

GLG 101 – CHAPTER 11 - EARTHQUAKES

- **Earthquakes** are vibrations of Earth produced by the rapid release of energy from rocks stressed to the point that they undergo brittle fracture. The energy radiates in all directions from the **focus** (point of rupture) in the form of vibrational (**seismic**) waves. Movement is typically concentrated along large fractures called **faults**, often associated with plate boundaries. Most earthquakes occur along the mid-oceanic ridges and along the “Pacific Rim”.
- Earthquakes are the act of rocks attempting to their equilibrium shape after being highly stressed. This is also known as **elastic rebound**. Readjustments (*along the same fault*) after the main quake are known as **aftershocks**.
- **Seismic waves** are of two main types: (1) **surface waves**, which travel along the outer surface of the Earth, and (2) **body waves**, which travel through the Earth’s interior. The body waves are subdivided into **primary**, or **P waves**, and **secondary**, or **S waves**. P waves push and pull the rocks parallel to the direction the wave is travelling, whereas S waves shake the ground at right angles to the direction the wave is travelling. Both solids and fluids (liquids and gases) transmit P waves. Solids only transmit S waves. In solids, the P wave travels about 1.7 times as fast as the S wave.
- The location on the Earth’s surface directly above the focus is called the **epicenter**. The epicenter location can be determined using the difference in speeds between the P and S waves to find distances from observational stations to the Earthquake’s location. By using three or more such stations, overlapping circles (with radii equal to the distances from the Earthquake to the stations) can then be drawn to determine the epicenter location. This technique is known as **triangulation**.
- Earthquake **intensity** (measured on the **Mercalli** scale) refers to the amount of shaking felt in a location at the surface. This depends on the Earthquakes **magnitude** (how much energy was released), the distance to the epicenter, and the types of rock and soil locally. The amount of damage produced will depend on the intensity and the local building materials and design. Earthquake **magnitude** is based on the **Richter Scale**, which measures the largest recorded wave amplitude (as recorded by a seismograph). The scale is logarithmic, so that the amplitude of a Magnitude 6 earthquake is ten times that of a Magnitude 5 earthquake (and so on – ten times different for each 1-point difference on the scale). The energy released by a Magnitude 6 quake is about 32 times that of a Magnitude 5 quake (and so on – 32 times different for each 1-point difference on the scale).
- **Tsunamis** are large waves produced by undersea quakes. The vibrational energy of the quake gets transmitted very rapidly through the ocean waters, sometimes producing a large amplitude seismic (not “tidal”) wave on surrounding shores. These waves can occur many thousands of kilometers from the epicenter, so the entire Pacific Rim is on alert after a major quake in that region.
- Much research is being conducted to try and **predict** the occurrence of Earthquakes. We are not yet able to give short-term warnings that a quake is about to occur. However, it is possible to use both historic earthquake patterns and recent activity to assess the likelihood or general risk of a large quake occurring over the next several decades in a given area. Although this will not allow for (the ultimate goal) evacuation and short-term disaster relief, it does provide for building codes and long-term planning that can ultimately minimize the loss of life and property that occur during a large quake.

