

# **National Certificate of Educational Achievement**

## **2011 Assessment Report**

### **Physics Level 1**

- 90937 Demonstrate understanding of aspects of electricity and magnetism**
- 90938 Demonstrate understanding of aspects of wave behaviour**
- 90939 Demonstrate understanding of aspects of heat**

## COMMENTARY

The majority of candidates made a real attempt to answer all the questions. Where candidates attempted whole questions, there was generally sufficient evidence to award at least an Achievement grade.

Candidates need to be more specific and accurate in their use of physics terms when answering explanation-type questions, where often ambiguity and lack of clarity prevented candidates from gaining higher grades.

Many candidates need to take more care communicating their understanding of the physics concepts used in calculations by showing the formula used at each step and the substitution of data followed by clearly laying out their working, to gain higher grades.

### **90937 Demonstrate understanding of aspects of electricity and magnetism**

#### **ACHIEVEMENT**

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

- understood electron transfer as a cause of static electricity
- stated that unlike charges attract
- recognised that charges are not created
- gave friction as the cause of static electricity
- explained the effect on brightness of bulbs connected in series
- calculated quantities such as total resistance and current in a series circuit
- calculated strength of the magnetic field around a wire
- recognised the weakest point in the Earth's magnetic field
- identified the shape of magnetic field produced by a solenoid, or the polarity of the solenoid
- stated one method to increase the strength of an electromagnet.

#### **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 typically:**

- did not identify electron transfer as a cause of static electricity
- did not differentiate the method of charging by friction from charging by induction
- did not showed understanding of the effect of a component failure in a series circuit
- did not show understanding of magnetic field due to a solenoid
- did not relate the strength of magnetic field to spacing of field lines.

## **ACHIEVEMENT WITH MERIT**

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

- showed understanding of the idea that static electricity resulted from an imbalance of charges
- described the difference between conductors and insulators in terms of electron movement
- related the variation of brightness, voltage, and current in components in a series circuit as more components are added
- explained that a break in a series circuit resulted in no current flowing through any components
- explained the use of the righthand grip rule to find the direction of the magnetic field produced by a current carrying straight conductor
- accurately calculated the strength of the magnetic field produced by a current-carrying straight conductor
- partially understood the effect of combining two magnetic fields from current-carrying straight conductors
- identified the shape of magnetic field produced by a solenoid and the polarity of the solenoid
- stated two methods for increasing the strength of an electromagnet
- showed understanding of how voltage and current varied in a parallel circuit and used their understanding to calculate the value of the required unknowns.

## **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:**

- accurately explained the difference between a conductor and an insulator when charged by friction, and the resulting forces between the charged objects
- calculated the energy used by different components in a series circuit
- fully explained the effect of combining two magnetic fields from current-carrying straight conductors
- calculated the total resistance of a parallel circuit correctly from the given data.

## **90938 Demonstrate understanding of aspects of wave behaviour**

### **COMMENTARY**

Most candidates attempted all questions in this standard. In general, candidates showed a good understanding of wave behaviour in a number of contexts.

The concepts of refraction and reflection were well understood by most candidates. However, many candidates did not to show a good understanding of diffraction and dispersion.

Most candidates were able to carry out simple calculations well. Explanation-type questions were often substantiated with the use of relevant equations and discussing the effect on a given situation when conditions are varied.

## **ACHIEVEMENT**

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

- constructed a partial ray diagram for refraction and reflection of light
- identified optical density of a material as the cause of refraction
- identified the correct positions of yellow, green and violet colours in an electromagnetic spectrum
- showed correctly how the word 'WAVES' is reflected in a plane mirror
- were able to identify regular or irregular reflection for a given situation
- explained why walls of a room lined with mirrors gave an apparent feeling of space
- correctly calculated the required quantities in single step questions
- described, in terms of particle arrangement, the meaning of the terms compression or rarefaction
- stated correctly how the distance between a compression and a rarefaction changed with increased frequency
- identified diffraction as the event taking place in a given situation.

## **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 typically:**

- did not draw a partial ray diagram for refraction and reflection of light
- did not state optical density of a material as the cause of refraction
- did not know the properties of an image formed by a plane mirror
- did not show how a mirror laterally inverts the image of an object in front of it
- did not carry out simple one-step calculations
- conveyed no understanding of the relationship between frequency and wavelength for a given wave
- did not identify diffraction as the event taking place in a given situation.

## **ACHIEVEMENT WITH MERIT**

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

- identified a change in optical density as the cause of refraction at the boundary between two media
- explained the workings of a bicycle reflector
- drew the ray diagram showing the image size and its position for a burning candle reflected by a glass table top, with minor flaws
- identified regular and irregular reflection for a given situation or explained the difference between regular and irregular reflection
- described, in terms of particle arrangement, the meaning of the terms compression and rarefaction
- stated correctly why the distance between a compression and a rarefaction changed with increased frequency
- linked two concepts correctly to calculate the required unknown value

- correctly drew a diagram to show the shape of diffracted waves in a given situation
- explained that dispersion of colours is due to their different frequencies or wavelength.

## **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:**

- drew a complete correct ray diagram showing the image size and its position for a burning candle reflected by a glass table top
- explained how a change in frequency affected the distance between a compression and the adjacent rarefaction of a longitudinal wave
- explained that dispersion of white light by a prism is caused by different colours travelling at different speeds
- carried out the multi-step calculations linking different concepts logically to find required unknown values.

## **90939 Demonstrate understanding of aspects of heat**

### **COMMENTARY**

Most candidates demonstrated a good understanding of absorption and reflection of radiant energy. Even though most candidates showed understanding of heat transfer methods, many did not explain correctly the concept of latent heat. A large number of candidates incorrectly suggested that “cold heat” transfers from cold objects to hot objects.

Many candidates too often made generalised statements without links to the specifics of the question, which prevented them from gaining higher grades.

### **ACHIEVEMENT**

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

- drew a graph for change of state of matter correctly for a given situation or identified melting and boiling points on the graph
- defined the concept of temperature or thermal energy
- compared the rate of absorption of heat energy by iron and aluminium
- calculated single-step calculations correctly to find the required unknown value
- showed understanding that materials like foam and wood are poor conductors of heat
- described that during the cooling process, heat transfer takes place from warm things to cold ones
- showed understanding that the process of evaporation requires absorption of heat energy
- compared the rate of absorption or radiation of heat by white and coloured substances.

## **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 typically:**

- did not draw a graph for change of state of matter correctly
- did not show any understanding of basic heat concepts such as temperature, heat energy, specific heat capacity and latent heat
- did not match the correct formula with the given data
- stated nonsensical concepts such as “cold heat” being transferred from cold to hot objects.

## **ACHIEVEMENT WITH MERIT**

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

- differentiated the concept of temperature from thermal energy
- drew a graph for change of state of matter correctly and identified melting and boiling points on the graph
- used the idea of specific heat capacity to compare the heat absorption properties of different metals
- applied heat ideas to evaluate the efficient design of a barbeque
- used latent heat to explain the process of evaporation and cooling
- carried out two-step problems correctly
- compared the rate of absorption or radiation of heat by white and coloured substances during day or night.

## **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:**

- used the concepts of mass and kinetic energy to differentiate temperature from thermal energy
- explained the variation in thermal absorption and radiation from white and dark walls during day and night
- carried out the multi-step calculations linking latent heat and specific heat capacity to find the required value
- carried out the multi-step calculations linking power and specific heat capacity to find the time needed for a plate to reach the required temperature.