

Assessment Schedule – 2013

Earth and Space Science: Demonstrate understanding of the causes of extreme Earth events in New Zealand (91191)

Evidence Statement

Question One:

Expected Coverage		Achievement	Merit	Excellence
<p>The Pacific and Australian Plates are locked together under the lower North Island.</p> <p>The Australian plate continues to slowly move. This leads to pressure building up over time which is eventually released as an earthquake.</p> <p>The Taranaki earthquake's epicentre was under the ocean, and the resulting earthquake released energy to the water above without displacing water.</p> <p>A tsunami is a giant wave of water that occurs because of ocean floor displacement, often as a result of an earthquake. This wave carries the energy from the earthquake through the water.</p> <p>This earthquake did not cause a vertical seafloor displacement and so a tsunami did not result.</p> <p>In order for this earthquake to cause a tsunami, the ocean floor had to move in a vertical direction, displacing the water above and beginning the wave. As the ground moved in a horizontal direction and the fault did not breach the ocean floor, a tsunami was not observed.</p>		<p>Describes:</p> <ul style="list-style-type: none"> • plate tectonics under Taranaki • earthquake as release of energy • the formation of a tsunami. 	<p>Explains the cause of ONE of</p> <ul style="list-style-type: none"> • the earthquake in terms of plate tectonics • formation of a tsunami. 	<p>Explains the cause of earthquake in terms of plate tectonics and links this to reason there was no tsunami in this case.</p>
Not Achieved	NØ	No response; no relevant evidence.		
	N1	Partially describes ONE of: <ul style="list-style-type: none"> • plate tectonics under Taranaki • an earthquake as a release of energy • the formation of a tsunami. 		
	N2	Partially describes TWO of: <ul style="list-style-type: none"> • plate tectonics under Taranaki • an earthquake as a release of energy • the formation of a tsunami. 		
Achievement	A3	Describes ONE of: <ul style="list-style-type: none"> • plate tectonics under Taranaki • an earthquake as a release of energy • the formation of a tsunami. 		

	A4	Describes TWO of: <ul style="list-style-type: none"> • plate tectonics under Taranaki • an earthquake as a release of energy • the formation of a tsunami.
Merit	M5	Explains the cause of ONE: <ul style="list-style-type: none"> • the earthquake in terms of plate tectonics • The earthquake in terms of the formation of a tsunami.
	M6	Explains the cause of BOTH: <ul style="list-style-type: none"> • the earthquake in terms of plate tectonics • The earthquake in terms of the formation of a tsunami.
Excellence	E7	Explains the cause of the earthquake in terms of plate tectonics and links this to reason there was no tsunami in this case.
	E8	Explains the cause of the earthquake in terms of plate tectonics and links this to energy released by the earthquake is in horizontal plane only, which results in no tsunami in this case.

Question Two:

Expected Coverage		Achievement	Merit	Excellence
<p>The Taupo Volcanic Zone (TVZ) is an area of NZ where the Pacific Plate is subducting beneath the Australia Plate. The subducting oceanic Pacific plate is forced downwards towards the mantle. An increase in temperature and chemical reactions due to large amounts of water present in the Pacific Plate create areas of molten rock (magma). This hot magma is less dense than the surrounding rock; it rises up through the continental crust of the Australian Plate.</p> <p>As the magma rises, it comes close to ground water reservoirs. This water heats up and tries to rise upwards through cracks / weaknesses in the crust. A geyser forms when this water from the underground reservoir cannot move upwards freely and gets forced through a narrow opening in the crust. This causes the water to become highly pressurised and increase in temperature until it is above boiling point (100°C). The pressure continues to build up and eventually the water and steam will erupt through an opening, creating the typical column of water steam shooting up into the air. This relieves the pressure in the reservoir. Eventually, the water will heat up again, the reservoir will fill from below, and the eruptive cycle will begin again.</p>		<p>Describes:</p> <ul style="list-style-type: none"> Subduction under TVZ as Pacific Plate (PP) subducts and melts beneath Australian Plate (AP) due to PP being more dense than AP. Geysers are made up of ground water heated by moving magma through a narrow opening in the crust. 	<p>Explains how subduction occurs under TVZ, leading to hot magma rising and heating ground water in reservoirs which causes it to rise upwards through weaknesses in crust and finally out a narrow opening into the atmosphere.</p>	<p>Explains how subduction occurs under the TVZ with a water-logged oceanic plate subducting under a continental plate leading to ground water being heated, pressurised, and forced upwards through weakness in the crust.</p>
Not Achieved	NØ	No response; no relevant evidence.		
	N1	Partially describes ONE of: <ul style="list-style-type: none"> Pacific plate subducting under the Australian plate the plate melts, forming magma under surface gives characteristic of geyser erupting. 		
	N2	Partially describes TWO of: <ul style="list-style-type: none"> Pacific plate subducting under the Australian plate the plate melts, forming magma under surface gives characteristic of geyser erupting. 		
Achievement	A3	Describes ONE of: <ul style="list-style-type: none"> process of subduction magma rising through crust magma heating ground water. 		
	A4	Describes TWO of: <ul style="list-style-type: none"> process of subduction magma rising through crust magma heating ground water. 		

Merit	M5	Explains how subduction leads to magma heating ground water.
	M6	Candidate explains how subduction leads to magma heating ground water which rises through crust.
Excellence	E7	Candidate explains in detail how subduction zone under Pohutu leads to superheated water and steam erupting from geyser under pressure.
	E8	Candidate explains in detail how subduction zone under Pohutu leads to superheated water and steam erupting from geyser under pressure regularly due to refilling of reservoir.

Question Three:

Expected Coverage	Achievement	Merit	Excellence
<p>The North Island volcanoes are formed because magma is produced when the Pacific plate is forced under the Australian plate, ‘subduction’. As the denser oceanic crust of the Pacific plate is forced down below the less dense continental crust of the Australian plate, it carries water down with it. Fractional melting and reactions between the water, crust, and mantle form pockets of gas-rich molten magma. This magma is less dense than the surrounding material and begins to rise to the surface. When it reaches the surface, it creates volcanic activity.</p> <p>The three different types of lava / eruptions are due to the composition of the lava erupting. Basaltic magma is formed by fractional melting of the oceanic crust. This type of magma is more fluid, hotter, lower silica and usually gas-poor. This means it is generally less explosive, because there is less gas dissolved in the magma and it can be released more easily. The Mt Tarawera eruption of 1886 erupted only basalt which could have come from molten oceanic crust or molten mantle material due to rifting / fissure in this area. Towards the east coast the magma that has risen to the surface is of molten oceanic crust or molten magma material so is basaltic and erupted on Mt Tarawera in 1886.</p> <p>Rhyolite magma is formed when basaltic magma pools and melts the overlying continental crust, which is then erupted. Rhyolite magma is rich in silica and gas-rich, so it is thick, viscous and highly explosive. The Lake Taupo eruption (26 500 years ago) was lava that was molten continental crust only and so Rhyolite lava was produced. The magma which has risen towards the middle of the North Island is made up of molten continental crust so is rhyolitic and erupted to form Lake Taupo.</p> <p>Mt Ruapehu’s andesitic lava results from a mixture of molten oceanic and continental crust which causes the intermediate nature of the magma in terms of its viscosity, silica content and explosiveness. The Magma that formed towards the west of the volcanic zone is a mixture of both molten oceanic and continental crust and erupted on Mt Ruapehu.</p> <p>These three different types of volcanic eruptions can be found in the North Island due to the subduction zone of oceanic crust subducting under continental crust.</p>	<p>Describes:</p> <ul style="list-style-type: none"> • how different types of volcano / lava are formed • how different lava causes different volcanic forms / shapes. 	<p>Explains how subduction zone leads to different types of volcano / lava being formed.</p>	<p>Explains in detail how one subduction zone can provide conditions that make different types of eruption possible including details of lava type / origin.</p>
Not Achieved	NØ	No response; no relevant evidence.	
	N1	Partial description of how one specified type of lava is formed OR how one specified type of lava leads to one volcanic shape.	
	N2	Partial descriptions of how TWO different types of lava are formed OR how the different TWO types of lava lead to different volcanic shapes.	
Achievement	A3	Describes how ONE different types of lava are formed OR how the different TWO types of lava lead to different volcanic shapes.	

	A4	Describes how TWO different types of lava are formed OR how the different TWO types of lava lead to different volcanic shapes.
Merit	M5	Explains how subduction zone leads to ONE different types of lava being formed.
	M6	Explains how subduction zone leads to TWO different types of lava being formed.
Excellence	E7	Explains in detail how one subduction zone can provide conditions to produce lavas that make more than one different type of eruption possible.
	E8	Explains in detail how one subduction zone can provide conditions that make TWO different types of eruption possible.

Judgement Statement

	Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
Score range	0 – 6	7 – 12	13 – 18	19 – 24