2015 NCEA Assessment Report

Chemistry Level 2 91164, 91165, 91166

Part A: Commentary

Candidates who gained Merit and Excellence levels of achievement demonstrated an ability to read the questions closely. They carefully planned their answers and demonstrated systematic working in calculations with the appropriate number of significant figures and the correct units. They were able to identify observations and wrote correctly balanced equations for reactions. They also applied the correct chemistry principles and used language, symbols and conventions appropriately.

Candidates who gained the Achievement level completed most of the questions but may have used vague or imprecise language which impacted on otherwise good answers. Some candidates appeared to rush their answers, leaving out large parts of discussions. A number appeared to have written pre-prepared answers that they were unable to adapt to the context of the question. They may not have used language, symbols and conventions appropriately or accurately.

Part B: Report on standards

1. Assessment Report for 91164: Demonstrate understanding of bonding, structure, properties and energy changes

Achieved	Candidates who were assessed as Achieved commonly: • drew Lewis diagrams for structures with single and double bonds • stated the shape and bond angle of molecules from their Lewis diagrams • identified polar bonds in a molecule • completed one step of a thermochemical calculation • identified an exothermic or endothermic reaction and gave a reason • identified potential user errors in carrying out an experiment to measure the energy released during the combustion of a fuel • drew an unlabelled energy diagram for an exothermic reaction • were able to recall that bond breaking requires an input of energy • identified the type of solid, type of particle and attractive forces between particles for metallic or ionic substances • gave basic reasons for some of the properties of metallic, ionic, covalent molecular or giant covalent substances.
Not Achieved	Candidates who were assessed as Not Achieved commonly: • were unable to draw Lewis diagrams of molecules that involve double bonds • could not provide a bond angle from a given Lewis diagram of a molecule • confused polar bonds and polar molecules • were unable to correctly complete one step of a thermochemical calculation, for example, the mole calculation • could not identify potential experimental errors in the process of carrying out an experiment to determine the energy released during the combustion of a fuel • failed to correctly draw an energy diagram for an exothermic reaction • stated incorrectly that bond making requires an input of energy • confused the type of solid and type of particles involved in metallic, covalent and ionic substances • were unable to give the requirements for malleability and solubility.
Achieved with Merit	Candidates who were assessed as Achieved with Merit commonly: • explained the shape or bond angle of a molecule in terms of the repulsion of the correct number of electron clouds • made some links between the electro negativities of different atoms, polar bonds and the overall polarity of molecules • completed at least two steps of thermochemical calculations involving bond

	enthalpies or the energy released in a reaction • identified possible errors in the design of an experiment to measure the energy released during the combustion of a fuel • identified the type of solid, particles and attractive forces between particles for metals, ionic substances, covalent molecular and giant covalent substances • made some links between the properties of different substances, and their structure and bonding.
Achieved with Excellence	Candidates who were assessed as Achieved with Excellence commonly: • provided a comprehensive analysis of molecules in terms of their shapes, bond angles and polarity, from given Lewis diagrams • carried out multi-step thermochemical calculations, including providing a correct unit and sign • drew a labelled energy diagram for an exothermic reaction and linked this to bond making in the products releasing more energy than was used to break the bonds of the reactants • linked the properties of a variety of substances accurately to their structure, particles within the structure, and bonding • used chemistry vocabulary, symbols and conventions correctly and consistently.
Standard specific comments	In the explanation of the properties of substances, candidates must be careful to ensure that they demonstrate understanding of substances at the particle level. A common misconception is that energy is required in order to form bonds. The opposite is true and this is an important principle in Chemistry. Candidates need to think carefully about the units and the sign when they have completed a thermochemical calculation. This indicates a deeper level of understanding of the principles involved.

2. Assessment Report for 91165: Demonstrate understanding of the properties of selected organic compounds

Achieved	Candidates who were assessed as Achieved commonly: • drew valid structural formulae • drew three other isomers of butan-1-ol • identified an error in the IUPAC naming of a molecule • drew valid structural and cis / trans (geometric) isomers • identified the colour change with potassium permanganate solution • identified the type of reaction as addition and elimination • gave only partial explanation of addition / elimination reaction types.
Not Achieved	Candidates who were assessed as Not Achieved commonly: • drew structural formulae that were not valid – too many or too few bonds to the carbon atoms • drew the same isomers of butan-1-ol in different ways • stated incorrect observations for colour changes • did not attempt the final question • described observations and the type of reaction for one reagent only • numbered carbon chains from both ends.
Achieved with Merit	Candidates who were assessed as Achieved with Merit commonly: • drew three correct structural isomers and linked the structure to that of the secondary alcohol • identified the correct type of reaction occurring • identified the correct reagents used in various organic reactions • explained addition, elimination reactions as the breaking, forming of a double bond, and the adding / removing of TWO atoms, groups of atoms.

Achieved with Excellence	Candidates who were assessed as Achieved with Excellence commonly: • wrote a valid procedure that correctly identified organic compounds • explained, using the symmetry of a molecule, why one or two products form in a reaction • analysed reactions using specific and accurate language for the compounds in the question • used the terminology of the achievement standard in their answers • compared and contrasted different reactions for alkenes.
Standard specific comments	Some candidates who wrote detailed answers did not use the terminology of the standard, in particular, using the terms: Hydration, bromination, hydro-halogenation, or hydro-bromination instead of addition; dehydration instead of elimination; neutralisation (as in Level 1) instead of acid-base. Some candidates confused oxidation and addition, in both permanganate and acidified water reactions. Some candidates, when asked to name a cis / trans (geometric) isomer, simply identified the isomer as cis / trans, rather than naming it. Many, who did name it, did not recognise the need for putting cis / trans as a prefix to the name. Some candidates did not pay attention to detail, e.g. omitted hydrogen atoms from structures. Some candidates failed to circle the functional groups, possibly because they did not read the question. Some candidates failed to fully explain addition / elimination reactions, e.g. not referring to the double bond breaking / forming or not stating the TWO atoms and/or groups that are added or removed.

3. Assessment Report for 91166: Demonstrate understanding of chemical reactivity

Achieved	Candidates who were assessed as Achieved commonly: • wrote correct equilibrium constants • were able to carry out straight forward pH calculations given the hydronium ion concentration • recognised that a catalyst lowers the activation energy of a reaction • applied equilibrium principles to predict or explain changes made to a system • classified ammonia as a base • were able to balance acid-base equations using correct formulae • identified the direction of an exothermic reaction from enthalpy data.
Not Achieved	Candidates who were assessed as Not Achieved commonly: • confused the terms strong and weak with concentrated and dilute when describing acids • were unable to recognise common acids and bases • thought catalysts provided energy in chemical reactions • linked incorrectly the use of a catalyst to the effects of surface area of a reactant • omitted or gave incorrect charges on common ions • used single-headed arrows for equilibrium reaction equations • lacked understanding of equilibrium principles and confused the directions of left and right with reactants and products • confused the effect of temperature with pressure and the number of moles in a system • used ‘x’ instead of ‘+’ within equilibrium constants • confused exothermic and endothermic reactions.

Achieved with Merit	Candidates who were assessed as Achieved with Merit commonly: • explained the role of a catalyst and linked it to both activation energy and reaction pathways • were able to calculate equilibrium constants • defined concentration as the number of particles per unit volume • recognised that temperature increased the reaction rate, due to the increased movement of particles and a greater proportion of particles having sufficient energy to overcome the activation energy • referred to an increase in reaction rate as a greater number of collisions per unit time • recognised that conductivity depends on the number of charged ions in a solution • used doubled-headed arrows for equilibrium reaction equations • identified strong and weak acids, and linked their hydronium ion concentration to dissociation and the degree of reactivity with a metal.
Achieved with Excellence	Candidates who were assessed as Achieved with Excellence commonly: • compared and contrasted reactions involving changes of temperature and concentration using correct equilibrium principles and collision theory • carried out multi-step calculations and gave answers with appropriate significant figures and units • compared and contrasted pH with reaction rate for strong and weak acids • justified comprehensively, conductivity of solutions supported by equations with correct arrows • used Le Chatelier's principle to predict and justify changes made to specific equilibrium reactions • drew a well-labelled diagram to demonstrate the effects of a catalyst.
Standard specific comments	Some candidates found difficulty performing calculations involving bases, while others confused hydronium ion and hydroxide ion concentration. Candidates frequently used an inappropriate number of significant figures and missed out the units for concentration. Some candidates did not follow instructions to compare AND contrast. Often only similarities OR differences were discussed which prevented the candidate from achieving at excellence level. Incorrect arrows were frequent in equations. Strong and weak acid dissociation equations often had identical arrows. Few candidates realised that soluble acidic ionic salts conduct through dissolved ions, with candidates thinking that this was due solely to weak acid dissociated ions. Emphasis needs to be placed on the dissolution of ionic salts as well as acid / base behaviour to adequately prepare for the assessment of this level three external standard. Weaker candidates had little concept of Le Chatelier's principle as applied to a system in equilibrium, with some confusing the name with Markovnikov's rule. Left and right direction changes that were not linked to reactants or products and lack of clear distinction often prevented the candidate from achieving overall. Some candidates confused exothermic and endothermic reactions with energy release or absorption.