Assessment Schedule – 2005

Biology: Describe genetic variation and change (90459)

Evidence Statement

Question	Achievement	Achievement with Merit	Achievement with Excellence
1(a)	**Describe TWO of** • Independent assortment. The separation of each pair of alleles is not influenced by the separation of another. **OR** • Segregation / one chromosome from each homologous pair is selected at **random** to form each gamete. **OR** • Crossing over / recombination part of one homologue may swap to the other homologue. **OR** • Half number of chromosomes in gamete. • The gametes are not identical to each other. • The gametes are different to parent cells.		
1(b)	**Description of how the chromosome number remains the same.** Reduction division / meiosis / chromosome number is halved followed by a fusion of two gametes – labelled annotated. Must be chromosome <u>number</u> halved. Diagrams may be used. Halving plus fusion / fertilisation. Both ideas needed.	**Give a reason for how numbers remain constant:** Somatic cells have 2N. Gametic cells N. In the reduction division homologous chromosomes separate into gametes and the chromosome number is restored (2N) when two gametes fuse. Explains the need for reduction division followed by fusion.	

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1(c)	**Describe TWO factors that contribute to genetic variation.** Eg • **mutation** change in genetic makeup of a cell • **meiosis** - independent assortment - segregation - recombination	**Explain how TWO factors lead to variation. Must include the idea of inheritance.** Eg **Mutation** – change in the genetic makeup. If this change occurs in the somatic cells, it cannot be passed on, but if in the sex cell, it may be inherited. **Meiosis** – each parent passes on one member of each pair of homologous chromosomes selected at random. At fertilisation the resulting zygote contains half it's chromosome complement from each parent. Alleles from each parent are present in new individual and this gives variation. (Recombination)	**Discussion includes BOTH mutation and an aspect of meiosis <u>linked</u> to variation.** The link is made when mutation in gametes allows it to be inherited and also includes the idea of random assortment
2(a)	**Description of genotype and phenotype.** Genotype: All BbTt Incorrect if more than one genotype stated. Phenotype: All Barker normal-tailed. Both must be correct "All" not needed unless answer is contradicted by phenotype or Punnett square.		
2(b)	Cross showing BbTt × BbTt Gametes BT, Bt, bT, bt **All correct** **OR** answer consistent with 2a (carry over error) If more than one genotype stated in (a) – any one of these used correctly in (b) is OK.		
2(c)	**Phenotypic ratio correct** 9 barker normal tail 3 barker twisted tail 3 silent normal tail 1 silent twisted tail Must include descriptor of phenotype. Expressed as a ratio, not fractions. **OR** answer consistent with answer in 2b		

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2(d)	**Description recognises possibility of heterozygous and selecting for breeding** B_T_ × with bbtt (Test Cross) / dogs with twisted tails / with homozygous recessive Just Test Cross or Back Cross not sufficient.	**Reason for why test cross used and how to establish pure breed.** Cannot tell by looking at the dominant trait (normal tail) whether it is homozygous or heterozygous, so a cross with a dog that is homozygous for the recessive trait (twisted tail) is carried out. If the recessive trait shows in the offspring then the original parent must be heterozygous for that trait. Explanation may include diagram.	**Discussion includes reasons for selecting and crossing.** Select homozygous normal tail from test cross and cross with desirable dog. Many different combinations of answer here but essentially want to get to homozygous × homozygous, ie true breeding. May discuss both traits rather than just tails. Only a discussion of tails is needed.
3(a)	**TWO processes correctly described:** • Bottleneck effect – a population is reduced to a few individuals. The genetic makeup of this small surviving population is unlikely to be representative of the original population. • Genetic drift – (small) random changes in allele frequencies (due to chance).		
3(b)	**Description of any two processes** • Founder effect / a chance change frequencies due to a small group becoming separated from the main population. • Natural selection / the unequal reproductive success of different genotypes. • Mutation / changes to the genetic code that may result in new alleles. • Gene Pool / a change in the number of different alleles and / or the gene frequency. • Bottleneck Effect / a significant reduction in the size of the population that may decrease the size of the gene pool. • Genetic Drift / Change in gene frequency due to chance events.	**Explanation of how TWO processes have contributed to the evolution of the Enderby Island breed of rabbits.** **Explanations must relate to the Enderby Island rabbits**. **Gene / allele frequencies must be explained with respect to each process.** **At least one appropriate reference to the Enderby Island situation as described in the introduction to the question along with an appropriate adaptation is required.** **Eg 1** Founder effect – A population is founded by a small sample of the parent population. In the case of the Enderby Island rabbits, 12 individuals with a small number of alleles that are not representative of the parent gene pool. **Eg 2** Natural Selection – Variation exists, those individuals with favourable variations will survive and breed to pass on the desirable characteristics to the next generation.	**Linking TWO of the processes** to the evolution of the Enderby Island rabbit. Eg Founder effect with small population and small gene pool could be acted on by natural selection to lead to a change in the gene frequencies, and therefore the phenotype, to form the Enderby Island breed of rabbit. **An integrated sequence or succession of processes is the key idea.** **At least two correct references to the Enderby Island environment and two appropriate adaptations must be linked to the processes discussed.**

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		Eg 3 Mutations – the introduction of new alleles through mutation may improve or reduce adaptation to environmental conditions. A successful mutation will result in natural selection with respect to that trait. **Eg 4** Gene Pool – Mutations may lead to a change in gene frequencies. In a small population accidental or natural mortality may significantly affect gene frequency. A reduction or increase in natality may also affect gene frequency. (Immigration and Emigration are unlikely in this context.) **Eg 5** Bottleneck Effect – A significant decrease in population greatly reduces the size of the gene pool and some alleles may be lost from the population. The absence of these alleles will affect the direction of evolution. **Eg 6** Genetic Drift – Change in allele frequency due to chance events.	

Judgement Statement

Achievement	Achievement with Merit	Achievement with Excellence
Total of FOUR opportunities answered at Achievement level or higher. 4 × A	Total of SIX opportunities answered. TWO at Merit level or higher *and* FOUR at Achievement level. 2 × M + 4 × A	Total of SEVEN opportunities answered. TWO at Excellence level *and* ONE at Merit level or higher *and* FOUR at Achievement level. 2 × E + 1 × M + 4 × A