91191

911910

2

SUPERVISOR'S USE ONLY

NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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

Tick this box if you have NOT written in this booklet

Level 2 Earth and Space Science 2021

91191 Demonstrate understanding of the causes of extreme Earth events in New Zealand

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of the causes of extreme Earth events in New Zealand.	Demonstrate in-depth understanding of the causes of extreme Earth events in New Zealand.	Demonstrate comprehensive understanding of the causes of extreme Earth events in New Zealand.

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 may be cut off when the booklet is marked.

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

Regional map showing locations referred to in this paper

This page has been deliberately left blank.
The examination continues on the following page.

QUESTION ONE: EDGECUMBE EARTHQUAKE

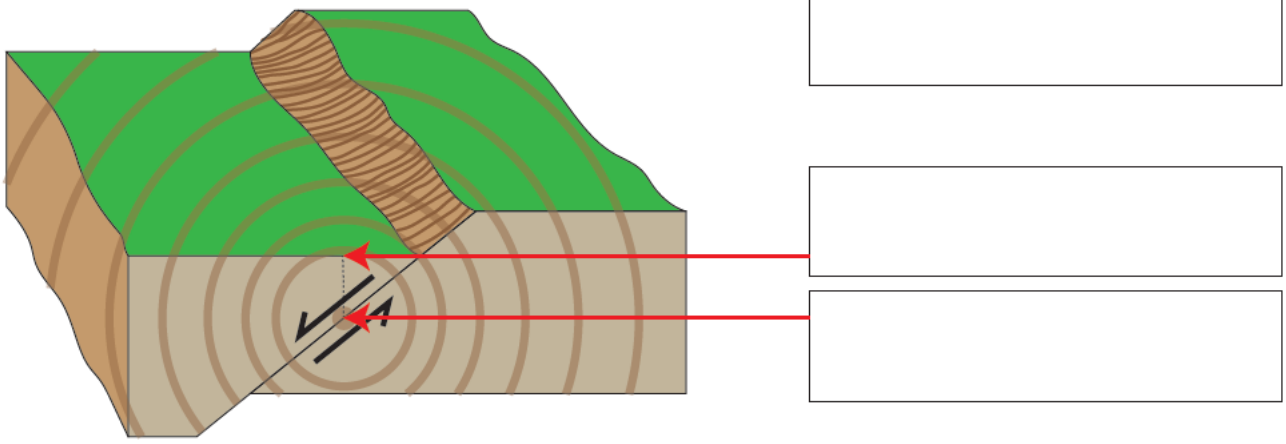
At 1.42 p.m. on 2 March 1987, a magnitude 6.5 earthquake struck the Bay of Plenty, along the Edgecumbe Fault, at a depth of 8 kilometres.

Source: https://en.wikipedia.org/wiki/1987_Edgecumbe_earthquake

Source: www researchgate net/figure/This-rupture-of-the-Edgecumbe-Fault-occurred-during-the-M63-Edgecumbe-Earthquake-2_fig42_285598682

The earthquake created a fissure 3 metres wide and 3 – 4 metres in depth, and caused the land to the north west of the epicentre to drop by 2.1 metres.

(a) Label the diagram below to show the focus and epicentre, and the type of fault involved in this earthquake.



(b) With reference to the New Zealand map on page 2, explain how movement of tectonic plates could lead to an earthquake along the Edgecumbe Fault.

In your answer you should:

- name and describe the tectonic plates involved
- describe the plate boundary involved.

(c) Discuss the possible effects of a magnitude 6.5 earthquake at a depth of 8 km, on the landscape and physical structures across a region like Edgecumbe.

In your answer you should consider the roles that magnitude, depth, and distance from the epicentre have on the possible effects.

QUESTION TWO: NEW ZEALAND'S ONLY FATAL TSUNAMI

On 14 August 1868, a magnitude 8.5 – 9 earthquake occurred at a **convergent plate boundary**, off the coast of Chile near Arica, resulting in the formation of a tsunami.

15 – 20-metre-high waves arrived in Arica 52 minutes after the earthquake, while 12 hours later a 6-metre-high wave struck the Chatham Islands, washing three whānau (families) out to sea. Three hours later, 7-metre-high waves were reported at Lyttelton, New Zealand.

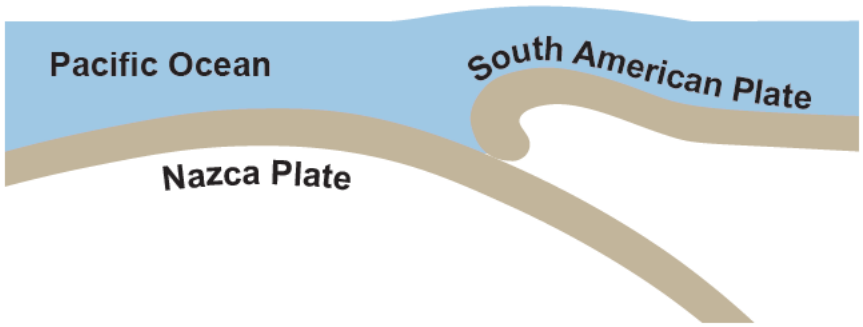
Refer to page 2 for the localities of Lyttelton and the Chatham Islands.

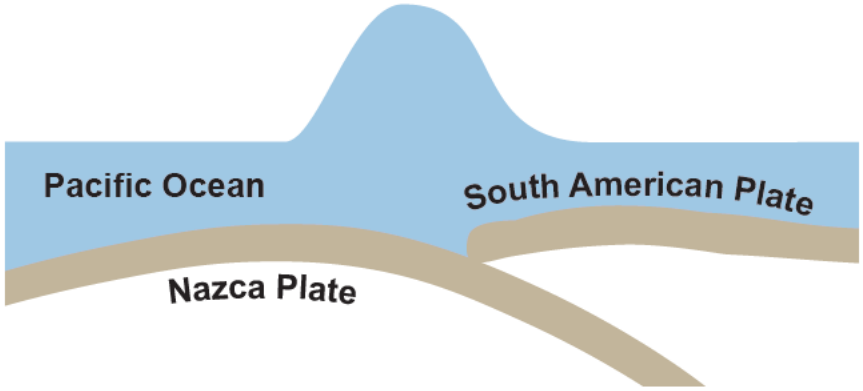
6.00 hours since earthquake **10.00 hours since earthquake**

14.00 hours since earthquake

Source: www.ecoast.co nz/tsunami-of-august-1868

(a) Add arrows to the two diagrams below to show the convergent plate movement, and add annotations to describe what the diagrams are showing.





(b) Explain in detail what a tsunami is, and how a tsunami wave is produced at a convergent plate boundary. In your answer you should refer to energy.

(c) Discuss how an earthquake near Arica could produce tsunami waves 15 hours later at Lyttelton, and what happens to the height (amplitude), wavelength, and speed of a tsunami wave as it approaches a coastline (land).

An annotated diagram may assist your explanation.

QUESTION THREE: THE DUNEDIN VOLCANO

Source: www.predatorfreepeninsula nz/wp-content/uploads/2019/03/2010-2013-Operational-Report.pdf

Between 24 – 9 million years ago, there were a number of active basaltic hot spot volcanoes in the Otago region, including the Dunedin Volcano, which are all now extinct.

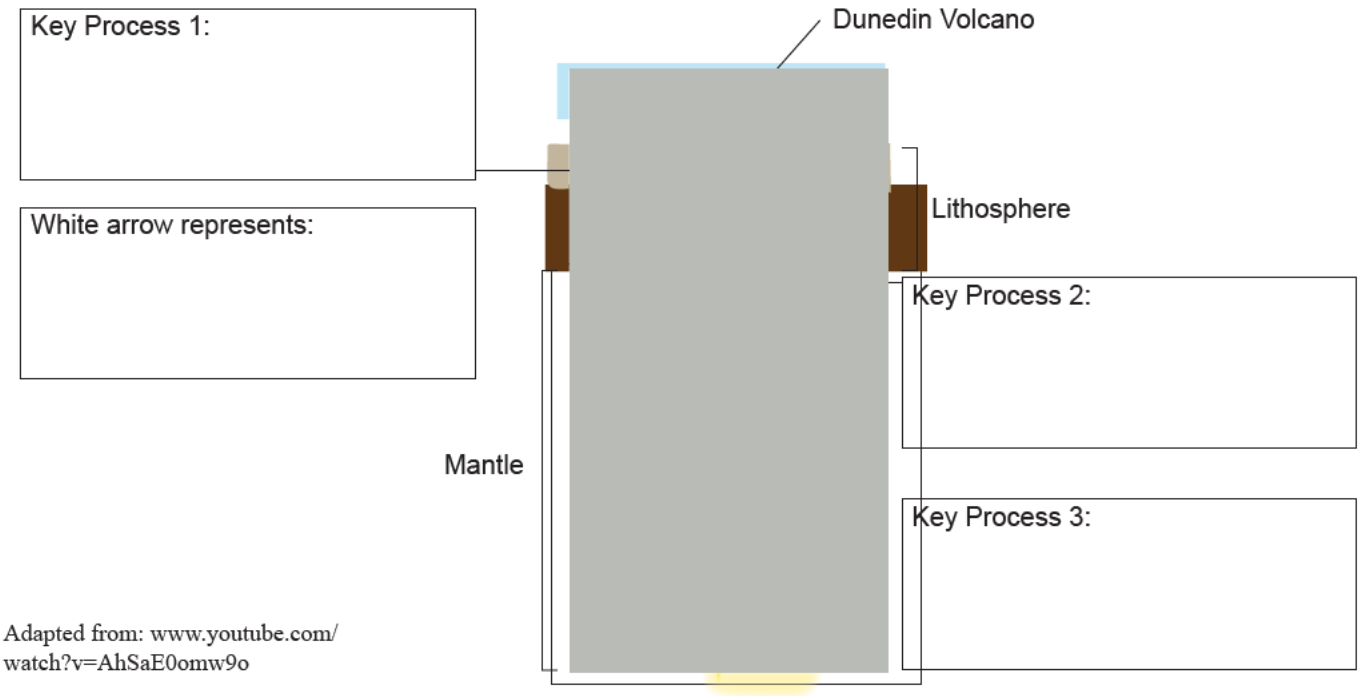
The Dunedin Volcano initially erupted below the ocean, forming a multi-vent shield volcano.

The volcano was probably around 1000 metres high, but over millions of years it has been eroded, with the remnants of the volcano crater now forming the hills around Otago Harbour.

(a) The diagram below shows what occurred below the surface leading to the formation of the Dunedin Volcano.

Identify the following on the diagram:

- what the white arrow represents
- the three key processes that lead to the formation of basaltic lava – 1, 2, and 3.



Adapted from: www.youtube.com/watch?v=AhSaE0omw9o

(b) Explain in detail the characteristics of basaltic lava, and how this leads to the formation of shield volcanoes.

A diagram may assist your explanation.

Question Three continues on the next page.

(c) Discuss the likely stages in the eruption of the Dunedin Volcano, and why it is now no longer active.
A diagram may assist your explanation.

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

QUESTION NUMBER