2015 NCEA Assessment Report

Science Level 1 90940, 90944, 90948

Part A: Commentary

Comment on the overall response of candidates to 2015 examinations for all achievement standards covered by this report.
The change this year from four questions in each paper to three resulted in fewer blank responses. However, it is still important for candidates to note that evidence for each question comes from the entire question, with unanswered parts limiting achievement.
Each question has an over-arching idea from the relevant standard, leading to a single grade for the question. Some questions have scaffolding but this should not be treated as separate parts. Answering the question will involve more than just addressing the bullet points. For all grades ideas from the bullet points need to be linked to give a reasoned response. For higher grades linking ideas by giving reasons or consequences relevant to the question is important.
The ability to apply ideas to a given context, which may be unfamiliar to the candidate, is expected and some candidates struggled to do this. Practice with a range of contextual questions is important.

Part B: Report on standards

1. Assessment Report for 90940: Demonstrate understanding of aspects of mechanics

Achieved	Candidates who were assessed as Achieved commonly: • chose the correct formula from the list and substituted in values • gave one reasoned answer and did not link ideas • carried out single step calculations • described basic concepts, such as net force, energy and pressure • were unable to give correct units • interpreted information from a graph, e.g. different motion types on distance-time graph • had difficulty converting grams into kilograms • had difficulty with understanding pressure in an unfamiliar context • confused friction with energy • could not make the link between mass and weight.
Not Achieved	Candidates who were assessed as Not Achieved commonly: • chose the incorrect formula for calculations • could not find the area of a triangle and/or rectangle • confused acceleration with velocity • attempted insufficient questions to gain an achieved grade • misread or could not interpret contextual questions • used non-scientific language regularly and had difficulty defining key words, e.g. weight and mass • mistook friction force as a type of energy.
Achieved with Merit	Candidates who were assessed as Achieved with Merit commonly: • manipulated formulae to complete multiple step calculations and used correct units • understood that forces cause movement rather than the reverse • showed understanding of the relationship between concepts, e.g. potential and kinetic energy in the context of conservation of energy • used the language of physics correctly to compare ideas, e.g. mass and weight, friction and thrust to net force, balanced and unbalanced forces to acceleration • explained physics concepts in context, e.g. pressure is force/area, and unbalanced forces cause a change in velocity

	• understood that energy loss during motion is due to friction and not a form of energy • communicated ideas clearly so that concepts were not misinterpreted.
Achieved with Excellence	Candidates who were assessed as Achieved with Excellence commonly: • demonstrated comprehensive understanding of the concept of energy conservation and transformation • explained that air resistance is between an object and air particles, and linked this to energy loss as heat and sound are released • included the context of the question into their answer and showed understanding of how physics concepts related to the given context • explained in detail the consequence of F=ma in context, i.e. constant speed, acceleration or deceleration • performed multiple step calculations carefully and precisely, using the answer from one formula in another • made clear links between ideas and their consequences, e.g. people climbing onto a pontoon provided increased mass resulting in increased weight force and so increased pressure on the same surface area and consequently the pontoon sinks further.
Standard specific comments	Candidates' understanding of conservation of energy and the subsequent calculation of velocity has improved markedly over the last few years, as has the understanding of how to find distance travelled using a v/t graph. The relationship between power and energy is not as well understood. There is also confusion about work done against gravity compared to moving an object horizontally (where the force is not weight). Candidates showed fairly good understanding of the key concepts and principles such as motion, energy and pressure. However, low levels of literacy and / or numeracy skills may have prevented some candidates from understanding what is being asked, or carrying out simple calculations accurately.

2. Assessment Report for 90944: Demonstrate understanding of aspects of acids and bases

Achieved	Candidates who were assessed as Achieved commonly: • predicted products for common reactions and wrote correct word equations • wrote formula for some, but not all, compounds, e.g. nitric acid but not calcium nitrate • described particle motion and related this to a decreased rate of reaction as the temperature decreases • interpreted a gas volume/time graph showing a reaction going fast, slowing and complete, and at a lower temperature • recognised that the same amount of gas would be produced in reactions that differed only in temperature • defined an ion as an atom that has lost or gained electrons and used examples to show how atoms lost or gained electrons, e.g. in Al, S and Cl • recognised that ionic bonds were neutral and are formed by the attraction of oppositely charged ions • did not express that electron transfer happens directly between atoms forming ions, resulting in ionic bonds • linked the colour of Universal Indicator with the correct pH, and the pH with the ions present • recognised that acids produce hydrogen (H+) ions and that hydroxide (OH-) ions are produced by hydroxides, e.g. sodium hydroxide • recalled that water is neutral at pH 7 and is formed by hydrogen ions and hydroxide ions reacting.
Not Achieved	Candidates who were assessed as Not Achieved commonly: • confused subatomic particles; neutrons, protons and electrons • responded vaguely, e.g. using the term 'particle' in a generic sense rather than

	reactant particle • incorrectly used faster as a synonym of frequently • stated that a reaction would produce less gas at lower temperatures (rather than the same amount more slowly) • stated that a reaction would finish more quickly at lower temperatures • stated that the change in gradient of a graph was linked to a decreasing surface area or temperature as it occurred (rather than decreasing concentration of reactant particles) • used terms incorrectly e.g. “dissolving” of solid reactants (marble chip) rather than “reacting” • confused ions, e.g. nitrate ion and ammonium, or sufide and sulfate • confused electrons ‘lost’ and ‘gained’ during ion formation or confused the charges • were unable to give the formula for ionic compounds that are not 1:1, e.g. $AlCl_3$ and Al_2S_3 • stated that water was formed from oxide ions and hydrogen gas, or from hydrogen gas and oxygen • used hydrogen interchangeably with hydrogen ions • did not answer the given question e.g. writing equations involving NaOH rather than $Mg(OH)_2$.
Achieved with Merit	Candidates who were assessed as Achieved with Merit commonly: • wrote symbol equations, but could not balance them • linked the rate of reaction in various contexts, e.g. start and end, cooler, to the reactant particle collisions • recognised that when the reaction had stopped it was due to one of the reactants being used up and so there is no more product (e.g. gas) formation • referred to frequency of collisions rather than speed of collisions/reactions • explained how ions combine in ratios beyond 1:1 to make a neutral compound • explained how electrons are transferred between atoms in compound formation • linked the production of neutral water to the hydrogen ions released by an acid reacting with the hydroxide ions released by a base.
Achieved with Excellence	Candidates who were assessed as Achieved with Excellence commonly: • used appropriate language specific to studies of acids and bases such as; reactant particles, effective or successful particle collisions, increased frequency of particle collisions, full valence shell, stability of an ion, donation of electrons, neutrality of an ionic compound, neutrality of a solution • related the increase of temperature in chemical reactions to a rise in kinetic energy that causes effective collisions between reactant particles that occur with increased frequency • compared two reactions occurring at different temperatures and discussed reasons why the same amount of product is always formed if the volume of reactants used remains the same • used ionic formulae to explain the movement of electrons as ions form and create a new stable compound • used the relationship between the hydroxide ions in bases and the hydrogen ions in acids to indicate pH of solutions as they are neutralised and then move to an excess of ions in acidic or basic solutions • recognised that hydrogen and hydroxide ions are always present in all aqueous solutions • explained the relationship between the prevalence of hydroxide and hydrogen ions and the colour of universal indicator, explaining that the ion prevalence changes as a solution moves from acidic to neutral to basic • wrote balanced chemical equations using correct notation, subscripts and superscripts.
Standard specific comments	Candidates showed good understanding of rates of reaction and the nature of acids and bases, particularly use of indicators in neutralisation reactions. Ion formation and the behaviour of subatomic particles was not as well understood, often restricting the candidate’s level of achievement.

3. Assessment Report for 90948: Demonstrate understanding of biological ideas relating to genetic variation

Achieved	Candidates who were assessed as Achieved commonly: • drew Punnett squares that related to the questions • showed a good basic knowledge of genetic language as defined by Explanatory note 9 of the standard • determined genotypes and phenotypes of individuals based on information provided in the question • described genetic variation of a population, i.e. differences in the DNA / genes / alleles • recognised the value of genetic variation in population survival.
Not Achieved	Candidates who were assessed as Not Achieved commonly: • drew incomplete Punnett squares or Punnett squares that did not relate to the question • showed limited understanding of genetic language, for example confused homologous with homozygous, or genotype with phenotype, or could not correctly use terms such as species, variation and adaptation • were unable to identify a heterozygous or homozygous combination of alleles • described fertilisation as a process that occurs before / during meiosis • confused phenotypic variation in response to environment with existing genetic variation • were unable to use resource material effectively.
Achieved with Merit	Candidates who were assessed as Achieved with Merit commonly: • used genetic language confidently • explained methods of determining the unknown genotype of an individual (eg a test cross) • determined the possible genotypes of parents that lead to a range of genotypes in the offspring • explained processes that lead to variation within individuals of a population • showed clear understanding of the use of Punnett squares and pedigree charts and used them to aid their response.
Achieved with Excellence	Candidates who were assessed as Achieved with Excellence commonly: • provided valid examples of the survival of certain individuals within a population and how that leads to survival of the population during environmental changes • demonstrated clear understanding of how sexual reproduction provides variation • demonstrated clear understanding of how the inheritance of parental alleles leads to certain genotypes and phenotypes of offspring • explained clearly and with reasons the differences between the predictions of Punnett squares and the actual observed outcomes • used bullet points to scaffold answers to develop comprehensive responses including definitions and examples • showed thorough knowledge of simple inheritance, genetic language and conventions.
Standard specific comments	Many candidates were not confident in their use of genetic language defined in Explanatory note 9 of the standard. Some common misconceptions are contained in a paper on the Science Learning Hub website called “alternative conceptions about genetics" which may be useful. Candidates this year were, as in previous years, confused over the order of meiosis and fertilisation. The idea of individuals (rather than populations) adapting in response to environment is quite ingrained amongst even good candidates.