PHYSICS 113
Assignment #4
SOLUTIONS

Chapter 6

2. Make a sketch of the Sun's atmosphere showing the locations of the photosphere, chromosphere, and corona. What is the approximate temperature of each region?

The photospheric layer has a temperature of between ~4000K - 10000K and extends about 1000km above the top of the convection (granulation) zone. The chromospheric layer has a temperature of between ~ 7000K - 15000K and extends about 2000km above the photospheric zone. The corona has a temperature of more than one million Kelvin and extends many thousands of kilometres above the chromosphere. To see a sketch, look at Figures 6.1 or 6.5 in the text.

3. Why do sunspots look dark?

Sunspots are caused as a result of magnetic fields breaking through the convective zone near the surface of the sun. Since the gas in these sunspots is COOLER than the gas in the surroundings, sunspots are cooler and therefore look darker than other regions on the surface of the sun.

17. Suppose an eruptive prominence rises at a speed of 150 km/sec. If it does not change speed, how far from the photosphere will it extend after 3 hours? How does this distance compare with the diameter of the Earth?

In 3 hours, there are 3 x 60 x 60 = 10800 seconds. Since the distance that something moves is just equal to its speed times the elapsed time ($d = v\,t$), thus

d= (150km/s) (10800s)= 1,620,000 km = 1.62 x 10^6 km

(We will ignore the distance between the photosphere and the corona since it is small by comparison [3000 km].) Since Earth has a diameter of about 13,000km, the number of Earth diameters that the prominence traveled is 1,620,000km/13,000km ~ 125. Thus the distance is approximately 125 times that of the diameter of the Earth.