

Sun Tracking: Earth's Revolution, the Sun, and the Seasons

Geology

Mr. Traeger

Name: _____

Period: _____

Date: _____

Purpose

The purpose of this activity is to become familiar with Earth's revolution around the sun and how it affects the seasons.

Materials

- Suntracker Globes
- Overhead Marking Pens
- Starry Night® Astronomy Software
- Textbook pages 80-83

Part 1 Procedure: Measuring the sun angle and direction using a Suntracker®

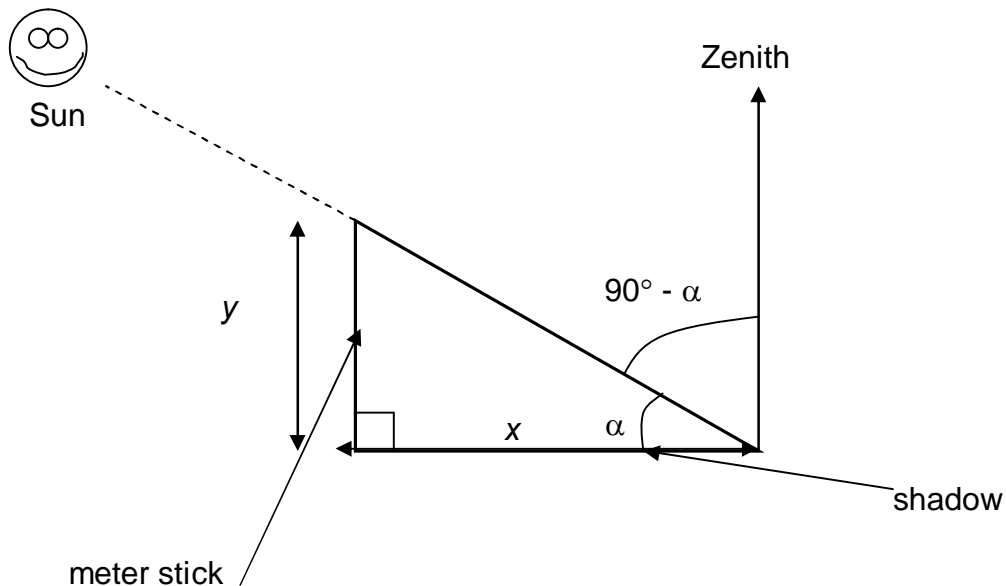
1. Get into groups of 3-4. Each person will be responsible for recording his/her data.
2. Position your Suntracker in a sunny spot. Level it so the bubble is centered. Orient the Suntracker so that the magnetic compass needle points to magnetic north. Rotate the Suntracker so that you find true north. To do this, you will need to rotate the Suntracker so that the compass needle reads 14°.
3. Using your overhead pen, find where the shadow of the tip of your pen intersects with the center of the mirror. Place a mark at this point on the globe. Record the angle of the sun from the horizon in degrees. Also record the amount of degrees either East or West of South (Azimuth).
4. Make sure to write your period #, date, and time next to your recordings. **DO NOT ERASE OR SMUDGE OTHER PERIODS' OBSERVATIONS!**

Data Recording Table

Period	Date	Time	Altitude (Angle from horizon in Degrees)			Azimuth (Compass Direction of Sun on Horizon)
			Shadow Length (x)	Length of Meter Stick (y)	Angle = $\tan^{-1}(y/x)$	
1						
2						
3						
5						
6						

Secondary method for calculating the angle of the sun using trigonometry

You may remember Chief SOHCAHTOA from your math classes. Sine = Opposite/Hypotenuse, Cosine = Adjacent/Hypotenuse, and Tangent = Opposite/Over Adjacent. Using trigonometry and a calculator, you can calculate the angle of the sun from the horizontal. Calculate the angle α by the equation $\alpha = \arctan(y/x)$.



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Part 2: Plotting the Position of the Sun using Starry Night®

- Follow along with the Starry Night® demonstration done on the computer projector. Record the altitude of the sun (in degrees) at each position for each date in the following table.

Date	Hours of Daylight	Directional Position of Sun						
		Northeast (45°)	East (90°)	Southeast (135°)	South (180°)	Southwest (225°)	West (270°)	Northwest (315°)
September 22	12	No data	0°	47°	56°	47°	0°	No Data
December 21	10	No data	No data	17.5°	32.5°	17.5°	No data	No data
March 21	12	No data	0°	47°	56°	47°	0°	No data
June 21	14	No data	46.5°	75.5°	79.5°	75.5°	46.5°	No data
Day Measured								

- Plot this data on The Reasons for the Seasons Worksheet. Use a different colored line to represent each day.

Part 3: Questions (Consult your data and textbook when answering these questions.)

- Where did the sun rise this morning? Where will it set tonight?
- At what position will the sun be highest in the sky today? How high in the sky will it be (angle)?
- Based on your worksheet and data, will the sun ever be seen in the Northern part of the sky at our latitude of 34°N? Why or why not?
- On what date will the sun be highest in the sky at mid-day? Why is this?
- On what date will the sun be lowest in the sky at mid-day? Why is this?
- Which day has the longest amount of daylight? Why is this?
- Which day has the shortest amount of daylight? Why is this?
- Which day(s) have 12 hour days? Why is this?
- Where does the sun set on the following dates? West, North of West, or South of West?

June 21 st	September 22 nd	December 21 st	March 21 st

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10. Where in the world (what latitude) would you go to see the sun directly overhead on the following dates?

June 21 st	September 22 nd	December 21 st	March 21 st

11. What is significant about the dates in question number 10?

12. On what day of the year would you be most likely to get a sunburn in La Cañada? Least likely?

Day Most Likely for Sunburn?	Day Least Likely for Sunburn?

13. Describe why it is that the date with the highest sun angle will result in a more intense sunburn? Remember the demo I did on the board with the light.

14. What is the reason for the seasons? Drawing an elliptical orbit diagram here is mandatory. (5 points)

15. What season is it right now in Australia, which is in the Southern Hemisphere?

16. How many hours of daylight will occur at the following locations on the following dates?

Location	June 21 st	September 22 nd	December 21 st	March 21 st
La Cañada, CA				
Equator				
North Pole				
South Pole				

17. How do the changing constellations give evidence that our earth is revolving around the sun?

18. How does parallax give evidence that our Earth is revolving around the sun?

19. You have just been hired by Phat Energy® of La Crescenta to install solar panels on the roof of the IRC. What direction should you face your solar panels in La Cañada to maximize the energy received from the Sun?

20. What angle from the horizontal should you mount your solar panels at if you want to maximize the amount of energy received on the following dates? Hint: Think complementary angles and show work.

	June 21 st ?	September 22 nd ?	December 21 st ?	March 21 st ?
Angle from horizontal				