Physics 127 Descriptive Astronomy Homework #1 Key (Chapter 1) Fall 2015

1-3. How are constellations useful to astronomers? How many stars are not part of any constellation?

Knowing the constellation of a star enables an astronomer to know immediately in what part of the sky that star is located. That lets the astronomer know (1) if a star can be observed from a particular observatory and (2) during what time of year that star best observed. Every star in the entire sky belongs to some constellation as the while sky is broken into constellations.

1-5. Why are different stars overhead at 10:00 pm on a given night than two hours later at midnight? Why are different stars overhead at midnight on June 1 than at midnight on December 1?

The earth rotates about its axis about once each 24 hours so it turns 15° every hour. Thus at midnight on any day the earth has rotated about 30° or 1/12 of a turn from its position of 10 pm on that same night. Thus stars which were overhead at 10 pm are 30° or two hours of right ascension west of stars which are overhead at midnight. As the earth orbits about the sun observers whose clocks say midnight are turned directly away from the sun, but on December 1 the earth is in an orbital position on almost exactly the opposite side of the sun from where it was on June 1. Thus midnight observers on December 1 are looking at stars in almost the opposite half of the sky from those they looked at midnight on June 1.

1-7. Where would you have to look to see your zenith?

One would look straight up.

1-8. How do the stars appear to move over the course of the night as seen from the north pole? As seen from the equator? Why are these two motions different?

From the NP the stars would appear to move left to right (westward) in small circles parallel to the horizon, centered on the zenith. (A star exactly on the horizon would move in a great circle.) These circles would be relatively large for stars near the horizon and progressively smaller for stars at greater altitudes. No star would ever move higher or lower in the sky and no star would rise or set (except the sun which would do so seasonally). From the equator all stars would rise in the eastern half of the sky and set in the western half of the sky along a small circle trajectory which would be perpendicular to the horizon at both the rising and the setting of each star regardless of where it rose or set. Every star would spend 12 hours above the horizon and 12 hours below the horizon each day. The track of each star would be a small circle, just as it would when seen from the NP but the center of that track would be the north point of the horizon for stars in the northern half of the sky and the south point of the horizon for stars in the southern half of the sky. The size of each star’s small circle of motion would be the same as it would be if that same star were viewed from the NP. However, as seen from the equator, exactly half of that small circle would be above the horizon and half below the horizon for every star in the sky. These motions would appear very different from the NP and the equator because the axis of those small circles of motion would pass through the zenith and nadir for an observer at the NP and through the north and south points of the horizon for an observer on the equator.