Assessment Report

Level 2 Chemistry 2017

Standards 91164 91165 91166

Part A: Commentary

Candidates gaining Merit and Excellence grades were more likely to write a comprehensive answer that reflected the instructions in the question such as ‘compare and contrast’ or ‘justify’. These candidates were also able to demonstrate evidence of planning in their answer with a systematic approach, including full working in any calculations. These candidates did not use terms such as ‘and vice versa’ or ‘like dissolves like’.

High achieving candidates could apply their answers to all contexts rather than simply producing a pre-prepared answer that did not specifically address the chemical substances in the question.

It is important that candidates use appropriate language, symbols and conventions in their answers as this is an essential skill in Chemistry.

Part B: Report on standards

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

Candidates who were awarded **Achievement** commonly:

- identified whether a reaction was endothermic or exothermic with a reason
- drew an energy diagram
- identified the polarity of molecules
- identified the type of substance, the type of particles and the attractive forces for different substances
- calculated moles from a given mass
- drew Lewis diagrams and identified molecular shapes
- identified the number of electron density regions that determine a molecules shape
- identified electronegativity differences between bonded atoms
- identified the bonds broken or made in a reaction
- identified the strength of bonds in different substances
- identified the non-directional nature of metallic bonding.

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

- confused endothermic and exothermic reactions with respect to their energy changes

- could not identify the type, particle and attractive forces for different substances
- described ionic substances as polar molecules
- used incorrect formula to calculate energy changes
- confused electron density regions with electronegativity
- did not know the relative bonding strengths of common substances
- could not define malleability.

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

- linked evaporation to the correct energy changes
- drew a labelled energy diagram
- explained, or showed diagrammatically, the attraction between water molecules and ions
- linked energy output to mass reacted through calculation
- linked enthalpy change to bonds broken and made
- explained how the number of a central atom's electron density regions gives rise to their 3D arrangement
- linked the polarity of bonds to electronegativity differences between the bonded atoms
- linked the type and strength of bonding in substances to the energy needed to break these bonds
- explained how a metal was malleable, linking it to its structure clearly.

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

- comprehensively linked increased temperature from exercise to the rate of evaporation
- justified the aqueous solubility of ionic compounds through analysing and drawing the attractive interactions between water and ions.
- evaluated multiple energy and enthalpy changes and arrived at appropriate conclusions using appropriate significant figures and correct units
- elaborated on how the number and nature of electron density regions around a central atom determine the shape and bond angle of a molecule.
- justified the polarity of molecules in terms of the electronegativity difference between bonded atoms, the relative polarity of different bond dipoles present and the overall symmetry of the molecules
- justified the relative melting points of substances using the nature and strength of the bonding present
- elaborated fully on the malleability of metals.

Standard specific comments

Candidates are expected to be able to identify which type of substance (ionic, molecular, covalent network or metallic) a particular substance, is for all levels of achievement. A significant number of candidates described NaCl as a polar molecule and S_8as a covalent network.

Candidates should be careful to give a full account of working during calculations. This should include listing any formula used, presenting each significant step of working made in a sequential manner, and giving final answers to the appropriate number of significant figures with the correct units.

Candidates should take care to ensure that they fully discuss each item in a question, statements like 'and vice versa' are not sufficient. They should further avoid using abbreviations without clarification where possible.

91165: Demonstrate understanding of the properties of selected organic compounds

Candidates who were awarded **Achievement** commonly:

- could draw the correct monomer from a given polymer
- could draw, name and classify selected organic structures
- punctuated the IUPAC names of organic compounds correctly
- identified and drew cis/trans isomers
- could draw organic products of addition, substitution and elimination reactions
- were able to identify and state the different types of organic reactions
- described a suitable chemical test to distinguish different organic molecules
- recognised that a neutralisation reaction occurs between an amine and a carboxylic acid
- could identify and name different functional groups in a given molecule.

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

- could not use correct or appropriate chemistry vocabulary
- struggled to name or draw organic structures
- could not describe the polymerisation reaction
- did not include hydrogen atoms on structural formulae
- confused elimination and substitution reactions
- did not draw a double bond in a monomer
- confused H_2, $H^+$and H, and ions and molecules in organic reactions
- described Markovnikov's Rule as "the rich get richer" without demonstrating any understanding of the chemistry involved.

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

- explained and drew major and minor products in an elimination reaction
- recognised the impact of a non-rotational double bond in the formation of geometric isomers
- explained addition polymerisation
- linked a chemical property to a use of a polymer
- wrote a balanced equation betweenan amine and a carboxylic acid
- explained addition and substitution reactions of bromine with an alkane and alkene
- used chemical tests to identify an alkene
- identified products, reagents and reaction types correctly in a reaction scheme
- explained the classification of a specific alcohol.

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

- explained the factors needed for geometric isomerism and then applied them to a specific example
- explained addition polymerisation with a supportingsuitable equation
- compared and contrasted the reactions of an alkene and alkane with bromine with observations, reagents and specific conditions
- explained, drew and justified why major and minor products form in an elimination reaction with an asymmetric haloalkane
- justified a neutralisation reaction between an amine and carboxylic acid by linking to proton transfer with a correctly balanced equation
- analysed reactions using specific terminology, symbols and accurate language for the compounds in question.

Standard specific comments

Candidates who carefully read and answered the question specifically for the different organic reactions achieved higher grades. It is important to communicate clearly when explaining reactions, reagents, observations or even structures of organic molecules.

Candidates must use IUPAC naming conventions appropriately.

91166: Demonstrate understanding of chemical reactivity

Candidates who were awarded **Achievement** commonly:

- identified that acids donate protons and bases accept protons
- calculated $[H_3O^+]$ from pH
- identified that mobile charged particles are needed for electrical conductivity
- recognised that iron is a catalyst and that a catalyst lowers the activation energy
- wrote an equilibrium constant expression from a given equilibrium equation
- substituted correctly into K_c expression
- recognised that the calculated Q should equal the given K_c if the mixture is at equilibrium
- identified that an increase in temperature causes the particles to move faster / collide more often
- identified the direction favoured by an equilibrium system when the concentration of a product is changed or pressure is altered.

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

- omitted charges from species when completing an equation
- identified a solution of sodium ethanoate as acidic
- identified electrons as the charged particles responsible for the electrical conductivity of ionic solutions
- stated that a catalyst gives energy to particles
- substituted incorrectly into a K_c expression
- could not identify which direction an equilibrium will move when changes are imposed.

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

- linked proton transfer to conjugate acid-base pairs
- explained the nature of a solution of sodium ethanoate with a correct equation showing the production of hydroxide ions
- calculated pH, $[H_3O^+]$, and $[OH^-]$ for strong acids and bases
- linked the electrical conductivity of a weak base to the degree of dissociation and relative concentration of most ions present
- explained that a catalyst increases the rate of a reaction by providing an alternative pathway with a lower activation energy
- linked an equilibrium reaction to its exothermic nature by referring to temperature changes and Kc values
- linked an increase in temperature to the kinetic energy of particles and the increased frequency of collisions
- used equilibrium principles to explain the effect of changing concentration, temperature, and pressure on the position of an equilibrium.

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

- compared and contrasted the conductivity of a basic salt and a weak base in terms of the degree of dissociation and relative concentration of all ions in solution
- justified the role of a catalyst in providing an alternative pathway with a lower activation energy by referring to particle movement and energy
- elaborated on the rate of reaction as the temperature changes, in terms of the kinetic energy of particles, the proportion of particles with sufficient energy to overcome the activation energy, and the total mass of products

- used equilibrium principles to comprehensively explain the change in position of an equilibrium when concentration, temperature, and pressure are changed, and related these to relevant observations.

Standard specific comments

Candidates commonly explained that particles had sufficient ‘force’ rather than ‘energy’ to overcome the activation energy.

Many candidates assumed that since sodium carbonate completely dissociated, it must be a strong base rather than recognising its ionic nature. Some candidates assumed only the hydroxide ions from the two bases contributed to their electrical conductivity.

When describing observations following a change in the position of an equilibrium, many candidates thought the colour would only be due to either the reactant or product. For example, when the increase in pressure caused the equilibrium to shift towards colourless N_2O_4, many described the observation as turning ‘colourless’ rather than a ‘lighter brown’.

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