

# 2023 NCEA Assessment Report

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

## General commentary

Successful candidates correctly described biological processes and defined biological terms. They wrote concise answers and used the appropriate biological language. Most candidates responded to each achievement standard question and attempted to address 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, rather than just write generally about the biological process / concept. Additionally, candidates who met with success at higher levels provided new information that was not already included in the resource material.

## 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 2023 assessment specification, which included: photosynthesis, factors that affect enzyme-controlled reactions, active transport and facilitated diffusion, and DNA replication and mitosis.

#### 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:

- showed clear understanding of key terms and definitions
- described the phases and equation for photosynthesis
- described the function of enzymes as well as factors influencing them

- described an example of active transport or facilitated diffusion
- described DNA replication
- described the purpose of mitosis.

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 fully address the context or the stem of the question
- wrote clear and concise definitions / descriptions and systematically addressed each bullet point
- explained the phases of photosynthesis well
- provided detail on the effects of high and low temperature on enzyme action
- gave both the concentration gradient and energy requirements for facilitated diffusion and active transport
- explained the role of mitosis, in terms of both growth and repair needed in a life-cycle, using the resource information provided.

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

- provided 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 the resource material to support and justify the information given in their answers
- linked high temperature to breaking bonds that hold the enzyme together
- linked the effect of low temperatures to collision theory, and the overall effect on rate of photosynthesis
- discussed the formation of enzyme-substrate complexes, as well as the effect of the concentration of reactants on the LDP and LIP of photosynthesis
- showed a comprehensive level of understanding on how or why cellular processes occurred, and used data from the resource material to support their answers
- evaluated the effectiveness of active transport and facilitated diffusion, in terms of transporting different particles across a cell membrane
- connected the importance of mitosis, in terms of continued cell function, with a high surface area: volume ratio and efficient movement of materials.

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
- repeated information from the question and / or resource material
- identified oxygen as a reactant of photosynthesis
- linked low temperatures to denaturing enzymes
- omitted concentration gradients from descriptions of active transport and facilitated diffusion
- described meiosis instead of mitosis.

## 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, as covered by the 2023 assessment specifications. Candidates were required to respond to all three questions, applying their understanding of how linked genes and the processes within meiosis affect genetic variation, as well as the effects of natural selection, genetic drift, and bottlenecks on allele frequencies in a gene pool. The questions also covered patterns of inheritance which included multiple alleles, incomplete dominance and dihybrid crosses.

### Commentary

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 or confused basic terms such as chromosomes and alleles. Many candidates wrote answers that did not apply to the question and contained little correct information. Each question provided key bullet points with lots of definitions, giving candidates relevant information to support Achievement.

### Grade awarding

Candidates who were awarded **Achievement** commonly:

- defined biological vocabulary correctly
- used biological terms correctly in their answers
- accurately completed a dihybrid Punnett square
- defined multiple alleles, incomplete dominance, and natural selection correctly, and / or identified the differential in the survivability of beneficial and harmful mutations
- defined precursor concepts (allele frequency, genetic variation, and genetic drift accurately)
- applied their answers to the questions.

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 addressed the bullet points in the questions
- distinguished between the terms 'gene' and 'allele' correctly
- could relate processes in meiosis to the effect on variation between gametes, and between gametic cells and germ cells
- were able to explain beneficial and harmful mutations
- explained genetic drift in terms of the effect on small and large 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 biological concepts together
- wrote comprehensive answers that explained how and / or why processes occurred
- wrote answers that clearly specified what structures or processes were being discussed
- were able to link both advantages and disadvantages of high and / or low levels of melanin to changes in allele frequency
- had a solid understanding of allele frequency as a percentage and not an absolute number
- discussed the effects on a small population's gene pool versus a large gene pool and were able to compare and contrast these effectively
- used correct writing and language conventions to remove ambiguity from their answers.

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 a dihybrid Punnett square correctly
- did not answer all three questions
- wrote answers that did not apply to the question.

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## **Achievement standard 91159: Demonstrate understanding of gene expression**

### Assessment

The examination included three questions relating to the biological principles relating to gene expression, as covered by the 2023 assessment specifications. Candidates were required to respond to all three questions and apply their understanding of mutations, mutagens, metabolic pathways, and protein synthesis.

### Commentary

Candidates who provide new information and used the context of the question to frame their answers gained higher achievement.

Questions One and Three were very straightforward in context whilst Question Two combined two of the topics (metabolic pathways and gene / environment interactions). Many candidates typically answered either the metabolic pathway OR the genotype / phenotype parts, but very few of them had both ideas together.

Many candidates restated information from the questions without showing evidence of understanding of the concepts.

### Grade awarding

Candidates who were awarded **Achievement** commonly:

- defined biological ideas correctly
- knew the correct definition of a mutation, metabolic pathway, and mutagen
- confused the terms 'mis-sense' and 'non-sense' mutations

- did not explain why the complementary base-pairing was important for accuracy
- could draw a complementary DNA strand but did not have the correct number of hydrogen bonds between the bases or the correct anti-parallel nature of DNA.

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 to address all bullet points
- explained how mutations affect protein function but neglected to discuss how mutations affect folding /shape of a protein and / or length of a polypeptide
- did not fully discuss how environmental factors could influence a gene's expression, changing phenotype but not genotype
- didn't fully compare the risk of skin cancer in people with albinism with people without albinism
- went into detail on the process of transcription and translation even though the question specifically stated this was not needed.

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

- linked effect of mutation to length of polypeptide as well as folding and function
- compared and contrasted the difference between a silent mutation and a non-sense mutation and justified their answer with reasons
- identified that a gene coded for one enzyme in a metabolic pathway
- explained in-depth that environmental factors could cause a gene to code for more of an enzyme / express more of an enzyme leading to a change in phenotype but not genotype
- compared the risk of skin cancer between people with albinism and people without albinism, contrasting the amounts of melanin and discussing reasons for the differences in amounts
- identified and explained why bases can only pair with each other, in terms of base size / structure and number of hydrogen bonds, and made links to accuracy of processes and functionality of proteins.

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

- did not describe key biological concepts correctly
- did not answer the question or address the bullet points
- rewrote the information from the question into the answer without showing any understanding
- did not answer some questions or missed some sections in all questions
- could not accurately transcribe a DNA sequence into an mRNA sequence
- could not use a codon table to translate mRNA into an amino acid sequence
- did not have a clear understanding of the difference between a mutagen and an environmental factor
- could not draw a complementary DNA strand.