The Genetics of Sickle-cell Anaemia – Answer Sheet

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| **TASK 17: SCIENTIFIC INQUIRY- The Genetics of Sickle-cell Anaemia**  Read and answer questions on the role of genetics on the inheritance of sickle cell anaemia. **[20 marks]**  Students have 45 minutes to complete the assessment. |

NAME: **ANSWER KEY**

Write your answers clearly in the space provided on this Answer Sheet. If you need more paper, there is a spare page at the end of this Answer Sheet.

QUESTION 1 [a] \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_HbS HbS [1]

[b] ­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_HbA HbS [1]

[=2 marks]

QUESTION 2

Cross: HbA HbS X HbA HbS - 1 mark

|  |  |  |
| --- | --- | --- |
|  | HbA | HbS |
| HbA | HbA HbA  normal | HbA HbS  trait |
| HbS | HbA HbS  trait | HbS HbS  anaemia |

1 mark

25% homozygous for Sickle-cell Anaemia – 1 mark

[3 marks]

[3]

QUESTION 3

|  |  |  |
| --- | --- | --- |
|  | HbA | HbS |
| HbA | HbA HbA  normal | HbA HbS  trait |
| HbS | HbA HbS  trait | HbS HbS  anaemia |
|  | HbA | HbA |
| HbA | HbA HbA  normal | HbA HbA  normal |
| HbA | HbA HbA  normal | HbA HbA  normal |

Couple both with Sickle-cell Trait – produce

25% normal

50% with the trait

25% with anaemia – generally die in childhood

( 1 mark)

100% normal

Hence the offspring of the normal cross will have more reaching adulthood (100%) (1 mark) than the heterozygous cross where 75% will reach adulthood (1 mark)

**Total – 3marks – must have all information to get the mark for working out**

[3]

QUESTION 4  **The death of children with Sickle-cell Anaemia will reduce the frequency of the gene for sickling, this removes the from the gene pool**

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QUESTION 5 **Not supported – the rate that genes are lost from the population is 100 times average mutation rate, hence does not explain how the gene for sickling is not reducing**

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QUESTION 6 **Not supported – no evidence people with Sickle-cell trait produce more children that those with normal haemoglobin …implication that fertility is not a factor.**

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QUESTION 7  **Malaria as the parasites (cause of transmission) multiply inside red blood cells.**

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QUESTION 8 So, percentage sicklers has gone from ~40% to ~22% in parts of Africa. By mixing with European populations, the frequency of sicklers will decrease as

The introduction of more ‘normal’ genes (assumption that Europeans are all normal) will ‘dilute’ the sickle cell genes and they will disappear from the gene pool

|  |  |  |
| --- | --- | --- |
|  | HbA | HbA |
| HbA | HbA HbA  normal | HbA HbA  normal |
| HbS | HbA HbS  trait | HbS HbA  trait |

Hence: this cross produced 50% sicklers

In a heterozygous cross, at least 75% have at least one sickle gene…

Trait or anaemia (see Q 2/3)

Gene frequency decreases as individuals with anaemia leave the population …which they would get from heterozygous crosses

[2]

QUESTION 9

**When an individual homozygous for sickling dies, genes are removed from the gene pool, hence the frequency of the gene for sickling will decrease.**

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