NAME TEACHER

**NQA**

Nayland Qualification Authority

**Level two Biology, 2013**

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| **91157: Demonstrate understanding of genetic**  **variation and change**  Credits: 4 |

### Suggested Time: 70 minutes

**Instructions**

* Answer all questions in the spaces provided.
* You must hand this examination paper to the supervisor at the end of the examination.
* Check that this paper has all 12 pages numbered and in the correct order.

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| Achievement Criteria. (for assessors only) | | | | | |
| Achievement | | Achievement  with Merit | | Achievement  with Excellence | |
| Demonstrate understanding of genetic variation and change |  | Demonstrate in-depth understanding of genetic variation and change |  | Demonstrate comprehensive understanding of genetic variation and change. |  |
| Overall Level of performance: | | | |  | |

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| **Question 1 Sea lions and Tuatara**  The New Zealand Sea lion is the rarest Sea lion in the world. Once widespread along the coastal shores of New Zealand, they are now found mainly in New Zealand’s sub-Antarctic islands. Sea lion numbers reduced dramatically in the 1900’s and only about 10,000 individuals remain today. Sea lion pup production has declined by 40% over the last decade.  The northern tuatara is a native reptile of New Zealand. Like the New Zealand Sea lion, Tuatara were once common on the mainland, but now are found on only 32 offshore islands.  In 2007, a small number (130) were taken from one offshore island to the predator-free Karori Wildlife Sanctuary in Wellington, to establish a new population.  Both photos: www.doc.govt.nz | NZ sea lion. Photo: Jeff Flavell.  Tuatara, close up of head and shoulders, Stephens Island.  Photo: Peter Morrison. |

Using the examples above, explain the effect of a population bottleneck and the

founder effect, and relate this to genetic drift.

Using the Tuatara as an example describe how the effect of genetic drift can be

minimised and evaluate the effectiveness of any methods you describe.

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| **Question 2 Genetic variation** |  |

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| There are 4 blood groups in humans, shown in the table.  These are determined by **3 alleles** IA, IB or i. This is an example of a multiple allele system. | **Blood group (phenotypes)** | **Possible genotypes** |
| O | i i |
| A | IA IA or IA i |
| B | IB IB or IB i |
| AB | IA IB |

Alleles IA and IB are co-dominant. Both IA and IB alleles are dominant to allele i. Allele i is recessive.

1. Explain what is meant by the term **co-dominance.** Use blood groups in your explanation and distinguish co-dominant alleles from alleles that can be described as having **Incomplete dominance**

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1. A woman with blood group type B, whose mother was type O, marries a type O man. What are the possible phenotypic ratios of their offspring? Explain how you determined this.

Diagram space:

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Meiosis is a type of cell division that results in the production of gametes.

Discuss how the processes that occur during meiosis AND fertilisation lead to genetic variation.

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| **Question 3** **Tail-less felines**  Manx cats are born with no tails. This is caused by a mutation in a gene required for normal spinal development,  The tailless Manx condition is produced by the heterozygous genotype (Tt).  Cats with normal tails are genotype tt.  Kittens homozygous for the T allele die before birth as a result of spinal defects and central nervous system abnormalities.   1. Define the term ‘mutation’. | File:Manx by Gambier Bolton.JPG  http://commons.wikimedia.org/wiki/File:Manx\_by\_  Gambier\_Bolton.JPG |

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1. Two Manx cats are mated. Give the expected phenotype ratio of the kittens and explain how you got this. You could use a punnet square to support your answer.

Phenotype ratio: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Diagram space if needed:

Explanation:

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**Mutations are considered to be the ultimate source of genetic variation**.

Discuss this statement. Consider the significance of both somatic and gametic mutations.

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| **Question 4 Poultry problems**  When chickens with white feathers are crossed with black-feathered birds, their offspring all have slate blue feathers.  When these blue chickens are crossed among themselves, they produce white, blue, and black offspring in the ratio of 1 : 2 : 1 respectively.   1. Explain how these feather traits are inherited. Use appropriate symbols to show the genotypes and phenotypes for these chickens.   Draw a punnet square to support your answer. | File:Andalusian Blue chicken (male).jpg  http://commons.wikimedia.org/wiki/File:  Andalusian\_Blue\_chicken\_(male).jpg |

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Space for punnet square:

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| In turkeys, bronze colour (R) is dominant over red (r) and normal feathers (H) are dominant over hairy feathers (h).  A turkey farmer bought a bronze coloured turkey with normal feathers and wants to use it to establish a population of pure-breeding bronze, normal feathered turkeys. Back on the farm he has a group of turkeys that display a mixture of the colour and feather phenotypes.  http://commons.wikimedia.org/wiki/File:  Male\_north\_american\_turkey\_supersaturated.jpg | File:Male north american turkey supersaturated.jpg |

1. Consider the options available to the farmer:

* explain how the farmer could determine the genotype of his new turkey
* explain how he would go about establishing a flock of pure-breeding bronze, normal feathered turkeys and analyse the methods he might chose
* evaluate the likely long term success of the farmer’s objective and any reasons he might not be totally successful.

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