



Name _____

Seasons

Most places on Earth experience four seasons every year. These are spring, summer, fall (or autumn) and winter. In these investigations we are going to find out why we have different seasons.

The seasons are caused by a combination of things.

- ⊗ The Earth is tilted as it moves around the sun.
- ⊗ Direct sunlight produces more heat than indirect light.
- ⊗ The Earth moves around the sun in a way you may not expect.

We will look at each of these in turn, and then see how all three, together produce the seasons.

Write the main idea of this paragraph below:

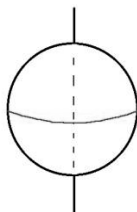
The Earth is Tilted



The Earth is a **sphere**. It can be divided into two **hemispheres**, the Northern and Southern Hemispheres.

The best way to understand this is to use a **model**. You will use a Styrofoam ball that is pierced with a stick.

Your model:



The stick represents the Earth's **axis**. The axis is an imaginary line running from the North to South poles. The Earth rotates (spins) on this axis all the time, turning around completely once every 24 hours. Take your ball, hold it by both ends of your stick, and turn the stick between your fingers.

Notice how the ball turns around. That is what gives us night and day. However, it has nothing to do with the seasons. So far we have only shown that the earth has night and day. So what makes the seasons happen? Talk it over with your partner.

Write what you believe causes the seasons below:

Right now you are holding your ball with the stick going straight up and down. This is not accurate. The Earth is actually **tilted**. Hold the ball in one hand and tip it, so that the top of the stick is nearer you than the bottom. THAT is how the Earth is in space. Now it should look like this:



Notice how the top half, or Northern Hemisphere, is tipped toward you, with more of it showing than the Southern Hemisphere.

Direct Light Produces More Heat

To demonstrate this idea we will do some simple investigations.
Materials needed are a flashlight, a piece of paper, ruler, and a textbook.

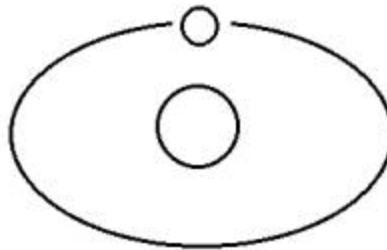
First of all you need to investigate with the flashlight. Put your hand up against the light source. Feel that it is warm. Move your hand away just a little. Notice how the heat is less, but it is still warm. Move your hand further and nearer the light, tip it so it is at an angle. Describe the differences you feel.



The reason that your hand felt warmer when you were shining the light directly on it is an important idea. **Direct light produces more heat than indirect light, or light striking something at an angle.**

How the Earth Moves Around the Sun

Remember that **the Earth is tilted all the time that it is moving around the Sun**. The Earth moves around the Sun once every year. It follows an elliptical orbit. This means that it goes almost in a circle around the sun, but gets a little further away at some times. The path it takes is like an oval.



Now, take your ball again, tip it like before and hold it at arms length, keeping it tipped. Slowly turn around in a circle. Notice how the tilt stays the same. The Northern hemisphere is always tipped toward you. This is **NOT** how the earth moves.

Put your ball down for a minute and walk around a stool. The way you would normally do it, you would walk around with one side of you facing the chair the whole time.

Do it a different way. Place the chair between you and a window. Leave enough space between it and the window so you can walk around it.

The chair represents the Sun.

Start on the opposite side to the window, facing the chair AND the window.

Now walk around the chair, all the way, but keep facing the window. Don't turn round (this means you will be walking backwards at some point, so **be careful**).

THAT is how the Earth moves around the sun.

Now do it again, holding the ball at your side, starting with the top of the ball facing towards the chair.

As you walk around, notice that the part of the ball facing the chair (Sun) changes.

First the Northern Hemisphere points to the chair (or Sun), then the tilt is sideways, with neither hemisphere pointing at the Sun, then the Southern hemisphere points at the Sun (when you are walking backwards) and finally neither hemisphere points at the Sun again.

Then you are back to the beginning and the Northern hemisphere is pointing at the Sun again.

What Causes the Seasons?

As you have seen, the Earth is tilted and direct light causes more heat than indirect light.

Remembering your walk around the chair, and how the tilt is at each point, can you figure out what causes the seasons? Talk it over with your partner and write down your ideas.

This is how it works. When the Northern hemisphere is pointing at the sun, sunlight falls most directly on it. This is summer in the Northern Hemisphere. As you get around to the side of the chair, neither hemisphere is pointing toward the Sun. The light strikes both equally and directly.

As the Earth moves around to the other side of the Sun the Northern Hemisphere is tilted away from the Sun. Now the light falls indirectly on it. It is winter. As it moves around to the fourth side, it the light again falls directly on it.

Notice that the exact opposite is happening in the Southern hemisphere. When the Northern Hemisphere has summer, the Southern Hemisphere has winter, and the other way round. So, how do you decide which has spring and which has fall? That is simple. Spring follows winter and fall follows summer!

Write the main ideas of this section below:

The Earth's seasons are not caused by the differences in the distance from the Sun throughout the year (these differences are extremely small). The seasons are the result of the tilt of the Earth's axis.



The Earth's axis is tilted at a 23.5° angle. **This tilting is what gives us the four seasons of the year:** Summer, Spring, Winter and Autumn.

Since the axis is tilted, different parts of the globe are pointed towards the Sun at different times of the year.

Summer is warmer than winter (in each hemisphere) because **the Sun's rays hit the Earth at a more direct angle** during summer than during winter and also because the days are much longer than the nights during the summer.

During the winter, the Sun's rays hit the Earth at an extreme angle, and the days are very short. These effects are due to the tilt of the Earth's axis.

To Do:

A second grade class thinks that the seasons are caused by the Sun being closer to the Earth in Spring and Summer and farther away in the Fall and Winter.

Make a handout for the students to show why this is not true and what really causes the seasons. Include diagrams. Use the space below.