2025 NCEA Assessment Report

Subject:	Chemistry
Level:	2
Achievement standard(s):	91164, 91165, 91166

General commentary

Candidates who achieved well provided relevant definitions, correct evidence to support their answers, and consistently answered the question posed in the examination. Candidates who achieved at Merit or higher consistently used chemical conventions, terminology, and ensured attention to detail regarding units and significant figures in calculated answers. Linking of evidence with concepts and relating back to examples in the question, comparing as required, was an essential Excellence skill.

Report on individual achievement standard(s)

Achievement standard 91164: Demonstrate understanding of bonding, structure, properties and energy changes

Assessment

The assessment had three questions, and candidates were expected to answer all parts of all three questions. Each question provided candidates opportunities to demonstrate their understanding by applying and explaining the chemical concepts by linking bonding, structure, and properties of chemical compounds, and the energy involved in physical and chemical changes.

Commentary

Successful candidates were able to identify key concepts in questions and apply correct terminology to explanations, particularly questions involving the properties of substances such as malleability and solubility. These candidates demonstrated a good understanding of the requirements to determine molecular polarity and could differentiate and apply key terms and concepts such as VSEPR theory, electronegativity, bond dipoles, and polar bonds. Candidates demonstrated clear understanding in recognition and representation of exothermic and endothermic reactions and relevant calculations. Stronger candidates used correct units, signs (+ / –) and significant figures to support their answers. At Merit level or higher, candidates were able to relate chemical concepts to the examples given in the question, and to compare and contrast, stating what was similar and what was different using consistent chemical conventions throughout. Where relevant, answers were supported by appropriately labelled diagrams.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- identified a difference in electronegativity between atoms in bonds
- drew Lewis diagrams and / or named shapes

- calculated moles correctly for enthalpy reactions
- calculated bonds, broken or formed
- identified the number of bonding and non-bonding regions in a molecule
- identified the types of solid particles and attractive forces between them
- recognised that conductivity requires mobile charged particles
- identified that non-directional bonds are needed for malleability
- identified that attractions between the solute and solvent are required for a substance to be soluble in water
- identified that repulsions between areas of electron density contribute towards molecular shape
- defined electronegativity
- linked the symmetry of a molecule to its polarity
- could select correctly from limited options.

Candidates who were awarded **Achievement with Merit** commonly:

- used the correct process for two consecutive steps of a thermodynamic calculation
- linked relative strength of forces with the amount of energy needed for melting a solid substance
- linked the structure and bonding of a metallic substance to its physical properties (e.g., malleable and ductile)
- correctly described the structure of covalent network solids
- linked regions of electron density and repulsion with regard to a central atom when determining a molecular shape with observed bond angles
- explained the polarity of a molecule by linking symmetry and dipole cancellation
- included hydrated ions in their diagram of NaCl dissolving
- linked polarity and the strength of attractive forces between a solute and solvent to the solubility of a substance.

Candidates who were awarded **Achievement with Excellence** commonly:

- rounded correct thermodynamic calculations to three significant figures with correct units and signs (+ / –)
- justified the melting points of ionic and molecular solids, with reference to structure, bonding and energy requirements
- compared and contrasted the conductivity of solids including covalent network substances with reference to bonding and structure
- used VSEPR theory to compare and contrast the shapes and bond angles of given molecules
- justified the polarity of a molecule with reference to electronegativity, bond polarity, and symmetry of bond dipole arrangement
- drew clear, annotated diagrams for the dissolving of an ionic substance in water, with dipoles on water and charges on dissolved ions
- justified the solubility of an ionic compound and a non-polar molecule in water, with reference to polarity and the strength of forces that needed to be overcome with clear annotated diagrams
- used comparative language to compare / contrast.

Candidates who were awarded **Not Achieved** commonly:

- used generic terms such as “particle” rather than identify the type of particle e.g., atom, ion, or molecule
- did not recognise diamond as a 3D covalent network substance
- could not describe the structure of diamond
- attributed conductivity solely to mobile electrons

- did not explain malleability of metals, or recognise that non-directional bonding allows cations or atoms to slide over each other
- used incorrect terminology for ions, molecules, electronegativity, dipoles, polar, and non-polar
- incorrectly described NaCl as a polar molecule
- did not correctly assign charges to ions when portraying the solubility of an ionic salt (NaCl).

Achievement standard 91165: Demonstrate understanding of the properties of selected organic compounds

Assessment

The assessment had three questions, and candidates were expected to answer all parts of all three questions. The assessment gave ample opportunities for candidates to demonstrate their understanding of the properties of organic compounds, linking to structure and functional groups.

Commentary

Successful candidates were able to demonstrate the core skills of naming and drawing chemical structures with consistent attention to detail. At Merit or higher, candidates who used the bullet points to assist with answering all parts of the question, linking answers to the context or the molecule's structure and relevant reactions and properties. These students applied their understanding of organic chemistry, integrating knowledge of chemical properties of organic compounds and their structure to specifically address the questions posed in the examination.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- correctly named and drew some organic compounds
- classified haloalkanes as primary, secondary, or tertiary
- identified the correct reaction type and provided a basic explanation
- identified observations related to common organic reactions e.g., colour changes
- explained one aspect of addition polymerisation e.g., the breaking of a double bond
- recognised geometric isomers, but did not explain the requirements
- identified major and minor products
- identified some reactants, products, and reagents in a reactions scheme
- recognised physical properties of teflon, but could not link to its use or molecular structure
- could draw at least three isomers for a straight-chained haloalkane.

Candidates who were awarded **Achievement with Merit** commonly:

- correctly named and drew organic compounds
- used Zaitsev's rule to identify and accuretly draw major and minor products
- linked the asymmetrical nature of a reactant to the production of two different products in elimination reactions
- explained the reactivity difference between monomers and polymers
- linked a reagent to a reaction type, product and structure, or observation
- linked the chain length of organic compounds to solubility or melting point
- explained the requirements for geometric isomerism (double bond and two different groups) and linked them to the 3D arrangement of molecules

- could provide an alternative chemical test (e.g., using a carbonate to identify a carboxylic acid) and state the correct observation (fizzing).

Candidates who were awarded **Achievement with Excellence** commonly:

- consistently and accurately drew structures and named them with correct terminology
- justified major / minor products by referencing the specific number of hydrogen atoms on the adjacent carbon atoms of the parent molecule
- clearly explained that physical properties are determined by the strength of forces between molecules that must be overcome
- successfully predicted all steps of the reaction scheme, including reagents, products, and reaction types
- when explaining geometric isomers, they explicitly stated that the C=C double bond prevents rotation, which is essential for the existence of cis/trans forms
- fully explained how a polymer's chemical property (e.g., unreactivity) makes it suitable for a specific application (e.g., non-stick cookware)
- included necessary conditions for reactions, such as the requirement for heat
- could distinguish between two similar substances (e.g., two different amines) by comparing their boiling points and linking this to their molecular size
- referred to the specific molecules provided in the question rather than giving generic textbook definitions
- combined reaction type, observations, conditions, and structural changes into a single, cohesive paragraph.

Candidates who were awarded **Not Achieved** commonly:

- drew bonds to the wrong atom, e.g., C–HO instead of C–OH
- confused elimination with substitution or addition reactions, leading to incorrect product structures
- drew "isomers" that were actually the same molecule just drawn from a different angle or flipped
- used non-scientific terms like "it changes colour" without specifying the initial and final colours
- provided incorrect colour changes for litmus paper or failed to state the starting colour of the paper
- did not draw a monomer from a polymer or vice versa; often included double bonds inside the polymer chain
- failed to recognise that geometric isomers must have two different groups on each carbon of the double bond.

Achievement standard 91166: Demonstrate understanding of chemical reactivity

Assessment

The assessment had three questions and candidates were expected to answer all parts of all three questions. The assessment gave multiple opportunities for candidates to demonstrate their understanding of chemical reactivity applying chemical vocabulary, symbols, and conventions.

Commentary

Successful candidates were able to apply the required vocabulary related to the chemical concepts of rates of reaction and equilibrium principles, particularly interpreting K_c values and the impact of changing pressure on an equilibrium system. A fundamental knowledge of expected acid and base formulas and their pH was required. At Merit or higher, candidates demonstrated a strong conceptual understanding and could integrate rate and equilibrium principles in commercial contexts, including the ability to understand and write appropriate chemical equations, demonstrating a good mathematical competency and correct use of terminology.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- performed basic one-step calculations (pH, $[H_3O^+]$, K_c)
- recognised the relationship between surface area and reaction rate
- defined acid / base and catalyst using rote-learned phrases
- wrote simple dissociation equations and K_c expressions
- identified favoured equilibrium direction when stress was applied
- related pH to $[H_3O^+]$ and conductivity to mobile charged particles
- missed units and significant figures in numerical answers.

Candidates who were awarded **Achievement with Merit** commonly:

- linked surface area increase to more successful collisions
- explained catalyst function and its effect on rate
- correctly wrote K_c expressions and interpreted their magnitude
- related conductivity and pH to degree of dissociation
- carried out two-step calculations with correct significant figures and units
- explained temperature effects on equilibrium and rate
- used correct equilibrium arrows and dissociation equations.

Candidates who were awarded **Achievement with Excellence** commonly:

- fully explained catalyst effect with reference to activation energy
- justified temperature changes in terms of K_c and exo/endothermic reactions
- compared and contrasted strong vs weak acids/bases for pH and conductivity
- integrated rate and equilibrium principles in commercial production scenarios
- completed calculations accurately with correct units and significant figures
- discussed proton transfer and linked changes in pressure to equilibrium shifts.

Candidates who were awarded **Not Achieved** commonly:

- left questions blank
- confused electrons with ions for conductivity
- could not calculate pH or write K_c expressions
- failed to link surface area to reaction rate
- misunderstood the role of a catalyst (e.g., thought it supplied energy)
- wrote incorrect dissociation equations and equilibrium expressions
- did not identify changes in equilibrium under stress.