

Assessment Report

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Part A: Commentary

Candidates who achieved Merit and Excellence generally provided concise and specific explanations. They used chemistry vocabulary with confidence, and clearly understood key terms and concepts.

It is important that candidates prepare for the examinations by reviewing all aspects of the achievement standards. Although some aspects may not be examined every year, such as heating curves in 91390, candidates should prepare according to the standards.

Part B: Report on standards

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

Candidates who were awarded **Achievement** commonly:

- identified forces between particles and their relative strengths
- carried out one step of an enthalpy change calculation
- wrote the equation for vaporisation of a substance
- related particle behaviour or change of state to a heating curve
- recognised that entropy increases when a gas or energy is produced
- wrote electron configurations (s, p, d notation)
- drew Lewis diagrams and named molecular shapes
- recognised factors affecting molecular polarity and / or shape
- understood that the attraction between the nucleus and its valence electrons affects the magnitude of an element's ionisation energy.

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

- could not identify appropriate attractive forces between particles
- could not calculate enthalpy changes
- could not interpret the information presented in a heating curve
- confused entropy with enthalpy
- could not draw Lewis diagrams or identify molecular shapes
- could not identify the factors affecting molecular shape or polarity.

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

- compared the strength of ionic bonding and intermolecular forces
- used correct processes in enthalpy change calculations
- linked changes in kinetic energy, particle movement, and / or temperature to a heating curve
- explained the entropy change of either the system or surroundings for a chemical reaction
- explained why a cation is smaller than its corresponding atom
- drew Lewis diagrams, including putting brackets around polyatomic ions
- explained factors affecting molecular shape or polarity

- explained trends in first ionisation energy across a period or down a group.

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

- justified differences in boiling points in terms of the relative strength of attractive forces between particles
- calculated a temperature change from calorimetric data, including correct units and number of significant figures
- fully explained sections of a heating curve in terms of particle movement, kinetic energy, and temperature
- justified the spontaneity of a chemical reaction in terms of entropy changes of the system and surroundings
- fully explained the shape and polarity of a molecule
- justified the trends in first ionisation energy in terms of energy levels, repulsion, and nuclear charge.

Standard specific comments

Many candidates do not understand the difference between the entropy of the system and the entropy of the surroundings.

Many candidates had difficulty interpreting a heating curve.

The difference in strength of temporary dipole attractions should be linked to the size of the electron cloud, not the molar mass of the molecule.

Attractive forces covered by this standard include ionic bonds, covalent bonds, temporary dipoles, and permanent dipoles (including hydrogen bonding).

91391: Demonstrate understanding of the properties of organic compounds

Candidates who were awarded **Achievement** commonly:

- drew and named structural formulae and functional groups
- completed at least one aspect of a reaction scheme
- identified reagents or chemical tests that could distinguish organic molecules
- understood that optical isomers have a 3D arrangement

- recognised that the plane of polarised light rotates rather than the enantiomer itself
- defined a hydrolysis reaction
- drew a correct structural formula of a product from a hydrolysis reaction
- described advantages of organic procedures such as heating under reflux.

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

- could not draw or name organic molecules using IUPAC conventions
- could not draw an enantiomer in a 3D arrangement
- could not identify appropriate reagents or conditions to identify functional groups
- could not identify or explain types of organic reactions.

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

- drew enantiomers in a tetrahedral arrangement, and explained relevant properties
- devised aspects of a scheme that could convert a haloalkane to an acyl chloride
- explained how organic molecules could be distinguished using appropriate reagents
- used a flow chart to link reactions between a number of different organic molecules
- explained necessary reagents for hydrolysis, and drew the structural formulae for some of the products of hydrolysis
- drew larger organic molecules, such as triglycerides and dipeptides
- explained the advantages of heating under reflux.

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

- determined structural formulae based upon descriptions of properties and chemical reactions
- fully explained a hydrolysis reaction in terms of reagents, conditions, and structural formulae of products

- developed a multi-step scheme to produce a specified organic molecule
- completed a flowchart linking the reactions of various organic molecules.

Standard specific comments

Candidates are encouraged to consider more than one functional group on a molecule or different ways that molecules can be converted to other organic molecules.

Candidates should recognise that reaction conditions can affect the type of reaction occurring.

Many candidates had difficulty explaining a hydrolysis reaction and drawing the structural formulae of the products.

91392: Demonstrate understanding of equilibrium principles in aqueous systems

Candidates who were awarded **Achievement** commonly:

- identified the pH range over which a solution can function as a buffer
- wrote both the equation and the K_s expression for the equilibrium occurring in a saturated solution
- calculated the solubility of a sparingly soluble solid
- predicted precipitation by comparing Q_s with K_s
- recognised that some metal ions can form a complex ion with ammonia solution
- linked a decrease in pH with an increase in $[H_3O^+]$
- stated that the presence of ions in a solution enables it to conduct electricity.

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

- gave the pK_a as the pH range for a buffer solution
- identified hydroxide ions as neutralising any acid added to a buffer solution

- assumed a buffer was more effective at neutralising strong acid if the pH of the buffer solution was greater than 7
- did not provide a unit for solubility
- did not dilute the concentrations when two solutions were mixed.

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

- explained the effectiveness of a buffer
- ranked solutions in order of decreasing pH by linking $[\text{H}_3\text{O}^+]$ to pH
- used the correct process to calculate whether a precipitate will form after two solutions are mixed
- explained how the solubility of a sparingly soluble solid is affected by the formation of a complex ion and / or a decrease in pH
- calculated the pH of a basic salt solution
- linked electrical conductivity in a solution to degree of dissociation and a high [ions].

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

- calculated the mass of an acidic salt required to prepare a buffer solution, and evaluated the buffer's effectiveness
- justified the pH of different solutions by linking degree of dissociation and $[\text{H}_3\text{O}^+]$, with support from balanced equations
- calculated whether a precipitate would form after two solutions are mixed
- explained how the solubility of a sparingly soluble solid is affected by both complex ion formation and a decrease in pH, with support from balanced equations
- calculated the solubility of a metal hydroxide at a specific pH
- calculated the pH at the equivalence point of a weak base versus strong acid titration.

Standard specific comments

Many candidates incorrectly calculated the concentration of a weak acid by determining $[\text{H}_3\text{O}^+]$ directly from the pH using $[\text{H}_3\text{O}^+] = 10^{-\text{pH}}$.

Many candidates considered that the H_3O^+ and OH^- ions in a buffer solution, rather than the weak acid and conjugate base present, are responsible for neutralising small volumes of either strong acid or strong base.

Very few candidates recognised that the concentration of an ion in solution depends upon the relative number of moles present. For example, one mole of magnesium bromide, MgBr_2 , produces one mole of Mg^{2+} ions and two moles of Br^- ions.

A significant number of candidates wrote equations for the dissociation of HCl and HBr as if they were ionic rather than molecular.

The majority of candidates struggled to relate the pH at the equivalence point to the appropriate species present.

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Previous years' reports

[2019 \(PDF, 113KB\)](#)

[2018 \(PDF, 127KB\)](#)

[2017 \(PDF, 48KB\)](#)

[2016 \(PDF, 250KB\)](#)