

National Certificate of Educational Achievement

2013 Assessment Report

Science Level 1

- 90940 Demonstrate understanding of mechanics**
- 90944 Demonstrate understanding of acids and bases**
- 90948 Demonstrate understanding of biological ideas relating to genetic variation**

COMMENTARY

Candidates who attempted all the questions and all the sections within each question generally achieved well because the overall grade is determined by the total score across the paper. It is important to note that markers collect evidence from all sections of a question so candidates should attempt all sections within a question. Unsuccessful candidates may have performed well in one or two of the questions but failed to attempt one or more questions. Leaving blank sections makes it very difficult for a candidate to show sufficient evidence to achieve the standard.

In general unsuccessful candidates showed a lack of understanding of the basic concepts required in each standard. They were often unable to select correct formulae or substitute correct values in the calculations. They also did not use all the resources provided to them in the paper.

Candidates who gained achieved had learned definitions and could state scientific concepts but were generally unable to link concepts to show sufficient understanding to gain higher grades. These candidates often just bullet pointed their answers rather than writing explanatory sentences containing words such as “because” or phrases like “this means ...”. Some candidates just answered the bullet points within questions without linking back to the main question. These bullet points are intended to scaffold candidates towards a full answer but are not sufficient in themselves.

Candidates who gained Merit generally showed in-depth understanding across several questions or contexts. Excellence candidates demonstrated comprehensive understanding of the concepts assessed with well-argued discussions within each given context.

Candidates who have knowledge of practical work as indicated in the Assessment Specifications continue to be at an advantage compared to those who do not.

STANDARD REPORTS

90940 Demonstrate understanding of mechanics

ACHIEVEMENT

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

- identified types of motion from a speed-time graph
- could draw and label forces correctly on diagrams to show the size and direction of the forces
- calculated distance travelled from a speed time graph for a section of constant speed
- identified net force as the overall force and know net force causes acceleration
- stated that the energy lost through friction was heat (sound)
- understood the concept of conservation of energy
- converted grams to kilograms in calculations involving mass
- could calculate weight from a given mass
- compared the weight forces or surface areas in relation to pressure.

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 typically:

- identified the types of motion on a speed-time graph incorrectly
- drew unlabelled arrows for forces, or labelled incorrectly
- did not show they understood that weight is a force
- could not identify the energy lost when a ball falls or what that energy is transferred to
- thought mass is the space or volume of the object
- used wrong formulae in carrying out calculations
- did not link pressure to sinking into soft surface.

ACHIEVEMENT WITH MERIT

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

- drew and labelled thrust and friction on a force diagram that showed the correct size and direction
- determined distance travelled from a speed-time graph for a section of acceleration
- calculated E_p and E_k correctly for an object halfway through a freefall
- explained what friction is or how heat (sound) energy is lost through friction
- explained the difference between mass and weight correctly
- explained that when the speed is doubled the time to lift the box is halved
- calculated the pressure correctly
- showed a good understanding of how changing force OR surface area affects pressure.

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:

- could give a detailed interpretation of a speed-time graph
- showed a clear understanding of how a pair of forces can lead to a net force and then how a net force affects motion in terms of deceleration
- explained constant acceleration/deceleration with correct calculation of acceleration
- gave a comprehensive discussion of an object hitting air particles to generate heat through friction, causing energy loss
- could solve for velocity in a conversion of energy situation involving E_p and E_k
- used appropriate formulae to carry out complex calculations
- could comprehensively explain how increased speed affected the power and time using calculations to support their explanation.
- compared forces and surface areas and linked this to pressure.

OTHER COMMENTS

Most candidates showed good a understanding of forces and motion; however, some candidates did confuse constant acceleration as accelerating with constant speed. The confusion between weight and mass continues to exist, as a number of candidates failed to identify weight as a force due to gravity and mass as the measure of the amount of

matter. Many candidates could not calculate weight when given mass. Candidates need to show greater understanding of the links between time, speed, and power. Many candidates were confident with questions asked directly and in a familiar situation but are not so confident when a similar question is asked in slightly different ways. Practice of this skill would enable candidates to reach higher grades.

90944 Demonstrate understanding of acids and bases

ACHIEVEMENT

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

- knew the difference between an atom and an ion
- recognised that elements on the Periodic table are arranged in vertical groups or columns and were able to state which groups elements belonged to
- described electron arrangements for both atoms and ions
- stated the number of electron(s) gained or lost to make the ions, and stated that an atom with a full valence shell did not need to gain or lose electrons
- completed word equations
- stated that a pH of 7 is neutral and this is green with universal indicator
- stated that acids provided hydrogen ions, or bases provided hydroxide ions
- gave several colours of universal indicator with corresponding pH values
- stated simple litmus paper changes
- knew surface area was the factor affecting rate of reaction
- knew that the horizontal straight line on the time/volume graph indicated that the reaction had stopped
- knew that smaller chips had a larger surface area
- knew that smaller chips reacted faster
- stated the purpose of universal indicator was to monitor pH levels
- recognised that fizzing would be observed when a metal carbonate reacts with an acid
- recognised that water is evaporated when a solution is left for a period of time.

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 typically:

- failed to recognise the difference between atoms and ions
- confused the charges on subatomic particles
- confused groups with rows on the periodic table
- failed to link the formation of ions with the concept of full electron shells
- wrote incorrect word equations
- failed to link numerical pH values to indicator colour
- reworded/retold the method and observations without adding any new information
- did not describe how litmus changes for an acid or base
- thought that a straight line on the time/volume graph indicated a constant rate
- thought that smaller marble chips had a small surface area OR large chips had a large surface area

- interpreted the graph for a rate of reaction slope as a speed/time graph
- described collisions in terms of increased temperature or concentration and not surface area (the factor being investigated)
- stated that the chemicals or the substance would be evaporated, rather than specifying water
- could not state what is observed when a metal carbonate reacts with an acid.

ACHIEVEMENT WITH MERIT

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

- recognised that charges on atoms and ions must be explained by talking about both electrons and protons (and their charges)
- recognised that the given atoms and ions all had an electron arrangement of 2,8
- Wrote correct symbols but unbalanced symbol equations
- recognised that H^+ and OH^- formed water which is neutral at pH 7
- recognised the relative amounts of H^+/OH^- ions during the experiment but failed to link it to pH values
- compared and contrasted the use of litmus and universal indicators
- explained how litmus paper worked in neutral solutions
- recognised a steeper gradient as meaning a faster reaction rate
- correctly described the relationship between surface area and either collision rate or reaction rate
- commented on the sections of a rate of reaction graph, linking it to the amount of particles present
- explained the need to control the amount of hydroxide added so neutrality was achieved
- recognised that the product carbon dioxide is a gas and will leave the beaker
- explained that water or a liquid would be removed from the evaporating basin by evaporation, leaving behind a salt.

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:

- linked the position of an atom on the periodic table to the process it underwent to achieve a full and stable outer shell with its electron configuration and the number of electrons in its outer shell
- completed balanced symbol equations
- compared the relative amounts of hydrogen ions or hydroxide ions when varying amounts of base are added to an acid and linked this to pH values
- discussed the reaction rate in terms of gradient, chip size, surface area, collision rate and reaction rate
- compared all three sections of the graph, discussing the amount of particles present and relative surface area exposed in each section and linked this to particle collisions
- linked the purpose of each step of the first acid base reaction to the production of a neutral salt solution and that the water product was removed by evaporation to leave the salt

- identified that carbon dioxide gas had a mass, and that this mass was lost to the beaker as it rose from the beaker into the atmosphere.

OTHER COMMENTS

Candidates were generally able to fill in a table showing the electron arrangements of atoms and ions. It is important that candidates can also explain the charges on ions or atoms in terms of the relative amounts of protons and electrons and the charges of these particles.

Candidates who could relate the relative amounts of hydrogen and hydroxide ions to solutions with the following pHs and relate this to amounts of acid or base present were successful; 1-2, 3-4, 7, 8-10, and 13-14.

A large number of candidates misunderstood the concept of surface area in relation to reaction rate. Knowledge of practical work continues to be an advantage in preparation of candidates for this standard.

90948 Demonstrate understanding of biological ideas relating to genetic variation

ACHIEVEMENT

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

- were familiar with basic genetic definitions and relationships such as genotype, phenotype, allele, and gene
- understood the idea of dominance of an allele
- could complete Punnet squares and interpret a pedigree chart
- understood the role of meiosis and/or fertilisation in variation
- identified that variation exists in a population prior to environmental change
- showed understanding of the importance of variation within a population to species survival.

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 typically:

- did not use the stimulus material to generate answers, or simply repeated it
- incorrectly stated that meiosis occurred after fertilisation
- demonstrated poor understanding of the causes and benefits of genetic variation within a population
- perceived variation as a response to environmental change rather than random recombination of alleles providing the raw material
- could not explain their thinking, often producing correct Punnet squares but not the reasoning to interpret these.

ACHIEVEMENT WITH MERIT

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

- were able to use the stimulus material effectively and demonstrate in depth understanding of the role of recessive and dominant alleles in terms of both genotype and phenotype
- were able to demonstrate in depth understanding of the role of meiosis and fertilisation in producing new alleles and genetic variation
- identified that variation within a population has an advantage in times of environmental change
- showed understanding of how phenotype variations within a population could lead to survival advantage in a changing environment
- identified that variation exists in a population prior to environmental change and recalled relevant examples.

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:

- linked and discussed effectively the role of recessive and dominant alleles across more than one generation
- discussed comprehensively the importance of phenotypic variation within a population to survival in a changing environment.
- provided comprehensive examples of populations that had existing variation and explained how beneficial phenotypes have a survival advantage over others when the environment changes.
- linked inheritance of alleles to changes in DNA base sequence and explained that the combination of these alleles lead to expressed phenotype
- demonstrated a high level of understanding of natural selection, linking variation through sexual reproduction to the possibility of favourable phenotypes being available in the event of environmental change
- recognised that a phenotype ratio will change very slowly over time as the favourable phenotype has greater reproductive success.

OTHER COMMENTS

The disadvantages of sexual reproduction were not commonly known and candidates were not able to express these. The role of meiosis relative to fertilisation is still commonly misunderstood by candidates. The role of sexual reproduction in producing new allele combinations is also poorly understood. A change in phenotypic ratios in a whole population over time (many, many generations) due to environmental change is not confidently expressed.