See back cover for an English translation of this cover

2

91157M

911575

SUPERVISOR'S USE ONLY

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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

Tohua tēnei pouaka mēnā KĀORE koe i tuhi kōrero ki tēnei pukapuka

Mātai Koiora, Kaupae 2, 2022

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 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 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 2–23 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 pea taua wāhanga ka mākahia ana te pukapuka.

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

TE TŪMAHI TUATAHI: TE WEHENGA PŪTAU HAUWHĀ

I ngā taika, ka whakatauhia te tae o te koti me te tauira tāhei e ngā ira rerekē e rua kāore e whai hononga ana. Tāpua katoa ana te koti karaka (W) ki te mā (w), ā, tāpua katoa ana te tauira tāhei (S) ki tērā kāore he tāhei (s).

Te mātāpuna: www.recreoviral.com/fotografia/fotografias-llamaran-atencion-cualquier-curioso/

Ka whakawhitia tētahi taika iraruarite mō ngā huruhuru me ngā tāhei karaka ki tētahi taika iraruarite mō ngā huruhuru mā kāore he tāhei. He ōrite te tohuira o ngā taika katoa i te reanga ka whai mai (F1).

(a) Tautuhia te tohuira o te reanga F1.

(b) Ka whakawhitia ngā taika F1 e rua kia puta ai te reanga F2.

Whakamahia te tapawhā Punnett hei:

- whakaatu i ngā pūtau hema F1 me ngā tohuira katoa o te reanga taika F2 i tōna tikanga ka puta
- whakaputa i ngā ōwehenga tohuāhua mō te whakawhitinga kua oti.

Pūtau hema F1

Pūtau hema F1				

Ngā ōwehenga tohuāhua:

(c) Matapakina te āhua o te pānga o te tūmomo motuhake me te whakawhiti ki ngā ira tūhono me ngā ira kāore he tūhononga ME te āhua o te pānga o ērā mea e rua ki te rerekētanga ā-ira i tētahi taupori.

I tō tuhinga, me whai wāhi:

- tētahi whakaahuatanga o ngā ira tūhono ME ngā ira kāore he tūhononga
- tētahi whakamāramatanga o ngā tukanga o te tūmomo motuhake me te whakawhiti, tae atu hoki ki te wā e puta ai ēnei
- tētahi whakamāramatanga o te take e kore ai ngā ira tūhono e whakawehe motuhake i roto i te tukanga o te wehenga pūtau hauwhā
- tētahi matapakinga e whakatairite ana i te pānga o ngā ira tūhono, o te tūmomo motuhake, me te whakawhiti ki te rerekētanga ā-ira i tētahi taupori.

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

QUESTION ONE: MEIOSIS

In tigers, coat colour and stripe pattern are determined by two different genes that are not linked.
The orange (W) coat colour is completely dominant to white (w), and the striped (S) pattern is completely dominant to no stripe (s).

Source: www.recreoviral.com/fotografia/fotografias-llamaran-atencion-cualquier-curioso/

A tiger homozygous for orange fur and stripes is crossed with a tiger homozygous for white fur and no stripes. All the next generation tigers (F1) have the same genotype.

(a) Identify the genotype of the F1 generation.

(b) Two of these F1 tigers are crossed to produce the F2 generation.

Use the Punnett square to:

- show the F1 gametes and all the expected genotypes of the F2 generation of the tigers
- give the phenotypic ratios for the completed cross.

F1 gametes

F1 gametes

Phenotypic ratios:

(c) Discuss how independent assortment and crossing over affects linked genes and unlinked genes AND how they both affect genetic variation in a population.

In your answer include:

- a description of linked genes AND unlinked genes
- an explanation of the processes of independent assortment and crossing over, including when they occur
- an explanation of why linked genes do not independently assort during the process of meiosis
- a discussion comparing and contrasting how linked genes, independent assortment, and crossing over affect genetic variation in a population.

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

TE TŪMAHI TUARUA: NGĀ IRANGA TAUPORI

E hia rau mano nei te maha o ngā kākāpō i mua i te taenga mai o te tangata ki Aotearoa. Nā ngā tāngata ngā konihi pērā i ngā ngeru me ngā toriura i kawe mai, ā, i te tau 1995 e 51 anake ngā kākāpō: e 50 i Rakiura, kotahi i tuawhenua. E whakaatu ana ngā raraunga i te noho tūhāhā a te taupori mōrehu ki Rakiura mō ngā tau 10 000. I taua wā, i te aitata ēnei manu, tētahi ki tētahi.

I whakaraupapatia, i tātaritia hoki e ngā kaimātai koiora ngā huinga ira kākāpō mai i ngā manu e 35 e ora ana i Rakiura, me ētahi tīpakonga 14 mai i te taupori tuawhenua kua korehāhā. Ko te kitenga whakaohorere, kāore i tāpiripiria ngā irakē takakino i ngā kākāpō rā i Rakiura, engari i ngaro kē. I kitea e ngā kaimātai koiora te iti iho o te kawenga o ngā irakē takakino ināianei, tēnā i te maha i kawea rā e te taupori i tuawhenua i tōna wā.

He mea whakahāngai te kōrero i: https://www.cell.com/cell-genomics/pdfExtended/S2666-979X(21)00002-1

Te mātāpuna: https://nzbirdsonline.org.nz/species/kakapo

(a) Matapakina ngā pūtake pea mō te whakakorenga o ngā irakē takakino i ngā manu o Rakiura, ahakoa te iti o te taupori.

I tō tuhinga, me whai wāhi:

- tētahi whakaahuatanga o te irakē, me te āhua o tana uru atu ki tētahi mātāira
- tētahi whakamāramatanga o tā te kākāpō noho taunga pea ki te whiringa māori, ki te terenga iranga, me te pānga whakaū
- tētahi whakamāramatanga o te take ka nui ake pea te tāpiripiria o ngā irakē takakino i roto i ngā taupori iti, tēnā i ngā taupori nui ake
- tētahi matapakinga o ngā pūtake e TORU i iti iho ai ngā irakē takakino i te taupori o Rakiura.

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

QUESTION TWO: POPULATION GENETICS

Kākāpō numbered in the hundreds of thousands before humans arrived in Aotearoa. Humans introduced predators such as cats and stoats, and by 1995 there were only 51 kākāpō: 50 on Stewart Island and one on the mainland. Data shows that the surviving population on Stewart Island had been isolated for 10 000 years. During this time these birds had been inbreeding with each other.

Biologists sequenced and analysed kākāpō genomes from 35 living birds from Stewart Island and 14 samples from the extinct mainland population. Surprisingly they found that the kākāpō on Stewart Island have lost harmful mutations rather than accumulating them. Biologists found they now carry fewer harmful mutations than the extinct population on the mainland once did.

Adapted from: https://www.cell.com/cell-genomics/pdfExtended/S2666-979X(21)00002-1

Source: https://nzbirdsonline.org.nz/species/kakapo

(a) Discuss the possible reasons for the removal of harmful mutations from the Stewart Island birds, even though the population is small.

In your answer include:

- a description of what a mutation is and how it enters a gene pool
- an explanation of how kākāpō might have been subjected to natural selection, genetic drift, and founder effect
- an explanation of why harmful mutations may accumulate more in small populations than in larger populations
- a discussion of THREE possible reasons why the Stewart Island population has fewer harmful mutations.

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

TE TŪMAHI TUATORU: NGĀ TAUIRA O TE TUKU IHOTANGA

Ka whakaputaina te tae koti o te rāpeti e te huhua o ngā tauira tuku iho rerekē. Kua whakaatu ētahi rangahau i tā te tae koti whakaatu i te tāpua-kore.

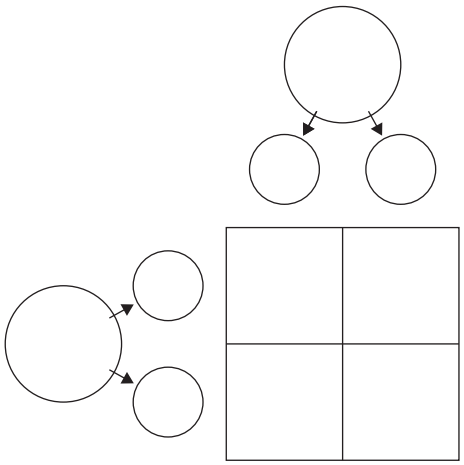
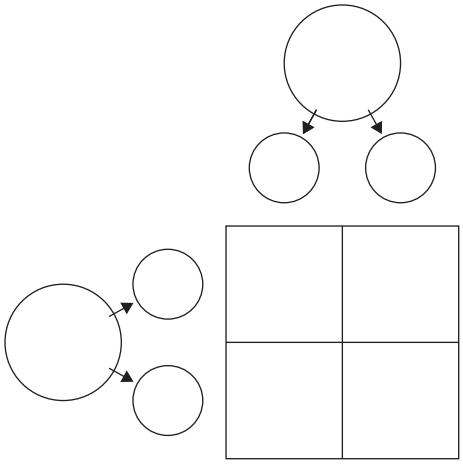
He maha ngā hua-irakē (*allele*) o te ira tae-koti e whakaatu ana i te raupapa o te tāpua. E whakaatu ana te tūtohi kei raro iho nei, kua whakangāwaritia, i te tae koti, i te tohu hua-irakē, me te raupapa o te tāpua mō ngā tohuāhua e toru.

Te tae koti	**Te momo pāwhara: pango**	**Te momo *Chinchilla*: kiwikiwi**	**Te kiri kōtea: mā**
Te tohuāhua			
Te tohu hua-irakē	C	c^{ch}	c
Te raupapa o te tāpua	He tāpua katoa ki ērā atu	Ka whakaatu te momo *chinchilla* i te tāpua-kore ki te kiri kōtea	He ira huna ki te momo pāwhara me te momo *chinchilla*

He mea whakahāngai ngā kōrero i: www.macmillanhighered.com/BrainHoney/Resource/6716/digital_first_content/trunk/test/hillis2e/asset/img_ch8/c08_fig09.html

(a) Whakaotia ngā tapawhā Punnett momorua ira-tahi (*monohybrid*) i te tūtohi kei te whārangi 13.

Whāia ngā tohutohu i te tūtohi rā hei whakaoti, hei whakatairite hoki i ngā whakawhitinga momorua ira-tahi mō te huruhuru rāpeti tuku iho.

I whakawhitia e tētahi kaiwhakaputa rāpeti ngā rāpeti e rua he iraruakē mō te huruhuru pango me te *chinchilla*.	**I whakawhitia e tētahi kaiwhakaputa rāpeti ngā rāpeti e rua he iraruakē mō te *chinchilla* me te kiri kōtea.**
Whakaahuatia te tohuira o ngā mātua:	Whakaahuatia te tohuira o ngā mātua:
Whakaahuatia te tohuāhua o ngā mātua:	Whakaahuatia te tohuāhua o ngā mātua:
Whakaotia te tapawhā Punnett kei raro iho, ā, whakaahuatia ngā ōwehenga ā-tohuira, ā-tohuāhua hoki i tōna tikanga ka kitea. 	Whakaotia te tapawhā Punnett kei raro iho, ā, whakaahuatia ngā ōwehenga ā-tohuira, ā-tohuāhua hoki i tōna tikanga ka kitea. 
Te ōwehenga tohuira e tāria ana:	Te ōwehenga tohuira e tāria ana:
Te ōwehenga tohuāhua e tāria ana:	Te ōwehenga tohuāhua e tāria ana:
Te tauira o te tuku ihotanga:	Te tauira o te tuku ihotanga:

QUESTION THREE: PATTERNS OF INHERITANCE

Rabbit coat colour is produced by a variety of different inheritance patterns. Some studies have shown that coat colour shows incomplete dominance.

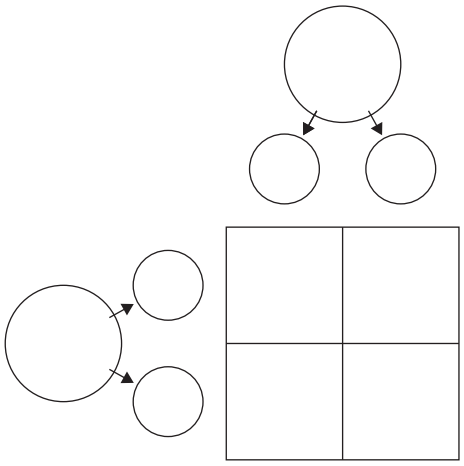
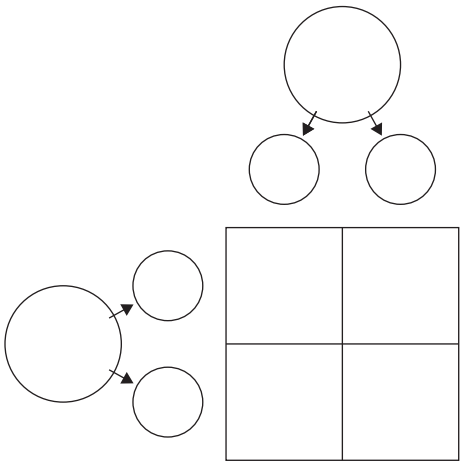
The coat-colour gene has multiple alleles which show an order of dominance. The simplified table below show the coat colour, allele symbol, and order of dominance for three phenotypes.

Coat colour	**Wild type: black**	**Chinchilla: grey**	**Albino: white**
Phenotype			
Allele symbol	C	c^{ch}	c
Order of dominance	Complete dominance over all the others	Chinchilla shows incomplete dominance over albino	Recessive to wildtype and chinchilla

Adapted from: www.macmillanhighered.com/BrainHoney/Resource/6716/digital_first_content/trunk/test/hillis2e/asset/img_ch8/c08_fig09.html

(a) Complete the monohybrid Punnett squares in the table on page 15.

Work through the instructions in the table to complete and compare the two monohybrid crosses for rabbit fur inheritance.

A rabbit breeder crossed two rabbits that were heterozygous for black fur and chinchilla.	**A rabbit breeder crossed two rabbits that were heterozygous for chinchilla and albino.**
Describe the genotype of the parents:	Describe the genotype of the parents:
Describe the phenotype of the parents:	Describe the phenotype of the parents:
Complete the Punnett square below, and describe the expected genotype and phenotype ratios. 	Complete the Punnett square below, and describe the expected genotype and phenotype ratios. 
Expected genotype ratio:	Expected genotype ratio:
Expected phenotype ratio:	Expected phenotype ratio:
Pattern of inheritance:	Pattern of inheritance:

(b) Mā te whakamahi i te tūtohi i oti rā i te wāhanga (a), matapakina te take e ōrite ana ngā ōwehenga tohuira mō ngā whakawhitinga e rua, engari e rerekē ana ngā ōwehenga tohuāhua.

I ō tuhinga, me whai wāhi:

- tētahi whakaahuatanga o te tāpua tōtōpū
- tētahi whakamāramatanga o te take e ōrite ana ngā ōwehenga tohuira mō ngā whakawhitinga i runga, engari e rerekē ana ngā ōwehenga tohuāhua
- tētahi whakamāramatanga o te tāpua-kore me ngā hua-irakē maha
- tētahi matapakinga o te take ka noho pea te tāpua, te tāpua-kore, me te hua-irakē maha hei huapai, hei huakino HOKI ki te momo e whai hononga ana ki te whiringa māori.

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

(b) Using the table completed in part (a) discuss why the genotype ratios are the same for both crosses, but the phenotype ratios are different.

In your answers include:

- a description of complete dominance
- an explanation of why the genotype ratios are the same for the above crosses, but the phenotype ratios are different
- an explanation of incomplete dominance and multiple alleles
- a discussion of why complete dominance, incomplete dominance, and multiple alleles could be an advantage AND a disadvantage to a species-link to natural selection.

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

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 2 Biology 2022

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 – 23 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.