

Team Number _____

This is the Dynamic Planet (Earthquakes and Volcanoes) test for Division C.

You may divide up the test, but if you do, please put your team number on every page.

The tiebreakers on this test are

- 1. The total score on Section B (the short answer section)**
- 2. The score/completeness of answer on problem C.3.**
- 3. The total score on Section D**
- 4. The total score on Section A**

Thank you for putting in the time to learn about this field. I hope that you find this test challenges you to put what you've learned into context.

Good luck!

Scores:

_____ **A (15 points)**

_____ **B (30 points)**

_____ **C (25 points)**

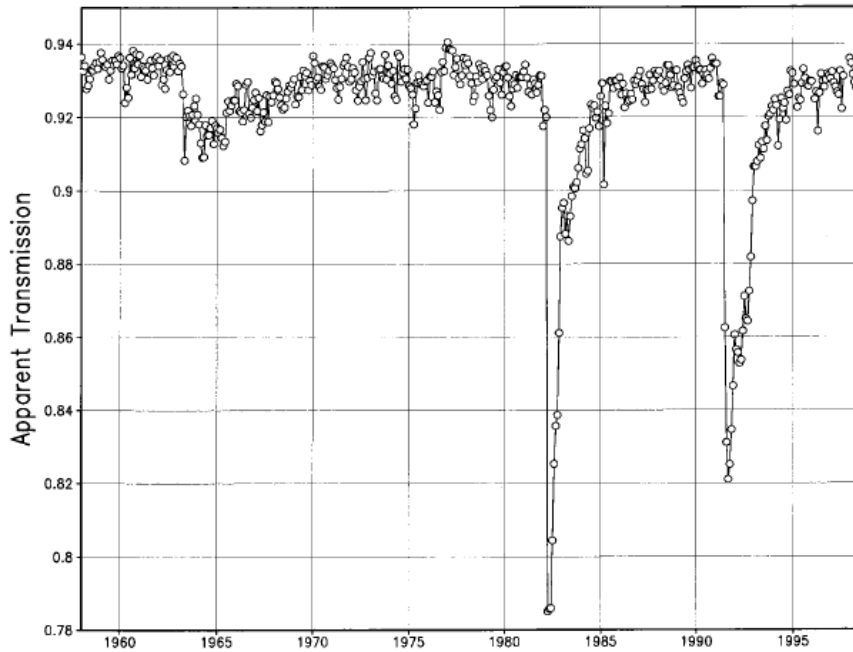
_____ **D (15 points)**

_____ **E (15 points)**

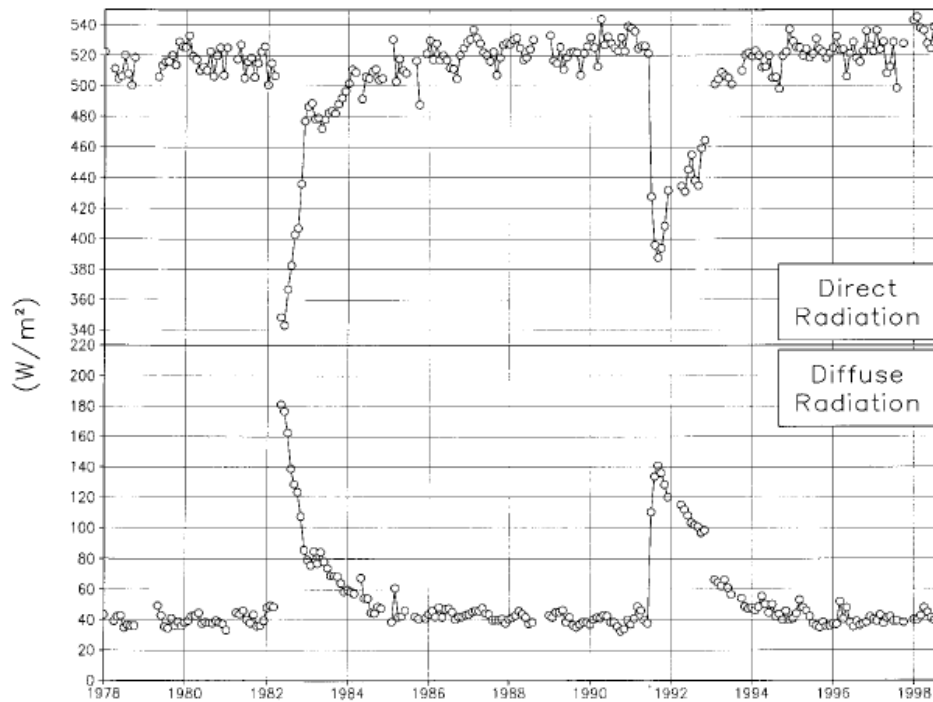
_____ **TOTAL**

Volcanic eruptions and climate (15 points)

The following plots are used in this section



Apparent atmospheric transmission at Mauna Loa Observatory, HI since 1958.



Direct (from face of sun) and diffuse (excluding face of sun) solar radiation at the same site. Note different time scale. Plots from Robock <http://climate.envsci.rutgers.edu/pdf/ROG2000.pdf>

1..What events do you see in these time series? Compare and contrast the events and link them to specific volcanic eruptions if you can. (5 points)

2. Describe the *net* impact of these eruptions on the total solar radiation reaching the surface. (5 points)

3. What constituents emitted by volcanoes account for this signal? (5 points)

B: Short answer (5 points each)

1. Is the lava flow below an example of a dike, a'a, lahar deposit, or pahoehoe? How do you know?

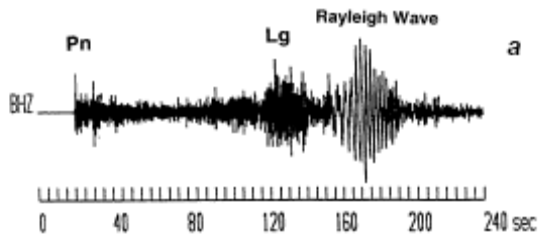


2. The picture below shows a feature known as a lava tube. How do such tubes form?



3. The rock on the left is an example of kimberlite (note the reddish and greenish crystals embedded in it). How is kimberlite formed and why are deposits of it so sought after?

4. What feature of seismic wave propagation provides evidence of a liquid core on earth?

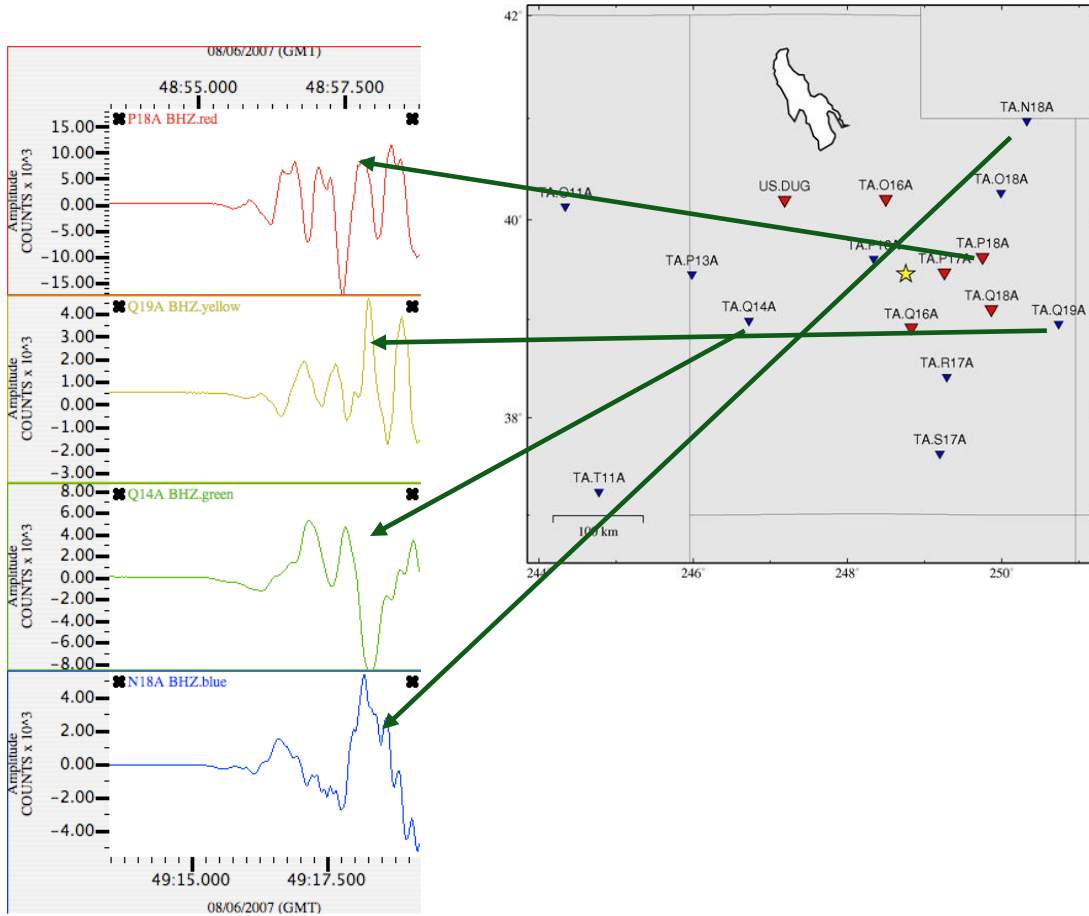


5. The picture above shows a seismic trace from the Indian nuclear test in 1998. Why are nuclear explosions particularly likely to generate Rayleigh waves?

6. Using the moment magnitude scale, how much more energy does a magnitude 7.0 earthquake release than a magnitude 5.0 earthquake?

C. Interpreting seismograms (25 points)

On August 8, 2007, a collapse, killing 6 miners, occurred at the Crandall Canyon Mine (yellow star below right). A number of seismographs were deployed in the area, and recorded this event as having a magnitude of 3.9. The graphs on the left show the vertical displacement associated with each of these seismographs.

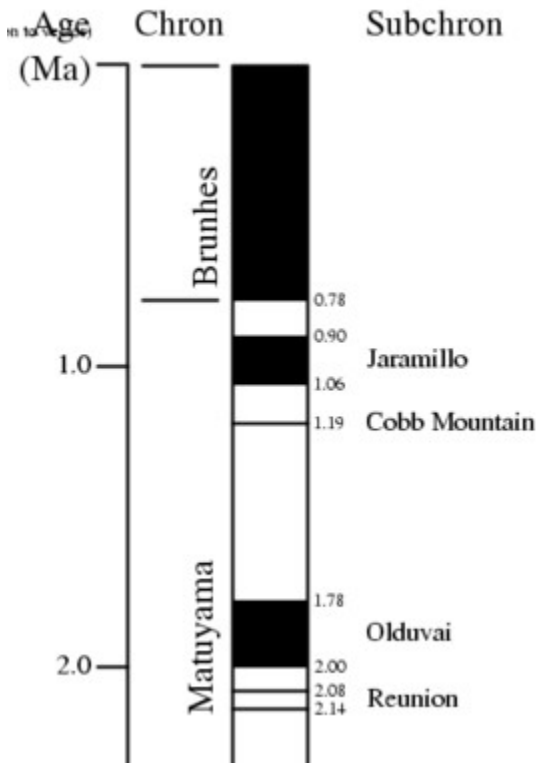


1. Noting the scale bar in the bottom left of the picture (100km) and the time scale on the top and bottom seismograms, estimate the P-wave velocity in this area. (5 points).

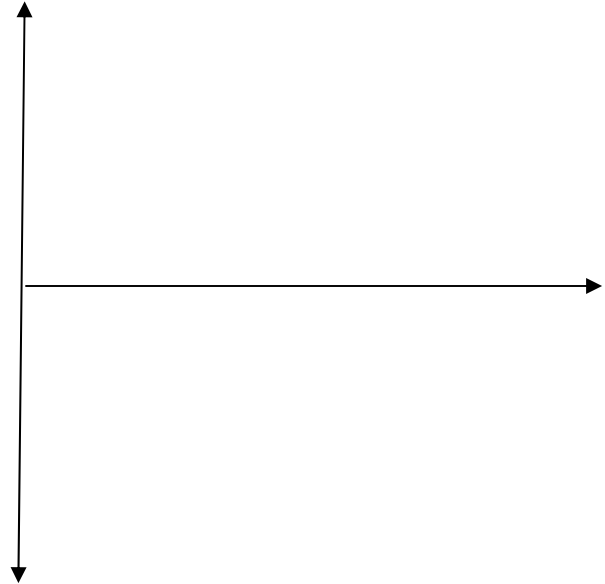
2. What are the physics behind P-wave propagation? (5 points)

3. The mining company claimed that this disaster was caused by an earthquake, but seismologists disagreed. Looking at the initial vertical displacement, how would you distinguish a collapse from a left-lateral slip on a north-south fault or a slip along a normal fault? (5 points for describing each pattern)

D. Magnetic reversals and plate tectonics (20 points)



The plot on the left shows magnetic reversals over the past two million years. Use this data to develop a plot of magnetic field vs. distance as you cross a mid-ocean ridge.



(Note, in order to solve this problem you will need to know the average speed of a spreading center). What is it?

E. Identification (3 points each)

1. Nuee ardente:
2. Richter scale:
3. Tsunami:
4. Stratovolcano:
5. Transform fault: