

See back cover for an English translation of this cover

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90948M



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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

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

Pūtaiao, Kaupae 1, 2022

90948M Te whakaatu māramatanga ki ngā ariā koiora e pā ana ki te rerekētanga ā-ira

Ngā whiwhinga: E whā

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki ngā ariā koiora e pā ana ki te rerekētanga ā-ira.	Te whakaatu māramatanga ki ngā ariā koiora e pā ana ki te rerekētanga ā-ira, kia hōhonu.	Te whakaatu māramatanga ki ngā ariā koiora e pā ana ki te rerekētanga ā-ira, kia tōtōpū.

Tirohia kia kitea ai e ōrite ana te Tau Ākonga ā-Motu kei tō puka whakauru ki te tau kei runga i tēnei whārangi.

Me whakamātau koe i ngā tūmahi KATOĀ 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 2–15 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 nei.

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

TE TŪMAHI TUATAHI: NGĀ PŪTAU PEWA

Ko te pūtau pewa he tahumaero ka puta i te irakē o tētahi ira. Nā tēnei, ka puta ngā pūtau toto whero e rerekē ana te hanga.

Tētahi ira māori:

↓ Ka tīmata te raupapa i konei

Te raupapa DNA	CAC	GTG	GAC	TGA	GGA	CTC	CTC
	GTG	CAC	CTG	ACT	CCT	GAG	GAG

Tētahi ira e irakē ana:

Te raupapa DNA	CAC	GTG	GAC	TGA	GGA	CAC	CTC
	GTG	CAC	CTG	ACT	CCT	GTG	GAG



He mea whakahāngai i: www.indiatimes.com/health/healthyliving/what-is-sickle-cell-diseases-237205.html?picid=812711

(a) He aha te irakē?

QUESTION ONE: SICKLE CELLS

Sickle cell disease is caused by a mutation in a gene. This leads to the production of red blood cells with a different shape.

Normal gene:

↓ **Start of coding sequence**

DNA sequence	CAC	GTG	GAC	TGA	GGA	CTC	CTC
	GTG	CAC	CTG	ACT	CCT	GAG	GAG

Gene with mutation:

DNA sequence	CAC	GTG	GAC	TGA	GGA	CAC	CTC
	GTG	CAC	CTG	ACT	CCT	GTG	GAG



Adapted from: www.indiatimes.com/health/healthyliving/what-is-sickle-cell-diseases-237205.html?picid=812711

(a) What is a mutation?

- (b) Whakamāramahia te āhua o tā te irakē o tētahi ira noho hei pūtake mō te tahumaero pūtau pewa. Me whakamahi koe i ngā kupu pūtaiao nei, arā, te DNA, te irakē, te ira, te huinga ira, te momo āhuahanga.

- (c) Whakamāramahia te āhua o te tukua iho o tētahi irakē ki te reanga ka whai mai.

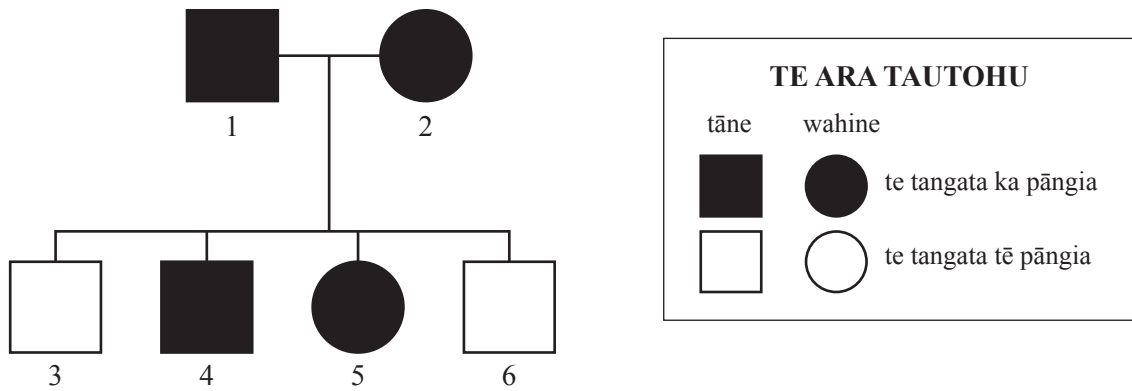
- (b) Explain how a mutation in a gene can cause sickle cell disease.
You should include the terms DNA, mutation, gene, allele, phenotype.

- (c) Explain how a mutation can be passed on to the next generation.

TE TŪMAHI TUARUA: TE TAHUMAERO HUNTINGTON

Kei raro nei te kāwai whakapapa mō tētahi whānau e pāngia ana e te mate ā-ira, e te tahumaero Huntington.

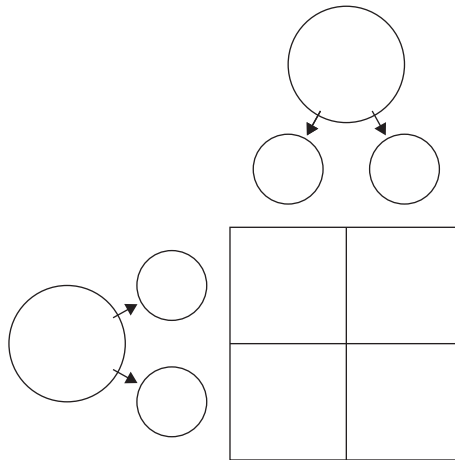
Ka noho tāpua te huinga ira o Huntington (H), tēnā i te huinga ira kāore i te pāngia (h).



- (a) Whiriwhiria te momo huinga ira o ēnei tāngata e toru.

Te tangata 1: _____ Te tangata 2: _____ Te tangata 3: _____

- (b) Whakaotihia te tapawhā Punnett mō te hononga ki waenga i te Tangata 1 me te Tangata 2.



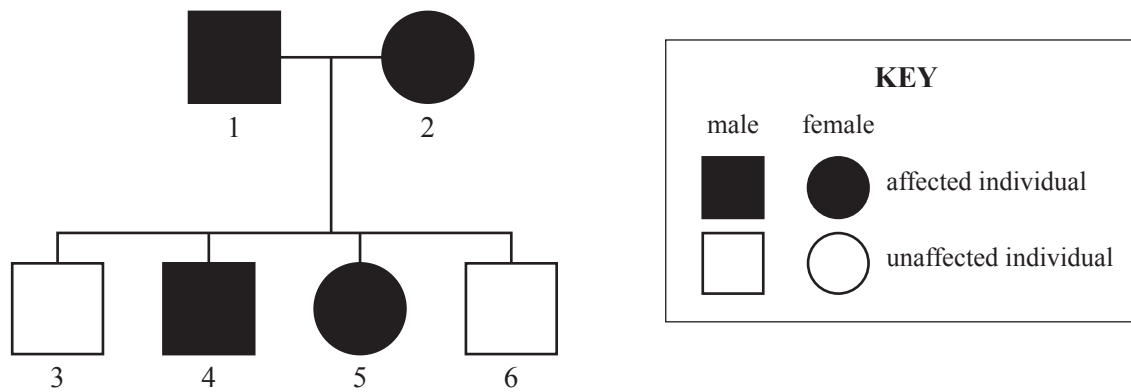
- (c) Whakaotihia te ōwehenga e matapaetia ana me te ōwehenga motuhenga mō te hononga ki waenga i te Tangata 1 me te Tangata 2.

	Te Ōwehenga e Matapaetia ana	Te Ōwehenga Motuhenga
Kua pāngia e Huntington:	:	:
Tē pāngia e Huntington:	:	:

QUESTION TWO: HUNTINGTON'S DISEASE

Below is a pedigree chart for a family with the genetic disorder Huntington's disease.

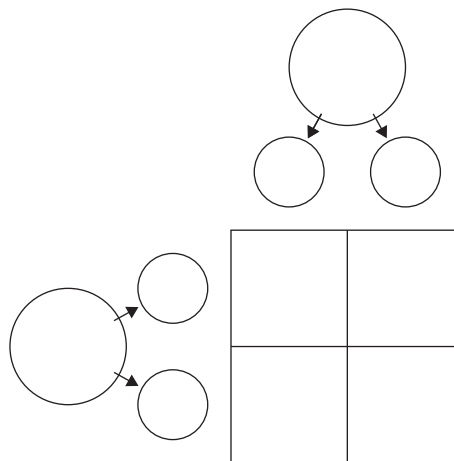
The Huntington's allele (H) is dominant over the unaffected allele (h).



- (a) Work out the genotypes of the following three individuals.

Individual 1: _____ Individual 2: _____ Individual 3: _____

- (b) Complete the Punnett square for the cross between Individual 1 and Individual 2.



- (c) Complete the expected ratio and actual ratio for the cross between Individual 1 and Individual 2.

	Expected Ratio	Actual Ratio
Affected by Huntington's:	:	:
Unaffected by Huntington's:	:	:

- (d) Ko te kāwai whakapapa i runga nei, e kitea ai ngā hononga ki waenga i te Tangata 1 me te 2, kei te whakaatu i ngā tamariki e rua ka pāngia me ngā tamariki e rua tē pāngia.

Whakamāramahia te rerekētanga i te nama motuhenga o ngā tamariki ka pāngia, tēnā i te nama ka matapaetia ka pāngia i te hononga ki waenga i te Tangata 1 me te 2.


- (e) Whakamāramahia te āhua o te whakamahinga o te kāwai whakapapa rā hei whakaatu i te korenga o te tahumaero Huntington e noho nei hei ira huna.

- (d) The cross between Individuals 1 and 2 in the pedigree chart opposite shows two affected children and two unaffected children.

Explain the difference in the actual number of affected offspring compared to the expected number of affected offspring in the cross between Individuals 1 and 2.

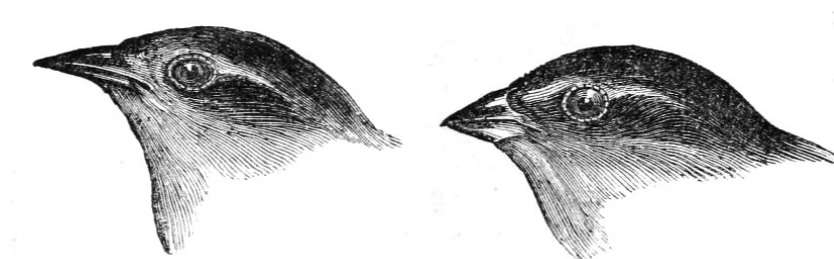
- (e) Explain how the pedigree chart opposite can be used to show that Huntington's disease is not recessive.

Kei te kitea i raro nei ngā manu me ngā ngutu e rerekē ana te rahi, nō te kāhui kotahi.



QUESTION THREE: GENETIC VARIATION

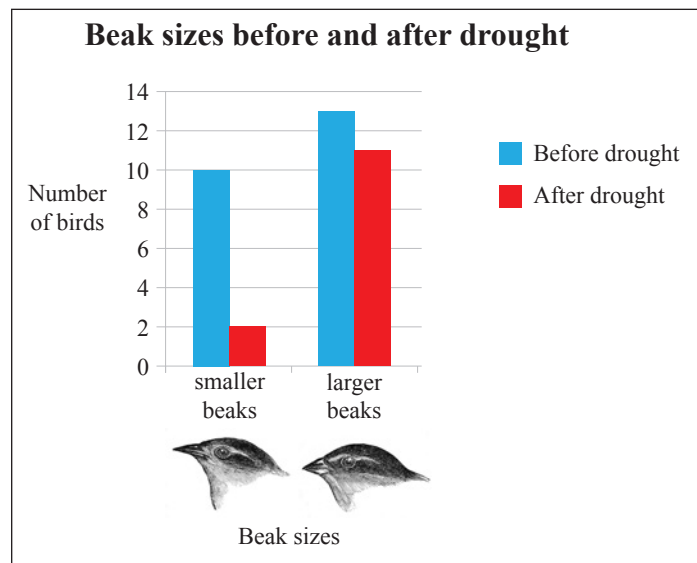
Birds with different beak sizes from the same population are shown below.



Adapted from: <https://www.biodiversitylibrary.org/page/2010582#page/392/mode/1up>

- (a) Explain how sexual reproduction leads to genetic variation in a bird population. In your answer, you should include the processes of gamete formation (meiosis) and fertilisation. You may use labelled diagrams, with notes, to support your answer.

- (b) In drought conditions, there is low rainfall. The beak sizes of birds before and after a drought were recorded. The results are shown in the graph below.



The drought reduces the number of smaller seeds that are available, causing a greater number of the smaller-beaked birds to die.

The drought does not change the number of large seeds that are available.

Discuss how genetic variation enabled the bird population to survive when faced with drought.

In your answer, you should include a prediction of how the population may change if drought conditions continue.

**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 1 Science 2022

90948M Demonstrate understanding of biological ideas relating to genetic variation

Credits: Four

90948M

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of biological ideas relating to genetic variation.	Demonstrate in-depth understanding of biological ideas relating to genetic variation.	Demonstrate comprehensive understanding of biological ideas relating to genetic variation.

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 2–15 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.