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91605M



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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Koiora, Kaupae 3, 2019

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

2.00 i te ahiahi Rātū 12 Whiringa-ā-rangi 2019
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 mēnā e rite ana te Tau Ākongā ā-Motu (NSN) kei runga i tō puka whakauru ki te tau kei runga i tēnei whārangi.

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

Mēnā ka hiahia whārangi atu anō koe mō ō tuinga, whakamahia ngā whārangi wātea kei muri o tēnei pukapuka, ka āta tohu ai i te tau tūmahi.

Tirohia mēnā e tika ana te raupapatanga o ngā whārangi 2–21 kei roto i tēnei pukapuka, ā, kāore tētahi o aua whārangi i te takoto kau.

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

TAPEKE

¹ kukuwhatanga

TŪMAHI TUATAHI

E tino mōhiohia ana te tātarakihi i Aotearoa nā te kaha, nā te tīkā hoki o te tangi. E 42 ngā momo me ngā momo iti mai i ngā puninga e rima kua āta whakaahuahia. Nō Aotearoa taketake ake ēnei.

Ko ngā momo whanaunga tata rawa kei Ahitereiria, te Moutere Nōpoke me Niu Karetōnia. E ai ki ngā rangahau i tae mai ngā tātarakihi o Aotearoa ki konei mai i ngā takahanga whakapūwhenua maha whakawhiti i Te Tai-o-Rehua mai i Ahitereiria me Niu Karetōnia. I tae mai ki konei i roto ngā tau 11 miriona nei, nō muri noa mai i te wehenga o Aotearoa mai i Ahitereiria.

I te taumata o te raumati, he hoihoi ake nei te tangi a ngā tātarakihi. Ko ngā toa anake ka tangi, i te nuinga o te wā kei te whakaipo.

He tino rerekē te tangi a ngā tātarakihi i waenga i ngā momo, mai i te tīoro ki te kitā iti noa a ētahi. Nā te tino rerekē o ēnei i ētahi wā ka mōhiohia te momo mā te whakarongo noa ki tana tangi. He koi te papaki, te ngetengete rānei a ētahi tātarakihi, mahia ai tēnei mā te tere o te papaki i ngā parirau ki te peka e nōhia ana.


He āhua ōrite ngā momo e rua, *Kikihia laneorum* me te *K. subalpina*, ā, e mōhiohia ana anake ēnei mā te tino rerekē o te tangi.



Kikihia laneorum

Kikihia subalpina

Kikihia angusta



Maoricicada alticola

Maoricicada oromelaena

Notopsalta sericea

Whakaahua 1: Ētahi momo tātarakihi e kitea ana i Aotearoa

He mea urutau mai i: www.landcareresearch.co.nz/science/plants-animals-fungi/animals/invertebrates/systematics/hemiptera/auchenorrhyncha/cicadas

QUESTION ONE

The loud and often shrill singing of cicadas makes them one of New Zealand's most familiar insects. There are 42 species and subspecies in five genera that have been formally described. All are unique to New Zealand.

The most closely related species are found in Australia, Norfolk Island and New Caledonia. Studies show that the New Zealand cicadas came about from several colonisation events across the Tasman Sea from Australia and New Caledonia. They arrived within the last 11 million years, well after New Zealand became isolated from Australia.

During the peak of summer, the massed chorus of cicadas can be deafening. Only the males sing, mainly to court females.

Cicada songs vary widely between species, ranging from harsh screeches to others having only faint chirps. These are sometimes so distinctive that individual species may be identified by song alone. Some New Zealand cicadas also make a sharp clapping or clicking sound by rapidly tapping their wings against the branch on which they are resting.

Two species, *Kikihia laneorum* and *K. subalpina*, are similar and only identifiable by their very different songs.

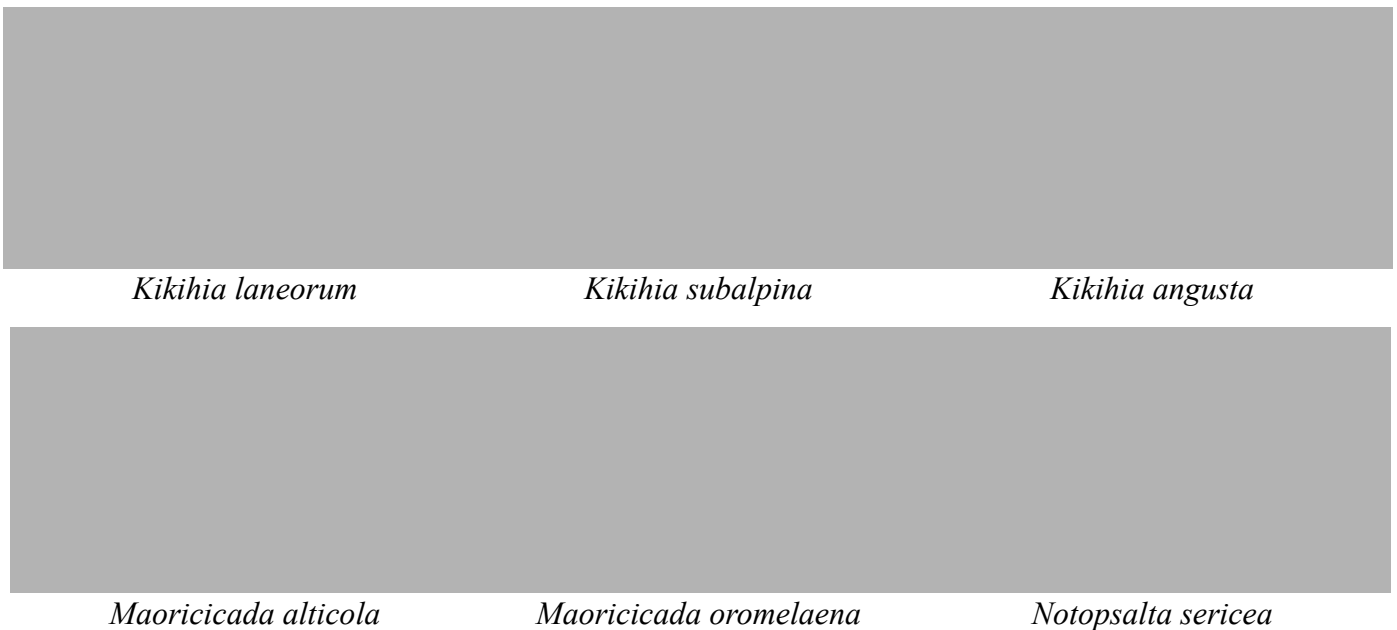
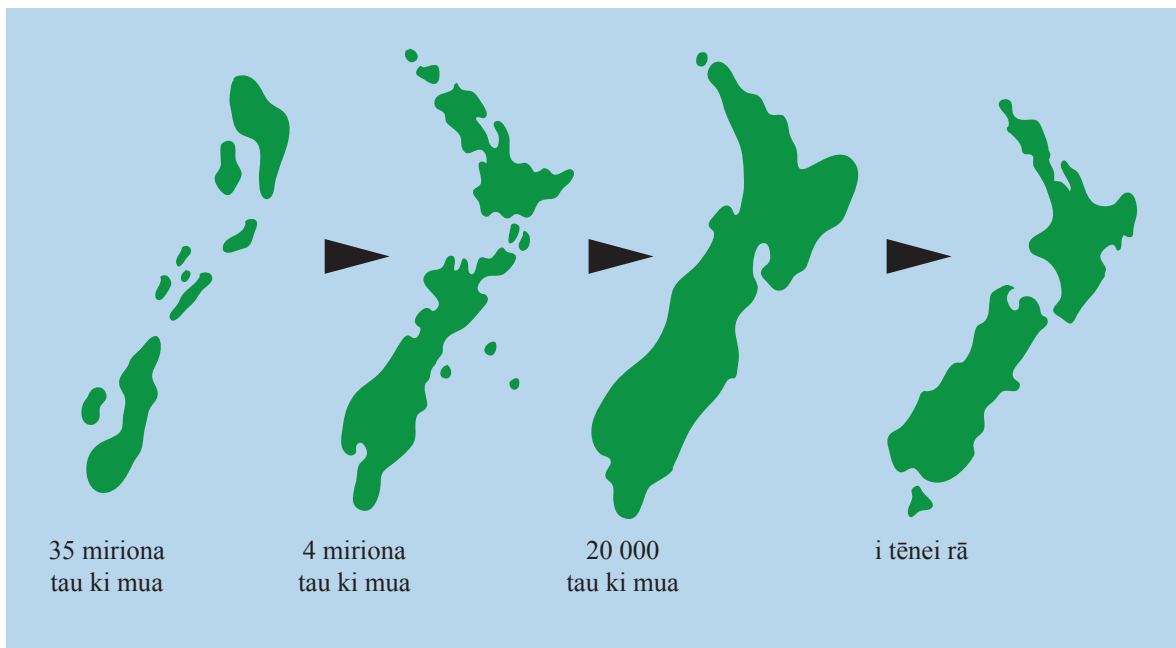


Fig. 1: Some cicada species found in New Zealand

Adapted from: www.landcareresearch.co.nz/science/plants-animals-fungi/animals/invertebrates/systematics/hemiptera/auchenorrhyncha/cicadas



Whakaahua 2: Mahere whenua nō te takutai o Aotearoa i roto i ngā tau 35 miriona kua hipa

Matapakitia te whakamomotanga o ngā momo tātarakihi i Aotearoa.

I tō tuhinga, me:

- whakaahua i te whakamomotanga me ngā āhuatanga e hiahiatia ana kia pā mai ai tēnei
- whakamārama mai i pēhea pea te puta o ngā momo tātarakihi rerekē i te whakamomotanga nohomawehe me te whakamomotanga nohotata
- mā te whakamahi i ngā mōhiohio kua tukuna, matapakitia te kunenga tihoi ka whakataurite atu ki te tūhekenga urutau i puta ai pea ngā momo tātarakihi o ēnei rā.

He wāhi anō mō tō tuhinga mō tēnei tūmahi kei te whārangi 6.

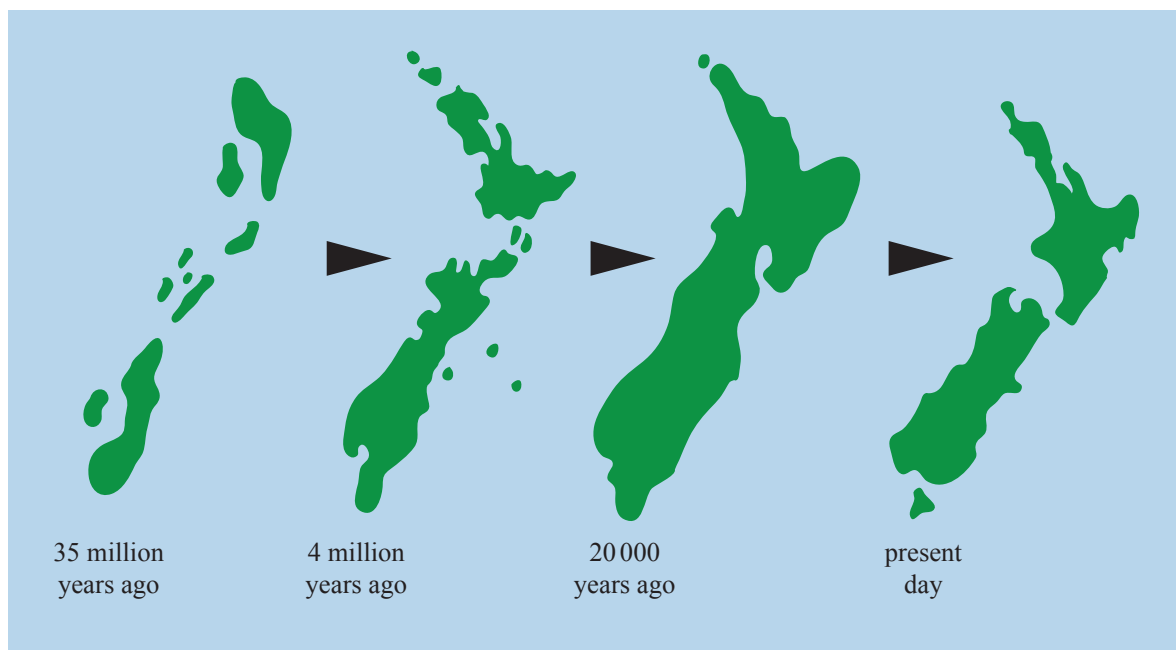


Fig. 2: Map of New Zealand's coastline over the last 35 million years

Discuss the speciation of the cicada species in New Zealand.

In your answer:

- describe speciation and the conditions that are required for it to occur
- explain how allopatric speciation and sympatric speciation could have led to the formation of different cicada species
- using the information provided, discuss divergent evolution and compare it to adaptive radiation that could have led to the formation of the present-day cicada species.

There is more space for your answer to this question on page 7.

TŪMAHI TUARUA

Ko te tūi (*P. n. novaeseelandiae*) tētahi o ngā kairuingahae matua o te harakeke (*Phormium spp.*), o te kōwhai (*Sophora spp.*) me te ngutu kākā (*Clianthus spp.*). Kāore he pānga o ēnei momo tipu. He ōrite ngā pua o ngā momo tipu nei ki te āhua o te ngutu o te tūi. He waihonga kei ngā pua mā te tūi, ā, ina tae atu ki te waihonga ka tau te hae ki tōna ūpoko ka whakawhitia ki ētahi atu tipu ōrite ina torotoro haere ana i ngā pua ki te rapu waihonga.

Whakaahua 1: Te āhua o te ngutu o te tūi

<http://nzbirdsonline.org.nz/species/tui>

Whakaahua 2: He tūi me te wharariki (*P. cookianum*)

www.terrain.net.nz/friends-of-te-henui-group/plants-native-botanical-names-m-to-q/flax-mountain-phormium-cookianum.html

Whakaahua 3: He tūi me te harakeke (*P. tenax*)

https://commons.wikimedia.org/wiki/File:Tui_Eating_Phormium_Tenax.JPG

Whakaahua 4: He tūi me ngā pua kōwhai

www.krystaldew.co.nz/tui-in-the-kowhai-7/

Whakaahua 5: He tūi me ngā pua o te ngutukākā

www.myfathersworld.net.nz/galleries/NZ_birds/slides/Tui_on_KakaBeak_120809_14e3.html

E rua ngā momo harakeke o Aotearoa. He mārō ngā rau, ā, he whero ngā pua o te *Phormium tenax*, e mōhiotia ana ko te harakeke. He ngāwari ake ngā rau, ā, he kōwhai ngā pua o te *Phormium cookianum*, e mōhiotia ana ko te wharariki. He pānga o ēnei momo harakeke e rua nei.

Whakatauritea te kunenga o te tae me te hanga o ngā pua o te harakeke, te kōwhai me te ngutukākā, me te hanga o te ngutu o te tūi.

I tō tuhinga, me:

- whakaahua i te kunenga ngātahi me te kunenga ūngutu, me ngā hanganga ōrite me ngā hanganga pūira huirua
- whakamārama i pēhea te kunenga mai o aua pua katoa kia ōrite ngā hanga me ngā tae purata
- whakataurite i ngā tukanga o te kunenga ūngutu me te kunenga ngātahi ki te hanga o te ngutu o te tūi me ngā pua o te harakeke, o te kōwhai me te ngutukākā.

QUESTION TWO

The tūi (*P. n. novaeseelandiae*) is one of the main pollinators of flax (*Phormium spp.*), kōwhai (*Sophora spp.*), and kākābeak/ngutu kākā (*Clianthus spp.*). These plant species are unrelated. Note that the flowers of the three unrelated plant species mentioned are similar in shape to the tūi's beak. The flowers provide nectar for the tūi and when it reaches the nectary, it gets pollen on its head and transfers it on to other plants of the same species when visiting their flowers in search of nectar.



Fig. 1: Tūi beak shape

<http://nzbirdsonline.org.nz/species/tui>

Fig. 2: Tūi and flax (*P. cookianum*)

www.terrain.net.nz/friends-of-te-henui-group/plants-native-botanical-names-m-to-q/flax-mountain-phormium-cookianum.html

Fig. 3: Tūi and flax (*P. tenax*)

https://commons.wikimedia.org/wiki/File:Tui_Eating_Phormium_Tenax.JPG



Fig. 4: Tūi and kōwhai flowers

www.krystaldew.co.nz/tui-in-the-kowhai-7/

Fig. 5: Tūi and kākābeak flowers

www.myfathersworld.net.nz/galleries/NZ_birds/slides/Tui_on_KakaBeak_120809_14e3.html

There are two species of New Zealand flax. *Phormium tenax*, also known as harakeke or swamp flax, has stiff leaves and red flowers. *Phormium cookianum*, also known as wharariki or mountain flax, has softer leaves and yellow flowers. These two species of flax are related.

Compare and contrast the evolution of the colour and shape of the flowers of the flax, kowhai and kākābeak and the shape of the tūi's beak.

In your answer:

- describe co-evolution and convergent evolution as well as analogous and homologous structures
- explain how all the flowers have evolved similar shapes and bright colours
- compare and contrast the processes of convergent and co-evolution on the tūi beak shape and the flowers of flax, kōwhai, and kākābeak plants.

Lined writing area for text entry.

TŪMAHI TUATORU

Ko te *Woodworthia maculata* te moko tāpiri e kitea noatia ana i Aotearoa. I whakahaerehia he rangahau, ā, ka kitea he iti iho i te 15 km te wehenga o te noho a ngā taupori pakeke nui mai i ngā taupori pakeke iti o te moko tāpiri i te takutai o te tonga o Te Ika-a-Māui. E rima ngā wāhi kohikohi i wehea i roto i te 15 km o ngā nōhanga takutai. Ko te ururua takutai matua ki Turakirae (wāhi 1) he pōhuehue, *Muehlenbeckia complexa*, ā, he nōhanga pai tēnei mō te moko tāpiri, ka āta rerekē haere i te takutai, atu ki Ocean Beach (wāhi 5), mātotoru ana te tipu o te kākūka, *Kunzea ericoides*, me te tutu, *Coriaria arborea*, i konei. I inea te roa ihu-tero o te moko tāpiri, ā, ka whakatauritea ki ērā i te takiwā o te 15 km.

Whakaahua 1: Ngā wāhi tīpakonga o te moko tāpiri. Tata ki te 4 km te wehenga o ngā wāhi ki tētahi rārangi ki te takutai.

Whakaahua 2: Ko te taurangatanga o te rahinga tinana (ngā tohuāhua roa ihu-tero) i waenga i ngā tīpakonga o ngā moko tāpiri pakeke i kohia mai i ngā wāhi e rima o te takutai i te tonga o Te Ika-a-Māui. E whakaaturia ana te tau toharite, ine mahora (SE), me te awhe.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3298942/>

Whakaahua 3: Te roa ihu-tero, i inea mai i te pito o te waha ki te tīmatanga o te whiore.

lis-upmc.snv.jussieu.fr/xper2/basesHtml/varanus/web/descriptors/SVL_snout_vent_length.htm

Matapakihia ka pēhea te pānga o te whiringa māori me te nuku iranga ki te whakamomotanga o te moko tāpiri, mā te whakamahi i ngā mōhiohio me ngā raraunga kua tukuna mai.

I tō tuhinga, me:

- whakaahua i ngā ia i te roa ihu-tero o te moko tāpiri me te ururua o ngā wāhi tīpako
- whakamārama ka pēhea te whai wāhi mai o te tīpakonga ahunga me te whakapūmau me te nuku iranga ki te whakamomotanga o te moko tāpiri
- tātari i ngā āhuatanga taratahi i mua, i muri hoki o te whakaputa i te pūtau hua e pā mai ai pea ki te whakamomotanga o te moko tāpiri.

QUESTION THREE

Woodworthia maculata is the common New Zealand gecko. A study was conducted and found that less than 15 km separates populations of small and large adult common geckos found on the south coast of the North Island of New Zealand. Five collecting sites were spaced along 15 km of coastal habitat. The main coastal vegetation at Turakirae (site 1) is *Muehlenbeckia complexa* (pohuehue), which provides ideal gecko habitat, which changes gradually along the coast, until at Ocean Beach (site 5), the small trees kanuka, *Kunzea ericoides*, and tutu, *Coriaria arborea*, dominate. The snout-vent length of the common gecko was measured and compared along the 15 km area.

Fig. 1: Sampling sites of the common gecko. Sites are approximately 4 km apart on a coastal transect.

Fig. 2: Body size variation (snout–vent length phenotypes) among samples of adult common geckos collected from five sites on the south coast of the North Island. Mean, SE, and range shown.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3298942/>



Fig. 3: Snout–vent length, measured from the tip of the mouth to the beginning of the tail.

lis-upmc.snv.jussieu.fr/xper2/basesHtml/varanus/web/descriptors/SVL_snout_vent_length.htm

Discuss how natural selection and genetic drift could cause speciation in the common gecko using the information and data provided.

In your answer:

- describe the trends in snout–vent length of the common gecko and the vegetation of the sample sites
- explain how directional and stabilising selection and genetic drift could play a role in speciation of the common gecko
- analyse the prezygotic and postzygotic isolating mechanisms that could lead to speciation in the common gecko.

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

TAU TŪMAHI

MĀ TE
KAIMĀKA
ANAKE

Lined writing area for student response.

English translation of the wording on the front cover

Level 3 Biology, 2019

91605 Demonstrate understanding of evolutionary processes leading to speciation

2.00 p.m. Tuesday 12 November 2019
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.

91605M

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 and clearly number the question.

Check that this booklet has pages 2–21 in the correct order and that none of these pages is blank.

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