Assessment Report

On this page

Level 3 Earth and Space Science 2020

Standards 91413 91414

Part A: Commentary

In both achievement standards, candidates were most successful when it was apparent that they had carefully read both the resources and questions provided and addressed each bullet point in their answers. Many successful candidates made good use of the space provided for diagrams, carefully annotating their diagrams, and linking these to their written responses.

Literacy skills continue to be a key requirement for both standards. Candidates who showed evidence of planning their answers, in general, provided more detailed and focused responses, and were able to link together a sequence of multiple ideas. In addition, when explaining key ideas, many candidates found difficulty in using appropriate scientific vocabulary, which would have enabled a deeper level of understanding to be shown.

Many candidates provided responses that appeared to be learned by rote from previous years' examinations. These often bore little relevance to the context and

question provided. Successful candidates were able to apply the key concepts that they had learned to unfamiliar contexts.

Part B: Report on standards

91413: Demonstrate understanding of processes in the ocean system

Candidates who were awarded **Achievement** commonly:

- used clearly annotated diagrams
- attempted to address each bullet point from the question provided in their response
- explained temperature, salinity and / or density as leading to sinking seawater
- explained increase in sea water density and the formation of the Thermohaline current
- explained changes in the Thermohaline current due to climate warming altering nutrient availability or carbon distribution
- explained the link between the deflection of ocean currents and air flow to the Coriolis effect
- explained rising sea levels as being due to melting of land-based ice
- established the link between the action of wind to driving ocean surface currents
- established the relationship of material collection in the South Pacific Gyre to the concept of the gyre's centre acting as a vortex.

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

- explained changes in temperature and salinity with ocean depth at different latitudes
- explained the Coriolis effect as a deflection to the east or west
- linked Earth's tilt to the Coriolis effect or heating of the Earth

- confused points on the compass, and/or interchanged the terms such as westerly and westward when describing wind and water current directions
- provided responses not linked to the context and question provided
- showed misunderstanding in explaining key concepts, such as sinking salt, rather than sinking salty water
- described the Earth's tilt as a cause of the Coriolis effect or differential heating with latitude
- linked higher tides to the sea levels being closer to the moon
- described the La Niña event using a description applicable to an El Niño

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

- explained in detail how downwelling occurs in polar regions due to a lack of solar radiation and subsequent lack of heating
- explained in detail how downwelling occurs in polar regions due to ice formation
- explained in detail the impacts on nutrient distribution and/or carbon sequestering and/or global heat distribution caused by a slow-down of the Thermohaline current
- explained the role of wind in forming ocean surface currents linked explicitly to the South Pacific Gyre context
- explained links between wind, Coriolis effect, and landmass on surface current formation in the South Pacific Gyre context
- explained in detail how a La Niña event causes sea level rise on the atolls of Kiribati by linking to a strengthening of the Easterly Trade Winds and ocean movement
- explained a link between an impact to Kiribati to its cause.

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

- developed a sequence of several ideas in a logical way
- explained comprehensively how the downwelling of the Thermohaline current in the polar regions is linked to both temperature, salinity, and the changes in sea water density

- explained comprehensively how climate warming could slow the Thermohaline current leading to global impacts on heat, nutrient and/or carbon distribution
- discussed how the South Pacific Gyre is formed by linking the actions of wind, landmass, and Coriolis in a logical sequence
- explained the different factors that would affect sea level and how the combination of factors would affect tidal levels around Kiribati, linking these factors to subsequent impacts on the atolls.

Standard specific comments

There is a common misconception amongst many that the Earth's tilt is responsible for the uneven heat distribution between the equatorial and polar latitudes. Additionally, the Earth's tilt was used to explain the Coriolis effect.

Candidates need to be familiar with the science and scientific vocabulary. In general, many understood the formation of currents in the ocean in relation to wind, and that landmasses and the Coriolis effect contribute to gyre formation, but many are unable to articulate their understanding in explanations using appropriate scientific vocabulary. Similarly understanding of such concepts as density or thermal expansion was poorly explained.

91414: Demonstrate understanding of processes in the atmosphere system

Candidates who were awarded **Achievement** commonly:

- used clearly annotated diagrams
- explained the formation of convection cells in terms of pressure and heat flow
- linked precipitation to humid air being uplifted to its dew point in the presence of aerosols
- linked a decrease in temperature, pressure, and atmospheric density to altitude
- linked cloud location to reflectivity and transmission

- described aerosols and identified the Sahara Desert and the Amazon rain forest as lying in the Hadley convection cell.

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

- were unable to explain differences in solar insolation due to solar angle at different latitudes
- incorrectly explained differences in solar insolation with latitude as due to axial tilt or distance from the sun
- were unable to identify the primary heat source of the troposphere as re-emitted solar insolation from the Earth's surface
- incorrectly identified winds in terms of the direction they are blowing, instead of the direction from which they originate
- confused altitude and latitude.

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

- described the role of insolation, temperature, and pressure on the formation of the Hadley and Polar convection cells
- related the role of temperature and flow direction on the ability of air parcels to absorb moisture from the surfaces they pass over
- explained the decrease in temperature with altitude as a product of re-emitted radiation as the primary heat source for the Troposphere
- explained the decrease in air pressure and density in terms of the downwards force of the column of air above a point, due to the Earth's gravity
- differentiated and described the cooling / heating effect of high- and low-level clouds on the earth/atmosphere system
- explained the effect of Coriolis force on the surface flow of the Hadley cell from 30 to 0 degrees and the effect on the path of the wind-borne aerosols
- explained the effect of aerosols on humid air at the equator in terms of nucleation.

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

- demonstrated awareness that after precipitation air can be considered effectively dry so the humid air uplifted at 60^{o}latitude has minimal moisture when it starts moving towards the poles

- effectively compared the conditions at the equator and poles to explain the difference in precipitation
- explained the physical gradients in the troposphere with altitude, and logically described the changes that could be expected with increases in surface and air temperature
- using the Hadley cell model, Coriolis force and the links between Coriolis force and the tropical east to west flow, candidates described the evaporation of water into the air stream
- linked that evaporated water uplifted due to insolation underwent cooling to the dew point and combined with the dust from the Sahara which further resulted in precipitation over the Amazon basin.

Standard specific comments

Many candidates incorrectly linked axial tilt or “distance from the sun’ to varying solar insolation at different latitudes.

Wind naming conventions, in terms of winds named for the direction in which they originate, was also a confusing concept for many candidates.

Science subject page

Previous years' reports

2019 (PDF, 105KB)

2018 (PDF, 114KB)

2017 (PDF, 45KB)

2016 (PDF, 212KB)