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NZQA | Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 2 Earth and Space Science 2024

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 will 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 assessment begins on the following page.

QUESTION ONE: AUCKLAND VOLCANOES

The Auckland volcanic field centred around Auckland city contains the remnants of over 53 volcanic eruptions in the form of scoria cones or craters, all originating from one basaltic magma source.

Mt Eden volcano
Source: www.sciencelearn.org.nz/images/715-maungawhau-mt-eden

Lake Pupuke crater
Source: www.sciencelearn.org.nz/images/736-pupuke-moana-lake-pupuke

Rangitoto volcano
Source: https://www.smh.com.au/traveller/inspiration/rangitoto-island-auckland-kayak-trip-sunset-kayak-to-island-volcano-20150430-1mwjk6.html

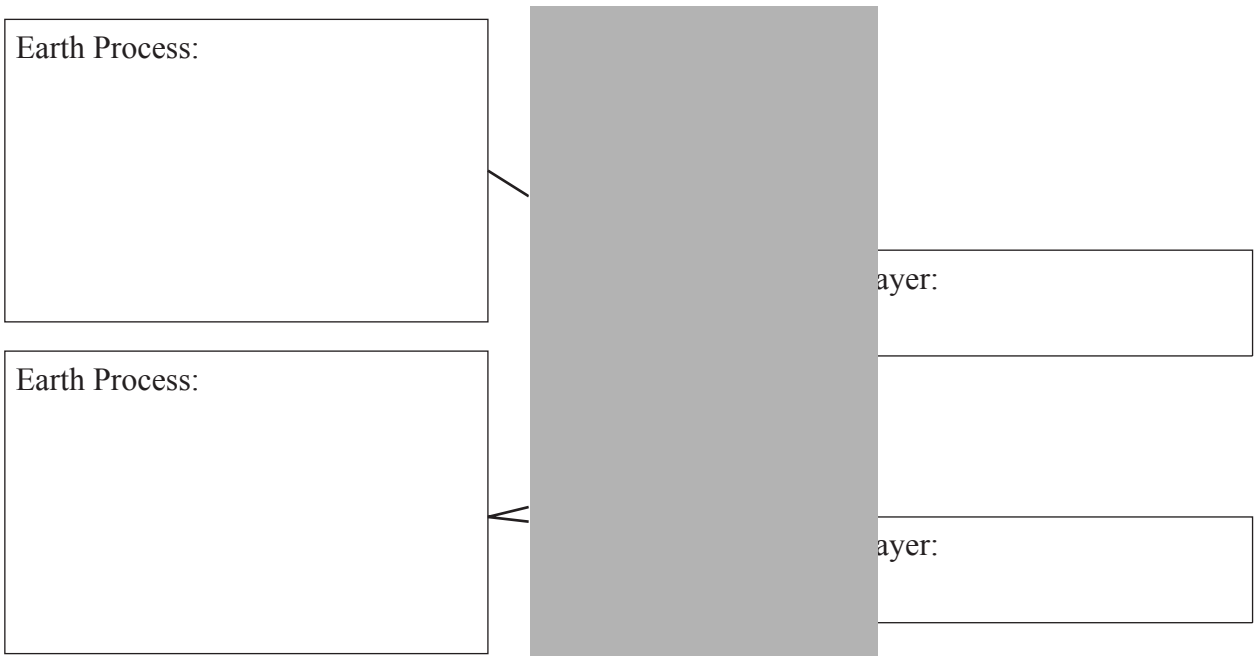
The field is still considered active, with the last eruption from Rangitoto 600 years ago.

(a) Complete the table below to describe the characteristics of basaltic magma by inserting the words high, low, or intermediate.

	Temperature	**Silica content**	**Viscosity**	**Gas content**
Basaltic magma				

(b) Explain, in detail, how the volcanic eruptions in Auckland were formed from one basaltic magma source.

In your answer you should label and annotate the diagram below to indicate the different Earth layers and Earth processes involved.



Adapted from: https://www.rnz.co.nz/national/programmes/ourchangingworld/audio/20174675/auckland's-volcanic-risk

(c) Some of the volcanic eruptions in the Auckland volcanic field occurred on land, while others occurred under the ocean.

Explain, in detail, the different types of basaltic eruption occurring in the Auckland volcanic field, and the types of volcanic features formed.

In your answer you should consider:

- the role of water in an eruption
- the stages of eruption
- the explosiveness of the eruption
- the type of volcano formed.

An annotated diagram may assist your answer.

QUESTION TWO: KĀPITI COAST EARTHQUAKE

On 15 February 2023, a magnitude 6.0 earthquake struck 50 km north-west of Paraparaumu, off the Kāpiti Coast, at a depth of 54 km.

The earthquake was felt in both the North and South Islands, with more than 60 000 New Zealanders between Auckland and Christchurch reporting that they felt it.

Source: https://www.nzherald.co.nz/nz/magnitude-60-earthquake-felt-in-wellington/65IK6BHLOBB45C7TGWKZTUUOTI/

(a) Explain the difference between the focus and the epicentre of an earthquake by referring to the earthquake above.

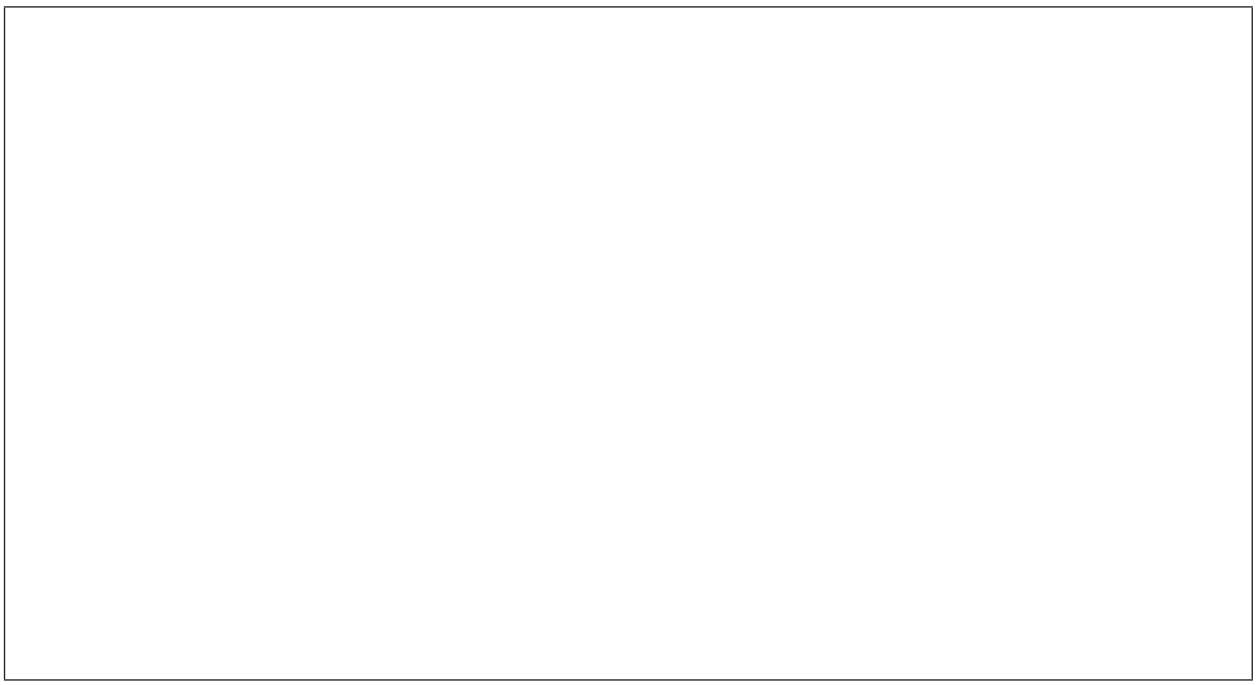
An annotated diagram may assist your answer.

(b) Explain, in detail, how tectonic processes led to this earthquake occurring off the west coast of the North Island over 100 km away from the plate boundary.

In your answer you should:

- refer to the map on page 2
- name and describe the tectonic plates involved and their motion
- state which tectonic plate the earthquake occurred in
- link the plate movement to this large magnitude earthquake.

An annotated diagram may assist your answer.



(c) Earthquakes that occur at a depth of about 50 km are generally felt over a much larger area than shallower earthquakes, but the damage caused is less.

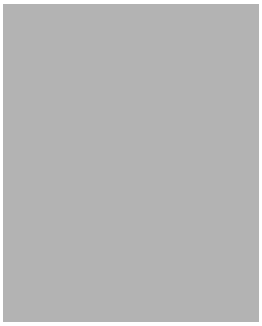
Explain, in detail, why the Kāpiti Coast earthquake was felt by so many people across the country, with little to no damage caused close to the epicentre.

In your answer you should consider:

- energy
- seismic wave movement
- what causes damage.

An annotated diagram may assist your answer.

QUESTION THREE: KAIKŌURA TSUNAMI

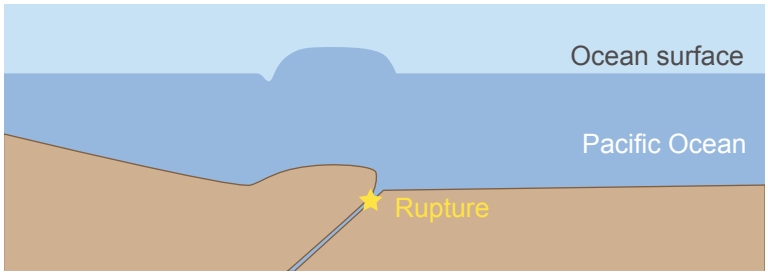


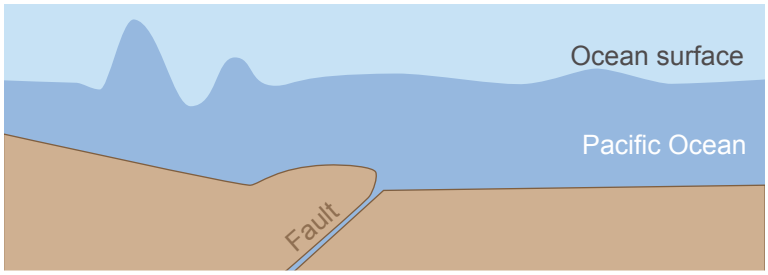
Source: https://img.geocaching.com/cache/large/c9a58c8a-2d9b-43c9-bcb8-b5f5986fde1c.jpg

In November 2016, across the Kaikōura area, over 21 fault ruptures occurred in under 3 minutes, resulting in a magnitude 7.8 earthquake being recorded.

Some of these ruptures were offshore, including the one along the Hundalee fault, generating several tsunami observed along the coasts of the South and North Islands as well as the Chatham Islands.

(a) Add arrows to the TWO diagrams below to show the movement on the fault line and in the water, and add annotations to describe what is happening.





(b) Explain, in detail, how a rupture along a fault line can result in the seafloor uplifting, causing a tsunami, and how a tsunami wave changes as it approaches the shoreline.

In your answer you should:

- describe what a tsunami is
- refer to energy changes
- consider the speed, wavelength, and amplitude of a tsunami in deep and shallow water.

Question Three continues on the next page.

Adapted from:
https://www.google.com/maps/@-42.4751009,173.554845,12z?entry=ttu
https://static.geonet.org.nz/info/images/quakes/historic/2016p858000/858000_07.jpg

(c) The highest tsunami was recorded at Goose Bay with a maximum run-up height above tide level of 6.9 m, while at Oaro the height was 5.3 m, with signs of inundation as far as 250 m.

Explain, in detail, what is meant by the run-up height and inundation of a tsunami, and why these differ for different locations.

An annotated diagram may assist your answer.

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

QUESTION NUMBER