

Assessment Report

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Level 3 Earth and Space Science 2019

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Part A: Commentary

Candidate responses in both achievement standards at Achievement with Merit and Achievement with Excellence, were articulate and showed a clear level of understanding of both ocean and atmospheric processes. Candidates linked their responses to the questions and bullet points provided and made use of the space provided for annotated diagrams.

Successful candidates had clearly been exposed to unfamiliar contexts related to the achievement standards, and were therefore able to investigate the ocean and atmospheric processes in a wide variety of contexts which linked to more than one process.

Both achievement standards required candidates to display a high level of literacy. Candidates who planned their responses to the questions before writing

their answers with annotated diagrams often produced good answers.

Many candidates at the Not Achieved or Achieved level, confused ocean and atmosphere processes when answering questions, leading to lower grades despite displaying a good understanding of the wrong system.

Part B: Report on standards

91413: Demonstrate understanding of processes in the ocean system

Candidates who were awarded **Achievement** commonly:

- defined a thermocline and explained its formation at different latitudes, in relation to solar heating
- explained how global warming may influence thermocline formation
- explained the link between an increase in carbon dioxide in the oceans and the increased use of fossil fuels
- explained the link between an increase in ocean acidity due to carbon dioxide dissolving in seawater and the vulnerability of shellfish
- explained the origins of the Antarctic deep-water currents and/or the warm Auckland current
- explained the influence of nutrient rich deep water being brought to the surface and phytoplankton growth.

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

- interchanged the term thermocline with thermohaline
- linked changes in the thermocline to either El Nino or La Nina
- described the pycnocline and its behaviour, rather than the thermocline

- associated the formation of the thermocline with evaporation and precipitation
- stated that differences in solar heating at different latitudes was due to changes in the distance of the Earth to the Sun
- described the biological carbon pump and the absorption of carbon dioxide into the oceans
- described the geology of the Chatham Rise
- described the thermohaline current with reference to the Antarctic Circumpolar current
- confused El Niño/La Niña as being the cause for the upwelling and phytoplankton bloom at the Chatham Rise.

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

- explained the formation of the thermocline at different latitudes in relation to solar heating
- explained how the thermocline changed with seasons in the midlatitudes
- explained how the thermocline may change with global warming in one latitude
- explained ocean acidity formation in terms of the dissociation of carbonic acid with chemical equations
- explained how an increase in hydrogen ion concentration in the ocean alters the availability of the carbonate ion in the ocean
- explained the effect of ocean acidity on shellfish and associated ecosystems
- explained ocean current formation and ocean current properties
- explained how the topography of the Chatham Rise leads to upwelling and a phytoplankton bloom
- explained the significance of phytoplankton blooms to the ecosystem and the fishing industry.

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

- explained the formation of the thermocline at all latitudes and explained seasonal variations
- explained the possible effects of global warming on the thermocline at all latitudes
- explained the effect of carbon dioxide in the ocean on shellfish and coral life in terms of ocean acidity and equilibrium chemistry associated with hydrogen ion formation and carbonate ions
- explained the links between ocean acidity and detrimental changes to ecosystems and their habitats.

Standard specific comments

Many candidates confused the thermocline with thermohaline circulation. Candidates that understood what a thermocline was were often unable to explain the effect of seasonal variation and latitude on it.

In general candidates understand the biological carbon pump in relation to the ocean, and that carbon dioxide is absorbed by the ocean, but many display a poor understanding of the carbonate chemistry involved in the physical pump.

Most candidates understood the link between upwelling and phytoplankton blooms. However, many were unable to explain why upwelling occurred at the Chatham Rise, displaying an inability to link their understanding about ocean circulation to an unfamiliar context.

91414: Demonstrate understanding of processes in the atmosphere system

Candidates who were awarded **Achievement** commonly:

- explained the reason for the temperature trend within the troposphere, stratosphere, and mesosphere
- drew basic annotated diagrams showing the wind belts, pressure systems and convection cells
- explained orographic lifting
- linked an increase in atmospheric carbon dioxide levels to an increase in surface temperature
- linked increased global temperatures to a named change in the water cycle
- explained one part of the carbon cycle.

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

- identified properties of the layers of the atmosphere
- confused the location of the ozone layer within the atmosphere
- confused the direction of the winds in the northern and southern hemispheres
- linked thermohaline circulation to the water cycle.

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

- explained the heating of the troposphere in terms of short and long wavelength radiation
- explained the role of the ozone layer in the heating of the stratosphere
- linked a lack of particles in the mesosphere to its temperature profile
- explained convection cell formation in terms of density and solar heating
- explained orographic lifting with reference to the Southern Alps
- explained the effect of increased temperature on a named change to the carbon and/or water cycle

- explained the natural greenhouse effect in terms of the absorption and re-emission of long wavelength radiation.

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

- explained how the uneven heating of the Earth affects the density of the air in the troposphere and how this contributes to the height of the troposphere
- explained the temperature profile of all atmospheric layers
- explained the role of the uneven heating of the Earth's surface and the Coriolis effect in the formation of the convection cells and wind linked to the Westerly wind belt
- explained how Earth's surface temperature affects both the carbon and water cycles and how named changes can cause positive or negative feedback loops.

Standard specific comments

Many candidates displayed a lack of understanding of the difference between long and short wavelength radiation and their role in the heating of the troposphere.

Candidates generally lacked an understanding of the role of ionisation of solar radiation in the thermosphere, to the temperature profile in this region of the atmosphere.

Candidates were generally able to explain the effects of increased global temperatures on the carbon and/or water cycle, but were unable to link these to named climatic changes.

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Previous years' reports

[2018 \(PDF, 114KB\)](#)

[2017 \(PDF, 45KB\)](#)

[2016 \(PDF, 212KB\)](#)

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