

National Certificate of Educational Achievement

2013 Assessment Report

Physics Level 2

- 91170 Demonstrate understanding of waves**
- 91171 Demonstrate understanding of mechanics**
- 91173 Demonstrate understanding of electricity and electromagnetism**

COMMENTARY

The overall performance of candidates in 91171 was fairly good. Those getting Excellence demonstrated a good understanding of level 2 mechanics. The main misconceptions were related to:

- the forces acting on a projectile when air resistance is ignored
- drawing a vector addition triangle for three vectors when forces are balanced.

Candidates should be specific in their responses. E.g. when told that voltage doubles, this is an indication that a numerical response is required: e.g. power quadruples, not just power increases.

Candidates should be aware that for waves, they need to use a ruler to draw ray diagrams.

STANDARD REPORTS

91170 Demonstrate understanding of waves

ACHIEVEMENT

Candidates who were awarded Achievement for this standard demonstrated the required skills and knowledge. They typically:

- knew some basic physics facts, but did not understand the underlying principles of a given context
- presented concepts in a confused way with flawed explanations linked to the context
- showed limited ability when completing or drawing diagrams
- demonstrated some understanding of the properties of mirrors, lenses and basic wave phenomena
- used correct formulae for calculations, but had difficulty completing the mathematical calculations necessary to give the required answer.

NOT ACHIEVED

Candidates who were assessed as Not Achieved for this standard lacked some or all of the skills and knowledge required for the award of Achievement. They typically:

- did not know where to start and left huge sections empty
- did not understand the context of the questions and often repeated statements already given or contradicted themselves in their answers
- mixed up related facts and ideas applying them incorrectly
- had poor algebraic, arithmetic and drawing skills and had difficulty substituting and rearranging formulae to solve problems.

ACHIEVEMENT WITH MERIT

In addition to the skills and knowledge required for the award of Achievement, candidates who were awarded Achievement with Merit typically:

- used the correct physics terminology and applied correct physics ideas to the contexts
- demonstrated good knowledge and ability to draw appropriate diagrams for mirrors, lenses and wave phenomena
- used appropriate formulae and made only minor errors in the calculations.

ACHIEVEMENT WITH EXCELLENCE

In addition to the skills and knowledge required for the award of Achievement with Merit, candidates who were awarded Achievement with Excellence typically:

- completed calculations without error
- were able to link calculations to written explanations
- constructed accurate and correct diagrams which linked to and explained a physical situation
- interpreted complex situations and made appropriate links
- correctly applied knowledge to unfamiliar situations.

OTHER COMMENTS

Work that is neatly laid out with clear, legible handwriting and supporting diagrams helps the markers make fair judgements.

The use of a ruler to draw diagrams should be a given.

91171 Demonstrate understanding of mechanics

ACHIEVEMENT

Candidates who were awarded Achievement for this standard demonstrated the required skills and knowledge. They typically:

- knew that the direction of the velocity of an object moving in a circle is tangential
- calculated the speed of an object moving in circular motion, given its period and the radius of the circle
- used the relationship between velocity, time and acceleration to calculate velocity
- recognised that an object moving at constant velocity has no unbalanced force acting on it
- understood that friction is a force opposing motion
- knew the names and directions of some of the forces acting on a balanced seesaw
- understood that the principle of balanced torques applies to a stationary object
- explained that the only force acting on a thrown ball is gravity
- calculated one of the components of the velocity of a projectile
- calculated the total momentum of a person in a car accurately
- demonstrated some knowledge of the physics underlying the cushioning of a collision
- could begin to apply the principle of conservation of momentum
- were able to calculate the elastic potential energy stored in compressed rubber, including the use of correct units
- knew how to calculate the impulse of a force.

NOT ACHIEVED

Candidates who were assessed as Not Achieved for this standard lacked some or all of the skills and knowledge required for the award of Achievement. They typically:

- did not recognise that the velocity of an object moving in a circle is tangential in direction

- were unable to calculate the speed of an object moving in circular motion from its period and the radius of the circle
- were unable to use the relationship $a = \Delta v / \Delta t$ to calculate Δv correctly
- thought that the weight force of an object moving at constant speed was unbalanced
- had little understanding of the forces acting on an object moving at constant speed
- did not know where to draw forces such as weight force or support force acting on a balanced seesaw
- lacked the ability to apply the principle of balanced torques to a stationary seesaw
- assumed that the force used in throwing a ball continued after the ball had left the thrower's hand
- failed to understand the concept of combined horizontal and vertical motion of a projectile
- applied the formula for momentum incorrectly
- had no clear idea of the physics underlying the cushioning of a collision
- did not realise that the quantity conserved in a collision is momentum
- forgot to use SI units when substituting into the formula for elastic potential energy
- were unsure of the concept of impulse.

ACHIEVEMENT WITH MERIT

In addition to the skills and knowledge required for the award of Achievement, candidates who were awarded Achievement with Merit typically:

- were accurate in their calculation of the velocity of an object in circular and consequent computation of the centripetal force on the object
- could substitute a calculated velocity into a second kinematic equation without allowing for negative acceleration
- understood that friction is a force opposing motion and that a reaction (support) force is at right angles to the supporting surface
- recognised that there is no downward force apart from gravity acting on a person sliding down a slope
- knew the names and directions of all of the forces acting on a balanced seesaw with no extraneous additional forces
- could write an accurate equation for balanced torques
- recognised that there is no force apart from gravity acting on a projectile and could explain the effect of this force on the motion of the projectile
- were able to calculate both the horizontal and vertical components of the velocity of a projectile and link that data to the next step in the calculation
- showed understanding of the physics underlying the cushioning of a collision by linking two valid ideas together
- could apply the principle of conservation of momentum to a collision accurately
- knew the correct units for the impulse of a force.

ACHIEVEMENT WITH EXCELLENCE

In addition to the skills and knowledge required for the award of Achievement with Merit, candidates who were awarded Achievement with Excellence typically:

- were accurate in their use of a second kinematic equation, recognising that a deceleration must be substituted as a negative acceleration
- understood the concept of vector addition and were able to apply it correctly to the situation of three forces in equilibrium
- could solve an accurate equation for balanced torques
- were able to follow through a comprehensive calculation relating to projectile motion correctly
- could write an in depth discussion of the physics underpinning the cushioning of a collision
- were able to complete an accurate calculation of the resulting velocity of two colliding cars, including stating the direction of travel.

91173 Demonstrate understanding of electricity and electromagnetism

ACHIEVEMENT

Candidates who were awarded Achievement for this standard demonstrated the required skills and knowledge. They typically:

- applied basic circuit formulae
- rounded numbers appropriately
- used correct units
- applied right hand rules or equivalent to determine direction of fields and forces
- could explain that increasing the voltage across a resistor increased the power output
- realised that removing a resistor from a parallel component increased the total resistance of the circuit
- recognised that the force being asked for was that on a current carrying wire in a magnetic field
- calculated kinetic energy of an electron given mass and speed.

NOT ACHIEVED

Candidates who were assessed as Not Achieved for this standard lacked some or all of the skills and knowledge required for the award of Achievement. They typically:

- confused magnetic and electric fields
- could not select the correct quantities from those supplied and substitute them into the formula
- used incorrect or no units
- used incorrect physics terms or used generic language in explanations
- mixed up concepts such as force on a moving charge and force on a current carrying wire
- were not aware that a charge moving parallel to the magnetic field experienced zero magnetic force.

ACHIEVEMENT WITH MERIT

In addition to the skills and knowledge required for the award of Achievement, candidates who were awarded Achievement with Merit typically:

- carried out multi step calculations
- realised that when the distance halved, the electric field and force doubled
- explained that a charged particle moving along the field lines experienced no force
- showed that doubling the voltage across a resistor caused a four-fold increase in power output.

ACHIEVEMENT WITH EXCELLENCE

In addition to the skills and knowledge required for the award of Achievement with Merit, candidates who were awarded Achievement with Excellence typically:

- interpreted complex situations and made appropriate links
- were able to easily link mathematics to a written explanation
- correctly applied knowledge to unfamiliar situations
- correctly argued that equal voltages were induced in both wires and that they cancelled making the current zero
- explained the effect on the voltage across one resistor of removing another resistor in parallel with it, in terms of the total circuit resistance and current.