The Reasons for the Seasons

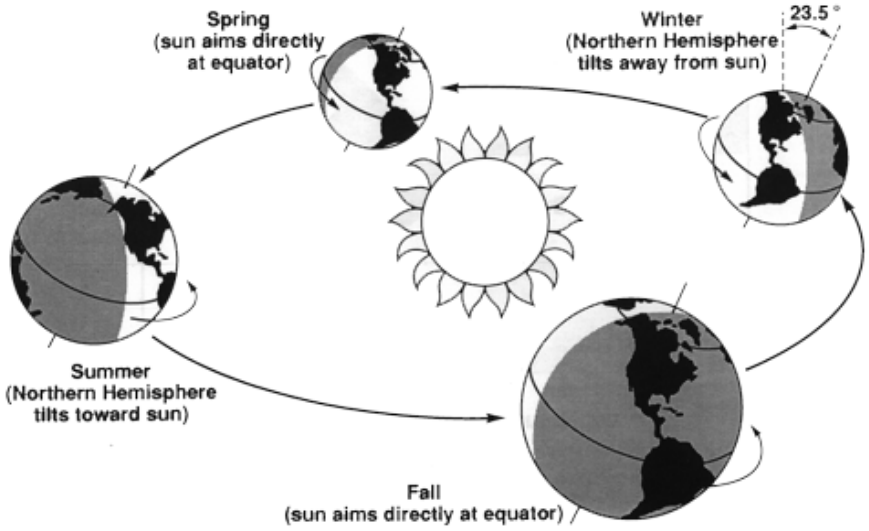
In most places on Earth, the weather changes with the seasons. We generally associate winter with cold, ice, and snow. We think of showers, green grass, and new flowers when we think of spring. Summer brings to mind hot, humid, sunny weather. Autumn means falling leaves with cooler temperatures. A **season,** then, is one of the four parts of the year (winter, spring, summer, and fall), each associated with a particular type of weather and happenings in nature.

Most of us have been comfortable with this knowledge since we were very young. We've observed it year after year. But how many of us have thought about why? (Or how many of us parents have forgotten why?) Why do we have the seasons?

To understand the reason for seasonal temperature differences, we must consider the following diagram. (See figure for seasons in the Northern hemisphere.) Specifically, we must pay attention to the angle of the tilt of the Earth as it relates to the sun in each of the four seasons. It helps to start with this information: The Earth's **axis** is not sitting perfectly vertical. That is, if the Earth were a big, fat, juicy apple and you stuck a popsicle stick (axis) through its South Pole and passed it up through its North Pole, it wouldn't sit flat. It would lean over. The amount it would lean is 23.5 degrees from vertical. Our big, fat, juicy Earth is leaning 23.5 degrees from vertical, too, regardless of the season. What changes from one season to the next is not the amount or the direction the Earth is tilted, but the orientation of the Earth's tilt *with respect to the sun*.

Look at the diagram again. Notice that the Earth is spinning on its axis. (The big, fat, juicy apple is spinning on its popsicle stick.) This is called **rotation**. It has nothing to do with the seasons, but makes a night and day difference in our lives! When our part of the Earth rotates to face the sun (regardless of the season), it's day. When we face away (again regardless of the season), it's night.

Getting back to the reason for the seasons, we now know what the reason for the seasons is NOT. It's not the rotation of the Earth on its axis. And it's not the tilt of the Earth *by itself*; the Earth tilts 23.5 degrees from vertical all the time. Look at the diagram again. Notice that as we go from one season to the next, the Earth revolves around the sun.



It makes one complete **revolution** (or path) around the sun in one year, actually in 365 1/4 days. Viewed from above, this path makes a circle. Now think about this for a minute: If the Earth made one revolution around the sun each year sitting straight up on its popsicle axis (in other words, if it had no tilt), our "seasons" would be really B-O-R-I-N-G! Why?

It's when we combine the ideas of axial tilt and one complete revolution around the sun that things get interesting. They get interesting because the end result is that during one season the Earth leans toward the sun, during one season the Earth leans away from the sun, and during two seasons the Earth leans neither toward nor away from the sun. Do you know which season is which? Answer the following questions assuming you live in the Northern hemisphere.

The season when the Earth leans toward the sun is _____.

The season when the Earth leans away from the sun is _____.

The seasons when the Earth leans neither toward nor away from the sun are _____ and_____.

Check out the diagram one more time. When the Earth tilts towards the sun, the Earth receives the sun's most direct rays. What does that mean for us? Have you ever been riding in the car on a long trip when the passengers in the car start to argue about how cool the air conditioner should be? The passengers sitting in the "sunny" parts of the car--where the suns's rays are the most direct--are HOT. They want the AC cranked. Those who are sitting where the sun's rays are not as direct want it a little warmer. It's the same with the seasons. During the season when our part of the Earth tilts towards the sun, the sun's rays strike us most directly and we're hot. (There are also more hours of daylight, which means more time for our part of the planet to absorb solar energy, which again means hot.)

Well, what do you think? Now that you've taken a big bite out of the old apple, do you know the reasons for the seasons?

Note: Did you know that we live in a counterclockwise world? If you put a clockface on top of our apple (excuse me, I mean Earth), you would notice that the Earth rotates counterclockwise on its axis. The Earth also revolves counterclockwise around the sun when this revolution is viewed from above.