91159M

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NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

2

SUPERVISOR'S USE ONLY

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

Koiora, Kaupae 2, 2020

91159M Te whakaatu māramatanga ki te whakatinana ira

9.30 i te ata Rāapa 2 Hakihea 2020
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.

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 2–19 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: NGĀ IRAKĒTANGA

MĀ TE KAIMĀKA ANAKE

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

Tracey Greenwood, Richard Allan, *Year 12 Biology 2003*, (Hamilton: (Hamilton, Biozone, 2003), wh. 287.

(a) Ka pā mai i tētahi irakē i roto i tētahi ira pūmua kiriuhi (CFTR) te mate hūware tāpiapia. E whakaaturia ana te raupapa pītauira tauira mō tētahi wāhanga o te pūmua māori me te pūmua irakē i te Tūtohi 2 i raro. He **kikorangi** te kawakore whai pānga, ā, kua tārarotia.

Whakaotihia te Tūtohi 2.

Tūtohi 2

	Raupapa ira CFTR māori	**Raupapa irakē e pā mai ai te mate hūware tāpiapia**
aho tauira pītauira	TAA TA**G** **AA**A CCA CAA	TAA TAA CCA CAA
aho mRNA		
raupapa waikawa amino		

(b) Matapakitia te pānga o tēnei irakētanga ki te raupapa waikawa amino me te pūmua whakamutunga.

Me whakauru ki tō tuhinga:

- he whakaahuatanga o te irakētanga e whakaaturia ana ki te Tūtohi 2
- he whakamāramatanga mō te take ko ngā torutanga TAG me te TAA ka whakawaeheretia mō te waikawa amino ōrite
- he whakamāramatanga o te neke taitapa (frameshift) me tōna pānga ki te raupapa waikawa amino whakamutunga
- he matapakinga mō te āhua o te pānga o tēnei irakētanga ki te raupapa waikawa amino me te mahi a te pūmua whakamutunga.

QUESTION ONE: MUTATIONS

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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

Tracey Greenwood, Richard Allan, *Year 12 Biology 2003*, (Hamilton: Biozone, 2003), p 287.

(a) A mutation in a membrane protein gene (CFTR) causes the disease cystic fibrosis. The template DNA sequence for part of the normal and mutated protein is shown in Table 2 below. The affected bases are shown in **blue**, and underlined.

Complete Table 2.

Table 2

	Normal CFTR gene sequence	**Mutated sequence causing cystic fibrosis**
DNA template strand	TAA TA**G** **AA**A CCA CAA	TAA TAA CCA CAA
mRNA strand		
amino acid sequence		

(b) Discuss the effect of this mutation on the amino acid sequence and final protein.

In your answer include:

- a description of the mutation shown in Table 2
- an explanation of why the triplets TAG and TAA, code for the same amino acid
- an explanation of a frameshift, and how it affects the final amino acid sequence
- a discussion of how this mutation affects the amino acid sequence and final protein function.

MĀ TE KAIMĀKA ANAKE

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

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

MĀ TE KAIMĀKA ANAKE

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TŪMAHI TUARUA: KŌTUITUINGA PŪMUA

MĀ TE KAIMĀKA ANAKE

(a) Ki te hoahoa i raro, tapaina ngā hanganga whai ake:

- aho tauira pītauira
- aho mRNA
- tRNA
- tuipūmua
- taura pētinirau.

He mea urutau mai i Tracy Green rāua ko Richard Allan, *Year 12 Biology* 2011 (Hamilton: Biozone, 2011), wh. 89

(b) E hiahiatia ana te tauwhaituhi me te tahuringa hei waihanga i tētahi taura pētinirau.

Whakatauritea ēnei tukanga e rua ME te parahau i te take he aha e hiahiatia ai ēnei mea e rua hei waihanga i tētahi taura pētinirau.

Me whakauru ki tō tuhinga:

- he whakaahuatanga o te aho tauira pītauira, mRNA, tRNA, te tuipūmua me te taura pētinirau
- he whakamāramatanga o te tauwhaituhi
- he whakamāramatanga o te tahuringa
- me parahau he aha e hiahiatia ai ngā tukanga e rua hei waihanga i tētahi taura pētinirau.

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

[2] matūora

QUESTION TWO: PROTEIN SYNTHESIS

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(a) On the diagram below, label the following structures:

- DNA template strand
- mRNA strand
- tRNA
- ribosome
- polypeptide chain.

Adapted from Tracy Green and Richard Allan, *Year 12 Biology* 2011 (Hamilton: Biozone, 2011), p.89

(b) Transcription and translation are both required to build a polypeptide chain.

Compare and contrast these two processes AND justify why both are required to build a polypeptide chain.

In your answer include:

- a description of DNA template strand, mRNA, tRNA, ribosome and polypeptide chain
- an explanation of transcription
- an explanation of translation
- justify why both processes are required to build a polypeptide chain.

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

MĀ TE KAIMĀKA ANAKE

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

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

MĀ TE KAIMĀKA ANAKE

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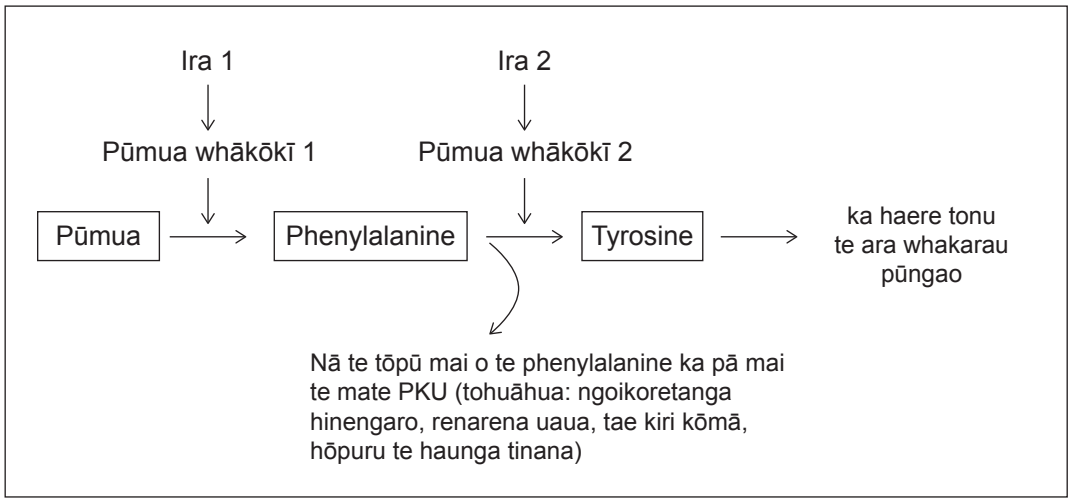
TŪMAHI TUATORU: NGĀ ARA WHAKARAU PŪNGAO

MĀ TE KAIMĀKA ANAKE

Pā mai ai te mate phenylketonuria (PKU) mai i te whakatōpū o te waikawa amino phenylalanine i roto i te aratoto o ngā tāngata whai irakē i roto i te ara whakarau pūngao.



Mā te whakamahi i te ara whakarau pūngao i runga ake, matapakitia he pēhea te whakahaere a ngā ira i te whakaputanga o te phenylalanine me te tyrosine.

Me whakauru ki tō tuhinga:

- he whakaahuatanga o te pātahitanga i waenga i ngā ira, ngā pūmua whākōkī me ngā hua i te ara whakarau pūngao
- me tautohu te ira ka pūmau te huri e pā mai ai te mate PKU
- he matapakinga he pēhea pea te tōpū o te phenylalanine i roto i te tangata
- he matapakinga he pēhea te whakaputa i te phenylalanine me te tyrosine.

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

QUESTION THREE: METABOLIC PATHWAYS

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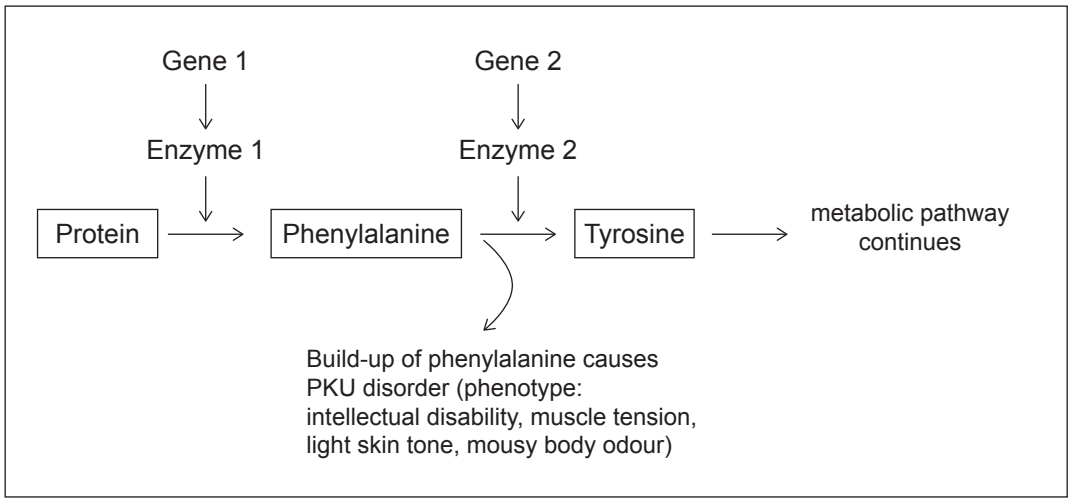
Phenylketonuria (PKU) disorder results from a build-up of the amino acid phenylalanine in the blood stream of individuals who have a mutation in the metabolic pathway.



Using the metabolic pathway above, discuss how genes control the production of phenylalanine and tyrosine.

In your answer include:

- a description of the relationship between genes, enzymes, and products in a metabolic pathway
- identification of the gene that permanently changes to produce the PKU disorder
- a discussion of how phenylalanine could build up in a person
- a discussion of how phenylalanine and tyrosine are produced.

There is more space for your answer to this question on page 17.

MĀ TE KAIMĀKA ANAKE

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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 2020

91159 Demonstrate understanding of gene expression

9.30 a.m. Wednesday 2 December 2020
Credits: Four

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.

91159M

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 2–19 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.