Assessment Report

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Level 2 Chemistry 2020

Standards 91164 91165 91166

Part A: Commentary

Higher levels of achievement were attained by students who linked chemical principles back to the examples used in the examination. This included not only succinct explanations of the relevant rules and concepts, but also the ability to apply these concepts to a range of new contexts. Calculations need to be laid out with clear working, appropriate rounding and correct units.

Students who find the subject difficult should endeavour to attempt all questions, as often identifying the relevant concept in a question is a requirement for achievement. Fundamental concepts across each standard should be identified and learned in preparation for the examination.

Part B: Report on standards

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

Candidates who were awarded **Achievement** commonly:

- identified reactions as exothermic or endothermic with a reason
- named the shapes of molecules
- identified the solubility of non-polar substances and ionic solids in water
- converted mass to amount in moles
- identified that mobile charged particles were needed for conductivity
- drew and labelled reactants and products on energy profile diagrams
- calculated the energy of bonds broken in reactants or bonds made in products
- identified types of solid(s), particle types, and the attractive forces between them
- identified that the number of electron clouds determines the parent geometry of molecules.

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

- failed to draw Lewis structures
- confused ionic substances with polar molecules
- used mnemonics without explanation
- confused endothermic and exothermic reactions
- could not correctly calculate amount in moles
- used the term electronegativity in an incorrect manner
- claimed covalent bonds are broken when a molecular substance evaporates
- were unable to state the types of particles and attractive forces present in ionic, molecular, and network solids.

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

- linked structure, bonding and particle movement to electrical conductivity

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- linked the relative strength of attractions between solvent and solute particles to solubility
- carried out two steps of a thermodynamic calculation correctly
- linked the number of electron clouds and their repulsion about the central atom to molecular shape and bond angles
- explained how molecular symmetry and dipole arrangement were linked to polarity
- linked the release or absorption of energy to the change in enthalpy for a reaction
- linked the breaking of intermolecular forces to the evaporation of molecular substances.

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

- justified electrical conductivity in terms of structure and free movement of correctly identified charged particles
- discussed solubility in terms of the relative strength of attractions between solute and solvent particles, with reference to correctly drawn diagrams,
- comprehensively explained the shape and bond angles of the molecules given
- rationalised the polarity of molecules through the consideration of bond polarity, molecular shape, and dipole symmetry
- navigated thermodynamic calculations without error with the correct unit, sign, and rounded to three significant figures.

Standard specific comments

The candidates' ability to recognise and describe the structure of metallic, ionic, molecular and network solids is a key skill, that is important for all levels of achievement.

Candidates should be accurate with the use of chemical terminology, particularly when using similar terms that are easily confused, for example; electronegativity and electron pair repulsion, polar bonds and bond dipoles.

Candidates should show all working for calculations as well as giving their answers to three significant figures where appropriate, along with correct units.

Candidates should be prepared to undertake simple conversions, for example, kilograms into grams.

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91165: Demonstrate understanding of the properties of selected organic compounds

Candidates who were awarded **Achievement** commonly:

- named and drew correct organic structures
- classified alcohols as primary, secondary, or tertiary
- identified reaction types in organic reactions
- identified common reagents used in organic reactions
- recognised how the saturation of monomers and polymers differed
- described the requirements for structural and geometric isomers
- drew the major and minor products of elimination reactions
- identified observations for common reagents.

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

struggled to name or draw organic structures

- were unable to identify reaction types, reagents used, associated observations and resulting products
- could not draw the monomer from a polymer
- failed to define structural or geometric isomerism
- could not draw the products of elimination reactions
- failed to differentiate between (*aq*) and (*alc*) conditions, and their respective reaction types.

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

- linked the position of hydroxyl groups in alcohols to their classification
- could explain addition and elimination reactions
- identified multiple structures, reagents, and reaction types in a reaction scheme
- linked the chemical reactivity of monomers and polymers to their degree of saturation
- linked principles back to the example in the question
- could describe Zaitsev's rule for elimination reactions
- could link homologous series to relevant reagents for identification.

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

- fully explained different reaction types, linked to the conditions through which they occur.
- identified all structures, reagents, and reaction types in a reaction scheme.
- analysed the chemical reactivity of monomers and their resulting polymers, with respect to the applications of each.
- explained the factors needed for constitutional and geometric isomerism, and linked them to the compounds in question.
- explained, drew, and justified why two products were formed in an elimination reaction of an asymmetric haloalkane.
- fully elaborated upon the products, reaction types, and observations of distinguishing tests
- consistently and accurately used appropriate chemistry vocabulary.

Standard specific comments

Candidates should endeavour to link their explanations back to the examples given in the question to achieve greater success.

Core skills such as naming, drawing and classifying organic molecules are crucial for all levels of achievement in this standard.

Candidates who were able to succinctly communicate the relevant rules and concepts for Level 2 Chemistry achieved higher levels of success.

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91166: Demonstrate understanding of chemical reactivity

Candidates who were awarded **Achievement** commonly:

- calculated the concentration of hydroxide and hydronium ions from a given pH, and vice versa
- identified the link between pH value and hydronium and hydroxide ion concentration
- linked temperature change to the kinetic energy of particles and the reaction rate
- identified that electrical conductivity is dependent upon the concentration of charged particles in solution
- distinguished between strong and weak acids
- wrote the equilibrium constant expression from the given equilibrium equation
- recognised that a negative enthalpy change value indicates an exothermic, forward reaction
- recognised that increasing the amount of reactants in a system at equilibrium, shifts the equilibrium to the right.

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

- wrote incorrect chemical equations for the dissolution or dissociation of acidic / basic species in solution.
- confused common acids for bases and vice versa
- did not link acid / base strength to the degree of dissociation and ion concentration
- confused the extent of a reaction with its rate
- explained, incorrectly, that the conductivity of an aqueous solution is due to free-moving electrons
- wrote K_c expressions with the numerator and denominator inverted

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- believed that K_c value is an indicator of whether a reaction is exothermic or endothermic
- explained, incorrectly, that removing reactants from an equilibrium system would favour the production of products.

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

- identified that a change in K_w value results in a change in the pH of pure water
- wrote correct chemical equations for the dissolution of salts, and for the dissociation of acidic and basic species in solution
- linked a difference in acid / base strength to a difference in hydronium ion concentration in solution
- successfully linked the ion concentrations produced by different acids to properties such as electrical conductivity and reaction rate
- recognised that reaction rate depends on the frequency of effective particle collisions
- wrote a K_c expression for a given system at equilibrium, and subsequently used provided concentrations to calculate its value
- explained how $K_c$values indicate the relative amounts of reactants and products
- linked temperature changes to the shifting of equilibrium and explained this in the context of the reactions in the question
- linked changes favouring one side of an equilibrium to observed colour changes.

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

- recognised that $[H_3O^+] = [OH^-]$ in pure water, and used this to calculate the pH at 0 °C
- wrote chemical equations and used them to link the strength of acids and bases to their extent of dissociation, as well as to properties such as pH, reaction rate, and electrical conductivity
- elaborated on the effects that changing concentration and temperature had on the frequency of effective collisions, and how this related to the rate of

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chemical reaction

- correctly predicted the response of a system at equilibrium to a range of changes, and linked the resulting observations to the altered concentrations of coloured reactants and products
- explained how the value of K_c is affected by temperature with reference to the relative amounts of reactants and products present at equilibrium.

Standard specific comments

Candidates are encouraged to link their explanation of equilibrium principles back to the examples used in the question, for example, colour changes observed when a change is made to a system at equilibrium.

Candidates were often thwarted by an inability to recognise the difference between the dissolution of an ionic compound and the dissociation of an acidic molecule.

Candidates need to not only recognise whether the forwards or reverse reaction is favoured when a change is made to a system at equilibrium, but also link this to the resultant change in reactant or product concentration.

Candidates who recognise the difference between concentration and amount tend to have a stronger understanding of pH.

Chemistry subject page

Previous years' reports

2019 (PDF, 123KB)

2018 (PDF, 128KB)

2017 (PDF, 52KB)

2016 (PDF, 258KB)

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