

National Certificate of Educational Achievement

2012 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

In general, candidates wrote more directed responses and demonstrated good examination technique. Successful candidates attempted all questions and all parts of each question to maximise their chances of success, which is important with grade score marking. It is important that candidates realise that evidence that can increase a grade score can be taken from any part of a question, e.g. evidence contributing to a grade score of 1, 2, 3, or 4 for a question could just as likely come from the last part of a question as the first part.

Some candidates who had difficulty produced rote responses without placing their answers in the context of the question. These students gave incorrect definitions and did not use visual resources provided. Many restated the question and used scientific terminology incorrectly.

Candidates who gained achievement often just gave responses to the bullet points in questions without any linking of these points. Clear evidence of response planning was seen on papers where candidates achieved at the higher levels. These candidates provided answers showing a greater depth of understanding of concepts rather than just content. Candidates who were able to sequence their responses to questions (rather than relying on bullet points as their answers) were more likely to gain Achievement with Merit or Excellence.

Familiarity with practical work continues to be a definite advantage for candidates.

STANDARD REPORTS

90940 Demonstrate understanding of mechanics

ACHIEVEMENT

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

- used appropriate formula to calculate one-step calculations correctly
- described motion in a distance-time graph or speed-time graph correctly
- could calculate a section of the distance travelled from a speed-time graph
- calculated acceleration using a speed-time graph
- knew the difference between weight and mass
- could explain that a golf ball made the deeper crater because of greater weight force/pressure/kinetic energy
- stated that the energy lost through friction was heat (sound)
- named the energy an object (buggy) has on top of a ramp correctly
- identified that more power is required to lift an object or less force is required to push an object up a ramp.

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 use the keywords when describing pressure, force or surface area
- Could not calculate the average velocity from a distance/time graph
- Confused a velocity/time graph with a distance/time graph
- were unable to make a comment regarding speed or acceleration from a graph in context
- confused mass and weight
- did not know that E_{GP} converts to E_k during a fall
- did not know that objects have E_{GP} when at the top of a ramp
- stated that lifting an object requires a different amount of work that when moved up a ramp
- stated that friction was a form of energy.

ACHIEVEMENT WITH MERIT

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

- used correct formula to solve two-step questions
- used given information to follow a three step calculation with one error
- explained that a constant speed means forces are balanced or $F_{net} = 0$
- calculated the total distance covered by one runner with a given v-t graph correctly
- knew the principles of conservation of energy and made the link of E_{GP} lost = E_k gained
- explained the relationships between mass and E_k , mass and E_{GP} , force and pressure
- explained that pushing an object up a ramp is easier as the work is spread out over time
- linked surface area to pressure in context
- interpreted a speed/time graph to fully describe a journey by giving numerical values for acceleration or speed/time graphs
- could calculate how much energy was lost through friction but did not state where it originated.

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:

- explained pressure and traction comprehensively by comparing weight force and surface area between the two different types of vehicle tread
- interpreted given information correctly and carried out a three-step calculation without error
- calculated the distance travelled by both runners from a speed-time graph
- explained how mass influences gravitational energy and then kinetic energy
- rearranged $E_{gp} = E_k$ equation and calculated speed correctly
- discussed the relationship between power, energy and time used on a ramp correctly in relation to the difficulty to do a task
- explained that the energy difference resulted from friction taking place between the ramp and the buggy or within the muscles of the women
- could calculate the correct velocity at the end of a section of a graph and then use this to find the net force acting on it in the next section.

OTHER COMMENTS

Some candidates displayed the lack of real understanding in questions involving pressure and energy conservation. They were able to explain the theories but were unable to relate to the real life situation. A number of candidates were confused between multiplication and division in the calculations and some were unable to rearrange a formula. Though units were not particularly emphasised during marking, the misuse of the unit clearly indicated misunderstanding or confusion between scientific terms.

90944 Demonstrate understanding of acids and bases

ACHIEVEMENT

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

- described electron arrangements for both atoms and ions
- completed word equations
- understood that red and blue litmus stay the same colour in neutral solution
- listed the sequence of colours observed in universal indicator when base is added to solutions
- stated that particles move faster at higher temperatures
- recognised that a horizontal line in a reaction rate graph indicated the reaction was finished
- described one step in the making of a salt.

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 identify ion symbols
- believed that litmus paper turned green in neutral solution
- were unfamiliar with how to make a salt
- did not state pH values for acidic, neutral or basic solutions
- did not state that reactions involve collisions between particles
- did not identify that a steeper line on a graph meant a faster rate of reaction.

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 elements of a particular periodic table group form ions with the same charge
- explained how two different elements formed ions with the same electron arrangement
- completed symbol equations
- described all necessary steps to produce a salt
- related pH changes in solutions to hydrogen and hydroxide ions
- linked faster movement of particles to increased collisions

- recognised that the volume of gas produced in a reaction is independent of temperature.

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:

- related full outer shells of electrons in ions to the number of electrons and protons
- completed balanced symbol equations
- recognised the need to use both red and blue litmus paper in identifying a neutral solution
- related the number of hydrogen and hydroxide ions present to acidic, neutral or basic solutions
- described what made collisions effective
- related the horizontal line in a reaction rate graph to the reaction being finished with reactants used up and no more gas being produced
- explained that the same amount of gas produced in both reactions was due to the same amount of reactants, and that temperature only affects the rate at which gas is produced.

OTHER COMMENTS

Candidates who could use the periodic table to relate ions to specific groups were able to explain charge and electron arrangement well. A few candidates were confused about the respective charges on electrons and protons.

Some candidates seemed unfamiliar with the names and formulas of common acids and products formed in acid-base and acid carbonate reactions.

Candidates who showed experience of laboratory sessions were able to recognise the need to evaporate off the water in a soluble salt solution. They also recognised that as base continued to be added to acid till there were no further changes, the endpoint will be a basic rather than neutral solution.

Some candidates limited their opportunities to achieve by being unclear of the respective roles and responses of litmus paper and universal indicator.

Some candidates disadvantaged themselves by referring to variables other than those given in rates of reaction.

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:

- could complete a punnet square
- understood the role of meiosis and/or fertilisation in variation
- linked genetic variation to survival advantage of certain phenotypes
- showed familiarity with basic genetic terms and concepts
- identified and stated genotypes from given information
- recognised the difference between dominant and recessive alleles, and genotype and phenotype

- showed understanding of the relationship between a change in environment and phenotypic ratios within a population
- showed understanding of how the process of meiosis leads to chromosome numbers in gametes being halved.

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:

- confused key terms and had not learned key definitions such as chromosome, gene, allele, genotype, phenotype, variation, species
- misunderstood the process of meiosis, often including fertilisation as part of, or preceding meiosis
- repeated information included in the stimulus material
- saw variation as a response to environmental change rather than a random process
- showed misunderstanding of basic ideas relating to heredity
- suggested a change in environment immediately results in a change in physical appearance.

ACHIEVEMENT WITH MERIT

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

- understood the effect of variation on a species or population as favourable alleles being more likely to aid survival and being passed on to offspring
- explained how the processes of meiosis and/or fertilisation created variation
- showed an in-depth understanding of the relationship between DNA, gene, alleles and chromosomes and how these related to specific features
- showed understanding of how each fertilisation is a separate event and that previous conceptions have no impact on a conception outcome
- showed understanding of how sexual reproduction leads to genetic variation through the process of gamete formation (e.g. random assignment of alleles) and fertilisation
- showed understanding of how physical differences within a population can lead to survival advantages for both the individual and the population.

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:

- explained how variation at the molecular level (i.e. base sequence) caused phenotypic variation in alleles and related how this variation was inherited through sexual reproduction
- explained that favourable phenotypes passed to offspring could change the phenotype ratio over time
- linked theoretical punnet square outcomes to random allele selection in meiosis and gamete combinations in fertilisation
- demonstrated a high level of literacy in integrating the parts of each question
- linked explanations of the structural relationship between DNA, chromosomes, genes and alleles with the production of a particular feature or protein resulting in observable variation

- explained comprehensively that if parents were heterozygous there was a 50% chance of each allele being donated to the offspring in the process of gamete formation resulting in 25% chance of both recessive alleles being inherited
- showed understanding of how selection pressures affect the gene pool of a species and resulting in a change to phenotypic ratios.

OTHER COMMENTS

A significant source of error for many candidates was confusion over the sequencing of meiosis and fertilisation, some candidates believed that fertilisation preceded meiosis. There was some confusion about how environment impacts on individuals within a population. Specifically students expressed that environment caused a change in genetics rather than correctly relate to a survival advantage with the advantageous genetics being passed on.