NZQA
New Zealand Qualifications Authority
Mana Tohu Matauranga O Aotearoa

Assessment Report

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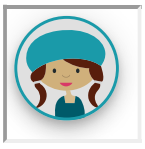
Level 2 Chemistry 2021

Standards 91164 91165 91166

Part A: Commentary

Candidates that achieved at merit level or higher were able to plan their answers to ensure they answered all parts of the questions, making particular references to include comparisons and use correct terminology and units. Students should always link chemistry concepts back to the substances present in the question. If a question asks the candidate to compare and contrast two substances, there needs to be a summary paragraph stating what is similar and what is different. Clear working should be shown for all calculations to allow the marker to award partial grades when a final answer is not fully correct. Candidates who were able to identify key concept(s) being covered in a question often provided sufficient evidence towards Achievement level.

Part B: Report on standards



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

Examinations

The examination included three questions of which candidates were required to respond to all three. Question 1 required candidates to apply their understanding of types of substances and their properties. Question 2 required candidates to apply their understanding of endothermic and exothermic reactions, solubility and enthalpy changes. Question 3 required candidates to apply their understanding of Lewis diagrams, shapes, polarity and bond enthalpy.

Observations

Candidates need to be accurate with terminology, particularly when using easily confused terms such as polar bonds and bond dipoles. Candidates should ensure they have added correct units and signs to their answers for calculations. Algebraic skills are required for calculations at this level and students should prepare for this. Understanding of the structures and properties of ionic, metallic, molecular and covalent networks is crucial for success at all levels of achievement.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- identified an exothermic reaction with a reason
- identified delocalised electrons as a requirement for conductivity in a metal
- identified the solubility of a non-polar substance in water and cyclohexane
- converted mass to number of moles
- related boiling point to the strength of forces of attraction in a substance
- linked symmetry and shape to molecular polarity
- drew Lewis diagrams correctly and/or named shapes
- identified by calculation, bonds broken in reactants or bonds made in products
- recognised that repulsion of electron clouds and/or the number of electron clouds determines molecular shape.

Candidates whose work was assessed as **Not Achieved** commonly:

- did not draw Lewis diagrams or name shapes correctly
- confused bonding and particle types in solids
- identified water as a non-polar molecule used mnemonics such as “like dissolves like” without an explanation
- confused endothermic and exothermic
- used incorrect formula to calculate moles
- confused electronegativity with electron clouds and bond dipoles
- included activation energy with enthalpy change for a reaction.

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

- linked structure, bonding and particle movement to explain conductivity and/or ductility for a metal
- linked the structure and the relative strength of attractive forces between particles to the boiling points of two substances
- carried out two steps of a thermodynamic calculation correctly
- linked regions of electron density and repulsion with regard to a central atom to explain shape and observed bond angles
- explained how molecular symmetry and dipoles were linked to polarity
- linked polarity and attractive forces for the solubility of a non-polar substance in solvents
- drew Lewis structures correctly and linked these to correct shapes.

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

- justified electrical conductivity and ductility of a metal in terms of structure and free movement of correctly identified particles and attractive forces
- justified the solubility of a non-polar molecule by linking polarity to attractions between solute/solvent attractive forces which need to be overcome
- explained comprehensively the difference in sublimation and boiling points of substances by describing fully the structure, particle type and bonding

- explained comprehensively using VSEPR theory to predict the shape and bond angle of molecules
- compared and contrasted the predicted polarity of molecules by linking electronegativity difference between bonded atoms, polar bonds and symmetry to bond dipole cancellation
- calculated correctly thermodynamic calculations with correct units, sign and three significant figures.

91165: Demonstrate understanding of the properties of selected organic compounds

Examinations

The examination included three questions of which candidates were required to respond to all three. Question 1 required candidates to apply their understanding of structural isomers, geometric isomers and addition reactions of both symmetric and asymmetric alkenes. Question 2 required candidates to apply their understanding of reaction schemes, addition polymerisation and the naming of organic compound. Question 3 required candidates to apply their understanding of alcohol/haloalkane classification, distinguishing tests and elimination reactions.

Observations

The ability to identify and explain the type of reaction occurring is a key skill in this standard. Relating an answer back to the organic compound in the question was a common theme among students who scored at merit level or higher. Core skills such as naming and drawing organic compounds are necessary for success at all levels. Students should use the provided bullet points as scaffolding for their answer to ensure all aspects of the question are being covered.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- identified correct constitutional (structural) isomers
- identified factors required for geometric isomerism
- applied addition reaction rules to alkenes to identify products

- partially completed a reaction scheme
- gave a partial definition of a polymerisation reaction
- drew and named organic molecules
- explained the difference between a primary and tertiary alcohol
- distinguished one pair of organic molecules using a chemical test
- identified the difference in one physical property for two compounds belonging to different homologous series
- able to link correct reagent and conditions to one type of reaction.

Candidates whose work was assessed as **Not Achieved** commonly:

- did not identify a requirement for geometric isomerism correctly
- did not correctly name or draw an organic compound from a structural formula and vice versa
- did not complete a reaction scheme
- did not correctly classify alcohols and haloalkanes
- did not correctly identify reaction types
- did not correctly use chemical or physical properties to distinguish between compounds.

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

- explained why a factor is needed for a geometric isomerism
- explained a reaction type and used Markovnikov’s rule correctly to determine major and minor products of addition reactions
- completed a reaction scheme with some errors
- fully described a polymerisation reaction
- identified the difference in chemical reactivity of an alkane and alkene
- classified and explained why alcohols / haloalkanes are primary, secondary or tertiary
- used chemical properties to distinguish two compounds including correct observations and structural formula for the product

- used physical properties to distinguish three compounds including observations
- correctly identified the different products formed when a haloalkane is reacted with KOH under both alcoholic and (aqueous conditions).

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

- drew correct structural formulae consistently
- consistently used chemistry vocabulary, symbols and conventions
- justified the different requirements for geometric isomers and related these back to the context explained
- drew and justified the various products formed when alkenes are reacted with an asymmetric reagent
- completed a full reaction scheme
- correctly drew an addition polymer and fully explained the type of reaction occurring in its formation
- elaborated upon the difference in chemical reactivity between alkenes and alkanes and linked this to addition polymer formation
- used chemical properties to distinguish two compounds including observations and structural formulae of products
- developed a procedure to identify three substance using their physical properties
- fully elaborated upon how the conditions in which the reagent KOH is used affects the product(s) formed when reacted with a haloalkane.

91166: Demonstrate understanding of chemical reactivity

Examinations

The examination included three questions of which candidates were required to respond to all three. Question 1 required candidates to apply their understanding of reaction rates. Question 2 required students to apply their understanding of factors that affect systems at equilibrium as well as Kc expressions and

associated calculations. Question 3 required students to apply their understanding of strong and weak acids and bases including pH calculations and conductivity.

Observations

Candidates should be cautious when using terms that are easily confused, such as concentration and amount, and avoid using them interchangeably. Clear working is required for the awarding of partial grades in calculation questions when an error has been made. Candidates should familiarise themselves with the reactions of common organic compounds with water, for example, methanamine, ethanamine, methanoic acid and ethanoic acid. Candidates that were successful clearly recognised the difference in requirements between Level 1 and Level 2 for both reaction rate and acid-base chemistry.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- correctly calculated pH, hydronium/hydroxide concentration, or Q/Kc, though often missing units or appropriate rounding
- recognised the need for sufficiently energetic particle collisions in order for a reaction to occur
- identified that powder has a larger surface area than chips identified that catalysts decrease the activation energy of a reaction
- did not link particle collision frequency to reaction rate
- wrote a correct chemical equation from a given Kc expression recognised a temperature increase shifts equilibrium in the endothermic direction
- identified that electrical conductivity is dependent upon the concentration of charged particles in solution
- recognised an increase in Kc value corresponds to an increase in products/decrease in reactants.

Candidates whose work was assessed as **Not Achieved** commonly:

- did not write correct chemical equations related to the question
- completed single-step calculations but did not correctly link these to any descriptions of what is happening in the chemical system
- confused which factor was relevant in rates of reaction questions

- did not correctly convert a Kc expression to a chemical equation
- did not correctly predict the favoured direction of equilibrium shift when changes were made to a system at equilibrium
- confused common acids for bases and vice versa
- did not correctly link acid/base strength to degree of dissociation and ion concentration
- incorrectly believed a Kc value of 1 meant a system was at equilibrium.

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

- correctly identified the relationship between pH and hydronium ion concentration
- correctly used chemical terminology such as concentration and collision frequency in their answers
- linked changes to a system at equilibrium to favoured reaction direction
- linked changes in surface area and/or addition of a catalyst to reaction rate
- understood that catalysts decrease activation energy and linked this to the rate of reaction
- explained the conductivity of substances by linking degree of dissociation to ion concentration
- carried out two-step calculations with correct units recognised catalysts decrease activation energy by providing an alternative pathway for a reaction to occur

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

- elaborated on the effects that changing surface area and the addition of a catalyst had on the frequency of successful collisions and the effect this had on reaction rate
- justified whether a reaction is exothermic or endothermic by referring to the change in Kc when the temperature of a system at equilibrium is altered correctly
- predicted the response of a system at equilibrium when various chemical species were added

- used knowledge of strong and weak acids and bases as well as soluble salts to fully justify the conductivity of various solutions, with use of correctly written chemical equations and a discussion of the degree of dissociation/ionisation
- fully explained how acid/base strength affects the degree of dissociation, hydronium ion concentration and pH.

Chemistry subject page

Previous years' reports

2020 (PDF, 224KB)

2019 (PDF, 123KB)

2018 (PDF, 128KB)

2017 (PDF, 52KB)

2016 (PDF, 258KB)