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NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

For Supervisor's use only

Level 3 Science, 2007

90729 Describe genetic processes

Credits: Four
9.30 am Wednesday 28 November 2007

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 answer 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.

For Assessor's use only	**Achievement Criteria**	
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Describe genetic processes. ☐	Explain genetic processes. ☐	Discuss genetic processes. ☐
Overall Level of Performance ☐		

You are advised to spend 45 minutes answering the questions in this booklet.

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QUESTION ONE: NUCLEIC ACIDS

The percentages of nitrogenous bases in pieces of nucleic acid are shown in the table below.

Base	A	G	C	T or U
Piece 1	29%	21%	21%	29%
Piece 2	45%	15%	30%	10%

(a) Name the type of nucleic acid represented by Piece 1. Explain your choice.

(b) Explain the differences in the percentages **within** the Piece 2 row.

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(c) Discuss why messenger RNA (mRNA) is a much shorter molecule than DNA. Consider the main **function** of each molecule in your answer.

(d) Describe the function of ribosomal RNA (rRNA).

(e) A piece of DNA contains 36% cytosine (C).

Calculate the percentage of adenine (A) present. Show your working.

QUESTION TWO: MUTATIONS

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This diagram shows both normal and sickle-shaped red blood cells. The change in the shape of the red blood cell is caused by a mutated gene that gives instructions to form an abnormal form of haemoglobin, causing the cells to become curved, like a sickle. This causes anaemia.

http://www.valleyhealth.com/images/image_popup/r7_sicklecells.jpg

A DNA sequence that codes for part of normal haemoglobin is:

TAC TGA CTC CTC GGA TTC

The mutated DNA sequence that codes for part of abnormal haemoglobin is:

TAC TGA CTC CAC GGA TTC

(a) Give the mRNA sequence for the **mutated** DNA sequence shown above.

_____

(b) Use the table below to determine the amino acid sequence produced by this mutation. Write your answer in the boxes below.

The Genetic Code

First Base	Second Base				Third Base
	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	Gln	Arg	A
	Leu	Pro	Gln	Arg	G
A	Ile	Thr	Asn	Ser	U
	Ile	Thr	Asn	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) Explain the significance of the DNA triplet TAC.

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(d) What is the anticodon for the amino acid Trp (tryptophan)?

(e) Another mutation occurs to the original DNA sequence to give the new sequence as shown below.

TAC TGA ATC CTC GGA TTC

Discuss the implication of this mutation to the functioning of the haemoglobin protein.

QUESTION THREE: DNA PROFILING

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DNA profiling is used to process genetic evidence gathered from crime scenes.
Below is a DNA profile showing crime scene DNA and the DNA of five suspects.

Suspect One	Suspect Two	Suspect Three	Suspect Four	Suspect Five	Crime Scene DNA
For copyright reasons, this resource cannot be reproduced here.					

http://www.mun.ca/biology/scarr/gel_electrophoresis.gif

(a) Explain why Suspect Three is most likely to have committed the crime.

(b) PCR is one of the techniques used to create the profile on page 6.

Describe PCR, AND explain why it is used in DNA profiling.

(c) Name and explain the main disadvantage associated with the use of PCR in crime scene work.

(d) Discuss why DNA profiling is widely used to gain information from DNA samples. Consider in your answer, areas other than crime scene analysis.

Extra paper for continuation of answers if required.
Clearly number the question.

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Question number