ASTR120 Homework #6 – (Hamilton)
due Thursday Oct. 25 (20 Points)

Finish reading Chapters 9 and 10! **These first six problems are from Chapter 9.**

30. On average, the temperature beneath the Earth's crust increases at a rate of 20°C per kilometer. At what depth would water boil? (Assume the surface temperature is 20°C and ignore the effect of the pressure of overlying rock on the boiling point of water.)

31. What fractions of Earth's total volume are occupied by the core, the mantle, and the crust?

36. The oldest rocks found on the continents are about 4 billion years old. By contrast, the oldest rocks found on the ocean floor are only about 200 million years old. Explain why there is such a large difference in ages.

39. Describe how the present-day atmosphere and surface temperature of the Earth might be different (a) if carbon dioxide had never been released into the atmosphere; (b) if carbon dioxide had been released, but life had never evolved on Earth.

41. Earth's atmospheric pressure decreases by a factor of one-half for every 5.5-km increase in altitude above sea level. Construct a plot of pressure versus altitude, assuming the pressure at sea level is one atmosphere (1 atm). Discuss the characteristics of your graph. At what altitude is the atmospheric pressure equal to 0.001 atm?

43. Antarctica has an area of 13 million square kilometers and is covered by an icecap that varies in thickness from 300 meters near the coast to 1800 meters in the interior. Estimate the volume of this icecap. Assuming that water and ice have roughly the same density, estimate the amount by which the water level of the world's oceans would rise if Antarctica's ice were to melt completely (see Figure 9-31). What portions of the Earth's surface would be inundated by such a deluge?

These next two problems are from Chapter 10.

26. Suppose two worlds (say, a planet and its satellite) have masses m_1 and m_2, and the center-to-center distance between the worlds is r. The distance d_{CM} from the center of world 1 to the center of mass of the system of two worlds is given by the formula

$$d_{CM} = \frac{m_2 r}{m_1 + m_2}$$

(a) Suppose world 1 is the Earth and world 2 is the Moon. If the Earth and Moon are at their average center-to-center distance, find the distance from the center of the Earth to the center of mass of the Earth-Moon system. (b) Is the Earth-Moon system's center of mass within the

Earth? How far below the Earth's surface is it located? (c) Find the distance from the center of the Sun (mass 1.989×10^{30} kg) to the center of mass of the Sun-Earth system. How does this compare to the diameter of the Sun? Is it a good approximation to say that the Earth orbits around the center of the Sun?

27. If you view the Moon through a telescope, you will find that details of its craters and mountains are more visible when the Moon is near first quarter phase or third quarter phase than when it is at full phase. Explain why.