

The Reasons for the Seasons

Purpose:

What causes the seasons to occur and change? What allows for the seasonal changes to be consistent year after year? Although we witness and experience seasonal weather and temperature changes yearly, we grapple with understanding why and how the Seasons occur. This demo activity displays how the Earth's orbit around the Sun and tilt on its axis effect the seasons. Students will begin to explore how the Earth's tilt determines the fact that while the Northern Hemisphere has summer, the Southern Hemisphere has winter. Additionally, students will be lead to understand the fact that during the Northern summer the North Pole is tilted towards the Sun and during the winter, it is tilted away. Your students may need further exposure to these facts and demos over the years but their initial exposure in **The Reasons for the Seasons** Activity will help them visualize the causal link between the Earth's tilt and orbit and our seasonal changes.

Teacher Background:

Most of the planets in our Solar System are tilted over on their spin axes. We are not sure why this is so, perhaps it is due to the violent collisions common in the early Solar System when there were thousands of small rogue planets circling the Sun. The Earth tilts over on its axis 23.5° with respect to the axis of the Solar System. This means that the Earth is always "pointing" to one side as it goes around the Sun. So, sometimes the Sun is in the direction that the Earth is pointing, but not at other times.

The effect the tilt has on the Earth is that at some times during the year, Earth's orbit makes the northern hemisphere tilt towards the heat and light of the Sun. The increased height of the Sun above the horizon lengthens the length of time this part of Earth receives daylight as well as the intensity of the Sun. This increases the amount of light this area of the world gets, thus the overall temperature there increases, since more time in the light means less time for the land and air to cool down before being lit and hence warmed again. In contrast, at the same time, the southern part of the Earth is receiving less daylight time and less intense light and thus is colder. In the southern hemisphere, they will always have winter when the north is having summer, and vice versa.

Spring and fall however are perhaps the most interesting times of the year from an astronomical point of view. The tilt of the Earth is not directed towards or away from the Sun, so it could be said that these seasons are more like what the planet's weather would be like if the Earth did not tilt at all. This also means that if we have some data from the very middle of either the Spring or Fall seasons and also from the very middle of Summer, we could make a comparison between the amount of sunlight and the tilt of the Earth.

(taken from Tilt-A-World Activity from the Everyday Classroom Tools found at <http://hea-www.harvard.edu/ECT/thrcontents.html>)

When asked "Why and what makes the Seasons occur?" some of your students (and most adults) will answer by describing the differences in temperature and weather from season to season. Additionally, many believe the Earth is closer to the Sun in summer than winter thus causing the higher temperatures. If you remember back to the activity **Our Closest Star, The Sun** you will notice the arc of the sun across the sky changes as the seasons change. The Earth's tilt causes the sun to appear higher in the sky during the summer and lower or closer to the horizon during winter. The higher the Sun appears in the summer sky the longer the amount of daylight and that translates into more intense, direct sunlight to cause hotter temperatures. The connection between the Earth's tilt, the length of daylight and the temperature in each hemisphere is dependent on this not so-normal merry-go-round ride Earth travels on year after year as we rotate around the Sun.