2023 NCEA Assessment Report

Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Subject: Earth and Space Science
Level: Level 3
Achievement standard(s): 91413, 91414

General commentary

In preparation for the examination, candidates are encouraged to practise unpacking and developing an understanding of the context and requirements of the exam questions. Planning answers helps candidates to provide clear answers that communicate their understanding of the ocean and atmosphere concepts studied.

Report on individual achievement standard(s)

Achievement standard 91413: Demonstrate understanding of processes in the ocean system

Assessment

The examination consisted of three required questions about ideas selected from the achievement standard, including polar downwelling, ocean surface heating, La Niña and surface ocean circulation. Each question required candidates to apply their knowledge of ocean systems to contexts provided. Candidates were encouraged to develop both written responses, and labelled and annotated diagrams in their answers.

Commentary

Candidates that were able to provide even a partial answer often picked up at least 1 or 2 points for the question, while many candidates who provided no response to one or more question were unable to be awarded any points. Use of diagrams is improving, but candidates must ensure these are linked in with the question asked, whether by annotation or adjacent written responses referring to the diagram.

Many candidates demonstrated a consistent level of understanding across the questions, but there were also a number who did particularly well in two questions but did not perform to the same level in the third.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- provided good descriptions or statements to show a basic understanding of the key ideas linked to the ocean processes
- described downwelling due to increased density, linked to either salinity or temperature
- described how the surface layer is heated by solar radiation

- described some aspects of gyre formation, such as the role of landmasses in diverting the current.

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

- showed ideas about how ocean systems linked together for a complete understanding
- explained the links between temperature or salinity with density and downwelling
- explained the process and effects of La Niña
- explained how gyres form with appropriate examples from the South Pacific.

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

- produced more complete answers, which demonstrated comprehensive understanding of the ocean processes
- linked changes to temperature *and* salinity to the density of water and its resulting downwelling
- showed a through appreciation of the processes and effects of La Niña, and applied that understanding to the context provided
- discussed a complete cause and effect of the movement of water around the South Pacific Gyre and how it brings debris onto Henderson Island
- answered all questions, generally to a consistent standard, showing a comprehensive understanding of the range of ocean processes.

Candidates who were awarded **Not Achieved** commonly:

- did not attempt more than one question or address the question that was asked
- did not demonstrate understanding of the concept of density in their description of the causes of downwelling
- described irrelevant science ideas, such as discussing thermohaline circulation instead of surface currents
- did not have a sufficient understanding of La Niña to describe how it produces warmer waters in the western Pacific / around New Zealand.

Achievement standard 91414: Demonstrate understanding of processes in the atmosphere system

Assessment

The examination consisted of three required questions about ideas selected from the achievement standard, including stratosphere and troposphere composition and gradients, atmospheric circulation, aerosols, global temperature regulation and the greenhouse effect. Each question required candidates to apply their knowledge of atmosphere systems to contexts provided. Candidates were encouraged to develop both written responses, and labelled and annotated diagrams in their answers.

Commentary

Compared to previous years, students appear to be more knowledgeable about the key issues of atmospheric phenomena but many lack the basic knowledge of atmospheric processes that relate to radiation absorption / emission and adiabatic cooling. Overall, the processes driving or resulting from atmospheric phenomena were less well explained.

Use of diagrams to support explanations has improved. However, many candidates are still not able to link relevant diagrams to questions using annotations and written answers. Overall evidence for learning related to atmospheric feedback loops seems of high standard.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- described key processes, e.g. heating in troposphere and stratosphere, surface emitting IR, warm, less dense air rising to leave low pressure, and greenhouse gases absorbing and re-emitting heat
- described gradients and trends, e.g. density and pressure, increasing temperature leading to ice melt, and dew point temperature required for condensation
- defined key Earth and Space Science terms such as greenhouse gases, aerosols, wind, density, and atmospheric composition

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

- could link concepts with cause and effect statements and explained processes with key Earth and Space Science processes
- explained how atmospheric gradients form due to gravity and distance from source of heating
- could link the formation of weather to key processes such as heating and water vapour, surface ice albedo causing cooling, and pressure gradients forming air circulation
- explained how the Coriolis occurs and influences air flow direction and how friction between air and water surface cause large waves and sea spray
- explained how human activities increase the greenhouse effect.

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

- evaluated cause and effect relationships, and linked them to the context provided
- compared differences in structure and properties of the troposphere and stratosphere
- understood the role of radiation sources in vertical mixing and weather
- explained the interaction between aerosols and water cycle processes to cause cloud formation
- described atmospheric circulation cells in detail
- explained the role of surface ice in regulating global temperature as part of a feedback loop
- evaluated the impact of various human activities on the greenhouse effect and rate of climate change.

Candidates who were awarded **Not Achieved** commonly:

- partially answered only one or two questions
- lacked knowledge about the fundamental facts that support our understanding of atmospheric phenomena
- could not describe or define key terms, including density, pressure, aerosols, greenhouse effect, or evaporation
- confused the relationship between gradients, linking higher temperature at surface to lower density, and stating increasing density and pressure with altitude
- confused key ideas such as the greenhouse effect with ozone depletion, ice as absorbing solar radiation, and wind over cold ice as reducing global temperature.