NZQA
New Zealand Qualifications Authority
Mana Tohu Matauranga O Aotearoa

Assessment Report

Level 3 Chemistry 2016

Standards 91390 91391 91392

Part A: Commentary

Candidates who achieved Excellence grades tended to respond succinctly and in the space provided.

Successful candidates defined terms without ambiguity and wrote with a scientific literacy that was appropriate in all three standards.

Candidates identified the reagents used in processes but some were unable to demonstrate adequate knowledge about the chemistry involved.

Part B: Report on Standards

91390: Demonstrate understanding of thermochemical principles and the properties of particles and substances

Candidates who were awarded **Achievement** commonly:

- defined key concepts such as fusion, ionisation energy and electronegativity
- wrote electron configurations correctly
- drew a Lewis structure or identified a shape correctly
- identified periodic trends
- identified attractive forces in different compounds
- used a recognised process to calculate enthalpy using Hess's Law
- calculated energy or moles for a calorimetry calculation
- understood that entropy was positive if there was more disorder in a system.

Candidates who were assessed as **Not Achieved** commonly:

- did not define key terms

- were unable to draw a Lewis structure or identify a shape
- did not complete electron configurations using the s, p, d format
- confused periodic trends
- did not understand the different attractive forces in various compounds
- believed fusion to be the formation of a compound.

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

- explained the periodic trends accurately
- linked a correct Lewis structure to its shape
- understood that the differences in energy were related to either the type of attractive forces or the number of forces that needed to be broken
- linked entropy changes with disorder of particles and understood that dissolving produced ions in solution, rather than a liquid.

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

- understood periodic trends and could accurately communicate their understanding of electronegativity
- linked shape and polarity to a full explanation of solubility without limiting it to ‘like dissolves like’
- related attractive forces to phase changes competently and accurately
- communicated clearly why a reaction could be spontaneous despite a positive enthalpy
- carried out Hess’s Law and calorimetry calculations competently with the correct sign, units and to appropriate significant figures
- understood the differences of entropy in a system and its surroundings.

Standard-specific comments

Candidates should acknowledge that the number of protons remains the same in an atom and its ion whilst also linking to the electron-electron repulsion that occurs for an anion.

The understanding of electronegativity should communicate that it is an attraction to shared bonding electrons.

It is important to answer a question fully by referring to the question rather than addressing only the scaffolded part(s), for example, the solubility of SeF_6 in water, instead of just giving explanations about the polarity and shape of SeF_6.

Successful candidates referred to bond dipoles cancelling rather than polar bonds cancelling.

Abbreviations such as TDD-TDD must be clarified, for example, TDD-TDD (temporary dipole-dipole attractions).

The solids studied in level two chemistry are still relevant in any discussion of attractive forces.

When a solid dissolves in water, the candidates should recognise the difference between a phase change to liquid and the composition of an aqueous solution.

In calorimetry calculations, candidates should be aware that it is the changes to water that is being measured.

91391: Demonstrate understanding of the properties of organic compounds

Candidates who were awarded **Achievement** commonly:

- drew structural formulae, including a 3-D enantiomer
- named functional groups and molecules
- recognised the conditions required for optical isomerism
- linked two peptides with a peptide bond
- recognised a condensation reaction
- chose the correct reagent to identify two functional groups
- partially completed reaction schemes and chose a correct reagent.

Candidates who were assessed as **Not Achieved** commonly:

- failed to identify functional groups
- did not define the requirements for optical isomerism
- failed to link the solubility of organic compounds to correct observations
- did not recall the reagents used or identify the products formed in a reaction scheme
- did not identify the products of acidic or basic hydrolysis.

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

- explained the requirements for optical isomerism and identified molecules with this feature
- drew dipeptides with minor errors
- explained the meaning of condensation
- drew the products for the reduction of an aldehyde and ketone
- selected appropriate reagents to distinguish between different organic compounds and described some applicable observations
- completed a reaction scheme and give some reagents, with minor errors
- devised a workable reaction scheme.

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

- drew correct connections between atoms, groups of atoms and functional groups when drawing structural formulae
- recognised the products of hydrolysis
- wrote correct chemical equations for reactions
- recalled observations for reactions correctly
- recognised the solubility in water of small chain organic compounds

- recalled all conditions needed for oxidation, elimination and addition.

Standard-specific comments

Successful candidates tended to clearly show which atoms are connected to which bonds when drawing structures.

Candidates are advised to ensure their understanding of acid and base hydrolysis and dipeptide formation is secure.

An understanding of the three reagents used to distinguish between aldehydes and ketones is expected.

91392: Demonstrate understanding of equilibrium principles in aqueous systems

Candidates who were awarded **Achievement** commonly:

- completed one or two steps of any given calculation correctly
- identified that a complex ion was responsible for increasing the solubility of the given solid
- demonstrated knowledge of how a base reacts with water to produce hydroxide ions in solution
- wrote K_s and K_a expressions
- recognised the reagents needed to form a complex ion
- identified the relative concentrations of species in solution
- differentiated between equilibrium reactions and reactions going to completion with the correct arrows
- recognised that the salt of a strong acid or weak base reaction is acidic.

Candidates who were assessed as **Not Achieved** commonly:

- misrepresented substances that partially dissociated in water
- failed to acknowledge the ammonium ion as being acidic
- wrote equations with charges on ions missing
- wrote incorrect K_a and K_s expressions
- did not identify the formation of a complex ion
- did not identify species in solution, by differentiating between soluble ionic species and species that partially hydrolysed.

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

- completed two steps of the solubility question correctly
- applied Le Chatelier's principle to explain the increased solubility of a substance when a complex ion is formed
- calculated the pH of a base correctly

- related pH to pK_a at the mid-point of the titration, in relation to the base and conjugate acid being the same concentration
- calculated the pH at the equivalence point of a titration correctly.

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

- completed most of the calculations correctly to the required number of significant figures, including calculations of the dilution of species
- represented all equations corectly with appropriate arrows
- fully explained the order of concentration of species in a solution, including all relevant equations and reference to the presence of hydronium ions and hydroxide ions due to the ionisation of water molecules
- related the titration mid-point pH to a buffer expression and explained the mathematics of pH = pK_a, regarding this expression.

Standard-specific comments

Candidates are expected to calculate pH at given points along the titration curve.

When candidates are asked to explain a trend in a property such as electrical conductivity or pH, it is advisable to define that property as well as the trend.

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