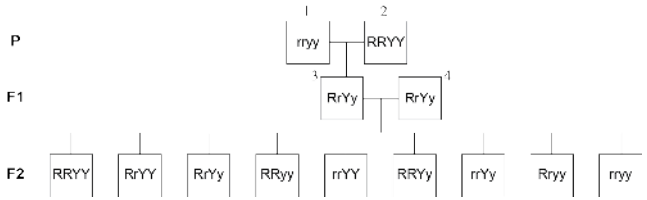
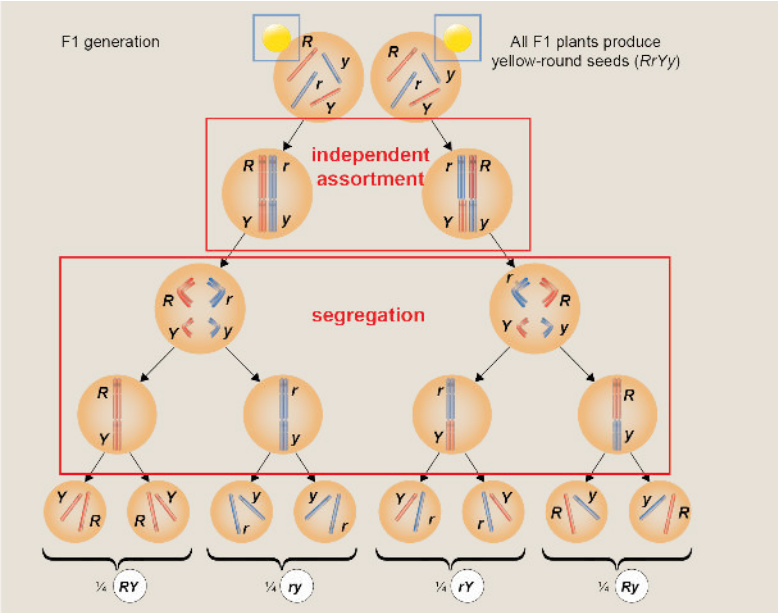
Assessment Schedule – 2020

Biology: Demonstrate understanding of genetic variation and change (91157)

Achievement Criteria

Evidence

Q	Expected Coverage	Achievement	Merit	Excellence
ONE (a)	All the gametes from rryy will have ry in them, and all the gametes from RRYY will have RY in them. Therefore, F1 generation will always have a RrYy genotype because during meiosis the parents' alleles segregate / separate / pull part equally into each gamete.	• State the alleles for the parent gametes. (for either gene). • Accept a Punnett square cross for either gene.	• Explains why the offspring has a genotype of RrYy using the concept of segregation / haploid gamete production	
(b)	<table><tr><td></td><td>RY</td><td>Ry</td><td>rY</td><td>ry</td></tr><tr><td>RY</td><td>RRYY</td><td>RRYy</td><td>RrYY</td><td>RrYy</td></tr><tr><td>Ry</td><td>RRYy</td><td>RRyy</td><td>RrYy</td><td>Rryy</td></tr><tr><td>rY</td><td>RrYY</td><td>RrYy</td><td>rrYY</td><td>rrYy</td></tr><tr><td>ry</td><td>RrYy</td><td>Rryy</td><td>rrYy</td><td>rryy</td></tr></table> OR RRYY, RRYy, RrYy, RrYY RRyy, Rryy rrYY, rrYy rryy AND 9 : 3 : 3 : 1 9 round yellow :3 wrinkled yellow : 3 round green : 1 wrinkled green F2 genotypes: RRYY, RRYy, RrYY, RrYy, RRyy, Rryy, rrYY, rrYy, rryy 	• Punnett square completed with correct gametes for F2 in the working area. OR 7 / 9 correct on pedigree chart. • Identifies the phenotype ratio.	• 9 / 9 correct on pedigree chart. AND Phenotype ratio.	

(c)	 Meiosis is type of cell division / reduction division that produces sex cells / gametes / sperm and eggs with half the number of chromosomes / haploid (as the body cell / parent cell / somatic cell). Produces genetically unique daughter cells. The process of independent assortment is where the **homologous** pairs line up **randomly** during meiosis. Alleles are reshuffled and different / new combinations of chromosomes / alleles / genotype are created. Therefore, gametes have different combinations of alleles and this increases genetic variation of offspring. The process of segregation is where Homologous chromosomes separate / pull apart and migrate to the cell poles during meiosis. During segregation, only one chromosome (gene / allele) from each homologous / pair is placed into the new cells / gametes made. During gamete formation alleles for each gene pull apart / separate from each other so that each gamete carries one allele per gene. Therefore, genetic variation is achieved / increased, because each new cell has a different combination of alleles from each other, and OR only ½ the chromosomes as the parent cell. *Do not accept different combinations of genes.*	• Describes meiosis. • Describes independent assortment. • Describes segregation. • Indicates on diagram where independent assortment takes place. • Indicates on diagram where segregation takes place.	• Explains independent assortment. • Explains that segregation results in only one allele from each gene pair going into each gamete. • Explains independent assortment / segregation **increase genetic variation** (unique traits / characteristics). • Explains that gametes are genetically different from parents – e.g. ½ number of chromosomes.	• Discusses how independent assortment increases genetic variation in gametes / offspring. evidence to include homologous and random line up, reshuffling / different combinations of alleles / chromosomes-therefore unique gametes increase in genetic variation • Discusses how segregation increases genetic variation in gametes / offspring. evidence to include pull apart / separate, one chromosome of homologous pair per gamete -therefore unique combinations of gamete increases genetic variation

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Describes any ONE statement from Achievement.	Describes any TWO statements from Achievement.	Describes any THREE statements from Achievement.	Describes any FOUR statements from Achievement.	Explains any TWO statements from Merit.	Explains any THREE statements from Merit.	Discusses ANY criterion for Excellence.	Discusses BOTH criteria for Excellence.

Q	Expected Coverage	Achievement	Merit	Excellence
TWO	Genetic diversity: variations in genetic make-up / genotype / total number of genetic characteristics in a species / population / genome / gene pool. Allele frequency: number / amount / percentage of each allele in a population / gene pool. Population bottleneck: a sudden / rapid / drastic reduction in population numbers that results in an under-representation of alleles in the gene pool (compared to original gene pool). Founders effect is when a small group of individuals from an existing population moves to another area and establishes a new population, / are reproductively isolated from the original population. Genetic drift: chance / random change (removal) of alleles (individuals) in a population that results in loss of alleles(0%AF) or alleles becoming fixed (100%AF). Low genetic diversity: low number of differing alleles in a population / fixed allele. Small populations mostly likely have low genetic diversity because there are less individuals (less alleles) in the population and most likely allele frequency not representative of the original population / increased likelihood of inbreeding Small populations are also more likely to lead to fixed alleles / death has a larger proportional effect decreases genetic diversity / variation. Predation by cats has resulted in genetic drift, because they have randomly and quickly removed large number of individuals (kākāpō) from the population. (The kākāpō have not been able to increase in numbers because the population of predators has increased very fast / rapidly (1.4million cats)(They have also evolved in a predator-free environment, and lack adaptations to avoid predation). The kākāpō population has been reduced due to indiscriminate predation by the cats and has resulted in only a total of approx. 211 individuals in NZ., however the founder effect is when a population becomes reproductively isolated from an original population. The new population is not representative of the original population. Because the current kākāpō population does not have an original population and is the only population in Aotearoa hence this is a bottle neck and not a founder's effect.	• Describes genetic diversity. • Describes allele frequency. • Describes population bottleneck. • Describes founder effect. • Describe genetic drift. • Identifying significant difference between cat and kākāpō population • Describe low genetic diversity.	• Explains why small population have low genetic diversity. • Explains genetic drift. • Explains why kākāpō have not been able to increase population numbers. • Explains why this is an example of bottleneck and not founder effect.	• Discusses genetic drift and correctly uses context of cats in answer. / Justifies why this is an example of genetic drift. Discuss using links why this is an example of bottleneck and not founder effect.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Describes any ONE statement from Achievement.	Describes any TWO statements from Achievement.	Describes any THREE statements from Achievement.	Describes FOUR statements from Achievement.	Explains any TWO statements from Merit.	Explains THREE statements from Merit.	Discusses ONE criterion for Excellence.	Discusses BOTH criteria for Excellence.

Q	Expected Coverage	Achievement	Merit	Excellence
THREE	Mutations are the only way totally new alleles can enter a population – Mutations are **permanent** changes to the DNA base sequence. Natural selection is the process where individuals that possess the 'best' phenotype (genotype) in an environment survive and reproduce, therefore passing on favourable / desirable / advantageous alleles onto offspring / into the gene pool. Some individuals do not fit the trend because there is variation of phenotypes (genotypes) within a population. Some tuatara may possess alleles that enable them to develop into male and females outside of 22 °C and 21 °C respectively. Some tuatara do not fit the trend because they have a mutation that enables them to develop into males / females at a different temperature. If temperatures rise fast over a short period of time, tuatara may not be able to respond to the environmental change / selection pressure. They have a very narrow temperature range and low genetic diversity, so the alleles in the population are similar. Mostly likely an increase in temperature would cause all the tuatara to develop into males. If temperatures rise slowly over a long period of time, tuatara will be more likely to respond to the environmental change / selection pressure. The small variation within the species may mean some females that can develop at higher temperatures can survive and pass the advantageous phenotype (alleles / genes) on to the next generation, and over time, both males and females can develop at high temperatures (and not go extinct).	• Identifies mutations as the only way totally new alleles enter a population. • Describes mutation. • Describes natural selection. • Describes some tuatara can become males and females at different temperatures outside of the trend • Prediction if temperature rise fast / over a short time, more chance of producing males / less chance of producing females / species extinct / no sexual reproduction. • Prediction if temperature rise slowly / over a long time, there will be similar male: female ratio / higher rates of sexual reproduction. • Describes sexual reproduction.	• Explains natural selection. • Explain individuals do not fit the trend because of genetic variation / mutation within the population. • Explains if temperature changes too fast, tuatara will not be able to respond through natural selection. • Explains if temperatures change slowly tuatara reproduction will have time to respond through natural selection. • Explains that slow temp change could allow some beneficial mutations to accumulate.	• Correctly discusses and predicts what could happen to the tuatara species if temperatures rise fast over a short period of time and related to natural selection. • Correctly discusses and predicts what could happen to the tuatara species if temperature rise slowly over a long period of time and related to natural selection.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Describes any ONE statement from Achievement.	Describes any TWO statements from Achievement.	Describes any THREE statements from Achievement.	Describes any FOUR statements from Achievement.	Explains any TWO statements from Merit.	Explains any THREE statements from Merit.	Discusses ONE criterion for Excellence.	Discusses BOTH criteria for Excellence.

Cut Scores

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