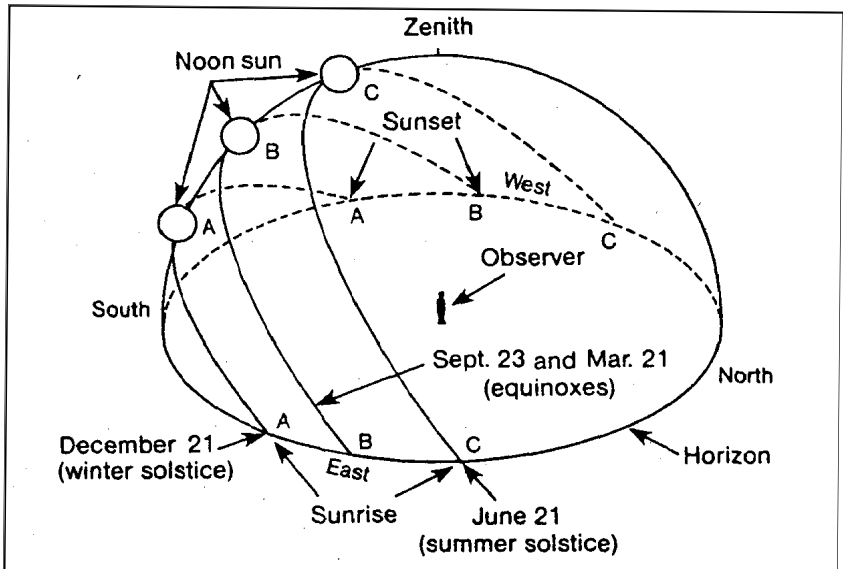
The Sun's Path Across the Celestial Sphere Lab

Name _____

Introduction: The Sun's *apparent* path through our sky varies over the course of a year. This is because of the *tilt* of Earth's axis, Earth's *revolution* (orbit) around the Sun, and the *parallelism* of Earth's axis (the North Pole always points in the same direction—toward Polaris). The apparent paths at a particular location depend on the latitude of the location. The annual variations have a direct effect on the angle, duration and intensity of insolation received over the course of a year. This in turn has a direct effect on the daily and seasonal average temperature variations.

Purpose: to demonstrate the relationships between the Sun's path across the sky and the daily and seasonal variations in angle of insolation, duration of insolation, and average temperature at the Earth's surface in Ballston Spa.



Apparent paths of the Sun across the sky throughout the year at Syracuse, New York.

Materials: celestial sphere, curve protractor, masking tape, ***erasable*** markers

Procedure:

1. Using the protractor, measure 23.5^0 altitude up from the S (south horizon), and make a mark on the globe with an erasable marker.
2. Make marks at the 47.0^0 and the 70.5^0 altitudes also.
3. Draw the Spring and Fall Equinox paths using an **overhead (erasable) marker:** draw a straight arc from the E (east horizon) to the 47^0 mark, and continuing on to the W (west horizon). Label this line "March 21 / Sept 23."
4. Now draw the Winter Solstice path: a line *parallel to the first line* and running through the 23.5^0 mark. Label this line "Dec. 21."
5. Draw the Summer Solstice path: a line *parallel to the other lines* and running through the 70.5^0 mark. Label this line "June 21."
6. Fill in the Chart A (on the back) using the answers given.
7. Answer the questions on the back, then answer the Conclusion question.
8. After answering the questions, erase the marks you made on your celestial sphere under running water (not the N, S, E or W), and return your materials to where you got them.

CHART A

APPROXIMATE DATE	LATITUDE OF SUN'S DIRECT RAYS	DIRECTION OF SUNRISE IN BALLSTON SPA	DIRECTION OF SUNSET IN BALLSTON SPA	ALTITUDE OF NOON SUN IN BALLSTON SPA	APPROXIMATE PERIOD OF DAY-LIGHT IN BALL-STON SPA	APPROXIMATE AVERAGE DAILY TEMPERATURE IN BALLSTON SPA
March 21 (Spring Equinox)						
June 21 (Summer Solstice)						
September 23 (Fall Equinox)						
December 21 (Winter Solstice)						

10^0C	8.5 hours	Due East	12 hours	23.5^0N (Tropic of Cancer)	0^0C	70.5^0	Just N of E	12 hours	23.5^0S (Tropic of Capricorn)	Just S of E	Due East
23.5^0	0^0	10^0C	Just N of W	Just S of W	47^0	Due West	0^0	47^0	Due West	20^0C	15.5 hours

Questions:

1. In what direction is the Sun at solar noon?

2. On all of the dates in Chart A, at what time of day is the Sun at its highest altitude?

3. On what date does Ballston Spa experience the highest Solar noon altitude?

4. On what date does Ballston Spa experience the lowest Solar noon altitude?

5. On what date does Ballston Spa experience the longest duration of insolation?

6. On what date does Ballston Spa experience the shortest duration of insolation?

7. On which of the dates in Chart A does Ballston Spa experience the highest average daily temperature? (Note: the actual highest temperatures are reached about one month later).

8. What are the directions of sunrise and sunset in Ballston Spa on the equinoxes?

9. Does the Sun ever cross directly overhead (90^0 or zenith) in Ballston Spa?

Conclusion: State the relationship between the tilt of the Earth's axis, the altitude of the noon Sun, the duration of insolation, and the average daily temperatures for June 21 in the Northern Hemisphere.