2022 NCEA Assessment Report

Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Subject: **Physics**

Level: **2**

Standards: **91170, 91171, 91173**

Part A: Commentary

Candidates who used precise physics language to support their arguments achieved higher grades. Candidates who knew what quantity each symbol in a formula stood for and its associated unit were easily able to attain the higher grades. Candidates need to be familiar with the standard prefixes c,m, and k. Candidates who reproduced answers / solutions from previous examinations were not able to display their understanding sufficiently. Candidates who used running calculations on their calculators without appropriate brackets often failed to achieve higher grades. Candidates who persevered and attempted all the questions often found they could answer some of the later questions.

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

- confused reflection, refraction, and diffraction
- did not demonstrated understanding sufficiently to recognise the different types of mirrors and lenses
- did not draw appropriate diagrams to demonstrate understanding of the paths or behaviour of waves
- did not ensure numbers were in correct SI units before calculating.

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

- demonstrated a good knowledge of waves and optics
- linked observations to physics phenomena stated accurately
- drew relevant diagrams for mirrors, lenses, pulses, and diffraction correctly
- clearly set out multi step calculations and performed these accurately.

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

- demonstrated a comprehensive understanding of optics and waves
- explained physics phenomena using correct terminology and wrote coherent statements that were both concise and accurate
- linked explanations back to the context of the question, rather than generic statements
- demonstrated good algebra skills in calculations, especially when dealing with reciprocals
- identified the different types of mirrors and lenses, and drew accurate ray diagrams to locate images
- drew the appropriate diagrams required for waves and pulses.

91171: Demonstrate understanding of mechanics

Examination

The examination included three questions. Candidates were required to respond to all three questions: kinematics, momentum, and forces. Question One assessed candidates on projectile motion. Question Two assessed candidate's understanding of collisions using the conservation of momentum. Question Three covered forces in a spring, equilibrium, and circular motion.

Observations

Question 3c was left blank by many candidates.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- solved single-step numerical problems correctly
- identified the quantities named in questions accurately
- drew both a free body force diagram and a vector diagram correctly
- explained physics phenomena in a manner that demonstrated their understanding.

Candidates who were awarded Not Achieved commonly:

- did not solve single step numerical problems, due to an inability, either to identify the quantities involved, or which equation to use, or being unable to rearrange simple equations
- confused vertical with horizontal directions
- did not follow instructions in a question
- did not demonstrate understanding of force with velocity or acceleration or momentum
- did not distinguish between energy with momentum correctly
- wrote vague answers
- provided rote-learned answers out of context.

Candidates who were awarded Achievement with Merit commonly:

- linked between ideas appropriately, demonstrating in-depth understanding
- solved multi-step numerical problems accurately
- demonstrated understanding of the reasons that different masses fall at the same rate
- demonstrated understanding of the assumptions that are made to simplify understanding of mechanics
- explained the application of conservation laws in context
- linked the force experienced in a collision to the damage caused
- demonstrated understanding of the concept of torques and applied that knowledge in context.

Candidates who were awarded Achievement with Excellence commonly:

- demonstrated comprehensive understanding of mechanics in explicit, detailed, yet succinct answers, using correct physics terminology
- showed all working, clearly set out
- converted units into SI units before calculations
- identified that when a question asks for “direction” an angle calculation is required
- were able to state Newton’s third law in context
- applied the concept of torque correctly to calculate support forces in a rotational equilibrium situation.

91173: Demonstrate understanding of electricity and magnetism

Examination

The examination included three questions. Candidates were required to respond to all three. The questions covered electrical field, electric circuits, and magnetic fields. Question One assessed candidates on static electricity: uniform electric field, electric field strength, force on a charge in an electric field, electric potential energy, work done on a charge moving in an electric field. Question Two assessed candidates on DC circuits: parallel circuits with resistive component(s) in series with the source circuit diagrams, voltage, current, resistance, power. Question Three covered electromagnetism: force on a current carrying conductor in a magnetic field, force on charged particles moving in a magnetic field, induced voltage generated across a straight conductor moving in a uniform magnetic field.

Observations

Candidates who used precise physics terminology were able to achieve in the examination. Candidates who differentiated between magnetic and electric fields and their effects were able to achieve higher grades. Some candidates did exceptionally well by demonstrating an understanding of how and why all voltage and current values in a circuit change when a component is added or removed (at constant supply voltage). Many candidates attempted to explain better ways to wire a circuit when asked to give reasons why it was a bad way to wire the circuit. It is unlikely that a candidate will be supplying evidence towards the standard if they just quote generic circuit concepts such as “current splits in parallel”.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- calculated the electric field strength given the voltage and plate separation
- demonstrated understanding that increasing the voltage across parallel plates increased the field strength
- applied a right-hand rule to determine the positive end of a wire moving in a magnetic field
- calculated the voltage induced in a moving conductor
- calculated the resistance of a component given its power and voltage
- calculated the total resistance of a combination of resistive components

- used $F = BIL$ to calculate force on a piece of wire in a magnetic field, however, did not consider only the length in the magnetic field has to be used.

Candidates who were awarded Not Achieved commonly:

- did not recognise prefixes, and used non SI units in calculations
- quoted generic circuit rules such as "current splits in parallel circuits" without applying them to the question
- did not demonstrate an understanding of electric and magnetic fields
- used learned responses from previous years to this year's questions
- chose the correct formula to use, as they did not know what the letters in a formula represented
- substitute values into formulas incorrectly, or did not manipulate the formulas accurately to get the correct answer
- mistook the value of the electric field strength as the value for the electromagnetic potential energy of the electron.

Candidates who were awarded Achievement with Merit commonly:

- explained the effect of adding a resistor to a branch in the circuit
- correctly transformed non-SI units such as cm to m
- recognised energy conversion as electron travels between plates, used correct formula, accurate substitution, and calculation to find final velocity.
- used ratios correctly – recognised that electric field decreased to a quarter when voltage was halved, and distance doubled
- calculated total resistance of a series and parallel combination correctly
- demonstrated understanding that only length of wire inside the magnetic field is responsible for any induced voltage or force.

Candidates who were awarded Achievement with Excellence commonly:

- set out answers in a logical and careful manner
- used correct physics terminology accurately
- explained that adding a component into a circuit changed all the circuit parameters excluding the supply voltage
- started their argument by explaining what happened to the total resistance in a circuit
- displayed comprehensive understanding of the principles by formulating their own answers that applied to the questions in this year’s paper
- carried out multistep calculations using correct SI units
- explained the effect of simultaneously changing the distance between the plates and the voltage on the electric field
- clearly explained, using Physics principles, why the brightness of a lamp would increase if the resistance of a different branch of the circuit was increased
- stated 3 reasons to explain the reason wiring a circuit as described in Q2c would not be a good idea.