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SUPERVISOR'S USE ONLY

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Level 2 Biology, 2012

91159 Demonstrate understanding of gene expression

2.00 pm Thursday 22 November 2012
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.

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 2–8 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.

TOTAL

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You are advised to spend 60 minutes answering the questions in this booklet.

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QUESTION ONE: EFFECT OF ENVIRONMENT

The environment can affect the phenotype of an organism through direct changes to the genotype, and/or by the way in which the genotype is expressed.

Discuss this statement, with reference to **mutagens**, **gene mutations** and **environmental factors**.

In your answer you should give at least one example of each of these key terms.

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QUESTION TWO: PROTEIN SYNTHESIS

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Part of a sequence of mRNA is shown below.

(a) Complete the DNA strands by filling in the missing bases, AND identify which strand is the DNA template, by circling the appropriate label.

DNA	T	A	C	_	_	_	_	_	_	_	_	_	**Strand 1**
	A	T	G	_	_	_	_	_	_	_	_	_	**Strand 2**
mRNA	A	U	G	G	C	A	G	A	U	U	C	U	

(b) With reference to the table below, explain what is meant by the term 'redundancy due to degeneracy within the code'.

TABLE OF mRNA CODONS

FIRST CODON ELEMENT	SECOND CODON ELEMENT				THIRD CODON ELEMENT
	U	**C**	**A**	**G**	
U	PHE	SER	TYR	CYS	**U**
	PHE	SER	TYR	CYS	**C**
	LEU	SER	STOP	STOP	**A**
	LEU	SER	STOP	TRP	**G**
C	LEU	PRO	HIS	ARG	**U**
	LEU	PRO	HIS	ARG	**C**
	LEU	PRO	GLU	ARG	**A**
	LEU	PRO	GLU	ARG	**G**
A	ILE	THR	ASPN	SER	**U**
	ILE	THR	ASPN	SER	**C**
	ILE	THR	LYS	ARG	**A**
	MET	THR	LYS	ARG	**G**
G	VAL	ALA	ASP	GLY	**U**
	VAL	ALA	ASP	GLY	**C**
	VAL	ALA	GLU	GLY	**A**
	VAL	ALA	GLU	GLY	**G**

(c) Discuss the formation of a functional protein, beginning with a completed mRNA strand.

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In your discussion, you should refer to each of the following:

- translation
- ribosomes
- tRNA
- codons AND anticodons
- start AND stop codons
- polypeptide chains.

QUESTION THREE: METABOLIC PATHWAYS

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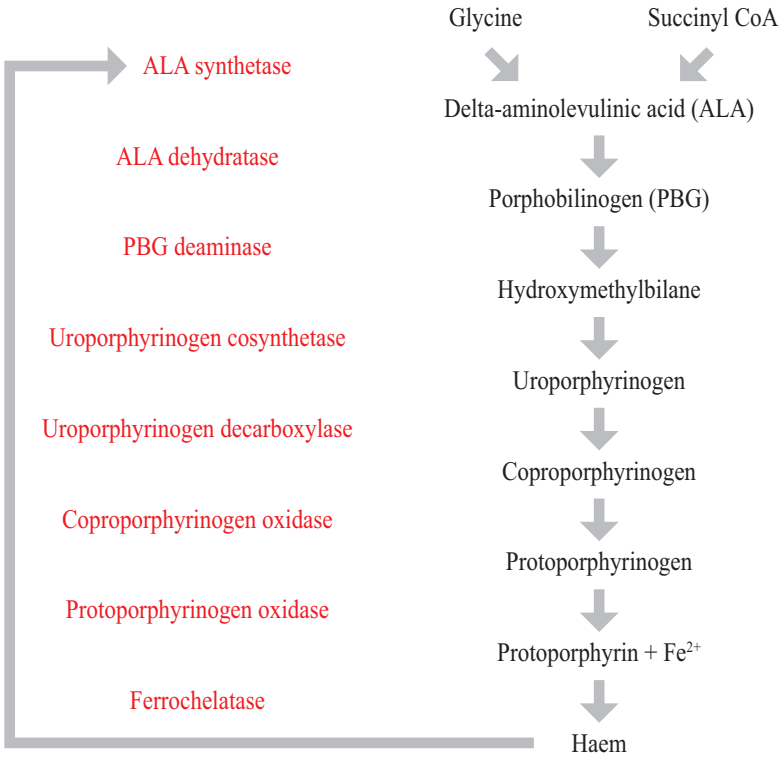
Porphyrias are a group of rare disorders passed down through families, in which an important part of haemoglobin, called haem, is not made properly.

Normally, the body makes haem in a multi-step process. Porphyrins are made during several steps of this process. Patients with porphyria have a deficiency of certain enzymes needed for this process. This causes abnormal amounts of porphyrins or related chemicals to build up in the body.



In the above diagram, the enzymes are shown in red.

Discuss why patients with Porphyria may have different causes of the disorder, and how two parents with Porphyria could give birth to children who do not have it.

In your answer you should consider:

- **description** of what is meant by the term 'metabolic pathway'.
- an **explanation** of why some enzymes might be deficient.
- an **evaluation** of the diagram to **justify** how there can be different causes of the disorder, AND how normal children could be born from affected parents.

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Extra paper if required.
Write the question number(s) if applicable.

QUESTION NUMBER

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