See back cover for an English translation of this cover

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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 tuhi kōrero ki tēnei pukapuka

Mātai Koiora, Kaupae 3, 2022

91605M Te whakaatu māramatanga ki ngā tukanga o te kunenga mai[1] e puta ai te whakamomotanga

Ngā whiwhinga: E whā

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki ngā tukanga o te kunenga mai e puta ai te whakamomotanga.	Te whakaatu māramatanga hōhonu ki ngā tukanga o te kunenga mai e puta ai te whakamomotanga.	Te whakaatu māramatanga tōtōpū ki ngā tukanga o te kunenga mai e puta ai te whakamomotanga.

Tirohia kia kitea ai e rite ana te Tau Ākonga ā-Motu (NSN) kei runga i tō puka whakauru ki te tau kei runga i tēnei whārangi.

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

Ki te hiahia wāhi atu anō koe mō ō tuhinga, whakamahia ngā whārangi wātea kei muri o tēnei pukapuka.

Tirohia kia kitea ai e tika ana te raupapatanga o ngā whārangi 2 – 19 kei roto i tēnei pukapuka, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

Kaua e tuhi ki ngā wāhi e kitea ai te kauruku whakahāngai ( ). Ka poroa pea taua wāhanga ka mākahia ana te pukapuka.

HOATU TĒNEI PUKAPUKA KI TE KAIWHAKAHAERE Ā TE MUTUNGA O TE WHAKAMĀTAUTAU.

[1] te kunenga = te kukuwhatanga

TŪMAHI TUATAHI: TE PAIHANA

Kōpūwaitōtara
Te mātāpuna: www.scienceabc.com/nature/animals/what-are-pufferfish-and-are-they-toxic.htm

Wheke rīngi-kahurangi
Te mātāpuna: www.nhm.ac.uk/discover/blue-ringed-octopus-small-vibrant-deadly.html

Mokomoko kiri taratara
Te mātāpuna: www.sciencenewsforstudents.org/article/toxic-germs-on-its-skin-make-this-newt-deadly

Ko te paihana tino mātuatua e kitea ana i ngā mokomoko (*newts*), i te wheke rīngi-kahurangi (*blue-ringed octopus*), me te kōpūwaitōtara *(pufferfish)* ko te *tetrodotoxin* (*TTX*). Koinei tētahi o ngā tāoke kino rawa atu e mōhiotia ana. Ka pāngia te pūnaha ioio o te pārurenga, ā, i ētahi wā ko te korenga o ngā uaua i mahi te hua, ā, ko te hemonga te otinga atu. Ka whakamahia e ngā kararehe hei parahau patu konihi.

Kua ara ake i roto i te huhua o ngā momo nākahi kai *newt* tētahi urutaunga ātete inati ki tēnei matū.

Ko ngā nākahi e noho ana ki ngā wāhi kei reira ngā pārurenga e mahi TTX ana, he pūmua tō rātou e rerekē ana tētahi waikawa amino e mau mai ana ki roto, ā, mā reira e āraia atu ai te pānga o te tāoke ki ngā ioio me te pūtautau uaua. E āhei ana ētahi nākahi, pērā i te nākahi kāta (*Thamnophis sirtalis*), ki te kai i ngā mokomoko tino tāoke nā te mea kua whakawhanake parenga rātou ki te TTX. Nā ngā panonitanga ki ētahi ira tuhiwaehere pūmua i pēnei ai.

I rangahaua e ngā kairangahau te angitu o te kai a ngā nākahi i ngā mokomoko i tētahi wāhi. I hoatu e rātou tētahi tatau tutukinga ā-ōrau nei e hāngai ana ki te oranga tonutanga o te taupori nākahi i roto i te wāhi whakamātau, e whakaaturia ana ki te kauwhata i raro nei. Ko te tikanga o te tatau 85%, ko te 85% o ngā nākahi i roto i te wāhi rā i ora, i whakaputa uri.

Te mātāpuna: www.newscientist.com/article/dn13438-toxic-newts-lose-war-against-super-immune-snakes/

Te mātāpuna: https://evolution4e.sinauer.com/exercise1301.html

Matapakina te āhua o te whakaaturia o te kunenga tahitanga me te kunenga ūngutu i tēnei tauira o ngā kararehe ira whakaputa TTX me ērā e whai parenga ana ki te TTX.

I tō tuhinga:

- me tautuhi te kupu 'kunenga tahitanga', te 'kunenga ūngutu', me te 'irakētanga'
- me whakamārama te āhua o tā te wheke, o tā te kōpūwaitōtara, me tā te mokomoko - ēnei momo katoa e whai TTX ana - otirā, o tā rātou whakatauira i te kunenga ūngutu
- mā te whakamahi i te raraunga mai i te kauwhata, matapakina te āhua o te pikinga o te putanga TTX i ngā mokomoko i te kunenga tahitanga; me aromātai hoki ngā pāpātanga o tēnei mō te oranga tonutanga me te angitutanga o te mokomoko.

QUESTION ONE: POISON

Pufferfish
Source: www.scienceabc.com/nature/animals/what-are-pufferfish-and-are-they-toxic.htm

Blue-ringed octopus
Source: www.nhm.ac.uk/discover/blue-ringed-octopus-small-vibrant-deadly.html

Rough-skinned newt
Source: www.sciencenewsforstudents.org/article/toxic-germs-on-its-skin-make-this-newt-deadly

The most important poison found in newts, the blue ringed octopus, and pufferfish is tetrodotoxin (TTX). It is one of the most dangerous toxins known. It acts on the nervous system of prey, and can result in muscles not being able to work, leading to death. It is used by the animals as an antipredator defence.

An adaptation of extreme resistance to this chemical has come about in several species of snakes that eat newts.

Snakes living in areas where there are prey who make TTX, have a protein expressed with a different amino acid which prevents nerve and muscle tissue being affected. Some snakes, such as the garter snake (*Thamnophis sirtalis*), are able to eat highly toxic newts because they have developed resistance to TTX, due to changes in a number of protein coding genes.

Researchers studied the success of snakes in eating newts in an area. They gave a percentage performance score based on the survival of the snake population in the survey area, as shown in the graph below. A score of 85% meant that 85% of the snakes in the area survived and reproduced.

Source: www.newscientist.com/article/dn13438-toxic-newts-lose-war-against-super-immune-snakes/

Source: https://evolution4e.sinauer.com/exercise1301.html

Discuss how both coevolution and convergent evolution are demonstrated in this example of animals with TTX- producing genes and those with resistance to TTX.

In your answer:

- define the terms coevolution, convergent evolution, and mutation
- explain how the octopus, the pufferfish and the newt each having TTX is an example of convergent evolution
- using data from the graph, discuss how coevolution has led to an increase in TTX production in newts, and evaluate the implications of this for the survival and success of the newt species.

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

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

TE TŪMAHI TUARUA: NGĀ IKA URUTIRA-TORU

Te mātāpuna: www.researchgate.net/figure/Triplefin-species-used-in-this-study-and-their-respective-distributions-Bellapiscis_fig2_351878084

Kei tōna 130 ngā momo ika urutira-toru kua tautohua puta noa i te ao e noho ana ki ngā nōhanga huhua, pērā i ngā moana e pārūrū ana, e tata-pārūrū ana, e hātai ana anō hoki, tae atu ki ērā kei te raki o Te Kōpakatanga ki te Tonga me te kūrae o Te Kōpakatanga ki te Tonga. I Aotearoa nei, e kitea ana te kanorautanga o ngā momo ika urutira-toru. He neke atu i te 20 ngā momo ika urutira-toru i Aotearoa, ko te katoa he taketake.

Matapakina te āhua o te noho a ngā ika urutira-toru o Aotearoa hei tauira mō te mahoratanga urutau.

I tō tuhinga, me:

- whakaahua te tikanga o te kupu ‘taketake’ me te ‘momo’
- whakamārama te āhua o tā te paemahana noho hei pēhanga whiringa e kitea ai ngā momo rerekē i ngā rohe rerekē o te tahatai, pērā i ngā momo ika urutira-toru e toru e whakaaturia ana ki te hoahoa i runga ake
- matapaki te āhua o te huanga o ngā momo ika urutira-toru huhua i konei i te tukanga o te whiringa māori.

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

QUESTION TWO: TRIPLE-FINNED FISH

Source: www.researchgate.net/figure/Triplefin-species-used-in-this-study-and-their-respective-distributions-Bellapiscis_fig2_351878084

Approximately 130 species of triplefin have been identified worldwide living in many habitats, such as in tropical, subtropical, temperate, subantarctic, and the Antarctic Peninsula polar sea regions. In New Zealand, we see a large diversity of triplefin species. New Zealand has over 20 species of triplefin, all of which are endemic.

Discuss how the New Zealand triplefins are an example of adaptive radiation.

In your answer:

- describe what is meant by the terms endemic and species
- explain how temperature may act as a selection pressure, and leads to different species being found at different zones of the beach, such as the three species of triplefin that are shown in the diagram above
- discuss how the process of natural selection has resulted in such a large number species of triplefin here.

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

TE TŪMAHI TUATORU: TE PŪIRA HUIRAU ME TE WHAKAMOMOTANGA

I te taenga mai o te Māori ki Aotearoa mai i Poronīhia pārūrū i te takiwā o te AD 1250, i haria mai e rātou te huhua o ngā huanga kai rākau me ngā huaone. E whakapaea ana he pūira huirau kei te takenga mai o ēnei momo e toru - te kūmara, te tī pore (te tī o Te Moana-nui-a-Kiwa, ka kitea anake i te moutere o Raoul ināianei, kei tōna 1000km mai i Aotearoa), me te uwhi. He rite tonu te kitea o ngā momo pūira huirau e nui ake ana i ngā momo i hua mai ai rātou, ā, ka noho tūhāhā rātou mō te whakaputa uri.

Kūmara
Te mātāpuna: www.nature.com/articles/nature.2013.12257

Tī pore
Te mātāpuna: www.nzpcn.org.nz/flora/species/cordyline-fruticosa/?web=1&wdLOR=c5453C15F-CE62-0243-961A-E58D334D15C8

Uwhi
Te mātāpuna: https://teara.govt.nz/en/photograph/17506/uwhi

Matapakina ngā tukanga e hua mai ai ngā momo hou.

E pai ana tō whakamahi i tētahi hoahoa hei tautoko i tō whakautu.

I tō tuhinga, me:

- tautuhi te kupu ‘pūira huirau’ (polyploid) me te ‘noho tūhāhā mō te whakaputa uri’ (reproductive isolation)
- whakamārama te āhua o te waihangahia mai o ngā momo pūira huirau
- matapaki te noho mai o te tukanga nei, te pūira huirau, hei tauira mō te whakamomotanga nohotahi; me whakamārama hoki te āhua o te whai wāhi mai pea a **ētahi atu** tikanga noho tūhāhā mō te whakaputa uri (ngā RIM) e rua ki te whakamomotanga o te kūmara, o te tī pore, me te uwhi.

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

QUESTION THREE: POLYPLOIDY AND SPECIATION

When Māori arrived in New Zealand from tropical Polynesia around AD 1250, they brought with them a number of tree and root crops. Polyploidy is inferred in the origins of three of these species – kūmara (sweet potato), tī pore (the Pacific cabbage tree, now only found on Raoul Island, approximately 1000 km from New Zealand), and uwhi (yams). Polyploids are often larger than the species they are formed from, and are reproductively isolated from them.

Kūmara
Source: www.nature.com/articles/nature.2013.12257

Tī pore
Source: www.nzpcn.org.nz/flora/species/cordyline-fruticosa/?web=1&wdLOR=c5453C15F-CE62-0243-961A-E58D334D15C8

Uwhi
Source: https://teara.govt.nz/en/photograph/17506/uwhi

Discuss processes that result in new species.

You may use a diagram to support your answer.

In your answer:

- define the terms polyploid and reproductive isolation
- explain how polyploids are formed
- discuss how the process of polyploidy is an example of sympatric speciation, and explain how two **other** reproductive isolating mechanisms (RIMs) could have contributed to the speciation of the kūmara, tī pore, and uwhi.

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

He whārangi anō ki te hiahiatia.
Tuhia te tau tūmahi mēnā e hāngai ana.

TE TAU TŪMAHI

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

QUESTION NUMBER

He whārangi anō ki te hiahiatia.
Tuhia te tau tūmahi mēnā e hāngai ana.

TE 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 2022

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 – 19 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.