

SOLUTIONS TO THE MODULE #6 STUDY GUIDE

1. a. Earth's crust – Earth's outermost layer of rock
- b. Sediment – Small, solid fragments of rock and other materials that are carried and deposited by wind, water, or ice. Examples would be sand, mud, or gravel.
- c. Sedimentary rock – Rock formed when chemical reactions cement sediments together, hardening them
- d. Igneous rock – Rock that forms from molten rock
- e. Metamorphic rock – Igneous or sedimentary rock that has been changed into a new kind of rock as a result of great pressure and temperature
- f. Plastic rock – Rock that behaves like something between a liquid and a solid
- g. Earthquake – Vibration of the earth that results either from volcanic activity or rock masses suddenly moving along a fault
- h. Fault – The boundary between two sections of rock that can move relative to one another
- i. Focus – The point where an earthquake begins
- j. Epicenter – The point on the surface of the earth directly above an earthquake's focus
2. The earth is divided into the atmosphere, hydrosphere, crust, mantle, and core.
3. We can directly observe the atmosphere, hydrosphere, and crust.
4. The Moho separates the crust from the mantle, and the Gutenberg discontinuity separates the mantle from the core. The Lehmann discontinuity separates the inner core from the outer core.
5. Sedimentary rock is formed when sediments are solidified through chemical reactions. Igneous rock forms when molten rock solidifies.
6. Metamorphic rock starts out as either igneous or sedimentary rock and is then transformed by high temperature and pressure.
7. The extremes in temperature and pressure make the rock behave sometimes like a liquid and sometimes like a solid. That's why we call it plastic rock.
8. Scientists observe seismic waves, which are usually generated by earthquakes. The behavior of these waves tells us a lot about the makeup and properties of the mantle and core.
9. The inner core is solid because of pressure freezing. Even though the inner core is hotter than the outer core, it remains solid because the pressure is so great that it forces iron atoms close enough together to be solid.

10. The magnetic field is generated in the earth's core.
11. The magnetic field is caused by a large amount of electrical flow in the core.
12. The dynamo theory says that the motion of the core is due to temperature differences in the core and the rotation of the earth. This motion causes the motion of electrical charges in the core, which creates electrical current. The rapid-decay theory states that the electrical current in the core started as a consequence of how the earth formed and is decreasing over time.
13. The rapid-decay theory has been used to accurately predict the magnetic fields of other planets. The dynamo theory fails miserably at this.
14. The rapid-decay theory requires a global catastrophe in order to be consistent with the data that indicate the magnetic field of the earth has reversed several times.
15. The fact that the rapid-decay theory requires a catastrophe like the worldwide Flood and the fact that the rapid-decay theory indicates an earth 10,000 years old or younger tend to make many scientists shy away from it. This is unfortunate, as there are good reasons to believe both of them!
16. Without the magnetic field, cosmic rays from the sun would hit the earth. These rays would kill all life on the planet.
17. The plates are large "islands" of the earth's lithosphere. These plates float around on the plastic rock of the asthenosphere.
18. One plate can slide under another and form a trench; the plates can move away from each other, allowing magma to rise and create new crust; the plates can push against each other, causing the crust to fold; or the plates can slide along each other.
19. Pangaea is a hypothetical supercontinent that might have existed in earth's past. At one time, all the continents might have fit together to form this supercontinent.
20. Some good scientists ignore plate tectonics because it is typically linked to the idea of an earth that is billions of years old. This is unfortunate because there is no reason to believe that the continents always moved slowly. Indeed, in a catastrophe like a worldwide Flood, they could have moved very quickly.
21. Earthquakes are caused by the motion of rock masses along a fault or by volcanic activity.
22. In the elastic rebound theory, rock masses moving relative to one another get caught on the rough, jagged edges of the fault that lies between them. The rock masses start to bend as they keep trying to move. At some point, the stress becomes too great, and the moving rock breaks free, causing the rock masses on both sides of the fault to snap back into their original shapes. The resulting vibrations are what we feel as an earthquake.
23. For every one step up in the Richter scale, the energy of the earthquake multiplies by 32. The first earthquake measured 4, and the second measured 8. The second earthquake was 4 units higher, which means it released $32 \times 32 \times 32 \times 32 = 1,048,576$ times more energy than the first!

24. The four types of mountains are: volcanic mountains, domed mountains, fault-block mountains, and folded mountains. Volcanic and domed mountains need magma from the earth's mantle, fault-block mountains need vertical motion along a fault, and folded mountains need rock masses pushing against each other.