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Level 2 Earth and Space Science 2022

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

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The examination continues on the following page.

QUESTION ONE: MT TARANAKI

Mt Taranaki is a stratovolcano found on the west coast of the North Island of New Zealand. It is the most recent of a sequence of volcanoes that erupted in this region over the last 600 000 years (see the diagram below). Mt Taranaki last erupted in 1854; Fantham's Peak is expected to be the next location of an eruption.

Adapted from: https://upload.wikimedia.org/wikipedia/commons/b/b7/NEO_egmont_big.jpg

(a) Annotate and label the diagram below to show how plate tectonics led to the formation of Mt Taranaki.

In your answer, you should:

- add arrows to show the plate movements
- name the two tectonic plates
- explain the key process indicated.

Adapted from https://teara.govt.nz/en/diagram/8693/subduction-under-the-north-island

(b) Explain, in detail, how andesitic magma leads to the formation of a stratovolcano.

In your answer, you should:

- describe the characteristics of andesitic magma
- explain how layering contributes to the shape of Mt Taranaki
- explain the link between magma composition and the shape of Mt Taranaki.

An annotated diagram may assist your answer.

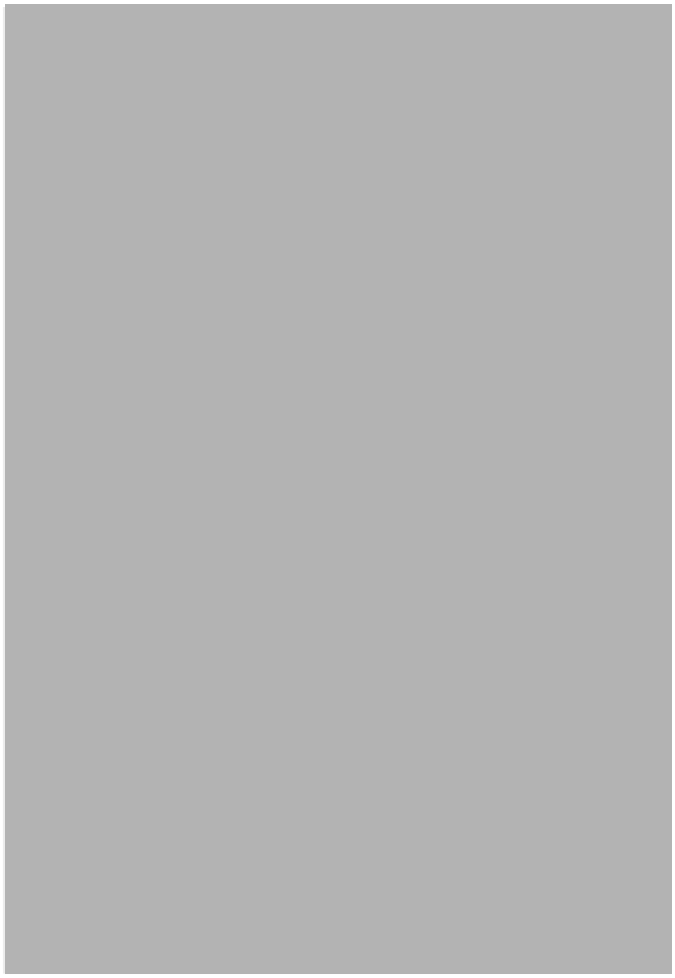
(c) Past eruptions of Mt Taranaki have produced lavas, pyroclastic flows, ash, and landslides.

A volcanic eruption from Fantham's Peak, south-west of Mt Taranaki, has been assessed as a moderate to very high hazard for the Taranaki region.

Explain, in detail, how the likely products of a future eruption may affect the surrounding area.

In your answer, you should consider:

- the links between magma composition and eruptive products produced
- the potential distance travelled by the eruptive products
- the potential effects of the eruptive products on the surrounding area.



Adapted from: https://resiliencechallenge.nz/wp-content/uploads/2018/08/McDonald-Cronin-et-al-2017.pdf

QUESTION TWO: RECLASSIFIED FAULT LINE IN FEILDING

A science report published in 2021 has reclassified a number of fault lines in the Manawatū area from inactive to active.

One of these fault lines is the Rauoterangi fault, which passes through the centre of Feilding township, including underneath a local school.

Adapted from: https://data.gns.cri.nz/af/

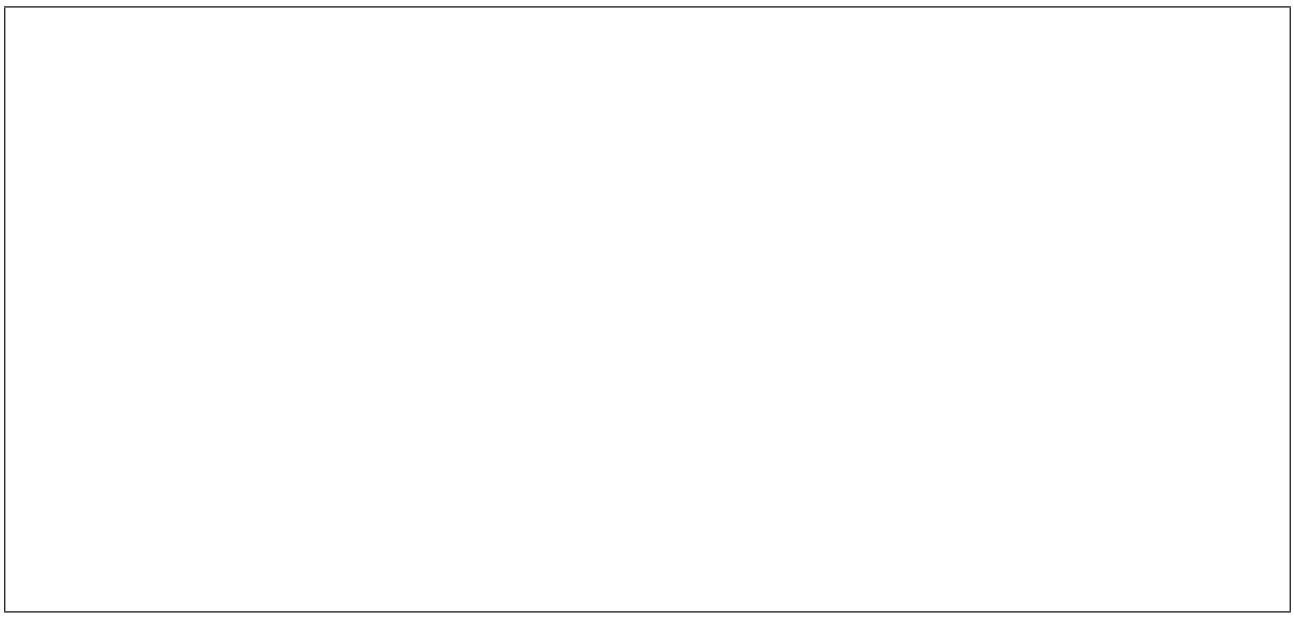
(a) Describe what a fault line is.

(b) Explain, in detail, how tectonic plate movement could lead to an earthquake along the Rauoterangi fault, which is over 200 km away from the plate boundary (refer to the New Zealand map on page 2).

In your answer, you should:

- name and describe the tectonic plates involved
- describe the type of plate boundary involved
- link the plate movement to the formation of an earthquake.

An annotated diagram may assist your answer.



(c) Explain, in detail, the factors that would affect the amount of damage experienced in Feilding if the Rauoterangi fault line were to rupture.

In your answer, you should consider:

- magnitude
- depth
- bedrock (underlying rock beneath Feilding)
- local area.

An annotated diagram may assist your answer.

QUESTION THREE: THE HEALY TSUNAMI

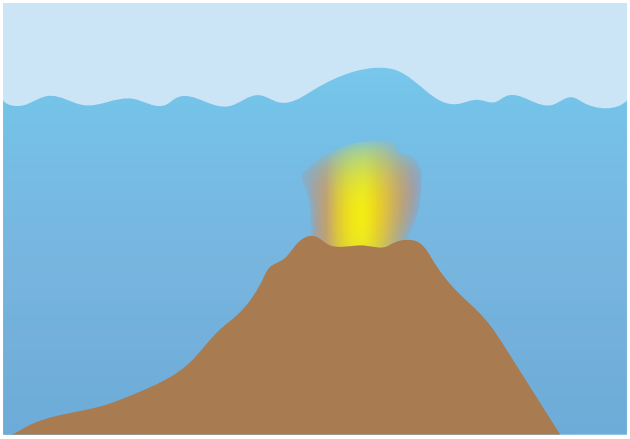
In 1360, the Healy underwater (submarine) volcano on the Kermadec Ridge erupted, forming a caldera and a tsunami that reached the Bay of Plenty in New Zealand.

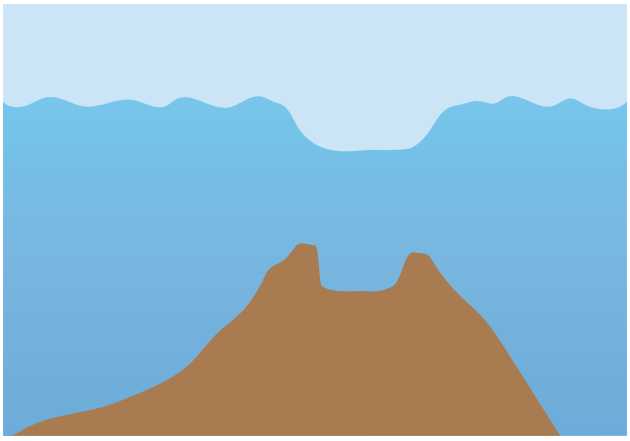
(a) Describe what a tsunami is.

(b) Explain, in detail, how an eruption of an underwater (submarine) volcano, like Healy, can create a tsunami.

In your answer, you should:

- add arrows to the TWO diagrams opposite to show the direction of the water displacement
- annotate the TWO diagrams to explain the displacement and movement of sea water
- explain the energy transfer involved from the eruption.





Question Three continues on the following page.

(c) Explain, in detail, how the size and depth of a large underwater (submarine) volcano like Healy affect the size of a tsunami produced, AND why there is a possibility of more than one tsunami event as a result of this type of eruption.

In your answer you should:

- link the size and depth of the volcano to the size of the tsunami produced
- link the stages of eruption to the formation of tsunamis.

An annotated diagram may assist your answer.

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

QUESTION NUMBER