Calculating position of the Sun

Name _____ Date_____

Laboratory Partner _____ Section _____

Objective: To be able to calculate different positions of the sun during a day. To be able to predict the positions of the sun during the day.

Materials:
- One half of a clear globe
- One half of a blue globe
- Flexible protractor (the teacher has to demonstrate on how to use this instrument)
- Calculator
- Masking tape
- Overhead pen (make sure you return directly to teacher)

You must read the Following Background Information:

The Sun appears to move across the sky every day. It is not really moving; the Earth's rotation on its axis makes this apparent movement. The Earth rotates 15^{o} per hour; this intern makes the Sun move across the sky 15^{o} per hour. In the northern -hemisphere the Sun can always be seen in the southern sky. This is what is called southern exposure.

The Sun also changes its path through the year because of the earth's tilt and its journey through space orbiting around the sun. In the summer at this latitude in New York State the Sun rises north of east and sets north of west; the Sun's path through the sky reaches a top altitude of 71^{o} at noon, and causes the Sun's rays to strike the earth at high angles. This happens on June 21^{st} the summer solstice, and causes the shadows to be short and it also causes sunburn and other damage.

The winter months will have the sun at very low angles and causes long shadows. The lowest is about 23^{o} and happens on December 21^{st} the winter solstice. This is also the reason you can not get sunburn in the winter. The rays are too low and therefore not as powerful.

On an equinox day the Sun's most direct rays are hitting at the equator. In New York at our latitude the sun makes an angle of about 47^{o}. On this day *every* location on Earth has 12 hours of day -light and 12 hours of darkness. The Sun rises due east and sets due west on this day.

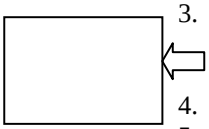
Procedure:

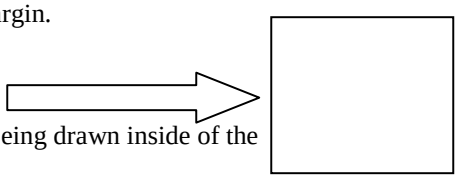
Part I

Clear globe preparation

Read each direction carefully and do exactly what it says step for step.

1. Take the clear globe half and place it dome up on your desk. The bottom is the horizon.
2. Along the bottom edge of the globe mark N for north, E for east, S for south and W for west. The North and south should be across from one anther, likewise for East and West
3. Starting at the south point, (where you put the S for south) place the flexible protractor vertically (straight up and down) along the surface of the clear globe and mark with your felt tip pen mark 23^{o}, 47^{o} and 71^{o} degrees up from the horizon. Look at diagram in the left hand margin.
4. Now turn the globe upside down on the table. (curved side down)
5. Place the blue globe inside of it with the top down. (also curved side down)
6. Now move the edge of the blue globe to the 23^{o} mark.
7. Take the felt pen and trace along the edge of the blue globe so that an arc is being drawn inside of the clear globe. Your Arc should go from east to west if you did it correctly.
8. Repeat step seven but this time you mark the arcs for 47^{o} and the 71^{o} marks.
9. When all the arcs are complete place the clear globe on the desk dome up, it should look like this.
10. Now take masking tape and place a strip of tape over the arcs so the entire arc is now covered.





Part II

Calculation and plotting of the suns Path.

1) Sunrise is along the edge of the globe on the eastern side
2) Noon is on the very top of the arcs (which the tape is covering) that you have drawn. Please mark and label noon with your pen on each strip of tape at the very top of the arc.
3) Calculate the position of the sun along each of the arcs for the time of 4:00 pm. Remember each hour is 15^o and the protractor can measure the number of degrees. You also know where noon is from step 3 above.
4) Plot on the tape the position of the sun for 4:00 pm. Repeat this for the two other arcs.
5) Calculate the position of the sun for each arc for the time of 10:00 am.
6) Plot on the tape the position of the sun for 10:00am for each of the arcs.
7) Carefully tear the masking tape off each arc and place each one on the spaces provided for you on the bottom of the page.

Part III

Measure on each tape the following to the ***nearest tenth of a centimeter.*** Place your answers on the spaces provided for each below.

- 1. From the 10:00 am mark to the Noon time mark
- 2. From the noon time mark to the 4:00 pm. mark
- 3. From the 10:00 am mark to the 4:00 pm. mark

1. 10 am-noon	2. noon to 4:00pm	3. 10:00am to 4:00pm
23^o_____	_____	_____
47^o_____	_____	_____
71^o _____	_____	_____

Discussion Questions: Answer the following questions in complete sentences on your laboratory report.

1. Which one of the measurement on the tape is the longest? _____.
2. Which arc is the longest?(the longest piece of tape) _____ .
3. Does the Sun ever reach overhead (zenith) in New York State?_____ .
4. Which arc represent June 21st, _____
   December 21st ,_____
   and the fall and spring equinox September and March 21st for position in New York?_____.
5. Where does the sun rise and set on a equinox day"? _____ .

Place and label tape in spaces below:

You may have to wrap your tape around the edges of the paper if it is too long