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School code

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School name

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Attach your
barcode ID label here

Book

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of

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books used

External assessment 2021

Question and response book

Biology

Paper 2

Time allowed

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

General instructions

- Answer all questions in this question and response book.
- Write using black or blue pen.
- QCAA-approved calculator permitted.
- Planning paper will not be marked.

Section 1 (42 marks)

- 13 short response questions





DO NOT WRITE ON THIS PAGE
THIS PAGE WILL NOT BE MARKED



Section 1

Instructions

- 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.
-

QUESTION 1 (4 marks)

Explain how one abiotic and one biotic factor will affect the population of mosquito larvae in a freshwater pond.

Do not write outside this box.

QUESTION 2 (3 marks)

a) Explain the difference between exons and introns.

[2 marks]

b) State a function of telomeres.

[1 mark]

Do not write outside this box.

QUESTION 3 (3 marks)

In coastal areas and deserts, bare sand dunes may be colonised by plants such as members of the *Poaceae* family (grasses). Identify three features of these plants that make them effective colonisers.

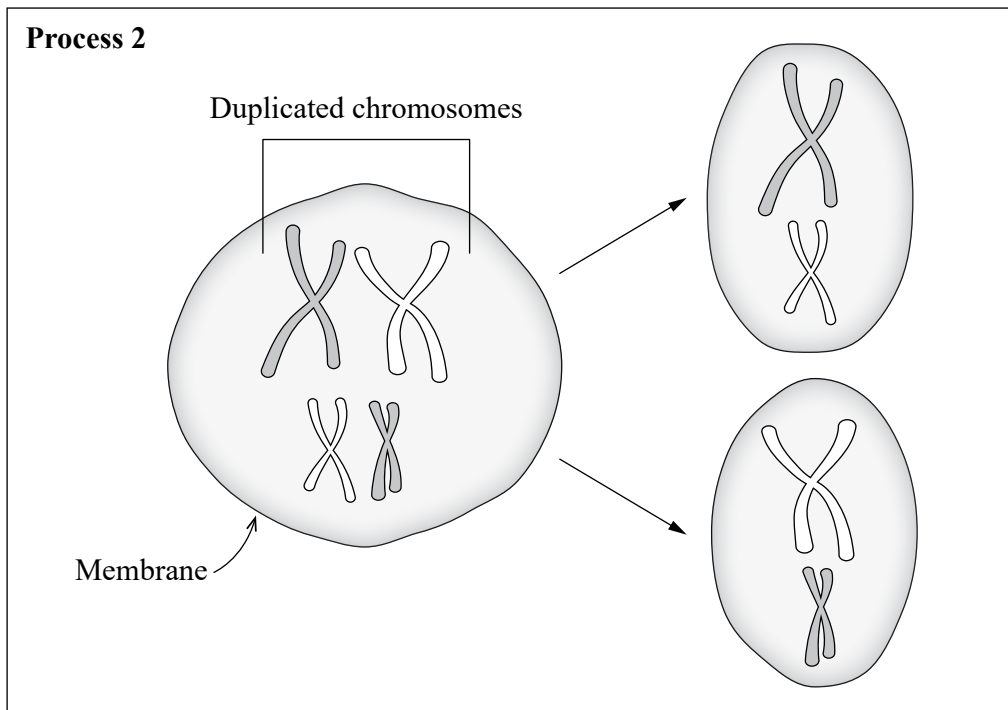
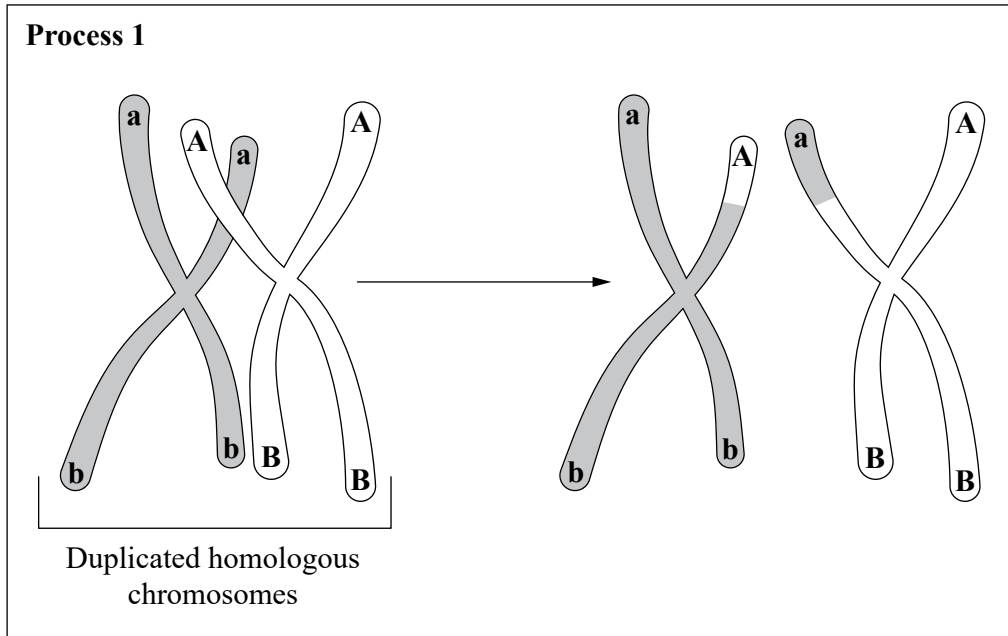
QUESTION 4 (2 marks)

Explain the purpose of the polymerase chain reaction (PCR) process and provide an example of its application.

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QUESTION 5 (6 marks)

Meiosis ensures that a wide range of genetic combinations occurs during the formation of gametes. The diagrams show two processes that occur during meiosis.



Do not write outside this box.

Describe the two processes shown in the diagrams and how they contribute to genetic variation in gametes.

Name and description of process 1: _____

Name and description of process 2: _____

Do not write outside this box.

QUESTION 6 (2 marks)

The term *species* could be defined as ‘one group of individuals that actually or potentially interbreed in nature’.

Identify two limitations of this definition.

QUESTION 7 (3 marks)

Koalas were once widespread in Australia. Due to a variety of factors, their population decreased and fragmented into small pockets, forcing them to inbreed. They have recently been hit by devastating epidemic diseases.

Explain why koalas face an increased extinction risk from disease.

Do not write outside this box.

QUESTION 8 (3 marks)

Australia has many bird species that have evolved to be largely dependent on mangroves.

These species are patchy in their distribution because of:

- the island-like distribution of their habitat
- exclusion by possible competitors
- geographical barriers.

Identify and describe the mode of speciation that may have caused diversity in mangrove bird species.

Do not write outside this box.

QUESTION 9 (3 marks)

A computer simulation was used to observe genotypic changes in the gene pool of 20 randomly selected rabbits. The simulation was set with these parameters:

- each rabbit’s coat colour was either black or white
- black alleles were dominant; white alleles were recessive
- the number of rabbits was constant in each generation and breeding was random throughout the population
- an environmental factor was chosen in the simulation to provide selection pressure.

The table shows the results of the simulation at the start and after 20 generations.

Initial population genotypes	Population genotypes after 20 generations
BB BB BB BB BB BB	BB BB
Bb Bb Bb Bb Bb Bb Bb Bb Bb Bb	Bb Bb Bb Bb Bb Bb Bb Bb
bb bb bb bb	bb bb bb bb bb bb bb bb bb bb

Contrast the initial allele frequency with the allele frequency after 20 generations to draw a conclusion about the effect of the selection pressure on the rabbit population.

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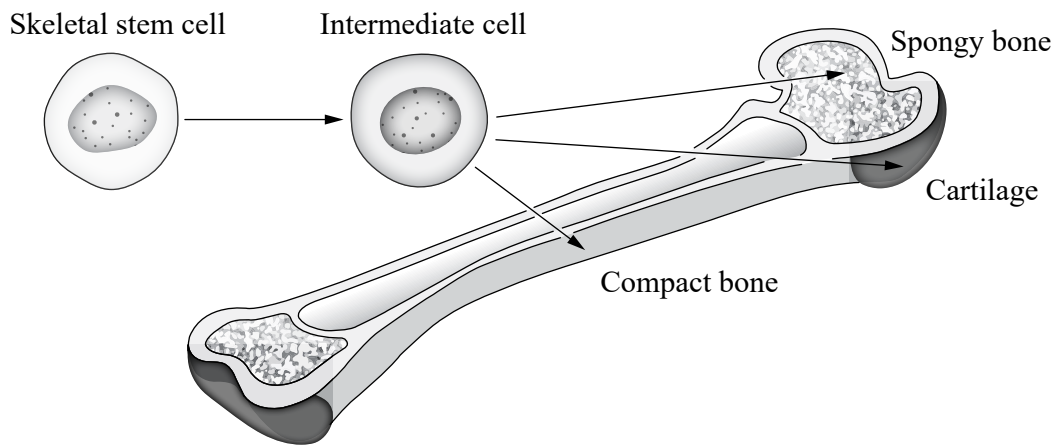
QUESTION 10 (3 marks)

Describe three ways DNA occurs in cells.

Do not write outside this box.

QUESTION 11 (2 marks)

Adult skeletal stem cells differentiate into intermediate cells and later into specialised bone tissue types.



The table shows how three transcription factors (A, B and C) affect bone tissue formation.

Transcription factor role	Intermediate cell	Cartilage	Compact bone
Activators	A	B, A	B
Repressors	—	C	A

Explain the effect of transcription factors on gene expression and tissue formation. Use an example from the table to support your answer.

Do not write outside this box.

QUESTION 12 (5 marks)

An investigation compared mangrove species diversity for two areas of different size in the same catchment. The table shows species population counts for each area.

		Area 1	Area 2
Total species count	Grey mangrove	37	7
	Red mangrove	32	3
	Yellow mangrove	25	88
SDI		0.67	?

- a) Calculate Simpson’s diversity index for Area 2. Show your working. [2 marks]

$$SDI = 1 - \left(\frac{\sum n(n-1)}{N(N-1)} \right)$$

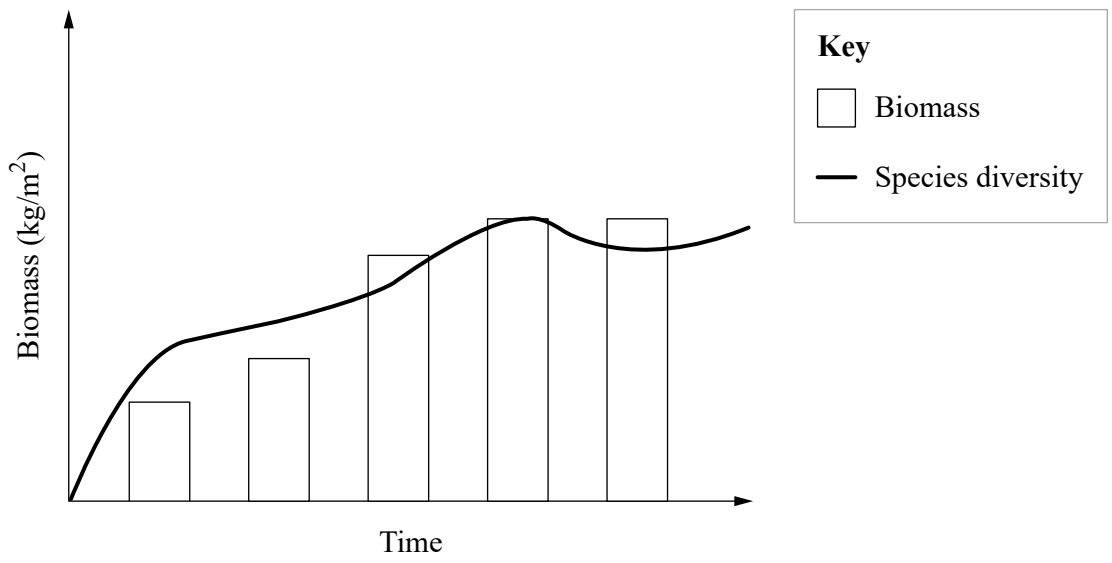
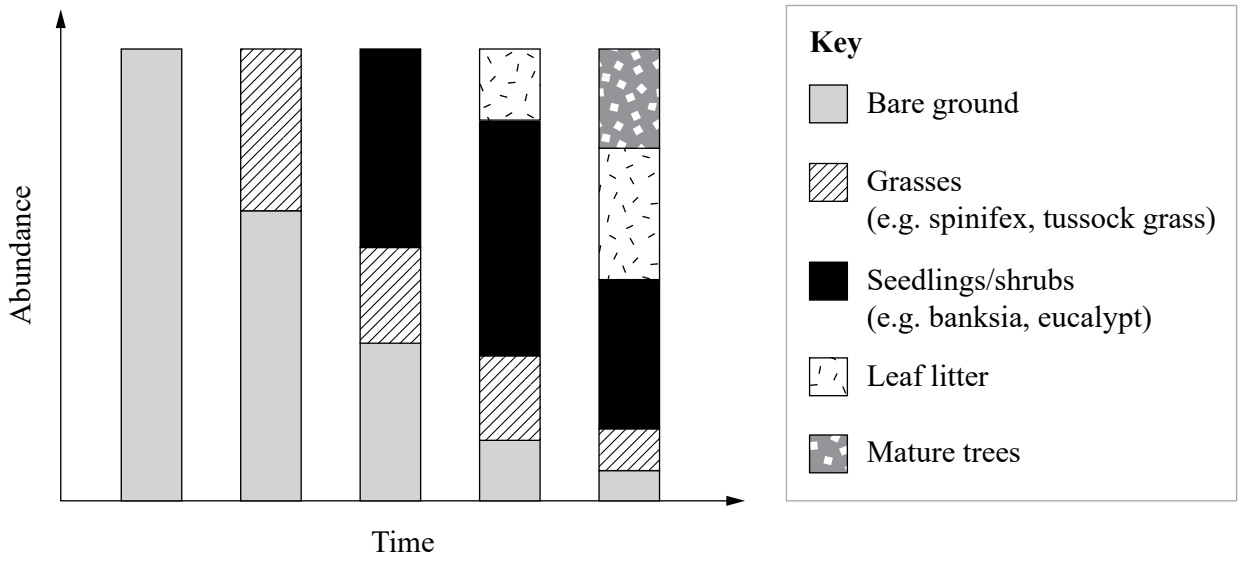
SDI = _____ (correct to two decimal places)

- b) Using your answer for Question 12a), compare the diversity of the two areas. [3 marks]

Do not write outside this box.

QUESTION 13 (3 marks)

The data shows changes in relative abundance of ground cover, biomass and species diversity for an abandoned sand mine site over time.



Do not write outside this box.

Based on the information provided, predict whether further ecological succession would occur in this community. Justify your answer with two relevant reasons.

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ADDITIONAL PAGE FOR STUDENT RESPONSES

Write the question number you are responding to.

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ADDITIONAL PAGE FOR STUDENT RESPONSES

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References

Question 11

Adapted from Clark, M, Choi, J & Douglas, M 2018, *Figure 38.17* in '38.2: Bone', *Biology 2e*, OpenStax, Rice University, p. 1094. Access for free at <https://openstax.org/books/biology-2e/pages/1-introduction>
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