SUPERVISOR'S USE ONLY

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

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NZQA | Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 2 Earth and Space Science 2025

91193 Demonstrate understanding of physical principles related to the Earth System

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of physical principles related to the Earth System.	Demonstrate in-depth understanding of physical principles related to the Earth System.	Demonstrate comprehensive understanding of physical principles related to the Earth 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.

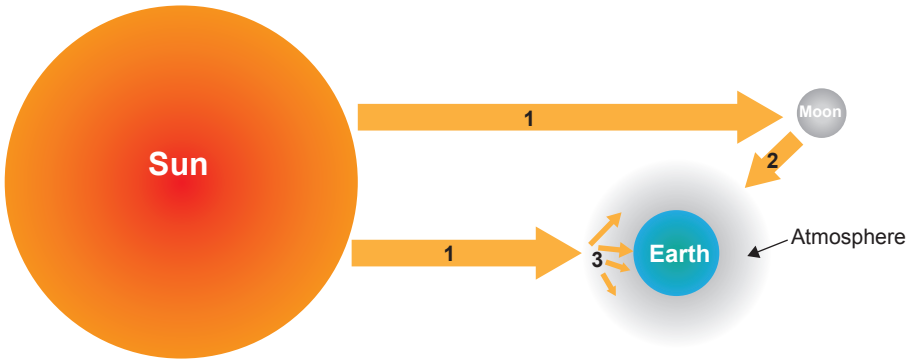
Check that this booklet has pages 2–16 in the correct order and that none of these pages is blank.

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: LIGHT AND THE ATMOSPHERE

(a) Refer to the diagram below, which is not to scale, and complete the table below it by describing how visible light travels through space to the Earth's atmosphere and the Moon, for numbers 1 to 3.



Number	Physical Process
1	
2	
3	

(b) Explain, in detail, the properties of visible light, and why the Earth's atmosphere appears blue from the ground.

In your answer you should consider:

- how the colours of the visible spectrum differ from each other
- the relationship between wavelength and colour
- the relationship between wavelengths and the colour of the sky.

An annotated diagram may assist your answer.

(c) In the summer of 2022, bushfires in Australia caused the Moon to appear a blood-red colour at moonrise in the early evening.

Normal moonrise
Source: www.boffamiskell.co.nz/news-insights/moonrise-over-mount-victoria

Blood-red moonrise
Source: https://inhabitat.com/how-to-watch-the-blood-moon-rising-across-north-america-tonight/

Explain, in detail, why the bushfires made the Moon appear a blood-red colour, compared to the colour of a normal moonrise.

In your answer you should consider:

- why the Moon normally appears yellow / orange at moonrise
- why the bushfires made the Moon appear blood-red.

An annotated diagram may assist your answer.

QUESTION TWO: COASTAL CLIMATES

(a) Describe how the Earth's surface is heated.

(b) During the day, the average land surface temperatures are higher than the average ocean surface temperatures. At night, these reverse.

Explain, in detail, why there is a difference between the land surface temperatures and the ocean surface temperatures during the day and night.

In your answer you should consider:

- absorption and emission of radiation
- what heat capacity is.

An annotated diagram may assist your answer.

(c) Coastal cities, such as New Plymouth, generally experience a mild climate during the winter months.

During the month of June, the average atmospheric temperature in New Plymouth is 12 °C, whilst the ocean temperature averages 15 °C.

Explain, in detail, how the ocean temperature can contribute to the mild June climate in New Plymouth.

In your answer you should consider:

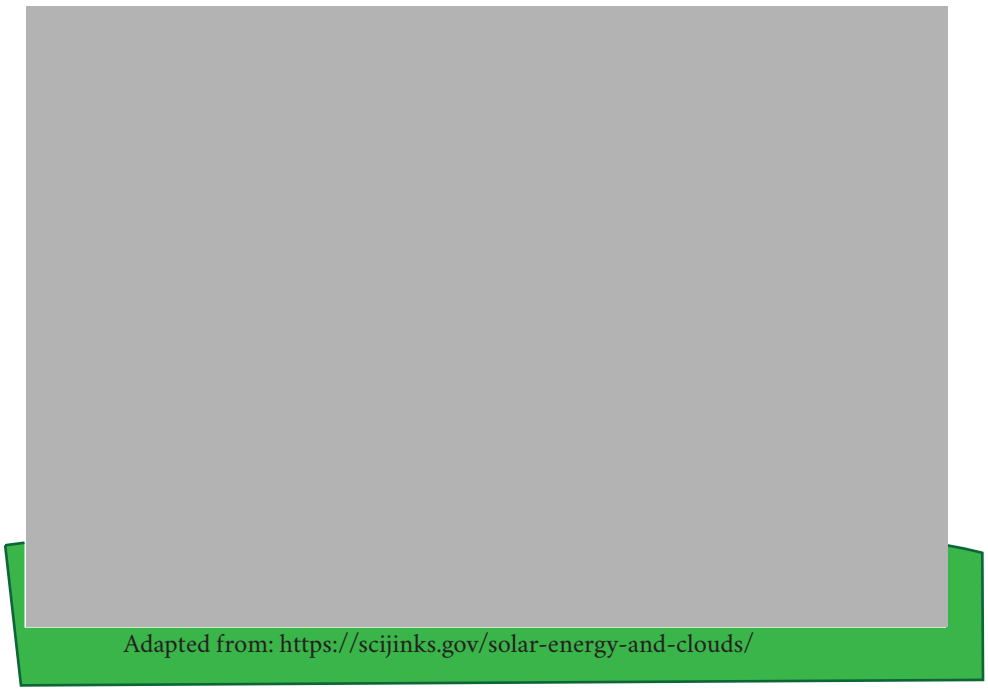
- conduction, convection, and radiation
- the transfer of heat from the ocean to the atmosphere.

An annotated diagram may assist your answer.

QUESTION THREE: CLOUDS

Clouds affect the Earth's surface temperature. Satellites and ground observations are used to measure the effect of cloud cover.

(a) Complete the diagram below by drawing arrows to show how incoming and outgoing radiation interacts with both high- and low-level clouds.



Adapted from: https://scijinks.gov/solar-energy-and-clouds/

(b) Explain, in detail, the effect high- and low-level clouds can have on incoming solar radiation and re-radiated outgoing radiation, and how this relates to the Earth's atmospheric temperature.

In your answer you should consider:

- your answer to part (a)
- the difference between the incoming solar and re-radiated outgoing radiation
- the greenhouse effect
- the relationship to Earth's atmospheric temperature.

An annotated diagram may assist your answer.

Question Three continues on the next page.

(c) Climate warming is resulting in an increase in the amount of cloud cover to mountainous regions like the Himalayas.

Explain, in detail, how the change in cloud cover could increase the atmospheric temperatures and climate in this region.

In your answer you should consider:

- the change in high- and low-level cloud cover
- changes in the greenhouse effect
- atmospheric temperatures and climate in mountainous regions.

An annotated diagram may assist your answer.

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

QUESTION NUMBER

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

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QUESTION NUMBER