Assessment Report

New Zealand Scholarship Physics 2022

Standard 93103

Part A: Commentary

The top candidates found the examination quite accessible. However, many candidate responses lacked the depth and conceptual understanding seen in recent years, indicating that they were not fully prepared to sit an examination of this type.

Candidates seemed to struggle with questions about ‘significance’ or ‘validity’, that required taking a step beyond a purely mathematical result, and consider how that result applies in the real world.

Only the better candidates were able to correctly state the difference in the concept of quantisation of energy between the photoelectric effect and the Bohr model of the atom. Many candidates were unable to use the fundamental laws of Newton to explain motion correctly, or to accurately substitute values in to given expressions. This is concerning given the level of this examination.

The ability to accurately communicate understanding in a “Show” question is a skill that needs significant development for many candidates. Many candidates made incorrect mathematical statements in an attempt to prove a given relationship. Candidates need to begin a mathematical derivation with conceptual physics statements. The mathematics will then follow and support the physics statements.

Part B: Report on performance standard

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

- completed the entire examination
- showed a wide breadth of conceptual understanding
- combined information from disparate aspects of the curriculum
- communicated written responses succinctly and accurately
- presented well laid out algebraic arguments, satisfying the convincing communication requirements of the standard
- considered alternative pathways to solutions
- described the difference in the concept of quantisation of energy between the photoelectric effect and the Bohr model of the atom
- solved complex, multi-step mathematical problems in various contexts by applying physics concepts such as centre of mass, vector components, etc
- demonstrated a thorough understanding of two bodies in orbit, and the key assumptions of the relationship
- demonstrated a detailed understanding of torques
- recognised the increased change in momentum, and hence force, when velocity is reversed, as opposed to stopping
- used mass deficit information to calculate number of photons, momentum, force, and correctly considered the proportion of photons that will have an effect.

Candidates who were awarded **Scholarship** commonly:

- completed the entire examination
- demonstrated sufficient algebraic and computational skills to meet the requirements of the Scholarship standard
- applied understanding of standing waves to an unfamiliar context
- used vector components successfully to solve a problem
- explained the effects of forces on linear motion, and the effect of torques on rotational motion

- recognised the link between change in momentum, forces, and Newton's third law
- stated differences between the Bohr model of the hydrogen atom and the photoelectric effect
- used mass deficit information to calculate number of photons, momentum, and force
- correctly applied trigonometric factors to calculate induced voltage for a conductor moving at a non- right angle to a magnetic field
- calculated net force acting on an orbiting body by considering either the centripetal force or the sum of gravitational forces.

Other candidates

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

- left questions unanswered
- made basic errors with numerical working
- wrote answers that did not address the question posed
- demonstrated poor communication skills
- failed to demonstrate highly developed knowledge skills
- selected incorrect units in some calculations
- commented incorrectly, or did not comment at all, on the validity of their responses
- demonstrated limited conceptual understanding of fundamental physics concepts including torques, Newton's Laws, centre of mass, vector components, and modern physics.

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