Part I: Looking North

For the activity, imagine that you are the observer shown in the northern hemisphere and that it is 6 PM. Looking north, the sky will appear as shown in Figure 1. The positions and motions of the stars in Figure 1 can be understood by imagining yourself as the observer at the center of the celestial sphere as shown in Figure 2. In the celestial sphere model, Earth is stationary and the stars are carried on a sphere that rotates about an axis through the North Star. Note that only the portion of the celestial sphere that is above your horizon is shown.

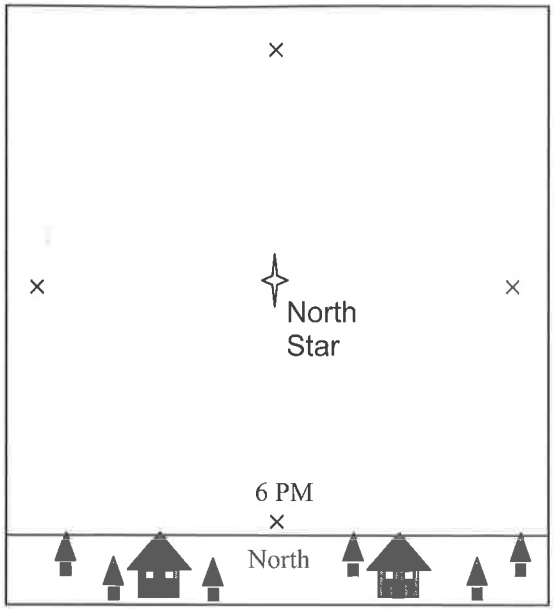

Figure 1

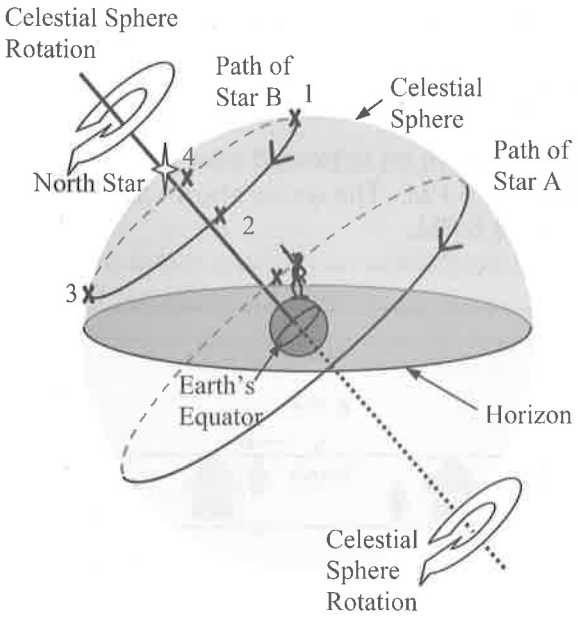

Figure 2

The ×'s in both figures represent four of the positions through which Star B will pass during the course of one revolution of the celestial sphere. Ignore Star A until question 5.

1) Note in Figure 1 the position of Star B at 6 PM. Circle the numbered position (1, 2, 3, or 4) in Figure 2 that corresponds to the location of Star B at 6 PM.

2) The rotation of the celestial sphere carries Star B around so that it returns to the same position at about 6 PM the next evening. Label each of the ×'s in both figures with the approximate time at which Star B will arrive (e.g., the location you circled in question 1 will be labeled "6 PM").

3) Using Figure 2, describe the direction you have to look to see Star B at 6 AM.

4) The position directly overhead is called the **zenith**. Label the direction of the zenith on Figure 2. How does the direction of the zenith compare to the direction that you identified in question 3?

5) Using Figure 2, describe in words the position of Star A halfway between rising and setting.

6) In Figure 1, use a dotted line to draw the entire path that Star B takes over the course of 24 hours. Next, draw an arrowhead on the path you just drew to represent the direction Star B would be moving when at each of the four locations marked with an ×. Check your answers with a nearby group.

Part II: Looking East

Figure 3 shows an extended view along the eastern horizon showing the positions of Stars A and B at 6 PM. The arrow shown is provided to indicate the direction that Star B will be moving at 6 PM.

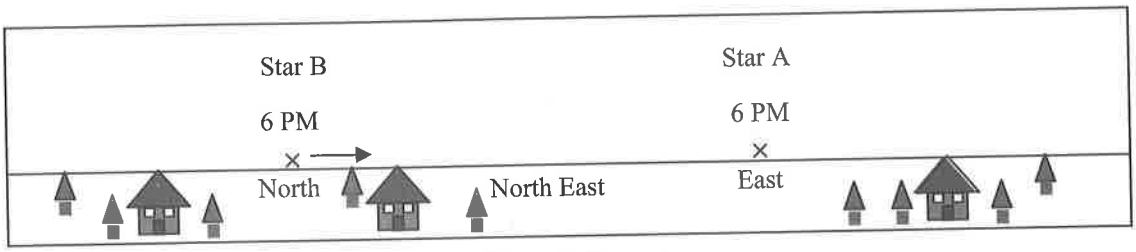

Figure 3

7) Recall that in question 5, you found that Star A ends up high in the southern sky halfway between rising and setting (and therefore never passes through your zenith). Draw a straight arrow at the × in the east in Figure 3 (the position of Star A at 6 PM) to indicate the direction Star A moves as it rises. Studying Figure 2 can also help clarify your answer.

8) Two students are discussing the direction of motion of a star rising directly in the east.

Student 1: *Stars move east to west so any star rising directly in the east must be moving straight up so that it can end up in the west. If the arrow were angled, the star would not set in the west.*

Student 2: *I disagree. From Figure 2, the path of Star A starts in the east, swings through the southern sky yet still sets in the west. To do this it has to move toward the south as it rises so I drew my arrow angled to the right.*

Do you agree or disagree with either or both of the students? Why?

9) Imagine you could see Star B at noon. Fifteen minutes later, in what direction will Star B have moved? Explain your reasoning.

10) Consider the student comment below.

Student: *The amount of time that all stars are visible above the horizon is 12 hours because it takes 12 hours for a star to rise in the east and then set in the west.*

Do you agree or disagree with this student statement? Why?

Consider the situation shown below in which the Sun and a group of constellations are shown at sunrise, Figure 4, and then shown again 8 hours later, Figure 5.

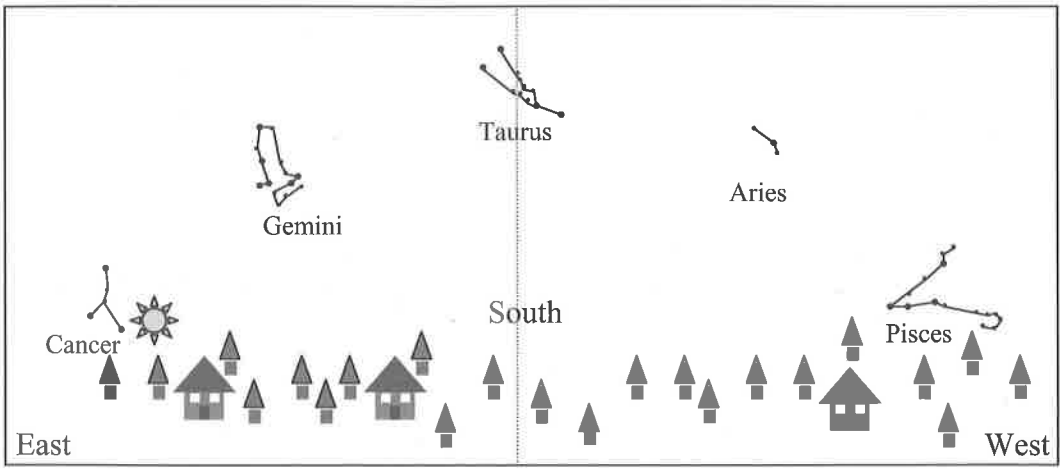

Figure 4

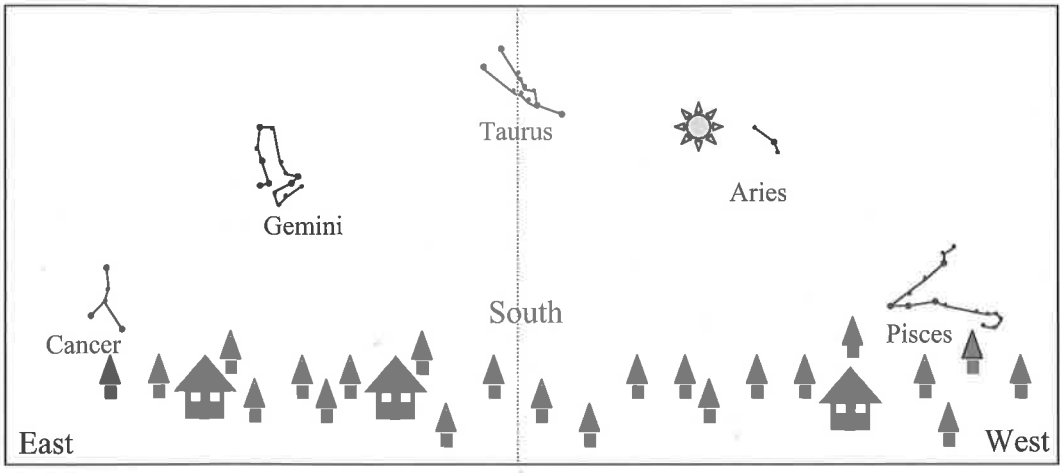

Figure 5

11) Consider the following debate between two students regarding the motion of the Sun and constellations shown in Figures 4 and 5.

Student 1: *We know the Sun rises in the east and moves through the southern part of the sky and then sets in the west. Eight hours after sunrise, it makes sense that the Sun will have moved from being on the eastern horizon near the constellation Cancer to being located high in the southwestern sky near the constellation Aries.*

Student 2: *You're forgetting that the stars and constellations also move from the east through the southern sky and to the west just like the Sun. So, the Sun will still be near Cancer eight hours later. So Figure 5 is drawn incorrectly. It should show that the constellations have all moved like the Sun, so Cancer would also be located high in the southwestern sky, with the Sun, eight hours later.*

Do you agree or disagree with either or both of the students? Why? Check your answers with a nearby group.

12) In question 11, we found that Figure 5 was drawn incorrectly. Redraw Figure 5 in the box below by sketching the approximate location of the Sun and any constellations from Figure 5 that would still be visible.