Year 12 Science: Earthquakes and volcanoes in Aotearoa

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. Which plate subducts under the North Island, and what type of crust is it?

2. What lowers the melting point of the mantle above a subducting plate?

3. A magnitude 6.2 and a magnitude 7.2 earthquake: roughly how many times more energy does the bigger one release?

4. What is the epicentre of an earthquake?

5. Which magma has the most silica, and what kind of volcano does it build?

Exam-style question: Ruapehu

Ruapehu is an andesitic stratovolcano in the central North Island, inland from the Hikurangi subduction zone. Its eruptions alternate between ash eruptions and short lava flows.

6. Name the two plates involved and the type of crust each is made of.

7. Explain how tectonic processes form the magma that feeds Ruapehu.

8. Explain how andesitic magma produces a steep, layered cone.

9. A shallow magnitude 6 earthquake and a deep magnitude 6 earthquake happen under the central North Island. Explain which one is more likely to damage buildings near the epicentre.

Fix the mistake

10. Correct this statement: "The Pacific Plate melts because of friction as it rubs against the Australian Plate."

11. Correct this statement: "The epicentre is where the earthquake happens underground."

12. Correct this statement: "A magnitude 7 is a bit bigger than a magnitude 6."

13. Correct this statement: "Andesite volcanoes are steep because the lava is hot and flows fast."

Answer key (for parents and tutors)

1. Which plate subducts under the North Island, and what type of crust is it?
   The Pacific Plate, which is oceanic crust.
2. What lowers the melting point of the mantle above a subducting plate?
   Water released from the subducting plate.
3. A magnitude 6.2 and a magnitude 7.2 earthquake: roughly how many times more energy does the bigger one release?
   One step of magnitude, so about 32 times.
4. What is the epicentre of an earthquake?
   The spot at ground level directly above the focus.
5. Which magma has the most silica, and what kind of volcano does it build?
   Rhyolite, which builds a caldera through huge explosive eruptions.
6. Name the two plates involved and the type of crust each is made of.
   Pacific Plate, oceanic crust; Australian Plate, continental crust (Achieved).
7. Explain how tectonic processes form the magma that feeds Ruapehu.
   Achieved: the Pacific Plate subducts and melts to make magma that rises. Merit: the denser oceanic plate sinks under the continental plate; water squeezed out of it lowers the melting point of the mantle, which partly melts into basaltic magma that rises because it is less dense. Excellence: the basaltic magma pools under the continental crust and melts some of it, adding silica, which turns it into andesitic magma; each step is linked to the next.
8. Explain how andesitic magma produces a steep, layered cone.
   Achieved: andesite has medium silica, is sticky and has some gas; it erupts ash and lava. Merit: sticky lava cools before it can flow far, so it builds up near the vent; explosive ash eruptions add layers. Excellence: alternating layers of ash and short, thick lava flows pile up near the vent eruption after eruption, so the steep sides and the layers both come from the medium silica and the trapped gas.
9. A shallow magnitude 6 earthquake and a deep magnitude 6 earthquake happen under the central North Island. Explain which one is more likely to damage buildings near the epicentre.
   The shallow one (Achieved). Merit: its seismic waves travel a shorter distance to the surface, so they lose less energy and the shaking at the epicentre is stronger. Excellence: both release the same energy, but waves from the deep focus spread out and lose energy on the way up, so they are felt over a wider area but more weakly; the shallow focus concentrates strong shaking (higher MM intensity) near the epicentre, which causes more damage.
10. Correct this statement: "The Pacific Plate melts because of friction as it rubs against the Australian Plate."
    Water released from the sinking plate lowers the melting point of the mantle above it; that is the main cause of melting.
11. Correct this statement: "The epicentre is where the earthquake happens underground."
    The focus is the underground starting point of the rupture; the epicentre is the spot at ground level directly above it.
12. Correct this statement: "A magnitude 7 is a bit bigger than a magnitude 6."
    Magnitude is logarithmic: one step up releases about 32 times more energy.
13. Correct this statement: "Andesite volcanoes are steep because the lava is hot and flows fast."
    Andesite is sticky and cools close to the vent, so short lava flows and ash layers pile up steeply.