

2025 NCEA Assessment Report

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

General commentary

Most candidates attempted all three questions of the paper, providing evidence of understanding across the standard. Those candidates who did not provide a response to one or more questions generally did not earn enough points to earn a grade.

Candidates who drew diagrams and then referred to them in their written response, produced more logically structured answers, earning higher grades in that question. Also, those who earned higher grades responded to all three questions to a sufficient and equivalent depth, showcasing a comprehensive understanding across the standard. They were also able to apply fundamental theoretical concepts like Coriolis effect and carbon cycling to specific contexts, locations, and scenarios to fully address the question.

Candidates who achieved with Excellence had a methodical approach to responding and it was evident past papers had been extensively revised in preparation. They also made extensive use of diagrams for planning and supporting evidence purposes.

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 the thermocline around New Zealand, absorption of carbon in the Southern Ocean, and the causes and effects of seasonal upwelling and downwelling off the coast of Somalia. 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 who attempted all three questions had a much higher chance of achieving the standard. Use of diagrams helped candidates to structure their answers and to provide a more relevant response related to the question and context given.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- explained the temperature variations of the ocean layers, with some indication of how the ocean conditions were affected by the seasonal changes
- demonstrated partial understanding of biological and / or physical pump processes
- described a chemical reaction involving the oceanic carbon cycle
- showed some understanding of the process of upwelling, and linked that to the transport of nutrient-rich waters to the surface.

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

- linked temperature and density together for a more detailed explanation of the formation and structure of the ocean layers, thermocline and pycnocline, and explained the strength of the thermocline by comparing the surface and pycnocline temperatures in different seasons
- demonstrated an in-depth understanding of how one carbon pump process caused another, e.g. photosynthesis → marine snow, and dissolving → ocean acidification
- described two chemical reactions involving the oceanic carbon cycle, including chemical equations
- explained how surface winds and Coriolis effects combine to move surface waters offshore, and how that resulted in upwelling or nutrient-rich waters to enhance fisheries.

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

- explained how the changes to wind in different seasons affected the surface layer in terms of distributing heat deeper into the water, and the consequences of this mixing on the depth of the surface layer, thermocline and pycnocline
- comprehensively explained the cause and effect of the biological and /or physical pumps to store large amounts of CO₂ in the ocean
- comprehensively explained the cause of surface winds, Coriolis effect and Ekman spirals, and how these phenomena combine to move significant amounts of water and nutrients.

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

- explained the difference in ocean layers by latitude, rather than by season as the question asked
 - partially defined and explained thermocline as change in temperature with depth
 - simply identified photosynthesis or ocean acidification as a component of the carbon pump, without describing them in sufficient detail to show understanding at Level 3
 - showed a lack of understanding of the causes of upwelling, or impacts of the Coriolis effect on water movement
 - tried to apply their understanding of El Niño / La Niña to explain the upwelling off the coast of Somalia instead of ocean circulation.
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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 how the different layers of the atmosphere protect the Earth, how heat is transferred around the atmosphere and the effects of a volcanic eruption on the atmosphere. 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

Some candidates still find it challenging to apply their knowledge to the context provided in the question. Questions with an unfamiliar context help to clearly identify the candidates working to Excellence at Level 3. Candidates performed better when they included an annotated diagram that was linked to the questions' context and their written answer.

Grade awarding

Candidates who were awarded **Achievement** commonly:

- identified 2 – 3 types of EM radiation and / or sources of energy for a layer of the atmosphere
- explained that meteorites burn up in mesosphere
- explained that clouds / aerosols reflect radiation
- stated changes during evaporation and/or condensation
- explained that solar radiation heats earth or earth emits infrared
- explained that convection / water vapour transport heat into atmosphere
- identified that heat is absorbed during evaporation.

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

- explained atmospheric processes in detail, with appropriate physical principles, e.g. density, friction, absorption, reflection, sensible and latent heat
- explained how processes in the ozone layer or ionosphere protect from UV / Gamma rays
- explained friction between particles and meteorites in the mesosphere, causing its destruction
- explained reasons for temperature gradients in troposphere / stratosphere / thermosphere
- explained absorption of short wave and release of long-wave radiation from the Earth's surface
- explained latent heat as energy absorbed or released during evaporation or condensation
- explained dew point in terms of temperature and saturation
- explained breaking of bonds due to kinetic energy during evaporation
- explained effect of clouds on temperature (cooling or heating)
- explained effect of atmospheric sulfur dioxide on temperature (cooling)
- explained how vertical circulation in the troposphere or horizontal circulation in the stratosphere affect lifetime or dispersion of aerosols.

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

- discussed the causes and effects of phenomena with physical principles
- discussed heat sources and the resulting effects on temperature gradients in all four layers of the atmosphere

- discussed how each layer acts as a protective barrier to radiation and/or space objects
- discussed the interactions between different electromagnetic wavelengths and atmospheric gases and how these affected the atmosphere
- discussed latent heat transfer processes during evaporation and condensation, often linking to other processes, e.g. convection
- discussed in detail how water vapour and / or volcanic aerosols interact with each other and with incoming radiation to affect surface temperatures
- explained comprehensively the mechanisms that make aerosols remain in the stratosphere for much longer than the troposphere.

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

- did not answer all three questions
 - mislabelled diagram or didn't draw diagrams
 - responded to questions with unrelated descriptions / explanations
 - contradicted causes / effect for cooling/heating after a volcanic eruption
 - mixed up short-wave and long-wave radiation
 - referred only to 'solar radiation' throughout their responses, not the different types of radiation
 - described characteristics of atmospheric layers
 - described the water cycle, but left out any heat transfer processes that drive the water cycle.
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