

Big Questions: Why is Earth rotating?

By NASA SpacePlace, adapted by Newsela staff on 10.17.19

Word Count **562**

Level **MAX**

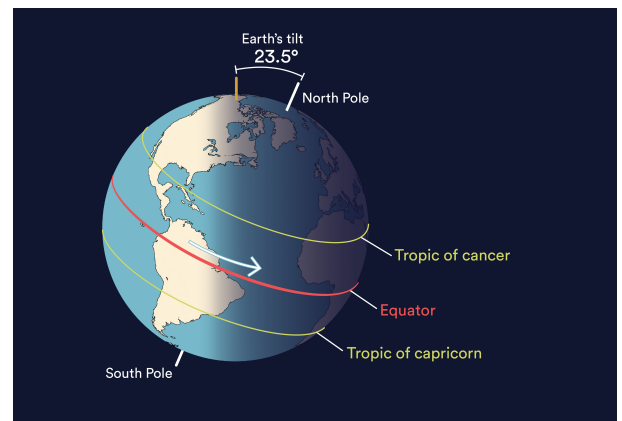


Image 1. A composite time-lapse image of the night sky over Corfe Castle in the United Kingdom. In time-lapse images, the stars appear to trace out circles in the sky. This pattern is a product of Earth's rotation. Photo by: Dan Kitwood/Getty Images

Earth's graceful 24-hour rotation rate is one of the traits that make our planet so friendly to life, allowing most parts of Earth to stay a nice, comfortable temperature as they are bathed in sunlight during the day and darkness at night.

Each planet in the solar system has its own unique rotation rate. Tiny Mercury, sizzling closest to the sun, takes 59 Earth days to turn around just once. Venus, the second planet, rotates once every 243 Earth days. What's more, Venus rotates backward from the direction of its orbit around the sun, as do Uranus and tiny dwarf planet Pluto. Uranus even lies down on the job, rolling around with its axis of rotation pointed nearly toward the sun.

Why do Earth and the other planets rotate at all? It will help to understand how our solar system formed.



Almost five billion years ago, our solar system had its beginnings as a vast cloud of dust and gas. The cloud began to collapse, flattening into a giant disk that rotated faster and faster, just as an ice skater spins faster as she brings her arms in. The sun formed at the center, and the swirling gas and dust in the rest of the spinning disk clumped together to produce the planets, moons, asteroids and comets. The reason so many objects orbit the sun in nearly the same plane (called the ecliptic) and in the same direction is that they all formed from this same disk.

While the planets were forming, there was not much peace in our solar system. Clumps of matter of all sizes often collided, and either stuck together or sideswiped each other, knocking off pieces and sending each other spinning. Sometimes the gravity of big objects would capture smaller ones in orbit. This could be one way the planets acquired their moons.

Scientists think that a large object, perhaps the size of Mars, impacted our young planet, knocking out a chunk of material that eventually became our moon. This collision set Earth spinning at a faster rate. Scientists estimate that a day in the life of early Earth was only about 6 hours long.

The moon formed much closer to Earth than it is today. As Earth rotates, the moon's gravity causes the oceans to seem to rise and fall. (The sun also does this, but not as much.) There is a little bit of friction between the tides and the turning Earth, causing the rotation to slow down just a little. As Earth slows, it lets the moon creep away.

We can use extremely accurate atomic clocks to measure exactly how much the rotation is slowing down. One hundred years from now, a day will be about 2 milliseconds longer than today. Two milliseconds is $\frac{1}{500}$ th of a second, or how long it takes a car going 55 miles per hour to travel only 2 inches, in other words, much less than the blink of an eye. So, if you live to be 100, you can't complain that the days are getting shorter! At this rate, though, you don't have to worry about the days getting longer enough to change things very much.

Quiz

- 1 In the United States, Florida is on the east coast, California is on the west coast, and Texas is in the middle. Which sequence shows the order in which each state will see a sunrise, going from first to last. Hint: Study the direction of Earth's spinning in Image 2.
- (A) California, Texas then Florida
 - (B) Florida, California then Texas
 - (C) Florida, Texas then California
 - (D) Texas, Florida then California
- 2 Why is Earth's rotation slowing down? How do you know?
- (A) Earth's rotation is slowing down in order to match up with the rotation rate of other planets. "Venus, the second planet, rotates once every 243 Earth days."
 - (B) Friction between the Earth and the oceans is causing Earth's rotation to slow down. "There is a little bit of friction between the tides and the turning Earth, causing the rotation to slow down just a little."
 - (C) The gravity of the sun is slowing down the Earth's rotation because of its larger size. "Sometimes the gravity of big objects would capture smaller ones in orbit."
 - (D) Extremely accurate atomic clocks have been used in order to show that Earth's rotation is slowing down. "We can use extremely accurate atomic clocks to measure exactly how much the rotation is slowing down."
- 3 Which statement is supported by evidence from the article?
- (A) Earth's moon was originally one of Mars' moons.
 - (B) Planets closer to the sun experience backward rotations.
 - (C) The sun and planets formed from different disks of dust and gas.
 - (D) Millions of years in the future, Earth's rotational period (day) will take longer than 24 hours.
- 4 Read the article.
- Select the paragraph from the article that suggests Earth's rotation is caused by early interactions with other planets.
- (A) Each planet in the solar system has its own unique rotation rate. Tiny Mercury, sizzling closest to the sun, takes 59 Earth days to turn around just once. Venus, the second planet, rotates once every 243 Earth days. What's more, Venus rotates backward from the direction of its orbit around the sun, as do Uranus and tiny dwarf planet Pluto. Uranus even lies down on the job, rolling around with its axis of rotation pointed nearly toward the sun.
 - (B) While the planets were forming, there was not much peace in our solar system. Clumps of matter of all sizes often collided, and either stuck together or sideswiped each other, knocking off pieces and sending each other spinning. Sometimes the gravity of big objects would capture smaller ones in orbit. This could be one way the planets acquired their moons.
 - (C) The moon formed much closer to Earth than it is today. As Earth rotates, the moon's gravity causes the oceans to seem to rise and fall. (The sun also does this, but not as much.) There is a little bit of friction between the tides and the turning Earth, causing the rotation to slow down just a little. As Earth slows, it lets the moon creep away.
 - (D) We can use extremely accurate atomic clocks to measure exactly how much the rotation is slowing down. One hundred years from now, a day will be about 2 milliseconds longer than today. Two milliseconds is 1/500th of a second, or how long it takes a car going 55 miles per hour to travel only 2 inches, in other words, much less than the blink of an eye. So, if you live to be 100, you can't complain that the days are getting shorter! At this rate, though, you don't have to worry about the days getting longer enough to change things very much.

5 These events occurred during the formation of the solar system.
Which sequence correctly lists these events in the order in which they happened?

1. *The gas and dust flattened into a spinning disk.*
2. *The sun formed at the center of the dust cloud.*
3. *Collisions impacted the rotation of the planets.*
4. *The solar system was a vast cloud of gas and dust.*
5. *Earth spins on its axis once every twenty hours.*

- (A) 1, 4, 3, 2 then 5
(B) 2, 5, 1, 4 then 3
(C) 3, 2, 4, 5 then 1
(D) 4, 1, 2, 3 then 5

6 Read the list of sentences from the article.

1. *Scientists estimate that a day in the life of early Earth was only about 6 hours long.*
2. *As Earth rotates, the moon's gravity causes the oceans to seem to rise and fall.*
3. *There is a little bit of friction between the tides and the turning Earth, causing the rotation to slow down just a little.*
4. *One hundred years from now, a day will be about 2 milliseconds longer than today.*

What central idea do these details support?

- (A) Earth's rotation is important for causing conditions that allow for life on our planet.
(B) Earth's rotation was very fast millions of years ago but is slowing down a little bit at a time.
(C) Knowing how our solar system formed helps scientists understand why Earth rotates the way it does.
(D) The moon causes forces of gravity and friction that affect the rate of Earth's rotation.

7 Which statement correctly describes solar system objects?

- (A) Moons are smaller than the objects they orbit.
(B) Venus has a shorter rotation period than Earth.
(C) Pluto rotates the same direction as Earth does.
(D) Mars and Earth collided during their formation.

8 Which sentence from the article would be MOST important to include in a summary of the article?

- (A) Each planet in the solar system has its own unique rotation rate.
(B) While the planets were forming, there was not much peace in our solar system.
(C) This collision set Earth spinning at a faster rate.
(D) The moon formed much closer to Earth than it is today.