Assessment Schedule – 2020

Science: Demonstrate understanding of biological ideas relating to genetic variation (90948)

Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	hh – unaffected by Huntington's / normal Hh – affected by Huntington's HH – affected by Huntington's	• Any genotype linked to phenotype correct.		
(b)	Genotype: the combination of two alleles coding for a trait. Phenotype: the physical representation of the genotype. In Hh the H allele is dominant over the h allele and masks it; thus the phenotype of this individual is affected by Huntington's. hh genotype codes for the phenotype to be unaffected by Huntington's. Both recessive alleles hh must be present to produce the phenotype unaffected by Huntington's. HH and Hh genotypes code for the phenotype to be affected by Huntington's.	• Definition of phenotypes. • Definition of genotype.	• Explains Hh codes for affected by Huntington's by masking of recessive allele h by dominant allele H, producing phenotype affected by Huntington's. • Explains both recessive alleles producing phenotype unaffected by Huntington's.	• Comprehensively explains how the two alleles H and h interact to produce three genotypes, which in turn code for two phenotypes.
(c)	DNA – contains the genetic instructions. Gene – a section of DNA that codes for a particular protein / feature / characteristic. Alleles are different versions of a gene that have a different base sequence. Alleles in this case will code for the phenotypes affected and unaffected by Huntington's. A mutation is a change in the order of DNA bases, which causes a new allele. The new allele codes for a different protein resulting in the phenotype of Huntington's.	• Defines DNA. • Gene as a section of DNA that codes for a trait / protein. • Allele is a different form of a gene. • Defines the phenotype in this case as 'Huntington' disease'. • Mutation as a change in DNA base sequence	• A mutation is a change in the order of DNA bases, which codes for a new allele. • Explains that the (DNA) base sequence on a gene determines the appearance of a particular feature. • Shows in-depth understanding of linkages between all 3 terms (DNA, genes, allele).	• Discussion which links the explanation of the relationship between DNA, genes and alleles with a mutation causing a change in the order of bases coding for a new allele producing a different protein resulting in Huntington's.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response, or no relevant evidence.	ONE Achievement point.	TWO Achievement points.	THREE Achievement points.	FOUR Achievement points.	ONE Merit point.	TWO Merit points.	TWO Excellence points; minor omission.	TWO Excellence points.

Q	Evidence	Achievement	Merit	Excellence
TWO (a)	<table><tr><td></td><td colspan="3">1</td></tr><tr><td rowspan="3">2</td><td></td><td>d</td><td>d</td></tr><tr><td>D</td><td>Dd</td><td>Dd</td></tr><tr><td>d</td><td>dd</td><td>dd</td></tr></table>	• Any correct line in Punnett square.		
(b)	3 : Dd 4 : dd	• Any correct genotype (can be taken from Punnett).		
(c)	3 has the genotype Dd. Parent 2 could either pass down a D or d allele because it has the genotype Dd heterozygous. Parent 2 must have passed down a D allele for individual 3 to be affected by Polycystic kidney disease. Parent 1 must have passed down a d recessive allele to 3 because it has the genotype d homozygous recessive and only has d recessive alleles to pass on. The offspring of cross 3 and 4 are both affected and unaffected; this proves that 3 has the genotype Dd and not DD. Offspring 7 is unaffected dd, and thus must have inherited a d allele from both parents 3 and 4. This proves 3 must have a d allele to pass onto offspring 7 and it must have a D allele because it is affected. Thus it proves 3 has the genotype Dd.	• 3 has a D allele because it is affected by polycystic kidney disease. • Parents 1 and 2 pass down a dominant and recessive allele to 3. • Offspring 7 inherited recessive allele passed down from 3 and 4.	• Fully explains why 3 has **inherited** the genotype Dd due to parent 1 passed down the recessive allele and parent 2 passed down the dominant allele. • Fully explains why 3 has the genotype Dd due to **passing on** the recessive allele to unaffected offspring 7.	• Comprehensively explains the genotype for individual 3 using inheritance from both the parents **and** passing on to offspring of 3 being affected by polycystic kidney disease.
(d)	The kidney failure was due to an infection. Kidney failure was caused by ‘environment’, not genetics. Only genetic characteristics can be inherited, not those acquired as a result of environment. Reproductive cells (gametes) can only pass on genetic characteristics and thus kidney failure caused by an infection will not pass to offspring.	• States this type of kidney failure is caused by environment / infection, **or not genetics**. • States only genetic traits / information in gametes can be passed on. • Somatic (body) cell changes cannot be passed on.	• Explains no children will be born with kidney failure because it was not caused by genetics and only genetic characteristic can be inherited. • Explains will not get kidney failure caused by environment / infection affect only somatic (body) cells and cannot be passed on	• Discusses how characteristics are inherited **and** the effect of the environment on acquired characteristics such as kidney failure.

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Q	Evidence	Achievement	Merit	Excellence
THREE (a)	Defines genetic variation as differences in (DNA / genes / alleles / ability to fight disease).	• Defines genetic variation differences in DNA / genes / alleles / physical appearance of hoiho.		
(b)	Gamete formation by meiosis. produces gametes / sex cells which have half the normal number of chromosomes as body cells. Description of meiosis: 1 cell producing 4 gametes. Random assortment / segregation / crossing-over of chromosomes producing genetically unique gametes. Process of fertilisation: Random male and female gametes join, each with unique DNA, producing a genetically unique zygote / offspring. Role of sexual reproduction: Random fertilisation produce new combination of alleles and thus genetic variation between individuals.	• Defines gamete as a cell with half the chromosome number. • Defines fertilisation as joining / fusion of 2 gametes (sperm / egg / ova).	• Explains meiosis and how random assortment / segregation / crossing-over of DNA / chromosomes during meiosis creates genetically unique gametes. • Explains fertilisation and how its random joining of 2 gametes create genetically unique offspring.	• Explains the role meiosis and sexual reproduction producing genetic variation among individuals.
(c)	Explanation: The advantage of genetic variation to a species is that it may enable some individuals to survive the parasitic infection and reproduce, passing on favourable alleles / genes to the next generation. Over many generations this genetic advantage / genes / alleles will rise in the population, allowing survival of the hoiho species.	• Defines random fertilisation. • Describes the advantage of sexual reproduction is to produce variation. • Describes an advantage of sexual reproduction; some will survive the disease.	• Individuals are varied and some survive the parasitic disease. • Survivors reproduce offspring carrying favourable alleles / gene onto future generations.	HOW **genetic** variation in a population leads some individuals to survive the parasitic disease and reproduce, passing on favourable alleles / genes to the next generations. Over many generations, the favourable genetic advantage / genes / alleles will rise in number in the population allowing the survival of the hoiho species.

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Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 6	7 – 13	14 – 18	19 – 24