Figure 3.1 Tsunami “Triggers”
Four processes that can trigger a tsunami. Clockwise from upper left: volcanic explosion, underwater faulting, meteor impact, landslide. In order for a tsunami to be generated a large volume of water must be displaced. (NG)
The density of a material is the amount of that material contained in a “unit volume” such as a cubic centimeter (or cubic meter). In short, mass per unit volume or 

\[
\text{DENSITY} = \frac{\text{mass}}{\text{volume}}
\]

The material’s density can change because the amount of material within a fixed (or unit) volume can depend on its temperature. This is because temperature \( T \) change cause the material to expand or contract.
Figure 3.3 Earth Crustal Configuration

The relatively thin oceanic crustal layer and the thicker continental crustal layers “float” on the mantle below...they are said to be **isostatic equilibrium**. It is their layer thickness differences that cause the continental crust to rise higher out of the mantle relative to the thinner oceanic crust. The different densities of the rock material only make slight differences. The resulting ocean basin depression catches the water that runs off of the land. Note the ~ 20 times (20x) vertical exaggeration of this profile. (IIIO)
**Figure 3.4 Hydrostatic Equilibrium**
Any object placed in a fluid displaces a volume of fluid equal in mass to that of the object. When the density of the fluid is greater than that of the object, the volume displaced is less than the volume of the object, causing the difference to float above the surface of the fluid. (IIO)

**Figure 3.5 Floating Icebergs**
- **An Example**
The density of the two icebergs is approximately equal, the percentage of the icebergs above the water is also equal. With the one on the left having a larger mass, more water is displaced but also more of the iceberg lies out of the water. (IIO)
Figure 3.6 Ocean Basin Geographic Zones
The geographic zones of the North Atlantic are identified in the bird’s eye view of the sea floor above. Below is shown a vertically exaggerated profile of the ocean sea floor features along the transect A-B. (LEiO)

Figure 3.7 A bathymetric profile of the coastal margin.
A more detailed picture of the radical changes in ocean depth near the edge of the North Atlantic ocean Basin. The relatively flat regions of the abyssal plain transition into the slightly steeper continental slope region, even steeper continental slope, and finally to the relatively flat and shallow continental shelf region. Note how the vertical exaggeration of the profile help to highlight the different features. (LEiO)
Figure 3.8 Plate Movement and Ocean Hazards
The Earth’s crust is composed of twelve major plates (named above), whose boundaries are moving as indicated by the orange arrows. Note the regions of plate divergence - usually along mid ocean ridges - and plate convergence - usually associated with ocean trenches. Earthquakes (black dots) silhouette some of these boundaries, with greater concentrations along active convergent zones, and lesser concentrations along active divergent zones. Along with the earthquake hazard is also the possibility of the tsunami hazard. Volcanism is also associated with the earthquake hazard. (lTo)
Figure 3.9 Plate Movement and Earthquakes
The San Andreas Fault in California (right) is a transform fault that is actually part of a spreading center in the Pacific that has been "overrun by the expanding North American Plate. Southern and Baja California are moving northward relative to the rest of California. (ItO)

Figure 3.10 Earthquake Hazard
Movement along the San Andreas Fault in 1989 (left) caused considerable damage and loss of life in the Oakland/San Francisco area of California (right). (ItO)
Figure 3.11 historical Continental Configurations
(top) Pangaea about 200 million years before present (MYBP);
(middle) 65 MYBP; and (bottom) present. The movement of the continents is indicated by the arrows.
Figure 3.12 Present Day plate Configuration
Major lithospheric plates and their boundaries. The plates are rigid lithosphere about 100 kilometers thick. They are in constant motion, and they interact with one another based upon their relative motion. At divergent boundaries, plates move apart and new crust is created. The spreading centers at mid-ocean ridges are divergent boundaries. At convergent boundaries, plates move together and one plate plunges under the other in the process of subduction. Thus, new crust is created at divergent boundaries and old crust is destroyed at convergent ones. Plates that slip horizontally past one another form the third type of boundary, known as a transform fault. [From Eldridge M. Moores, Editor, Shaping the Earth: Tectonics of Continents and Oceans; Readings from Scientific American, W. H. Freeman and Company, New York]
The Ocean Sea Floor is formed
Along the Mid-Ocean Ridge Spreading Centers

The Ocean Sea Floor is destroyed in the Subduction Zones