

Bay Area Scientists in Schools Presentation Plan

Lesson Name: There are days and seasons (turn, turn, turn)

Presenter(s): Stephen Pepe and Justin Vandenbroucke

Grade Level: 3rd

Standards Connection(s):

Earth Science (4): Earth orbits sun with other planets.

Earth Science (5): Position of sun in sky changes during day and seasonally.



Abstract: This lesson aims to show kids that there are days and nights because the Earth spins, and that there are seasons because the Earth orbits around the Sun (and is tilted on its axis). We'll do some hands-on demonstrations with the kids spinning themselves, orbiting around each other, and simulating days and seasons with flashlights and globes. We'll also discuss why the North and South Poles are so different from the Equator. Finally, we'll connect this with our personal experiences living and working in Antarctica. There, it is cold and icy; the sun goes around in a circle and never sets; and there are unique animals—all because of the way the earth spins and orbits the sun.

Vocabulary/Definitions:

Antarctica – The southern-most continent, which includes the South Pole

Spin – To move around yourself in a circle

Orbit – To move around something else in a circle

Equator – Imaginary line dividing the Earth into top and bottom halves

North Pole – The very top of the Earth, which the Earth spins around

South Pole – The very bottom of the Earth, which the Earth spins around

Materials:

- Pictures from Antarctica which demonstrate that it is always light in summer; it's cold; it's icy; and there are strange animals.
- Globe with location marker.
- Flashlight (to project light in one direction—not a lamp that illuminates in all directions.)

Classroom Set-up:

- Ensure room can be darkened by drawing shades and turning off lights.
- Put pictures of Antarctica on walls.
- Divide students into groups of about 4.



CRS

COMMUNITY RESOURCES FOR SCIENCE
practical support for great science teaching

1611 San Pablo Avenue, Suite 10 B
Berkeley, CA 94702

(510) 527-5212 | www.crscience.org

Classroom Visit

1. Personal Introduction:

5 Minutes

We are Pepe and Justin. Justin is an astronomer and Pepe is an engineer. We have both worked in Antarctica. (Can anyone find Antarctica on the globe?) Justin studies the stars there (astronomy). Pepe works on using the sun to make electricity.

Topic Introduction:

10 Minutes

Show some photos from Antarctica. Talk about how cold it is, how much ice there is, how the sun never sets when we are there in the summer (it moves around in a circle) and how it never rises during the winter. Why does this happen in Antarctica? And why is it so cold there? To find out, first we have to figure out:

- What causes day and night?
- What causes the seasons?

2. Learning Experience(s)

20 Minutes

I. SPINNING AND ORBITING

Students get in groups of 4, and each group has two pairs. What does it mean to **SPIN**? Can anyone show us? Now everyone can try spinning in place (like a top). Spinning is moving in a circle around yourself. What does it mean to **ORBIT**? It means to move in a circle around something else. (Demonstrate.) Now everyone can try orbiting around their partner. Switch, so your partner can orbit you. Can you spin and orbit around your partner at the same time? Try! Switch.

This is what the earth does! It spins, and at the same time it orbits around the sun.

II. DAY AND NIGHT:

First, let's see what happens when the earth spins.

One student puts the marker where California is on the globe. One student holds globe and one holds light. Darken room and shine flashlight on globe. Is California light or dark? How does that change when the earth **SPINS**? So, why do we have day and night? What determines how much time one day takes?

III. SEASONS:

Now let's see what happens when the earth orbits the sun.

First a brief demo on the effect of light being tilted: new student to demonstrate. Hold the flashlight pointed straight at a wall. Look at how bright it is. Now hold it at an angle to the wall. How bright is it now? If this was sunlight, in which case would it be warmer & cooler? When



CRS

COMMUNITY RESOURCES FOR SCIENCE
practical support for great science teaching

1611 San Pablo Avenue, Suite 10 B
Berkeley, CA 94702

(510) 527-5212 | www.crscience.org

sunlight shines straight down on you, it's stronger than when it shines at an angle. Example: it's cooler at sunrise and sunset than at noon.

New pair of students holding light and globe. Show how earth **ORBITS** around the sun, always pointing in the same direction (to the left or right of the classroom, so that chalkboard drawings will match.). Notice how sometimes California is tilted towards the sun, and sometimes away from it. Stop when it is tilted towards the sun, and draw situation in 2-D on the board, for quick comparison later. Does the sunlight hit California straight on or at an angle? Do the same when CA is tilted away from the sun. In which case will it be warmer? In which case cooler? So, why do we have seasons? What determines how much time it takes to go through all the seasons?

-OR-

Next show what the globe looks like relative to the light source when it is winter in California, and when it is summer. How can we get the Earth to tilt California toward the sun and away from the sun at different times of year? Need two facts: (1) Earth rotating around the sun and (2) Earth spin axis tilted.

IV. POLAR AND TROPICAL CLIMATE

New pair of students holding flashlight and globe. Identify the **EQUATOR**, the **NORTH POLE**, and the **SOUTH POLE**. Using what we learned about tilted light, will these areas be hot or cold? (For confirmation, locate examples on globe: Alaska is near the North Pole, Hawaii is near the equator. 2-D drawings on chalkboard could also help.) How does this affect the weather and life in each area?

Are day and night different at the North and South Poles? Move marker to North Pole and spin globe—what happens? (Day all the time.) Do the same for the South Pole. (Night all the time.) Move the globe around the sun (flashlight) so it's winter in the northern hemisphere. Now how long are day and night at the Poles? At the North Pole and South Pole, sometimes it's dark all the time and sometimes it's light all the time.

3. Wrap-up: Sharing Experiences and Building Connections 10 Minutes

Back to Antarctica: Can we use what we learned to explain the things Pepe and Justin experienced in Antarctica?

- Why didn't the sun ever set? (Because the earth is tilted, sometimes it's always sunny, sometimes always dark.)
- Why is it cold? (Even when the sun is up all the time, its light comes in at an angle, like during winter.)
- Why is it icy? (When it's cold all the time, all the water stays frozen as ice.)
- Why are there penguins? (Not many animals can live where it's so cold, but penguins, seals, and whales can.)



CRS

COMMUNITY RESOURCES FOR SCIENCE
practical support for great science teaching

1611 San Pablo Avenue, Suite 10 B
Berkeley, CA 94702

(510) 527-5212 | www.crs-science.org

-OPTIONAL-

What would the Earth be like if it did not spin?

No day/night cycle - or if it orbited around the Sun but did not spin, it would be like life in Antarctica: one very long day and one very long night per year. In California, the long day would be really hot and the long night would be really cold.

4. Close:

5 Minutes

Thanks & goodbye!

TOTAL 50 – 60 Minutes

Follow-up – After Presentation

Justin wants to run an astronomy experiment in Antarctica, but he needs electricity. Pepe thinks he should use solar panels, which make electricity when the sun shines on them. Is this a good idea or a bad idea? What if Justin's experiment was in Hawaii instead of Antarctica?

Send Justin & Pepe a letter to answer their questions with pictures or words.

Here are some facts about solar panels to help you:

- Solar panels make electricity when the sun shines on them. No sun, no electricity!
- The stronger the sun shines on them, the more electricity the solar panels make.
- Solar panels make a little bit more electricity when they're cold, and a little bit less when they're hot.

Justin the Astronomer & Pepe the Engineer
c/o Community Resources for Science (CRS)
1611 San Pablo Ave Suite 10 B
Berkeley, CA 94704

Reading Connections:

- Come See the Earth Turn by Lori Mortensen
<http://www.nsta.org/recommends/ViewProduct.aspx?ProductID=20615>
- Experiments with the Sun and Moon by Salvatore Tocci
<http://www.scholastic.com/teachers/book/experiments-sun-and-moon>
- Sun Up, Sun Down: The Story of Day and Night by Jacqui Bailey
<http://www.capstonepub.com/product/9781404805675>
- What Makes Day and Night by Dr. Franklyn M. Branley
<http://www.harpercollins.com/book/index.aspx?isbn=9780064450508>



CRS

COMMUNITY RESOURCES FOR SCIENCE
practical support for great science teaching

1611 San Pablo Avenue, Suite 10 B
Berkeley, CA 94702

(510) 527-5212 | www.crscience.org