

# *Adventures in the Attic* Educator Guide

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# Concept Enhancement Lesson Plan

## Adventure in the Attic

### Objectives:

1. Students will be able to explain what causes Earth to have seasons.
2. Students will be able to recognize that when the Northern Hemisphere is experiencing one season, the Southern Hemisphere is experiencing the opposite season (i.e. summer/winter, spring/fall).

### Reading Comprehension Objectives:

1. Students will be able to cite passages in the text to support their ideas.
2. Students will be able to summarize the story.

### Vocabulary:

**Axis:** An imaginary straight line around which an object spins.

**North Star (Polaris):** A bright star at the end of the handle of the Little Dipper in the constellation Ursa Minor. It remains in the same location in the sky all year, making it a useful navigation tool.

**Northern Hemisphere:** The half of the Earth that is north of the equator.

**Orbit:** The path followed by an object in space as it goes around another object.

**Season:** Each of the four divisions of the year (spring, summer, autumn, winter) marked by particular weather patterns and daylight hours, resulting from the Earth's changing position with regard to the Sun.

**Southern Hemisphere:** The half of the Earth that is south of the equator.

**Estimated Shared Reading Time:** 20 minutes.

### National Science Education Standards:

Content Standard D: As a result of their activities in grades K-4, all students should develop an understanding of objects in the sky: The Sun provides light and heat necessary to maintain the temperature of Earth; Changes in Earth and sky: Objects in the sky have patterns of movement.

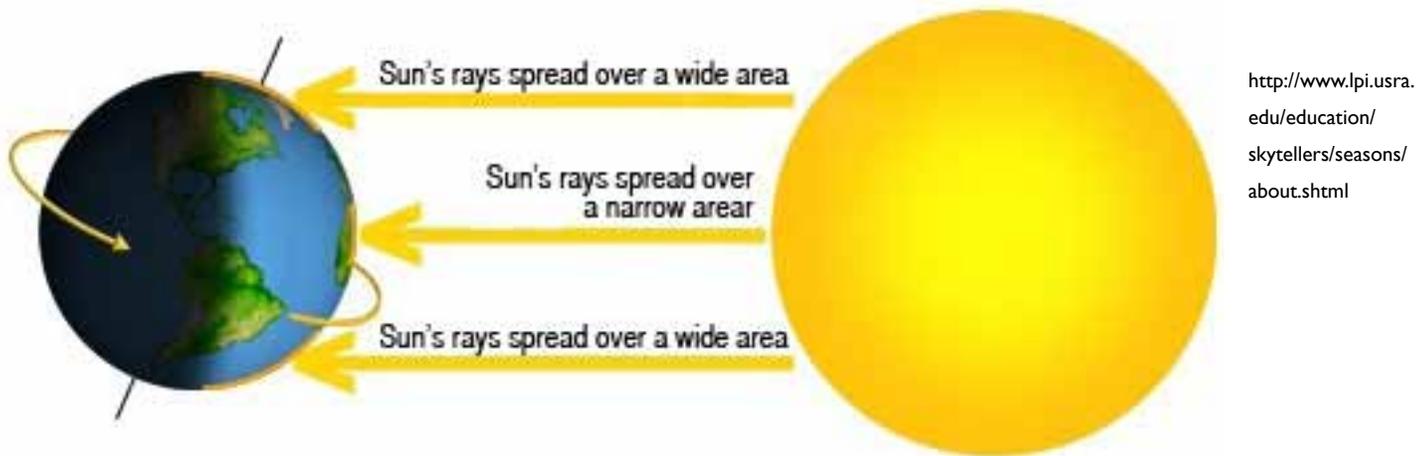
Content Standard D: As a result of their activities in grades 5-8, all students should develop an understanding of Earth in the solar system: Seasons result from variations in the amount of the Sun's energy hitting the surface, due to the tilt of the earth's rotation on its axis and the length of the day.

### Background Information:

Seasons are caused by the 23.5-degree tilt of the Earth's axis with respect to our plane of orbit around the Sun. Earth's axis is tilted toward the North Star (Polaris); if you extended the line of the axis into space, it would touch the star. As the Earth orbits around the Sun, its axis is continually tilted in this direction. This is why, to people living on Earth, Polaris appears to remain in the same place while all the stars rotate around it. The Earth rotates about its axis once each day.

It takes one year for the Earth to revolve once around the Sun. As the Earth orbits around the Sun, whichever hemisphere is tilted toward the Sun receives more hours of daylight. Days are longer in the summer than in the winter because of this. The tilt of the Earth's axis also affects the angle that sunlight hits the Earth, which has an affect on seasons. In summer, sunlight hits the ground more straight on, resulting in it being more

concentrated and intense. Conversely, in winter, sunlight hits the Earth at a shallower angle, resulting in it being more spread out and less intense. You can model this concept using a flashlight. Compare what a beam of light shining on the floor looks like when aimed (1) straight down at the floor (so it hits the floor at a 90-degree angle) and (2) from the same height at a shallower angle (i.e. 45-degree angle). The light shining on the floor in scenario 1 should be more concentrated and intense than the light shining on the floor in scenario 2. In the demonstration, scenario 1 correlates to how light hits the Earth in warmer months and scenario 2 correlates to how light hits the Earth in colder months. For more information, refer to the Resources section on page 50.



### Materials:

- Worksheet for each student
- Desk or heat lamp
- Thermometer
- Watch or clock
- Flashlight
- Globe

### Hands-On Activity: Reasons for the Seasons

In this activity, students compare the seasons through identifying activities and drawing scenes in each season. Students learn that Earth heats more when the Sun is in the sky longer by comparing the temperature on thermometers left under a lamp for different lengths of time. As an extension, students learn that the spherical shape of Earth causes the seasons to be opposite in each hemisphere (i.e. summer/winter, spring/fall).

### Content:

Begin by having students brainstorm activities and events that occur in each season. This can be done in groups on a sheet of paper divided into four sections, or as a class where the teacher or students write on a whiteboard or poster paper. Ideas may include: swimming in summer, school beginning in the fall, leaves turning in the fall, colder temperatures or snow in the winter, rain in the spring, or other local activities and events.

Ask students to write down their answers to the following questions: "Why do we have different activities in different times of year? How are the seasons different?" When they are done writing, have a few students read their answers out loud.

Ask students if they notice changes in the time the Sun rises and sets during the year. Students may notice that they have more time in the summer to play outside before it gets dark, that the Sun comes up later in the

morning during winter, etc. After taking some answers, guide students to the observation that the Sun rises later and sets earlier in the winter, and the days are shorter than at other times of the year. The opposite is true in the summer; the Sun rises earlier and sets later, and the days are longer.

### **Lab Activities:**

Tell students they are about to do an experiment to see if daylight has anything to do with the difference between summer and winter. Ask students what kind of experiment they think would help them to tell if having more hours of daylight affects temperature. After brainstorming ideas, hand out the worksheet (Daylight and Temperature) and have students look over the procedure for the experiment. Explain that they will be recording a change in temperature with a thermometer under a lamp left on for four different amounts of time.

1. Guide students through filling out the prediction section of the worksheet, completing the statement: "The longer we leave the thermometer under the lamp, the \_\_\_\_\_ the temperature will be." (Answer: higher)
2. Continue the experiment by setting up a lamp over a thermometer. Be sure to measure the distance between the lamp and the thermometer, making sure that both tests occur at the same distance. Also, if the lamp is too far away it will take too long to heat up. Place it approximately 15 cm (six inches) from the thermometer, depending on the intensity of the lamp. (Note: Make sure the thermometer is away from drafts as this can affect its ability to heat up.)
3. Have students work as a class or in groups, keeping time and recording the data. Record the thermometer reading once every thirty seconds. Data can be plot on a graph in front of the class as well as on student worksheets.
4. Conclude the experiment by analyzing the data students collected. Discuss what the data tells them and how it relates to the length of day on Earth. Ask them to write down if their prediction was correct.

Next, take out a globe and a flashlight. Shine the flashlight on the globe and ask students to identify the side that is night and the side that is day. Tell students that the Earth's axis is tilted at a 23.5-degree angle with respect to our plane of orbit around the Sun. Tilt the globe, keeping the flashlight in the same orientation. Ask them if they can see a difference between the top (Northern Hemisphere) and the bottom (Southern Hemisphere). The hemisphere tilted toward the Sun will have the most light shining on it. Have students guess what season it is in that hemisphere (summer). Ask them what season it would be in the opposite hemisphere (winter). Conclude by restating that the tilt of the Earth's axis causes different parts of the Earth to receive sunlight for varying lengths of time during the year. Also reiterate that, just as the children discussed in the book, the angle at which sunlight hits the Earth contributes to why we have seasons; sunlight hitting straight on is more concentrated and intense (warmer months), while sunlight hitting at an angle is more spread out and less intense (colder months).

### **Extensions:**

1. Create a model of the Sun and the Earth in its orbit like the children in the story did. Encourage the use of creative materials in its construction, emphasizing labels and correct orientation.
2. Have students write a letter to a pen pal in Australia (or the US if you are in a Southern Hemisphere country) talking about the current season and asking them about the weather where they are now.
3. Have students perform a skit or class play based on the story.

## Resources:

- Ignite Learning—What Causes Earth’s Seasons? (video): <http://youtu.be/DuiQvPLWziQ>
- Lunar and Planetary Institute—Seasons:  
<http://www.lpi.usra.edu/education/skytellers/seasons/about.shtml>
- University of Illinois Extension’s Tree House Weather Kids—Earth, Sun, and Seasons:  
<http://urbanext.illinois.edu/treehouse/seasons.cfm?Slide=1>
- University of Wisconsin—Reasons for the Seasons:  
<https://pantherfile.uwm.edu/kahl/www/CoVis/Seasons/>

## Assessment

### Science Comprehension Questions:

#### Knowledge

- What causes the seasons on Earth?
- When it is summer in the Northern Hemisphere, what season is it in the Southern Hemisphere?

#### Application

- Create a chart or model that illustrates the relationship between the Earth and the Sun for all twelve months of the year.
- Write a paragraph that Matt and Matilda could turn in with their project that describes the relationship between the Sun and Earth for an entire year.

#### Evaluation

- How would you feel if the Earth did not have seasons? Why?
- How would you have built the model differently? What would you have used?

### Reading Comprehension Questions

#### Knowledge

- What did Matt and Matilda have to make?
- Why did Matt and Matilda go to their Aunt Dramada’s house to do their project?

#### Application

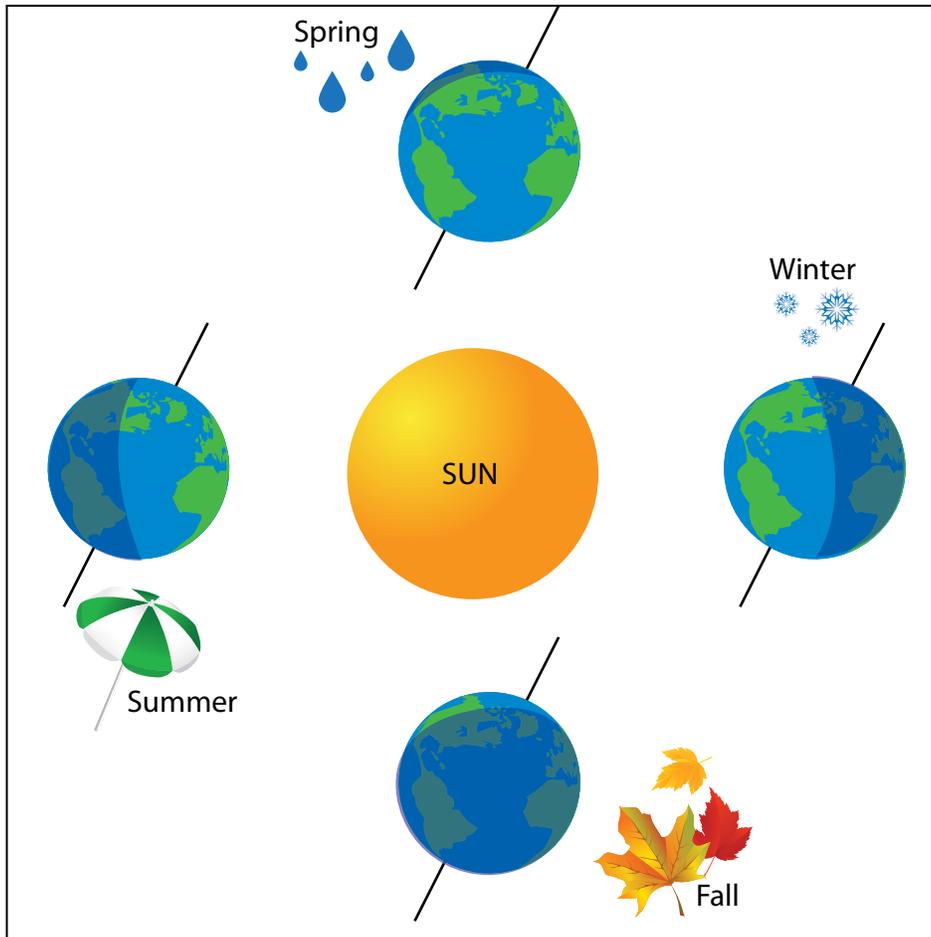
- Write a diary entry for one of the characters that describes what happened during the story and how they felt about the events that took place.
- Retell the story in your own words.

#### Evaluation

- Where in the story would you have acted differently than Matt and Matilda? What would you have done instead?
- Do you believe Matt and Matilda should have told their aunt about the globe? Justify your answer.

## Bulletin Board Idea

This bulletin board idea demonstrates to students how sunlight hits the Earth at different times during the year. The season labels reflect what season it would be in the Northern Hemisphere. (Note: If you live in the Southern Hemisphere, first swap the spring and fall labels with each other, and then swap the summer and winter labels with each other.)



# Adventure in the Attic: Daylight and Temperature

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Predict:** What will happen if we leave the thermometer under the lamp?

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“The longer we leave the thermometer under the lamp,  
the \_\_\_\_\_ the temperature will be.”

Measure the distance from the thermometer to the lamp: \_\_\_\_\_

TIME	TEMPERATURE
30 seconds	
1 minute	
1 minute 30 seconds	
2 minutes	
2 minutes 30 seconds	
3 minutes	
3 minutes 30 seconds	
4 minutes	
4 minutes 30 seconds	
5 minutes	

# Adventure in the Attic: Math Connection!

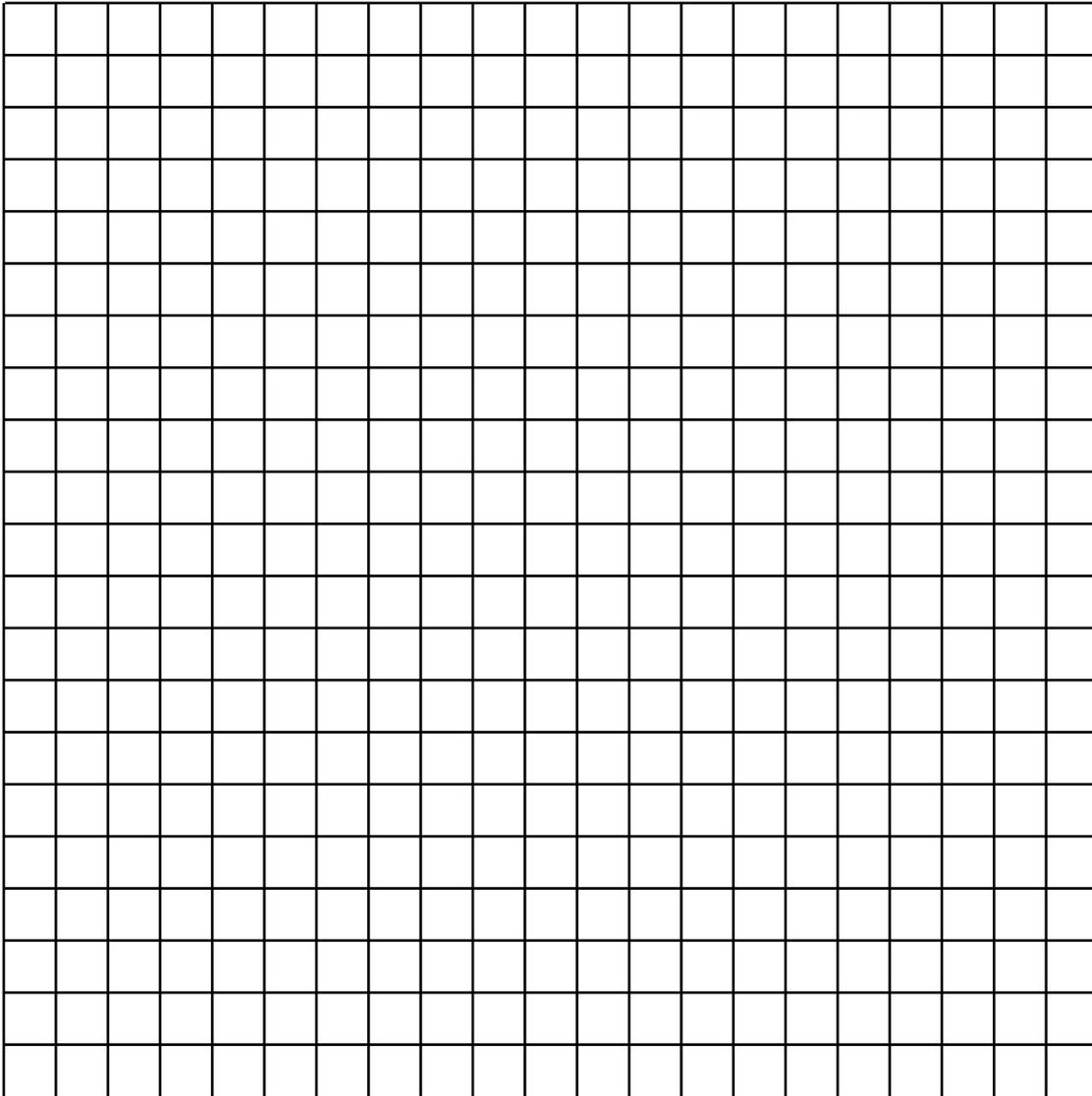
Name: \_\_\_\_\_

Date: \_\_\_\_\_

Create a bar graph showing the change in temperature over time: Don't forget to label your graph!

On the X Axis is: \_\_\_\_\_

On the Y Axis is: \_\_\_\_\_



Questions:

1. What was your beginning temperature measurement? \_\_\_\_\_
2. What was your ending temperature measurement? \_\_\_\_\_
3. How long did you record temperature measurements? \_\_\_\_\_
4. Bonus: Write down the rate at which the temperature changed. \_\_\_\_\_

# Adventure in the Attic: Story Arc!

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Describe each part of the story arc in Adventure in the Attic. Write a summary of what happens, and include page numbers where those parts of the story can be found

## **Beginning**

## **Rising Action**

## **Climax**

## **Falling action**

## **Resolution**

# Adventure in the Attic: Story Arc! – Answer Key

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Describe each part of the story arc in Adventure in the Attic. Write a summary of what happens, and include page numbers where those parts of the story can be found.

## **Beginning**

Pgs. 1-7: Matt and Matilda go to their aunt's house to work on their science project. Aunt Dramada leads them to the attic to work on their project.

## **Rising Action**

Pgs. 8-21: Matt and Matilda gather all of the materials for their project. They start discovering some interesting things about the old globe that they find.

## **Climax**

Pgs. 22-29: The climax begins when Matt and Matilda make their first discovery about their special globe when it changes to winter. The climax continues until the two have figured out what is causing the changes.

## **Falling Action**

Pgs. 30-37: Matt and Matilda complete a few more experiments and confirm their ideas about how the positions of the Sun and Earth cause the different seasons.

## **Resolution**

Pgs. 38-42: Matt and Matilda clean up the mess they made in the attic before Aunt Dramada returns home.

### The ABC's of Inquiry: Activity Before Concept

Engage students in the concept to be learned without priming them first. Don't tell them what you are going to teach them, let them figure it out for themselves. Through discussion following the activity the concept can be teased out. What was in their subconscious will emerge and become a solid concept that is not only connected to their prior knowledge, but is now a rewarding "Aha!" moment.

<b>Concept from Think Scientifically Book 2:</b>	<b>Activity you will use to demonstrate concept...</b>
"Seasons are caused by the tilt of the Earth on its axis."	
"Sunlight is most intense during months where it hits the Earth straight on, like in summer; it's least intense during colder months because it hits the Earth at a shallower angle, which causes sunlight to be more spread out."	
"As the Earth travels around the Sun, its axis is pointed toward Polaris (the North Star)."	
"Seasons and months correlate to the position of the Earth in its orbit around the Sun."	

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Adventure in the Attic – Book Walk

VOCABULARY			
<p>_____</p> <p>A period of the year that is characterized by certain conditions.</p>	<p>_____</p> <p>An imaginary line around which an object spins.</p>	<p>_____</p> <p>The path followed by an object in space as it goes around another object.</p>	<p>_____</p> <p>A bright star that remains in the same location in the sky all year.</p>

WHAT IS THE ASSIGNMENT?
<p>In your own words, what do Matt and Matilda have to do for the science fair?</p>
<p>_____</p> <p>_____</p> <p>_____</p>

MATERIALS LIST:	
Write what the twins use to represent real life items in their project as you hear them in the story.	
Real Life Item	Characters Use...
<b>EARTH</b>	
<b>SUN</b>	
<b>POLARIS</b>	

PREDICTION CHART			
Prediction Number	Question	My Prediction	What Happened?
1	How will Matt and Matilda start their project? (Pg. 5)		
2	What do you predict is happening? (Pg. 23)		

## PREDICTION CHART (Continued)

3	What do you think will happen when Matt and Matilda move the globe to the other side of the table? (Pg. 26)		
4	How will Matt and Matilda fix their 'mess'? (Pg. 38)		

## FIX THE MISTAKE!

Draw the twins' project illustrating their mistake.	Draw the twins' project with the mistake fixed.
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## HELP MATT AND MATILDA WITH THEIR PROJECT!

Matt and Matilda have to fill out the chart below for their science fair project, and they need your help! Help them by answering the questions about the seasons based on the categories in the left-hand column.

Category	Summer	Winter
1. What is the weather like? What outdoor activities do you do?		
2. Are days long or short? When does the sun come up? When does it go down?		
3. Does sunlight hit your hemisphere straight on or at an angle? Is sunlight really spread out or not?		

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Adventure in the Attic – Book Walk Answer Key

VOCABULARY			
<p><u>Season</u> A period of the year that is characterized by certain conditions.</p>	<p><u>Axis</u> An imaginary line around which an object spins.</p>	<p><u>Orbit</u> The path followed by an object in space as it goes around another object.</p>	<p><u>Polaris (North Star)</u> A bright star that remains in the same location in the sky all year.</p>

WHAT IS THE ASSIGNMENT?
In your own words, what do Matt and Matilda have to do for the science fair?
<i>Example: Matt and Matilda had to build a 3D model of the Sun and Earth that showed how the seasons change on Earth as it orbits the Sun. The model had to show the Sun-Earth relationship over an entire year.</i>

MATERIALS LIST:	
Write what the twins use to represent real life items in their project as you hear them in the story.	
Real Life Item	Characters Use...
EARTH	globe
SUN	disco ball
POLARIS	ornament

PREDICTION CHART			
Prediction Number	Question	My Prediction	What Happened?
1	How will Matt and Matilda start their project? (Pg. 5)		<i>Example: They started their project by searching in their aunt's attic for things to build their model with.</i>
2	What do you predict is happening? (Pg. 23)		<i>Example: The magic globe made the weather change when it was moved around the table.</i>

## PREDICTION CHART (Continued)

3	What do you think will happen when Matt and Matilda move the globe to the other side of the table? (Pg. 26)		<i>Example: When they moved the globe, nothing happened. The weather did not change as I expected.</i>
4	How will Matt and Matilda fix their 'mess'? (Pg. 38)		<i>Example: They moved the globe to where it said April on the table so the leaves would disappear.</i>

## FIX THE MISTAKE!

<p>Draw the twins' project illustrating their mistake.</p> <p><i>(The picture should show that the Earth's axis <u>is not</u> tilted toward Polaris in the model. You can refer students to pgs. 26-29 in the book to help get them started.)</i></p>	<p>Draw the twins' project with the mistake fixed.</p> <p><i>(The picture should show that the Earth's axis <u>is</u> tilted toward Polaris in the model.)</i></p>
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## HELP MATT AND MATILDA WITH THEIR PROJECT!

Matt and Matilda have to fill out the chart below for their science fair project, and they need your help! Help them by answering the questions about the seasons based on the categories in the left-hand column.

Category	Summer	Winter
1. What is the weather like? What outdoor activities do you do?	<i>Example answers: The weather is usually hot and sunny. I go to the pool and the beach.</i>	<i>The weather is cold and snowy. I go ice skating and sledding.</i>
2. Are days long or short? When does the sun come up? When does it go down?	<i>The days are longer than in other seasons. The sun rises before I wake up and it goes down when I'm getting ready for bed.</i>	<i>The days are shorter in winter than at other times of the year. The sun comes up after I wake up and it goes down at dinnertime.</i>
3. Does sunlight hit your hemisphere straight on or at an angle? Is sunlight really spread out or not?	<i>Sunlight hits more straight on in the summer, which makes it more intense. It is not as spread out as in the winter.</i>	<i>Sunlight hits at a shallower angle than in the summer, making it more spread out and less intense.</i>