Name _____ **Earth Science**

Lab 14: Solar Pathways – Seasons, Circumference and Daylight Hours **Date** _____

Objectives:

- To determine the angular distance along the sun's path during different times of the day and during different times of the year.
- To determine the circumference of Earth using different times of the day and different times of the year.
- To determine the position of sunrise and sunset during different times of the year.
- To determine the length of daylight hours during different times of the year.

Materials:

Plastic Hemisphere	External Protractor	Masking Tape
Calculator	Flexible Kilometer Scale	String

Procedure:

1. Observe your hemisphere.

   Make note of the following:
   a) Directions: North, South, East and West as marked on your hemisphere
   b) The three seasonal arcs of the Sun's path:
      1. **A** – Sun's path on December 21 – Winter Solstice
      2. **B** – March 21 and September 23 – Spring & Fall Equinox
      3. **C** – June 21 – Summer Solstice
   c) The location and time of the Sun's path on each of Arcs A, B and C at Point **X**

During which season(s) does the sun appear to rise directly East and set directly West? _____

During which season(s) does the sun appear to rise North of East and set North of West? _____

During which season(s) does the sun appear to rise South of East and set South of West? _____

2. Using the hemisphere, record the time for Point X for all three arcs (A, B, C) in the table below (Column 1).

	1	2	3	4
ARC	**Point X (time)**	**Point Y**	**Point Y (time)**	**Degree Difference between X and Y**
A		1 hour later		
B		2 hours later		
C		3 hours later		

3. Using the information from column 1 and column 2, determine the time at Point Y. Record in column 3.
4. Since the Sun appears to move across the sky at a rate of 15° per hour (due to the rate of rotation of Earth), calculate the number of degrees between Point X and Point Y. Record in column 4.
5. Using your hemisphere
   a. Place a piece of masking tape along Arc A
   b. Label the tape with the letter of the Arc
   c. Mark and label Point X
   d. From Point X, use an external protractor to measure the angular distance to Point Y - as noted in above in column 4. Mark and label this on your masking tape as Point Y.
   e. Remove masking tape and place in the "Observations" section of this lab.

6. Repeat step 5 for Arc B and Arc C.

OBSERVATIONS (Place masking tape here):

A

B

C

7. Using the flexible kilometer scale, measure the distance from Point X to Point Y on your making tape for all three Arcs (A, B, C). Place your results in the table below (Data Table 1).

DATA TABLE 1

ARC	Distance in km from X to Y	Circumference in km
A		
B		
C		

8. Using the formula for circumference, calculate the circumference from your values for Arc A, B and C. Place your results in the above table (Data Table 1).

Circumference: $\frac{\text{angle}}{360°} = \frac{\text{distance}}{\text{circumference}}$ ** angle = degree difference from column 4

Determining the Length of Daylight

1. Using a piece of string and the flexible kilometer scale, determine the distance along Arc A from sunrise to sunset. Place the data in the table below (Data Table 2). Repeat for Arc C.

DATA TABLE 2

ARC	Sunrise to Sunset Distance (km)	Circumference (km)	Number of Degrees Calculated	Number of Daylight Hours
A				
C				

2. From Data Table 1, fill in the calculated circumference for Arc A and Arc C in Data Table 2.

3. Using the circumference formula, calculate the number of degrees for Arc A and Arc C and record in Data Table 2.

4. Calculate the number of daylight hours for Arc A and Arc C using the number of degrees calculated in the previous step. Record in Data Table 2.

Conclusion:

1. What causes the changes in the lengths of day and night during the year at a given location?

2. What is the approximate angular distance in degrees the sun appears to travel in one hour? _____

3. At the rate calculated in question #2, how many hours would it take the sun to appear to travel 360°?

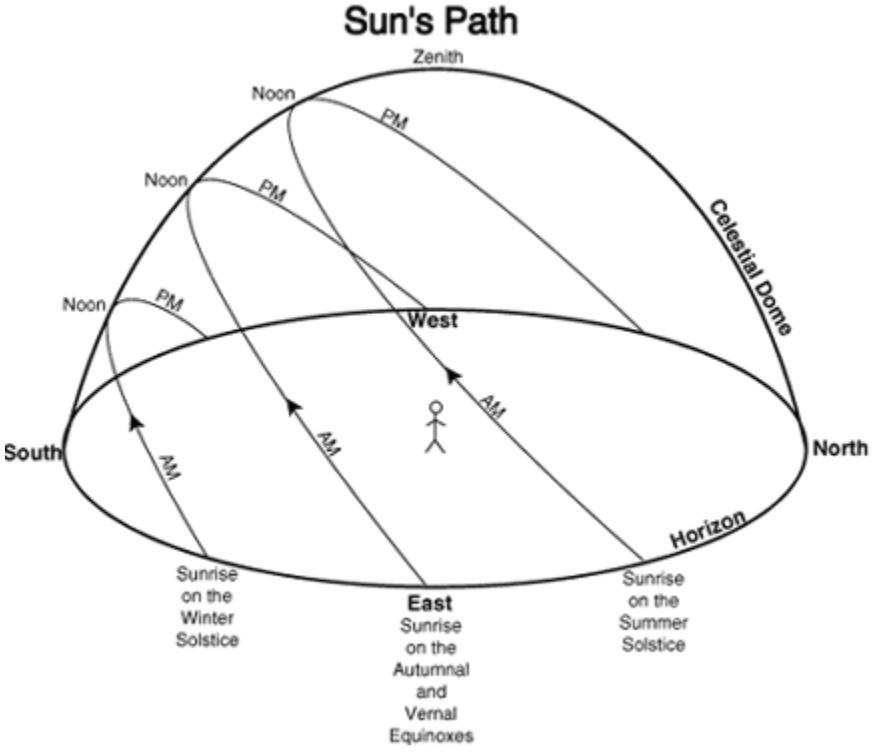
4. In this lab you calculated the daylight hours for Arc A and Arc C. Estimate the number of daylight hours for Arc B **and** <u>give evidence</u> to support your estimate.

5. In relationship to the three arcs on the hemisphere, describe the approximate position of the sun's path on:

   May 5 -

   November 10 –

6. On the diagram below, draw and label the apparent path of the sun for **AUGUST 10.**



7. In the diagram, draw in where the person's shadow would be at noon.