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| **QUESTION ONE - Evidence** | | | **Achievement** | | **Merit** | | **Excellence** | |
| **Genetic bottleneck**: Reduction in genetic variation due to the rapid decrease in population size and loss of alleles.  **Natural** **selection:** Individuals best adapted to the environment will survive and reproduce.  **Founder Effect**: Differences in allele frequencies between two populations (past or present) is due to a small/unrepresentative group of founders. It is the result of genetic drift.  **Genetic Drift:** The change in the frequency of alleles within a population due to chance.  EXPLANATIONS:  **Genetic drift**:  Frequency of the alleles can change through chance especially if the population is or becomes small  **Natural Selection**:  Individuals with the most fit (well adapted) phenotype will survive to reproduce with greater success. Subsequent generations possess a higher allele frequency of favourable alleles.  **Allele frequency** is the prevalence (% or proportion) of each allele in a gene pool. | | | Defines  genetic bottleneck  genetic drift  natural selection  founder effect. | | Explains giving reasons  genetic bottleneck – explains that alleles are lost due to foreign species (predation/loss of habitat) reducing genetic diversity due to death of all but one breeding pair of surviving birds.  natural selection did not affect the rim laying allele frequency between 1980 and 1989. Changes during this time were due to artificial selection/human intervention which removed the selection pressure against the dominant rim-laying allele.  how natural selection reduced the frequency of the rim-laying allele after 1989 by explaining reasons for lower reproductive success of these birds (insufficient incubation to hatch, falling from nest)  Loss of alleles prior to 1980 due to chance, not fitness. Or the loss of alleles from the black robin population prior to 1980 was not due to natural selection, but due to introduced species. | | Discusses links between past and present relative allele frequencies and:  genetic drift – presence of rim laying is non-representative of original population.  bottleneck – the survivors made it through by chance, not as a result of fitness. None of the black robins carried alleles resulting n their survival over foreign species, as they were all vulnerable, thus genetic drift not selection accounts for the allele frequency of rim-laying.  founder effect – increase in rim laying allele/behaviour is non-representative and due to all living birds sharing common ancestors (sole surviving breeding pair)  natural selection- comprehensive discussion of how the effect of natural selection did affect the frequency of the rim-laying allele at some times, and not at others. | |
| **NØ** | **N1** | **N2** | **A3** | **A4** | **M5** | **M6** | **E7** | **E8** |
| No relevant information. | Statements from Achievement incorrect. | Provides ONE correct statement from Achievement. | Provides TWO correct statements from Achievement. | Provides THREE correct statements from Achievement. | Explains TWO correct processes from Merit | Explains THREE correct processes from Merit | Links TWO processes to changes in allele frequencies | Links THREE processes to changes in allele frequencies |

**Assessment Schedule – Biology 2.5: Demonstrate understanding of genetic variation and change (AS 91157)**

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| **QUESTION TWO Evidence** | | | **Achievement** | | **Merit** | | **Excellence** | |
| (a) Possible genotypes for black polled are **BBpp** or **Bbpp** | | | Provides both possible genotypes for black polled in (a)  Genotypes for both parents correct in (b)  Punnett square completed correctly.  Phenotypes proportions or percentage given or specifically states 25% chance in (c)  Defines migration | | Genotype for both parents explained fully in (b)  Migration explained as gene flow influencing allele frequencies and observed phenotypes.  Explains benefit of genetic variation linked to increased potential for the population to survive future changes. Alleles present in the Islandic sheep that were not previously in the Corriedale sheep may provide new resistance to illness or adverse conditions.  Disadvantage of horned phenotype linked to decrease in survival rate due to injury  Explains how variation is produced through independent assortment resulting in gametes with new combinations of alleles. | | Breeding horned sheep with polled sheep would produce all polled sheep since the allele for horns is recessive. Controlling breeding would remove the phenotype, but not the genotype. Thus genes also present on the chromosome containing the honed allele would remain in the population.  Due to independent assortment not all the Icelandic alleles would necessarily be lost when the chromosome housing the horned allele fails to be passed on. Gametes produced from heterozygous lambs could have any number of the other 26 chromosomes that were inherited from the original escaped male since these chromosomes would have assorted independently. | |
| (b) To obtain a brown 4-horned lamb, **bbpp**, both parents must carry a brown allele and a 4-horned allele ie. **b and p**  Therefore parents must have genotypes **bbpp**X **BbPp** | | |
| |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | BP | Bp | bP | Bp | | bp | BbPp | Bbpp | bbPp | Bbpp | |  |  |  |  |  |   **(c) Phenotypes:** 1 black polled: 1 black horned: 1brown polled :1 brown horned  **Therefore 25%** chance of producing a black polled lamb BbPp | | |
| **(d) Migration** describes gene flow via the introduction of individuals from outside the population.  **Independent Assortment** is the random segregation of non-homologous chromosomes into gametes during meiosis. New combinations of maternally and paternally inherited chromosomes are found in the gametes.  (note: crossing over is between homologous chromosomes, so does not relate to independent assortment in this case) | | |
| **NØ** | **N1** | **N2** | **A3** | **A4** | **M5** | **M6** | **E7** | **E8** |
| Statements from Achievement incorrect. | ONE Achievement statement. | TWO Achievement statements. | THREE Achievement statements. | FOUR Achievement statements. | THREE correct Merit statements. | FOUR OR MORE correct Merit statements. | ONE Excellence statement. | BOTH Excellence statements. |

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| **QUESTION THREE - Evidence** | | | **Achievement** | | **Merit** | | **Excellence** | |
| (a) Mutation can be defined as a (permanent) change in the nucleotide sequence of the DNA.  Mutagen is an environmental factor that causes a change in nucleotide sequence  Gametic mutations only occur in sex cells during meiosis, eg, sperm / eggs (accept pollen).  Explanation of why these are different in terms of producing new alleles that can enter the gene pool include:  A mutation which changes the DNA / base sequence might occur (by, eg substitution / deletion / mutagenic influence) which creates a new allele.  Gametic mutations are heritable transferred to the next (& possibly subsequent) generations provided they do not inhibit reproduction or result in an unfit phenotype.  . | | | * Defines mutation. * Defines mutagen * Describes gametic mutations   Punnett square completed correctly.  Phenotypes and proportions or percentages given. | | Good explanations of:  A change in the DNA / base sequence which creates a new allele during meiosis.  **OR**  How gametic mutations may are passed to all cells at fertilisation.  Explains sources of variation.  Explanation of segregation allowing 2 offspring from same parent to inherit different traits.  Fully annotated diagram showing crossing over to produce a chromosome with a new combination of alleles | | Comprehensive discussion linking  Crossing over to the presence of one star eyed curly winged fly  Segregation producing offspring with only one of the two lethal traits  Star and Curly alleles on same chromosome producing near 1:1 ratio of these traits in offspring. Therefore, these genes are linked/not independently assorting | |
| (b) Rr x Rr.   |  |  |  | | --- | --- | --- | |  | R | r | | R | RR | Rr | | r | Rr | rr | | | |
| (c) Phenotypes: 2 curly : 1 normal (RR lethal and therefore do not develop) | | |
| (d) Segregation is the separation of chromatids (of homologous chromosomes) into different gametes, producing gametes with only one half of the parental genotype (note: this is not to be confused with independent assortment)  Crossing over results in recombinant chromosomes with new combinations of alleles | | |
| **NØ** | **N1** | **N2** | **A3** | **A4** | **M5** | **M6** | **E7** | **E8** |
| Statements from Achievement incorrect. | Provides ONE correct statement from Achievement. | Provides TWO correct statements from Achievement. | Provides THREE correct statements from Achievement. | Provides FOUR correct statements from Achievement. | Provides TWO correct statements from Merit. | Provides THREE correct statements from Merit. | Provides ONE bullet point from Excellence. | Provides TWO bullet points from Excellence. |

# Judgement Statement

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|  | Not Achieved | Achievement | Achievement  with Merit | Achievement  with Excellence |
| Score range | 0 – 7 | 8 – 12 | 13 – 18 | 19 – 24 |