Name: _____

Date: _____

Section: _____

Astron 104 Laboratory #2
The Celestial Sphere

Basic Setup

The celestial sphere can be an exact model of the heavens in relation to your location on Earth. To achieve this, three simple steps are required.

1. Use the degree scale and grid system on the celestial globe to set the angle between the North Celestial Pole (NCP, which is near Polaris) and North Horizon (the cardinal points appear on the plastic base) to be equal to the desired latitude. Be sure not to just read off the angle from the metal meridian. You should measure the angle from the NCP. To bring your location on the World Globe to the top, you rotate the World Globe with the white knob at the South Pole so that you are pointing toward the zenith.

2. Line up the date and hour dials at the North Pole with the date and hour of the observation. Rotate the Celestial Globe until the date of observation on the date dial printer on the globe lines up with the hour of observation on the hour dial on the axis. *The hour dial should always be fixed to the axis with midnight always pointing to the zenith. If the hour dial is not fixed in this position, it should be reset by lifting the whole celestial sphere and repositioning it.* During daylight savings time (DST), set the time to be one hour earlier. It may be necessary to hold the knob at the South Pole so that the World Globe does not rotate while you turn the outer Celestial Globe. This will ensure your location on the World Globe remains at the zenith.

3. The movable yellow Sun located between the Star Globe and the Earth can be positioned for any given date along the ecliptic to show its relationship to Earth. Rotate the Sun pointer knob at the North Ecliptic Pole until the Sun is in line with the correct date on the ecliptic.

Altitude and Azimuth

To locate a star in the sky, we can use the horizon of the observer as a reference. **Azimuth** is the equivalent of a compass direction, with 0° pointing North and 90° pointing East. **Altitude** is an indication of how far above (+) or below (−) the horizon an object is.

Your Relationship to the Universe

Once the Globe has been set for the place and time as outlined above, it becomes an actual model of the sky showing the stars and constellations in their correct positions. If you look through the transparent Celestial Globe, you will see the positions of the stars as seen from your location. For example, set the Globe for Milwaukee (latitude 43° N) at 10 pm on October 15. Then look through the Globe from the South toward the North Pole. Note that the Big Dipper is lying along the North Horizon, and Cassiopeia is above the North Star (Polaris is very close to the North Celestial Pole). *If you don't see these constellations in these locations, please ask for assistance.* Now rotate the Celestial Globe to 11 pm and notice that the stars appear to move in a counter-clockwise direction around the North Star.

Stars below the horizon are not visible. For a northern observer, the stars near the North Star will *never* go below the horizon while stars near the South Celestial Pole will *never* rise above the horizon. Other stars are visible between their rise and set times.

Apparent Motion

Our field of view as we look into the sky is determined by the time of day, the time of year, and your location on Earth. To demonstrate the fact that different stars are visible from different times and places, set the Globe for your location at 10 pm on December 15. Notice the *constellations* visible at that time. Then set the Globe for 10 pm on March 15, June 15 (DST), and September 15 (DST). Notice the seasonal changes. Record the constellation nearest the zenith for each of those dates:

Date	**Dec 15, 10pm**	**Mar 15, 10pm**	**Jun 15, 10pm**	**Sep 15, 10pm**
Constellation nearest zenith				

Now rotate the Earth Globe form West to East one complete rotation with the knob at the South Celestial Pole. Notice that different sections of the sky are visible from your location throughout the day and night. When looking at the night sky, the stars appear to move from East to West. However, it is the rotation of the Earth from West to East that causes this apparent motion of the stars.

1. Determine what bright stars are visible from the North Pole, the equator, and the South Pole.

2. Find the location of Ursa Major (containing the Big Dipper) for 10pm on July 15 (DST) and 10pm on January 15 from your location. Double check that midnight on the hour dial is pointing toward the zenith. To indicate the location you should record the altitude and azimuth of Ursa Major on those dates.

Date	**Jul 15, 10pm**	**Jan 15, 10pm**
Azimuth		
Altitude		

3. Where will the star Vega (in Lyra) be at 10 pm on January 15? Will it be visible from your location?

4. What constellations are never visible from your location? And which bright stars are always visible in the evening and do not rise or set?

5. Find the time of sunrise and sunset for December 23 and June 5 (DST) at your location. Determine the length of the day for each date.

Date	Dec 23	Jun 5 (DST)
Sunrise		
Sunset		
Length of day		

6. What is the Sun's highest altitude above the horizon in Milwaukee for today?

7. Set the Globe for 0° (equator) and find the times of sunrise and sunset for December 23 and June 5.

Date	Dec 23	Jun 5
Sunrise		
Sunset		

8. Set the Globe for Sydney, Australia (−35°) and determine whether or not it will be dark at 6pm on November 2.