

Some Notes about Earthquakes

1. The epicenter of an earthquake is located on the Earth's surface directly above the place in Earth's interior where the earthquake was generated (known as the hypocenter or focus of the earthquake).
2. Displacement (a change in the shape) of the ocean floor during an earthquake is one cause of a tsunami.
3. Tsunamis get to be such tall, broad waves when they reach the shoreline because the entire water column, from the bottom of the ocean to the top, is in motion away from the place where the tsunami was generated, and this huge mass of water builds great waves as the seafloor shallows near the coastline.
4. Most earthquakes occur along or near plate boundaries.
5. Most, if not all, shallow-focus earthquakes in the crust are caused by frictional sliding along faults.
6. Deep-focus earthquakes are associated with the subduction of the lithosphere into the mantle.
7. The deepest earthquakes ever recorded are as deep as ~700 km.
8. It takes three geographically separate seismographs to locate an earthquake epicenter by triangulation.
9. The time difference between the first arrival of P and S waves at a given seismograph tells us the distance (but not the direction) from that seismograph to the epicenter.
10. The amplitude of the seismic signal recorded by a seismograph gives us information about the magnitude of the earthquake, once the distance to the epicenter is known.
11. A seismic body wave is an elastic wave that is able to pass through the solid interior of Earth.
12. P and S waves are seismic body waves.
13. S waves do not travel through liquid.
14. Surface waves cause most of the damage during an earthquake.
15. P waves are the fastest seismic waves, and so arrive at a distant seismograph first.
16. P waves can travel through the interior of Earth, through liquid, solid and gas.
17. Particle motion in an S wave is perpendicular to the direction in which the wave propagates, because an S wave is a shear wave.
18. Particle motion in a P wave is parallel to the direction in which the wave propagates, because a P wave is a compressional wave.
19. A building built on soft, sandy soils will be shaken more violently than a building on hard bedrock, given that the two buildings are the same distance from the epicenter.
20. In the process of liquefaction, an earthquake shakes loosely-packed (unconsolidated) fine/medium-grained sandy material that is saturated with water and the grains tend to reorganize into a more tightly packed mass and the excess water is pushed upward, resulting in phenomena such as sand volcanoes, ground-surface cracking and subsidence.
21. The primary cause of human death and injury during an earthquake is building collapse.
22. The primary tool that society uses to protect its citizens from death and injury due to earthquakes is proper enforcement of a well designed building code.
23. There is a significant chance of a damaging earthquake during the next 500 years near Los Angeles, Seattle, Memphis and Salt Lake City.
There is little significant chance of a damaging earthquake during the next 500 years near Chicago, New York, Dallas or Waco.
24. Most fires that damage urban areas after an earthquake are caused by spilled fuel used for heating/cooking and ruptured natural gas lines.
25. The name of the major plate-boundary fault in California is the San Andreas fault.
26. The San Andreas fault is not the only fault capable of producing large earthquakes in southern California. Other faults thought capable of producing magnitude ~7 earthquakes include the San Jacinto, Whittier-Elsinore, Newport-Inglewood, Palos Verdes, Malibu Coast, Hollywood, Sierra Madre, Cucamonga, and maybe the Puente Hills faults.
27. We know that Earth has a core because of the way seismic waves are reflected and refracted off of the core-mantle boundary.
28. We know that Earth has a liquid outer core because S waves do not pass through it.
29. We know that the density of the mantle increases with depth because of the time it takes for a P wave to travel through the mantle from an earthquake to a distant seismograph.

30. Given two chunks of the mantle, both of which are the same composition and are under the same pressure (because they are at the same depth) but chunk A is hotter than chunk B, chunk A will be less dense than chunk B.
31. The Mercalli intensity scale for earthquakes is useful in planning the locations of critical and sensitive facilities (hospitals, schools, police stations, fire stations, electrical and water-supply facilities, etc.) because it helps us map the areas that are most seriously affected by earthquakes.
32. The Mercalli intensity at a given location is determined based on the phenomena that people observe during the earthquake at that location: sights, sounds, damage, vibrations in surface water, etc.
33. If we define the energy difference between a Richter-style magnitude 1 earthquake and a magnitude 2 earthquake as equal to 30 screaming cheerleaders, the energy difference between a magnitude 5 earthquake and a magnitude 8 earthquake is $30 \times 30 \times 30$ screaming cheerleaders.