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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, 2019

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

9.30 i te ata Rātū 19 Whiringa-ā-rangi 2019
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 koe mō ō tuhinga, whakamahia te (ngā) whārangi wātea kei muri o tēnei pukapuka, ka āta tohu ai i te tau tūmahi.

Tirohia mēnā e tika ana te raupapatanga o ngā whārangi 2–20 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 WHĀITI PŪIRA

Drosophila whai tinana parauri me ngā karu
whero

Drosophila whai tinana pango me ngā karu
parauri

www.indiana.edu/~oso/lessons/Genetics/Dihybrid.html

E whakaatu ana te ngaro huarākau, *Drosophila melanogaster*, i te tauira ira tāpua mō te tae tinana me te tae karu. He tāpua te irarā tae tinana parauri (B) ki te irarā tae tinana pango (b), ā, he tāpua te irarā mō ngā karu whero (R) ki te irarā mō ngā karu parauri (r). Kāore he hono ā-ira o ngā ira mō te tae tinana me te tae karu.

- (a) I whakawhitia e tētahi kaimātai koiora tētahi ngaro huarākau iraruarite mō te irarā tinana parauri me te irarā karu whero, me tētahi ngaro huarākau iraruarite mō te tae tinana pango me ngā karu parauri.

Tuhia ngā tohuhema ka puta i ia kātua: _____

Tuhia te tohuira¹ o te reanga F1: _____

- (b) Whakamahia te tūtohi Punnett i raro nei hei whakaatu i ngā tohuhema o te reanga F1, me ngā tohuira katoa ka taea o te reanga F2.

Ngā tohuhema F1

Ngā tohuhema F1

¹ momoira

- (c) Whakaahuahia ngā ōwehenga tohuāhua (F2) e matapaehia ana ka puta i tēnei whakawhitinga.

- (d) Ko te roa parirau tētahi atu tohuāhua i roto i ngā ngaro huarākau, ā, kitea ai te ira ki ngā pūira ōrite ki te tae tinana me te tae karu. Heoi anō, hāunga te āhua ki te ōwehenga tohuāhua o te whakawhitinga F2 i te wāhanga (c), ina whakawhitia ngā ira mō te tae tinana me te roanga parirau, ka puta ko te ōwehenga tohuāhua o te parirau parauri, roa e 5 : te parirau parauri, poto 1 : te parirau pango, roa 1 : te parirau pango, poto e 5.

Tātarihia te hoahoa i raro.



He mea urutau mai i: Campbell N.A. rāua ko Reece, J. B. *Biology. Putanga 7* (Capetown: Pearson Benjamin Cummings, 2005)

Matapakitia me ngā pūtake i parahautia he aha te take ka taea e ngā ira kei te pūira kotahi te noho hono, kore hono hoki.

Me whakauru ki roto i tō tuhinga:

- tētahi whakaahuatanga o ngā ira hono ME te kore hono
- tētahi whakamāramatanga he pēhea te pānga o te whakawhiti atu me te whakawehenga ki ngā ira hono ME te kore hono
- tētahi matapakinga mō te take e kīia ana te tae tinana me te tae karu he kore hono, engari ko te tae tinana me te roa parirau e kīia ana he hono.

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

QUESTION ONE: MEIOSIS

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USE ONLY

Drosophila with brown body and red eyes

Drosophila with black body and brown eyes

www.indiana.edu/~oso/lessons/Genetics/Dihybrid.html

The fruit fly, *Drosophila melanogaster*, displays a complete dominance inheritance pattern for body colour and eye colour. The brown body colour allele (B) is dominant to the black body colour allele (b), and the allele for red eyes (R) is dominant to the allele for brown eyes (r). The genes for body colour and eye colour are not genetically linked.

- (a) A biologist crossed a fruit fly homozygous for the brown body colour allele and the red eye allele, with a fruit fly homozygous for black body colour and brown eyes.

State the gametes produced by each parent: _____

State the genotype of the F1 generation: _____

- (b) Use the Punnett square below to show the gametes of the F1 generation, and all of the possible genotypes of the F2 generation.

		F1 gametes			
F1 gametes					

- (c) Describe the predicted phenotype (F₂) ratios produced by this cross.

- (d) Wing length is another phenotype in fruit flies and the gene is found on the same chromosomes as body colour and eye colour. However, in contrast to the phenotype ratio F₂ cross in part (c), when the genes for body colour and wing length are crossed, the observed phenotype ratio of 5 brown, long wings : 1 brown, short wings : 1 black, long wings : 5 black, short wings is produced.

Analyse the diagram below.



Adapted from: Campbell, N. A., & Reece, J. B. *Biology. 7th. Ed* (Capetown: Pearson Benjamin Cummings, 2005)

Discuss with justified reasons why genes on the same chromosome can be both linked and unlinked.

In your answer include:

- a description of linked AND unlinked genes
- an explanation of how crossing over and segregation affect linked AND unlinked genes
- a discussion of why body colour and eye colour are considered unlinked, whereas body colour and wing length are considered linked.

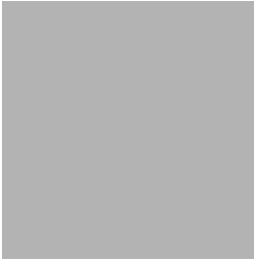



There is more space for your answer to this question on page 7.

TŪMAHI TUARUA: WHIRINGA MĀORI

Noho ai te kārearea, *Falco novaeseelandiae*, puta noa i Aotearoa. He kaikonihī te kārearea e rere haere ai ki te hopu kai māna. E ai ki ngā rangahau noho tonu ai ngā toa ki tētahi wāhi ake, ā, ko ngā uwaha ka heke ki wāhi hou.

E rua ngā tohuāhua motuhake o ngā manu o Te Ika-a-Māui me Te Waipounamu.

Ko te rahinga taupori he 7000. Kua kitea e ngā tātāritanga iranga te rerenga ira i waenga i ngā taupori o Te Ika-a-Māui me Te Waipounamu, ā, he iti te rerenga kētanga ira.

Ngā Tohuāhua	Tūwāhi	Nōhanga	Pāmahana Toharite ā-Tau (°C)
Rahinga iti  www.oiseaux-birds.com/card-new-zealand-falcon.html	Te-Ika-a-Māui	Ngahere māori me te ngahere paina  www.aucklandbotanicgardens.co.nz/our-gardens/native-forest/	10.6 – 14.5
Rahinga nui  http://nzbirdsonline.org.nz/species/new-zealand-falcon	Te Waipounamu	Nōhanga tuwhera me ngā pāmu o ngā whenua teitei  www.odt.co.nz/rural-life/rural-life-other/increase-visitors-could-close-high-country-walks	5.9 – 10.5

Matapakitia ngā pēhanga tīpakonga i puta ai ngā tohuāhua motuhake e rua o te kārearea ME ngā āhuatanga i rerekē ai te auautanga irarā i roto i tētahi puna ira.

Me whakauru ki roto i tō tuhinga:

- tētahi whakaahuatanga o te auautanga irarā ME te puna ira
- tētahi whakamāramatanga he pēhea te pānga o te hekenga ME te nuku iranga ki te puna ira o te kārearea
- me whai whakaaro ki ngā tohuāhua motuhake e rua ka matapaki he pēhea te whakaawe a te whiringa māori i ngā tohuāhua i Te Ika-a-Māui me Te Waipounamu. Whakamahia ngā mōhiohio mai i te tūtohi hei tautoko i tō matapakinga.

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



QUESTION TWO: NATURAL SELECTION

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USE ONLY

Kārearea, *Falco novaeseelandiae*, live throughout Aotearoa. They are predators that use flight to hunt their prey. Research shows that males tend to remain in a particular area, while females migrate to new areas.

Birds found in the North and South Islands have two distinct phenotypes.

Population size is estimated at 7000. Genetic analysis has found that gene flow occurs between North and South Island populations, and the population has low genetic diversity.

Phenotypes	Location	Habitat	Annual Mean Temperature (°C)
Small size	North Island	Native bush and pine forest	10.6 – 14.5
			
www.oiseaux-birds.com/card-new-zealand-falcon.html		www.aucklandbotanicgardens.co.nz/our-gardens/native-forest/	
Large size	South Island	Open habitat and high country farms	5.9 – 10.5
			
http://nzbirdsonline.org.nz/species/new-zealand-falcon		www.odt.co.nz/rural-life/rural-life-other/increase-visitors-could-close-high-country-walks	

Discuss the selection pressures that drive the kārearea's two distinct phenotypes AND the factors that cause changes to allele frequency in a gene pool.

In your answer include:

- a description of allele frequency AND gene pool
- an explanation of how migration AND genetic drift may affect the kārearea's gene pool
- consider the two distinct phenotypes and discuss how natural selection has influenced the phenotypes in the North and South Island. Use the information from the table to support your discussion.

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

TŪMAHI TUATORU: NGĀ PŪTAKE RERENGA KĒTANGA I ROTO I TĒTAHI PUNA IRA

Nō Amerika ki te Raki me te Puku o Amerika te ika wai māori e kīia ana ko te southern platyfish, *Xiphophorus maculatus*. He māmā te waiho ki rō kauranga ika, nō reira he tino ika tēnei mā ngā kaiwhakatipu ika.

Ka kitea tētahi ira e waehe ana mō tētahi tauira ngakutae kiri i te pūtake o te pakihau hiku i te tauwāhi P ki tētahi o ana pūira. E 8 ngā irarā-rau kei tēnei tauwāhi.



www.bunnycart.com/shop/fishes/mickey-mouse-platy/

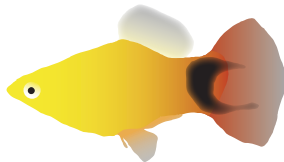
- (a) Whakamāramahia mai te kupu "irarā-rau".

- (b) E whakaaturia ana i roto i ngā pikitia i raro ko ngā tauira korotiwaha hiku (irarā) e whakaaturia ana e te platyfish.

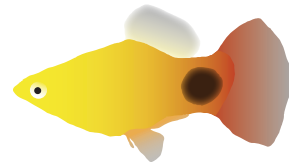
He ira tāpua ngātahi ngā irarā katoa engari anō te irarā kore korotiwaha, he ira huna tēnei ki ērā atu irarā katoa.



Kāore he korotiwaha i te hiku
Tohu irarā: P⁺



He korotiwaha pewa kei te hiku
Tohu irarā: P^C



He korotiwaha tongi kei te hiku
Tohu irarā: P^D

Whakamāramahia mai te rerekētanga i waenga i te tāpua ngātahi me te ira huna tuku iho.

QUESTION THREE: SOURCES OF VARIATION WITHIN A GENE POOL

ASSESSOR'S
USE ONLY

The southern platyfish, *Xiphophorus maculatus*, is a freshwater fish native to North and Central America. It is easy to keep in an aquarium, so has become a popular aquarium fish among breeders.

A gene that codes for a pigmentation pattern at the base of the tail fin is found at P locus (location) on one of its chromosomes. There are 8 multiple alleles found at this locus.



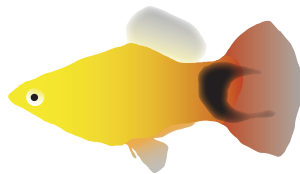
www.bunnycart.com/shop/fishes/mickey-mouse-platy/

- (a) Describe the term multiple allele.

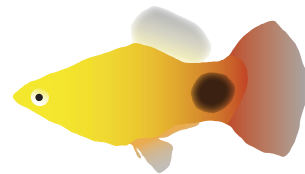
- (b) The pictures below show some of the tail spot (allele) patterns expressed by platyfish. All alleles are co-dominant except the no spot allele, which is recessive to all other alleles.



No spot found on tail
Allele symbol: P^+



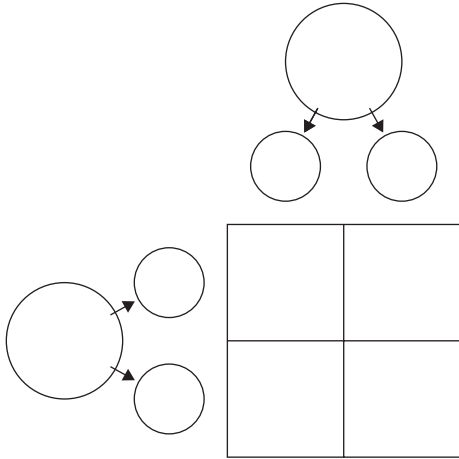
Crescent spot found on tail
Allele symbol: P^C



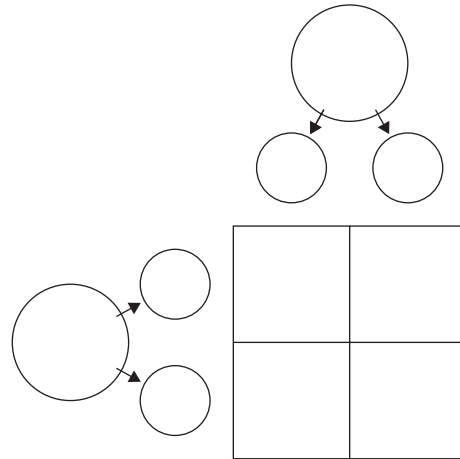
Dot spot found on tail
Allele symbol: P^D

Explain the difference between co-dominance and recessive inheritance.

I whakawhitia e tētahi kaiwhakatipu ika ngā ika e rua he iraruakē mō te pewa me te kore korotihua ($P^C P^+$). Whakaotihia te tapawhā Punnet i raro ka whakaahua i te ōwehenga tohuira me te ōwehenga tohuāhua e tūmanakohia ana.



I whakawhitia anō e te kaiwhakatipu ika ngā ika e rua he iraruakē mō te pewa me te korotiwaha tongi (P^CP^D). Whakaotitia te tapawhā Punnet i raro ka whakaahua i te ōwehenga tohuira me te ōwehenga tohuāhua e tūmanakohia ana.

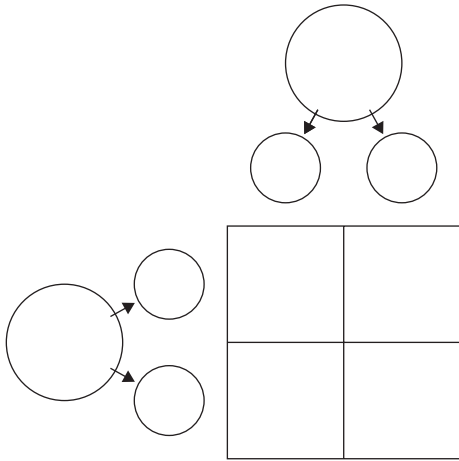


Ōwehenga tohuāhua tūmanako:

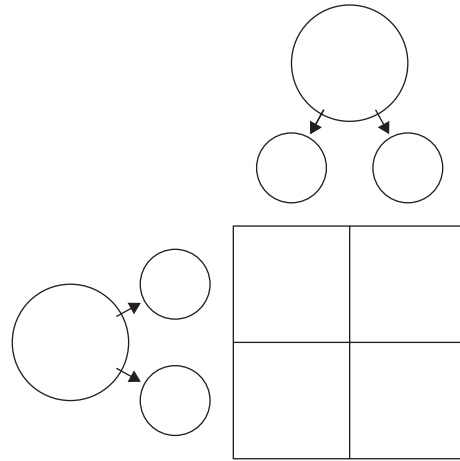
He wāhi anō mō tō tuhinga mō
tēnei tūmahi kei te whārangi 16.

Koiora 91157M, 2019

- A fish breeder crossed two fish that were both heterozygous for crescent and no spot ($P^C P^+$). Complete the Punnett square below and describe the expected genotype and phenotype ratio.



The fish breeder also crossed two fish that were both heterozygous for crescent and dot spot ($P^C P^D$). Complete the Punnett square below and describe the expected genotype and phenotype ratio.



Expected phenotype ratio:

**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, 2019

91157 Demonstrate understanding of genetic variation and change

9.30 a.m. Tuesday 19 November 2019
Credits: Four

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 2–20 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.

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