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NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

For Supervisor's use only

Level 3 Science, 2008

90729 Describe genetic processes

Credits: Four
2.00 pm Thursday 20 November 2008

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 2–10 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.

Assessor's use only

QUESTION ONE: DNA REPLICATION AND PCR

(a) Explain the role of complementary base pairing in the production of an exact copy of DNA during replication. Labelled diagrams may assist your answer.

(b) PCR (polymerase chain reaction) is a laboratory process used to make multiple copies of DNA.

Discuss how contamination with foreign DNA could be a problem in the use of PCR in EITHER forensics, OR archaeology, OR gene therapy.

Assessor's use only

QUESTION TWO: PROTEIN SYNTHESIS

Assessor's use only

(a) Describe the role of **transcription** in the production of a protein molecule.

(b) Discuss why transfer RNA (tRNA) molecules have a shorter length than messenger RNA (mRNA) molecules, by considering the function of each molecule in the process of protein synthesis.

(c) Discuss why there are three bases to a codon, rather than only two. Use the amino acid table below to support your answer.

Assessor's use only

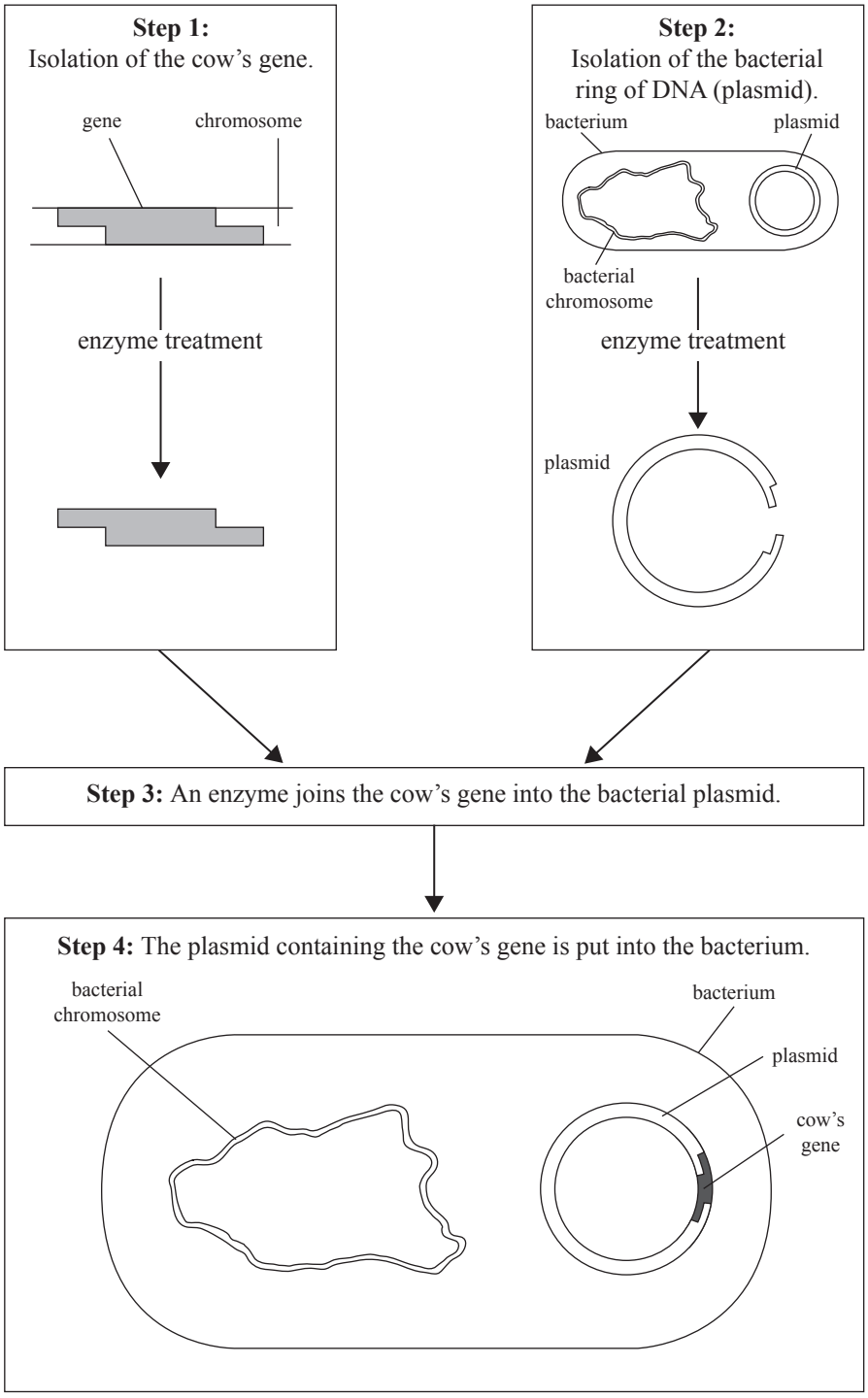
The Genetic Code

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

QUESTION THREE: TRANSGENESIS

The production of milk from cows can be increased by injecting them with a hormone (a protein) that is produced by genetically engineered bacteria. The gene that codes for the hormone is transferred from a cow into the bacterium. The steps are outlined in the diagram below.

Steps in genetically engineering bacteria



Assessor's use only

(a) Describe what is meant by the term **transgenesis**.

Step 1 shows the isolation of the cow's hormone gene.

(b) Explain how a restriction enzyme cuts the hormone gene from the cow's chromosome.

The hormone gene is inserted into a bacterial plasmid using the enzyme DNA ligase.

(c) Describe the role of DNA ligase in joining the hormone gene into the bacterial plasmid.

(d) Discuss why bacteria are used to produce large amounts of this hormone.

Assessor's use only

QUESTION FOUR: IT'S A QUESTION OF ETHICS

Assessor's use only

Cystic fibrosis is a genetic disorder. It affects the mucus lining of the lungs, leading to breathing problems and other respiratory difficulties.

Research is being undertaken into cystic fibrosis, including gene therapy treatments. Gene therapy involves delivering a copy of the normally-functioning cystic fibrosis gene to the cells lining the lungs. The normal gene is contained within a genetically modified plasmid, and delivered to lung cells using a vector such as a virus.

Discuss the scientific and ethical issues involved in cystic fibrosis gene therapy research.

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

Assessor's use only

Question number