National Certificate of Educational Achievement

2014 Assessment Report

Physics Level 2

91170 Demonstrate understanding of waves

91171 Demonstrate understanding of mechanics

91173 Demonstrate understanding of electricity and electromagnetism

COMMENTARY

Able candidates expressed their answers clearly and economically, using physics terms fluently without repetition or contradiction. They also displayed good mathematical skills. Less well-performing candidates would benefit from focusing on their comprehension of physics ideas and their ability to explain basic physics concepts, as well as on their interpretation of examination-style questions.

Candidates need to know how their calculator works, they need to know when extra brackets are necessary, and also that if a calculator displays the answers as 2.4E-10 they need to write this correctly in scientific notation.

Although calculation questions can be answered without any written explanation it is difficult to award any credit for a page of numbers scrawled throughout the answer space without any guidance from the candidate as to what they think they are calculating.

Candidates need to realise that rounding should only be carried out on the final answer and not intermediate steps.

STANDARD REPORTS

91170 Demonstrate understanding of waves

ACHIEVEMENT

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

- could complete simple diagrams for waves and rays and were able to describe images as real or virtual for convex lenses
- identified basic physics concepts such as Total Internal Reflection, refraction, diffraction, interference and the movement of different types of waves/pulses in various media
- could substitute into formulae and solve simple calculations giving answers with correct units and significant figures.

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 commonly:

- could not draw wave, pulse or ray diagrams correctly or describe image types for convex lenses
- were unsure or confused when dealing with basic physics phenomena e.g. did not know the difference between lenses and mirrors, light and sound waves and refraction and diffraction
- often substituted values incorrectly into formulae and could not do simple calculations.

ACHIEVEMENT WITH MERIT

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

- could correctly draw more complex diagrams e.g. convex lens with object between the focus and the lens and reflection of a pulse at a 'light to heavy' spring boundary
- were able to make appropriate links for physics phenomena e.g. diffraction to wavelength, phase changes to boundaries and nodes to destructive interference
- could complete more complex calculations 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:

- could write coherent statements that were both concise and accurate
- could correctly complete multistep calculations using two formulae
- were able in their answers to link explanations back to the specifics of the question rather than give mere generalisations e.g. why a virtual image cannot be captured by a camera, or how path difference and wavelength lead to nodes and antinodes and how these form.

91171 Demonstrate understanding of mechanics

ACHIEVEMENT

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

- chose the formula to use for calculating impulse
- understood that projectile motion has two independent components
- could explain the reasons for the values of the components of projectile motion
- had the ability to calculate elastic potential energy
- could calculate the work done in lifting a mass
- drew the free body forces on a punch-bag
- used a vector diagram to calculate a force
- had a fair idea of the link between force and stopping time
- knew how to calculate a vertical support force
- understood that equilibrium implies balanced forces
- could apply formulae to solve a problem on force and motion
- were able to calculate momentum with units
- understood and applied the principle of energy conservation.

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 commonly:

- could complete the first step in solving a numerical problem
- did not comprehend what a question was asking and thus either did not answer it at all or wrote an irrelevant response

- did not understand the concept of impulse
- confused the conservation principles of energy and momentum and their application in various contexts
- misunderstood the distinction between mass and weight
- failed to draw force diagrams
- had no understanding of balanced and unbalanced forces.

ACHIEVEMENT WITH MERIT

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

- showed understanding of the concept of conservation of momentum
- applied the concept of conservation of energy in problem solving
- knew that numerical work in physics is carried out using SI units and were able to convert thereto
- drew the free body forces on a supported barbell in position with no missing or extraneous forces
- were able to apply the concept of balanced torques
- understood that the size of a force is related to time of impact through the concept of impulse or change of momentum
- explained the meaning of equilibrium as a situation where zero net force results in no acceleration and showed a clear understanding of centripetal force
- had the ability to perform an algebraic manipulation
- gave a direction for a momentum change
- completed at least two steps of a three-step calculation.

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:

- explained the necessary condition for conservation of momentum and applied it in the case of a falling ball
- stated clearly that if it is assumed that all energy is converted from one form to another, then no energy may be lost to other forms
- made a clear statement that impulse or change of momentum must be assumed to be the same when comparing the forces for different collision times
- explained clearly that road friction supplies the necessary centripetal force for a car rounding a bend, that this force becomes zero on ice, and described fully the resulting motion of the car.

OTHER COMMENTS

The overall performance of candidates in the mechanics standard was widely spread and reflected a broad spectrum of understanding.

91173 Demonstrate understanding of electricity and electromagnetism

ACHIEVEMENT

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

- rounded correctly and could state why they rounded to that number of significant figures
- started the calculation by following the hint
- recognised resistances in series and could calculate the total resistance
- could apply V=IR to a single component
- could calculate the magnetic force given B,q,V
- name the upwards force in Milikans experiment.

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 commonly:

- confused electric and magnetic forces and fields
- did not realise that the power of a resistor determined its heat output
- misunderstood powers of ten and thought the mass of an electron was more than a proton
- lacked calculator skills often stating correct equation with correct substitution but calculating an incorrect answer
- thought there could be different current through series components
- did not realise that adding/removing a component from a circuit affects all circuit properties except the supply voltage
- thought gravity acted upwards
- used imprecise everyday words to try and describe physics phenomena.

ACHIEVEMENT WITH MERIT

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

- realised that moving parallel plates closer together increased the field strength between them
- knew voltages in series added to the supply voltage
- knew adding a resistance in parallel decreased the total R of the circuit and this increased the total current
- knew that the charges in a conductor experience a force when a conductor is pushed through a magnetic field.

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:

- realised that a complete circuit is needed to get an induced current when a conductor is pushed through a magnetic field
- could calculate the total R for a combination of series and parallel resistors
- knew that power depends on current squared times resistance and that resistors in series had the same current, therefore the bigger resistor had the higher power output
- based arguments on physics formula and used precise physics language.