2022 NCEA Assessment Report

Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Subject: **Physics**

Level: **1**

Standards: **90937, 90938, 90939**

Part A: Commentary

Candidates had the opportunity to demonstrate their understanding over a broad range of physics concepts covered by the three standards.

Many candidates have issues with use of scientific notation and have difficulty correctly carrying out calculations on a calculator.

Many candidates attempted to answer questions without using precise physics language. which hindered their chances of gaining a higher grade.

Candidates who were awarded Achievement or Not Achieved commonly left parts of the questions blank.

Part B: Report on standards

AS90937: Demonstrate understanding of aspects of electricity and magnetism

Examination

The examination had three questions with four parts to each question. Candidates had the opportunity to demonstrate their understanding in static electricity, DC electrical circuits, and electromagnetic theory.

Observations

The exam tested all key concepts of the standard. Candidates that used physics specific terminology often did better than those that used common language. Candidates' ability to do calculations on a calculator needs developing. and they struggled with understanding prefixes in measurements. Some candidates also displayed misconceptions about which charge moves – electrons move and protons do not move. Some candidates demonstrated familiarity with basic electrical equipment like electroscopes and solenoids in their responses to answers.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- used key phrases to describe concepts
- selected the correct formula
- stated what conductors and insulators were

- drew field lines correctly
- substituted numbers into an equation, and provided an answer
- were able to draw compass direction
- stated how a compass identified field lines
- completed questions that required a two-step process when solving equations
- did not understand charge separation
- understood the basic principle of electromagnets, but struggled to apply to the given context
- displayed a good understanding of one out of the three parts of the standard – static electricity, circuits, or electromagnetism.

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

- did not use key terms to explain basic concepts, or substitute into basic equations and find an unknown
- did not produce a magnetic field diagram
- displayed very little knowledge of the scientific concepts they were required to identify and explain, or left questions blank
- wrote that protons move, or positive electrons move
- could not identify and use the appropriate formula to calculate the correct quantity
- did not state the difference between conductors and insulators
- did not calculate resistance
- did not explain Ohm's Law.

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

- stated more than just the obvious, e.g. realised that decreasing the resistance of the resistor affected the whole circuit
- performed nearly all the calculations correctly
- drew most diagrams, but often made careless mistakes with diagrams and explanations, or omitted important information.
- identified key concepts and linked scientific ideas together, i.e. linking the drop in variable resistance to the total resistance of the circuit and, then the increase in current
- completed calculations with equations that required a two-step problem solving technique
- displayed understanding of the principle of electromagnetism and were able to determine the magnetic field, using the current direction
- displayed understanding of the effect of "grounding", and could explain the difference between a conductor and an insulator
- acknowledged quantities that were constant when explaining the relationships between quantities in formulae
- displayed a good understanding of two out of the three parts of the standard – static electricity, circuits and / or electromagnetism

- often used the word charge instead of poles (unlike poles attract) or did not directly link the field direction with the current direction – many candidates stated that the current flowed from North Pole to South Pole.

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

- explained concepts simply and clearly, using English and technical terms well
- displayed a very good understanding of the key concepts, and were able to link the key scientific concepts of electricity and magnetism together
- produced diagrams that were accurate and precise
- completed all the calculations, and were able to use scientific notation on their calculators accurately
- answered scaffolded questions accurately by responding to all bullet points in the question clearly
- displayed a good understanding of all three parts of the standard – static electricity, circuits, and electromagnetism
- related their answers fully to the context of the question.

AS90938: Demonstrate understanding of aspects of wave behaviour

Examination

The examination had three questions with four parts to each question. Candidates with a basic knowledge of waves were able to achieve in this examination. Candidates that used more physics specific language usually attained higher grades.

Observations

The examination covered all aspects of the standard and gave candidates a fair chance to succeed. Candidates who were able to produce well-drawn and accurate diagrams using two light rays instead of one achieved higher than those that did not. Candidates need to be familiar with the term optical density.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- knew the definition of diffraction
- could draw basic diffraction around a barrier
- knew that water waves slow down as depth decreases
- correctly draw and label angle of incidence and refraction
- knew that waves slowdown in optically denser mediums
- knew the term Total Internal Reflection
- could identify sound as a longitudinal wave.

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

- could not define diffraction or refraction, and commonly confused them

- could not calculate one step calculations using either $f = 1/T$, $v = f\lambda$ or $v = d/t$
- could not correctly draw and label angle of incidence/refraction
- did not use the word “optical” in optical density
- could not identify sound as a longitudinal wave.

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

- could use $v = f\lambda$ to correctly explain changes in wavelength as water waves changed depth, including calculations
- linked the slower speed of a wave in higher optical density to bending toward the normal
- stated both criteria for Total Internal Reflection
- explained that white light is made of different frequencies / wavelengths of light that refract different amounts
- identified sound as a longitudinal wave, and accurately described how the particles vibrated as the wave travelled.

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

- drew correctly diffracted waves around a barrier
- drew and labelled correctly dispersion of white light through a prism
- could accurately draw refracted rays into water, and backtrack to locate an image
- completed all aspects of what the question asked.

AS90939: Demonstrate understanding of aspects of heat

Examination

The examination had three questions with four parts to each question. The examination covered all aspects of the standard with topical and familiar contexts.

Observations

Candidates that attempted all questions were able to show their knowledge across the range of concepts covered in this standard. Candidates often did not label the states and the phase change, or diagrams, and many found the graph hard to interpret.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- correctly defined terms, e.g. latent heat; correctly described phenomena, e.g. thermal expansion
- linked the concepts of heat transfer to the question context but answers lacked depth, e.g. not identifying or explaining the method of heat transfer; completing heating curves without labelling
- used the correct formulae, but did not check for inaccuracies in calculations
- partially answered questions, e.g. listing rather than explaining, calculating only part of an answer and describing a diagram or the trend in a graph.

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

- left parts in each question unanswered
- attempted calculations unsuccessfully, or chose incorrect formulae for calculations
- were unable to link the concepts of heat transfer to the context of the questions
- were unable to describe thermal expansion.

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

- clearly explained a range of concepts within each question, and ensured the answer was linked directly to the question
- clearly identified the specific aspect of heat being examined, e.g. thermal expansion or the method of heat transfer, in unfamiliar contexts
- carried out multiple step calculations accurately.

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

- explained and discussed relevant concepts within each question
- made links between aspects of heat and the context of exam questions, e.g. rate of evaporation linked to comparative specific heat capacity and latent heat of evaporation
- carried out multiple step calculations accurately.