2022 NCEA Assessment Report

Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Subject: **Biology**

Level: **2**

Standards: **91156, 91157, 91159**

Part A: Commentary

Successful candidates correctly described biological processes and defined biological terms. They wrote concise answers and used the appropriate biological language. Most responded to each question and attempted to answer each bullet point within each question. Candidates who used the resource material to make links between biological ideas provided stronger answers. Successful candidates framed their answers to address the context of the questions, and provided new information that was not already included in the resource material.

Part B: Report on standards

91156: Demonstrate understanding of life processes at the cellular level

Examination

The examination included three questions of which the candidates were required to respond to all three. Questions required candidates to apply their understanding of life process at the cellular level. The questions covered the requirements of the 2022 assessment specification, which included photosynthesis, the structure of the chloroplast, factors that affect enzyme controlled reactions, as well as aerobic and anaerobic respiration.

Observations

Candidates who referred to the resource material and restricted responses to the context of the question gained higher achievement. Some showed little understanding of biological concepts by describing organelle function incorrectly, and 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:

- showed clear understanding of key terms and definitions
- described (or defined) the key biological terms, ideas and processes relating to respiration and photosynthesis
- used word equations for photosynthesis and respiration where appropriate
- described enzymes, co-factors and the effect of pH on enzyme activity with reference to denaturing

- correctly interpreted data tables and graphs.

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

- provided descriptions and / or definitions that were incomplete or inaccurate
- did not attempt all question parts in the examination paper
- did not understand or refer to the resource material or example / case studies
- repeated information from the question and / or resource material.

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

- showed greater understanding of a concept by linking accurate descriptions as to how or why a biological process occurred
- answered most or all parts of each question, but did not address the context or the stem of the question
- wrote clear and concise definitions / descriptions and systematically addressed each bullet point
- linked the structural features of the chloroplast to their role in light dependent and light independent phases of photosynthesis and its reactants and products
- explained in detail how co-factors and environmental factors affect enzyme activity and the rate of biological reactions
- explained both anaerobic and aerobic respiration in terms of the amount of ATP produced, the presence of toxic by-products, and relevance to the overall activity of a living organism.

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

- provided thorough comprehensive discussions of key biological concepts in each question by making the correct links between multiple concepts
- communicated effectively by writing concise and correct answers that linked structure to function in the correct context
- used the information provided in graphs and data tables to support and justify the information given in their answers
- comprehensively discussed how the reactants of photosynthesis and structures of the chloroplast work together to efficiently carry out the light-dependent and light-independent reactions to produce glucose and oxygen.
- comprehensively discussed the role of co-factors in forming an enzyme-substrate complex
- used the graph provided to link enzyme denaturing with the correct corresponding pH values and to identify the enzyme's optimal range
- connected the processes involved with anaerobic and aerobic respiration to the amount of ATP produced, the presence of toxic by-products, and linked the discussion correctly to the context of the question.

91157: Demonstrate understanding of genetic variation and change

Examination

The examination included three questions relating to biological principles of genetic variation and change covered by the 2022 assessment specifications. Candidates were required to respond to all three questions and apply their understanding of how linked genes and the processes within meiosis affect genetic variation, as well as the effects of genetic drift and natural selection on allele frequencies in a gene pool. The questions also covered patterns of inheritance which included multiple alleles, incomplete dominance, complete dominance and monohybrid and dihybrid crosses.

Observations

Candidates who applied their answers directly to questions gained higher achievement. Some candidates showed little understanding of biological concepts. They defined biological vocabulary incorrectly, and used incorrect terminology when describing biological processes. Many left out key terms from their answers, such as homologous when describing chromosomes during meiosis. Many candidates wrote answers that did not apply to the question, and contained little correct information.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- defined biological vocabulary correctly
- used biological terms correctly in their answers
- accurately completed Punnett squares
- described Genetic Drift correctly
- described why different genotypes produced different phenotypes
- applied their answers to the questions.

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

- provided descriptions and / or definitions that were incomplete or inaccurate
- used biological terms incorrectly or not at all
- did not complete monohybrid and di-hybrid Punnett squares correctly
- did not answer all three questions
- wrote answers that did not apply to the question.

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

- correctly defined and used biological vocabulary in their explanations
- wrote explanations that were supported with examples that applied to the context of the question
- applied their answers directly to the question without adding unnecessary information
- methodically answered the bullet points of the questions
- distinguished between the terms ‘gene’ and ‘allele’ correctly
- explained how crossing over and independent assortment affected genetic diversity

- explained how the processes of founder effect and genetic drift affect populations.

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

- comprehensively discussed the biological concepts in each question, using the correct definitions and vocabulary
- used the bullet points and context of each question to write answers that linked several accurately explained biological concepts
- wrote comprehensive answers that explained how and / or why processes occurred
- wrote answers that clearly specified what structures or processes were being discussed, especially in the case of linked versus unlinked genes during meiosis
- discussed in detail how genetic drift, founder effect, and / or natural selection could result in less harmful mutations within a population
- discussed in detail how different inheritance patterns affect genotype and phenotype ratios
- discussed the advantages and disadvantages of the different inheritance patterns in terms of population survival
- discussed that an increase in favourable phenotypes is essential for a population to survive selection processes
- used correct writing and language conventions to remove ambiguity from their answers.

91159: Demonstrate understanding of gene expression

Examination

The examination included three questions relating to the biological principles relating to gene expression covered by the 2022 assessment specifications. Candidates were required to respond to all three questions and apply their understanding of protein synthesis, the effects of mutations on proteins, and how environmental factors interact with genotype to produce different phenotypes in a metabolic pathway.

Observations

Candidates who provide new information and used the context of the question to frame their answers gained higher achievement. The interaction between the environment and genotype to produce different phenotypes in a metabolic pathway was poorly understood by candidates. Many candidates didn't explain how temperature / environmental factors affect how enzymes function to produce a different phenotype despite the genotype remaining the same in all parts of a rabbit's body. Many candidates restated information from the questions without showing understanding of the concepts.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- defined biological ideas correctly
- attempted all parts of each question

- gave clear basic definitions and descriptions of translation, mutations, and metabolic pathways
- identified which mutations were most likely and least likely to affect proteins
- described how the environment interacts with the genotype to produce a phenotype.

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

- did not describe key biological concepts correctly
- could not identify which types of mutations had the most and least effect on proteins
- confused transcription with translation
- did not answer the question or address the bullet points
- rewrote the information from the question into the answer without showing understanding.

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

- explained biological concepts in relation to a context correctly
- made some links between biological concepts while attempting all bullet points
- explained the relationship between genes, enzymes, and products in relation to a metabolic pathway
- explained how the environmental factor of temperature can interact with the genotype to produce different phenotypes in rabbits
- explained the process and importance of translation
- explained why DNA is not directly translated into a protein
- explained why a substitution mutation may code for the same amino acid and have the least effect on the polypeptide chain
- explained why insertion / deletion mutations caused a reading frameshift and have the most effect on the final protein
- showed understanding of how the degeneracy due to redundancy of the code was responsible for several different codons coding for the same amino acid
- explained the relationship between genes, enzymes and products in a metabolic pathway
- explained how black fur was produced in the extremities of a Himalayan rabbit because an enzyme did not work correctly.

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

- wrote comprehensive answers that included clear explanations of key biological concepts in relation to context of the questions
- made multiple links between biological concepts while attempting all bullet points
- explained the relationship between genes, enzymes, and products in relation to a metabolic pathway
- explained how the environmental factor of temperature interacts with the genotype and affects the phenotype in rabbits
- comprehensively explained the process and importance of translation

- wrote two reasons to justify why DNA is not directly translated into a protein
- comprehensively discussed how degeneracy of the code is can buffer the effect of substitution mutations
- comprehensively discussed how insertion / deletion mutations affect the amino acid sequence, protein folding and protein function
- comprehensively explained the relationship between genes, enzymes, and all products in the metabolic pathway, and linked this to the production of both black and white fur
- wrote a discussion that recognised that the genotype of every rabbit cell was the same and the enzyme was still produced throughout the rabbit's whole life / whole body, therefore, the environmental factor of temperature affected enzyme function and was responsible for producing black or white fur.