

What Causes the Seasons?

The text and images are from NASA Space Place.

It's all about Earth's tilt!

Many people believe that Earth is closer to the sun in the summer and that is why it is hotter. And, likewise, they think Earth is farthest from the sun in the winter.

Although this idea makes sense, it is incorrect.

It is true that Earth's orbit is not a perfect circle. It is a bit lop-sided. During part of the year, Earth is closer to the sun than at other times. However, in the Northern Hemisphere, we are having winter when Earth is closest to the sun and summer when it is farthest away! Compared with how far away the sun is, this change in Earth's distance throughout the year does not make much difference to our weather.

There is a different reason for Earth's seasons.

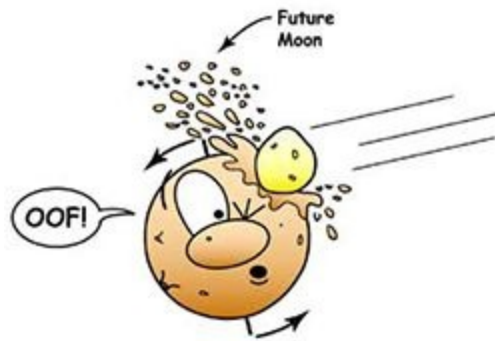
Earth's axis is an imaginary pole going right through the center of Earth from "top" to "bottom." Earth spins around this pole, making one complete turn each day. That is why we have day and night, and why every part of Earth's surface gets some of each.

Earth has seasons because its axis doesn't stand up straight.

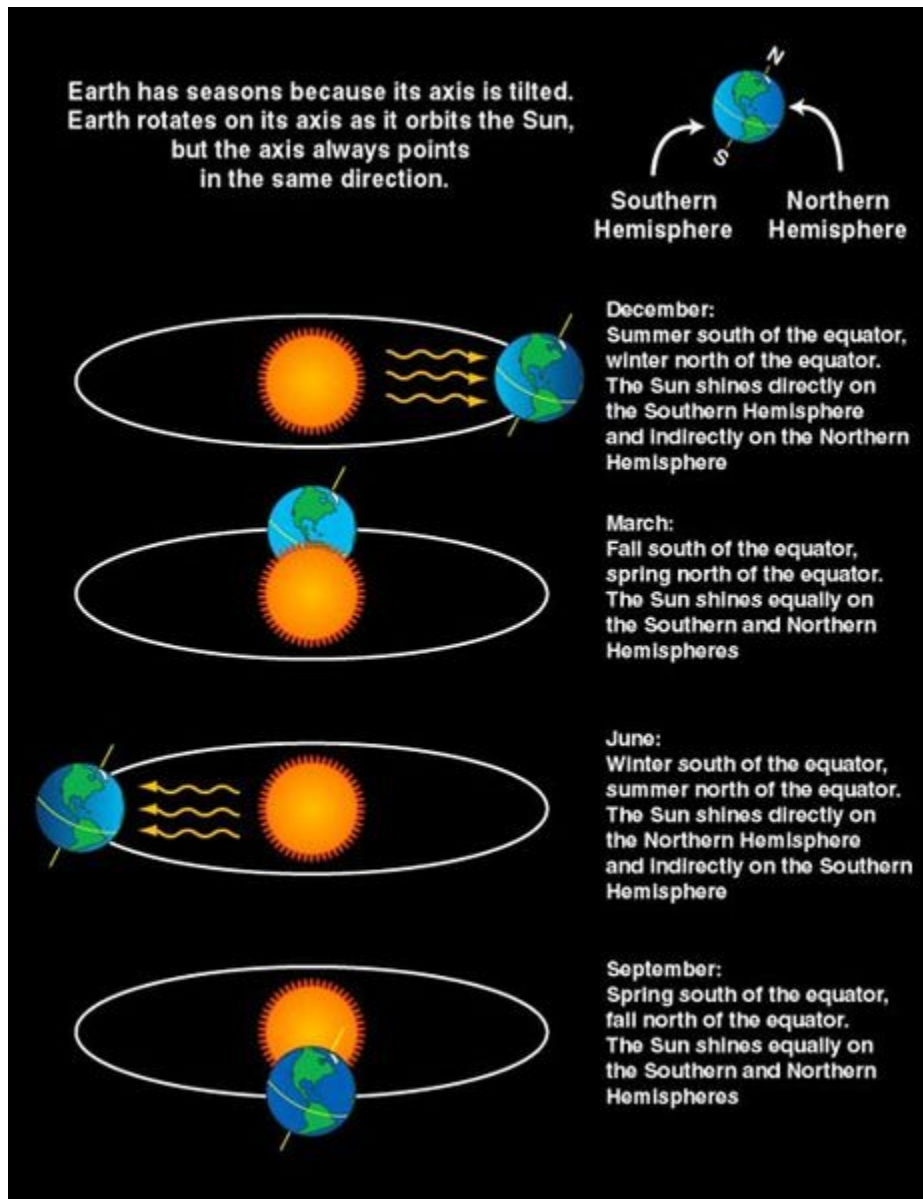
But what caused Earth to tilt?

Long, long ago, when Earth was young, it is thought that something big hit Earth and knocked it off-kilter. So instead of rotating with its axis straight up and down, it leans over a bit.

By the way, that big thing that hit Earth is called Theia. It also blasted a big hole in the surface. That big hit sent a huge amount of dust and rubble into orbit. Most scientists think that that rubble, in time, became our Moon.

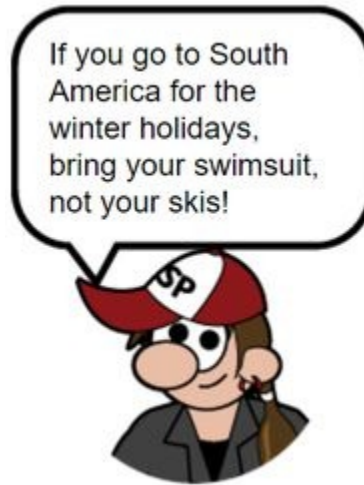


As Earth orbits the sun, its tilted axis always points in the same direction. So, throughout the year, different parts of Earth get the sun's direct rays.



Sometimes it is the North Pole tilting toward the sun (around June) and sometimes it is the South Pole tilting toward the sun (around December).

It is summer in June in the Northern Hemisphere because the sun's rays hit that part of Earth more directly than at any other time of the year. It is winter in December in the Northern Hemisphere, because that is when it is the South Pole's turn to be tilted toward the sun.



axis **ax** **·** **is****Advanced Definition****noun**

1. a straight line that serves as the unmoving center about which a body or figure turns.

Earth makes a complete turn on its axis every twenty-four hours.

2. a straight line that divides a body or figure symmetrically.

Canada's east-west axis is approximately 3600 miles long.

Cut along the vertical axis.

3. in anatomy and botany, a main or central structure.
4. (cap.) the alliance of Germany, Italy, Japan, and other nations during the Second World War (prec. by the).

The nations of the Axis were defeated in 1945.

Spanish cognate

axis: The Spanish word *axis* means axis.

These are some examples of how the word or forms of the word are used:

1. Our planet is always spinning around its **axis**. The **axis** is the invisible line through the center of the earth around which the planet turns. Imagine spinning a basketball on your finger. Now, imagine a line going from the tip of your finger, where it touches the basketball, straight through the center of the ball. That line would be the ball's **axis**.
2. You have probably experienced seasonal shifts, such as winter in New England, when it snows; or fall in the Southwest, when temperatures begin to drop. These seasonal changes occur because of the Earth's tilt on its **axis**. As the Northern Hemisphere tilts away from the sun temperatures in that area drop, for example, and this temperature change causes weather patterns to shift.
3. Have you ever heard of the polar ice caps? The ice caps are the regions at the North and South Poles that are always covered in frozen water--either snow or ice. Polar climates occur only above 60 degrees north latitude or below 60 degrees south latitude. They are the coldest climates on Earth. Polar regions get less of the sun's direct rays because of the tilt of the Earth's **axis**.

orbit or bit

Advanced Definition

noun

1. the curved path in which a planet, satellite, or spacecraft revolves about another body.

Earth's orbit around the sun is elliptical.

2. one complete revolution along such a path.

A little more than 365 days is the amount of time that the earth takes to complete one orbit around the sun.

3. a sphere or area of experience, knowledge, control, or power.

Such questions are really outside of my orbit.

4. one of the two bony sockets that encase the eyeballs.

transitive verb

1. to revolve about (another body) in a curved path.

Several moons orbit Jupiter.

2. to send into an orbit.

intransitive verb

1. to travel in an orbit.

The space station is now orbiting.

Spanish cognate

órbita: The Spanish word *órbita* means orbit.

These are some examples of how the word or forms of the word are used:

1. Cassini snapped shots of Enceladus (en-SELL-ahdus) as the craft **orbited** Saturn.
 2. Fearing the worst, scientists kept their eyes on NT7. They plotted its **orbit**, or path, around the sun.
 3. The Kuiper belt is a wide band of icy and rocky objects circling the sun just beyond the **orbit** of Neptune.
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4. The next stop on the tour was the new Mission Control, where engineers keep tabs on the International Space Station (ISS) **orbiting** above Earth.
5. He took out a high-powered telescope, through which Emine could see Saturn and its rings. She was amazed at how rapidly it moved out of focus, because it was **orbiting** the sun so quickly.
6. A planet must be nearly round and must **orbit** the sun. Its orbit should not cross the orbit of another planet.
7. More than 60 moons **orbit** Jupiter. One of these moons is Europa.
8. Eight planets **orbit**, or revolve around, the sun. The planets and the sun are parts of our solar system.
9. The Hubble Space Telescope makes a full **orbit** every 97 minutes. If a car could move that fast, it could go from New York to California in less than 10 minutes!

tilt**tilt****Advanced Definition****transitive verb**

1. to place or turn on an incline or at a slant.

He tilted the chair against the wall.

intransitive verb

1. to lean on one side or in one direction; be or become inclined or slanted.
2. to attack with a lance (usu. fol. by at).

noun

1. an act or instance of tilting; slope.
 2. the state of being tilted; inclination or slant.
 3. a duel or contest with lances, or a single thrust in such a contest.
 4. any duel, contest, or dispute.
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These are some examples of how the word or forms of the word are used:

1. Earth **tilts** as it travels around the sun. In the summer, the north half of Earth tilts toward the sun. The United States is in Earth's north half.
2. Point your flashlight at the mirror. Now **tilt** the mirror. By moving the mirror around, you can make the light beam bounce off its shiny surface and fall on different objects in the room.
3. The Leaning Tower of Pisa is a bell tower. It was built on soft soil. That caused the tower to **tilt** to one side soon after workers began building it more than 800 years ago.
4. Polar climates occur only above 60 degrees north latitude or below 60 degrees south latitude. They are the coldest climates on Earth. Polar regions get less of the sun's direct rays because of the **tilt** of the Earth's axis.
5. Using a mirror, you can take light from one place and make it travel to another. Point your flashlight at the mirror. Now **tilt** the mirror. By moving the mirror around, you can make the light beam bounce off its shiny surface and fall on different objects in the room.
6. In some parts of the world, the sun can be up in the sky for the entire day. During the summer, the Earth is **tilted** to the sun so much that the sun in northern Alaska never goes below the horizon. In Barrow, Alaska, the sun doesn't even set for almost three months! This phenomenon is called midnight sun. Try sleeping through that!

Name: _____ Date: _____

1. What is the Earth's axis?

- A. an imaginary pole that passes through the center of the Earth
- B. the path that the Earth travels around the sun
- C. the object that hit young Earth long ago, causing it to lean over
- D. the distance between the Earth and the sun

2. This text describes what causes us to have seasons at different times of the year on different parts of the Earth. What is one thing that causes seasons?

- A. the shape of the Earth
- B. the oval-shaped orbit of the Earth
- C. the tilt of the Earth
- D. the distance between the Earth and sun

3. The text says, although many people believe that we have summer when the Earth is closest to the hot sun, that we actually have summer when the Earth is farthest away from the sun. What conclusion can be drawn from this evidence?

- A. Earth's orbit changes shape almost every year.
- B. Scientists do not know for sure why we have seasons.
- C. Earth's seasons are caused by the moon rather than the sun.
- D. Earth's distance from the sun does not affect the seasons.

4. Based on the text, what causes a hemisphere on Earth to have summer?

- A. direct sunshine from the sun hitting that hemisphere
- B. indirect sunshine from the sun hitting that hemisphere
- C. that hemisphere's closeness to the sun, relative to its closeness at other parts of the year
- D. that hemisphere's natural climate and the warmth of the Earth's atmosphere in that area

5. What is the main idea of this text?

- A. Earth's oval-shaped orbit causes the seasons.
- B. Earth's tilted axis causes the seasons.
- C. The shape of the Earth causes the seasons.
- D. Earth's distance from the sun causes the seasons.

6. Please read the following sentences from the passage.

"But what caused the Earth to **tilt**? Long, long ago, when Earth was young, it is thought that something big hit Earth and knocked it off-kilter. So instead of rotating with its axis straight up and down, it leans over a bit."

What does the word **tilt** mean as used in these sentences?

- A. skip
- B. spin
- C. move
- D. lean

7. Please choose the answer that best completes the sentence below.

When the Northern Hemisphere is tilted towards the sun, the Southern Hemisphere does not receive direct sunshine, ____ it is winter in the south.

- A. because
- B. if
- C. so
- D. first

8. Why is the Earth's axis tilted?

9. Why does the Northern Hemisphere have summer in June? Use evidence from the text in your answer.

10. Imagine that the Earth's axis went straight up and down, instead of tilting. Explain whether or not the Earth would still have different seasons. Support your answer with evidence from the text.
