

## Assessment Report

# New Zealand Scholarship Physics 2025

## Performance standard 93103

### General commentary

Candidates should be aware of the assessment specifications and ensure they have studied all the material that may be assessed. There were some questions that showed a lack of familiarity with entire sections of the material examined. Many candidates failed to stay for more than the minimum allocated time. The gap between candidates who are prepared to attempt an examination at this level and those who are not continues to grow. Candidates must be supported to understand the rigour and expectations of Scholarship Physics. It is concerning to see so many students who are clearly unprepared.

Candidates should pay particular attention to the wording of the question. For example, the phrase “considering the forces acting” was used in several questions so forces should be included in the explanation or calculations.

Performance across all four questions was very similar. There were some individual parts of questions that were very challenging for all candidates apart from those who achieved Outstanding Performance. Candidates at that level continue to show an excellent understanding of physics across the entire curriculum. Their ability to be flexible and apply their understanding in unfamiliar contexts is a core component of their success.

### **Question One:**

#### DC Electricity

Reasonably well done. However only around 30% showed full understanding, and many scholarship candidates have very poor understanding of the basic concepts of electrical circuits. Some recurring misconceptions about how Kirchhoff’s laws apply to cells connected in parallel (cells ‘cancel each other out’, or ‘same voltage but three times the current’) were clearly evident. There was also a small, but noticeable, number of students who interpreted the symbol for a cell as a capacitor, despite the information given describing them as cells several times.

#### AC Electricity

It is clear from a large proportion of the responses to parts One (c) and One (d) that many students either had not studied NCEA Physics standard 3.5 (Demonstrate understanding of electrical systems) or had completed programmes other than NCEA that do not include AC electricity.

Of those who did attempt the questions, there appears to be a lack of understanding of phasor diagrams and energy transfers occurring in AC circuits.

### **Question Two:**

Most candidates were able to state changes that would increase frequency in relation to changes in the speed or wavelength of the wave on a string. However, many neglected to specify other parameters that remain constant when the change is made. Some candidates seem unaware of the distinction between the speed of a transverse wave in a string and the speed of a longitudinal sound wave in air.

In relation to standing waves in open-ended pipes, responses showed widespread misconceptions about the nature of longitudinal waves in pipes. It seems likely that these misconceptions are a result of misinterpreting diagrams of standing waves in pipes that represent a longitudinal wave as if it was a transverse wave. Statements about the wave reflecting off the sides or edges of the pipe were common.

The latter parts of this question were challenging for all candidates. Very few candidates were able to determine the value of the constant  $k$ , and even though many were able to draw an appropriate trend for part (d), most were unable to provide any conceptual explanation for this proposed behaviour.

### **Question Three:**

Some candidates gave up on Question Three, perhaps because it was an unfamiliar situation. However, scholarship questions are often in unfamiliar contexts and this should not deter candidates, as the questions are designed to use content that they will have covered in their learning programmes.

For those that attempted all parts, considerable success typically resulted. Part (a) was well done by most. Part (b)(i) was well completed by Scholarship level candidates. In part (c), grounding is not a familiar concept but those who did understand that concept produced excellent responses. For part (d), many candidates focused more on the energy of the photon, rather than the energy of the electron in the metal. Answers that specifically referred to electrons having quantised / discrete energy were clearer than general comments about energy levels.

### **Question Four:**

A noticeable trend was for candidates to try to apply familiar generic statements and formulae, rather than considering how fundamental principles such as forces apply in an unfamiliar context.

Students with a good understanding of physics concepts were generally able to score well in this question. Many students could use horizontal and vertical components to derive an equation for the acceleration of the pendulum. They seemed to understand the concept of SHM and ideal conditions for SHM. For part (b) most candidates recognised that the spring had no effect, and calculated the correct answer. However, some simply stated that the spring had no effect, and did not justify why this was so. Part (c) was generally well done, although the justification for why the force from the spring is doubled was not always clear. In part (d), few candidates were able to give a clear, concise explanation of the motion. For many candidates, it was unclear whether they were describing a single oscillation of the pendulums, or the periodic change in motion over a number of oscillations. However, the more common issue was to only discuss *either* forces *or* energy, not both as was stated in the question.

## Report on performance standard

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

- attempted all questions
- had a sound grasp of the curriculum
- mostly identified the physics that was pertinent to the question
- could derive an equation in a clear and logical manner
- realised that they had time to think, and that most answers only required a modest amount of writing
- showed strong algebraic skills
- linked phenomena to underlying physics principles
- described how the fundamental frequency of a standing wave can be changed by altering other parameters of the standing wave

- explained the reflection of a longitudinal wave at the open end of a pipe in terms of pressure difference
- applied mathematical reasoning to extend a trend to extreme values
- recognised the importance of forces acting on an object travelling in a circular path
- understood how to increase the frequency of a sound produced by a stringed instrument, and what variables needed to be kept constant
- could calculate the kinetic energy of an electron, and identified the relationship between the centripetal force and electric force
- could use vertical and horizontal components to find the acceleration of a pendulum.

Candidates who were awarded **Scholarship** commonly:

- displayed a subject grasp beyond the requirements of the problems
- made links between multiple relevant concepts
- showed an organised approach to tackling the tasks
- set out mathematical working in a clear, logical manner
- clearly linked phenomena to underlying physics principles with statements of assumptions made
- used physics concepts to justify the behaviour of a trend extended to extreme values
- demonstrated insights that showed they fully understood the physics of the question
- demonstrated logic in their answers, minimising extraneous content
- could describe the conditions and energy transfers that occur when an LCR circuit is at resonance
- understood how sound waves behave in an open pipe.

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

- did not answer the question that was asked
- left out key steps in the working
- did not plan their answer
- did not attempt some parts of questions
- did not structure answers logically, instead writing a cloud-like grouping of equations; some correct, and some incorrect or irrelevant
- often gave up on a total question, rather than considering whether individual sections were still achievable, even with an incomplete understanding of the question
- could describe ways of increasing the frequency of sound produced in a stringed instrument, but didn't always include the variables that were being kept constant
- did not make clear links between phenomena and the physics principles that cause them
- misunderstood the mechanisms of longitudinal wave propagation and reflection
- misinterpreted circuit symbols and some mistakenly thought cells in a circuit were capacitors
- assumed that cells behave in a similar way as resistors when connected in series and parallel, rather than applying fundamental concepts.