For Supervisor's use only

2

90459

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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

Level 2 Biology, 2004

90459 Describe concepts and processes that relate to genetic variation and change

Credits: Three
2.00 pm Thursday 25 November 2004

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 pages 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.

Achievement Criteria *For Assessor's use only*		
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Describe biological concepts and processes that relate to genetic variation and change. ☐	Explain biological concepts and processes that relate to genetic variation and change. ☐	Discuss biological concepts and processes that relate to genetic variation and change. ☐
Overall Level of Performance ☐		

You are advised to spend 40 minutes answering the questions in this booklet.

Assessor's use only

QUESTION ONE: FRUIT FLIES

In 1933 Thomas Morgan received a Nobel Prize for his studies of the genetics of the fruit fly *Drosophila melanogaster.* These flies are used because they are easy to control in the laboratory and they have a short life cycle, meaning results can be obtained quickly.

At the start, Morgan bred red-eyed fruit flies over a period of more than two years and the results were always red-eyed offspring. But one day he noticed that a white-eyed individual was produced.

(a) **Describe** how this white-eyed individual arose.

Morgan and his colleagues did some investigations on the **crossing over** of chromosomes and **recombination** of genes in the fruit flies. A fly with normal straight wings and a grey body was crossed with a fly with vestigial (short and wrinkled) wings and a black-coloured body.

normal wing and grey body fly

vestigal wing and black body fly

The offspring all had normal wings with grey bodies.

The usual ratio for independently assorting genes in a cross between an individual that is heterozygous for both genes with another individual that is homozygous recessive for both genes, would be 1 : 1 : 1 : 1.

When one of these F_1 offspring was then crossed with a fly homozygous for the recessive alleles, the following numbers of offspring were obtained:

Normal wing and grey body	90	Vestigial wing and grey body	11
Normal wing and black body	9	Vestigial wing and black body	86

(b) **Explain** this result.

(c) **Describe** the **process** of crossing over between two homologous chromosomes. Clearly labelled diagrams may be used.

Assessor's use only

(d) **Explain** the importance that **crossing over** between homologous chromosomes has for a population.

QUESTION TWO: MUTATIONS AND GENE POOL

Assessor's use only

Mutations affect gene pools and are important for evolution..

(a) Define mutation and gene pool.

Mutation:

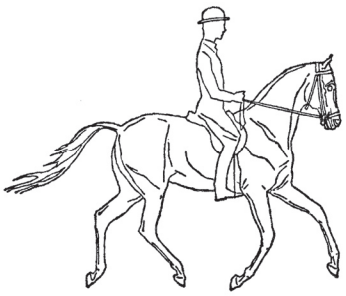
Gene pool:

(b) **Discuss** how a mutation could affect the **population** over a period of time.

QUESTION THREE: HORSE BREEDING

Assessor's use only

In horses, black coat colour is influenced by the dominant allele (**B**) and chestnut coat colour by the recessive allele (**b**). Trotting gait is due to a dominant gene (**T**), pacing gait to the recessive allele (**t**).



Horse trotting

Horse pacing

A horse trainer wanted to find the **genotype** of a black trotter she had just bought.

(a) Give the **genotype** and **phenotype** of the horse she would use to find out the genotype of a black trotter. **Explain** your answer.

Assessor's use only

(b) Use a Punnett square to work out the **phenotypic ratio** of all the possible offspring when a male black trotter that is **heterozygous** for both traits is mated with a female that is **heterozygous** for both traits.

		Possible sperm			
Possible eggs					

Phenotype ratio:

(c) **Explain** why, when breeding chestnuts together, she would not get any black foals, but when breeding black horses, she could get chestnut foals.

QUESTION FOUR: HEDGEHOGS

Assessor's use only

Hedgehogs found throughout New Zealand are the descendants of a small number of animals introduced from England in the 1870s. **Discuss** why the present gene pool of the New Zealand hedgehog population is unlikely to be the same as that of the present English population.

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

Assessor's use only

Question number