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90729

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

Level 3 Science, 2006

90729 Describe genetic processes

Credits: Four
9.30 am Tuesday 28 November 2006

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 2–9 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: PROTEIN SYNTHESIS

Key nucleic acids involved in protein synthesis

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http://www.hhmi.org/bulletin/pdf/ribosomes.pdf

(a) Name the enzyme that makes messenger RNA (mRNA).

(b) Discuss the relationship between **mRNA** and **DNA**.

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QUESTION TWO: POINT MUTATIONS

Phenylketonuria is a genetic disorder in which a mutation of a gene means that an enzyme (PAH) is no longer synthesised. The lack of PAH results in the build-up of abnormally high phenylalanine levels in the blood and brain, which causes mental retardation.

(a) Explain the relationship between a **gene** and an **enzyme**.

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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 / **Start**	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

(b) Below is part of the DNA sequence of the gene that codes for PAH.

A T A | G A T | T G A | C G G | C T T

(i) Use the table above to work out the amino-acid sequence for this section of the gene.

A mis-sense mutation has been identified that causes the error in the enzyme PAH. The DNA sequence has changed as shown below.

A T A | G A T | T G A | T G G | C T T

(ii) Describe what happens to the amino-acid sequence as the result of this mutation.

Another mutation gives the following DNA sequence:

A T A	G T T	GAC	GGC	TT

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(iii) Name the type of mutation shown above.

(iv) Discuss the changes to the structure and function of the enzyme PAH as a result of this mutation.

QUESTION THREE: GENETIC ENGINEERING OF PLANTS

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Genetic engineering can be used to produce transgenic organisms.

(a) Describe a transgenic organism.

Genetic engineering requires at least two pieces of DNA to be joined together.

(b) State the name of the enzyme that joins together the pieces of DNA.

(c) Explain how the enzyme named in (b) joins together two pieces of DNA. Draw a labelled diagram to help your answer.

Genetic engineering has been used in a variety of ways. One example is that a gene for a virus coat protein has been cloned and inserted into tobacco, potato and tomato plants. The coat protein makes the plants much more resistant to viral attack.

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(d) One concern about genetically engineered plants is that the pollen from these plants will spread long distances.

Discuss the implications of such pollen spreading.

QUESTION FOUR: DNA PROBES

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DNA probes are single stranded lengths of DNA between 20–100 nucleotides in length. One type of probe is fluorescently labelled and shows up when illuminated with ultraviolet light. DNA probes are used to identify and label specific DNA fragments.

(a) Describe ONE practical use of DNA probes.

(b) Explain how DNA probes are able to find a specific fragment of DNA in a mixture of different pieces of DNA. Draw a diagram to help your answer.

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

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Question number	