

Name _____

Section _____

Partners(s) _____

Date _____

NAVIGATING THE STARS USING THE CELESTIAL SPHERE

After your instructor has shown you how to set your position on the celestial sphere, answer the following questions.

1. Set each of the following dates (use the Sun knob at top) and the time at noon (Sun directly over break in horizon ring) given in the table below. Determine the following:
 - ' the maximum altitude above your horizon of the Sun at noon
 - ' the length of daylight hours (Sun is above your horizon) Each 15E longitude on Earth is 1 hour or change in time zone.
 - ' at what latitude the Sun is directly overhead on Earth

Date	Solar Altitude	Number of Daylight Hours	Sun Overhead (Latitude)
22 September			
22 December			
22 March			
22 June			

2. Set today's day with the time at midnight. Answer the following:

Name a rising constellation: _____

Name a setting constellation: _____

Name an object at your zenith:
(directly overhead) _____

3. Rotate the Earth from dusk to dawn for today's date and find:

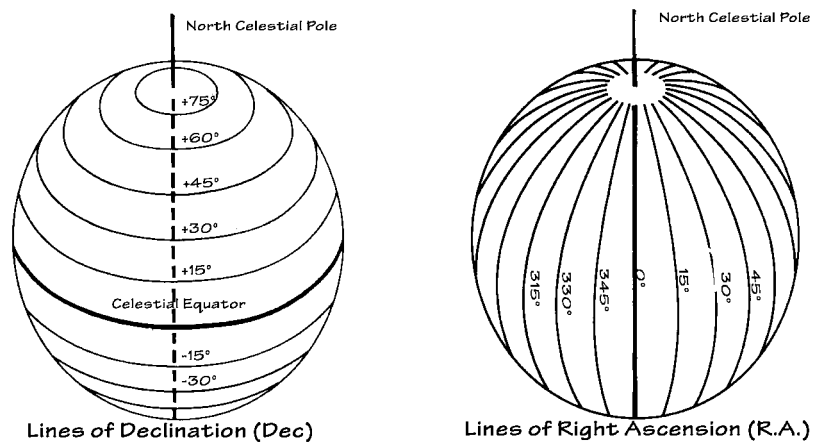
A constellation that will remain up all night: _____

A constellation that will not be in view: _____

4. Locate the celestial sphere that is set as if you were an observer at one of the polar regions on December 25th. Rotate the Earth from dusk to dawn and observe the polar regions of the Earth. Describe the light conditions at the north and south poles.

If you were standing on the Earth's north pole, how would you describe the location of Polaris?

Notice the grid system on the sphere. It should remind you of the Earth-based latitude and longitude lines! There is a similar system for locating celestial objects. Celestial longitude lines are called **lines of right ascension (RA)**. Celestial latitude lines are called **lines of declination (DEC)**. Objects south of the celestial equator have negative declinations while objects to the north have positive declination values.



The right ascension is measured in hours and minutes but declination is measured in degrees and minutes. The declination of the celestial equator is zero (0E) like the Earth's equator. The north celestial pole and south celestial pole have values of +90E and -90E respectively.

5. What is located at each of the celestial poles?

6. Identify the stars found at the celestial coordinates given in the table below.

Stars	RA	DEC	Identity
1	11h 04m	62E	
2	10h 08m	12E	
3	06h 20m	-53E	

7. Determine the right ascension and declination of the following stars:

Star	Constellation	RA	DEC
Rigel	Orion		
Sirius	Canis Major		
Regulus	Leo		
Antares	Scorpius		
Deneb	Cygnus		

Look on the sphere near the celestial equator. You should be able to find a line that is offset from the equator. Names of the months and dates are labeled on this line which is called the **ecliptic**. The ecliptic is the apparent path the Sun follows among the stars.

8. On what two dates do the celestial equator and the ecliptic cross? These dates are called the equinoxes. Why?

9. Which equinox is the zero line for right ascension?

10. Locate the points where there is the greatest separation between the ecliptic and the celestial equator. What dates are these? These dates are called the solstices.

11. What is the maximum angle of separation between the ecliptic and celestial equator?
This is the tilt of Earth's axis

12. Are the planets represented on this sphere? Why or why not?

Recall that the word planet means “wanderer.” Planets change their positions with respect to the stars because of their orbits around the Sun. Astronomers know the right ascension and declination of each planet at any given time and can pinpoint a planet's current position with respect to the star field with this information. The long-term “wandering” of the planets among the stars is not related to the Earth's daily rotational motion.

13. Using the planetarium program available in the laboratory, get the coordinates of Jupiter for tonight.

Date _____ RA _____ Dec _____

What constellation would Jupiter be in?

Would it be visible to you during evening hours (6 pm to 6 am)?

If it is visible tonight, see if you can find it!

14. As you look at the ecliptic plane starting on January 1st, trace around the ecliptic and label the various constellations that you are in during the year. Remember the constellations are outlined with dashed blue lines on the celestial sphere. Make a list of the constellations with their range of dates.

Constellation	Date Range

Are these constellations familiar to you? Why?

You just toured through the signs of the zodiac based on modern observations.

15. Look up the dates for the signs of the zodiac in the *Washington Post* or *Washington Times*.

Sign of the Zodiac	Date Range

According to the newspaper, how long should the Earth be in each sign?

16. Do you see a problem with the zodiacal signs when you compare the celestial sphere with the newspaper? Explain.

Astrologers put great faith into the signs of the zodiac and yet even these are incorrect based on modern observations. The original signs of the zodiac were determined a few thousand years ago. Since that time the orbital parameters of the Earth have shifted slightly. This has changed our view of the stars.