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NZQA

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Level 2 Earth and Space Science, 2017

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

9.30 a.m. Thursday 30 November 2017
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.

A regional map showing locations referred to in the questions is on Page 16 of this booklet.

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 2–16 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.

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A regional map showing locations referred to in this paper is on page 16.

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QUESTION ONE

A severe 7.1-magnitude earthquake struck approximately 125 km off the coast of East Cape on Friday 2 September 2016, at just after 4.30 in the morning. This shallow, 22 km-deep earthquake triggered tsunami alerts for the East Coast of the North Island of New Zealand.

Tsunami waves measuring 30 cm were picked up by gauges at Gisborne Port, Great Barrier Island and East Cape.

Civil Defence issued the map below showing the most likely North Island locations for tsunami waves.

http://www.stuff.co.nz/national/83823009/71-magnitude-earthquake-off-east-cape-shakes-north-island

How can a 7.1-magnitude earthquake in the sea off the East Cape produce tsunami waves, AND why is it difficult to predict the size and effect of the waves reaching the coast?

In your answer, you should include:

- why a tsunami forms
- how an earthquake can affect the movement of sea water
- why tsunami waves change in **height** (amplitude) and **speed** as they approach the coast (land).

An annotated diagram will assist your answer.

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More space for this answer is available on the following pages.

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QUESTION TWO

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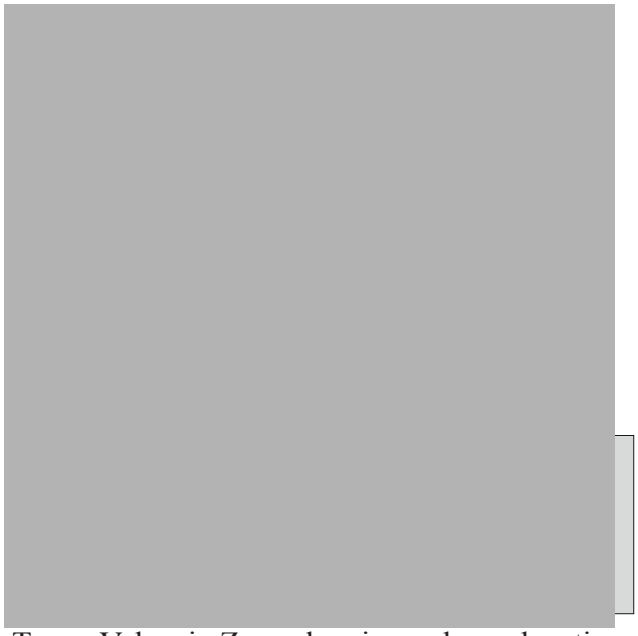
Summit of Mount Ruapehu, taken from a plane on 26 September 2007, showing the larger lahar.

https://volcano.si.edu/volcanoes/region04/newzeal/ruapehu/3211rua3.jpg



Taupo Volcanic Zone showing volcano locations and many active faults.

http://bullard.esc.cam.ac.uk/~rowlands/research.html

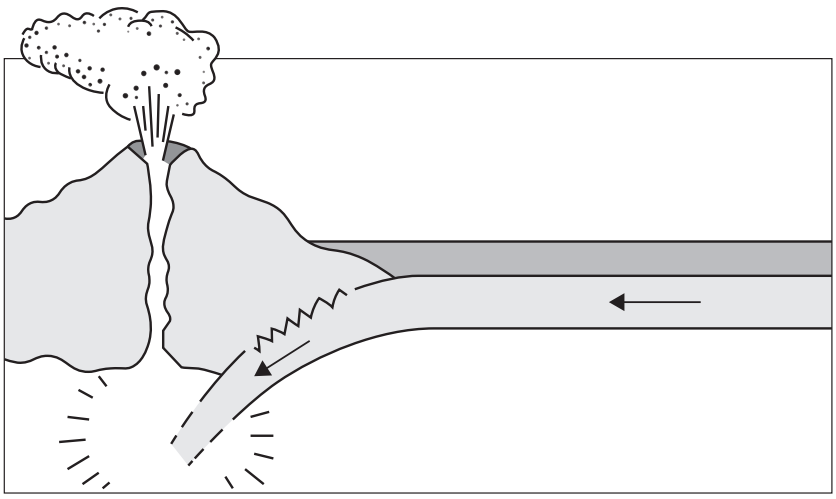
At about 8.20 p.m. on 25 September 2007, a hydrothermal eruption occurred on Mount Ruapehu without warning. Two lahars (a type of debris flow composed of a slurry of pyroclastic material, rocky debris, and water) travelled down the mountain and activated warning signals from the lahar warning system. This prompted the evacuation of some ski lodges on the mountain, and the closure of roads in the area.

Why do stratovolcanoes of the southern part of the Taupo Volcanic Zone (TVZ) – the Tongariro Volcanic Centre that includes Mount Ruapehu and Mount Tongariro – erupt mainly gas, ash, andesitic lava (52 – 63% silica), and occasionally produce lahars?

In your answer, you should:

- annotate the diagram below to show how plate tectonics lead to the formation of volcanoes
- explain how plate tectonics at the TVZ in particular lead to the formation of volcanoes
- explain magma composition and the resulting eruption products.

Annotations added to the provided diagram will assist your answer. You may also draw and annotate additional diagrams.



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The examination continues on the following page.

QUESTION THREE

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www.stuff.co.nz/waikato-times/news/68159250/scientists-discover-potential-fault-line-under-hamilton

Source: GNS active fault database

Recent investigations revealed an unmapped fault through Hamilton that crosses under the Waikato River, with a pre-historic record of large earthquakes of between 6.3 and 7.0 magnitude. The ruptures have involved up to 2 m of vertical displacement of the ground surface per event. Previously, the closest fault was thought to be the Kerepehi fault on the Hauraki Plains. In the event of an earthquake, liquefaction is considered to be the biggest risk to Hamilton.

Explain in detail how a rupture on this newly discovered fault could lead to a magnitude-7 earthquake AND the possible effects if the epicentre was in the centre of Hamilton.

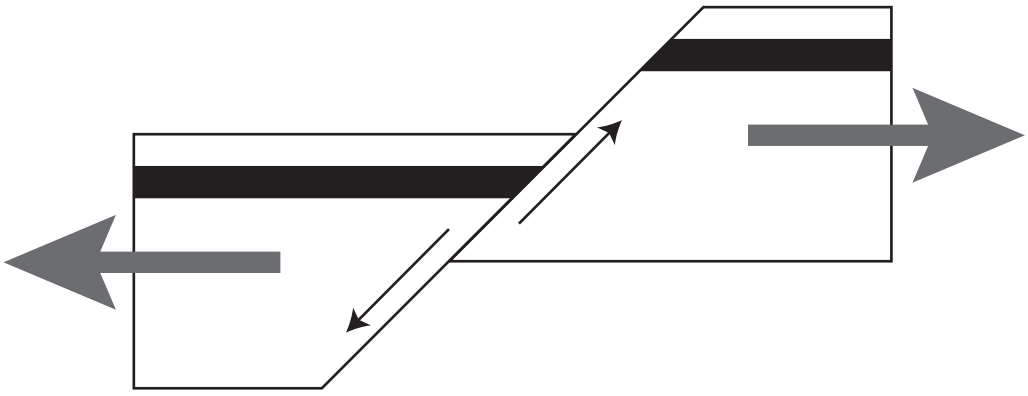
In your answer, you should include:

- how plate tectonics cause earthquakes
- the likely effects of an earthquake on the landscape (including liquefaction) and on physical structures (including buildings, roads, and bridges).

Annotations added to the provided diagram may assist your answer.

You may also draw and annotate additional diagrams.

Normal Fault



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

QUESTION NUMBER

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Write the question number(s) if applicable.

QUESTION NUMBER

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Regional Map Showing Locations Referred to in this Paper