2024 NCEA Assessment Report

Subject:	Biology
Level:	2
Achievement standard(s):	91156, 91157, 91159

General commentary

Successful candidates accurately described biological processes and defined biological terms.

They wrote concise answers that addressed the specifics of the questions and used the appropriate biological language. Successful candidates avoided writing generally about the biological processes and concepts. The majority of successful candidates responded to all three questions in each standard, and attempted to address the bullet points that supported each question. Candidates who used the resource material to make links between biological ideas provided stronger answers. Additionally, candidates who met with success at higher levels provided additional information that was not already included in the resource material, showing their depth of understanding.

Report on individual achievement standard(s)

Achievement standard 91156: Demonstrate understanding of life processes at the cellular level

Assessment

The examination comprised three questions, and the candidates were required to respond to all of them. The questions required candidates to apply their understanding of life processes at the cellular level. The questions covered the requirements of the 2024 assessment specification, which included: aerobic and anaerobic respiration, stages of photosynthesis and the structure of chloroplasts, diffusion and the importance of the surface area to volume ratio in cells.

Commentary

Candidates who referred to the resource material and restricted responses to the context of the question gained higher achievement. Some candidates showed limited understanding of biological concepts by using incorrect terminology when describing biological processes. Many candidates provided biological information that was not asked for in the question and could not receive credit for this information. Some candidates did not refer to the resource material in their answers which limited their achievement.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- described the biological processes involved in this standard (aerobic and anaerobic respiration, photosynthesis, as well as the light-dependent / light-independent phases)
- identified the locations of different stages of photosynthesis and respiration

- listed advantages and disadvantages of both aerobic and anaerobic respiration
- described diffusion as passive and substances as travelling through a cell membrane to enter cells
- identified the changes of surface area and volume relating to cell growth, and gave examples of increased cell division rates.

Candidates who were awarded **Achievement with Merit** commonly:

- explained why both types of respiration are required in different settings
- explained the steps of aerobic and anaerobic respiration, as well as advantages and disadvantages of each
- connected the size and number of chloroplasts to rates of photosynthesis
- identified keys steps of the light-dependent phase and the light-independent phase of photosynthesis
- explained why the surface area to volume ratio of cells affected cell function and cell division
- explained the purpose of diffusion and why it is a passive mode of transport.

Candidates who were awarded **Achievement with Excellence** commonly:

- elaborated on the resource information and their understanding of energy demands to discuss why both aerobic and anaerobic respiration can be beneficial at different times
- evaluated the effectiveness of chloroplasts and justified how different parts work together to optimise the rate of photosynthesis
- compared and contrasted rates of photosynthesis for different plant types and under different environmental conditions
- linked diffusion to cell functioning, the effect of different surface area to volume ratios, justified higher cell division rates, and illustrated with appropriate examples.

Candidates who were awarded **Not Achieved** commonly:

- wrote incorrect equations or definitions for key processes, including aerobic/anaerobic respiration and photosynthesis
- described the function of chloroplasts and mitochondria as similar/identical
- provided incomplete descriptions of the process of diffusion
- linked descriptions to examples unrelated to context material provided.

Achievement standard 91157: Demonstrate understanding of genetic variation and change

Assessment

The examination included three questions relating to biological principles of genetic variation and change. Candidates were required to respond to all three questions, applying their understanding of how linked genes can affect genetic variation, as well as how the founder effect, genetic drift, and bottlenecks impact allele frequencies in a gene pool. The questions also covered patterns of inheritance which included lethal alleles, co-dominance, and dihybrid crosses.

Commentary

Candidates who applied their answers directly to questions gained higher achievement. Some candidates showed limited understanding of key biological concepts. They used biological vocabulary incorrectly and used inappropriate terminology when describing biological processes.

Many left out key terms from their answers or confused basic terms such as dominant and recessive. Many candidates wrote answers that did not address the bullet points of the question and contained little correct information that could be awarded marks. Each question provided key bullet points with guidance for structuring answers and relevant information to support Achievement.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- were able to complete the F1 generation genotype, the dihybrid cross, the phenotypic ratio with or without a definition of complete dominance and/or co-dominance
- demonstrated understanding of XX for female and XY for male
- demonstrated understanding of differences between dominant and recessive alleles
- were able to write correct definitions for all three mechanisms of change in Question 2
- identified problems with low genetic diversity
- provided suggestions for how genetic diversity could be improved
- understood what lethal alleles were and were able to demonstrate a test cross, however, failed to explain how a test cross works.

Candidates who were awarded **Achievement with Merit** commonly:

- identified that there is one allele for a trait on one chromosome, and they used this idea to explain why females could have two alleles for fur colour and males could only have one
- were able to elaborate on ideas, e.g. explaining why only females were tortoiseshell in colour
- were able to use the idea of loss and fixation of alleles in relation to at least two genetic drift events and to explain the effects on genetic diversity
- were able to identify inbreeding as an issue that causes low genetic diversity which, in turn, makes the population vulnerable
- were able to expand on the issues they explained by providing a solution and expanding on the effect of actions on improving the genetic diversity within the population
- were able to explain both possible punnett squares and their associated ratios: test, cross, and ratios, as mentioned in the question
- were able to identify the need for the survival of an organism to adulthood to reproduce and pass on a dominant lethal allele
- were able to explain how recessive lethal alleles were more common, as they could be masked by the dominant allele and thus could be passed on.

Candidates who were awarded **Achievement with Excellence** commonly:

- recognised and conveyed which sex had which potential genotypes and their associated phenotypes
- made links between the differential susceptibility to recessive sex-linked disorders
- linked the ideas of complete, co-dominance, and sex-linkage together, making reference to the alleles found on the sex chromosomes
- were able to link loss and/or fixation of alleles to at least two genetic drift events in context
- were able to link multiple problems and solutions in the context of the takahē populations
- discussed the problem of low genetic diversity in terms of inbreeding and susceptibility to disease, and they then linked the idea of how this low diversity could be improved by introducing new alleles from other populations to improve diversity
- discussed the idea of recessive lethality in terms of the two different punnett squares, making reference to the ratio to support their answer.

Candidates who were awarded **Not Achieved** commonly:

- left entire questions or parts of questions unanswered
- did not demonstrate understanding of XX for female and XY for male
- were unable to define co-dominance and complete dominance correctly
- did not complete the dihybrid cross or include the correct phenotype description with the 9:3:3:1 ratio
- used the terms gene and allele interchangeably and incorrectly
- used the terms inbreeding and interbreeding interchangeably
- had a lack of understanding of gene flow
- failed to recognise the difference between loss and fixation of alleles (0% and 100% allele frequency) with decrease and increase of alleles, and how the former reduces genetic diversity
- had a poor understanding of the randomness of genetic drift and the fact that it has a disproportionately large effect on small populations
- wrote that alleles survive and die, not organisms
- could not distinguish between genetic drift (random) and natural selection (selection-pressure caused)
- drew a double heterozygote cross or another wrong cross instead of a test cross
- confused the dominant and recessive allele letters and thus were unable to articulate them correctly in a written answer
- provided incorrect or only partial definitions of lethal allele, and dominant and recessive allele.

Achievement standard 91159: Demonstrate understanding of gene expression

Assessment

The examination included three questions relating to the biological principles relating to gene expression. Candidates were required to respond to all three questions and apply their understanding of protein synthesis, the effects of mutations on proteins, and how mutations and environmental factors affected a haem formation metabolic pathway.

Commentary

Explanations of how the structure of mRNA and tRNA related to their stability or instability during protein synthesis demonstrated poor understanding by candidates. Many answers could not link the single-strand structure of mRNA to it being a short-lived molecule and/or the clover-leaf structure of tRNA to it being a long-lived molecule. Explanations of how the substitution mutation changed only one amino acid but no other amino acids, and the length of the polypeptide chain remained the same was often missed in answers. Candidates could link mutations to either final protein structure or function but often did not link these back to the context of the questions. Many candidates only restated information from Question 3 and did not explain the metabolic pathway. Candidates often did not explain the relationship between genes and enzymes or recognise that lead and iron were environmental factors that influence enzymes.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- described two differences between DNA and mRNA
- described protein synthesis

- described the function of mRNA and tRNA
- outlined transcription and translation
- identified two causes of mutation and could define a mutation
- identified the mutation in the question was a substitution mutation
- could describe a metabolic pathway
- identified that genes code for enzymes
- identified that lead inhibits enzymes from working.

Candidates who were awarded **Achievement with Merit** commonly:

- explained the function of mRNA
- recognised the complementary nature of codons and anticodons
- recognised the significance of mRNA being short lived and linked this to a valid reason
- recognised the significance of tRNA being long lived and linked this to a valid reason
- explained a mutation and included two examples
- identified the mutation as a substitution and identified the change in one amino acid
- explained the relationship between the two genes, two enzymes, and three molecules for the specific metabolic pathway in the question
- explained how lack of iron or high levels of lead would prevent enzyme 2 from working / catalysing the intermediate substrate into haem formation.

Candidates who were awarded **Achievement with Excellence** commonly:

- discussed the function of mRNA and tRNA in transferring the genetic code / gene from DNA to the ribosome and its complementarity to the specific tRNA molecule and tRNA (anticodon), forming a specific protein
- discussed the effect of the substitution mutation on the amino acid sequence, and the functioning and shape of the final haemoglobin beta polypeptide
- discussed this specific metabolic pathway, including how anaemia can be caused by mutations in gene 1 or 2 or both.

Candidates who were awarded **Not Achieved** commonly:

- did not answer the question or address the bullet points
- did not define biological concepts correctly
- could not describe mutations or identify the substitution mutations in the question
- could not describe protein synthesis
- were unable to describe key biological concepts at Level 7 of the curriculum
- rewrote information from the question into the answer without actually showing any understanding.