Physics I (Spring 2013)

Problem Set 1 - due to 15 March 2013

1)Antarctica is roughly semicircular, with a radius of 2000 km. The average thickness of its ice cover is 3000 m. How many cubic centimeters of ice does Antarctica contain? (Ignore the curvature of Earth.)

2)Suppose that, while lying on a beach near the equator watching the Sun set over a calm ocean, you start a stopwatch just as the top of the Sun disappears. You then stand, elevating your eyes by a height $H = 1.70$ m, and stop the watch when the top of the Sun again disappears. If the elapsed time is t $t = 11.1$ s, what is the radius r of Earth?

3)A vertical container with base area measuring 14.0 cm by 17.0 cm is being filled with identical pieces of candy, each with a volume of $50.0 mm^3$ and a mass of $0.0200 g$. Assume that the volume of the empty spaces between the candies is negligible. If the height of the candies in the container increases at the rate of 0.250 cm/s, at what rate (kilograms per minute) does the mass of the candies in the container increase?

4)An astronomical unit (AU) is equal to the average distance from Earth to the Sun, about $92.9106 mi$. A parsec (pc) is the distance at which a length of $1 AU$ would subtend an angle of exactly 1 second of arc (Fig. 1-8). A light-year (ly) is the distance that light, traveling through a vacuum with a speed of $186000 mi/s$, would cover in 1.0 year. Express the EarthSun distance in (a) parsecs and (b) light-years.

5)One molecule of water H_2O contains two atoms of hydrogen and one atom of oxygen.A hydrogen atom has a mass of 1.0 u and an atom of oxygen has a mass of 16 u, approximately. (a) What is the mass in kilograms of one molecule of water? (b) How many molecules of water are in the worlds oceans, which have an estimated total mass of $1.4 \times 10^2 1$ kg?

6)An astronomical unit (AU) is the average distance between Earth and the Sun, approximately 1.50×10^8 km. The speed of light is about 3.0×10^8 m/s. Express the speed of light in astronomical units per minute.

7)The worlds largest ball of string is about 2 m in radius. To the nearest order of magnitude, what is the total length L of the string in the ball?