Celestial Sphere Lab
Astronomy 25

Purpose:
To illustrate the celestial sphere, coordinate system, ecliptic, equinoxes and solstices.

Apparatus:
Celestial sphere

Introduction:
Examine the celestial sphere and locate the Big Dipper. Try to visualize it by imagining that you are at the center of the globe looking out. This is the way it would appear in the night sky. Notice that the sphere is pivoted at the North Celestial Pole (NCP) and at the South Celestial Pole (SCP). These are the points in the sky resulting from the intersection of the Earth's Polar Axis and the Celestial Sphere. Halfway between the celestial poles lies the Celestial Equator, the intersection of the plane of Earth's equator and the Celestial Sphere.

Notice that the Moon and planets are not shown on the globe. They do not have fixed positions on the Celestial Sphere. The apparent path of the Sun, called the Ecliptic, is shown inclined $23\frac{1}{2}°$ to the Celestial Equator. This is what causes our seasons. The Ecliptic might also be thought of as the projection of the Earth's orbit onto the Celestial Sphere. Months and days of the year are marked off along the Ecliptic so that you can locate the position of the Sun on any day of the year.

As the Sun moves Eastward along the Ecliptic, it eventually crosses the Celestial Equator as it goes from the southern half of the sky into the northern half. This point of intersection is called the Vernal Equinox and the Sun arrives there around March 21.

Procedure:
Answer all questions on a separate piece of paper to turn in next week. No trick questions! Read them all at face value. Questions 1 - 7 were answered in class. Neatness counts!

(1) Move the Sun until it appears to be at a point on the Ecliptic that corresponds to your birthday. a) Write your birthday and the Constellation you find this point to be in. b) Is this the "sign" you usually associate with your birthday? c) If not, what is?

(2) Find the following dates: a) When the Sun is at its highest point in the northern sky, b) when the Sun is at its lowest point in the southern sky and c) when the Sun is on the Celestial Equator (two dates here.)

(3) Find the Declinations of the following: a) the Celestial Equator, b) the North Celestial Pole, and c) the South Celestial Pole.

(4) Find the Right Ascension line marked "0 Hours". Note: a) Where it crosses the Celestial Equator. b) What do we call that point? Place the Sun at this point. c) Record the approximate Date and the Right Ascension and Declination of the Sun.

(5) Move the Sun along the Ecliptic, forward in time. Find the approximate Dates, Right Ascensions and Declinations of the Sun when it is at the a) Vernal Equinox, b) Summer Solstice, c) Autumnal Equinox and d) Winter Solstice. (12 answers here.)

(6) Determine the Declination of the Zenith point. Is there any relation between the Latitude of your position (Use 34° for Mission Viejo) and the Declination of your Zenith point?

(7) Move the Sun to either Equinox point. Find the Sun's relation to the Equator of the Earth to the Celestial Equator.

(8) Move the Sun to the Winter Solstice point. Turn the Earth so that your location on the Earth is facing the Sun as directly as possible (meridian). How high is it above the Horizon (not the Equator)? (Draw a diagram to illustrate this.)

(9) With the Sun still on the Winter Solstice, rotate the Earth so that your location on the Earth is facing away from the Sun. What Constellation is almost directly opposite the Sun? (Remember to pick one of the 12 Zodiacal Constellations.)

(10) Move the Sun to the Summer Solstice and answer the same question as in (9).

(11) Why do the Constellations change from season to season. (Hint: Earth's tilt is not the answer.)

(12) Draw a diagram showing why the Sun is higher in the sky at the Summer Solstice than at the Winter Solstice.

(13) Imagine two observers, one at the North Pole and the other at the South Pole of the Earth. Which stars can they both see? (Assume a very slight overlap due to atmospherics.)