Seasons on Earth

What do you imagine when you read these words: summer, spring, fall, winter?

Most of us come up with a mental picture of daylight, the average temperature, and the behavior of plants and animals are some indicators of the season. But do seasons change over time? What have you learned in class about the reasons for the seasons?

Seasons are pretty easy to tell apart in most parts of the United States. The amount of daylight, the average temperature, and the behavior of plants and animals are some indicators of the season. But do seasons change over time? What have you learned in class about the reasons for the seasons?

Even without a calendar, you can tell that this photograph was taken in autumn. The colorful leaves, responding to changes in light and temperature, are a clue to the season.
Earth's Motion

1 year

Revolution: Earth's orbit around the Sun

Perpetual motion: something that goes on forever

Earths orbit around (other) the Sun

Complete revolution: Earth moves to the same starting point

If you draw a line from Earth to the Sun, it returns to the same position after 1 year.

Every Earth orbit is 365.25 days, which we call a year.

Here is a quick review of basic information:

Take Note

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Earth's Tilt

Earth is not straight up and down on its axis as it revolves around the Sun. It is tilted at a 23.5° angle. The reasons for the seasons are linked to Earth's tilt.

Think about Earth revolving around the Sun. As Earth revolves, it also rotates on its axis. One rotation takes 24 hours. Throughout its rotation and revolution, Earth's North Pole always points toward the North Star, no matter where Earth is.
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**Earth's Orbit and the Seasons**

- **Equinoxes**: Spring equinox and Fall equinox. During these times, the Sun is directly above the equator, and day and night are approximately equal in length.
- **Solstices**: Summer solstice and Winter solstice. During these times, the Sun is at its northernmost or southernmost position, respectively, causing the Sun to appear higher or lower in the sky, affecting the length of day and night.
- **Dependence on Orbital Distance**: The Earth's orbit is elliptical, meaning its distance from the Sun varies throughout the year. This variation affects the amount of sunlight received and thus the seasons.

**Take Note**
- The Earth's orbit is not a perfect circle, but an ellipse, which means the Earth is closest to the Sun at different times of the year, affecting the intensity of sunlight on different parts of the globe.
- The Earth's axial tilt of 23.5 degrees relative to its orbit around the Sun is crucial for the development of seasons, as it causes the Sun's rays to strike the Earth differently at different times of the year.

These factors combined explain why seasons occur and why they are not constant throughout the year.
Look at the position of Earth 6 months later (at winter solstice). Now the opposite is true. Even though Earth is closer to the Sun at this time, the Northern Hemisphere is leaning away from the Sun. Daylight hours are shorter, and sunlight hits the Northern Hemisphere at a lower solar angle, so it gets less solar energy. It is winter in the Northern Hemisphere.

In the Northern Hemisphere on the winter solstice, there are areas of Earth where the light from the Sun never reaches. People gather nearby to watch the Sun rise and set, barely peeking over the horizon.

Four days in the year have names based on Earth’s location around the Sun. In the Northern Hemisphere, summer solstice is June 21 or 22, when the North Pole tilts toward the Sun. Winter solstice is December 21 or 22, when the North Pole tilts away from the Sun.

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On the June solstice, the North Pole is tilted toward the Sun, and the Sun appears higher in the sky. The days are long, and the nights are short. The tropics are in the noonday, the equator is in the shadow, and the Sun is above the horizon. The climate is warm and humid.

On the December solstice, the South Pole is tilted toward the Sun, and the Sun appears lower in the sky. The days are short, and the nights are long. The tropics are in the shadow, the equator is in the noonday, and the Sun is below the horizon. The climate is cold and dry.

On the March equinox, the Sun appears directly overhead at the equator, and the length of day and night are equal. The climate is mild and fair.

On the September equinox, the Sun appears directly overhead at the equator again, and the length of day and night are equal. The climate is mild and fair.

These variations affect the climate and weather patterns around the world. The Sun's rays hit the Earth at different angles, causing changes in temperature and precipitation.
Because Earth is tilted, the length of day and night for any one place on Earth changes as the year passes. This table shows how hours of daylight change at different latitudes during the year. When it is summer in the Northern Hemisphere, the North Pole tilts toward the Sun. During summer at the North Pole, the Sun never sets. Above the Arctic Circle (latitude 66.5° north), daylight can last up to 24 hours in the summer. Night can last up to 24 hours during the winter.

### Length of Daylight in the Northern Hemisphere

<table>
<thead>
<tr>
<th>Latitude</th>
<th>Summer Solstice</th>
<th>Winter Solstice</th>
<th>Equinoxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0° N</td>
<td>12 hr.</td>
<td>12 hr.</td>
<td>12 hr.</td>
</tr>
<tr>
<td>10° N</td>
<td>12 hr. 35 min.</td>
<td>11 hr. 25 min.</td>
<td>12 hr.</td>
</tr>
<tr>
<td>20° N</td>
<td>13 hr. 12 min.</td>
<td>10 hr. 48 min.</td>
<td>12 hr.</td>
</tr>
<tr>
<td>30° N</td>
<td>13 hr. 56 min.</td>
<td>10 hr. 4 min.</td>
<td>12 hr.</td>
</tr>
<tr>
<td>40° N</td>
<td>14 hr. 52 min.</td>
<td>9 hr. 8 min.</td>
<td>12 hr.</td>
</tr>
<tr>
<td>50° N</td>
<td>16 hr. 18 min.</td>
<td>7 hr. 42 min.</td>
<td>12 hr.</td>
</tr>
<tr>
<td>60° N</td>
<td>18 hr. 27 min.</td>
<td>5 hr. 33 min.</td>
<td>12 hr.</td>
</tr>
<tr>
<td>70° N</td>
<td>24 hr.</td>
<td>0 hr.</td>
<td>12 hr.</td>
</tr>
<tr>
<td>80° N</td>
<td>24 hr.</td>
<td>0 hr.</td>
<td>12 hr.</td>
</tr>
<tr>
<td>90° N</td>
<td>24 hr.</td>
<td>0 hr.</td>
<td>12 hr.</td>
</tr>
</tbody>
</table>

### Think Questions

Turn to your notebook entry about the reasons for the seasons that you made at the beginning of this article. What do you need to add? What do you need to change?