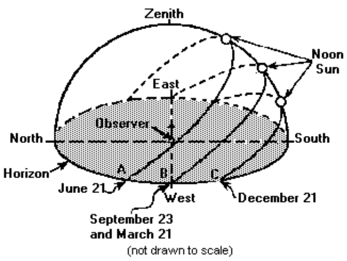
Name___________________________________ Date_______
Lab # _________ Period _____



Title: The Apparent Path of the Sun

Problem—How do hours of daylight change as you travel from the North Pole toward the Equator for each of the seasons?

Introduction: The earth's rotation makes it appear that the sun is moving from East to West across the sky. This daily path of the sun changes as the earth revolves around the sun because the axis of the earth's rotation is tilted in respect to the earth's orbital plane.

Zenith: ____

Horizon: ____

In this investigation you will draw the daily apparent path of the sun for the beginning of each season at different latitudes. Imagine the sun traveling across the sky along the paths that you draw for each of the latitudes given. You will be measuring the angular lengths of these paths and calculating the hours of daylight for each path drawn. Since the Earth rotates at 15 degrees per hour the Sun appears to move 15 degrees per hour. In order to find the number of hours of sunlight you need to divide your measured angular distance of the sun's path by 15 deg/hour.

Hypothesis— Fill in the following hypothesis statements with (increase, decrease, or remains the same).
Traveling from the North Pole:

A. the hours of daylight __________________________ as you approach the equator during the Summer Solstice.

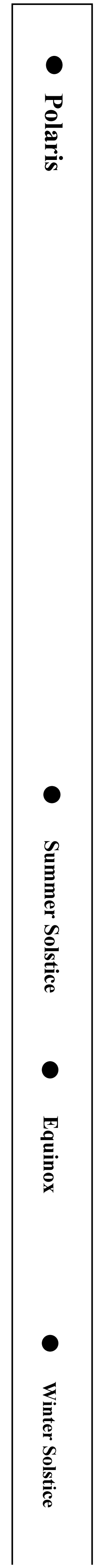
B. the hours of daylight __________________________ as you approach the equator during the Equinox.

C. the hours of daylight __________________________ as you approach the equator during the Winter Solstice.

Materials: Transparent plastic hemisphere, external protractor, piece of paper, water color pen, stick, star that represents Polaris, paper towels, water, calculator.

Procedure:

1. Use your pointed stick to make holes at the points for Polaris, the solstices and equinoxes.
2. Cut out the strip of paper at edge of this page.
   Note: only one strip of paper is needed per group.
3. Slide the paper you cut out through the stick at the hole that you made for the star Polaris.
4. Place the stick into your hemisphere where Polaris would be viewed if you were at the North Pole.
   Note: make sure the pointed end of the stick goes into the center of the model (position of the observer).
5. Measure and record the latitude of your position using your external protractor and the North Star position.
6. Stick your North Star Sticker onto the blunt end of the stick. This represents the star Polaris.
7. Use your paper to trace the path of the sun at different times of the year and **label your lines**.
8. Using an external protractor count the number to degrees for the sun's path and calculate the number of daylight hours for each date. **Note: A complete circle = 360 degrees = 24 hours**.
9. Fill in the Angular Distances and Daylight Hours Data Tables.
   Based on your models, determine the length of "daylight" for each season.
   Since the earth rotates 15 degrees/hour, every 15 degrees along the sun's path is equal to one hour of daylight.
   Use your external protractor to measure the length of the **sun's path** and calculate the length of daylight by dividing your measured distance by 15 deg./hour. Round to the nearest whole hour.
   Example: Your measured "angular distance" is 145 degrees, divide it by 15 deg./hour = **10 hours**
10. Clean sphere and repeat for all other latitudes.



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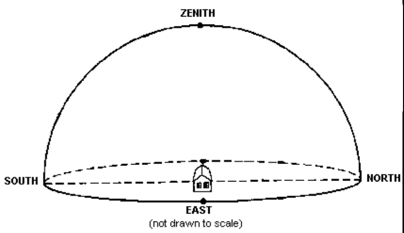
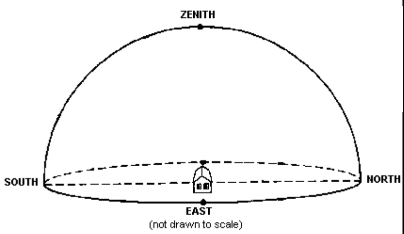
Latitude = 90 degrees north The North Pole   Finish this example with your teacher.



Draw and label your lines

	Summer Solstice	**Equinoxes**	**Winter Solstice**
Angular Distance (Degrees)	**360**		
Calculated Distance (Hours)	**24**		

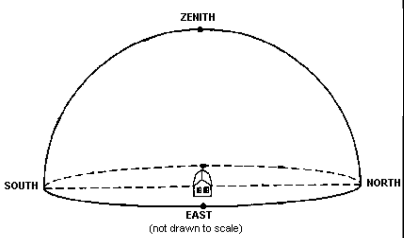
Latitude = ______________________________________ Clean your model.



Draw and label your lines

	Summer Solstice	**Equinoxes**	**Winter Solstice**
Angular Distance (Degrees)			
Calculated Distance (Hours)			

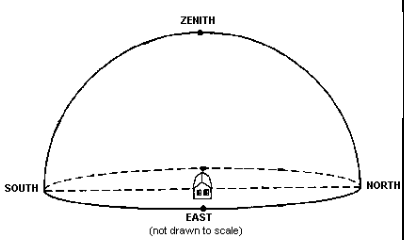
Latitude = ______________________________________ Clean your model.



Draw and label your lines

	Summer Solstice	**Equinoxes**	**Winter Solstice**
Angular Distance (Degrees)			
Calculated Distance (Hours)			

Latitude = ______________________________________ Clean your model.



Draw and label your lines

	Summer Solstice	**Equinoxes**	**Winter Solstice**
Angular Distance (Degrees)			
Calculated Distance (Hours)			

Graph: Make a line graph plotting Latitude on the x-axis and hours of daylight on the y-axis. You should have one line for each season. You may want to use colored pencils or make a key for your graph. Once your graph is finished go on to the conclusion and questions. (Do not graph the North Pole data.)

Conclusion: Explain the relationships between latitude and daylight hours for each season.

Did you prove yourself correct or incorrect? What would you do differently to make your data more precise?

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____

Analysis and Conclusion Questions: Be careful, think about both hemispheres (complete sentences please).

1. According to your graph predict the number of daylight hours at the equator for the following dates:
   a. June 21st ________________
   b. March 21st ________________
   c. September 23rd ____________
   d. December 21st ____________

2. Where would you have to be for the sun to be highest overhead at noon on June 21st? Explain.

   ____

   ____

3. Where would you have to be for the sun to be highest overhead at noon on December 21st?

   ____

   ____

4. Where would you have to be for the sun to be highest overhead at noon on March 21st?

   ____

   ____

5. Explain why the sun appears to move across the sky.

   ____

   ____

6. During what times of the year does the sun rise and set due east and west?

   ____

   ____

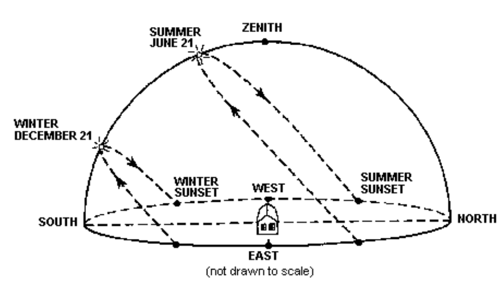
7. What happens to the length of your noon shadow as the seasons change?

   ____

   ____

For questions 8-10 use this model.

8. Draw the path of the sun for the 21st of March.
9. Draw the path of the sun for the 23rd of September.
10. Draw Polaris on the celestial sphere.



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