See back cover for an English translation of this cover

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91159M

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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!

Tohua tēnei pouaka mēnā KĀORE koe i tuhituhi i roto i tēnei pukapuka

Koiora, Kaupae 2, 2021

91159M Te whakaatu māramatanga ki te whakatinana ira

Ngā whiwhinga: Whā

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki te whakatinana ira.	Te whakaatu māramatanga hōhonu ki te whakatinana ira.	Te whakaatu māramatanga matawhānui ki te whakatinana ira.

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.

Ki te hiahia koe ki ētahi atu wāhi hei tuhituhi whakautu, whakamahia te wāhi wātea kei muri i te pukapuka nei.

Tirohia mēnā e tika ana te raupapatanga o ngā whārangi 2–19 kei roto i tēnei pukapuka, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

Kaua e tuhi ki roto i tētahi wāhi kauruku whakahāngai (). Ka tapahia pea tēnei wāhi ina mākahia te pukapuka.

ME HOATU RAWA KOE I TĒNEI PUKAPUKA KI TE KAIWHAKAHAERE Ā TE MUTUNGA O TE WHAKAMĀTAUTAU.

TŪMAHI TUATAHI: NGĀ WAIKAWA KARIHI

E rua ngā momo waikawa karihi, arā, ko te pītau ira (DNA) me te waikawa tuipūmua (RNA).

(a) Whakamāramatia mā te tūtohi ngā tairitenga ME ngā rerekētanga i waenga i te DNA me te RNA.

I tō tuhinga me whakauru ēnei:

- te pākawa tūtaewhetū
- te huka
- ngā hononga hauwai
- ngā pāpāhua[1]: adenine, thymine, guanine, cytosine me te uracil
- te pūiokarihi (nucleotide).

	DNA	**RNA**
Hoahoa:		
Ngā rerekētanga:		
Ngā tairitenga[2]:		

[1] waikawa kore

[2] ōritenga

QUESTION ONE: NUCLEIC ACIDS

There are two types of nucleic acids: deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).

(a) Use the table to explain the similarities AND differences between DNA and RNA.

In your answer include the following:

- phosphate
- sugar
- hydrogen bonds
- bases: adenine, thymine, guanine, cytosine, and uracil
- nucleotide.

	DNA	**RNA**
Diagram:		
Differences:		
Similarities:		

(b) Ka ahu mai te DNA i ngā kanoi e rua, arā, ko te kanoi waehere me te kanoi tātauira, ā, ka ahu mai te mRNA i te kanoi kotahi.

Matapaki he pēhea te whai wāhi mai o te hanganga me te mahi a ēnei kanoi ki te hanga pūmua.

Me whakauru ki tō tuhinga:

- he whakamāramatanga o te mahi a ngā kanoi waehere me ngā kanoi tātauira o te DNA
- he whakamāramatanga o te kanoi mRNA, tae atu ki hea, he pēhea te hangaia
- he matapakinga he pēhea e tutuki ai te tauwhaituhi tika o te DNA.

He wāhi anō mō tō tuhinga mō tēnei tūmahi kei ngā whārangi o muri mai.

(b) DNA is made up of two strands, the coding strand and the template strand, while mRNA is made of one strand.

Discuss how the structure and function of these strands are involved in making proteins.

In your answer include:

- an explanation of the function of DNA coding and template strands
- an explanation of the mRNA strand, including where and how it is made
- a discussion of how accurate transcription of DNA is achieved.

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

TŪMAHI TUARUA: NGĀ IRAKĒTANGA

Tūtohi 1: mRNA (pūihokarihi) : Waikawa Amino

Pūwāhi Tuatahi	Pūwāhi Tuarua: U	Pūwāhi Tuarua: C	Pūwāhi Tuarua: A	Pūwāhi Tuarua: G	Pūwāhi Tuatoru
U	UUU Phe	UCU Ser	UAU Tyr	UGU Cys	U
	UUC Phe	UCC Ser	UAC Tyr	UGC Cys	C
	UUA Leu	UCA Ser	UAA STOP	UGA STOP	A
	UUG Leu	UCG Ser	UAG STOP	UGG Trp	G
C	CUU Leu	CCU Pro	CAU His	CGU Arg	U
	CUC Leu	CCC Pro	CAC His	CGC Arg	C
	CUA Leu	CCA Pro	CAA Gln	CGA Arg	A
	CUG Leu	CCG Pro	CAG Gln	CGG Arg	G
A	AUU Ile	ACU Thr	AAU Asn	AGU Ser	U
	AUC Ile	ACC Thr	AAC Asn	AGC Ser	C
	AUA Ile	ACA Thr	AAA Lys	AGA Arg	A
	AUG Met	ACG Thr	AAG Lys	AGG Arg	G
G	GUU Val	GCU Ala	GAU Asp	GGU Gly	U
	GUC Val	GCC Ala	GAC Asp	GGC Gly	C
	GUA Val	GCA Ala	GAA Glu	GGA Gly	A
	GUG Val	GCG Ala	GAG Glu	GGG Gly	G

He mea urutau mai i: Tracey Greenwood rāua ko Richard Allan. 2003, *Year 12 Biology 2003*, Biozone, w. 287.

Ka pā mai i tētahi irakē i te whakawaehere ira mō te pūmua whākōkī phenylalanine hydroxylase (PAH) te mate phenylketonuria.

(a) E whakaaturia ana te raupapa DNA tātauira mō te wāhanga o te ira māori me ngā irakētanga rerekē e rua ki te Tūtohi 2 i raro. E whakaaturia ana ngā pāpāhua whai pānga ki te whero, ā, kua tārarotia.

Whakaotihia te Tūtohi 2.

Tūtohi 2

	Raupapa ira PAH māori	**Irakē pūwāhi 1**	**Irakē pūwāhi 2**
Kanoi tātauira DNA	TAT GGA GCC GGG	TAT GGA ACC GGG	TAT GGA TCC GGG
Kanoi mRNA			
Raupapa waikawa amino			

QUESTION TWO: MUTATIONS

Table 1: mRNA (codon) : Amino Acid

First Position	Second Position: U	Second Position: C	Second Position: A	Second Position: G	Third Position
U	UUU Phe	UCU Ser	UAU Tyr	UGU Cys	U
	UUC Phe	UCC Ser	UAC Tyr	UGC Cys	C
	UUA Leu	UCA Ser	UAA STOP	UGA STOP	A
	UUG Leu	UCG Ser	UAG STOP	UGG Trp	G
C	CUU Leu	CCU Pro	CAU His	CGU Arg	U
	CUC Leu	CCC Pro	CAC His	CGC Arg	C
	CUA Leu	CCA Pro	CAA Gln	CGA Arg	A
	CUG Leu	CCG Pro	CAG Gln	CGG Arg	G
A	AUU Ile	ACU Thr	AAU Asn	AGU Ser	U
	AUC Ile	ACC Thr	AAC Asn	AGC Ser	C
	AUA Ile	ACA Thr	AAA Lys	AGA Arg	A
	AUG Met	ACG Thr	AAG Lys	AGG Arg	G
G	GUU Val	GCU Ala	GAU Asp	GGU Gly	U
	GUC Val	GCC Ala	GAC Asp	GGC Gly	C
	GUA Val	GCA Ala	GAA Glu	GGA Gly	A
	GUG Val	GCG Ala	GAG Glu	GGG Gly	G

Adapted from: Tracey Greenwood and Richard Allan. 2003, *Year 12 Biology 2003*, Biozone, p. 287.

A mutation in the gene coding for the enzyme phenylalanine hydroxylase (PAH) causes the disease phenylketonuria.

(a) The template DNA sequence for part of the normal gene and two different mutations is shown in Table 2 below. The affected bases are shown in red, and underlined.

Complete Table 2.

Table 2

	Normal PAH gene sequence	**Point mutation 1**	**Point mutation 2**
DNA template strand	TAT GGA GCC GGG	TAT GGA ACC GGG	TAT GGA TCC GGG
mRNA strand			
Amino acid sequence			

(b) Matapakitia te pānga o aua irakētanga ki te raupapa waikawa amino me te mahi a te pūmua whākōkī whakamutunga.

Me whakauru ki tō tuhinga:

- he whakaahuatanga o ngā pūtake o ngā irakētanga
- he whakamāramatanga o ngā irakētanga pūwāhi 1 me te 2
- he whakamāramatanga e rārangi ana mēnā e whai pānga ana ēnei irakētanga ki ngā pūihokarihi tīmata me ngā pūihokarihi whakamutu
- he matapakinga he pēhea te whakaawe a aua irakētanga e rua i te mahi whakamutunga a te pūmua whākōkī.

He wāhi anō mō tō tuhinga mō tēnei tūmahi kei ngā whārangi o muri mai.

(b) Discuss the effect of these mutations on the amino acid sequence and the functioning of the final enzyme.

In your answer include:

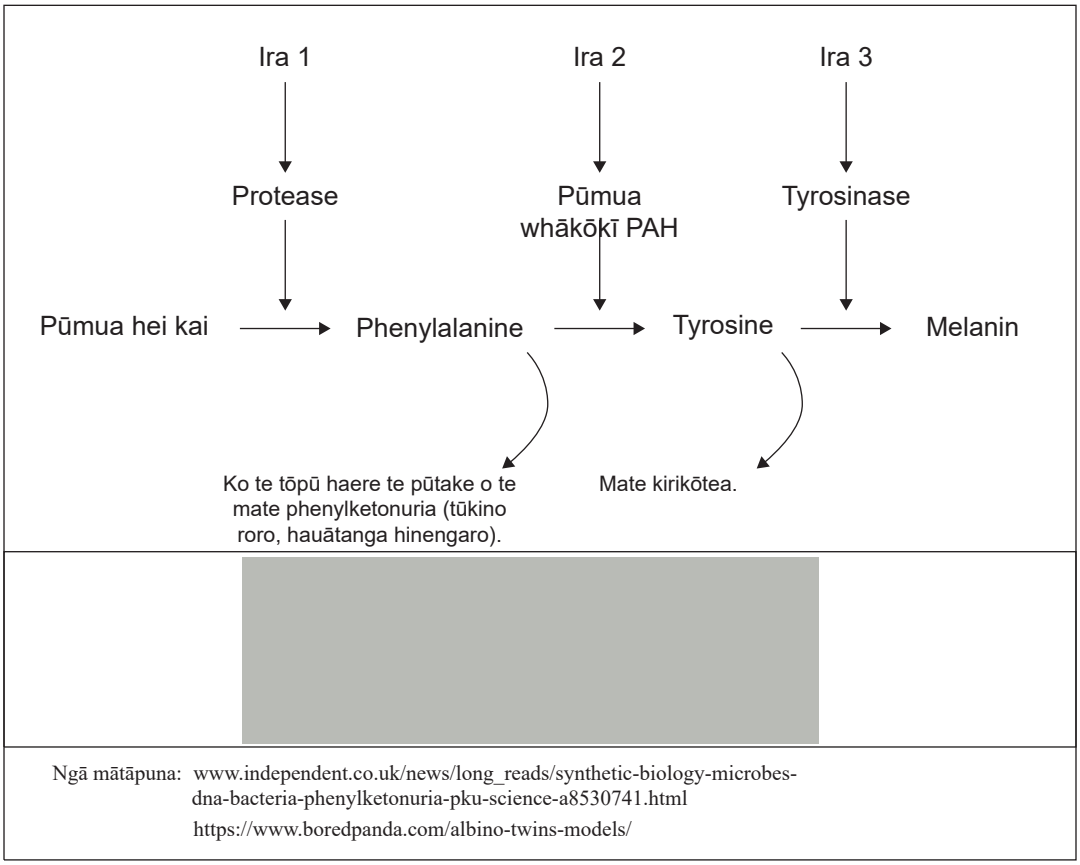
- a description of the causes of mutations
- an explanation of the point mutations 1 and 2
- an explanation outlining if these mutations affect the start and stop codons
- a discussion of how these two mutations affect the final functioning of the enzyme.

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

TŪMAHI TUATORU: TE TAIAO ME TE WHAKATINANA IRA

Ko te mate phenylketonuria (PKU) te pūtake o te nui o te waikawa amino phenylalanine i te toto. Ka taea e ngā phenylalanine tino nui te tūkino te roro me ngā hauātanga hinengaro. I te whānautanga, ka aromatawaitia ngā pēpi mō te mate PKU. Kāore e pā mai ki ngā pēpi kua whakatauhia ki te mate PKU ngā tohumate o te mate, ā, ka pai noa iho tō rātau ao mēnā ka ū rātau ki te kai i ngā kai pūmua iti anake mō ngā rā katoa o tō rātau ao me te kai i te tyrosine hei kai tāpiri.

Ka pā mai te mate kirikōtea mēnā kāore e whakaputahia te melanin (taekiri). Ko te hunga mate kirikōtea he iti noa te taekiri kei ō rātau kiri, makawe, karu hoki.



Ngā mātāpuna: www.independent.co.uk/news/long_reads/synthetic-biology-microbes-dna-bacteria-phenylketonuria-pku-science-a8530741.html
https://www.boredpanda.com/albino-twins-models/

Mā te whakamahi i te ara whakarau pūngao māmā i runga ake, matapakitia te take he aha e taea ai e te taiao te ārai te pānga mai o te mate PKU ki te tangata, engari kaua te pānga mai o te mate kirikōtea.

Me whakauru ki tō tuhinga:

- he whakamāramatanga o tēnei mea te ara whakarau pūngao[3]
- he whakamāramatanga mō te take me mātua ū te tangata e pāngia ana e te mate PKU ki ngā kai pūmua iti mō ngā rā katoa o tōna ao
- he matapakinga he pēhea te pā mai o te mate PKU me te mate kirikōtea ki te tangata.

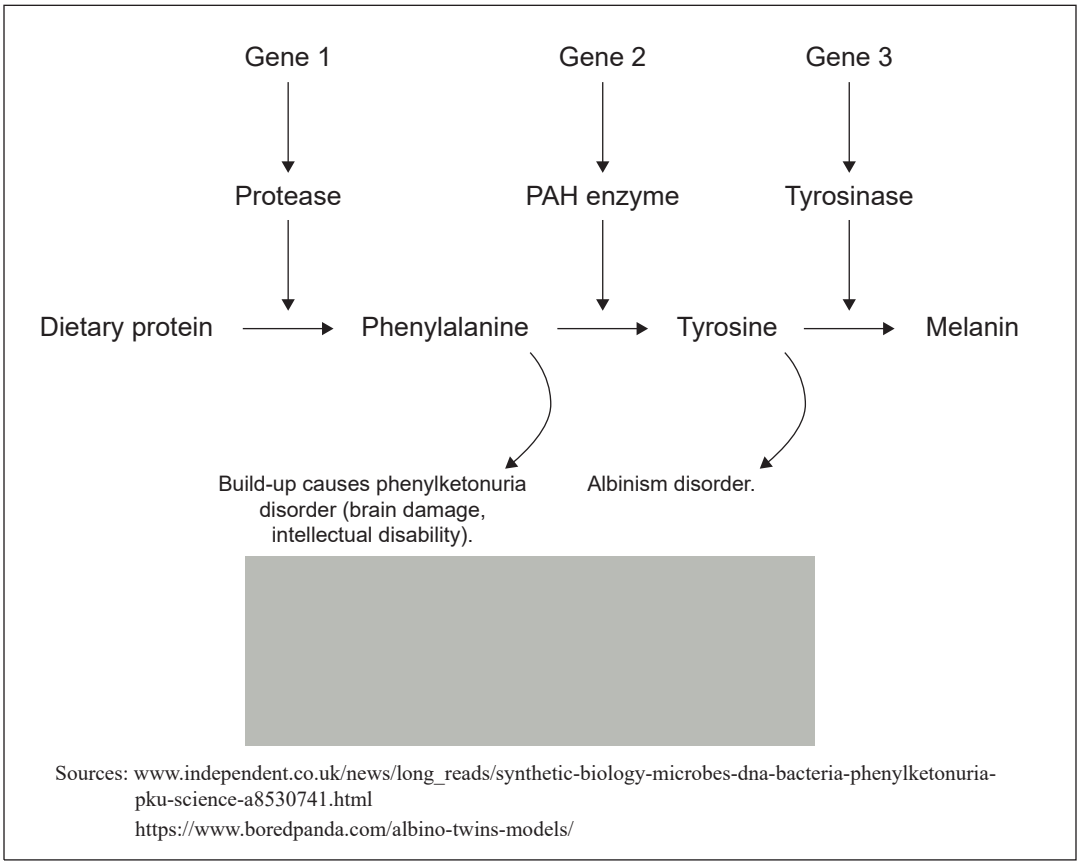
He wāhi anō mō tō tuhinga mō tēnei tūmahi kei ngā whārangi o muri mai.

[3] ara matūriaka

QUESTION THREE: ENVIRONMENT AND GENE EXPRESSION

Phenylketonuria (PKU) disorder causes high levels of the amino acid phenylalanine in the blood. High levels of phenylalanine can cause brain damage and intellectual disabilities. At birth, babies are tested for the PKU disorder. Babies who are diagnosed with PKU do not develop the symptoms of the disorder and can have a normal healthy life if they stick to a strict diet of low protein intake their entire life and consume a tyrosine supplement.

Albinism is caused when melanin (pigment) is not produced. People with albinism lack pigment in their skin, hair, and eyes.



Sources: www.independent.co.uk/news/long_reads/synthetic-biology-microbes-dna-bacteria-phenylketonuria-pku-science-a8530741.html
https://www.boredpanda.com/albino-twins-models/

Using the simplified metabolic pathway above, discuss why the environment can prevent a person from developing PKU disorder, but not from developing albinism.

In your answer include:

- an explanation of a metabolic pathway
- an explanation of why a person with PKU must stick to a low protein diet for their entire life
- a discussion of how a person develops both PKU AND albinism.

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

He whārangi anō ki te hiahiatia.
Tuhia te (ngā) tau tūmahi mēnā e tika ana.

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 2021

91159M Demonstrate understanding of gene expression

Credits: Four

91159M

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of gene expression.	Demonstrate in-depth understanding of gene expression.	Demonstrate comprehensive understanding of gene expression.

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 – 19 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.