Assessment Report

New Zealand Scholarship Physics 2020

Standard 93103

Part A: Commentary

The mix of problems requiring descriptive and mathematical solutions worked well to identify candidates who understood physics concepts and who could correctly apply those concepts.

Question 1 many candidates struggled with the algebra of (d).

Question 2 (a) and (c) showed widespread understanding of Doppler phenomena though often not at Scholarship level.

Specific comments

Q1 was well done by many candidates. Most identified the importance of “out of phase” but many did not identify the unique conditions.

Q2 Many just listed one assumption – that the velocity needed to be constant, but failed to appreciate the second assumption. It seems the apparent complexity of the target expression dissuaded many candidates from attempting this straightforward problem.

Many candidates found a great array of algebraic solutions.

Q3 The conservation laws were generally listed but rarely used to explain the system behaviour. Again scholarship level responses were rare.

There was much confusion over the use of large indices and the significance of the relationship between velocity and kinetic energy. A number of state answers were physically impossible.

For part (c)(ii), a majority of the attempts at answering suggested that many candidates did not actually understand what they had shown earlier.

Q4 Almost all students recognise that moving electrons through a magnetic field will usually result in the electron being moved in some way.

The condition for constant velocity is widely understood, but in many cases (a significant fraction) candidates do not know that a net force causes acceleration.

There was generally a lack of understanding of the basic conservation laws while part e was generally poorly done.

Part B: Report on performance standard

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

- were able to answer all parts of the paper
- laid out their arguments clearly and with brevity

- demonstrated correct application of key physics concepts such as conservation laws
- made no mathematical errors
- were able to correctly apply detailed analysis to problems that required multiple steps
- recognised the significance of reactance value in determining the value of voltage for inductors and capacitors in A.C. circuit
- showed that in an elastic collision between two identical objects complete transfer of momentum and kinetic energy is a necessary result, rather than just assuming it to be true
- considered the proportion of energy lost, as well as the mechanism.

Candidates who were awarded **Scholarship** commonly:

- were able to answer all or nearly all parts of the paper
- showed sound ability in mathematics
- correctly applied fundamental physics principles, such as conservation laws
- were generally able to correctly identify the important physics in an unfamiliar context, and were able to cope with problems that drew on material from different parts of the curriculum
- provided written reasoning to support numerical answers
- understood that the reactance of the capacitor and the inductor are out of phase at resonance
- could describe how the overall impedance of a circuit is determined, and had some knowledge of the formula and mathematics involved
- can competently use and explain the Doppler shift formula
- can understand and apply the conservation of momentum and energy ideas
- explained the interactions of magnetic fields and currents to produce forces, and the resulting effects of those forces on motion.

Other candidates

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

- had gaps in their knowledge, causing them to leave sections of the paper unanswered
- did not follow the instructions given in a question, and as a result did not answer all parts of a question
- could not link the appropriate mathematical skills to solve a problem
- did not correctly apply fundamental physics principles, such as conservation laws
- made errors that contradicted fundamental physics principles
- did not recognise the significance of phase relationships when carrying out calculations with inductors and capacitors in an A.C. circuit
- misused scientific terms. For example, stated “inductance” instead of “inductor reactance”
- compared different Doppler effect situations using a single specific example, rather than in general terms
- recognised that momentum is conserved in a collision, but ignored that kinetic energy is also conserved if the collision is elastic.

Subject page

Previous years' reports

2019 (PDF, 166KB)

2018 (PDF, 95KB)

2017 (PDF, 41KB)

2016 (PDF, 184KB)
