

# 3

91414



NEW ZEALAND QUALIFICATIONS AUTHORITY  
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## Level 3 Earth and Space Science, 2019

### 91414 Demonstrate understanding of processes in the atmosphere system

2.00 p.m. Thursday 28 November 2019  
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 and clearly number the question.

Check that this booklet has pages 2–15 in the correct order and that none of these pages is blank.

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

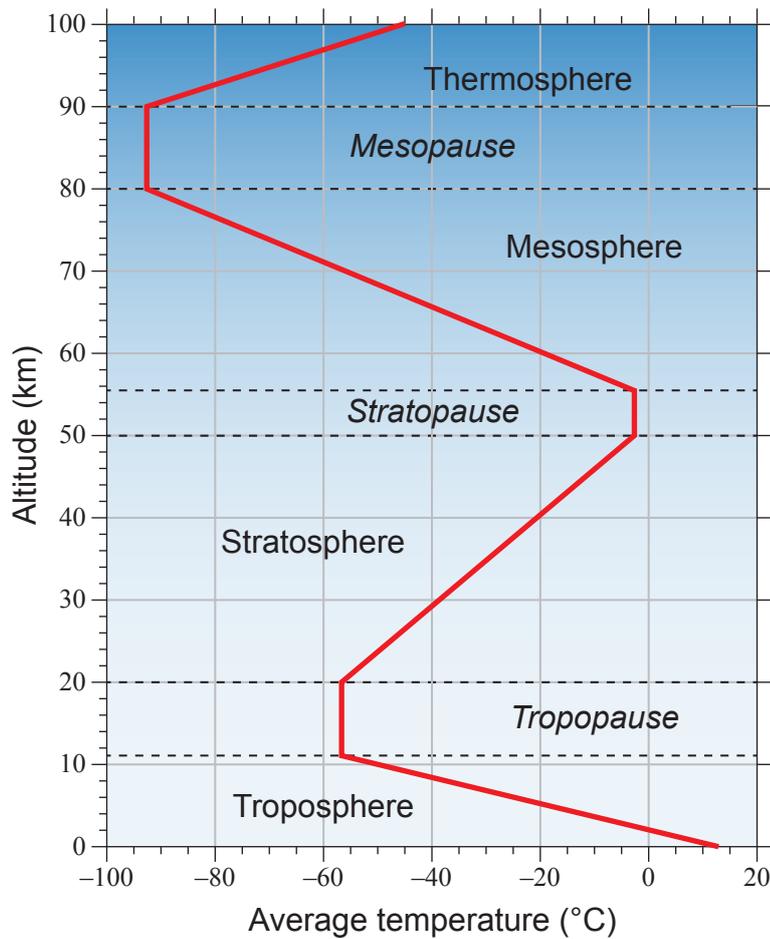
**TOTAL**

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## QUESTION ONE: TEMPERATURE WITHIN THE ATMOSPHERE

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The graph below shows the **average** temperature gradient for the Earth's atmosphere.



Adapted from: [www.physicalgeography.net/fundamentals/images/atmslayers.gif](http://www.physicalgeography.net/fundamentals/images/atmslayers.gif)

Explain the temperature gradient graph.

In your answer, you should consider:

- the heat source of each layer, and the type of radiation involved
- reasons for the temperature changes shown
- the effect of changes in latitude and seasons on the height of the troposphere.

*You may use a diagram to help support your answer.*

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## QUESTION TWO: THE ROARING FORTIES AND THE WEST COAST OF NEW ZEALAND

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Sailors call the latitudes between 40° and 50° south the 'Roaring Forties'. New Zealand lies in the 'Roaring Forties', represented by the green band on the map below.



Source: [http://www.thesuperfins.com/wp-content/uploads/2017/02/001-the-Roaring-Forties-TheSuperFins.com\\_.jpg](http://www.thesuperfins.com/wp-content/uploads/2017/02/001-the-Roaring-Forties-TheSuperFins.com_.jpg)

Explain how the westerly winds of the 'roaring forties' are formed, AND how these contribute to the high annual precipitation rates found on the west coast of the South Island of New Zealand.

In your answer, you should consider:

- the role of solar heating and air pressure on wind formation
- the role of the Coriolis effect on the westerly wind belt
- the role of the Southern Alps in the South Island on precipitation rates.

*You may use a diagram to help support your answer.*

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**QUESTION THREE: THE CARBON AND WATER CYCLES**

The carbon and water cycles are closely linked, and help to regulate the Earth's temperature. One example of this is shown in the diagram below.



Adapted from: <https://iopscience.iop.org/article/10.1088/1748-9326/10/7/070201/pdf>

Explain how changes to the carbon AND water cycles can **influence** climate change.

In your answer, you should consider:

- how the Earth's temperature affects the water cycle
- the role of the carbon cycle in the Earth's temperature regulation
- how human activities have changed the carbon and water cycles.

*You may use a diagram to help support your answer.*











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