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Tuhia he (☒) ki te pouaka mēnā kāore koe i tuhi kōrero ki tēnei puka ☐

Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Te Mātai Koiora, Kaupae 2, 2023

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

Ngā whiwhinga: E whā

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

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 tētahi wāhi e kitea ai te kauruku whakahāngai (). Ka poroa taua wāhanga ka mākahia ana te pukapuka.

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

TE TŪMAHI TUATAHI: TE WHĀITI PŪIRA

Kitea ai i ngā kawatere tētahi tauira ā-ira e tāpua katoa ana. E tāpua ana te hua-irakē mō ngā huruhuru kākāriki (G) tēnā i te hua-irakē mō ngā huruhuru kikorangi (g). E tāpua ana te hua-irakē mō te parirau tāhei (B) i te hua-irakē mō te parirau wātea (b). Kāore he hononga i ngā ira mō te tae o te huruhuru me te tauira o te parirau, nā te mea kei pūira kē ērā hua-irakē.

Ka honoa tētahi kawatere iraruarite *(homozygous)* mō ngā huruhuru kākāriki me ngā parirau tāhei hoki me tētahi kawatere iraruarite mō ngā huruhuru kikorangi me ngā parirau wātea.

(a) Tuhia te tohuira o te reanga F1 ka puta i tēnei hononga.

(b) Whakamahia te tukutuku Punnett i raro nei hei whakaatu i:

- ngā pūtau hema F1 o tēnei hononga
- ngā tohuira katoa o te reanga kawatere F2 i tōna tikanga ka puta.

Ngā pūtau hema F1

Ngā pūtau hema F1

QUESTION ONE: MEIOSIS

Budgies display a complete dominance pattern. The allele for green (G) feathers is dominant over the allele for blue (g) feathers. The allele for barred (B) wing is dominant to the allele for clear (b) wing. The genes for feather colour and wing pattern are not linked, being found on different chromosomes.

A budgie homozygous for both green feathers and barred wing was crossed with a budgie homozygous for blue feathers and clear wing.

(a) State the genotype of the F1 generation this cross produces.

(b) Use the Punnett square below to show:

- the F1 gametes of this cross
- all the expected genotypes of the F2 generation of budgies.

F1 gametes

F1 gametes

(c) Whakaahuatia ngā ōwehenga tohuāhua *(phenotype)* i tōna tikanga ka puta i tēnei hononga.

(d) Nā te whāiti pūira i hua mai ai ngā pūtau hema mō te reanga F1 me te F2 kei te whārangi 2.

Matapakina ngā take i hua mai ai ngā momo pūtau hema ōrite i ngā kātua o ngā manu takitahi o te reanga F1, engari i hua mai ngā momo pūtau hema e whā e rerekē ana i ngā manu takitahi o te reanga F1.

I tō tuhinga, me kōrero mō:

- te whāiti pūira, tae atu ki tētahi whakaahuatanga
- ngā pūira ōrite
- te wehenga motuhake o ngā ira, te whakawhitinga o te pītau ira, me te wehenga o ngā hua-irakē
- te āhua o te pānga a te wehenga motuhake o ngā ira, a te wehenga o ngā hua-irakē, me te whakawhitinga o te pītau ira ki te rerekētanga ā-ira.

E pai ana tō whakamahi i tētahi hoahoa i tō tuhinga.

He wāhi anō mō tō tuhinga mō tēnei tūmahi kei ngā whārangi e whai ake nei.

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

(d) Meiosis produced the gametes for the F1 and F2 generations on page 3.

Discuss why the parents of F1 individuals produced all the same type of gametes, while the F1 individuals themselves produced four different types of gametes.

In your answer, include a discussion of:

- meiosis, including a description
- homologous chromosomes
- independent assortment, crossing over, and segregation
- how independent assortment, segregation, and crossing over affect genetic variation.

You may use a diagram in your answer.

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

TE TŪMAHI TUARUA: TE WHIRINGA MĀORI

Ka hua mai te kano o te kiri (te tae ā-manauri) i ngā hua-irakē maha (me ngā ira). Ka whakaatu ētahi o ēnei hua-irakē i te tāpua-kore.

Ka noho te manauri i ngā pūtau ki te mata o te kiri (kiriwaho), ā, ka ārai tērā i ngā pūtau i ngā hihi katikati e puta ai pea he irakē whakakino. Heoi, me miti te tinana o te tangata i tētahi rahinga o te rama katikati e puta ai te huaora D.

He hirahira te huaora D mō te mahi a ngā pūtau me te ora o ngā kōiwi. Ka kaha ake hoki te matahua i te huaora D, ā, ka nui ake te tūponotanga o te ora tonu o te wahine i te whānautanga mai o te pēpi.

Te toharite o te kano o te kiri i ngā taupori o ngā iwi taketake i ngā wā o mua

Mā te whakamahi i ngā pārongo kua hora me te mahere o runga nei, matapakina te putanga o te kano o te kiri o te tangata i te whiringa māori.

I tō tuhinga, me kōrero mō:

- ngā hua-irakē maha me te tāpua-kore, tae atu ki tētahi whakaahuatanga o tēnā, o tēnā
- te whiringa māori
- ngā take e mau tonu ai ngā irakē whai painga i tētahi taupori, engari kāore e pērā ana ngā irakē whakakino
- ngā take he parauri ake te kiri o te tangata nō ngā rohe e pātata ana ki te weheruatanga o te ao, ā, he kiritea ake te kiri o te tangata nō ngā ahopae nui ake.

QUESTION TWO: NATURAL SELECTION

Skin colour (melanin pigmentation) is produced by multiple alleles (and genes). Some of these alleles show incomplete dominance.

Melanin is located in the surface cells of the skin (epidermis) and protects cells from ultraviolet (UV) rays that can cause harmful mutations. However, the human body does need to absorb a certain amount of UV light in order to produce vitamin D.

Vitamin D is important in maintaining cellular function and bone health. Vitamin D also improves fertility and increases a woman's chance of surviving child birth.

Average skin pigmentation levels among historical indigenous populations

Using the information given and the map above, discuss how human skin colour is a result of natural selection.

In your answer, include a discussion of:

- multiple alleles and incomplete dominance, including a description of each
- natural selection
- why beneficial mutations are retained in a population and harmful mutations are not
- why people from equatorial regions tend to have darker skin colour, and people from higher latitudes tend to have lighter skin.

TE TŪMAHI TUATORU: NGĀ TAUPORI ITI

Ko te tara iti tētahi o ngā manu onge katoa i Aotearoa. Iti iho ana i te 40 ngā tara iti e toe ana, ā, e 8–10 anake ngā uwha whakaputa uri i taua kāhui. Kua heke iho te taupori ki te taumata mōrearea nā ngā kaikonihi hou, nā te whāiti haere o ngā wāhi noho, nā ngā mahi hoki a te tangata.

Matapakina ngā take ka pā ki te auau o ngā hua-irakē me te rerekētanga ā-ira o te tara iti, me ngā putanga o te iti o te taupori.

I tō tuhinga, me kōrero mō:

- te auau o te hua-irakē, mō te rerekētanga ā-ira, me te nuku ā-ira, tae atu ki tētahi whakaahuatanga o tēnā, o tēnā
- te whakawhāititanga o te mātāira *(bottleneck effect)*, tae atu ki tētahi whakaahuatanga o tērā, me te take e noho ana te tara iti hei tauira mō te whakawhāititanga o te mātāira o te taupori
- te āhua pea o te pānga a te whakawhāititanga o te mātāira ki te rerekētanga ā-ira o te taupori tara iti
- ngā pānga rerekē o te nuku ā-ira ka pā pea ki te mātāira o te taupori tara iti, tēnā i te pānga ki tētahi taupori e nui noa ake ana, me ngā uauatanga ka hua ake mō tēnei momo manu hei ngā tau e heke mai ana.

QUESTION THREE: SMALL POPULATIONS

The tara iti (fairy tern) is one of Aotearoa New Zealand’s rarest birds. There are fewer than 40 individuals remaining, including only 8–10 breeding females. The population has decreased to critical levels due to introduced predators, habitat loss, and human activity.

Discuss the factors that affect allele frequencies and genetic variation of the tara iti, and the consequences of having a small population size.

In your answer, include a discussion of:

- allele frequency, genetic variation, and genetic drift, including descriptions of each
- bottleneck effect, including a description, and why tara iti are an example of a population bottleneck
- how the bottleneck effect could affect the genetic variation of the tara iti population
- the different effects genetic drift would have on the gene pool of the tara iti population, compared to a much larger population, and future challenges this creates for the species.

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

Ngā Mihi

He mea whakahāngai ngā kōrero i ngā mātāpuna e whai ake nei hei whakamahinga i tēnei aromatawai:

Te whārangi 2
Te whakaahua: http://mybudgiesinfo.blogspot.com/p/mutation-and-varieties.html

Te whārangi 10
Te whakaahua: https://www.nature.com/articles/ng1440

Te whārangi 18
Te whakaahua: https://www.doc.govt.nz/globalassets/documents/conservation/native-animals/birds/tara-iti-new-zealand-fairy-tern.pdf

Acknowledgements

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

Page 2

Image: http://mybudgiesinfo.blogspot.com/p/mutation-and-varieties.html

Page 10

Image: https://www.nature.com/articles/ng1440

Page 18

Image: https://www.doc.govt.nz/globalassets/documents/conservation/native-animals/birds/tara-iti-new-zealand-fairy-tern.pdf

English translation of the wording on the front cover

Level 2 Biology 2023

91157M Demonstrate understanding of genetic variation and change

Credits: Four

91157M

Achievement	Achievement with Merit	Achievement with Excellence
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 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 will be cut off when the booklet is marked.

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