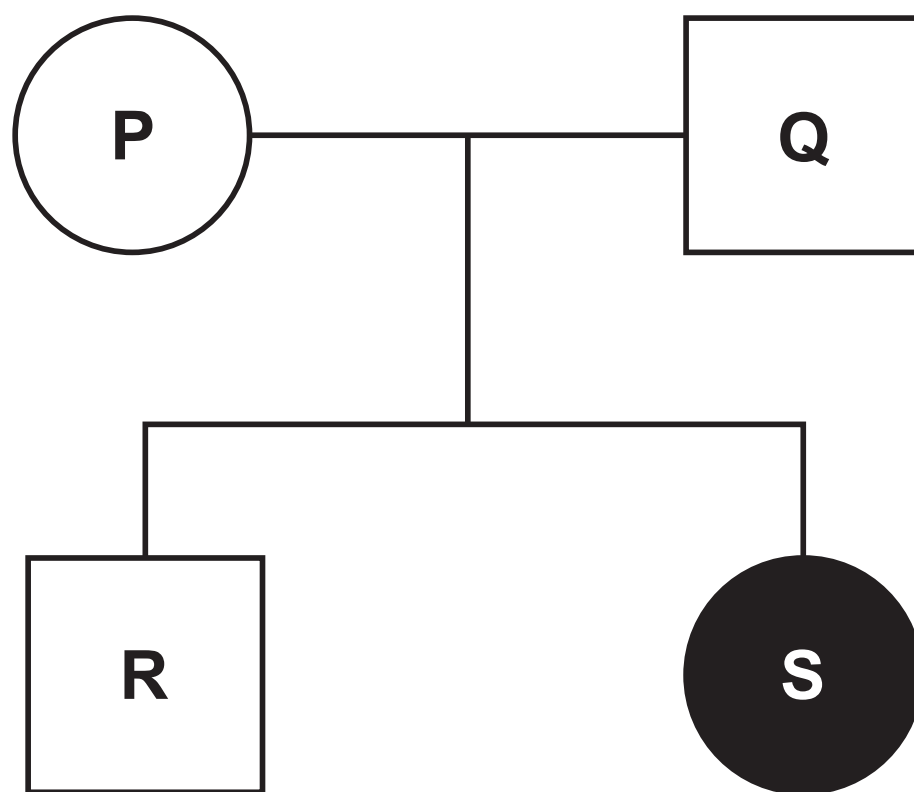
2 _____

(Total for Question 6 = 10 marks)

- 7 Inherited conditions may be caused by a dominant allele (D) or by a recessive allele (d).

The diagram shows a family pedigree for an inherited condition.

The shaded circle shows a female with the condition.



- (a) Look at the table for Question 7(a) in the Diagram Booklet. Complete the table by giving the genotype of each individual.

One has been done for you.
(3 marks)

(continued on the next page)

7 continued.

(b) The parents have a third child.

Calculate the probability that this third child is female and has the condition.

(1 mark)

probability = _____

(continued on the next page)

7 continued.

- (c) Look at the graphs for Question 7(c) in the Diagram Booklet. They show changes in the concentrations of the hormones testosterone and oestrogen in child R and in child S between the ages of 11 to 15.**

Explain how the changes in hormone concentrations affect the development of each child.

(4 marks)

(continued on the next page)

Turn over

7 continued.

(Total for Question 7 = 8 marks)

8 Look at the table for Question 8 in the Diagram Booklet. It gives the percentage composition by mass of human breast milk, and of cow's milk.

(a) Discuss whether cow's milk is a suitable alternative to breast milk for young babies.

**Use data from the table and your own knowledge to support your answer.
(6 marks)**

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8 continued.

(b) Human breast milk may contain insufficient vitamin D for a growing child.

**Give two ways that additional vitamin D could be provided for the child.
(2 marks)**

1

2

(continued on the next page)

8 continued.

- (c) Describe how a sample of cow's milk could be tested for protein.
(2 marks)**

(Total for Question 8 = 10 marks)

- 9 The scientist, Richard Doll, collected data about deaths from cancer in the 1950s.

The table shows data for four groups.

Cause of death	Number of deaths				
	non-smokers	light smokers	medium smokers	heavy smokers	total
lung cancer	0	12	11	13	36
other cancers	15	35	24	18	92
all deaths	82	345	206	157	790

- (a) (i) Using the grid for Question 9(a)(i) in the Diagram Booklet, plot a bar chart to show the number of deaths from lung cancer and from other cancers for each of the four groups.
(5 marks)

(continued on the next page)

9 continued.

- (ii) Calculate the difference in the percentage of all deaths caused by lung cancer in heavy smokers compared to the percentage of all deaths caused by lung cancer in light smokers.
(3 marks)**

difference = _____%

(continued on the next page)

9 continued.

(b) This table gives no information about the age of the people who died.

Suggest why age may affect the likelihood of dying from lung cancer.

(2 marks)

(continued on the next page)

9 continued.

- (c) Explain one effect, other than lung cancer, that smoking has on health.
(2 marks)**

(Total for Question 9 = 12 marks)

10 Humans can control their internal environment.

(a) State the term used to describe the control of an organism's internal environment.

(1 mark)

(b) Coordination uses hormones and nerves.

Some responses are simple reflex arcs.

Describe the structure and functioning of the withdrawal reflex of a finger from a hot object.

(4 marks)

10 continued.

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10 continued.

- (c) Humans use their skin to regulate their body temperature. Look at the diagram for Question 10(c) in the Diagram Booklet. It shows a section through the skin with two structures labelled A and B.**

Changes take place in the skin when a person moves from a warm environment to a cold environment.

- (i) Explain the changes that take place in structure A as a person enters a cold environment.
(2 marks)**

10 continued.

**(ii) Explain the changes that take place in structure B as the person enters a cold environment.
(3 marks)**

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10 continued.

- (d) Modern humans have less body hair than their ancestors.**

Explain how this evolutionary change was brought about by natural selection.

(4 marks)

(continued on the next page)

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(Total for Question 10 = 14 marks)

11 Pollution of air or water can affect ecosystems.

(a) (i) Explain the biological consequences of air pollution by sulfur dioxide.
(3 marks)

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11 continued.

**(ii) State how sulfur dioxide pollution can be reduced.
(1 mark)**

(continued on the next page)

11 continued.

- (b) Some scientists have suggested that adding hydrogencarbonate solution to soil, instead of adding water, can increase plant growth.**

Design an investigation to discover the effect that adding hydrogencarbonate solution has on the growth of seedlings.

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

(6 marks)

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11 continued.

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11 continued.

(Total for Question 11 = 10 marks)

TOTAL FOR PAPER = 110 MARKS

END