A. Fill in the blank  (2 points each)

1. The Earth is about ______4.6 billion_______ years old.

2. The block diagram above illustrates a _____normal____ fault.

3. Tectonic plates are destroyed when they plunge back into the mantle at ___convergence__ zones.

4. Tectonic plates slide past each other at ___transform___ plate boundaries.

5. The radioactive isotope ____^{14}C (Carbon-14)_____ is the most useful for dating very young (<10,000-year-old) wood and charcoal.

6. The oldest oceanic crust on Earth is less than ____180-200____ million years old.

7. Oceanic crust is about _____8____ km thick whereas continental crust is about ____45___ km thick.

8. Most earthquakes occur at the ____boundaries____ of the Earth's lithospheric plates.

9. Plates move at rates of a few ____cm____ per ____year____.
10. Earthquakes deeper than 100 km are generally found only at ___subduction zones______________.

11. Magnetic anomalies help us determine the ____age____ of the oceanic crust.

12. The viscosity of a lava increases as the ___silica__ content of the lava increases.

13. The oldest rocks on Earth are about ____4 billion___ years old.

14. The size or magnitude of an earthquake is determined using __surface__ waves.

15. The exact location of an earthquake within the Earth is its ___focus___.

16. The point on the surface of the Earth directly above the location in question 15 is called the earthquake's __epicenter___.

17. The maximum height above sea level reached by a tsunami is called its ___runup___.

18. The horizontal distance from normal water's edge reached by a tsunami is called its __inundation__.

19. Tsunamis move at speeds up to ___500 mph___ in the deep ocean and have wavelengths of ___100 km______.

20. The principle of superposition tells us that in a sequence of undisturbed layered rocks, the ___oldest (youngest)___ rocks are on the ___bottom (top)____.
B. Short Answer. Briefly answer the following questions; continue on back of page if necessary.

1. What do we mean by the "half-life" of a radioactive element? (5 pts)
The time for ½ of the nuclei in a sample to decay. Time taken for a population of radioactive elements to decay to half their original number.

2. Describe the mechanisms by which tectonic plates are transported. (10 pts)
Two different mechanisms may be involved. Convection cells within the Earth's mantle move laterally beneath the lithosphere as part of their cycle. As they do, they physically drag the plates along. Ridge push and slab pull may also be part of the mechanism; in this process, gravity pushes plates away from uplifted mid-ocean ridges and pulls the plates down into the Earth's interior at subduction zones.

3. What do we mean by "Uniformitarianism"? (5 pts)
The present is the key to the past. Geologic processes that we see in operation today have worked much the same way over geologic time — however, rates and intensity of processes may have changed.

4. What causes earthquakes? (10 pts)
Earthquakes are caused by the sudden release of energy accumulated in deformed rocks. At great depths, rocks subjected to strain may be pliable enough to deform plastically. But at more shallow depths, rocks are brittle and deform elastically. When subjected to sufficient stress, they fracture. Rocks on either side of the fracture shift in relation to each other, and an earthquake results. After shifting, the two sides of the fault lock in place and accumulate additional strain energy. When the friction between the two sides is overcome, another earthquake results.

5. Explain the difference between absolute and relative age. Give an example. (10 pts)
Absolute age give us a numerical date of a rock. Relative dates tell us which rock unit is older or younger. An absolute date of a dike of 20 millions years crosscutting a sediment layer tells that the sediment layer is older than 20 my.

6. What are the critical pieces of information needed to locate the epicenter of an earthquake? (5 pts) How many seismic stations are needed to EXACTLY locate the epicenter of an earthquake? (5 pts; total question 10 pts)
Arrival times of P and S waves. Three seismic stations are required to exactly locate the epicenter of an earthquake.
7. Based on the general laws of geology, summarize the sequence of events indicated by the geologic cross-section below. List the events (for example, deposition of a layer, faulting, erosion, etc.) in order of occurrence, from oldest (first to occur) to youngest (most recent). Eleven events occurred. (10 pts)

Event # 11 (youngest) _____ Erosion of layer 6
Event # 10 _____ Deposition of layer 6
Event # 9 _____ Deposition of layer 5
Event # 8 _____ Erosion of layer 4 forming unconformity
Event # 7 _____ Uplift and tilting of layers 1-4
Event # 6 _____ Granite intrusion
Event # 5 _____ Fault formation
Event # 4 _____ Deposition of layer 4
Event # 3 _____ Deposition of layer 3
Event # 2 _____ Deposition of layer 2
Event # 1 (oldest) Deposition of layer 1