NYC Modeling Seasons Lesson Addition

For part of the homework in Lesson 3.1, students are assigned the article "The Endless Summer of the Arctic Tern," which introduces students to how Earth's orbit and tilt lead to the cyclic pattern of the seasons. It is recommended that NYC teachers insert an additional lesson between Lessons 3.1 and 3.2 in order to have students complete this reading assignment in class along with an additional Sim activity. This will allow students to apply what they have been learning about the Earth-Moon-sun system to the familiar phenomenon of seasons.

Note: If teaching this Modeling Seasons lesson, do not assign reading "The Endless Summer of the Arctic Tern" article for homework in Lesson 3.1. However, students should still model a lunar eclipse with the Modeling Tool for homework, as they will be revisiting and revising this model in Lesson 3.3.

The following guide is provided for this additional Modeling Seasons lesson.

Assessment Opportunity: Student Understanding of the Cause of Earth's Seasons

This Modeling Seasons lesson can be used to assess students' understanding that the tilt of Earth's spin axis relative to its orbit around the sun is what causes the seasons on Earth. Look for whether students can describe that Earth is tilted, so that as Earth orbits around the sun, the hemisphere that is tilted toward the sun gets more direct sunlight, and there is one winter and one summer each year because it takes Earth one year to make an entire orbit around the sun. If students do not seem to understand the role of Earth's tilt, you might demonstrate this using a lamp and a Moon sphere. Draw small circles on opposite sides of the sphere, and place the sphere on a pencil so that the pencil is in the middle of one of the circles, which will be the south pole. Tell students that this time, the sphere represents Earth. Ask a student to hold the sphere tilted at an angle relative to the lamp, and to keep it at the same tilt as she moves it around the lamp. Ask the student to stop when the entire top circle is in the light of the lamp, and invite students to observe that this would be summer in the Northern Hemisphere: the northern half of Earth is facing more toward the sun. Then repeat this at a place representing summer in the Southern Hemisphere. Help students notice that the tilt is the same; it is the tilt relative to the orbit that causes the seasons to happen.

NYC Modeling Seasons guide

1. Direct students to the article "The Endless Summer of the Arctic Tern" (found in the NYC Student Edition or in the Amplify Library).
2. Have students read and annotate the article using the Active Reading approach.
3. Discuss students' annotations.
4. Direct students to the associated questions (which can be found in the *Earth, Moon, and Sun* Investigation Notebook or on the student screen in Lesson 3.1, Activity 5): *Why are there seasons on Earth? Why is there one winter and one summer each year?* Give students time to return to the article and discuss these questions with a partner. Have students record their responses.
5. Discuss the questions as a class.
6. Project the article and scroll to the 'December' diagram (on the third page of the article, or between paragraphs 3 and 4 if projecting from the Amplify Library). Ask students to describe what they observe in this diagram. [It shows Earth, the sun, and the path of Earth's orbit; it shows arrows representing sunlight; it shows Earth's axis; it shows that Earth's axis is tilted.]
7. Ask students whether all parts of Earth will receive the same intensity of sunlight at this time of year. [No: the Southern Hemisphere will receive more intense sunlight because it is tilted toward the sun; the Northern Hemisphere will receive less intense sunlight because it is tilted away from the sun.]
8. Ask students what this diagram tells them about the seasons at this time of year. [It is winter in the Northern Hemisphere and summer in the Southern Hemisphere.]
9. Have students work with a partner to use the *Earth, Moon, and Sun* Sim to collect more evidence about seasons. Have students use the *Earth, Moon, and Sun* Sim in Three-View mode and turn off the camera, View from Earth, and Top View. Ask students to use the Sim to get evidence about when winter occurs in the Southern Hemisphere. Students should be able to show, using the Sim, that in June the Southern Hemisphere is tilted away from the sun and the Northern Hemisphere is tilted toward the sun. They should be able to explain that this means it is summer in the Northern Hemisphere and winter in the Southern Hemisphere.
10. Reinforce the idea that at certain times of year, as Earth moves in its annual orbit around the sun, one hemisphere of Earth is tilted toward the sun. While tilted toward the sun, that hemisphere experiences summer because it receives more hours of sunlight each day than it does during other times of year, and the sunlight it receives is more intense than at other times of year. During that period, the other hemisphere is experiencing winter conditions. Six months later the conditions are reversed.