

National Certificate of Educational Achievement

2014 Assessment Report

Science Level 1

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

COMMENTARY

A number of candidates gave rote-learned answers for the previous year's examination with little or no reference to the questions in the 2014 examination paper. Different, though similar questions are asked each year but it would seem that some candidates had learnt how to answer specific examination questions rather than working to understand the concepts being assessed in these standards. It is important that candidates actually answer the question rather than just listing information that they think may relate to some of the words in the question. In questions where bullet points are used to help candidates to scaffold answers candidates need to relate the bullet points back to the main part of the question, rather than just answering the bullet points as though they are standalone questions. The bullet points are intended to scaffold candidates to write full answers but they do not repeat the whole question.

To achieve well candidates need to attempt all parts of a question as well as all questions in the examination. It is important to note that markers collect evidence from all sections of each question. Unsuccessful candidates may have performed well in several questions but often failed to attempt one or more questions. Leaving blank sections makes it more difficult for a candidate to show sufficient evidence to achieve the standard.

Candidates who achieved the standard were often able to state, or list facts but could not use these facts to explain concepts. Candidates who gained Merit showed in-depth understanding across several contexts. Excellence candidates demonstrated comprehensive understanding of the concepts assessed with well-argued discussions within each given context.

It is important to note the change signalled in the assessment specifications for 2015 from four to three questions in the examination for each standard.

STANDARD REPORTS

90940 Demonstrate understanding of aspects of mechanics

ACHIEVEMENT

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

- identified the type of the motion on distance-time and speed-time graph correctly
- used correct formula to calculate force (weight) speed or acceleration
- identified that a carpeted floor has more friction compared to a wooden floor
- described that the energy lost through friction was due to heat (sound)
- understood that work done is related to force and distance
- identified gravitational potential energy correctly
- calculated distance for one section on a speed-time graph correctly
- compared surface areas between the footstool and the legs of the chair in terms of pressure
- named and described situations when gravitational energy changes to kinetic energy
- identified and accurately gave the sizes of the major forces acting on objects.

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 commonly:

- incorrectly identified the types of motion from the distance-time and speed-time graph
- were unable to calculate force, work
- showed little understanding of energy and energy conservation
- identified friction as a type of energy
- failed to explain relationship between pressure and surface areas in context
- failed to realise that gravity is 10Nkg^{-1}
- did not use the correct formulae when doing calculations.

ACHIEVEMENT WITH MERIT

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

- were able to carry out calculations that involved more than one step
- calculated pressure for the leg(s) of the chair correctly
- explained pressure difference in comparison to the surface area, in context
- explained how friction occurred or how the heat (sound) energy is lost through friction
- explained the difference between mass and weight correctly
- had a good understanding of the concept of conservation of energy
- had a good understanding of energy types and how they are used, transformed and linked
- understood balanced forces/net forces and constant speed.

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 commonly:

- explained power in relation to work and time correctly
- discussed pressure in relation to force and surface area in context
- used appropriate formulae to carry out complex calculations
- clearly explained energy conservation
- calculated the distance travelled given two lines on a speed/time graph and then linked this to a justified conclusion.

OTHER COMMENTS

In order to gain higher grades candidates need to link concepts. It is important that candidates think about whether a calculated answer makes sense. That is they should check their calculations in order to avoid “silly mistakes”. It is also important that candidates check they are using the right formula before doing calculations by confirming they have all the necessary information available to them.

90944 Demonstrate understanding of aspects of acids and bases

ACHIEVEMENT

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

- produced correct ionic formula
- showed correct electron configurations of atoms and ions
- stated that a gas (or carbon dioxide) was released when calcium carbonate reacts with an acid
- recognised that powdered calcium carbonate particles have a greater surface area than calcium carbonate pieces
- stated one condition that increases reaction rate, with reference to increased collisions
- wrote correct word equations
- correctly identified unknown solutions as either acidic/basic/neutral using results of tests using litmus paper or universal indicator
- linked pH to universal indicator colour
- stated that a more acidic solution had more hydrogen ions
- stated that hydrogen ions and hydroxide ions 'cancel out'
- stated that pH 7 is green in UI and that this represents a neutral solution.

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 commonly:

- wrote incorrect ionic formula
- misused terms (e.g. atoms losing/gaining ions instead of electrons)
- wrote incorrect electron configurations for atoms and ion
- misnamed the gas formed when calcium carbonate reacts with acid
- did not refer to particle collisions in attempts to explain reaction rate
- wrote incorrect word equations
- incorrectly interpreted information to give wrong pH values for the three unknown liquids (too high, too low or too wide a range)
- stated that acids contained more hydroxide than hydrogen ions OR vice versa
- referred to hydrogen and hydroxide atoms instead of ions
- referred to UI colours at the beginning and end of a reaction, with no reference to pH values.

ACHIEVEMENT WITH MERIT

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

- explained that atoms lost or gained electrons to achieve full valence shells
- explained that a certain ratio of ions in an ionic compound led to the compound being neutral **or** having no charge
- correctly showed that two aluminium ions had a combined charge of +6 and three oxide ions had a combined charge of -6

- explained that increasing surface area led to more particle exposure, so more collisions and a faster reaction
- used correct formula in equations without necessarily balancing the equation
- correctly linked the relative number of hydrogen ions in a solution of pH 1 to the number in a solution of pH 6
- explained that hydrogen ions and hydroxide ions form water/ can form a neutral solution
- explained the general trend in the change in ions as acid is added to base (excess hydroxide ions at the start, excess hydrogen ions at the end).

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 commonly:

- linked ion formation to loss or gain of electrons from an atom giving a full outer shell and linking the resulting ion charges to the ratio of ions in a neutral ionic compound
- explained that increasing surface area led to more particle exposure, so more collisions and a faster reactions per unit time
- explained one additional factor that increased reaction rate - with reference to increased collisions per unit time
- wrote correctly balanced symbol equations
- identified three unknown liquids with reference to pH, litmus paper, and universal indicator colour
- explained that two acidic solutions (pH 1 and pH 6) both had excess hydrogen ions compared to hydroxide ions
- compared relative amounts of hydrogen ions and hydroxide ions in beakers 4 and 5 and correctly concluded that beaker 4 was more acidic
- linked indicator colour changes to pH and ions at all three points as acid is added to base (beginning, middle, end) by referring to ratios of hydrogen ions and hydroxide ions at all three points
- discussed relative amounts of hydroxide ions and hydrogen ions at an intermediate point (e.g. pH 9 or pH 3) with reference to pH number and colour.

OTHER COMMENTS

Candidates who gained higher grades were able to clearly link the amount of hydrogen ions and hydroxide ions to pH. At times candidates found it difficult to apply their learning and correctly learned concepts were confused leading to incorrect conclusions.

Knowledge and understanding of practical work continues to show up as an advantage in this standard as successful candidates are familiar with laboratory apparatus and techniques.

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 commonly:

- demonstrated basic understanding of genetic language and were able to give simple definitions of terms from the standard such as meiosis, gene, allele, genotype and phenotype
- were confident in using punnett squares to explain an idea
- used diagrams to explain an answer
- recognised a 'pure' individual as being homozygous
- recognised dominant and recessive alleles and their effect on phenotype.

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 commonly:

- lacked understanding of basic genetic language such as the difference between phenotype and genotype
- were unable to interpret a pedigree chart
- gave only one example of an environmental factor when two were asked for in the question
- were unable to, or did not understand, the need to define key terms such as gene, allele, meiosis, phenotype, genotype in their answers
- commonly confused the order of meiosis and fertilisation
- suggested that plants only reproduce asexually so variation can only come from mutation.

ACHIEVEMENT WITH MERIT

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

- recognised and explained that a recessive characteristic requires two recessive alleles
- recognised and explained that a dominant characteristic requires only one dominant allele
- explained that a test cross requires breeding with a homozygous recessive individual
- clearly explained the essential stages of meiosis and how this results in variation - often aided by diagrams
- were able to explain the relationship between environmental factors and phenotype in plants
- interpreted a pedigree chart correctly and used it to explain inheritance.

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 commonly:

- discussed comprehensively the relationship between meiosis and fertilisation in producing a mix of alleles which results in phenotypic variation
- expanded a discussion about test crosses to include the importance of multiple tests with a wide variety of individuals to develop a pure breeding group
- drew from a range of contexts to explain the difference between inheritable and non-inheritable variation and how these differences were important in aiding species survival in a changing environment
- structured their answers well by defining key terms, providing examples, referring back to the resource material and linking key ideas
- correctly explained the effects of environmental factors on phenotype, recognising that characteristics are only inheritable if passed through gametes
- demonstrated comprehensive understanding of inheritance, including the mixing of alleles through meiosis and fertilisation and how these alleles affect phenotype and genotype
- fully discussed how test crossing could be used to develop a pure breeding group.

OTHER COMMENTS

Candidates are confusing the events of meiosis and fertilisation.

Confusion arises when relating the homologous pairs in the parents to the homologous pairs in the zygote (offspring). Candidates are not required to name the stages in meiosis but do need to understand the role of meiosis in generating gametes and some understanding of the stages and the effects on the chromosomes is helpful. The idea that fertilisation follows gamete formation is essential. Some candidates are sequencing the events of meiosis and fertilisation incorrectly.

Some candidates are struggling with the link between gene and allele.

It is essential that candidates link definitions to explanations when answering longer questions. The tendency of some weaker candidates to write very long answers that repeat information in the question and in doing so do not answer the question at all is a concern. Candidates should aim to be precise and concise in their answers.

Common misconceptions that teachers may want to consider are contained in this 2011 paper on the Science Learning Hub website – [Alternative conceptions about genetics](#).