Assessment Schedule – 2016
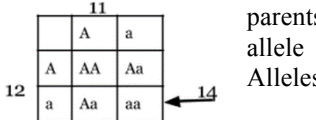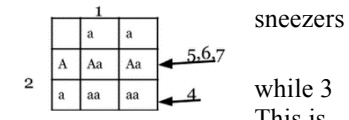
Science: Demonstrate understanding of biological ideas relating to genetic variation (90948)

Evidence Statement

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	1 = aa, 2 = Aa, 11 = Aa, 12 = Aa	• ¾ genotypes correct.		
(b)	14 is a non-sneezer, but their parents are sneezers. The non-sneezing must be hidden in 11 and 12. Alleles that can be hidden are recessive. OR If non-sneezing was dominant, individual 14 would have to have A. This must have come from one of their parents, who would therefore show the trait. But neither does, so non-sneezing cannot be dominant. 13 is a sneezer so must have A. They could be AA or Aa as each parent can pass on either. The Punnett square shows that 25% are expected to be AA and 50% Aa. Without offspring we can't prove either.	• ONE Punnett square filled in correctly (or in (c)). • Recessive allele can be hidden (or equivalent) OR dominant is shown if present. • 13 is "AA or Aa" may be from pedigree chart. • Identifies 14 as aa / homozygous recessive.	• Explains allele must be hidden (or similar) in 11 and 12 and so is recessive, with correct Punnett square or 14 or aa in offspring OR by reverse: if affected was recessive 11x12 could not have unaffected / different offspring • Explains that 13 must have A to be a sneezer and the parents can pass on either A or a alleles and so 13 is AA or Aa. OR Parents are Aa so can pass on / donate / produce / etc either A or a alleles and so 13 is AA or Aa.	• (Uses Punnett square) to show that sneezing is dominant, and to show that 13 could be either AA or Aa. Must include number 14 or aa or homozygous recessive in explanation.
(c)	Punnett square shows 50% sneezers are expected. 1 and 2 have 1, less than expected, while 3 and 4 have 3, more than expected. This is because each of the offspring is an independent event. Each offspring is unaffected by previous outcomes, and so each has a 50% chance of inheriting the a allele from #2. We would expect to be very close to 50% with a larger number of offspring, e.g. if the offspring from 1 / 2 and 3 / 4 are combined it *is* 50%.	• Gives 1PS : 1 NPS expected. • Gives 1PS :3 NPS for 1 and 2 and 3PS : 1NPS for 3 and 4. • Total number of PS : NPS is as expected OR small sample size. • Fertilisation is random OR independent events.	• Explains that phenotype ratios, with all three correct, and with correct Punnett square shows difference depends on chance / are independent events/ need many offspring. OR Gives the 1:1 but not the observed ratio but give a good explanation stating that it is chance (e.g. fertilisation, etc.) / many offspring that causes the difference.	• Connects the 50% expected with the 25% and 75% actuals with offspring being independent/separate/chance events, showing the inheritance of *a* allele and how (with correct Punnett square) ratio is 'expected' only and needs large sample size (may not be observed in smaller sample).

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response, or no relevant evidence.	ONE idea from Achievement.	Two points from Achievement.	Three points from Achievement.	Four points from Achievement.	ONE point from Merit.	TWO points from Merit.	ONE point from Excellence	TWO points from Excellence.

Q	Evidence	Achievement	Merit	Excellence
TWO (a)	**DNA** is the (molecule) that carries the genetic code/ **information.** The base sequence is the order of bases (A, T, C and G) that carry the code. A **gene** is a section of DNA that codes for 1 trait / protein, e.g. mouse fur colour. An **allele** is a gene form, e.g. light or dark fur. A difference in the DNA results in a difference in how the genetic information is read and can create a different appearance (phenotype). This is a different gene form (allele). In this case, the light coloured mouse would have a different base sequence to the dark mouse on the gene for fur colour.	• TWO definitions (gene, allele, DNA) using the context of fur colour in mice. • DNA structure described • A difference in the DNA base / mutation produces new allele / phenotype / appearance / **protein**.	• Explains that the **DNA** (base sequence / structure / code) gives/determines the gene which instructs for fur colour and the allele gives the colour (light, dark) in pocket mice. • Explains that a **difference in the DNA** (base sequence / structure / code), e.g. an A instead of a C, results in a **different allele** for the fur colour, e.g. light fur instead of dark. In this way the DNA (base sequence / structure / code) controls the appearance.	• Links a difference or change in the **DNA base code** (A, C, T, G) to different alleles, i.e. light or dark, for the fur colour **gene**.
(b)	Phenotype is the appearance of a trait, e.g. dark or light fur. Genotype is the code for the alleles present for the gene. Each mouse receives one copy of each gene from each of its parents during fertilisation, one from the sperm and one from the egg, and so has two copies of each. If either of these are the dominant allele (i.e. DD or Dd), the mouse will be dark, as the dark allele is dominant (and so masks the light allele). If both are recessive (dd), the mouse will be light.	Defines phenotype as the appearance of the gene / alleles / genotype / trait OR states the phenotypes are light and dark fur. • Defines genotype as the alleles present OR states that the three genotypes for the example are DD, Dd, and dd. • Describes that a mouse inherits one gene copy / allele from each parent.	• Explains how the given two phenotypes are coded for by the give three genotypes AND explains why Dd is dark not light. • One copy of each allele from each parent (through the sperm and egg) combine (fertilisation) to produce (different) phenotypes with a fur example from the question.	• Full explanation, linking the inheritance of one copy of each allele from each parent combines (through the sperm and egg / fertilisation) AND how these alleles interact via three genotypes to give the two phenotypes, with reference to dominant alleles as in merit.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; or no relevant evidence.	ONE partial idea from Achievement.	ONE point from Achievement.	TWO points from Achievement.	THREE points from Achievement.	ONE point from Merit.	TWO points from Merit.	ONE point from excellence	TWO points from Excellence.

Q	Evidence	Achievement	Merit	Excellence
THREE (a)	Sexual reproduction involves combining DNA from two parents using gametes. These gametes (sex cells) are formed during meiosis. Gametes have only one set of chromosomes, and so these can be combined with another parent to make a unique individual. This increases variation [OR crossing over OR independent assortment OR meiosis OR fertilisation]. Variation means that some plants will be better suited to conditions, and so will survive better. For example, they might produce deeper roots (or more traps, or more effective traps, etc.). These better adapted plants will produce more offspring, and so over time the **population** can adapt. If all Venus flytraps were the same, they may all die from the same disease or the same set of unfavourable environmental conditions. [L2 Biology terms such as segregation, independent assortment, etc. are acceptable, but not required.]	• Describe sexual reproduction as involving two parents / using meiosis to produce offspring. • Describes one process increasing variation, e.g. meiosis is the production of gametes / sex cells (combining two sets of DNA). • Describes increased survival **OR c**onsequence of little or no variation.	• Explains one process in sexual reproduction leading to varied offspring / gametes, e.g. meiosis is the formation of gametes with one set of genetic information instead of the normal two. Each parent produces different gametes. OR Fertilisation where 2 gametes fuse/join (one from each parent) and combine to form unique / different offspring/ individuals. • Explains how variation increases survival chances for some Venus flytraps and so benefits the **population /** species. Must talk about passing on / reproduction/new generations.	• Fully explains the role of a process in sexual reproduction in producing variation and how this results in benefits for the Venus flytrap population by being better suited / adapted for the new / next / future generations.
(b)	Inheritable variation can be passed on to offspring and involves a change / mutation / information in the DNA, whereas non-inheritable variation may be due to the environment (or only occurs in body cells) and so affects only that organism, not its offspring. Lack of light has caused the fly trap in the shade to grow longer leaves. This is not due to a change in the DNA, and so cannot be passed on. The red colouration is due to DNA differences, and so can be passed on – as long as the DNA in the gametes is also affected.	• Describes inheritable as a change/ information in the DNA that can be passed on. OR Information can be passed on (as long as) it is in the gametes. • Non-inheritable as a change in the somatic cells. OR Due to environmental factors.	• Explains that the long leaves are due to where it is (environment) / not a change/ information in the DNA (gene), and so it cannot be passed on whereas the red colour of the B-52 is due to DNA (differences), and so can be passed on.	• Fully explains that the non-inheritable leaf-length variation is a response to the environment (lack of light) and so there is no DNA / gene / allele information that can be passed on, whereas the red colouration is a DNA mutation / allele / trait / variation (has some link to the colour information) and so can be passed on through the gametes / fertilisation / during sexual reproduction.

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No response; or no relevant evidence.	ONE partial idea from Achievement.	ONE point from Achievement.	TWO points from Achievement.	THREE points from Achievement.	ONE point from Merit.	TWO points from Merit.	ONE point from Excellence	TWO points from Excellence.

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0–7	8–13	14–18	19–24