2015 NCEA Assessment Report

Physics Level 1 90937, 90938, 90939

Part A: Commentary

Comment on the overall response of candidates to 2015 examinations for all achievement standards covered by this report.

In AS90937 (Demonstrate understanding of aspects of electricity and magnetism) the space provided for answers was adequate and the overall length of the paper was appropriate as the vast majority of candidates finished the exam. Overall candidates had the opportunity to demonstrate their understanding over a broad range of physics concepts covered by this standard. Candidates were well prepared for questions involving series and parallel circuits with a majority of candidates achieving merit or excellence in this section of the examination. Some candidates were less prepared for concepts involving magnetism and electromagnetism.

In AS90938 (Demonstrate understanding of aspects of wave behaviour) the diagrams were clear and students mostly had sufficient space to write their answers. Overall most candidates attempted all questions and showed a reasonable understanding of the subject matter. The concepts of reflection and refraction were sufficiently understood, however some candidates struggled to describe the physics conditions required for Total Internal Reflection. Some candidates struggled to complete a ray diagram to show the formation of an image in a plane mirror.

In AS900939 (Demonstrate understanding of aspects of heat) most candidates attempted all questions and the examination provided sufficient opportunity for candidates to show their knowledge across the range of concepts covered in this standard. However it is noted that the space provided for answers was too limited for some candidates. Most candidates were well prepared for the concepts involving heat transfer methods, however some struggled to use correct physics terminology in their answers. Candidates are encouraged to use the correct terminology, with definitions, in their explanations.

Part B: Report on standards

1. Assessment Report for 90937: Demonstrate understanding of aspects of electricity and magnetism

Achieved	Candidates who were assessed as Achieved commonly: • applied Ohm's law and the power equation in circuit calculations • stated how objects become statically charged • described the rule that opposite charges attract • drew a magnetic field pattern with some minor errors • knew that iron was used as the core of an electromagnet.
Not Achieved	Candidates who were assessed as Not Achieved commonly: • confused the ideas of voltage and current in circuits • used general wording rather than specific physics terminology in explanations • knew rules of electrostatic attraction but were unable to apply them in context • confused static electricity and magnetism, charges and poles • were unable to rearrange formulae when needed for calculations.

Achieved with Merit	Candidates who were assessed as Achieved with Merit commonly: • explained how resistance, voltage and current were related in series circuits • calculated the total current in a parallel circuit given various characteristics of components • explained electrostatics in terms of electron transfer and net charge on objects • were familiar with the operation of a lightning conductor • explained the operation of a relay.
Achieved with Excellence	Candidates who were assessed as Achieved with Excellence commonly: • linked explanations of the various features of a lightning conductor together to explain the overall action • explained the action of a relay and correctly rearranged the formula for magnetic field strength in order to calculate current.
Standard specific comments	Candidates who achieved in this standard had generally received scores at the level of achievement in at least two questions. Many candidates struggled with the static electricity explanations as they were not sure if the cat's hair became positively or negatively charged. This resulted in some over long and some confused answers.

2. Assessment Report for 90938: Demonstrate understanding of aspects of wave behaviour

Achieved	Candidates who were assessed as Achieved commonly: • identified a sound wave as longitudinal • calculated a wave period but did not convert kHz to Hz • calculated distance given speed and time values, but did not realise sound had to travel there and back for an echo to be heard • realised that sound will echo back from a distant object "quicker" than from a far object but did not explain that quicker meant "in a shorter time period" • recalled that diffraction occurs when waves pass a rock • deduced the number of waves shown in a diagram and use this to calculate wavelength • calculated wave speed from frequency and wavelength data • stated the law of reflection • drew a single ray, with arrows, to show how a sea lion could see its reflected image • knew one of the two conditions needed for Total Internal Reflection to occur • calculated speed from time and distance values but used an incorrect value for frequency to calculate a wavelength.
Not Achieved	Candidates who were assessed as Not Achieved commonly: • did not recognise the diagram as a longitudinal wave and/or described the motion of a transverse wave • could not select a formula to attempt a wave period calculation • drew reflected waves instead of diffracted waves or were unable to draw waves of constant wavelength • were unable to deduce the angle of reflection from information in a diagram • could not draw a refracted ray through a new medium • thought reflected rays (in the same medium) travelled slower due to losing energy on impact • attempted a ray diagram for a plane mirror with incorrect ray paths not reaching the sea lion's eye or drawing rays leaving the sea lion's eye • were unable to describe the difference between real and virtual images • were unable to explain any of the conditions required for Total Internal Reflection to occur.

Achieved with Merit	Candidates who were assessed as Achieved with Merit commonly: • explained a longitudinal wavelength using correct terminology involving compression and rarefaction • described the motion of particles in a longitudinal wave as oscillating parallel to the direction of wave travel • calculated wave period with the conversion of kHz to Hz • attempted to calculate the distance of dolphin to fish but forgot to halve the distance • explained that time taken for sound to return to the dolphin depended on how far away the objects are that the sound wave reflects off • drew a diffraction diagram showing constant wavelength and correct amount of curvature • carried out a two step calculation involving wavelength and speed having correctly interpreted that six wavefronts represents five wavelengths • drew ray diagrams for refracted rays as light passes into plastic then air • explained that the speed of a ray was unchanged if the medium it was travelling in remained the same • drew a ray diagram with two rays (with direction and dotted lines for virtual rays) to show how a reflection is seen • described a virtual image in terms of light rays rather than properties of reflected images • recalled the two conditions required for Total Internal Reflection in terms of optical density of the different media and angle of incidence/critical angle • could describe the inverse relationship between frequency and wavelength, when the velocity is constant.
Achieved with Excellence	Candidates who were assessed as Achieved with Excellence commonly: • able to calculate the distance from the dolphin to the fish using velocity = distance/time, including halving the distance and then related physics concepts of time, velocity and distance to the context of echoes travelling between far or close objects • were able to fully draw and explain what happened to refracted rays as they enter plastic from water, and air from plastic, taking account of the difference in their optical densities • calculated wavelength from two other calculated values and then described the inverse relationship between frequency and wavelength using a formula to illustrate.
Standard specific comments	Although a clear mistake was made with the wording in question two, most candidates who attempted the question completed it correctly. Candidates who did not correctly draw ray diagrams involving a plane mirror often confused the direction of the rays, these should be drawn to enter the eye of the observer.

3. Assessment Report for 90939: Demonstrate understanding of aspects of heat

Achieved	Candidates who were assessed as Achieved commonly: • stated heat energy flows from a hot region to a cool region • identified the method of heat transfer for a given context • identified and used the equation needed to determine the temperature increase given appropriate data • stated that white/shiny objects are good reflectors / poor absorbers of heat radiation • recognised that latent energy is released when a change of state occurs from gas to liquid • calculated the energy required for a given mass of water to change state from liquid to gas

	• drew or described the formation of a convection current • drew particle diagrams to represent a solid and a gas state • described the effect of an increase in temperature on the distance between particles in a liquid.
Not Achieved	Candidates who were assessed as Not Achieved commonly: • could not identify the correct values to use in an appropriate formula • could not describe how heat losses are reduced • incorrectly described conduction, convection and radiation in a given context • could not describe that particles spread out when heated • could not describe the effect of latent heat on a change of state • could not draw a convection current • described particles as expanding when heated.
Achieved with Merit	Candidates who were assessed as Achieved with Merit commonly: • calculated heat gained by a substance on heating using supplied data • explained how heat loss is minimised using understanding of a single heat transfer principle • explained, using particle models, how heat energy travels by conduction and convection • completed two step calculations to determine the temperature rise of a heated substance • used the idea of latent heat to explain how energy is released when a substance changes state from gas to liquid • used correct SI units.
Achieved with Excellence	Candidates who were assessed as Achieved with Excellence commonly: • explained the prevention of heat transfer using correct physics terms and linking the types of heat transfer to the given context • completed two step calculations to determine the temperature rise of a heated substance and explained heat exchange systems • fully explained convection ovens and their use in a given context.
Standard specific comments	At times, it was noted that candidates were not answering both parts to a written question in the examination. Some candidates did struggle to use correct physics terminology in their explanations.