Assessment Report

New Zealand Scholarship Physics 2023

Performance Standard 93103

General commentary

The 2023 paper contained four questions. The questions involved candidates utilising a range of physics concepts relevant to the Level 3 NCEA Physics achievement standards. Many candidates completed the paper within the three-hour period.

This paper was similar in difficulty to recent examinations at this level. The very top candidates found the examination very accessible. However, on average, candidates' responses lacked the conceptual understanding and mathematical dexterity required of a challenging examination of this type.

General performance across Questions One, Two, and Three was reasonably similar. Candidates found Question Four the most challenging of the four questions. Many candidates have a basic understanding of Rutherford's investigations and the consequences of the results. The concept and application of binding energy is reasonably well understood by the candidates.

Often candidates did not read questions carefully, and gave incorrect responses as a result. Many candidates did not show understanding of some of the fundamental concepts in DC electricity theory. Reponses to Question Four showed that some candidates were not prepared to respond to questions of this type. Many candidates presented answers for the drift speed of an electron that were clearly inappropriate, and a surprising number did not know what dimensional consistency was. A large number of candidates found the latter parts of this question unfamiliar, and struggled as a result.

Candidates achieving Scholarship showed a sound breadth of conceptual understanding across the four questions. They showed solid mathematical skills that supported their conceptual understanding.

Candidates who gained Scholarship with Outstanding Performance found the paper very accessible and consistently demonstrated a high level of performance across all four questions. These candidates showed a maturity of conceptual understanding and very sound mathematical skills.

Report on performance standard

Candidates who were awarded Scholarship with **Outstanding Performance** commonly:

- completed all parts of all questions
- demonstrated a wide breadth of conceptual understanding
- were able to answer questions that combined disparate aspects of the curriculum
- communicated written responses succinctly and accurately
- used alternative pathways to solutions
- set out working for calculations in a clear, concise sequence
- were able to provide clear and concise explanations of concepts
- were able to solve problems that relied on multiple different physics concepts
- described how increased binding energy per nucleon increases nuclear stability
- identified that a magnetic force on a moving electron can be balanced by the electrostatic force produced by separation of charge, and used these forces to derive the relationship for the voltage produced.

Candidates who were awarded **Scholarship** commonly:

- were able to answer questions across a wide range of topics
- were comfortable using exponents

- were familiar with the relevant physics laws and were able to correctly identify which concept was relevant to solving a problem
- were able to extrapolate a solution to one problem into an unfamiliar situation
- understood the concept of binding energy
- could explain how the force due to gravity affects the vertical motion of a projectile
- could describe and apply Kirchhoff's laws
- linked the observations of the gold foil experiment to Rutherford's model of the atom
- identified that a magnetic force on a moving electron can be balanced by the electrostatic force produced by separation of charge.

Candidates who were **not awarded Scholarship** commonly:

- demonstrated knowledge gaps with some fundamental physics laws
- made numerical errors, especially in cases where exponents were included in a calculation
- made general or incorrect statements about Rutherford's model of the atom
- made incorrect statements about energy conversions
- set out working for calculations in an unclear order
- misunderstood the meaning of the phrase "dimensionally consistent"
- described the balance of forces by incorrectly applying Newton's Third law.