

National Certificate of Educational Achievement

2012 Assessment Report

Physics Level 2

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

COMMENTARY

STANDARD REPORTS

91170 Demonstrate understanding of waves

ACHIEVEMENT

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

- knew some basic facts, but did not understand the underlying physics principles of a given situation
- showed limited ability drawing/completing diagrams
- presented concepts in a confused way with incorrect explanations linked to the situation
- demonstrated some understanding of the properties of mirrors and lenses and basic wave phenomena
- used correct formulae for one-step calculations, but had difficulty performing the mathematical calculations.

NOT ACHIEVED

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

- knew few or none of the basic facts concerning waves and their behaviour
- did not interpret questions correctly and often repeated statements already given, or contradicted themselves in their answers
- did not understand and/or could not draw or complete diagrams correctly
- confused mirrors and lenses and terms such as refraction and diffraction and used terms inappropriately
- 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 commonly:

- were able to express the physics underlying a concept and applied reasoning to solve a problem
- showed ability drawing/completing diagrams and understanding of the properties of mirrors and lenses and basic wave phenomena
- used formulae and rearranged correctly and were able to calculate one step mathematical problems, but did not recognise negative distances with the lens calculation
- used significant figures and units correctly.

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 commonly:

- constructed accurate and correct diagrams which linked to and explained a physical situation
- interpreted complex situations and made appropriate links
- correctly substituted and rearranged a mathematical equation when calculating an answer and were able to recognise a negative length for lens calculations
- were able to easily link mathematics to a written explanation
- correctly applied knowledge to unfamiliar situations.

OTHER COMMENTS

It is acceptable to annotate answers using diagrams to illustrate meaning.

It is important to use a ruler while drawing ray diagrams and rays need to have arrows drawn to show their direction.

91171 Demonstrate understanding of mechanics

ACHIEVEMENT

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

- understood that circular motion requires a centripetal force
- understood that mechanical energy is conserved during a fall
- understood that momentum is conserved during a collision
- were able to apply conservation of momentum to a collision
- applied the principle of balanced torques correctly in a numerical context
- explained how many significant figures were appropriate to use in an answer and applied their understanding
- applied a kinematic equation correctly
- could describe energy transfers correctly in the context of an elastic rope
- understood the direction of a reaction force
- demonstrated some understanding of the effect of the tightness of an elastic rope
- showed some understanding of the effect of a weight force in extending an elastic rope
- could calculate the horizontal component of a force vector correctly
- recognised that a system in equilibrium could be moving with constant velocity
- showed understanding of how to increase the horizontal component of a force without changing the magnitude of that force.

NOT ACHIEVED

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

- did not understand that energy can change form when conserved
- understood that momentum is conserved during a collision

- were unable to apply conservation of momentum in a numerical context
- did not understand the concept of centripetal force
- failed to equate clockwise and anticlockwise torques correctly
- did not understand the appropriateness of significant figures
- could not calculate the vertical component of a velocity vector
- showed no understanding of the energy transfers involved in falling or stretching an elastic rope
- could not explain how the tightness of an elastic rope affected the person landing on it
- demonstrated no understanding of the energy stored in a stretched rope
- had some understanding of the concept of equilibrium
- misinterpreted the question regarding drawing the forces acting on a specified object.

ACHIEVEMENT WITH MERIT

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

- were able to apply conservation of energy in a numerical context
- did not use kinematic equations inappropriately (viz: did not confuse vertical and horizontal velocities)
- used correct descriptors for the direction of a force
- calculated the vertical component of a velocity vector correctly
- showed some understanding of the two dimensional nature of projectile motion
- showed understanding of the effect of a weight force in extending an elastic rope
- could combine ideas about force and elasticity to calculate the energy stored in a stretched elastic rope
- were able to describe some of the conditions required for equilibrium
- expressed clear understanding of how to increase the horizontal component of a force without changing the magnitude of that 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 commonly:

- showed clear understanding of unbalanced forces in the context of motion in a vertical circle
- were able to express their understanding of unbalanced forces in the context of motion in a vertical circle concisely and without contradiction
- demonstrated clear understanding of the two dimensional nature of projectile motion
- were able to express their understanding of the two dimensional nature of projectile motion concisely and without contradiction
- recognised and explained the effect of external forces on projectile motion
- demonstrated clear understanding of the effect of rapid deceleration
- explained in concise detail their understanding of what effect the tightness of an elastic rope would have on the forces exerted on a person landing on that rope
- were able to discuss clearly all of the conditions required for equilibrium
- showed good understanding of forces

- demonstrated ability to link an increased horizontal force component with the development of an unbalanced force and hence an acceleration.

91173 Demonstrate understanding of electricity and electromagnetism

ACHIEVEMENT

Candidates who were awarded Achievement demonstrated the required skills and knowledge. They commonly:

- could explain 12V, 5W in terms of voltage and power.
- could explain that when two lamps have the same voltage drop across them the one with the larger power rating will be brighter.
- did not convert time into seconds
- made specific, in context, comments on the properties of series circuits eg the current through each bulb is the same as throughout the circuit, in a series circuit
- calculated the total resistance of the circuit
- stated the current in a branch of a parallel circuit is halved if the lamps are identical
- either stated that battery was connected to stop the drop from falling, or stated forces were equal and opposite
- either calculated the voltage, or recognised the need for 2sf
- could calculate the weight force
- could apply the right hand slap rule to find the direction of the force on a current carrying wire
- correctly used $V=IR$ and $F=BIL$.

NOT ACHIEVED

Candidates who were awarded Not Achieved (0, 1 or 2) for this question lacked some or all of the skills and knowledge required for the award of Achievement (3 or 4). They commonly:

- mixed up physics concepts and talked about such things as voltage flowing, more electricity etc
- could not state the definition for V and W
- confused series and parallel circuits
- were unable to state the effect of a series circuit on the current
- were unable to begin the calculation of the current
- were unable to state the effect of a parallel circuit in anything other than vague and ill-explained ideas
- had no understanding of Millikan's experiment
- either did not recognise that gravity was acting on the drop, or recognised the forces were equal but not opposite in nature
- incorrectly applied the right hand slap rule
- explained the reason for the force as being "the right hand slap rule"
- confused electric and magnetic fields.

ACHIEVEMENT WITH MERIT

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

- were able to relate power output to brightness
- stated the meaning of V and W
- used time in seconds for the energy calculation
- could find the resistance of a bulb given its power and voltage.
- stated the current was the same everywhere in a series circuit
- stated that the lamps were identical and therefore had $4V$ across each of them
- were able to calculate the problem to at least the R_{total} for the circuit
- stated the current in the branch is halved as the lamps were identical
- calculated the voltage accurately
- identified 2sf required
- correctly explained why 2sf was appropriate
- could explain why a current carrying wire in a magnetic field experienced a force.

ACHIEVEMENT WITH EXCELLENCE

In addition to the skills and knowledge required for the award of Achievement with Merit (5 or 6), candidates who were awarded Achievement with Excellence (7 or 8) commonly:

- were able to relate power output to brightness
- could calculate the total resistance of combinations in parallel
- related brightness to power and argued from $P=IV$
- followed specific instructions (e.g. began 2b by finding the resistance of each lamp)
- realised that in 2c both I and V changed for bulbs B and C and/or used calculations to find the power for each bulb
- explained Millikan's experiment and were specific as to why the top plate was positive
- understood that the forces acting on the drop had to be equal and opposite
- calculated the voltage accurately
- identified 2sf required
- correctly explained why 2sf was appropriate
- explained in terms of induced current and Lenz's law why a wire made to move in a magnetic field slows down
- correctly identified the length of the conductor carrying the current.