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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!

Koiora, Kaupae 2, 2015

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

9.30 i te ata Rāhina 16 Whiringa-ā-rangi 2015
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.

Mēna 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 2–21 kei roto i tēnei pukapuka, ka mutu, 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

MĀ TE KAIMĀKA ANAKE

TŪMAHI TUATAHI: TE TOUTOUWAI

MĀ TE KAIMĀKA ANAKE

I runga i ngā here manatārua,
kāore e whakaaetia te
whakaaturanga o tēnei
rauemi i konei.

http://nzbirdsonline.org.nz/species/black-robin

Nā te whakaurunga mai o ngā momo kararehe pēnei i ngā ngeru me ngā kiore i tino heke ai te maha o ngā toutouwai o Rēkohu (*Petroica traversi*) ki te rima i te tau 1980. Nā ngā tino mahinga whāomoomo, kua piki te maha o te momo manu nei ki te 250 i roto i te puna ira[1].

(a) Whakamāramahia mai ngā kupu 'puna ira'.

(b) Whakamāramahia mai he pēhea te pānga o te terenga iranga ki te puna ira o te toutouwai.

[1] mātāira

QUESTION ONE: BLACK ROBINS

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http://nzbirdsonline.org.nz/species/black-robin

Introduced species such as cats and rats caused the Chatham Island black robin (*Petroica traversi*) population to plummet to five individuals in 1980. Due to intensive conservation efforts, the species now has over 250 individuals in the gene pool.

(a) Describe the term gene pool.

(b) Explain how genetic drift affects the black robin's gene pool.

(c) I te nuinga o te wā whakawhānau ai ngā toutouwai uwha i ā rātou hua ki roto i ō rātou kōhanga. Ēngari, i kitea e ngā kaiatawhai taiao i whakawhānau kē ētahi manu i ā rātou hua ki te taha o ngā kōhanga, ki te wāhi kāore e ora ngā hua. Whāia, ka whakahokia atu ngā hua ki roto i ngā kōhanga kia whakaawhitia[2], ā, kia tika ai te paopao. Ēngari, nā tēnei pēhanga whiriwhiri mai i te tangata i piki ai te irarā whakawhānau i te taha kē ki te 50% i roto i te taupori toutouwai. Ka whakatauria kia kaua e whakahokia atu ngā hua ki roto i ngā kōhanga hei ārai i te puta o te whanonga ki roto i te taupori. I te tau 2011 e 9% anake o te taupori i whakawhānau hua ki te taha o ngā kōhanga.

I runga i ngā here manatārua, kāore e whakaaetia te whakaaturanga o tēnei rauemi i konei.

He kōhanga me te hua i whakawhānautia ki te taha.
www.math.canterbury.ac.nz/~r.sainudiin/preprints/plos_br_preprint.pdf

MĀ TE KAIMĀKA ANAKE

Matapikitia he aha te take e whakawhānau hua ai ētahi toutouwai uwha i te taha kē o ngā kōhanga, ā, ko te nuinga ka whakawhānau kē ki roto i ngā kōhanga, ka mutu me te pānga o te tangata ki tēnei whanonga.

Me whakauru ki tō tuhinga:

- he whakaahuatanga o te tikanga o te irarā me te auautanga irarā
- he whakamāramatanga he aha ngā pēhanga whiriwhiri, ā, he pēhea ngā pānga ki te whiriwhiri māori
- he matapakitanga o te whiriwhiri māori mā te whakamahi i te tauira o te whakawhānau hua a te toutouwai
- he matapakitanga he aha i piki ai te whanonga whakawhānau i te taha kē o te kōhanga nā te wawao a te tangata, ā, ka heke i te mutunga o te wawao a te tangata.

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

[2] nōhia

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(c) Female black robins usually lay eggs inside their nests. However, conservationists found some birds laid eggs on the rims of nests, where the eggs could not survive. So, they pushed the eggs back into the nests where they could be incubated and hatch successfully. However, this selection pressure from humans caused the rim laying allele to increase to 50% in the black robin population. They decided to stop pushing eggs back into the nests to prevent the behaviour from spreading throughout the population. In 2011 only 9% of the population laid eggs on the rims of nests.

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Nest showing egg laid on rim.
www.math.canterbury.ac.nz/~r.sainudiin/preprints/plos_br_preprint.pdf

Discuss why some female black robins lay eggs on the rims of nests, while most lay eggs inside the nests, and how humans affected this behaviour.

In your answer include:

- a description of what allele and allele frequency mean
- an explanation of what selection pressures are, and how they affect natural selection
- a discussion of natural selection using the black robin egg laying example
- a discussion of why the rim laying behaviour increased with human intervention, then decreased once the intervention stopped.

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

MĀ TE KAIMĀKA ANAKE

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TŪMAHI TUARUA: MOMO TOTO

MĀ TE KAIMĀKA ANAKE

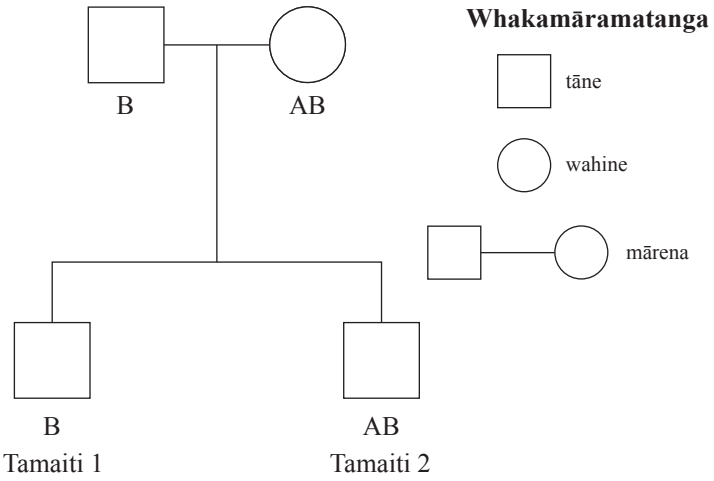
He maha ngā irarā e whakaritea ai te momo toto o te tangata. E mōhiotia ana ēnei ko I^A, I^B me i^O. He ngoi[3] ngā irarā I^A me I^B ki i^O. Ēngari, ina whakahekehia ngātahitia a I^A me I^B, ka whakaaturia he ngoi-ngātahi.

(a) Whakaahuatia he aha te irarā maha.

(b) E whakaatu ana te tūtohi kāwai i raro i ngā tamariki e rua me ō rāua tohuāhua i puta mai i tētahi tāne he tohuāhua B me tētahi wahine he tohuāhua AB.

Ngā Momo Toto

Tohuāhua	Tohuira
A	$I^A I^A$, $I^A i^O$
B	$I^B I^B$, $I^B i^O$
AB	$I^A I^B$
O	$i^O i^O$



Whakamāramatia te take e rua kē ngā tohuira o te Tamaiti 1 e taea ana, ā, kotahi anake te tohuira o te Tamaiti 2 e taea ana.

Ka whakaaetia te whakamahi hoahoa hei tautoko i tō tuhinga.

He wāhi anō mō tō tuhinga mō tēnei tūmahi kei te whārangi 10.

[3] tāpua

QUESTION TWO: BLOOD TYPE

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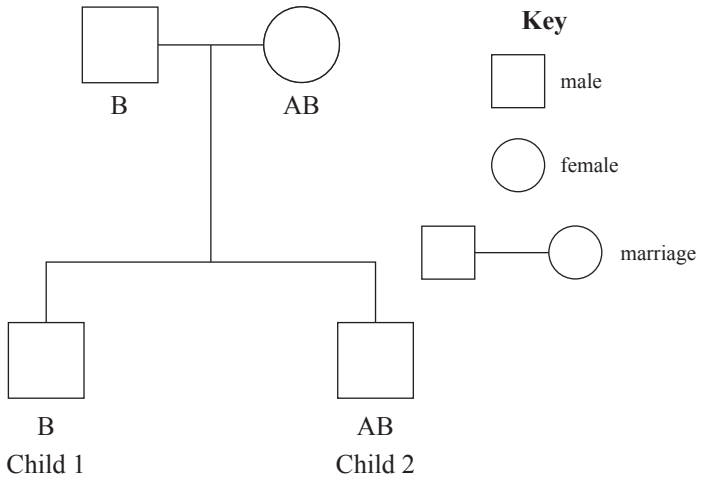
There are multiple alleles that determine a human's blood type. These are known as I^A, I^B and i^O. Alleles I^A and I^B are dominant over i^O. However, when I^A and I^B are inherited together, they show co-dominance.

(a) Describe what multiple alleles are.

(b) The pedigree chart below shows the two children and their phenotypes that result from a male with phenotype B and a female with phenotype AB.

Blood Types

Phenotype	Genotype
A	$I^A I^A$, $I^A i^O$
B	$I^B I^B$, $I^B i^O$
AB	$I^A I^B$
O	$i^O i^O$



Explain why Child 1 has two possible genotypes while Child 2 has only one possible genotype.

You may use diagrams in your answer.

There is more space for your answer to this question on page 11.

MĀ TE KAIMĀKA ANAKE

(c) Ka whai tamariki te Tamaiti 2 (AB) i roto i te tūtohi kāwai kei te whārangi 8 me tētahi wahine he momo toto O iraruarite tōna.

Matapakitia te tukunga iho o ā rāua uri.

Me whakauru ki tō tuhinga:

- ngā tohuāhua ME ngā tohuira e tāea ana mō ā rāua uri
- he whakamāramatanga o ngā rerekētanga i waenga i te ngoi me te ngoi-ngātahi
- he matapakitanga i te take kāore tētahi o ā rāua tamariki e whiwhi i te momo toto O, AB rānei.

Ka whakaaetia te whakamahi hoahoa hei tautoko i tō tuhinga.

He wāhi anō mō tō tuhinga mō tēnei tūmahi kei te whārangi 12.

ASSESSOR'S USE ONLY

(c) Child 2 (AB) in the pedigree chart on page 9 has children with a female having homozygous O blood type.

Discuss the inheritance of their offspring.

In your answer include:

- the possible phenotypes AND genotypes of the offspring
- an explanation of the difference between dominance and co-dominance
- a discussion of why none of their children will have the blood type O or AB.

You may use diagrams in your answer.

There is more space for your answer to this question on page 13.

MĀ TE KAIMĀKA ANAKE

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TŪMAHI TUARUA: TAE HURU

MĀ TE KAIMĀKA ANAKE

I te tau 1905, i mātaihia e Lucien Cuénot ngā ōwehenga rerekē i a ia e rangahau ana i te tukunga iho o te tae huru i roto i ngā kiore iti. I muri i te aihono i ngā kiore iti kōwhai iraruakē e rua (Yy), ko tāna i mātai kāore tētahi uri i whakaatu i te ōwehenga tohuāhua 3:1 māori. Ēngari kē, he rite tonu tana mātai i tētahi ōwehenga 2:1, arā e rua ngā kiore iti kōwhai mō ia kiore iti kiwikiwi. Ko tana whakatau he ngoi ake te tae huru kōwhai (Y) i te tae huru kiwikiwi (y), ā, mā te whakamahi i ngā whakawhiti whakamātautau i whakaatu ia he iraruakē ana kiore iti kōwhai katoa. Ēngari, mai i ana whakawhiti maha, kāore rawa i puta i a Cuénot tētahi kiore iti kōwhai iraruarite ngoi kotahi.

I runga i ngā here manatārua, kāore e whakaaetia te whakaaturanga o tēnei rauemi i konei.

www.themouseconnection.org/t955-what-are-these-sooty-colors

Otirā, i whakaaetia kāore he kiore iti kōwhai iraruarite ngoi nā tētahi irarā whakamate.

(a) Whakaahuahia tētahi (ētahi) irarā whakamate.

(b) Matapakitia i pēhea te whakamahi a Cuénot i ngā whakawhiti whakamātautau hei whakarite he iraruakē katoa ngā kiore iti kōwhai ora.

Me whakauru ki tō tuhinga:

- he whakaahuatanga o te iraruarite ME te iraruakē
- he whakamāramatanga he aha te whakawhiti whamātautau
- he matapakitanga i pēhea te whakamahi a Cuénot i ngā whakawhiti whakamātautau ki te mātai i tētahi ōwehenga 2:1 (e rua ngā kiore iti kōwhai mō ia kiore iti kiwikiwi), me te whakatau he iraruakē katoa ngā kiore iti kōwhai ora.

Ka whakaaetia te whakamahi hoahoa hei tautoko i tō tuhinga.

He wāhi anō mō tō tuhinga mō tēnei tūmahi kei te whārangi 16.

QUESTION THREE: COAT COLOUR

ASSESSOR'S USE ONLY

In 1905, Lucien Cuénot observed unusual ratios when studying inheritance of coat colour in mice. After mating two heterozygous yellow mice (Yy), he observed that the offspring never showed a normal 3:1 phenotypic ratio. Instead, he always observed a 2:1 ratio, with two yellow mice for every grey mouse. He concluded that yellow coat colour (Y) was dominant over grey coat colour (y), and by using test crosses he showed that all his yellow mice were heterozygotes. However, from his many crosses, Cuénot never produced a single homozygous dominant yellow mouse.

Subsequently, it was confirmed that no homozygous dominant yellow mice were present because of a lethal allele.

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www.themouseconnection.org/t955-what-are-these-sooty-colors

(a) Describe a lethal allele(s).

(b) Discuss how Cuénot used test crosses to determine that all the live yellow mice were heterozygous.

In your answer include:

- a description of homozygous AND heterozygous
- an explanation of what a test cross is
- a discussion of how Cuénot used the test crosses to observe a 2:1 ratio (two yellow mice for every grey mouse), and determine that all live yellow mice were heterozygous.

You may use diagrams in your answer.

There is more space for your answer to this question on page 17.

MĀ TE KAIMĀKA ANAKE

(c) Ko te pūtake o te mate iranga mate hūware tāpiapia ko ngā irarā whakamate. He iraruarite ngoikore te tangata e pāngia ana, ēngari he kaikawe ngā tāngata iraruakē i te irarā whakamate. Ko te pūtake o ngā irarā whakamate ko ngā irakētanga. Ka puta te irakētanga mō te mate hūware tāpiapia i roto i ngā tohuhema.

Matapakitia he pēhea te puta o ngā irarā whakamate mai i ngā irakētanga, Ā, he aha i noho tonu ai ngā irarā o te mate hūware tāpiapia i roto i te taupori.

Me whakauru ki tō tuhinga:

- he whakaahuatanga he aha te irakētanga
- he whakamāramatanga mō te rerekētanga i waenga i te irāketanga tohuhema (gametic) me tētahi irakētanga "somatic".
- he matapakitanga mō te take e noho tonu te irarā whakamate o te mate hūware tāpiapia i roto i te taupori tangata.

He wāhi anō mō tō tuhinga mō tēnei tūmahi kei te whārangi 18.

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(c) The genetic disease cystic fibrosis is caused by lethal alleles. An affected individual is homozygous recessive, however heterozygous individuals are carriers of the lethal allele. Lethal alleles are caused by mutations. The mutation for cystic fibrosis occurs in the gametes.

Discuss how mutations cause lethal alleles, AND why cystic fibrosis alleles remain in the population.

In your answer include:

- a description of what a mutation is
- an explanation of the difference between a gametic mutation and a somatic mutation
- a discussion of why the cystic fibrosis lethal allele remains in the human population.

There is more space for your answer to this question on page 19.

MĀ TE KAIMĀKA ANAKE

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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

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English translation of the wording on the front cover

Level 2 Biology, 2015

91157 Demonstrate understanding of genetic variation and change

9.30 a.m. Monday 16 November 2015
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 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 2–21 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.