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91157M



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NEW ZEALAND QUALIFICATIONS AUTHORITY  
MANA TOHU MĀTAURANGA O AOTEAROA

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

SUPERVISOR'S USE ONLY

## Koiora, Kaupae 2, 2017

### 91157M Te whakaatu māramatanga ki te rerekētanga ā-ira me te huringa

2.00 i te ahiahi Rāapa 22 Whiringa-ā-rangi 2017  
Whiwhinga: Whā

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki te rerekētanga ā-ira me te huringa.	Te whakaatu māramatanga hōhonu ki te rerekētanga ā-ira me te huringa.	Te whakaatu māramatanga matawhānui ki te rerekētanga ā-ira me te huringa.

Tirohia mēnā 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.**

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

Tirohia mēnā 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.

**HOATU TE PUKAPUKA NEI KI TE KAIWHAKAHAERE HEI TE MUTUNGA O TE WHAKAMĀTAUTAU.**

TAPEKE

MĀ TE KAIMĀKA ANAKE

## TŪMAHI TUATAHI: NGĀ IRANGA KERERŪ

E whakaatu ana te taurā parihau me ngā huruhuru waewae o te kererū i te tino tāpua. He tāpua te irarā parihau tāhei (**B**) ki te irarā parihau koretāhei (**b**). He tāpua te irarā mō ngā huruhuru waewae (**F**) ki te irarā kāore he huruhuru waewae (**f**). Kāore he hono o ēnei ira e rua.



**Tāhei (B)**

**Koretāhei (b)**

<http://learn.genetics.utah.edu/content/pigeons/pattern/>



**Whai huruhuru (F)**

**Kore huruhuru (f)**

<http://unews.utah.edu/pigeon-foot-feather-genes-identified/>

- (a) I aihonotia<sup>1</sup> e tētahi kaiwhakatipu he kererū iraruarite mō te irarā tāhei me te irarā huruhuru waewae ki tētahi kererū kāore he tāhei i te parihau, ā, kāore he huruhuru i ōna waewae.

Tuhia te tohuira<sup>2</sup> o te reanga F1: \_\_\_\_\_

Tuhia te tohuāhua o te reanga F1: \_\_\_\_\_

<sup>1</sup> whakawhitia

<sup>2</sup> momoira

**QUESTION ONE: PIGEON GENETICS**ASSESSOR'S  
USE ONLY

Pigeon wing pattern and leg feathering both show complete dominance. The bar wing allele (**B**) is dominant to the barless allele (**b**). The allele for leg feathers (**F**) is dominant to the allele for not feathered (**f**). These two genes are not linked.

**Bar (B)****Barless (b)**<http://learn.genetics.utah.edu/content/pigeons/pattern/>**Feathered (F)****Not Feathered (f)**<http://unews.utah.edu/pigeon-foot-feather-genes-identified/>

- (a) A breeder crossed a pigeon homozygous for the bar allele and the leg feathers allele with a pigeon that had a barless wing pattern and no feathers on its legs.

State the genotype of the F1 generation: \_\_\_\_\_

State the phenotype of the F1 generation: \_\_\_\_\_

- (b) Whakamahia te tūtohi Punnett hei whakaatu i ngā tohuhema<sup>3</sup> o te reanga F<sub>1</sub>, me ngā tohuira katoa ka taea o te reanga F<sub>2</sub>.

Ngā tohuhema F<sub>1</sub>

Ngā tohuhema F <sub>1</sub>				

- (c) Whakaahuahia ngā ōwehenga tohuāhua ka matapachia ka puta i tēnei whakawhitinga.

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<sup>3</sup> pūtau hema

- (b) Use the Punnett square below to show the gametes of the F<sub>1</sub> generation and all of the possible genotypes of the F<sub>2</sub> generation.

		F <sub>1</sub> gametes			
F <sub>1</sub> gametes					

- (c) Describe the predicted phenotype ratios produced by this cross.

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## TŪMAHI TUARUA: TĪEKE O TE WAIPOUNAMU

Kua whakaawetia te puna ira o te tīeke o Te Waipounamu e te pānga whakaū me te pānga whakawhāiti i ngā wā rerekē i roto i te hītori. I te tuatahi e korara whānui ana te tīeke o Te Waipounamu i te whenua, ā, i whakatūhia hoki ngā taupori ki ētahi moutere i te moana, pēnei i Taukihepa, i te mea ka taea te rere atu ki reira mai i te tūwhenua. E whakataurite ana te kauwhata i raro i te rerenga kētanga ā-ira o ngā taupori tīeke o nehe i te moutere o Taukihepa me te tūwhenua o Te Waipounamu i te wā o ngā tau 1800 ki te taupori onāiane (i te tau 2005) i te Moutere o Kaimohu.

I muri i te taenga mai o ngā kainoho Māori me te Pākehā, nā wai rā ka korehāhā te tīeke o Te Waipounamu, engari anō te taupori o Taukihepa. I te tau 1964 i whakawāteahia ngā tīeke o Te Waipounamu katoa mai i Taukihepa ka heria ki ngā moutere whakaruruhau kore-kīrearea pērā i te Moutere o Kaimohu. Nā te kore kiore me ētahi atu kaikonihī, kei te piki te taupori o te tīeke o Te Waipounamu i te Moutere o Kaimohu, ā, kei te whakamahia anō ki te whakatū i ētahi atu taupori i Te Waipounamu.

Matapaki he pēhea te whakaawe a ngā pānga whakaūnga me te whakawhāiti ki te puna ira onāiane o te tīeke o Te Waipounamu i Kaimohu.

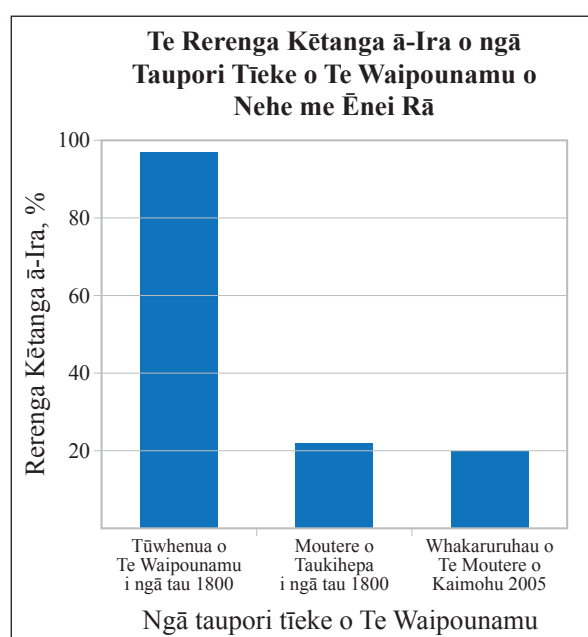
Me kōrero mō te mōhiohio i runga ake, me te kauwhata, hei tautoko i tō matapakitanga.

Me whakauru ki tō matapakitanga:

- he whakaahuatanga o tētahi puna ira
- he whakamāramatanga o te pānga whakawhāiti ME TE pānga whakaūnga
- he matapakitanga he aha i iti ai te rerenga kētanga ā-ira o te taupori o te Moutere o Taukihepa i te wā o ngā tau 1800 tēnā i te taupori o te tīeke o Te Waipounamu o taua wā anō
- he matapakitanga he aha i iti ai te rerenga kētanga ā-ira o te taupori o te Moutere o Kaimohu.



<http://nzbirdsonline.org.nz/species/south-island-saddleback>



He mea urutau nō: Jameson, Ian G., 2009, 'Loss of genetic diversity and inbreeding in New Zealand threatened bird species'. *Science for Conservation* 293, wh. 20. Te Papa Atawhai, Te Whanganui-a-Tara

## QUESTION TWO: SOUTH ISLAND SADDLEBACK

ASSESSOR'S  
USE ONLY

The South Island saddleback's gene pool has been affected by both the founder effect and the bottleneck effect at different points in history. The South Island saddleback was originally widespread over the mainland and also had established populations on some of the offshore islands, such as Big South Cape Island, because they were within flying distance from the mainland. The graph below compares the genetic diversity of historic saddleback populations on the offshore island of Big South Cape Island and the South Island mainland in the 1800s with the current population (in 2005) on Kaimohu Island.

After Māori and European settlers arrived, the South Island saddleback eventually became extinct, with the exception of the population on Big South Cape Island. In 1964 all South Island saddlebacks were removed from Big South Cape Island and taken to pest-free island sanctuaries such as Kaimohu Island. Safe from rats and other predators, the South Island saddleback population on Kaimohu Island is increasing, and is being used to establish other populations around the South Island.

Discuss how the founder and bottleneck effects have influenced the current South Island saddleback gene pool on Kaimohu Island.

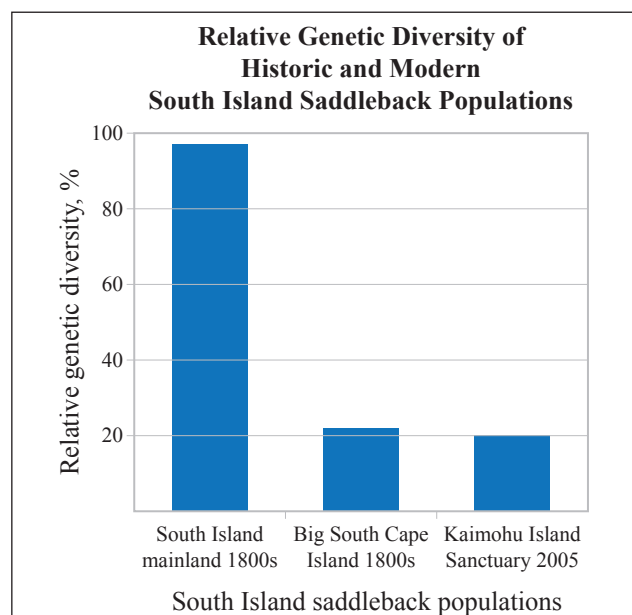
Refer to the information above, and the graph, to support your discussion.

Your discussion should include:

- a description of a gene pool
- an explanation of the bottleneck effect AND the founder effect
- a discussion of why the 1800s Big South Cape Island population had low genetic diversity compared to the 1800s South Island population
- a discussion of why the Kaimohu Island population has low genetic diversity.



<http://nzbirdsonline.org.nz/species/south-island-saddleback>



Adapted from: Jameson, Ian G., 2009, 'Loss of genetic diversity and inbreeding in New Zealand threatened bird species'.

*Science for Conservation* 293, p. 20. Department of Conservation, Wellington.





## TŪMAHI TUATORU: TE WHIRINGA MĀORI ME TE HEKENGĀ

He pūmua whākōkī te whākōkī ngako ka whakaputaina e ngā pēpi e taea e rātou te nakunaku me te whiwhi hua mai i te waiū. Ka ngaro te kaha ki te whakaputa whākōkī ngako i te nuinga o ngā kōhungahunga i muri i te mutunga o te ngote i te waiū o tō rātau whaea, i tō rātou taenga pea ki te toru tau te pakeke. Ko ngā pakeke me ngā tamariki kāore e taea te whākōkī ngako te whakaputa, ka tino kaha te mamae o tō rātou puku ki te inu miraka. E kīia ana tēnei ko te kore rata ki te reihuka.

I waenga i te 7 000 me te 9 000 tau ki mua, e rua ngā irakētanga rerekē i ara motuhaketia i ngā taupori i te raki o Uropi me Awherika i taea ai e ēnei taupori te whakaputa i te whākōkī ngako tae atu ki te pakeketanga (te pāuaua reihuka - tirohia ngā wāhi A me B i te mahere). I kai kau me te miraka ngā taupori A me B. I roto i te wā, ka mauroa ngā irakētanga i roto i ēnei taupori o Uropi me Awherika.

E whakaatu ana tēnei mahere i te ōrau o ngā tāngata i roto i te taupori ka taea te nakunaku miraka i ēnei rā.

<http://www.hhmi.org/biointeractive/making-fittest-got-lactase-co-evolution-genes-and-culture>

Matapakitia ka pēhea te mauroa o tētahi irakētanga i roto i te puna ira o tētahi taupori me te hōrapa ki ētahi atu puna ira.

Me kōrero tō matapakitanga mō ngā taupori tauwhāiti kei te mahere, me te whakauru:

- he whakaahuahanga o te whiringa māori ME TE hekenga
- he whakamāramatanga i pēhea te mauroa o ngā irakētanga i ngā taupori A me B
- he matapakitanga he aha i rerekē ai ngā ōrau irakētanga o ngā taupori B, C me D.

**QUESTION THREE: NATURAL SELECTION AND MIGRATION**ASSESSOR'S  
USE ONLY

Lactase is an enzyme produced by babies that allows them to digest and gain nutrition from milk. Most young children lose the ability to produce lactase after they stop drinking their mother's milk, at about three years old. Adults and older children who cannot produce lactase suffer severe stomach upsets if they drink milk. This is called lactose intolerance.

Between 7 000 and 9 000 years ago, two different mutations arose independently in north-European and African populations that allowed these populations to produce lactase into adulthood (lactose persistence – see areas A and B on the map). Both populations A and B used cattle and their milk as a food source. Over time, the mutations became established in each of these European and African populations.

The map below shows the percentage of humans in the population who can digest milk today.



<http://www.hhmi.org/biointeractive/making-fittest-got-lactase-co-evolution-genes-and-culture>

Discuss how a mutation would become established in a population's gene pool and spread to other gene pools.

Your discussion should refer to specific populations on the map, and include:

- a description of both natural selection AND migration
- an explanation of how the mutations became established in A and B populations
- a discussion of why populations B, C, and D would have different percentages of the mutation.

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

TAU TŪMAHI

MĀ TE  
KAIMĀKA  
ANAKE

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

QUESTION  
NUMBER

ASSESSOR'S  
USE ONLY

*English translation of the wording on the front cover*

## **Level 2 Biology, 2017**

### **91157 Demonstrate understanding of genetic variation and change**

2.00 p.m. Wednesday 22 November 2017

Credits: Four

91157M

<b>Achievement</b>	<b>Achievement with Merit</b>	<b>Achievement with Excellence</b>
Demonstrate understanding of genetic variation and change.	Demonstrate in-depth understanding of genetic variation and change.	Demonstrate comprehensive understanding of genetic variation and change.

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 space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–19 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.**