This assessment is based on a now-expired version of the achievement standard and may not accurately reflect the content and practice of external assessments developed for 2026 onwards.

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Draw a cross through the box (☒) if you have NOT written in this booklet

NZQA

Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 3 Earth and Space Science 2025

91414 Demonstrate understanding of processes in the atmosphere system

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of processes in the atmosphere system.	Demonstrate in-depth understanding of processes in the atmosphere system.	Demonstrate comprehensive understanding of processes in the atmosphere system.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–16 in the correct order and that none of these pages is blank.

Do not write in any cross-hatched area (▨). This area will be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

QUESTION ONE: HOW DOES THE ATMOSPHERE PROTECT THE EARTH?

The atmosphere plays an important role in protecting the Earth and making it suitable for life.

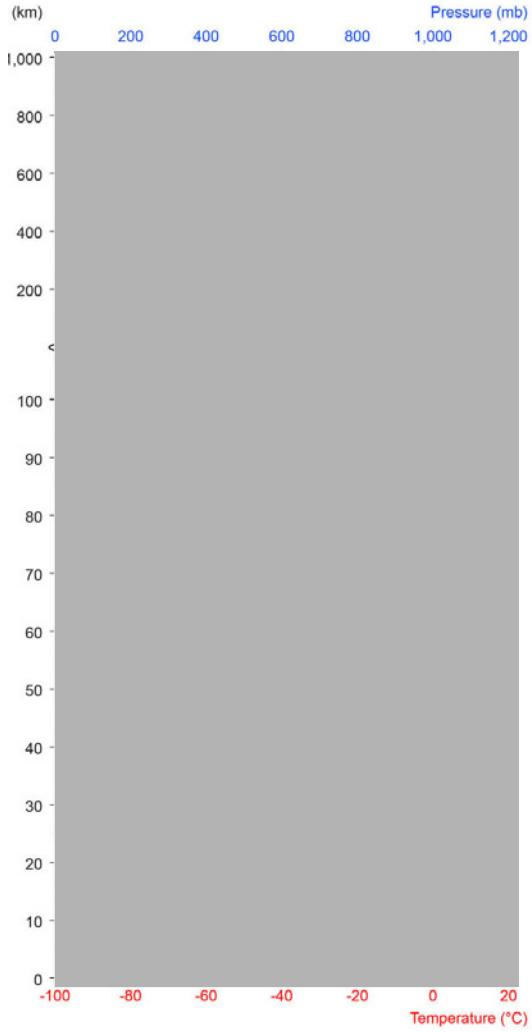
Explain the role that each layer of the atmosphere plays in protecting the Earth's surface from harmful matter and radiation.

In your answer, you should consider:

- the different forms of radiation that enter the Earth's atmosphere
- physical space objects, such as meteors and charged particles
- the reason for the changing temperature for each of the atmosphere's layers.

An annotated diagram may assist your answer.

Layers of the atmosphere



Adapted from: www.severe-weather.eu/wp-content/gallery/weather-maps/winter-storm-bomb-cyclone-gaetan-uk-atmospheric-layers.jpg

There is more space for your answer to this question on the following pages.

QUESTION TWO: HEAT TRANSFER

Heat is transferred from the ocean and land into the atmosphere by different processes. These include radiation, conduction, convection, evaporation, condensation, and sublimation.

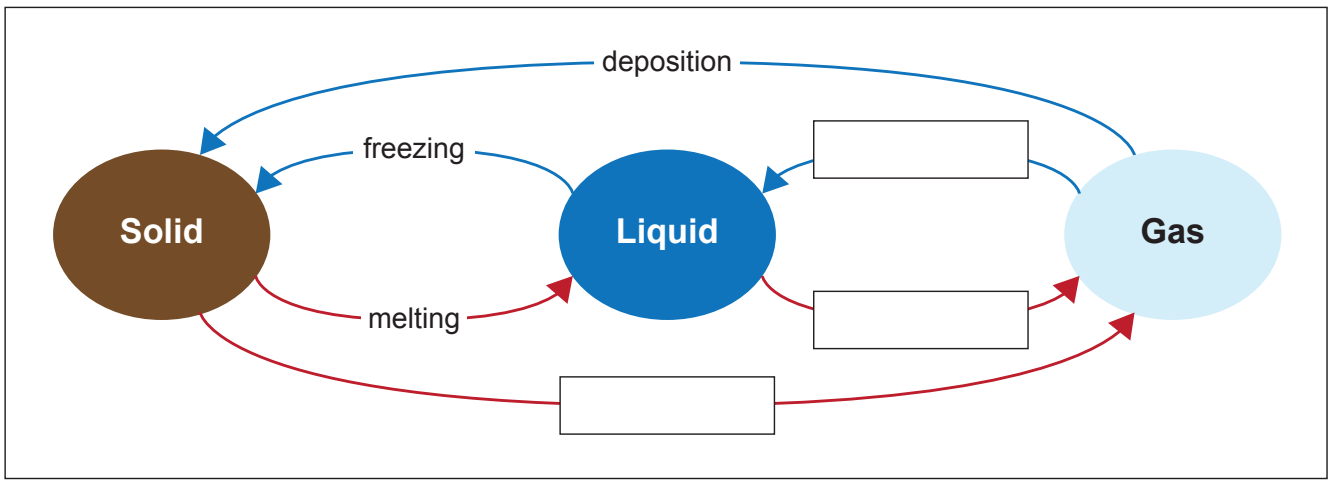
Adapted from: https://earthobservatory.nasa.gov/features/EnergyBalance

Explain, in detail, how heat is transferred from the Earth's surface to warm the atmosphere.

In your answer, you should:

- label processes in the text boxes on the diagram below
- explain three processes that transport heat from land to the atmosphere
- explain how heat is transported through the water cycle into the atmosphere
- explain how latent and sensible heat transfers are linked to the processes.

An annotated diagram may assist your answer.



There is more space for your answer to this question on the following pages.

QUESTION THREE: THE HUNGA ERUPTION

On 15 January 2022, the underwater volcano Hunga Tonga-Hunga Ha‘apai (Hunga) erupted. This was the largest underwater explosion ever recorded by modern scientific instruments. It launched huge amounts of water vapour and sulphur dioxide into the troposphere and stratosphere, which may impact the climate.

Hunga Tonga-Hunga Ha‘apai eruption plume

Source: www.qatarday.com/volcano-in-tonga-sends-plume-half-way-into-space

Explain the likely effects of the Hunga eruption on climate.

In your answer, you should:

- consider local effects of the eruption on the troposphere
- consider the effects of the huge increase in stratospheric clouds caused by the volcanic eruption
- consider the effect of large amounts of sulphur dioxide entering the stratosphere
- compare the likely circulation patterns of the water vapour and aerosols in the troposphere and stratosphere.

An annotated diagram may assist your answer.

There is more space for your answer to this question on the following pages.

Extra space if required.
Write the question number(s) if applicable.

QUESTION NUMBER

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