



Why is it Light All Day and All Night at the South Pole during Summer?

Students are often confused by the idea that the scientists can work around the clock while they are in the field in Antarctica. How can they tell what time to go to sleep or when to eat? It's an area worth exploring!

Knowing that the seasons exist because of the tilt of the Earth and that the Poles experience 24 hour daylight and darkness is something we learn and often just accept. Ask a student, or an adult for that matter, to explain this occurrence and you might be surprised at the answers. Why are our shadows longest in the winter even though the days are shorter? Why are the days shorter? Why is it warmer in the summer? To understand this, it helps to know about light and shadows on different surfaces. It also helps to experience the seasons and the tilt of the Earth from a bird's eye view. By manipulating the interaction of the light from the sun and the axis of the Earth, students can better understand concepts like seasons, time zones and latitude.

Many people believe that we have warmer weather in the summer because we are closer to the sun. In fact, we are closest to the sun during the winter of the Northern Hemisphere. The reason for the seasons and the length of days is not one simple thing. The sun's rays hit the Earth more directly in the summer with more sun time to warm it during the longer days. During the winter, the angle of the rays is much more extreme so the heat is less intense and the days are much shorter. Our rotation around the sun, the tilt of the Earth off of a 90° angle, and our spherical shape work together to create the seasons and the day length variations.

In the activities that follow, students begin by exploring the behavior of light rays on a variety of surfaces and from various angles. They will find that light rays travel in a straight line and that it is the surface that changes what we see of the light. They will continue their explorations with a sphere and discover the mechanics of day and night. Finally, the students will see how the 23.5° tilt of the axis affects the rays of the sun as the Earth spins and as it revolves around the sun.

The activities that follow build an understanding of the relationship of the Earth in motion to the sun's light. The shadow tape activity is appropriate for primary through middle level grades. It is especially good with 5-7 as a basis for discussion and exploration of the concept. The remaining activities work best with 5-8 as the concepts are difficult and the manipulation of the materials more demanding.

Activity 1 How Long will my Shadow Grow? (Keeping a shadow tape through the year)

- Activity 2** How does the surface affect the light we see?
Activity 3 Preparing an axis holder for *The Shadow Shows*
Activity 4 The Shadow Shows (The Reason for the Seasons) Part 1
The Shadow Shows (The Reason for the Seasons) Part 2

Web references:

<http://www.enchantedlearning.com/subjects/astronomy/planets/earth/Seasons.shtml>

<http://www.usatoday.com/weather/tg/wseason/wseason.htm>

<http://www.crh.noaa.gov/fsd/astro/season.htm>

<http://daphne.palomar.edu/jthorngren/tutorial.htm> (This is an excellent tutorial)

<http://www.scienceu.com/observatory/articles/seasons/seasons.html>

<http://www.weathersavvy.com/Seasons2.html>

<http://www.ecology.com/ecology-today/tilting-earth/>

<http://www-istp.gsfc.nasa.gov/istp/outreach/sunearthmiscons.html> (This is a fun site that dispels common myths and other bad science)