LUI | | | | | | | | | | | School code | | | | |

School name

Given name/s

Family name

Attach your barcode ID label here

Book of books used

External assessment 2024

Question and response book

Biology

Paper 1

Time allowed

- Perusal time — 10 minutes
- Working time — 90 minutes

General instructions

- Answer all questions in this question and response book.
- QCAA-approved calculator permitted.
- Planning paper will not be marked.

Section 1 (20 marks)

- 20 multiple choice questions

Section 2 (27 marks)

- 7 short response questions

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Queensland Government | QCAA Queensland Curriculum & Assessment Authority

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Section 1

Instructions

- This section has 20 questions and is worth 20 marks.
- Use a 2B pencil to fill in the A, B, C or D answer bubble completely.
- Choose the best answer for Questions 1–20.
- If you change your mind or make a mistake, use an eraser to remove your response and fill in the new answer bubble completely.

	A	B	C	D
Example:	●	○	○	○

	A	B	C	D
1.	○	○	○	○
2.	○	○	○	○
3.	○	○	○	○
4.	○	○	○	○
5.	○	○	○	○
6.	○	○	○	○
7.	○	○	○	○
8.	○	○	○	○
9.	○	○	○	○
10.	○	○	○	○
11.	○	○	○	○
12.	○	○	○	○
13.	○	○	○	○
14.	○	○	○	○
15.	○	○	○	○
16.	○	○	○	○
17.	○	○	○	○
18.	○	○	○	○
19.	○	○	○	○
20.	○	○	○	○

Ensure you have filled an answer bubble for each question.

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Section 2

Instructions

- Write using black or blue pen.
- If you need more space for a response, use the additional pages at the back of this book.
  - On the additional pages, write the question number you are responding to.
  - Cancel any incorrect response by ruling a single diagonal line through your work.
  - Write the page number of your alternative/additional response, i.e. See page …
  - If you do not do this, your original response will be marked.
- This section has seven questions and is worth 27 marks.

QUESTION 21 (7 marks)

In 2014, a group of scientists surveyed a plant community and determined Simpson's diversity index (SDI) to be 0.84. They returned to the same site in 2024 and collected this data.

Species	Number of individuals
A	133
B	96
C	256

a) Calculate SDI in 2024 using the formula $SDI = 1 - \left(\frac{\sum n(n-1)}{N(N-1)} \right)$. Show your working. *[2 marks]*

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b) The scientists noted that species richness was the same in 2024 and 2014.
Infer how species evenness changed over the 10-year period. Justify your response. *[2 marks]*

c) Describe how sampling could be used to collect data for this investigation.
Include at least two strategies to minimise bias. *[3 marks]*

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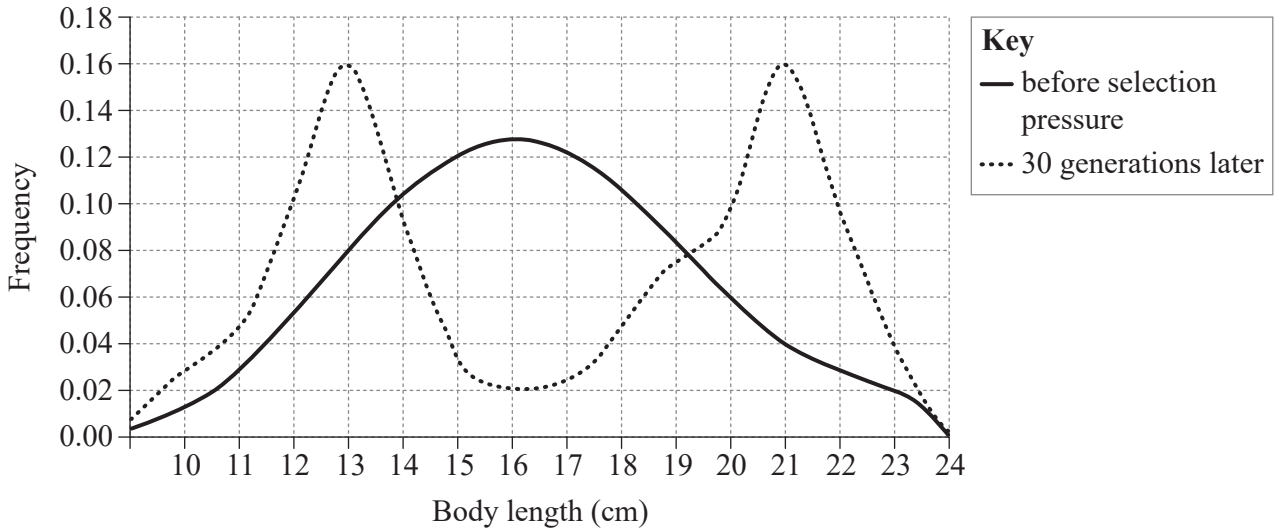
QUESTION 22 (4 marks)

The graph shows the effect of a selection pressure on the body length of a fish population.



a) Determine which type of phenotypic selection has occurred. *[1 mark]*

b) Use the principles of natural selection to explain the observed trends. *[3 marks]*

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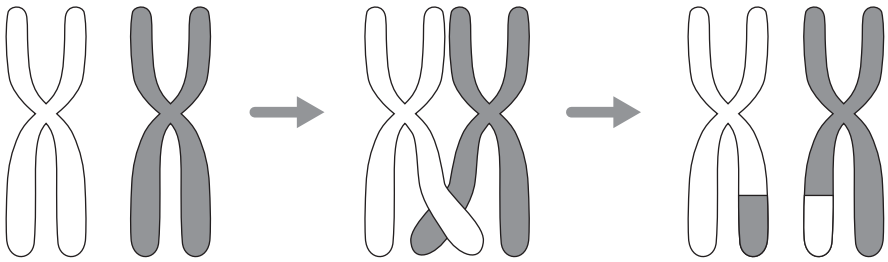
QUESTION 23 (3 marks)

In rabbits, black fur is dominant to white fur. A male that is heterozygous for black fur is crossed with a female with white fur, producing 12 offspring.

Predict the number of offspring with white fur. Justify your response using a Punnett square.

QUESTION 24 (3 marks)

The diagram shows a process that occurs during meiosis.



a) Identify the process. *[1 mark]*

b) Explain how this process contributes to genetic variation in the genotypes of offspring. *[2 marks]*

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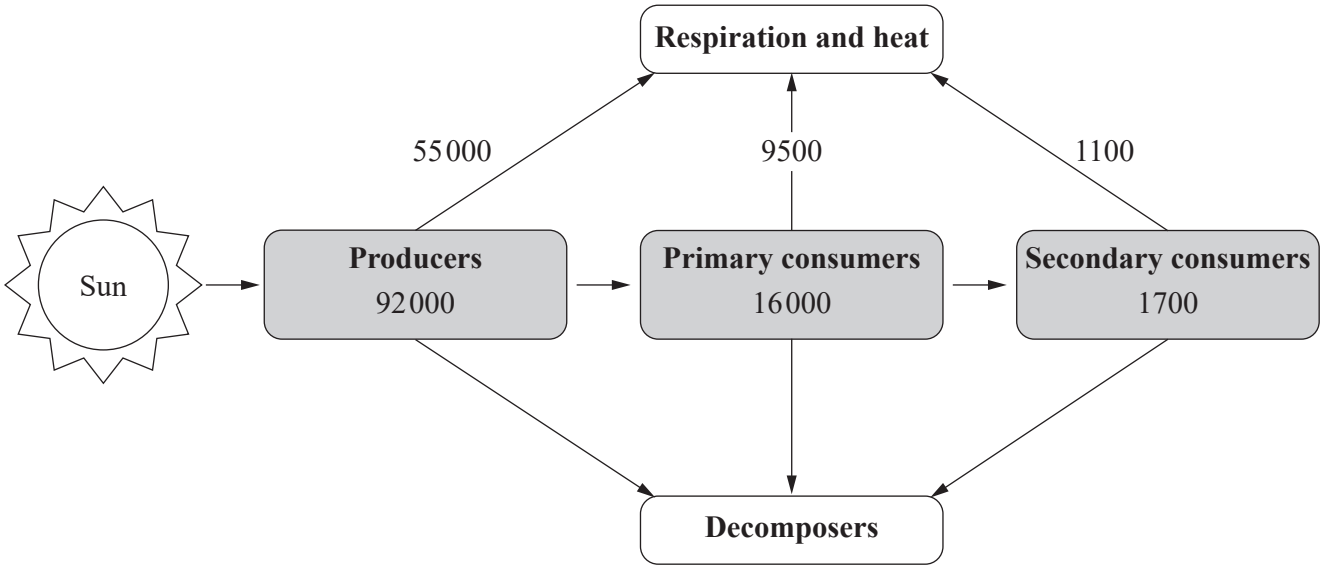
QUESTION 25 (2 marks)

Describe what is meant by an *interspecific hybrid*, using an example.

QUESTION 26 (6 marks)

The diagram shows energy flow through an ecosystem. Values are in kJ m^{-2} $year^{-1}$. Shaded boxes represent gross productivity.



a) Calculate the efficiency of energy transfer between primary and secondary consumers. Show your working. *[2 marks]*

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b) Determine the amount of energy lost to decomposers at the producer level.
Show your working. *[2 marks]*

c) Describe two ways energy is transformed in this ecosystem. *[2 marks]*

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QUESTION 27 (2 marks)

To determine the reliability of the capture–recapture technique and the Lincoln index $N = \frac{M \times n}{m}$, two researchers collected data on a mouse population from the same site at the same time.

Researcher	Number of mice in first capture	Number of mice in second capture	Number of marked mice in second capture
I	160	140	80
II	100	60	?

If the reliability of the technique is high, how many marked mice would be expected in the second capture for researcher II? Show your working.

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ADDITIONAL PAGE FOR STUDENT RESPONSES

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References

Question 24

BioNinja 2023, *Forming Recombinant Chromosomes via Crossing Over*, https://old-ib.bioninja.com.au/higher-level/topic-10-genetics-and-evolu/101-meiosis/crossing-over.html

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