

**Assessment Schedule – 2013****Biology: Demonstrate understanding of genetic variation and change (91157)****Assessment Criteria**

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding involves defining, using annotated diagrams or models to describe, and describing characteristics of, or providing an account of, genetic variation and change.	Demonstrate in-depth understanding involves providing reasons as to how or why genetic variation and change occurs.	Demonstrate comprehensive understanding involves linking biological ideas about genetic variation and change. The discussion of ideas may involve justifying, relating, evaluating, comparing and contrasting, or analysing.

**Evidence Statement**

	Expected Coverage	Achievement	Merit	Excellence																									
ONE (a)	PpLl	<ul style="list-style-type: none"> <li>Describes the F<sub>1</sub> genotype.</li> <li>Completes a punnet square showing F<sub>1</sub> gametes and F<sub>2</sub> genotypes.</li> <li>Correctly describes the expected ratio.</li> <li>Defines linked genes / P is linked to L and p is linked to l (or diagram)</li> <li>OR</li> <li>crossing over</li> <li>OR</li> <li>independent assortment.</li> <li>States the genes are a short distance apart.</li> </ul>	<ul style="list-style-type: none"> <li>Explains how / why linked genes do not assort independently.</li> <li>Explains how crossing over produces recombinants.</li> <li>Explains the genes are a short distance apart on the same chromosome.</li> </ul>	<ul style="list-style-type: none"> <li>Compares the effect of the 2 processes (IA and CO) on linked genes.</li> <li>Linking the short distance apart of the genes to the low occurrence of recombinants.</li> </ul>																									
(b)	<table border="1"> <tr> <td></td> <td>PL</td> <td>Pl</td> <td>pL</td> <td>pl</td> </tr> <tr> <td>PL</td> <td>PPLL</td> <td>PPLl</td> <td>PpLL</td> <td>PpLl</td> </tr> <tr> <td>Pl</td> <td>PPLl</td> <td>PPlL</td> <td>PpLl</td> <td>Ppll</td> </tr> <tr> <td>pL</td> <td>PpLL</td> <td>PpLl</td> <td>ppLL</td> <td>ppLl</td> </tr> <tr> <td>pl</td> <td>PpLl</td> <td>Ppll</td> <td>ppLl</td> <td>ppll</td> </tr> </table>					PL	Pl	pL	pl	PL	PPLL	PPLl	PpLL	PpLl	Pl	PPLl	PPlL	PpLl	Ppll	pL	PpLL	PpLl	ppLL	ppLl	pl	PpLl	Ppll	ppLl	ppll
	PL				Pl	pL	pl																						
PL	PPLL				PPLl	PpLL	PpLl																						
Pl	PPLl				PPlL	PpLl	Ppll																						
pL	PpLL	PpLl	ppLL	ppLl																									
pl	PpLl	Ppll	ppLl	ppll																									
(c)	9 purple long :3 purple round :3 red long :1 red round.																												
(d)	<p>Linked genes / alleles are on the <b>same chromosome</b>.</p> <p>IA: They do not assort independently (like genes on different chromosomes, therefore ratio is not 9:3:3:1) as they are physically linked to each other on the same chromosome and <b>cannot separate</b> (randomly) during meiosis.</p> <p>CO: Crossing over exchanges genetic information of the chromosome between the two chromatids during meiosis when <b>homologous chromosomes</b> are paired up. Crossing over produces the Pl and pL gametes / new combination of alleles OR well-annotated diagram.</p> <p>The low occurrence indicates the genes / alleles must be <b>close together</b> on the same chromosome because the probability of crossing over / number of recombinants increases as gene distance increases.</p>																												

Not Achieved	N0	No response; no relevant evidence.
	N1	Partial evidence towards one of the Achievement statements but does not fulfil any of the Achievement criteria completely
	N2	Provides any ONE statement from Achievement.
Achievement	A3	Provides any TWO statements from Achievement.
	A4	Provides any THREE statements from Achievement.
Merit	M5	Provides any ONE explanation / reason from Merit.
	M6	Provides any TWO explanations / reasons from Merit.
Excellence	E7	Provides ONE of the criteria for Excellence.
	E8	Provides BOTH the criteria for Excellence.

	Expected Coverage	Achievement	Merit	Excellence
TWO (a)	<p><b>Describes incomplete dominance, co-dominance and complete dominance as:</b></p> <ul style="list-style-type: none"> <li>• <b>Incomplete dominance</b>, eg is a form of inheritance in which one <b>allele</b> for a specific trait is not completely dominant over the other allele. This results in an intermediate phenotype. Neither fully expressed.</li> <li>• <b>Co-dominance</b>, eg is when both <b>alleles</b> in a heterozygous organism contribute to the phenotype. Both fully expressed.</li> <li>• <b>Complete dominance</b>, eg is the <b>dominant allele</b> will always be expressed.</li> </ul> <p><b>Explains how each gene produces the different phenotypes.</b></p> <p>Complete dominance – in the heterozygous cat the dominant allele will always be expressed in the phenotype / homozygous recessive is the only genotype that will produce a recessive phenotype (long hair).</p> <p>Incomplete dominance – is when both alleles are only partially expressed so in a heterozygous cat the phenotype will be intermediate between dominant and recessive, eg is medium spotting.</p> <p>Co-dominance – both alleles are equally / independently expressed. BB is the same allele so the coat colour is black, bb is the same allele so coat colour is tan but heterozygous cats (Bb) the phenotype will be both black and tan (tabby) coat colour.</p>	<ul style="list-style-type: none"> <li>• Describes incomplete dominance.</li> <li>• Describes co-dominance.</li> <li>• Describes complete dominance.</li> <li>• Describes independent assortment or effect.</li> <li>• Describes mutation.</li> </ul>	<ul style="list-style-type: none"> <li>• Explains incomplete dominance.</li> <li>• Explains complete dominance.</li> <li>• Explains co-dominance.</li> <li>• Recognises complete dominance produces three possible genotypes, but results in only the two possible phenotypes due to the interaction between dominant and recessive alleles and co-dominance and incomplete dominance produces three genotypes, three phenotypes.</li> <li>• Explains mutations.</li> <li>• Explains independent assortment.</li> </ul>	<ul style="list-style-type: none"> <li>• Makes links / distinguishes between independent assortment <b>and</b> changing existing allele combinations / <b>and</b> mutations introducing totally new alleles.</li> <li>• Distinguishes the different result of gametic and somatic mutation to produce variation (within an organism/ gene pool).</li> </ul>
(b)	<p><b>Describes independent assortment / mutation.</b></p> <p><b>Independent assortment:</b> Eg, when (homologous) pairs of chromosomes line up / separate <b>randomly</b> (either homologous or pairs acceptable), the arrangement is random.</p> <p><b>Mutation, (permanent) change in the (base sequence of) DNA.</b></p> <p><b>Explains why mutations produce new alleles.</b></p> <p>Mutations are a random change to the DNA which may create a new allele. These mutations are the only way totally new alleles are introduced into a gene pool.</p> <p>Independent assortment leads to different combinations of existing chromosomes (in daughter cells / gametes) resulting in new combinations of existing alleles.</p> <p><b>Compares and contrasts both independent assortment and mutation</b></p> <p>Gametic mutation forms a new allele that can be passed onto the offspring whereas somatic mutation forms a new allele which may affect the individual, but cannot be passed on to the offspring.</p>			

	Therefore, independent assortment re-shuffles existing alleles producing new combinations of alleles / characteristics / unique gametes. Whereas, a mutation introduces a totally new allele into a gene pool.			
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Not Achieved	NØ	No response; no relevant evidence.
	N1	Partial evidence towards ONE of the Achievement statements but does not fulfil any of the Achievement criteria completely.
	N2	Provides any ONE statement from Achievement.
Achievement	A3	Provides any TWO statements from Achievement.
	A4	Provides any THREE statements from Achievement.
Merit	M5	Provides any TWO explanations / reasons from Merit.
	M6	Provides THREE explanations / reasons from Merit. (ONE of the three must come from Part (b).)
Excellence	E7	Provides ONE of the criteria for Excellence.
	E8	Provides BOTH the criteria for Excellence.

	<b>Expected Coverage</b>	<b>Achievement</b>	<b>Merit</b>	<b>Excellence</b>
THREE	<p><b>Founder effect</b> is when a new population is established by a small number of individuals from (ancestral population).</p> <p><b>Genetic drift</b> is the random change in the relative frequency in which an allele occurs in a population due to / chance.</p> <p>Genetic drift has affected NZ population because it is a small population where relatively small changes in allele numbers can have a big impact on the frequency of alleles in the total population.</p> <p>The founding population of the fruit flies was only 6. These 6 individuals were a non-representative sample of the ancestral (North American) population so when they colonised NZ alleles in the North American population were lost to the NZ population.</p> <p>The New Zealand population has fewer alleles at each locus because the founding population was 6 and had very few alleles. These 6 individuals inbred and low genetic variation resulted. Only 50 years has passed since colonisation, which is not long for sources of variation to affect allele frequency. The North American population is the ancestral population therefore has high genetic variation / more individuals to mate with preventing inbreeding. It has also had time for mutations to develop within the population.</p>	<ul style="list-style-type: none"> <li>• Describes the founder effect.</li> <li>• Describes genetic drift.</li> <li>• Describes the NZ population has low genetic diversity due to the small founding population / some idea of inbreeding.</li> </ul>	<ul style="list-style-type: none"> <li>• Explains changes in the gene pool due to genetic drift.</li> <li>• Explains changes to the gene pool due to founder effect.</li> </ul>	<ul style="list-style-type: none"> <li>• Discusses why the NZ population has a low allele frequency compared to the North American population – discuss due to time.</li> <li>• Discusses why the NZ population has a low allele frequency compared to the North American population – discuss due to small original population.</li> <li>• Uses data from the question to support the answer.</li> </ul>

Not Achieved	N0	No response; no relevant evidence.
	N1	Partial evidence towards one of the Achievement statements but does not fulfil any of the Achievement criteria completely.
	N2	Provides any ONE statement from Achievement.
Achievement	A3	Provides any TWO statements from Achievement.
	A4	Provides ALL THREE statements from Achievement.
Merit	M5	Provides any ONE explanation or reason from Merit.
	M6	Provides any TWO explanations or reasons from Merit.
Excellence	E7	Provides ONE of the first two statements from Excellence.
	E8	Provides any TWO statements from Excellence.

### Judgement Statement

	<b>Not Achieved</b>	<b>Achievement</b>	<b>Achievement with Merit</b>	<b>Achievement with Excellence</b>
<b>Score range</b>	0 – 7	8 – 13	14 – 19	20 – 24