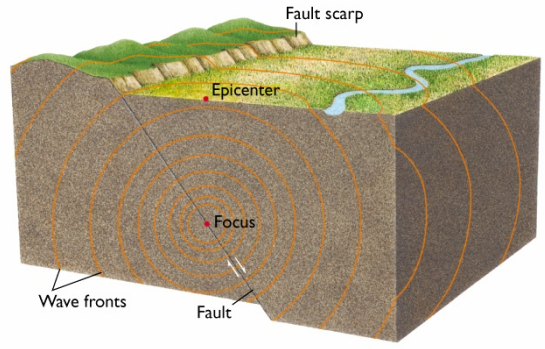
GEOL 103 Writing Assignment 8 Key: Earthquakes

Name _____ Lab section: Monday or Tuesday (circle one)
To be counted, must be turned in by Monday December 2.

1) Sketch a block diagram (you don't need different rock layers) that illustrates the following

fault focus of an earthquake
epicenter of an earthquake fault scarp
wave fronts emanating from an earthquake



2) Explain the elastic rebound theory in your own words. Use a series of sketches if you find that helpful.
As stress builds up, rocks begin to bend elastically to accommodate the stress. When the stress becomes too great, the two blocks of rock move past each other along a fault, releasing the stress as seismic energy, and the rocks "spring back" elastically, and the bending (folding) is not recorded in the rocks.

3) Explain the physical operations in a simple seismograph. What parts move (and why do they move) and what does not move? (Modern seismographs use more electronic components instead, but the principles are the same.) Use the following components: earth, box (holding the seismograph), spring or lever holding a mass, mass (attached to a pen), recording paper.
When an earthquake occurs, the Earth, the box holding the seismograph, the spring or lever, and the recording paper all move together. Due to its inertia and because it is mounted on a spring or lever, the mass (attached to a pen) does not move relative to the other components, thus the system records the movement of the Earth where the seismograph is located. Other answers are possible, depending on the perspective of the observer.

4) What are the name of the three types of seismic waves that can pass through rock following an earthquake?
P-waves (primary), S-waves (shear waves), surface waves, in that order. See Fig 13.5.

5) Explain the movement of P and S wave fronts through a body of rock, referring to Figure 13.5 in your text. What does each type of wave do to the rock it passes through? How do the velocities of each wave differ from each other? What types of materials do S waves not travel through.
See Fig. 13.5 and associated text and captions. P-wave velocity > S-wave velocity > surface wave velocity. S-waves do not travel through liquids or gases because these substances do not have sufficient shear strength.

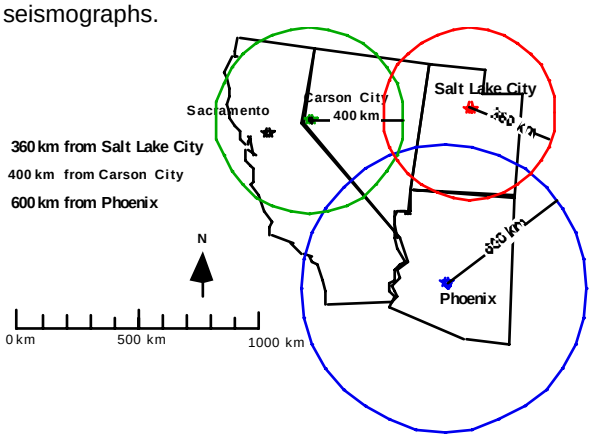
6) What are the differences between the Modified Mercalli Intensity Scale and the Richter Scales? What do each measure?
An intensity scale measures damage to human-related objects and indicates whether and how much people can sense an earthquake. The Richter scale is more quantifiable, and is based upon how much the ground displacement occurs a certain distance from an earthquake; recorded by analyzing data from several seismographs. Richter magnitude is linearly related to the energy released by an earthquake.

7) Explain in your own words what taking the logarithm does to numbers that vary widely from each other.
Taking the logarithm of a group of widely varying numbers compresses the numbers so they can be more easily compared as illustrated in the table below.

x	x as a power of ten	log(x)
1	10^0	0
10	10^1	1
100	10^2	2
1000	10^3	3
10000	10^4	4
100000	10^5	5
1000000	10^6	6

8) What are the relative differences in ground motion and energy released when comparing Richter magnitude 5 and 7 earthquakes?
At the same distance from a seismograph, a magnitude 5 earthquake would cause 100 times less ground movement than a magnitude 7 earthquake. This is because the Richter scale is a log scale, with a factor of ten difference between each Richter unit (10 x 10 = 100 times more ground movement). There is about30 times more energy associated with each Richter unit, so 30 x 30 = 900 times less energy associated with the magnitude 5 quake.

9) Sketch on the diagram to the right (map view) to illustrate how the epicenter of an earthquake can be located using seismographs.



10) The world now has an extensive seismic network that allows us to monitor earthquakes all over the world. This network took a lot of money to develop. Scientific curiosity and hopes that we could predict damaging earthquakes were not the only driving forces behind setting up this network. What political events during the time period from World War II and the 1990's were a driving force behind development of this network?
The network was primarily funded to be able to document nuclear explosions to enforce the nuclear test ban treaty. Scientists can tell the difference between underground nuclear explosions and earthquakes.

11) Earthquakes do not occur in random locations. At what three tectonic settings do most earthquakes occur, and what types of faults are most common in those settings? Do these earthquakes have shallow or deep foci? (See Fig 13.12) Why are most deep-focus earthquakes cause little damage at the surface? (Hint: Compare an explosion deep in the ocean to one near the surface.)
Divergent zones (rift zones and mid-ocean ridges): shallow focus quakes, normal and) faulting
Transform boundaries (sea-floor and on land); shallow focus quakes; transform (strike-slip) faulting
Convergent zones (subduction zones, ocean-continent and continent-continent collisions): shallow focus quakes, deep focus quakes along subducted plate, reverse and thrust faulting
Intraplate quakes: shallow focus within contintents; not associated with plate boundaries; not well understood
The energy of most deep-focus quakes is largely absorbed by the Earth before reaching the surface.

12) How well are we able to predict earthquakes? In what kind of terms are these predictions couched? Give an example of such a prediction.
Not very well. We are able to predict based on probability. A prediction would take a form like this one: the probability of a M 6.8 or larger earthquake occurring during the next 30 years in the San Francisco Bay region is about 67 percent (twice as likely as not).

13) How earthquake prone is your hometown (see Fig 13.18)? How is your hometown situated with respect to plate boundaries?