NZQA
New Zealand Qualifications Authority
Mana Tohu Matauranga O Aotearoa

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Assessment Report

New Zealand Scholarship
Chemistry 2019

Standard 93102

Part A: Commentary

Successful candidates were able to integrate their understanding of Chemistry concepts from the broader curriculum to address the majority of the examination.

It is anticipated that candidates who enter for the examination are able to address questions related to all internal and externally assessed areas of the Level 3 Chemistry curriculum.

Candidates who had wide curriculum knowledge were more successful than candidates who were only able to address selected curriculum topics.

These candidates were able to logically interpret the information provided in the examination questions and produce answers which demonstrated clear understanding and insight.

Candidates who were able to correctly carry out calculations involving data, stoichiometric principles, and applications of common formulae, were more successful in this examination than candidates who were not prepared in these areas. Knowledge of calculations involved in thermochemical changes, quantitative analysis, aqueous equilibria, and electrochemistry is expected. Candidates are expected to carry out calculations without introducing rounding errors and use appropriate significant figures and units when describing final answers.

Convincing communication was achieved by candidates who had clear understanding of the language of chemistry, particularly with respect to attractive forces, enthalpy and entropy changes, and molecular shapes.

Understanding of the practical aspects of quantitative analysis, and changes occurring in aqueous systems involving precipitates, complex ions, and titration curves, were all areas of weakness in some candidate's performance . Additionally, many candidates were unable to interpret spectroscopic data to determine and justify the identity of an unknown organic compound.

Part B: Report on Performance

Candidates who were awarded Scholarship with **Outstanding Performance** commonly:

- used appropriate significant figures in answers based on the accuracy given in the data
- recognised the appropriate value of their answers, particularly positive endothermic values
- communicated their understanding with detail and correct language such as lattice, kinetic energy, or "occupy positions of maximum separation to minimise repulsion" over "repel to minimise repulsion"
- supported answers with clear diagrams
- recognised that the addition of a carbon chain (methyl group) when replacing a carboxylate group with an ester group results in decreased polarity
- recognised dimerization of carboxylic acids as significant
- concisely compared and explained differences in intermolecular forces
- understood the reasons for using primary standards, recognised that acidification of redox reactions changed the products and therefore mole ratios, and recognised the need for precise end points

- recognised the difference between bonding and non-bonding electrons in terms of repulsion and positioning in axial and equatorial positions around a central atom
- outlined the different possible positions the lone pairs of electrons could occupy and justified the most likely positions
- used data to work out organic reaction schemes so that the parent carbon chain had the correct structure (i.e. branched, and functional groups attached to correct carbons)
- integrated IR, 13C NMR, and MS data together to determine plausible structures and suggest tests to distinguish between them
- accurately determined the pH for all points along a titration curve
- recognised simple hydroxide precipitates
- recognised links between the decreasing OH- concentration in the titration and the disappearance of $Zn(OH)_2$ precipitate in terms of Qs vs Ks.
- gave concise answers to discussion questions
- gave answers that demonstrated a logical approach to discussing unfamiliar substances
- completed calculations with logical, well laid out, detailed working, with units.

Candidates who were awarded **Scholarship** commonly:

- used enthalpy change to determine a practical outcome (temp change).
- demonstrated a sound understanding of processes involved in spontaneous reactions including entropy and enthalpy and were able to communicate this understanding clearly with relevant detail
- demonstrated a sound understanding of factors affecting melting point including key intermolecular forces
- followed a titration procedure and completed multiple calculation steps to get a reasonable answer or progress towards it
- recognised the difference between accurate and approximate concentrations and used the accurate values in calculations
- drew and justified Lewis diagrams and shapes for molecules with 5 and 6 areas of electron density around a central atom
- justified bond angles and polarity clearly and accurately
- correctly balanced redox equations
- identified correct reduction potentials and use them to calculate correct E°cell values
- followed a complex organic scheme using given information and could carefully identify functional group transformations
- used IR, MS and 13C NMR data to identify relevant information about symmetry, molar mass, fragments, presence/absence of functional groups
- determined the quantity of a substance and/or could calculate solubility in $molL^{-1}$ and Ks of a non 1:2 compound
- used information from a titration to calculate pKa and some other points on a titration curve
- could sketch a sensible titration curve
- recognised the formation of a complex ion as a reason for the absence of an initial precipitate.

Other candidates

Candidates who were **no**t awarded Scholarship commonly:

- wrote unnecessarily long answers for some questions, while not completing others
- showed very poor, difficult-to-follow working in calculations
- did not attempt all questions
- could not carry out calculations, or make sense of questions that deviated from the standard level 2 or 3 NCEA examination approaches
- could not communicate their ideas in enough detail or with enough clarity
- mixed up endothermic/exothermic and temperature change increasing/decreasing and other simple thermochemical concepts
- did not use available information when completing questions
- did not recognise when calculation answers were unreasonable
- could not differentiate between the effects on system and surroundings when using enthalpy and entropy changes
- misunderstood the effect of enthalpy on entropy
- referred to Gibb's free energy equations to justify changes instead of explaining the changes occurring
- attempted to use concepts outside the NZC to answer questions, to limited success and often to the detriment of core fundamental principles
- could not differentiate between a Hess's law diagram and real-world applications
- did not show understanding of the links between electron clouds and temporary dipole forces

- did not understand that hydrogen bonding was an attractive force between molecules, or would refer to molecules as "having" hydrogen bonds
- could not use balanced equations/mole ratios correctly in calculations
- were unable to write redox equations or carry out E°cell calculations from a range of reduction potentials
- could not draw Lewis diagrams and shapes or explain polarity for simple structures
- could not determine structural aspects from 13C NMR spectra, or could not determine structural aspects given the chirality information provided in the question
- did not link data to spectra or aspects of molecules
- could not interpret features of an organic molecule based on spectroscopic data
- did not show understanding of simple organic reactions
- drew skeletal structures incorrectly when identifying organic compounds, or drew incorrect organic structures with missing atoms or incorrect numbers of bonds
- spent time naming organic structures that was not required of the questions
- could not convert g L^{-1} to mol L^{-1}
- could not calculate a Ks value from solubility information provided
- could not calculate a pKa value from pH information provided, or calculate part of an acid-base titration curve
- were unable to determine why a precipitate formed when a range of substances were mixed
- did not use units to indicate the meaning of calculation values
- made poor use of chemical terminology.

Subject page

Previous years' reports

2018 (PDF, 105KB)

2017 (PDF, 43KB)

2016 (PDF, 203KB)
