

# The Wizard from Space

## Why Are There Seasons?

A teacher-led demonstration for the whole class

**Objective:** Students will come to better understand that the seasons are caused by the tilt of the earth's axis and because our planet orbits the sun.

### Background:

Our Earth doesn't only spin on its axis like a toy top. It also circles the sun in a giant ellipse that's called an orbit. Earth's path around the sun, along with the tilt of Earth's axis of rotation, is what gives us the four seasons. During winter Sweden and the northern hemisphere are tipped away from the sun. The decrease in sunlight gives us a colder climate and snow. In the summer the northern hemisphere and Sweden are tipped toward the sun. This increase in sunlight causes the higher temperatures associated with this time of the year.

### Materials:

- a bright source of light, such as a desk, or table lamp, with its decorative shade removed (to represent the sun), or an overhead projector
- a classroom-type globe of the earth (or four globes if possible)
- copies of the "Earth Tips Over!" handout (one per student)
- copies of the "The Seasons" handout showing the four classroom globes on their stands (one per student)
- copies of the "The Seasons" handout showing the four Earths (one per student)

### Discussion:

Set the classroom Earth globe on a table where all can see it easily. Show the location of Sweden to the students as well as how the globe rotates (counterclockwise), reminding them about how that motion of Earth gives us day and night.

Point out the north and south poles. Do they lie upright, or tipped? Is the earth globe upright, or tipped? Is it just Earth globes that are tipped like this, or is the real Earth also tipped over?

Pass out a copy of the "Earth Tips Over!" handout sheet to each student and show them how Earth actually tilts over and that our planet's axis is pointed toward Polaris, the Pole Star.

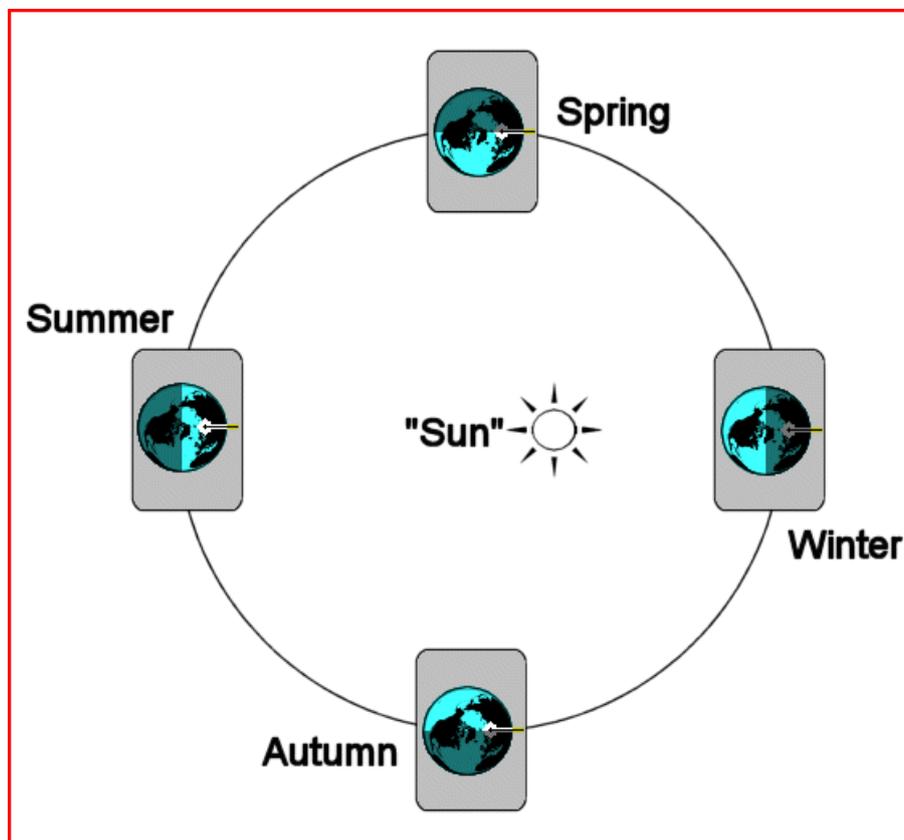
Lead into a discussion about the four seasons – winter, spring, summer and autumn – with such things as weather, temperature and the amount of daylight in mind. What sorts of activities can they do during each one? Do other people in other countries have the same seasons that we do? Ask if anyone has any suggestions as to what causes Earth's seasons. *Optional: You may wish to show them pictures from magazines, or calendars, taken during different parts of the year and ask them how they can tell which season is shown.*

**Procedure:**

1) Set up the light source on a tall stand, or table, just to the right of the center of an open room, or after having moved all the student's desks to the perimeter of the classroom. By placing the light source off center we are duplicating that the earth's orbit around the sun is not circular, but elliptical. Have the students stand evenly distributed around the room so that they all can see it.

2) Place four students' desks at 90 degrees from each other around the light source (see drawing below). These desks will hold the classroom Earth globe(s) and represent our planet's position on the first day of each season. Be sure to leave room for the students to move around between the desks. *Optional: You may wish to tape a copy of the four seasonal activity pictures featuring Space Wizard (from "Space Wizard's Coloring Book") on each of the four desks to help the students distinguish which desk represents the earth's location each "season."*

3) Place the globe on the desk labeled "Winter" and align its axis so that it tilts to the right as shown in the drawing. This is because the earth's axis always points the same direction as it travels in space; toward the star Polaris.



It is important to keep the globe's axis oriented the same way as it gets moved from desk to desk throughout the activity. *Optional: If you have four globes (perhaps small globes you have made yourself?) place one on each desk and align their axes so that they ALL point to the right as shown in the drawing.*

Pass out a copy of the "The Seasons" handout sheet showing the four classroom globes on stands to each student. Make the observation that the four globes in the handout are represented by the globe(s) they can now see in the classroom.

4) Turn on the light source and turn off the classroom lights. Without blocking the light from the light source "sun," have the students observe how the light is hitting the earth globe. Make sure that they notice how little light the Northern Hemisphere of the globe receives since it is tipped away from the "sun." It may help to make it clearer by rotating the globe on its axis (without moving its stand) so that Sweden is pointing toward the "sun." Relate to the students that it is because of the shorter days (bringing less sunlight) that the earth gets cooler and they experience winter and all of the various activities that can be done during that time of the year.

5) Move the globe to the next table, which is that for spring. Make sure that the globe's stand is pointing the same direction as before in winter's example. Have the students observe how the light is hitting the earth globe. Make sure that they notice that the Northern Hemisphere of the globe now receives more light than winter since it is tipped neither away, nor towards, the "sun." As in the first example it may help to make it clearer by rotating the globe (without moving its stand) so that Sweden is pointing toward the "sun." It is because of the longer and nearly equal days and nights (bringing more sunlight) that the earth begins to warm and they experience spring and all of the various activities that can be done during that time of the year.

6) Move the globe to the next table, which is that for summer. Once again, be sure that the globe's stand is pointing the same direction as before for winter's and spring's examples. Have the students observe how the light is hitting the earth globe. Make sure that they notice that the Northern Hemisphere of the globe now receives the most light since it is tipped directly towards, the "sun." As before it may help to make it clearer by rotating the globe (without moving its stand) so that Sweden is pointing toward the "sun." Perhaps by now the students themselves will be able to see directly (after the two other examples) that it is because of the longer days (bringing the most amount of sunlight) that the earth is at its warmest and they experience summer and all of the various activities that can be done during that time of the year.

7) Now move the globe to the last table, which is that for autumn. As before be sure that the globe's stand is pointing the same direction as the previous three examples. Have the students observe how the light is hitting the earth globe. Make sure that they notice that the Northern Hemisphere of the globe now receives less light than summer since it is tipped neither away, nor towards, the "sun." As before it may help to make it clearer by rotating the globe (without moving its stand) so that Sweden is pointing toward the "sun." In this final example with the globe it is because of the longer and nearly equal days and nights (bringing less

sunlight) that the earth begins to cool again and they experience autumn and all of the various activities that can be done during that time of the year.

8) Pass out copies of the “The Seasons” handout sheet showing the four Earths. Have the students note that just as the globe moved from desk to desk and experienced its seasons due to the light source, the real Earth does the same thing as it goes around the sun.

9) Now have the students return to the desk for winter. Bring the earth globe back and this time rather than let it sit on its stand hold the globe so that its axis of rotation is upright. Turn Sweden toward the light source. Ask the students to note the amount of “sunlight” hitting the earth if its axis were straight up and down. What is different this time? (There is a lot more sunlight!)

10) Take the globe to the other three season tables, rotate Sweden toward the light source and repeat the observation. Would we have seasons if the real Earth went around the sun like this? (No since the earth would be receiving the same amount of sunlight at every place along its orbit. Without the variation in the amount of energy from the sun hitting the earth due to the tilt of its axis our planet would have the same seasons all year long.)

#### **Follow-up:**

1) Younger students may wish to color in the four pages from “Space Wizard’s Coloring Book” that show him performing the same seasonal activities as shown in miniature on the two “The Seasons” handout sheets.

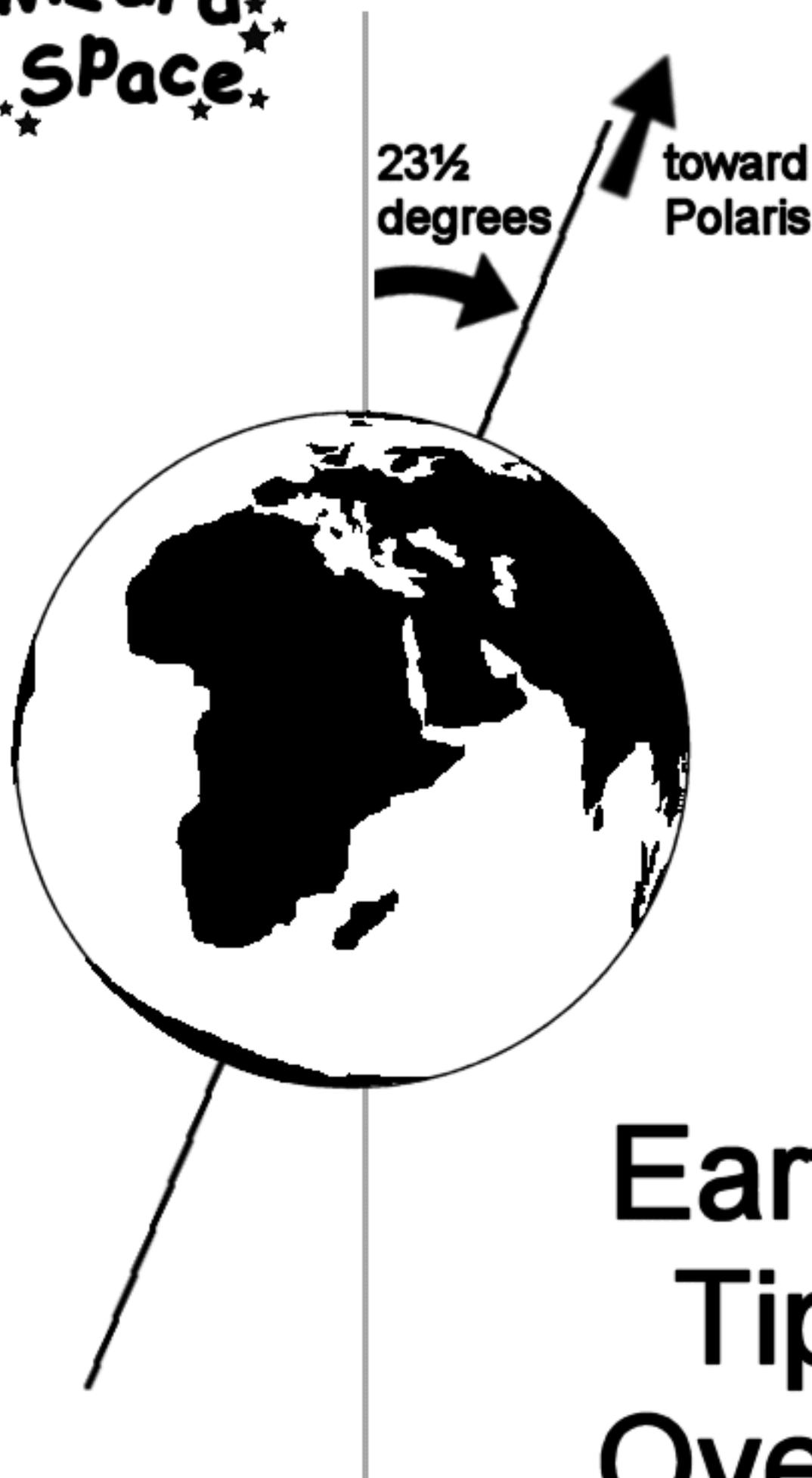
2) Have the children tell, or draw pictures showing, what it would be like to celebrate Christmas with summer’s weather and Easter with autumn’s weather just as they do in the Southern Hemisphere.

3) The students can easily imagine what sort of activities they can do during the four seasons of winter, spring, summer and autumn that they are already familiar with. Could they imagine what sort of experiences one could have on a planet where there were no seasons as would be the case if the earth’s axis were straight up and down rather than tipped over? One subtle point that they may not see at first is that the temperature would still vary with latitude; it would be warmer at the equator and colder toward that planet’s North and South Poles. One could go swimming at the equator and skiing closer to one of the two poles.



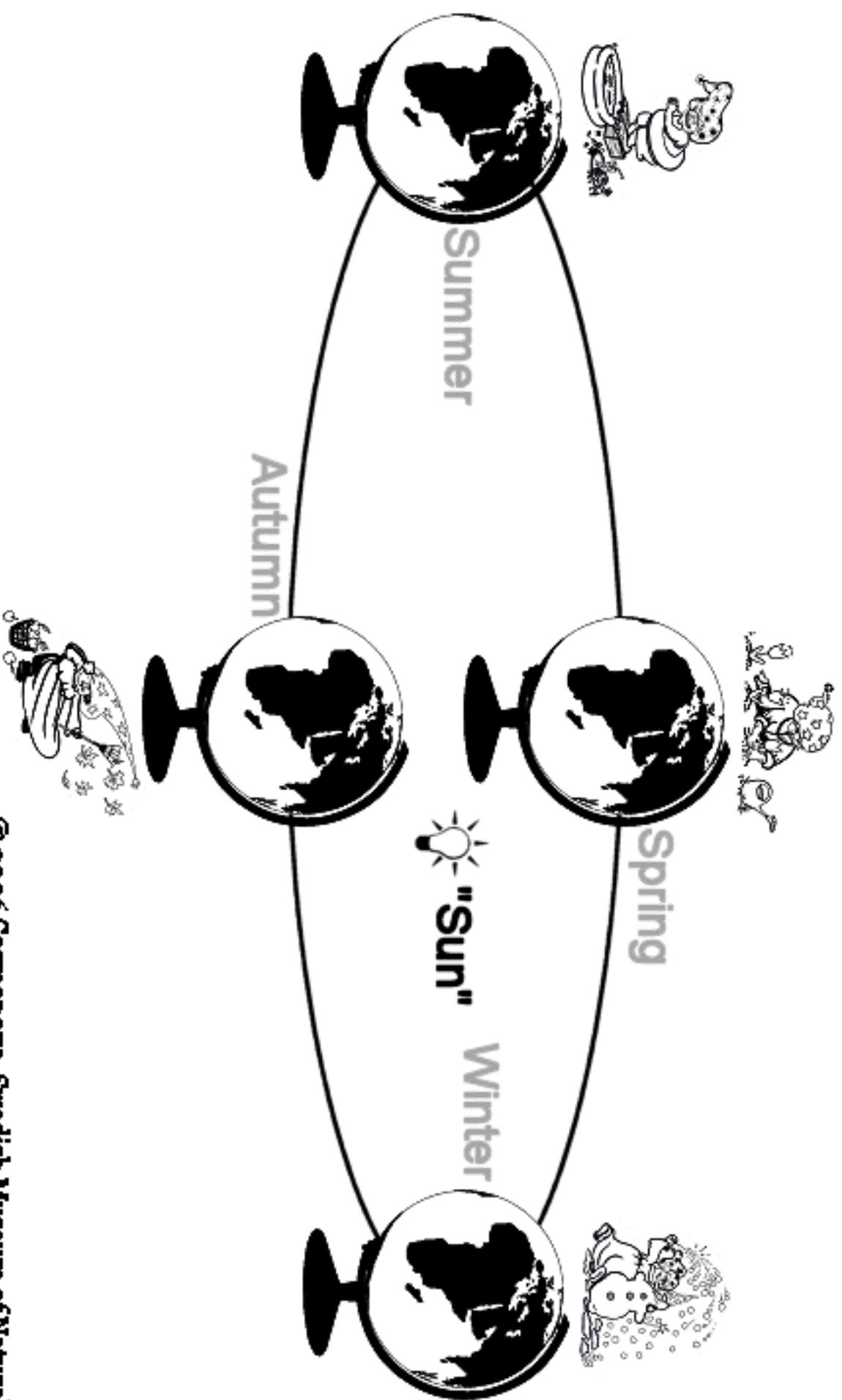
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☆ Polaris



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