

National Certificate of Educational Achievement

2014 Assessment Report

Chemistry Level 2

- 91164 Demonstrate understanding of bonding, structure, properties and energy changes**
- 91165 Demonstrate understanding of the properties of selected organic compounds**
- 91166 Demonstrate understanding of chemical reactivity**

COMMENTARY

Candidates who reached Merit and Excellence levels of achievement had closely read the questions and planned their answers carefully. They showed systematic working in calculations and provided correct units. They also applied the correct chemistry principles and used language, symbols and conventions appropriately.

Candidates who reached the Achievement level completed all or most of the questions but may have written long answers using generalisations rather than specific details. This meant that they ending up repeating or contradicting themselves. They may not have used language, symbols and conventions appropriately or accurately.

STANDARD REPORTS

91164 Demonstrate understanding of bonding, structure, properties and energy changes

ACHIEVEMENT

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

- drew Lewis diagrams for structures with single bonds
- stated bond angles or regions of electron density from a molecule's shape
- identified polar bonds in a molecule
- identified the type of particle and attractive forces present in a metallic or molecular substance
- gave reasons for the properties of a covalent network, metallic or molecular substance
- identified an exothermic reaction and gave a reason
- described sodium chloride as an ionic substance or water as a polar molecule
- completed one step of a thermochemical calculation.

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:

- omitted non-bonding electrons when drawing Lewis diagrams
- were unfamiliar with bond angles for different shapes of molecules
- confused polar bonds and polar molecules
- described incorrectly the electronegativity of a molecule rather than the electronegativity of an atom
- could not give the requirements for ductility, solubility or conductivity
- described incorrectly an ionic substance as being polar
- were unable to correctly complete one step of a thermochemical calculation, for example, the mole calculation.

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 the bond angle of a simple molecule in terms of the arrangement of the regions of electron density, and repulsion
- made some links between the polarity of a molecule, bond polarity and electronegativity of the atoms
- made links between some of the properties of given substances and their structure and bonding
- gave correct explanations as to why an ionic salt dissolves in water, however often confused symbols and conventions
- demonstrated at least two steps of the calculations involving bond enthalpy or the energy released in a reaction.

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 the structure and bonding in small molecules to both bond angle and bond polarity
- related the properties of different substances to the structure and bonding within the substances
- explained, with both words and in diagrammatic form, the process of dissolving an ionic salt in water
- carried out multistep calculations allowing a conclusion to be justified
- used chemistry vocabulary, symbols and convention correctly and consistently.

OTHER COMMENTS

Some candidates used vague, imprecise language which jeopardised otherwise good answers.

Candidates should set out calculations in a systematic way; which may lead to fewer errors.

91165 Demonstrate understanding of the properties of selected organic compounds

ACHIEVEMENT

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

- drew correct structures for organic compounds, including alcohols
- wrote correct names for selected compounds
- identified organic reaction types correctly
- drew *cis* and *trans* isomers correctly
- stated the requirements for geometric isomers to exist
- stated Markovnikov's rule correctly
- drew correctly two repeating units for an addition polymer.

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:

- drew *cis* and *trans* isomers for an incorrect compound
- stated that addition or elimination involved the addition or elimination of just one atom
- stated Markovnikov's Rule as "the rich get richer" without demonstrating any understanding of the chemistry involved
- described polymerisation incorrectly
- were unable to identify the nature of the particles involved in reactions
- did not use correct or appropriate chemistry vocabulary.

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 substitution in terms of atoms or groups of atoms being replaced
- linked the formation of the layered solutions to the polarity of organic substances
- were able to explain why a specified compound could not have geometric isomers
- explained partially the different reaction types
- recognised the impact of a non-rotational double bond
- explained substitution and elimination reactions
- explained major and minor products
- linked the formation of different polymers to the positioning of the double bond.

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:

- compared and contrasted three substitution reactions with reference to specific atoms/ groups of atoms involved in substitution
- justified why two layers form when hexane reacts with bromine water by linking solubility to polarity
- explained the requirements that allow geometric isomerism to occur in one compound but not in others
- compared and contrasted the reactions of carboxylic acids, amines and alcohols by fully describing (with conditions) the acid-base reactions of carboxylic acids and amines; the substitution and elimination reactions of alcohols
- compared and contrasted the addition reactions involved in two polymerisation reactions to explain why the two polymers formed were different.

91166 Demonstrate understanding of chemical reactivity

ACHIEVEMENT

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

- identified acid/base conjugate pairs
- wrote correct chemical equations involving ions
- used data provided to identify solutions with one aspect of supporting evidence
- carried out straightforward calculations for hydronium ion concentration from the pH
- wrote correct equilibrium constants
- applied principles to predict or outline the effect of changes to a system at equilibrium
- stated that the reaction rate is due to the availability of reacting particles
- recognised that a catalyst increases the reaction rate by lowering the activation energy
- recognised that a strong acid has a higher concentration of hydronium ions than a weak acid
- recognised that strong acids will react faster with carbonates.

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:

- failed to identify water as an acid and ammonia as a base
- confused properties of weak and strong bases especially with regards to conductivity
- confused cubing with squaring in equilibrium constant calculations
- re-wrote observations from the table of data given without applying equilibrium principles
- failed to provide observations when asked
- identified endothermic reactions as being favoured by a temperature decrease
- identified exothermic reactions as being favoured by a temperature increase
- confused reaction directions
- confused surface area with particle concentration
- could not interpret reaction rate graphs
- failed to identify that the presence of hydronium ions was the reason that an acid reacts with metals and carbonates.

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 proton transfer in acid-base reactions
- carried out more complex calculations, such as the hydroxide ion concentration or the pH of a basic solution
- linked the electrical conductivity of bases and salts to the presence of charged particles
- calculated equilibrium constants correctly
- explained and linked the effects of applying changes to an equilibrium system, using equilibrium principles

- linked the reaction rate to the concentration of reactants and the collisions that occur
- explained the role of a catalyst with regards to reaction rate
- explained acid strength in terms of dissociation.

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:

- carried out calculations competently using K_w and pH with units, where appropriate
- justified the identification of a strong base and a neutral salt by linking observations to known chemical and physical properties, and explaining that neutral salts conducted electricity through dissolved ions
- calculated the value of K_c to determine whether or not a system is at equilibrium
- justified the changes in an equilibrium system with regards to pressure and temperature using equilibrium principles and linked this to the species, observations and the direction of change
- related the role of a catalyst to the proportion of successful collisions per unit time
- compared strengths of acids supported by calculations, equations with correct arrows, predicted observations and relevant collision theory.

OTHER COMMENTS

Some candidates had difficulty in carrying out pH calculations involving bases.