Physics 109: Homework #7 Solutions

7.1 P- and S-waves are seismic waves that move outward from the site of an earthquake and can be detected by a seismograph. P-waves are pressure waves that alternately expand and compress the material medium through which they move. P-wave vibrations occur in the direction of the wave motion. On the other hand S-waves are shear waves that cause side-to-side motion of the medium, something like the vibration of a guitar string. S-wave vibrations are perpendicular to the direction of the wave motion. Studying these waves can tell us about the interior structure of the Earth.

7.2 Earthquakes and volcanos are evidence that the Earth is geologically active. Much of this activity arises from the motion of crustal plates popularly known as "continental drift." Plate tectonics is the study of this motion. The motion of the crustal plates is believed to be due to convection in the semi-solid layer of the mantle called the aesthenosphere. The ultimate energy source of this geological activity is the heat from accretion and radioactivity that flows through the Earth's mantle.

7.3 The nitrogen came mostly from outgassing by volcanos. The oxygen was generated by living organisms through photosynthesis. These are the major constituents of the atmosphere because the other common volcanic gases either escaped into space (hydrogen), condensed to form oceans (water), or dissolved in the oceans (CO_2).

7.4 We must be in the penumbral shadow of Venus, because the Sun is not totally eclipsed by the planet. During a total solar eclipse, the Earth would appear full when viewed from the Moon.

7.5 The Earth's rotation will slow down due to tidal friction. Likewise tidal friction causes the Moon to recede from the Earth. Given enough time the Earth's rotation rate will synchronize with the Moon's orbital period so that the same side of the Earth will face the Moon (as only one side of the Moon faces the Earth now).