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!

2

SUPERVISOR'S USE ONLY

Tohua tēnei pouaka mēnā kāore he tuhituhi i roto i tēnei pukapuka

Koiora, Kaupae 2, 2020

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

9.30 i te ata Rāapa 2 Hakihea 2020
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 2–23 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 KĀWAI PĪ

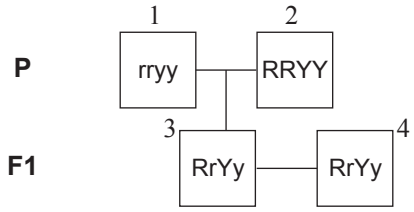
MĀ TE KAIMĀKA ANAKE

I whakawhiti parito pūrua a Gregor Mendel mō te tipu pī (*Pisum sativum*). E whakaatu ana ngā tipu pī i tētahi tauira tuku iho tāpua[1]. He tāpua te irarā mō te porohita (R) ki te irarā mō ngā kākano kurehe (r). Ko te irarā mō ngā kākano kōwhai (Y) he tāpua ki te irarā mō ngā kākano kākāriki (y).

Mātāpuna: https://plantscientist.wordpress.com/2013/08/15/why-plants-can-be-great-models-for-studying-genetics/

E kitea ana ngā ira mō te hanga me te tae o te kākano i ngā pūira rerekē.

Whakamahia te tūtohi kāwai kei raro hei whakatutuki i ngā tūmahi e whai ake nei:



(a) Whakamāramahia te take he aha i whai tohuira RrYy ai ngā uri kei te reanga F1 i ngā wā katoa.

[1] ngoi

QUESTION ONE: PEA PEDIGREE

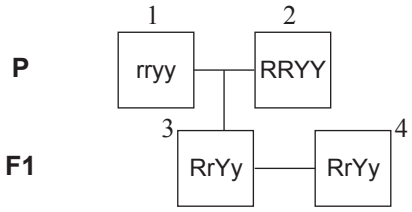
ASSESSOR'S USE ONLY

Gregor Mendel carried out a dihybrid cross for the pea plant (*Pisum sativum*). Pea plants display a complete dominance inheritance pattern. The allele for round (R) is dominant to the allele for wrinkled (r) seeds. The allele for yellow (Y) seeds is dominant to the allele for green (y) seeds.

Source: https://plantscientist.wordpress.com/2013/08/15/why-plants-can-be-great-models-for-studying-genetics/

The genes for seed shape and colour are found on different chromosomes.

Use the pedigree chart below to answer the following questions:

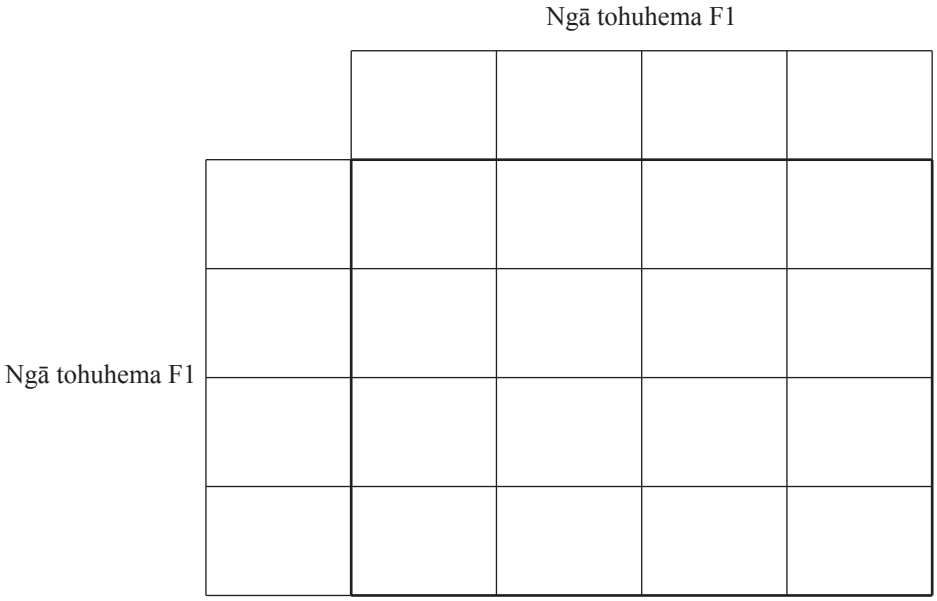


(a) Explain why the offspring in the F1 generation will always have the genotype of RrYy.

MĀ TE KAIMĀKA ANAKE

(b) E iwa ngā tohuira (F2) ka taea mai i tēnei whakawhitinga i waenga i ngā tohuhema o te reanga F1 (RrYy).

(i) Mā te whakamahi i te wāhi mahi i raro, whakatauhia ngā tohuira e iwa ka taea ka whakatau i te ōwehenga tohuāhua.

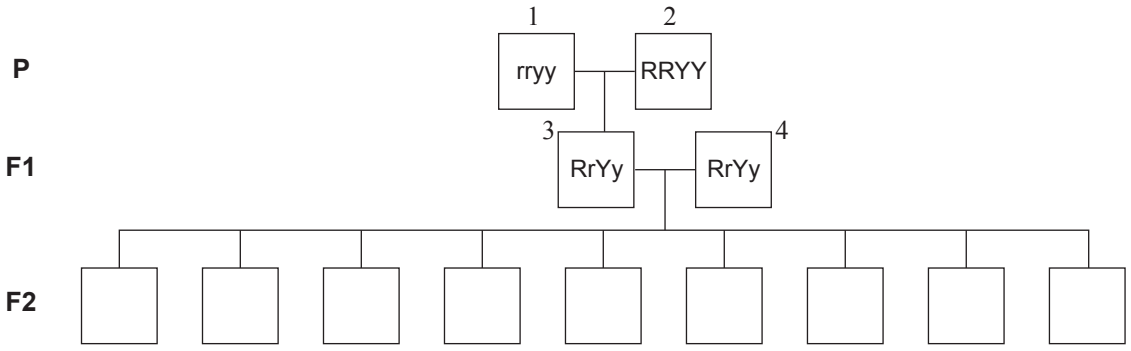


Ōwehenga tohuāhua: _____

_____

_____

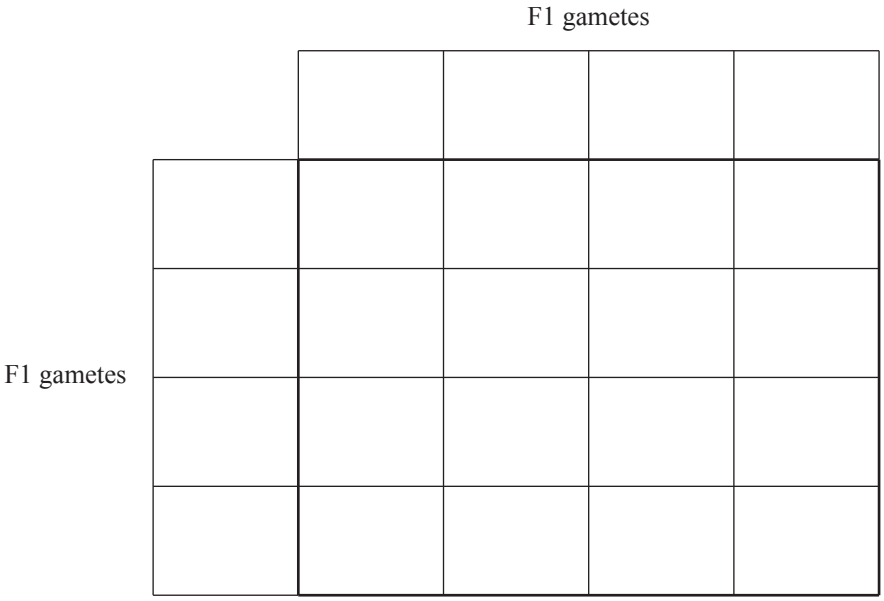
(ii) Whakakīa ngā tohuira e iwa katoa ka taea mō te reanga F2 ki te tūtohi kāwai i raro.



ASSESSOR'S USE ONLY

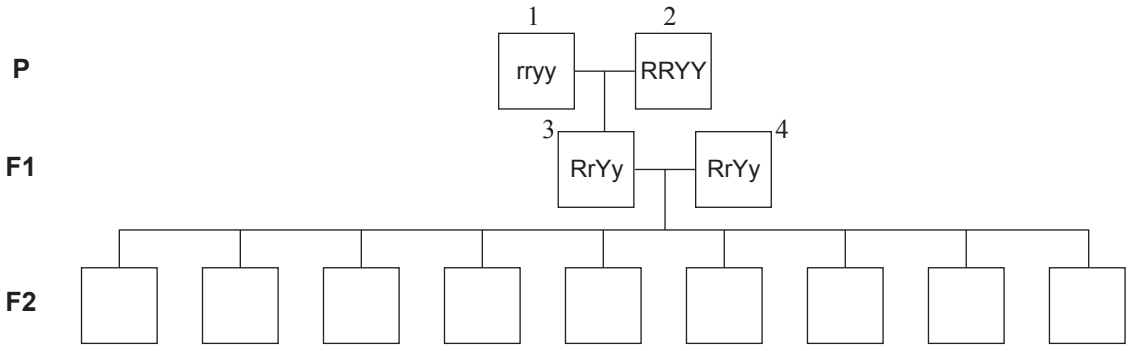
(b) There are nine possible genotypes (F2) from this cross between the gametes of the F1 generation (RrYy).

(i) Using the working space below, determine the nine possible genotypes and determine the phenotype ratio.



Phenotype ratio: _____

(ii) Fill in all the possible genotypes for the F2 generation on the pedigree chart below.



(c) Whakamahia te hoahoa māmā kei raro hei matapaki i ngā tukanga ka pā mai i te whāiti pūira[2] e nui ake ai te rerekētanga ā-ira i roto i ngā tohuhema.

MĀ TE KAIMĀKA ANAKE

He mea urutau mai i: Campbell, N. A., Mitchell, L. G., & Reece, J. B. (2000). *Biology*. Benjamin/Cummings.

Me whakauru ki tō tuhinga:

- he whakaahuatanga o te whāiti pūira
- he whakamāramatanga o te hiatonga korehere, ka tapa ina pā mai ki te hoahoa
- he whakamāramatanga o te whakawehenga, ka tapa ina pā mai ki te hoahoa
- he matapakinga he pēhea te whakapiki ake a ēnei tukanga i te rerekētanga ā-ira o ngā tohuhema.

He wāhi anō mō tō tuhinga mō tēnei tūmahi kei te whārangi 8.

[2] maiohi

(c) Use the simplified diagram below to discuss the processes that occur during meiosis that increase genetic variation in gametes.

ASSESSOR'S USE ONLY

Adapted from: Campbell, N. A., Mitchell, L. G., & Reece, J. B. (2000). *Biology*. Benjamin/Cummings.

In your answer include:

- a description of meiosis
- an explanation of independent assortment, and label when it occurs on the diagram
- an explanation of segregation, and label when it occurs on the diagram
- a discussion of how these processes increase genetic variation of gametes.

There is more space for your answer to this question on page 9.

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

TŪMAHI TUARUA: MĀTAI IRANGA TAUPORI

MĀ TE KAIMĀKA ANAKE

Mai i te taenga mai o te tangata (700 tau ki mua) me ētahi atu konihi whāngote kua tino iti haere ake te nuinga o ngā momo taketake o Aotearoa.

I te tau 1977 i kitea te taupori whakamutunga o te kākāpō i Rakiura. Ko te whakaaro ko ngā tino konihi o ēnei manu ko ngā ngeru puihi.

Momo	Te maha o te taupori i Aotearoa	Rerenga ā-ira
Kākāpō (momo māori)  Mātāpuna: http://nzbirdsonline.org.nz/species/kakapo	~ 211	iti
Ngeru rata (nō tāwāhi)  Mātāpuna: https://now.tufts.edu/articles/cat-eat-bird-world	~ 1.419 miriona	nui

Mā te whakamahi i ngā mōhiohio i runga ake, matapakitia te take he aha i iti ai te rerenga ā-ira o te kākāpō ME te parahau he aha i pā mai ai te terenga iranga nā te konihitanga a te ngeru.

Me whakauru ki tō tuhinga:

- he whakaahuatanga o te rerenga ā-ira me te auautanga irarā
- he whakamāramatanga o tētahi puru taupori me te tino take e iti ai te rerenga ā-ira o ngā taupori iti
- he whakamāramatanga e kī ana he tauira tēnei o te pānga puru (bottleneck effect), kaua te pānga whakaūnga (founder effect)
- he matapakitanga nā te konihitanga a ngā ngeru i te kākāpō kua pā mai te terenga iranga.

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

QUESTION TWO: POPULATION GENETICS

ASSESSOR'S USE ONLY

Since the arrival of humans (700 years ago) and other mammalian predators, the population numbers of most native species found in Aotearoa, New Zealand have decreased significantly.

In 1977 the last wild population of kākāpō was discovered on Stewart Island / Rakiura. The birds' main predators there were thought to have been feral cats.

Species	Total population number in Aotearoa	Genetic diversity
Kākāpō (native)  Source: http://nzbirdsonline.org.nz/species/kakapo	~ 211	low
Domestic cat (introduced)  Source: https://now.tufts.edu/articles/cat-eat-bird-world	~ 1.419 million	high

Using the information above, discuss why the genetic diversity of kākāpō is low AND justify why cat predation has resulted in genetic drift.

In your answer include:

- a description of genetic diversity and allele frequency
- an explanation of a population bottleneck, and why small populations (most likely) have low genetic diversity
- an explanation of why this is an example of bottleneck effect and not founder effect
- a discussion of why kākāpō predation by cats has resulted in genetic drift.

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

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

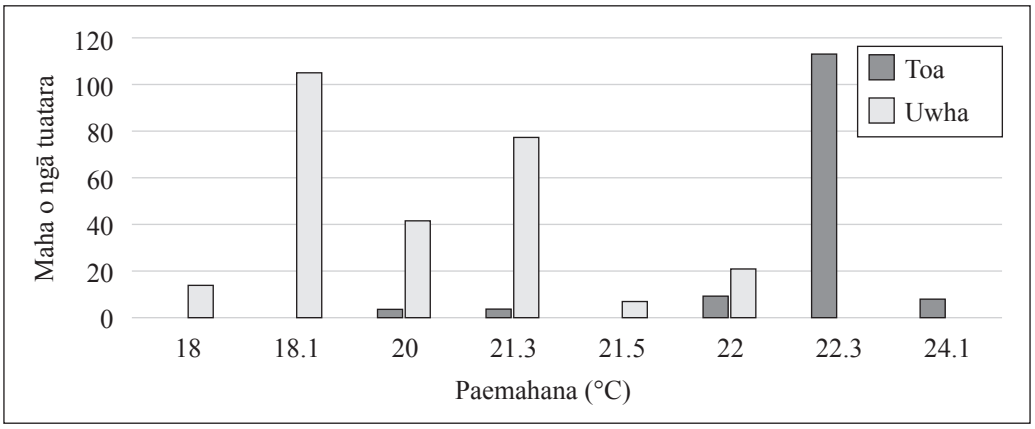
TŪMAHI TUATORU: WHIRINGA MĀORI

Mātāpuna: https://www.stuff.co.nz/environment/climate-news/109319809/tuatara-kea-and-pua-are-among-kiwi-creatures-threatened-by-climate-change

Ka whakaputa uri te tuatara mā te whakaputa uri tōrua. He iti noa te taupori me te rerenga ā-ira. Kei te paemahana e nōhia ana ngā hua tuatara e puta ai te ira tuatara o ngā uri. Nō reira, puta ai ngā toa i ngā paemahana neke atu i te 22 °C, ā, puta ai ngā uwha i ngā paemahana i raro i te 21 °C. He whāiti tēnei awhe paemahana.

Engari, kāore i te hāngai ētahi tuatara takitahi o te taupori ki tēnei ia, ā, ka puta ētahi toa i te 20 °C me te 21 °C me te puta o ētahi uwha i te 22 °C. Tirohia te kauwhata o raro.

Te maha o ngā tuatara ka puta hei toa me te uwha i ngā paemahana rerekē



He mea urutau mai: Mitchell, N. J., Nelson, N. J., Cree, A., Pledger, S., Keall, S. N., & Daugherty, C. H. (2006). Support for a rare pattern of temperature-dependent sex determination in archaic reptiles: evidence from two species of tuatara (Sphenodon). Frontiers in Zoology, 3(1), 9.

Me whai whakaaro me pēhea te whakamahi i te tukanga o te whiringa maōri ki te matapae ka ahatia te momo i roto i ngā āhuatanga e whai ake:

- mēnā ka tere te piki o ngā paemahana i roto i te wā poto
- mēnā ka āta piki haere ngā paemahana i roto i te wā tino roa.

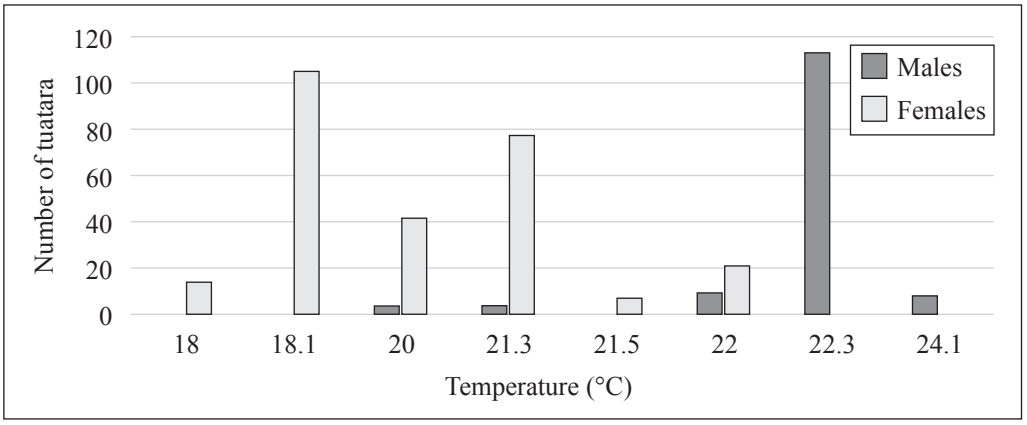
QUESTION THREE: NATURAL SELECTION

Source: https://www.stuff.co.nz/environment/climate-news/109319809/tuatara-kea-and-pua-are-among-kiwi-creatures-threatened-by-climate-change

Tuatara produce offspring through sexual reproduction. Population numbers and genetic diversity are low. The temperature at which tuatara eggs are incubated determines the sex of offspring. In general, temperatures over 22 °C produce males while temperatures under 21 °C produce females. This is a narrow temperature range.

However, some individuals in the population do not fit this trend, with some males developing at 20 °C and 21 °C and some females developing at 22 °C. See graph below.

Number of tuatara that develop into males and females at different temperatures



Adapted from Mitchell, N. J., Nelson, N. J., Cree, A., Pledger, S., Keall, S. N., & Daugherty, C. H. (2006). Support for a rare pattern of temperature-dependent sex determination in archaic reptiles: evidence from two species of tuatara (Sphenodon). Frontiers in Zoology, 3(1), 9.

Consider how the process of natural selection can be used to predict what could happen to the species in the following circumstances:

- if temperatures rise rapidly over a short period of time
- if temperatures rise slowly over a very long period of time.

I tō tuhinga, me:

- tapa me te whakaahua he pēhea te whakauru a ngā irarā hou ki tētahi taupori
- whakamārama mai he aha te whiringa māori
- whakamārama, me te whakauru mai i tētahi pūtake, he aha i kore ai e hāngai ētahi toa, uwha hoki ki tēnei ia
- matapae ka ahatia pea te momo ina tere piki ai ngā paemahana i roto i te wā poto, ina whakatauritea ki te āta pikitanga i roto i te wā roa.

MĀ TE KAIMĀKA ANAKE

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

ASSESSOR'S USE ONLY

In your answer:

- name and describe how totally new alleles enter a population
- explain natural selection
- explain, including a reason, why some males and females do not fit the trend
- predict what could happen to the species when temperatures rise quickly over a short period of time, compared with when they rise slowly over a long period of time.

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

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

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

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 2020

91157 Demonstrate understanding of genetic variation and change

9.30 a.m. Wednesday 2 December 2020
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 2–23 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.