



## Path of the Sun

## Lab #7

**Discussion:** Light for growing plants, seasons that stimulate growing plants, day and night are all a result of the sun and motions of planet Earth.

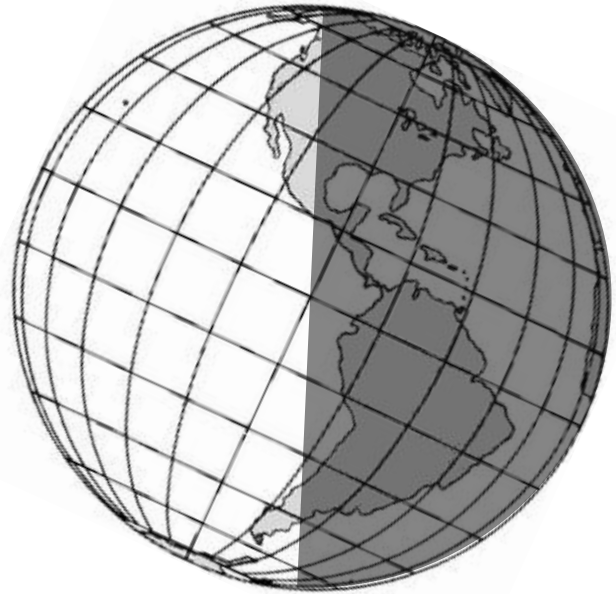
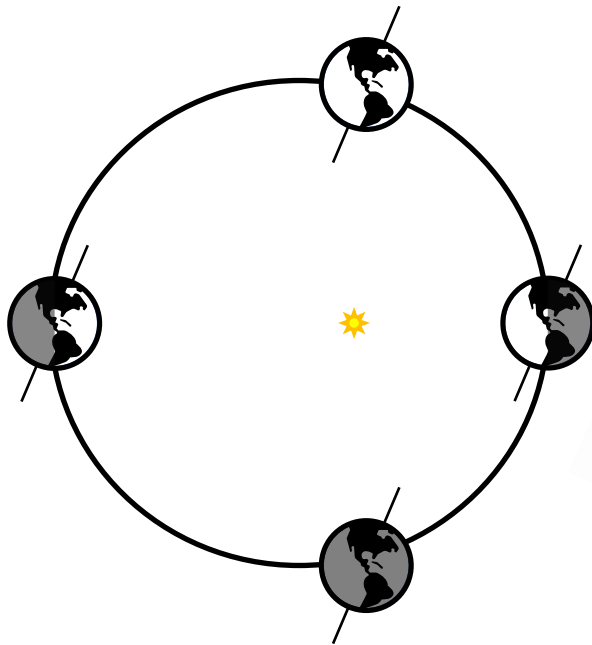
**Purpose:** By the time you finish this investigation, you should be able to:

1. determine the number of hours of daylight given a hemisphere plot of the sun's path for a day
2. determine the number of degrees the sun moves in one hour given a hemisphere plot of the sun's path for one day
3. determine the direction of sunrise and sunset given a hemisphere plot of the sun's path for a day
4. identify the season given a hemisphere plot of the sun's path for a day

**Hypothesis:** Using drawings and data charts as models helps us understand the world around us.

### **Theory:**

Earth's axis is tilted 23.5°:



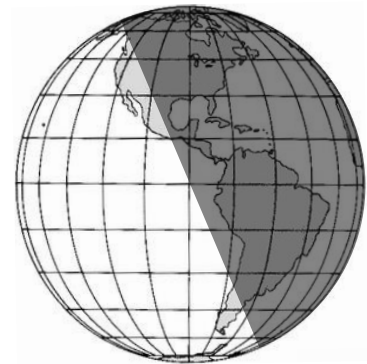
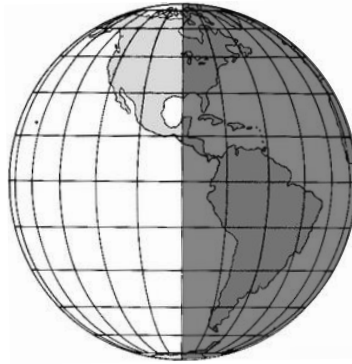
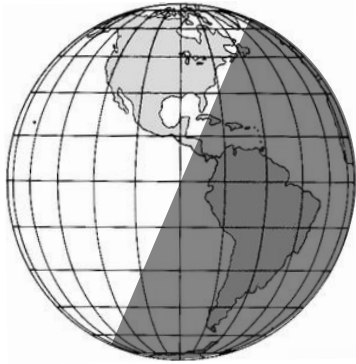
**Materials:** pencil                      metric ruler                      this packet

**Method:**

Summer

Spring and fall

Winter



1. Analyze the supplemental sheet with high noon observations (see last page). Look for the information in the following steps.
2. Maximum altitude of the sun each day.
3. Highest value for maximum altitude listed.
4. Lowest value for maximum altitude listed.
5. Fill in the data on the chart below.

**Data Collection and Processing:**

1. List the value and date for maximum altitude listed on the high noon observations for the:  
Highest maximum value: 71° 25' on June 24  
Lowest maximum value: 24° 34' on December 23
2. Make a plot altitude vs. time from the high noon observations table.
3. Define the terms below and give the latitude for each:  
Tropic of Cancer: The northernmost latitude at which the sun can be directly overhead, 23.5° N.  

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Tropic of Capricorn: The southernmost latitude at which the sun can be directly overhead, 23.5° S.  

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4. Write labels for the beginning of each season on the globe maps at the top of this page.
5. Where would we observe due East and due West from FHS? (Is this on a longitude or latitude line?)  
Latitude 43° N  

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6. What is the shape of the apparent path of the sun across the sky? An arc.  

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7. Compare and contrast the shape of the sun's apparent path throughout the year.  
The sun's path is always an arc, but the arc moves north and south of 43° N.  

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8. From the second day of spring until the last day of summer, where will the sun rise and set?  
North of 43° N.  

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9. From the second day of fall until the last day of winter, where will the sun rise and set?  
South of 43° N.
10. Measure the latitude line that passes through the Great Lakes on the summer and winter globes at the top of page 2. Record the length of this line (to  $\pm 0.01$  cm) that is in shadow and in the light.  
 Summer: 2.30 cm for the light side and 1.00 cm for the dark side.  
 Winter: 2.30 cm for the dark side and 1.00 cm for the light side.
11. What is the rate of the sun's apparent movement across the sky? 15 degrees / hour

**Analysis and Conclusions:** (Use complete sentences.)

1. Calculate the range of the values from lowest to highest maximum altitude (Data 1):  
The range is 47°.
2. How many degrees are between the Tropic of Cancer and the Tropic of Capricorn (Data 3)?  
The range is 47°.
3. Compare your answers to Conclusions 1 and 2. Explain any similarity you observe.  
The range is the same for both differences, 47°. This is true because the range is caused by the axial tilt of the Earth, so the range will always be 47°.
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4. Calculate the number of hours of daylight and night on winter solstice at 45° (see Data 10).  
(24 hrs / 3.3 cm) 1.0 cm = 7.3 hours of light. (24 hrs / 3.3 cm) 2.3 cm = 16.7 hours of night.
5. Will the sun ever go through the zenith in Syracuse, NY? Explain.  
No, the zenith is 90° and the highest noon altitude in Syracuse is 71° 25' on the table.
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6. What has been happening to each of the following during the month of October?  
 Direction of sunrise: has been moving toward the south.  
 Direction of sunset: has been moving toward the south.  
 Altitude of the sun at local noon: has been decreasing.  
 Rate of the sun's movement: has been constant at 15° / hour.  
 Length of daylight hours: has been getting shorter.  
 Time of sunrise: has been getting later.  
 Time of sunset: has been getting earlier.
7. In which direction will the shadow of a flagpole point at sunrise on:  
 September 21: due west.  
 December 21: north of west.  
 March 21: due west.  
 June 21: south of west.

# Supplemental Sheet

## High Noon Observation Table

Date	Degrees	Minutes	Time of Maximum Altitude	Date	Degrees	Minutes	Time of Maximum Altitude
Jan. 1	24	54	12:03	July 1	71	07	12:04
8	25	37	12:06	8	70	30	12:05
15	26	40	12:09	15	69	33	12:06
22	28	04	12:11	22	68	19	12:06
29	31	46	12:13	29	66	48	12:06
Feb. 5	32	44	12:14	Aug. 5	65	01	12:06
12	33	56	12:14	12	63	02	12:05
19	36	19	12:14	19	60	50	12:03
26	38	52	12:13	26	58	28	12:02
Mar. 4	41	30	12:12	Sept. 2	55	58	12:00
11	44	14	12:10	9	53	23	11:57
18	47	00	12:08	16	50	42	11:55
25	49	45	12:06	23	48	00	11:53
Apr. 1	52	29	12:04	30	45	26	11:50
8	55	09	12:02	Oct. 7	42	34	11:48
15	57	43	12:00	14	39	55	11:46
22	60	09	11:58	21	37	22	11:45
29	62	25	11:57	28	35	56	11:44
May 6	64	30	11:56	Nov. 4	32	40	11:44
13	66	21	11:56	11	30	37	11:44
20	67	56	11:56	18	28	49	11:45
27	69	16	11:57	25	27	17	11:47
June 3	70	18	11:58	Dec. 2	26	04	11:50
10	71	00	11:59	9	25	12	11:52
17	71	23	12:01	16	24	42	11:56
24	71	25	12:02	23	24	34	11:59
				30	24	40	12:03

## High Noon Observations Plot of Altitude vs. Time

