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NZQA | Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 1 Science 2023

90948 Demonstrate understanding of biological ideas relating to genetic variation

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of biological ideas relating to genetic variation.	Demonstrate in-depth understanding of biological ideas relating to genetic variation.	Demonstrate comprehensive understanding of biological ideas relating to genetic variation.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (DO NOT WRITE IN THIS AREA / DO NOT WRITE). This area will be cut off when the booklet is marked.

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QUESTION ONE: PINK MANTA RAYS

(a) Complete the missing labels in the following diagram.

Adapted from: https://upload.wikimedia.org/wikipedia/commons/b/b4/0321_DNA_Macrostructure.jpg

(b) Define the term mutation.

(c) Scientists in Australia have found a pink manta ray. This colouring is caused by a genetic mutation.

Normal-coloured manta ray

Source: https://en.wikipedia.org/wiki/Manta_ray#/media/

Pink-coloured manta ray

Source: https://resources.stuff.co.nz/content/dam/images/4/z/0/8/7/f/image.related.StuffLandscapeSixteenByNine.1420x800.255ahh.png/1660528054032.jpg?format=pjpg&optimize=medium

Explain how a mutation can give the manta ray a pink colour.

In your answer you should use the terms: DNA, gene, allele, mutation, and phenotype.

(d) Flamingos are not born pink, and this colour is not inherited. As they get older, flamingos turn pink as a result of the food that they eat.

Source: https://edition.cnn.com/style/article/flamingos-mexico-conservation-photography-climate-hnk-spc-intl/index.html

Compare the inheritance of the pink colouration in manta rays to the development of pink colouration in flamingos.

In your answer you should use the terms environmental and genetic.

QUESTION TWO: STRIPES

In sheep, a recessive allele (b) causes offspring to be born striped. The dominant allele (B) leads to solid black offspring.

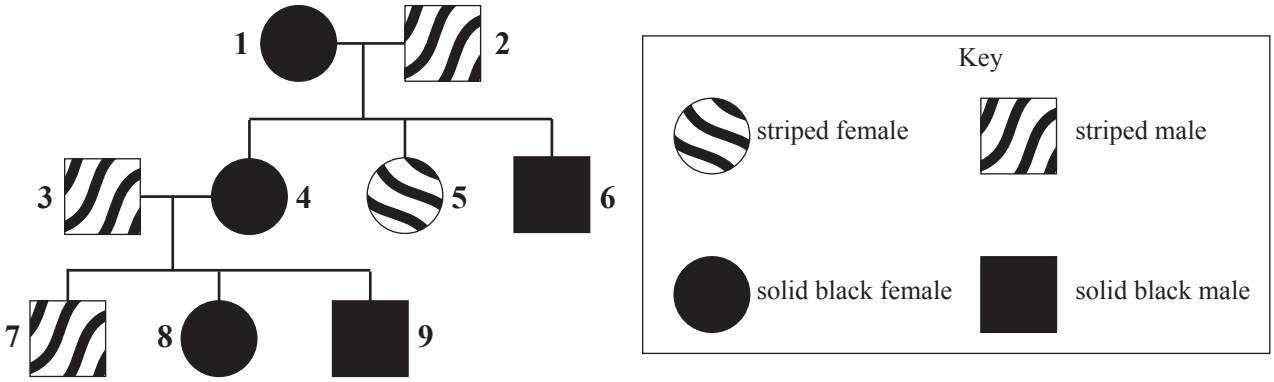
Source: www.colouredsheep.org.nz/wp-content/uploads/2020/02/Lyn-Hansens-Transverse-stripes-cropped.jpg

Source: https://stock.adobe.com/search?k=%22black+lamb%22&asset_id=456206583

(a) State the possible phenotypes for the following genotypes.

Genotype	Phenotype
BB	
Bb	
bb	

The striped and solid black colours in a family are shown in the pedigree chart below.



(b) State the genotypes of Individual 3 and Individual 4.

Individual 3: _____ Individual 4: _____

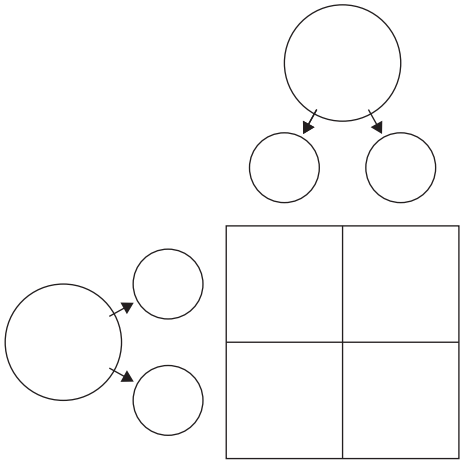
(c) Explain how you worked out the genotype for Individual 4.

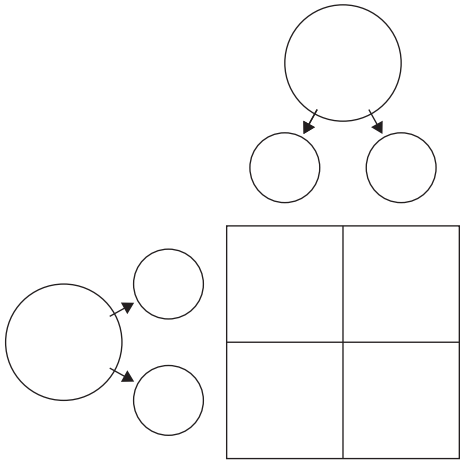
You should support your answer using evidence from BOTH the parents AND offspring of Individual 4.

(d) Discuss how a farmer could use crosses (breeding) to find out if a solid black sheep has a pure breeding genotype for this trait.

In your answer you should:

- define pure breeding and genotype
- state the possible genotypes of the black sheep
- use the Punnett squares provided.





QUESTION THREE: DEEP BLUE

Penguins are successful in New Zealand waters because they can use oxygen efficiently, which allows them to dive deep to catch their food. Some penguins can dive deeper than others, depending on the genetic information they have.

Source: https://i.pinimg.com/originals/7e/0d/47/7e0d47409a7076c4912956faa82652f9.jpg

(a) Define the term genetic variation, using penguins as an example.

(b) Explain how sexual reproduction contributes to genetic variation, and affects the diving ability of penguins.

In your answer, you should consider the processes of sex cell formation (meiosis) and fertilisation.

Question Three continues on the following page.

(c) The ability to dive deeper is important, as the food source of penguins now lives in deeper water because of sea temperature rises.

Discuss how the ability to dive deeper could become more common in a population of penguins over time.

In your answer, you should discuss the importance of variation within the penguin population for survival in a changing environment.

Extra space if required.
Write the question number(s) if applicable.

QUESTION NUMBER

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QUESTION NUMBER