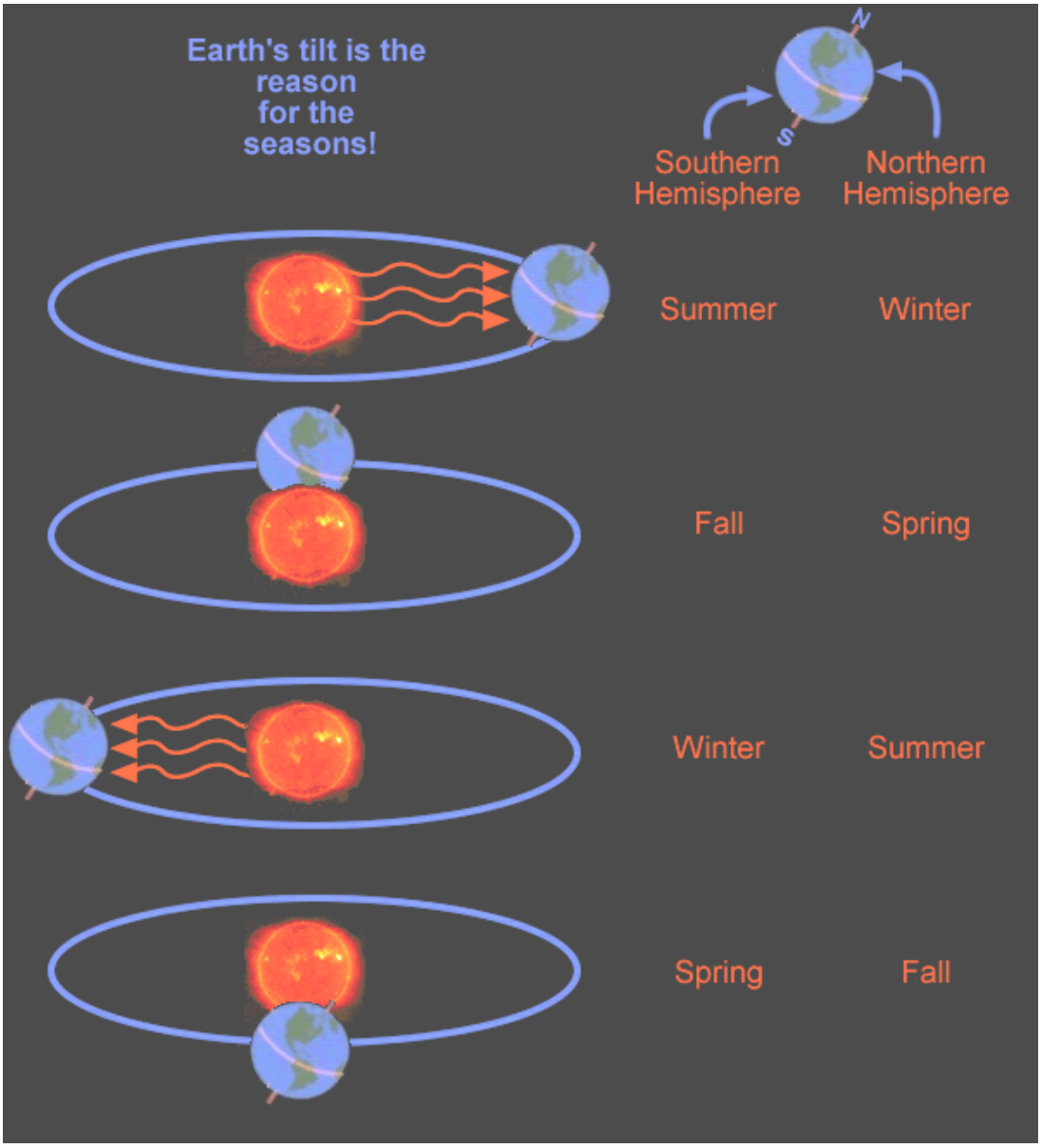
# Earth's Tilt Is the Reason for the Seasons!

During the year, the seasons change from winter to spring to summer to fall. Why does it happen? Seasons depend on the Sun!

The seasons happen as the Earth, travels in a loop around the Sun each year. This loop is called an eclipse. Each year the Earth makes one trip around the Sun. Because the Earth is tilted on its axis, summer happens in the part of the Earth tilted towards the Sun, and winter happens in the part of the Earth tilted away from the Sun. As the Earth travels around the Sun, the part of the Earth that is tilted towards or away from the Sun changes. But the tilt itself does not change.

The part of the Earth that is tilted towards the Sun is warmer because sunlight travels more directly to the Earth's surface and less gets scattered in the atmosphere. That means that when it is summer in the northern half of the Earth (the Northern Hemisphere), it is winter in the southern half of the Earth (the Southern Hemisphere). The hemisphere tilted towards the Sun has longer days and shorter nights.

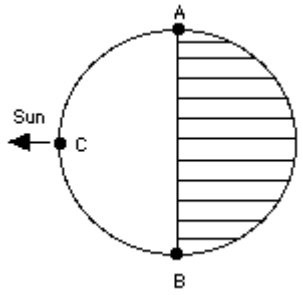



During winter in the northern hemisphere, the Earth is tilted so that the Southern Hemisphere receives more sunlight. During summer in the Northern Hemisphere, the Northern Hemisphere gets more sunlight.

# What If….

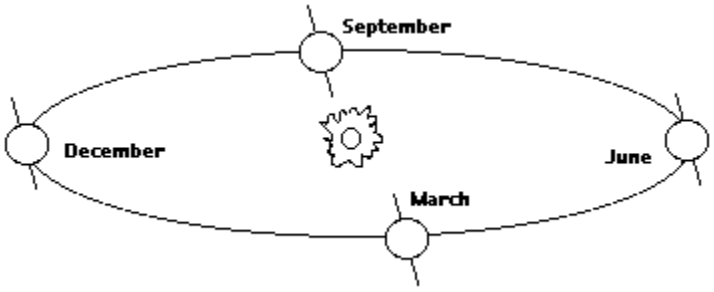
We know that the earth is in outer space at a tilt. But what if the Earth's axis were **perpendicular** to its ecliptic path in space, as in the drawings here, the Sun's position in the sky would be halfway between the north and south poles, and its daily path, seen from any point on Earth, would stay exactly the same, day after day. In New York, we would have the same season all year. It would never get over 40 degrees F. Label the axis, and where the equator would be.

**Actually**, the axis of rotation makes an angle of about 23. 5 degrees with the direction perpendicular to the ecliptic. That makes life **a lot more interesting**.




**Equinox and Solstice**

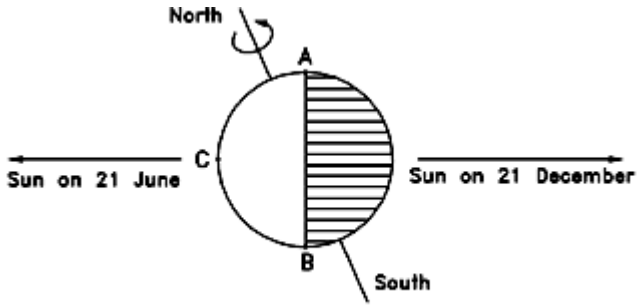
The angle between the Earth's axis and the Earth-Sun line changes throughout the year. Twice a year, at the spring and fall **equinox** (around March 21 and September 22--the exact date may vary a bit) the two directions are **perpendicular**. Label fall and spring equinox positions.




Twice a year, the angle is <u>as big as it can get</u>, at the summer and winter **solstices**, when it reaches 23.5 degrees. In the summer solstice (around June

21) the north pole is inclined **towards** the Sun, in the winter solstice (around December 21) it faces **away** from it. Label the summer and winter solstice positions on the diagram above.

Let us look at the summer solstice first, with the Sun on the left.




## Summer and Winter

The line AB between sunlight and shadow--between day and night--is **always** perpendicular to the Earth-Sun line, as it was in the example shown at the beginning. The tiltled north/south axis is drawn. The earth rotates on its axis.

But because of the tilted axis, as each point on Earth is carried on its daily trip around the rotating Earth, the part of the trip spent in daylight (unshaded part of the drawing) and in the shadow (shaded) are usually not equal. North of the equator, day is longer than night, and when we get close enough to the north pole, there is no night at all. The Sun is then **always** above the horizon and it just makes a 360-degree circuit around it. That part of Earth enjoys **summer**. Point to the part of the earth that is having summer above. Point the part that is having winter.

Opposite happens south of the equator. Nights are longer than days, and the further one gets from the equator, the larger is the imbalance--until one gets so close to the pole that **the sun never rises**. That is the famous polar night, with 24 hours of darkness each day. In that half of the Earth, it is **winter** time.

A big difference between summer and winter is thus the length of the days: note that on the equator that length does not change, and hence Spring,

Summer, Fall, and Winter **do not exist** there (depending on weather patterns, however, there may exist a "wet season" and a "dry season").

At equinox, the situation is as in the first drawing, and night and day are equal (that is where the word "equinox" comes from) Equinox means equal day and night minutes.

## Some interesting facts

If June 21 is the day when we receive the most sunshine, why is it regarded as the **beginning** of summer and not its hottest? And similarly, why is December 21, the day of least sunshine, the **beginning** of winter and not the coldest?

ANSWER: **Blame the oceans**, which heat up and cool down only slowly. By June 21 they are still cool from the winter time, and that delays the peak heat by about a month and a half. Similarly, in December the water still holds warmth from the summer, and the coldest days are still (on the average--not always! ) a month and a half ahead.

And what about our **distance from the Sun**? It, too, varies, because the Earth's orbit around the Sun isn't an exact circle. We are closest to the Sun--would you believe it? --in the cold wintertime, around January 3-5!!! That proves that our warm summer is not because we are closer to the sun, but that the tilt of the earth towards the sun, causes our summer.

**Name _____**

**Use your science notes to review, "Why the earth has seasons."**

**1.** Name the four seasons.

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**2.** Are the Earth's seasons caused by the differences in the distance from the Sun throughout the year or the tilt of the Earth's axis?

_____

**3.** What is the tilt of the Earth's axis (in degrees)?

_____

**4.** During which season do the Sun's rays hit the Earth at the most direct angle? _____

**5.** During which season are the days the shortest?

_____

**6.** What is the name of the shortest day of the year (and the beginning of winter)? _____

**7.** What is the name of the longest day of the year (and the beginning of summer)? _____

**8.** What is the name of a day in which the day and night are of equal duration? _____

9. What is revolving around the earth? _____. How long does it take this 'body' to revolve around our planet? _____

10. What happens to the earth's oceans because of #8? _____

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