Science 90948 (1.9): Demonstrate understanding of biological ideas relating to genetic variation

Question ONE: DNA

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| Expected Coverage | Evidence for Achievement | Evidence for Merit | Evidence for Excellence |
| A gene is a section of DNA that carries the instructions for a particular feature, e.g. hair colour.An allele is the alternate form of a gene, e.g. dark or light hair.DNA is the molecular building block of genetic information.The order of the DNA bases within a gene determines the phenotype displayed for a particular feature. A change in the base sequence of the gene results in different features and variation shown in offspring. For example, changing the code above to AA**A**… may result in a different protein formed – perhaps light hair instead of dark.  | * Defines gene
* Defines allele
* Defines DNA
* Recognises that a different base sequence results in different proteins / features
 | * Explains the difference between a gene and an allele
* Explains that the base sequence of a gene determines the appearance of a particular feature
 | * Discusses how a change in the DNA base order affects the phenotype, correctly using the terms gene, allele and DNA.
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| NØ | N1 | N2 | A3 | A4 | M5 | M6 | E7 | E8 |
| No response or response does not relate to the question | ONE partial A | ONE A or TWO partial | TWO A | THREE A | ONE M, using example | Better than M5 | E | E, correctly using example. |

Question TWO: **TOMATOES**

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| Expected Coverage | Evidence for Achievement | Evidence for Merit | Evidence for Excellence |
| One advantage of cuttings is that it is a fast method of reproduction. There is no need to wait for seeds to germinate, giving a head start. Also, offspring are genetically identical to the parent, so if the parent plant produced good tomatoes, so will the plants produced from cuttings (if produced under the same conditions).Genetic variation is important in a population for species survival in a changing environment. If the environment changes or, for example, a new pest insect turns up, if there is variation in the population it increases the chance that some members of the population will be less tasty to the new insect, so they will survive and reproduce therefore ensuring survival of the species. Or other environmental change, etc.Overall, the benefit of variation provided by sex outweighs the extra time, energy and resources required. | * Asexual advantage (e.g. fast, efficient, known quality)
* Sexual advantage (i.e. variation)
* Defines variation or describe importance for species survival.
 | * explains advantages of using cuttings for growing tomato plants
* explains why variation is important in a population for species survival
 | * Demonstrates comprehensive understanding of the advantages of asexual reproduction and the importance of variation within a population for species survival.
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| NØ | N1 | N2 | A3 | A4 | M5 | M6 | E7 | E8 |
| No response or response does not relate to the question | ONE part A | ONE A | TWO A | THREE A | ONE M | ONE M, with example of tomatoes | E | E, using example and justification (overall, sex is better as… *or*… despite the advantages of asexual, sexual is used because…)  |

Question THREE: ALBINISM

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| Expected Coverage | Evidence for Achievement | Evidence for Merit | Evidence for Excellence |
| NnRecessive traits/alleles are masked by dominant alleles, so for a recessive trait to show up, both alleles must be recessive (i.e., homozygous recessive).Individuals J and L must have inherited a copy of the recessive allele from BOTH parents (G and H). Since G and H show the dominant trait (melanin production), they must be heterozygous (Nn). They carry the recessive allele n, but it is masked by the dominant allele N. By the recessive trait being masked, albinism can remain hidden in multiple generations until 2 heterozygous parents mate. This would result in:

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|  | N | n |
| N | NN | Nn |
| n | Nn | **nn** |

Although only 25% would be **expected** to be albino (nn), there are 2 out of 4 shown in generation 4. This is due only to chance – each of the offspring is an independent event (not affected by the others). | * Correct genotype
* Recessive alleles are masked by dominant alleles OR

recessive traits only show if both alleles for the trait are recessive* Punnett square to show how albinism occurs
* Expect 25% in gen 4
 | * Uses example to explain how a recessive trait could skip generations.
* Uses Punnett square to predict outcome (25%) in gen 4
* Compares expected (25%) to actual (50%), citing chance.
 | * Comprehensively discusses inheritance of alleles AND how the appearance of traits can skip some generations.
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| NØ | N1 | N2 | A3 | A4 | M5 | M6 | E7 | E8 |
| No response or response does not relate to the question | Some relevant information | ONE A, or TWO parts | TWO A | THREE A | ONE M | TWO M | E | E including “chance” for 50% actual outcome |

Question FOUR: **SWEETCORN**

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| Expected Coverage | Evidence for Achievement | Evidence for Merit | Evidence for Excellence |
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|  | P | p |
| P | PP | Pp |
| p | Pp | pp |

3 purple: 1 yellowMutation is a permanent change in DNA / base sequence. This can create a new version of a gene (allele), e.g. changing the colour from purple to yellow.However, only mutations that occur in the gametes/sex cells (or gamete producing cells) will be passed on to future generations (unlike somatic mutations).Meiosis creates new *combinations* of alleles through:* segregation/ fertilization – separating homologous chromosomes and combining them with another individual
* independent assortment – the way the chromosomes are separated is random, increasing variation
* crossing over – parts of chromosomes can be exchanged, separating allele combinations

Mutation is the **only process** that creates new alleles. | * Correct Punnett square
* Correct phenotype ratio
* Mutation defined
* Mutation described as source of new alleles
* Describes some process increasing variation, or that meiosis can only make new combinations
* States only mutations in gametes will be passed on
 | * Idea of mutation as ‘ultimate source of variation’ explained
* Explanation of one meiotic process leading to variation
* Explains how gametic mutations are inherited and somatic mutations are not
* Uses Punnett square to get correct phenotype ratio
 | Discussion demonstrates comprehensive understanding of how mutations create new alleles compared to processes in meiosis that reshuffle existing genetic material. |

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| NØ | N1 | N2 | A3 | A4 | M5 | M6 | E7 | E8 |
| No response, or response does not relate to the question. | ONE A or TWO PARTIAL | TWO A | THREE A | FOUR A or 1M and 1A | TWO M | THREE M | E | E, with **justification** (mutation *creates* alleles, meiosis just mixes them up) *or* **explanation of 2 processes** |

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|  | **Not Achieved** | **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| Score range | 0-10 | 11-17 | 18-24 | 25-32 |