

90948



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1

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Level 1 Science 2022

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.

You should attempt ALL the questions in this booklet.

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 (///). This area may be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

QUESTION ONE: SICKLE CELLS

Sickle cell disease is caused by a mutation in a gene. This leads to the production of red blood cells with a different shape.

Normal gene:

↙ Start of coding sequence

DNA sequence	C A C	G T G	G A C	T G A	G G A	C T C	C T C
	G T G	C A C	C T G	A C T	C C T	G A G	G A G

Gene with mutation:

DNA sequence	C A C	G T G	G A C	T G A	G G A	C A C	C T C
	G T G	C A C	C T G	A C T	C C T	G T G	G A G



Adapted from: www.indiatimes.com/health/healthyliving/what-is-sickle-cell-diseases-237205.html?picid=812711

(a) What is a mutation?

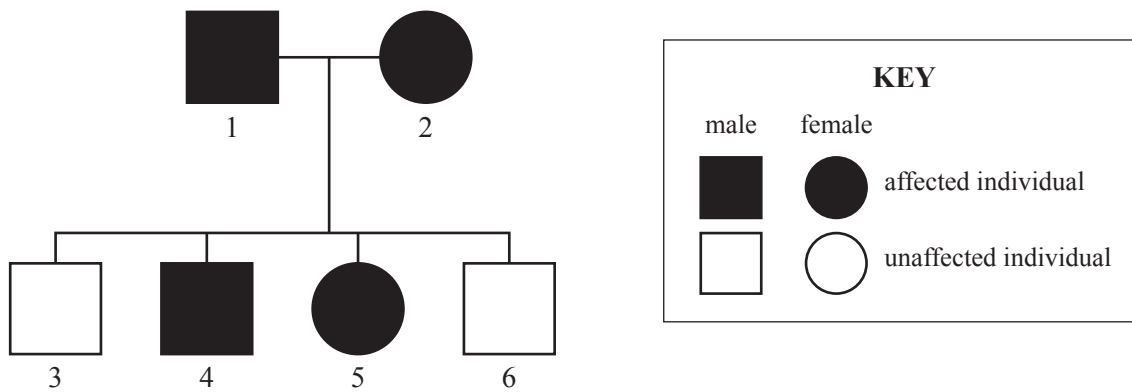
(b) Explain how a mutation in a gene can cause sickle cell disease.
You should include the terms DNA, mutation, gene, allele, phenotype.

(c) Explain how a mutation can be passed on to the next generation.

QUESTION TWO: HUNTINGTON'S DISEASE

Below is a pedigree chart for a family with the genetic disorder Huntington's disease.

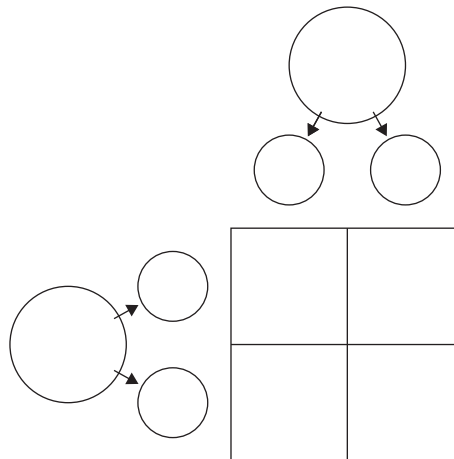
The Huntington's allele (H) is dominant over the unaffected allele (h).



- (a) Work out the genotypes of the following three individuals.

Individual 1: _____ Individual 2: _____ Individual 3: _____

- (b) Complete the Punnett square for the cross between Individual 1 and Individual 2.



- (c) Complete the expected ratio and actual ratio for the cross between Individual 1 and Individual 2.

	Expected Ratio	Actual Ratio
Affected by Huntington's:	:	:
Unaffected by Huntington's:	:	:

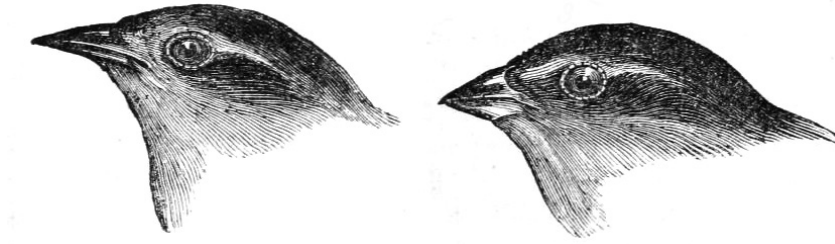
- (d) The cross between Individuals 1 and 2 in the pedigree chart opposite shows two affected children and two unaffected children.

Explain the difference in the actual number of affected offspring compared to the expected number of affected offspring in the cross between Individuals 1 and 2.

- (e) Explain how the pedigree chart opposite can be used to show that Huntington's disease is not recessive.

QUESTION THREE: GENETIC VARIATION

Birds with different beak sizes from the same population are shown below.



Adapted from: <https://www.biodiversitylibrary.org/page/2010582#page/392/mode/1up>

- (a) Explain how sexual reproduction leads to genetic variation in a bird population. In your answer, you should include the processes of gamete formation (meiosis) and fertilisation. You may use labelled diagrams, with notes, to support your answer.

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

QUESTION
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