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91605



Draw a cross through the box (X) if you have NOT written in this booklet

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Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 3 Biology 2023

91605 Demonstrate understanding of evolutionary processes leading to speciation

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of evolutionary processes leading to speciation.	Demonstrate in-depth understanding of evolutionary processes leading to speciation.	Demonstrate comprehensive understanding of evolutionary processes leading to speciation.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (DO NOT WRITE). This area will be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

Genetic drift theory suggests that a small population is likely to have accumulated harmful mutations. Analyses on the impact of the long-term, small population size shows that the present-day island kākāpō have a smaller number of harmful mutations when compared to mainland kākāpō. This is possibly due to natural selection, where harmful mutations are selected out.



In your answer, include discussion of:

- the terms mutation and gene pool, including definitions
- how the founder effect enables genetic drift to be more apparent in the kākāpō species
- how genetic drift and natural selection may have implications for the survival of the species.

There is more space for
your answer to this question
on the following page.

Some are shrubs, some are subshrubs (woody and short), some are trees growing up to 7.5 m tall, and others are more mat-like.



Coprosma acerosa

In your answer, include discussion of:

- There is more space for your answer to this question on the following pages.

Biology 91605, 2023

QUESTION THREE: PERIPATUS/NGĀOKEOKE – THE VELVET WORM

Although there are up to 200 species of velvet worms worldwide, in New Zealand, there are approximately 30 species. Of those 30 species, only 9 have been clearly identified and studied. It is expected that, with more DNA research, new species will be described.

Peripatus (ngāokeoke) are classified in two genera. *Peripatoides* is ovoviviparous, meaning females have live young from eggs which hatch internally. *Ooperipatellus* is oviparous, meaning females lay eggs which then hatch later. Egg-laying peripatus are found only in New Zealand and Australia. Egg-layers tend to be found in colder, more open areas, and at high altitudes, for example, the Tasman Glacier species. Those worms that have live young tend to live in warm, more enclosed habitats and at lower altitudes.



Peripatoides indigo



Live young, hatched internally, then birthed



Adult with infant



Peripatoides novaezealandiae

Discuss aspects of the evolution of velvet worms.

In your answer, include discussion of:

- allopatric speciation and sympatric speciation, including definitions
- how geological processes might give rise to increased speciation in the New Zealand velvet worm
- why DNA analysis might lead to the discovery of new species
- how TWO named, reproductive isolating mechanisms (RIMs) could ensure the worms do not form hybrids.

There is more space for
your answer to this question
on the following page.

Extra space if required.
Write the question number(s) if applicable.

QUESTION
NUMBER

Extra space if required.
Write the question number(s) if applicable.

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NUMBER

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Acknowledgements

Material from the following sources has been adapted for use in this assessment:

Page 2

Image: <https://www.doc.govt.nz/nature/native-animals/birds/birds-a-z/kakapo/>

Page 5

Images: (*C. repens*) https://en.wikipedia.org/wiki/Coprosma_repens
(*C. ochracea*) https://en.wikipedia.org/wiki/Coprosma_ochracea
(*C. acerosa*) <https://www.tawapou.co.nz/index.php/catalogue/coprosma-acerosa-red-rock>

Page 8

Images: (*P. indigo*) <https://www.doc.govt.nz/nature/native-animals/invertebrates/peripatus-ngaokeoke>
(Live young), (Adult with newborn) <https://www.nzgeo.com/stories/velvet-underground/>
(*P. novaezealandiae*) <https://en.wikipedia.org/wiki/Peripatoides>