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91605M



916055



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

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Tohua tēnei pouaka mēnā
KĀORE koe i tuhituhi i roto i
tēnei pukapuka

Koiora, Kaupae 3, 2021

91605M Te whakaatu māramatanga ki ngā tukanga o te kunenga mai¹ e whakaputa ai i te whakamomotanga

Ngā whiwhinga: Whā

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki ngā tukanga o te kunenga mai e whakaputa ai i te whakamomotanga.	Te whakaatu māramatanga hōhonu ki ngā tukanga o te kunenga mai e whakaputa ai i te whakamomotanga.	Te whakaatu māramatanga matawhānui ki ngā tukanga o te kunenga mai e whakaputa ai i te whakamomotanga.

Tirohia mehemea e ōrite ana te Tau Ākonga a-Motu kei tō pepa whakauru ki te tau kei runga ake nei.

Me whakamātau koe i ngā tūmahi KATOĀ kei roto i tēnei pukapuka.

Ki te hiahia koe ki ētahi atu wāhi hei tuhituhi whakautu, whakamahia te wāhi wātea kei muri i te pukapuka nei.

Tirohia mēnā e tika ana te raupapatanga o ngā whārangi 2–17 kei roto i tēnei pukapuka, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

Kaua e tuhi ki roto i tētahi wāhi kauruku whakahāngai (X). Ka tapahia pea tēnei wāhi ina mākahia te pukapuka.

ME HOATU RAWA KOE I TĒNEI PUKAPUKA KI TE KAIWHAKAHAERE Ā TE MUTUNGA O TE WHAKAMĀTAUTAU.

¹ kukuwhatanga

TŪMAHI TUATAHI: TE WHIO

Nō Aotearoa taketake te whio, *Hymenolaimus malacorrhynchus*. Pērā i te maha o ngā manu taketake nō Aotearoa, kāore e tino pai te rere, ā, kāore hoki e rere i runga ake o ngā kahiwi ki ngā awa o tua. Ko ngā kai a ēnei manu ko ngā tuaiwi-kore iti noho wai, ā, he noho i ngā awa he nui ngā tāheke. Kāore e momoho ētahi atu momo rakiraki i ēnei awa.

He maha ngā āhuatanga o te whio kāore i ētahi atu; hei tauira, he waewae huirapa nui, he kaha ngā maikuku, otirā e taea ai e ngā pīpī tonu te nekeneke haere i ngā ia me ngā toka e pae ana i te awa.

Ahako te āhua nei he rerenga ira iti noa i waenga i ngā taupori paetata, ko te rerenga ira i waenga i Te Ika-a-Māui me Te Waipounamu he tino rerekē, ā, hei tā ngā tohunga pūtaiao ka tihoi pea ā tōna wā ki ngā momo e rua.



Te whio o Te Ika-a-Māui.

Te whio o te Te Waipounamu.

www.nzbirdsonline.org.nz/species/blue-duck

Aromātaihia te kukuwhatanga me te anamata ka taea mō ngā momo whio.

I tō tuhinga, me:

- whakaahua te kupu 'momo' me te 'whakamomotanga'
- whakamārama he pēhea te whakaawe a ngā terenga iranga ki te angitu o te whio
- matapaki he pēhea te whakaawe a te rerenga ira me te whiringa māori ki te whakamomotanga **anamata** o te whio.

He wāhi anō mō tō tuhinga
mō tēnei tūmahi kei ngā
whārangi o muri mai.

Lined area for writing or drawing.

TŪMAHI TUARUA: KUNENGA ŪNGUTU

Ko te tipu kuihana, he pāpaku te tipu, he rite ki te whāriki tōna tipu e kitea ana i ngā wāhi maha, pērā i ngā whaiawa, ngā maunga, me ngā taiao mātaratara puta noa i te Ao. He nui, he hōhonu ngā pakiaka, ā, e hāngai ana kia pōturi te tipu i tētahi taiao taiora-iti me te takaroa o te whakaputa uri me ngā urutaunga o te hurihanga whakaputa uri. Kei roto i ngā rōpū tipu rerekē (ngā clade) ngā tauira maha o tētahi tipu kuihana.

https://en.wikipedia.org/wiki/Azorella_macquariensis#/media/File:Azorella_macquariensis.jpg

www.nzpcn.org.nz/flora/species/donatia-novae-zelandiae/

www.southernalpsphotography.com/Plants/New-Zealand-Flora/Ground-covers/Phyllachne-colensoi/i-F47Jfm2

https://en.wikipedia.org/wiki/Pterygopappus#/media/File:Pterygopappus_lawrencei_1.jpg

Matapakitia te kukuwhatanga ūngeri o ngā tipu kuihana.

I tō tuhinga, me:

- tautuhi te kupu ‘kukuwhatanga ūngutu’
- whakamārama mai he pēhea te whakaawe a te irakētanga i tēnei tauira kukuwhatanga, ā, ka pēhea e ārai ai ētahi āhuatanga whakapūreirei e RUA i mua i te hanga pūtau hou, kua whakaingoatia, i te hanga momorua
- matapaki he aha e maha ai ngā wāhi o Papatūanuku e momoho ana ngā momo tipu kuihana.

*He wāhi anō mō tō tuhinga
mō tēnei tūmahi kei ngā
whārangi o muri mai.*

QUESTION TWO: CONVERGENCE

A cushion plant is a compact, low-growing, mat-forming plant that is found in many areas, such as river beds, mountainous regions, and arctic environments around the world. They have large and deep roots, and are adapted to slow growth in a nutrient-poor environment with delayed reproductivity and reproductive cycle adaptations. Many different plant groups (clades) include examples of a cushion plant.

https://en.wikipedia.org/wiki/Azorella_macquariensis#/media/File:Azorella_macquariensis.jpg

www.nzpcn.org.nz/flora/species/donatia-novae-zelandiae/

www.southernalpsphotography.com/Plants/New-Zealand-Flora/Ground-covers/Phyllachne-colensoi/i-F47Jfm2

https://en.wikipedia.org/wiki/Pterygopappus#/media/File:Pterygopappus_lawrencei_1.jpg

Discuss convergent evolution of cushion plants.

In your answer:

- define the term ‘convergent evolution’
- explain how mutation influences this pattern of evolution, and how TWO named prezygotic isolation mechanisms would prevent species hybridising
- discuss how so many areas of the Earth can have successful cushion plant species.

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

TŪMAHI TUATORU: TE TIKOAKA I AOTEAROA

He waepuku noho moana te tikoaka (*Amalda*) e tino kitea ana i ngā wai hātai (ko ngā wāhi me te āhuarangi hātai kāore nei e tino rerekē ake). Ko te kanorau ā-ao o te tikoaka ora he nui ake i te 90 momo (me ngā momo korehāhā 30–60).

Kei te tikoaka o Aotearoa ko tētahi o ngā whakaaturanga pai rawa o te pateko wetemomo kukuwhatanga; e hiahia ana tēnei mō te ariā tauritenga pūputu.

Noho ai, konihi ai te tikoaka i ngā wāhi kirikiri e pātata ana ki uta. Ko te tino kai a te tikoaka he angarua. Nā te wāhi e noho ana te tikoaka, ko ngā wai hōhonu me te parakiwai ngāwari, he nui te tūponotanga o te whakamātātokatanga. I Aotearoa neke atu i te 45 miriona tau te hītori mātātoka o te tikoaka.

Kua mātaitia e ngā tohunga pūtaiao o Te Kunenga ki Pūrehuroa te pāpātanga o te kunenga mā te whakamahi i ngā tūmomo tūtohu iranga e rua kia kite ai mēnā ka whakaaturia te ātawhanake, te tauritenga pūputu rānei hei pāpātanga/tauirā o te kukuwhatanga.



Hoahoa 1: Te tuaritanga o te momo *Amalda*.

Mātāpuna: Gemmell MR, Trewick SA, Hills SFK, Morgan-Richards M. Phylogenetic topology and timing of New Zealand olive shells are consistent with punctuated equilibrium. *J Zool Syst Evol Res*. 2019;00:1–12. <https://doi.org/10.1111/jzs.12342>



Hoahoa 2: Ngā wā ūngeri whakatau tata o ngā kāwai tikoaka nō Aotearoa.

He mea urutau mai i: Gemmell MR, Trewick SA, Hills SFK, Morgan-Richards M. Phylogenetic topology and timing of New Zealand olive shells are consistent with punctuated equilibrium. *J Zool Syst Evol Res*. 2019;00:1–12. <https://doi.org/10.1111/jzs.12342>

Matapakitia ngā taunakitanga mō tēnei rōpū momo kua kiia ināiane he tauira o te tauritenga pūputu.

I tō tuhinga, me:

- whakaahua te ātawhanake, te tauritenga pūputu hoki
- whakamārama he pēhea te whakaatu a ngā raraunga mai i te Hoahoa 2 i te tauritenga pūputu
- matapaki nā ngā pāpono whakamomotanga i whakaaturia ai tēnei pāpātanga/tauira.

*He wāhi anō mō tō tuhinga
mō tēnei tūmahi kei ngā
whārangī o muri mai.*

QUESTION THREE: OLIVE SHELLS IN NEW ZEALAND

Olive shells (*Amalda*) are marine gastropods that live mostly in temperate waters (areas with mild temperatures with little change). The global diversity of living *Amalda* is greater than 90 species (plus 30–60 extinct species).

The New Zealand *Amalda* has one of the best demonstrations of evolutionary morphological stasis; a prerequisite for punctuated equilibrium theory.

Amalda generally live in sandy near-shore environments, where they are predators. They feed mostly on bivalves. The environment they live in, being deep water with soft sediment, means there is a high probability of fossilisation. In New Zealand, *Amalda* has a fossil record dating back 45 million years. Scientists from Massey University have examined the rate of evolution using two types of genetic marker to see if they showed gradualism or punctuated equilibrium as a rate/pattern of evolution.



Figure 1: Distribution of *Amalda*.

Source: Gemmell MR, Trewick SA, Hills SFK, Morgan-Richards M. Phylogenetic topology and timing of New Zealand olive shells are consistent with punctuated equilibrium. *J Zool Syst Evol Res.* 2019;00:1–12. <https://doi.org/10.1111/jzs.12342>



Figure 2: Estimated divergence times of New Zealand *Amalda* lineages.

Adapted from: Gemmell MR, Trewick SA, Hills SFK, Morgan-Richards M. Phylogenetic topology and timing of New Zealand olive shells are consistent with punctuated equilibrium. *J Zool Syst Evol Res*. 2019;00:1–12. <https://doi.org/10.1111/jzs.12342>

Discuss evidence for this group of species now being considered an example of punctuated equilibrium.

In your answer:

- describe both gradualism and punctuated equilibrium
- explain how data from Figure 2 above shows punctuated equilibrium
- discuss how speciation events led to this rate/pattern being shown.

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

**He whārangi anō ki te hiahiatia.
Tuhia te (ngā) tau tūmahi mēnā e tika ana.**

TAU TŪMAHI

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

QUESTION
NUMBER

English translation of the wording on the front cover

Level 3 Biology 2021

91605M Demonstrate understanding of evolutionary processes leading to speciation

Credits: Four

91605M

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 2–17 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (▨). This area may be cut off when the booklet is marked.

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