

3

91414



914140



NEW ZEALAND QUALIFICATIONS AUTHORITY  
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD  
KĀ NOHO TAKATŪ KI TŌ ĀMUA AO!

SUPERVISOR'S USE ONLY

Tick this box if you  
have NOT written  
in this booklet

## Level 3 Earth and Space Science 2021

### 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 (XXXX). This area may be cut off when the booklet is marked.

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

## QUESTION ONE: WEATHER SYSTEMS



Adapted from: [www.bom.gov.au/australia/charts/viewer/index.shtml?type=mslp-precip&tz=AEDT&area=GAuR&model=CSCG&chartSubmit=Refresh+View](http://www.bom.gov.au/australia/charts/viewer/index.shtml?type=mslp-precip&tz=AEDT&area=GAuR&model=CSCG&chartSubmit=Refresh+View)

New Zealand is subject to a wide range of weather. One of the main causes of variation in weather is air pressure, which can develop into high- and low-pressure systems.

High-pressure systems are linked to clear skies and calm conditions. Low-pressure systems often lead to cloudy conditions and rainfall.

Discuss the formation of bands of high- and low-pressure shown in the diagram, and explain how these lead to different weather conditions.

In your answer, you should consider:

- the role of atmospheric circulation with latitude
- why high-pressure systems often lead to calm and clear conditions
- why low-pressure systems are often linked to cloudy, rainy conditions.

*An annotated diagram may assist your explanation.*

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





**QUESTION TWO: YEAR WITHOUT A SUMMER**

1816 was known in western Europe as “Eighteen Hundred and Froze to Death” due to the severe climate anomalies. Average global temperatures decreased by 0.4 to 7 °C, causing major food shortages across the Northern Hemisphere.

This was a result of a massive eruption of Mount Tambora in what is now Indonesia. The eruption plume released 100 km<sup>3</sup> of sulfur, ash, pumice, and aerosols into the atmosphere, reaching up to 45 km high.

Explain in detail how a volcanic event in Indonesia could cause such a climate change in Western Europe.

In your answer, you should consider:

- the size of the eruption and the effects on layers in the atmosphere
- the material released from the volcano
- the transport of material between and within layers of the atmosphere
- how this material may have affected the global temperature.

*An annotated diagram may assist your explanation.*



Source: <http://apogeospatial.com/extreme-volcanic-eruptions/>

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







### QUESTION THREE: HUMAN IMPACTS ON THE CARBON CYCLE

Most atmospheric carbon is in the form of carbon dioxide, with smaller amounts of methane and other compounds. The atmospheric reservoir of carbon is small, so it reacts quickly to changes in the global carbon cycle. Since the beginning of the industrial revolution, humans have had a large impact on the balance of this carbon cycle.



<https://pixabay.com/photos/smoke-changes-chimney-exhaust-sunset-3002404/>

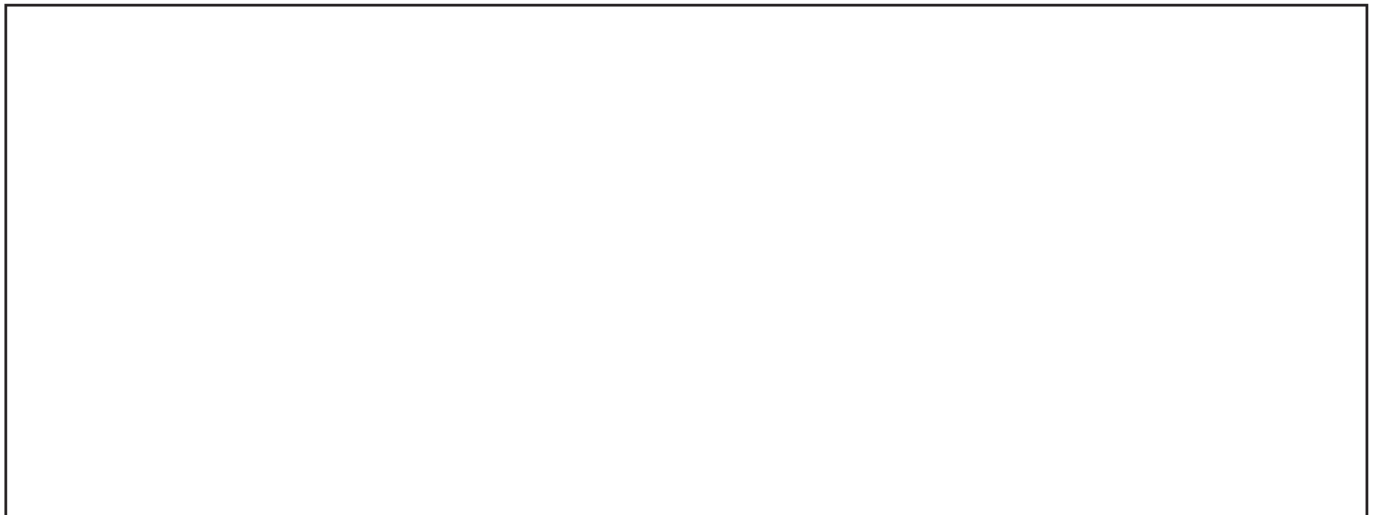
[www.esrl.noaa.gov/gmd/ccgg/carbontracker/CT2013B/tutorial\\_p2.php](http://www.esrl.noaa.gov/gmd/ccgg/carbontracker/CT2013B/tutorial_p2.php)

Explain in detail how humans have affected the processes that add and remove carbon from the atmosphere over the last 200 years.

In your answer, you should consider:

- THREE processes that add carbon to the atmosphere
- THREE processes that remove carbon from the atmosphere
- the impact of human activity on each process that alters atmospheric carbon dioxide levels.

*An annotated diagram may assist your explanation.*



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





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

QUESTION  
NUMBER

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

QUESTION  
NUMBER

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

QUESTION  
NUMBER

91414