

National Certificate of Educational Achievement

2011 Assessment Report

Chemistry Level 2

- 90308 Describe the nature of structure and bonding in different substances**
- 90309 Describe the structural formulae and reactions of compounds containing selected organic functional groups**
- 90310 Describe thermochemical and equilibrium principles**
- 90311 Describe oxidation-reduction reactions**

COMMENTARY

This was the final year for examinations to assess these achievement standards.

Successful candidates planned their answers. This helped to ensure their answers were succinct, addressed all parts of the question, and related back to the question.

Successful candidates also took care with the specific terminology used in chemistry. Their answers were precise, and they did not use terms carelessly or make and use generalisations.

STANDARD REPORTS

90308 Describe the nature of structure and bonding in different substances

ACHIEVEMENT

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

- drew Lewis structures correctly
- named shapes for molecules given the Lewis structure or correctly stated the number of electron repulsion regions
- stated, from a given formula, if a molecule was polar or non-polar, or contained a polar or non-polar bond
- described solid type, particle type, and attractive forces between particles using appropriate terminology
- described the electrical conductivity and hardness of different substances
- described the structure or bonding of one type of substance
- identified forces broken during melting and related the force strength to the relative energy required.

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:

- used incorrect terminology to describe solids at the particle level
- did not include non-bonding electrons in Lewis structures
- referred to repulsion between bonded atoms instead of between regions of negative charge or electrons
- confused polar bonds with polar molecules
- described diamond as a weak electrical conductor and graphite as hard
- did not relate physical properties of solids to their structure and bonding (e.g. melting of ice to weak intermolecular forces)
- did not recognise a multiple bond as a single region of negative charge.

ACHIEVEMENT WITH MERIT

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

- linked correct, named molecule shape to the number and nature of negative charge regions
- linked bond polarity to electronegativity difference between bonded atoms
- linked molecule shape and polarity to the symmetrical/asymmetrical arrangement of polar bonds
- explained physical properties of substances in terms of both the structure, particles and bonding
- used precise and specific terms and phrases to explain and link concepts e.g. carbon atoms not just carbons, strong ionic bonds between sodium cations and chloride anions.

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:

- discussed fully the factors that affect the shape and polarity of molecules
- discussed fully the electrical conductivity of a substance in terms of structure and bonding of the substance, including the correct particle responsible for conduction
- discussed fully the hardness of a substance in terms of the constituent particles, and the strength and nature of attractive forces between the particles
- discussed fully the melting and dissolving of a substance, including the constituent particles of the substances, and the strength and nature of the forces between them.

90309 Describe the structural formulae and reactions of compounds containing selected organic functional groups

ACHIEVEMENT

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

- drew and named organic molecules
- recognised some reaction types, with reasons
- identified molecules that exhibited geometric isomerism
- predicted and drew both monomer and polymer structures
- identified functional groups in molecules
- stated a correct colour change for the reaction of an alkene with bromine water.

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:

- answered insufficient questions, or did not attempt all parts of all questions
- did not draw or define a structural isomer
- did not define a tertiary alcohol or haloalkane

- did not show care in counting bonds and numbering carbon atoms when drawing structures
- misused the term functional group
- confused the terms empirical formula and molecular formula
- stated that chlorine (or other halogen) is required for *cis-trans* isomerism
- used vague terms such as 'side' rather than 'carbon of the double bond'
- used the word substituted when defining a substitution 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:

- linked the two criteria required for geometric isomerism to the molecules in the question
- applied Markovnikov's rule correctly, showing a clear understanding and avoided generalisations such as '*the rich get richer*'
- drew structural formulae of both the hydrolysis products with either an acid or a base
- linked the reaction type e.g. addition or hydrolysis to the reaction occurring.

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:

- answered the question fully, by relating their answers to the examples given in the question
- wrote answers fluently and succinctly, that linked the two criteria for geometric isomerism to the three molecules in the question
- recognised that a carbon to carbon double bond fixes the position of the atoms/groups of atoms attached to the carbon atoms of the double bond
- linked the addition reaction of symmetrical and asymmetric alkenes to the reasons for the products formed in terms of the number of hydrogen atoms attached to each carbon of the double bond
- wrote equations to show acid and base hydrolysis of an ester
- explained the term hydrolysis.

OTHER COMMENTS

Some candidates stated that geometric isomerism needs the same group rather than two different groups. Other candidates did not clearly state that these two different groups are on the same carbon atom involved in the double bond.

90310 Describe thermochemical and equilibrium principles

ACHIEVEMENT

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

- linked rate of reaction to the number of collisions per second
- applied principles to predict the effect of changes to systems at equilibrium
- calculated pH values

- wrote chemical equations
- calculated enthalpy changes.

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 appropriate key terms
- used inappropriate theory
- stated more collisions rather than more collisions per second
- did not frame an equilibrium expression
- did not accurately write chemical equations involving ions
- did not identify conjugate acid-base pairs.

ACHIEVEMENT WITH MERIT

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

- explained that with increased surface area, more particles would be exposed to collision
- discussed the magnitude of the equilibrium constant when deciding whether the equilibrium was reactant or product favoured
- worked through two-step acid-base calculations
- identified bond breaking as endothermic and bond forming as exothermic.

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:

- understood that at reduced temperature, fewer particles would have sufficient kinetic energy to overcome the activation energy barrier
- used Le Chatelier's principle to predict a reverse change on altered pressure or temperature
- knew that conductivity related to ion concentration
- applied stoichiometric principles to enthalpy calculations
- used appropriate units and appropriate numbers of significant figures consistently.

90311 Describe oxidation-reduction reactions

ACHIEVEMENT

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

- recalled the colour of basic ions
- assigned oxidation numbers correctly
- balanced simple half-equations
- identified oxidants and reductants in reactions
- understood electron transfer in oxidation-reduction reactions

- identified the products of electrolytic cells
- made simple observations related to electrolytic cells.

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 oxidation with reduction
- confused oxidant with reductant
- confused electrolysis with electroplating
- confused cathode with anode
- did not pay attention to the given bullet points
- used incorrect formulae for basic ions.

ACHIEVEMENT WITH MERIT

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

- linked correct colour changes to correct chemical species
- balanced more complicated half-equations
- justified the identification of oxidation or reduction through the use of oxidation numbers or electron transfer
- accounted for the observation and process of at least one electrode in electrolysis.

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:

- balanced oxidation-reduction equations from half-equations correctly
- answered all bullet points methodically
- recognised and discussed the relative oxidising strengths of the halogens
- knew the oxidation product of HSO_3^-
- discussed, in detail, ion and electron movement in electrolytic cells.

OTHER COMMENTS

Some candidates confused the colours of the ions, Fe^{2+} and Fe^{3+} . Some wrote the colour red, perhaps from the confirmatory test of Fe^{3+} with KSCN.

Some candidates demonstrated poor knowledge of basic ion charges and formulae e.g. Cr_2^{2+} , Cr_2^{3+} and Al_2^+ , Al_2^{2+} , O_3^- , O_3^{2-} .

Questions requiring candidates to distinguish between solutions were sometimes poorly done.