

# Seasons Reasons

(Modified from Science U)

You have noticed that the weather changes during the year. It is hotter during the summer and colder in winter. It's somewhere in between during spring and fall. These are the seasons. It is a regular change in temperature that repeats every year.

What causes these changes? The Sun is our main source of heat. These changes are the same every year. Does it have anything to do with the movement of Earth around the Sun? Is Earth closer to the Sun during summer and farther during winter? This seems to be a good answer. If you believe that, that's right, you're wrong! The seasons in the Northern and Southern Hemisphere are reversed. When it is summer in Utah, it is winter in Australia. (Hint – Australia and Utah are always the same distance from the Sun all year!)

Besides, that the Earth's orbit is an ellipse, not a circle. At some times Earth is closer to the Sun than at others; but this ellipse is very nearly a circle. The distances from Earth to the Sun do change through the year. The distances don't matter. It's like standing 10 feet from a fire and then moving six inches closer or farther away. You

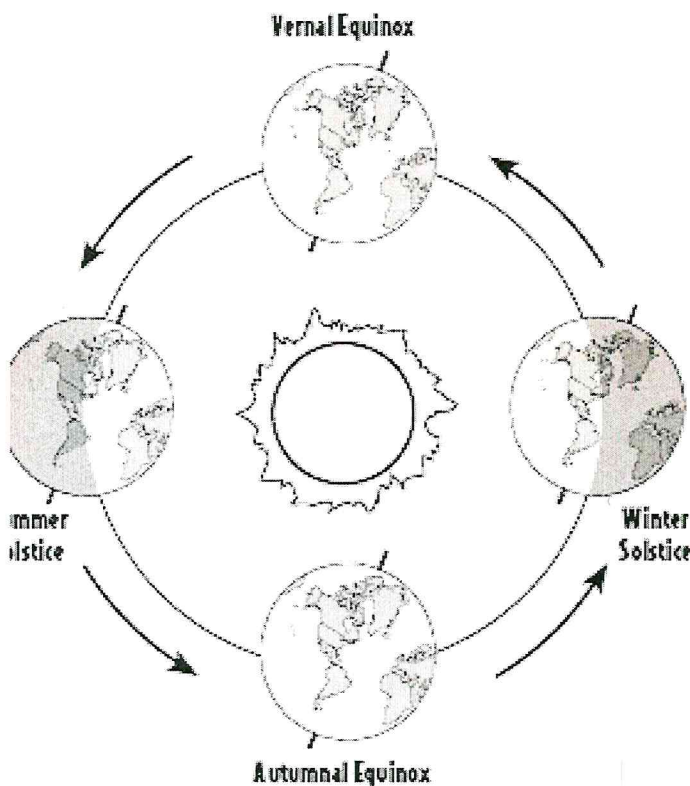
won't notice any difference in the heat. Guess what? The Earth is closer to the Sun during the northern hemisphere winter! So much for that idea!

What, then, is the cause of the seasons?

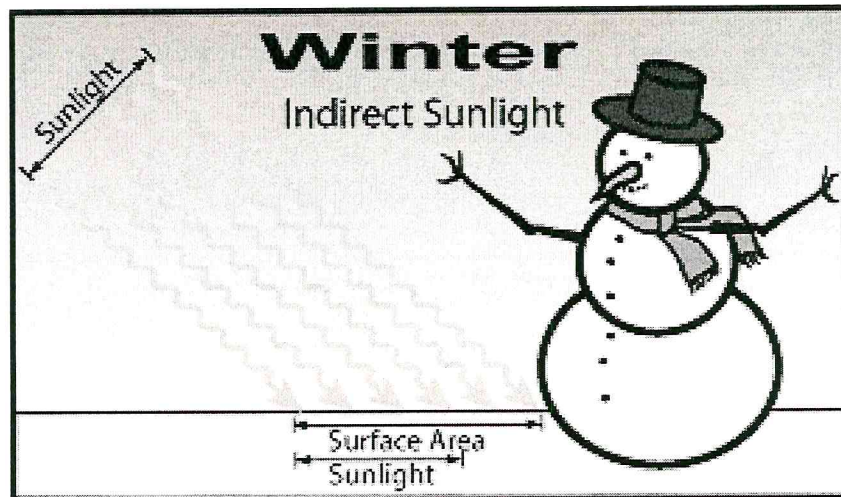
What causes this? The Earth's axis is tilted of  $23.5^\circ$ .

In the diagram on the left, you can see the Earth revolving around the Sun. At position A, the northern hemisphere is tilted towards the Sun. It is summer in Michigan; it is winter in Australia. Six months later Earth is at position C. The southern hemisphere is tilted towards the Sun. It is summer in Australia; it is winter in Michigan.

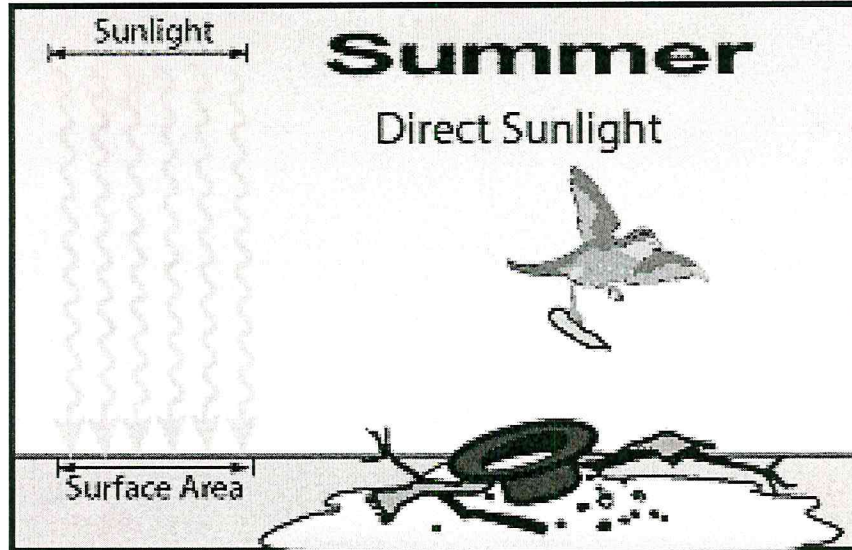
As the Earth revolves around the Sun, this axis points in the same direction. It points towards Polaris, the North Star. This is why different parts of Earth tilt towards or away from the Sun throughout the year.



What has this to do with temperature? When the northern hemisphere tilts away from the Sun, the sunlight (heat energy) comes in at a smaller angle. We receive indirect sunlight. This means that the same amount of light is distributed over a larger surface. These places receive less heat than the others. The temperatures become cooler.



When the northern hemisphere tilts towards the Sun, the sunlight (heat energy) comes in at a larger angle. We receive direct sunlight. This means that the same amount of light is distributed over a smaller surface. These places receive more heat than the others. Temperatures become warmer.



The seasons are then the result of this tilt of the Earth's axis. If the tilt of the Earth's axis was  $0^\circ$  there would be no difference in how the rays from the Sun hit its different regions, and there would be no seasons.

Not all planets have the same kind of tilt as the Earth has: Uranus, for example, has a tilt of almost  $98^\circ$ . Its axis, then, lies almost on the plane of its orbit, and a day there lasts about as much as one year on Uranus: about 84 Earth-years.



# Seasons Reasons – Worksheet

1. There are \_\_\_\_\_ seasons during the year. (*Enter a number*)
2. Temperatures change in a random pattern through the year.
  - a. True
  - b. False
3. This is our main source of heat.
  - a. Electricity
  - b. Moon
  - c. Natural Gas
  - d. Sun
4. We have seasons because Earth is closer to the Sun in the winter than the summer.
  - a. True
  - b. False
5. Which is closest to the Sun in winter, Australia or Michigan?
  - a. Australia
  - b. Michigan
  - c. Neither
6. Earth's orbit is a(n) ...
  - a. annuls.
  - b. circle.
  - c. ellipse.
  - d. semi-circle.
7. During which northern hemisphere season is Earth closest to the Sun.
  - a. Fall
  - b. Spring
  - c. Summer
  - d. Winter
8. The Earth's axis is tilted \_\_\_\_\_. (*Enter a number*)

*Match the season with the Earth's position in the diagram on pg. 1. (Answers may be used more than once or may not be used at all)*

- \_\_\_\_\_9. Winter (southern hemisphere)    A. A
- \_\_\_\_\_10. Summer (northern hemisphere)    B. B
- \_\_\_\_\_11. Winter (northern hemisphere)    C. C
- \_\_\_\_\_12. Summer (southern hemisphere)    D. D

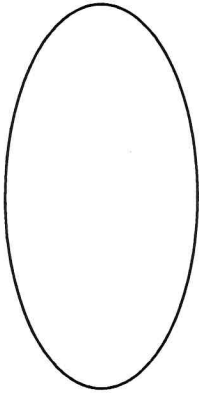
13. As the Earth revolves around the Sun, the Earth's axis is pointed at...

- a. Deneb.
- b. Polaris.

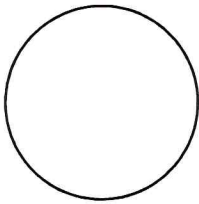
- c. Thuban.
- d. Vega.

*Match the circle with the type of heat energy.*

\_\_\_\_\_ 14.



\_\_\_\_\_ 15.



A. Direct Heat Energy

B. Indirect Heat Energy

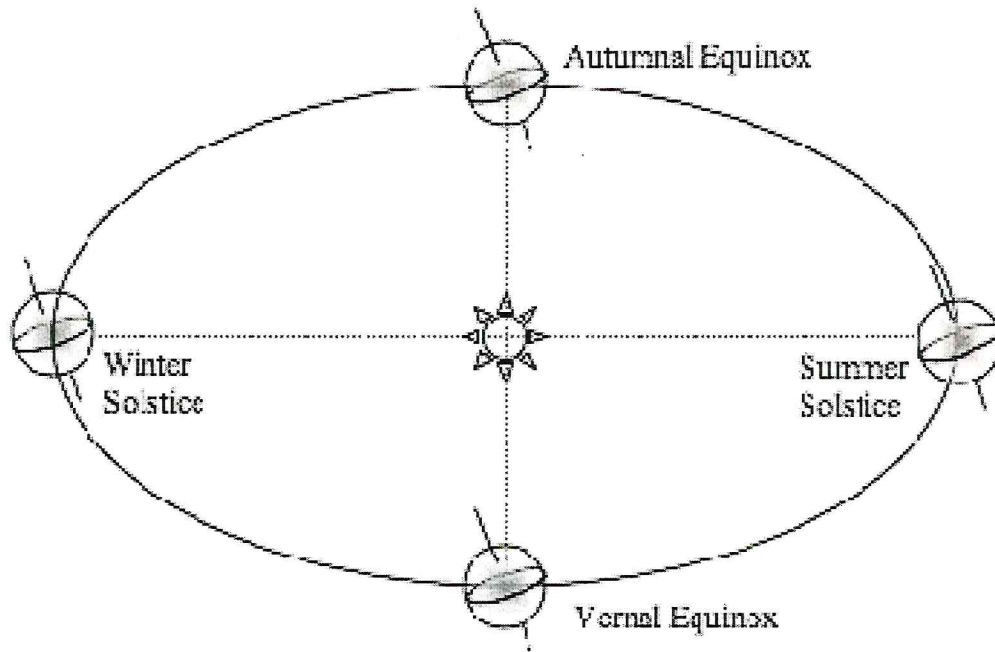


# Earth's Tilt Is the Reason for the Seasons!

(Modified from Windows to the Universe)

Seasons change depending on the amount of sunlight (heat energy) reaching the Earth as it revolves around the Sun.

We have seasons for two reasons. The first is that Earth is tilted  $23.5^\circ$  on its axis. The second is that Earth revolves around the Sun.



Summer happens in the hemisphere tilted towards the Sun. Winter happens in the hemisphere tilted away from the Sun. As the Earth travels around the Sun, the hemisphere that is tilted towards or away from the Sun changes. The hemisphere that is tilted towards the Sun is warmer because sunlight travels more directly to the Earth's surface.

The hemisphere tilted towards the Sun has longer days and shorter nights. That's why days are longer during the summer than during the winter.

At the equator there are no seasons because each day the Sun strikes at about the same angle. Every day of the year the equator receives about 12 hours of sunlight.

The poles remain cool because they are never tilted in a direct path of sunlight. During midwinter, when a pole is tilted away from the Sun, there is no daylight at all. The Sun never rises! However, during the summer, a pole receives sunlight all the time and there is no night!

# Earth's Tilt Is the Reason for the Seasons – Worksheet

16. Identify why we have seasons *(There are two answers to this question.)*

- a. Earth is closer to the Sun in summer than winter.
- b. We receive direct and indirect sunlight during the seasons.
- c. Earth is farther from the Sun in winter than summer.
- d. The Earth is tilted.

Use the diagram on pg. 3 to answer questions #17-#19.

17. The autumnal equinox occurs between which events? *(There are two answers to this question.)*

- |                     |                    |
|---------------------|--------------------|
| a. Autumnal equinox | c. Vernal equinox  |
| b. Summer solstice  | d. Winter solstice |

18. The vernal equinox occurs between which events? *(There are two answers to this question.)*

- |                     |                    |
|---------------------|--------------------|
| a. Autumnal equinox | c. Vernal equinox  |
| b. Summer solstice  | d. Winter solstice |

19. The summer solstice occurs between which events? *(There are two answers to this question.)*

- |                     |                    |
|---------------------|--------------------|
| a. Autumnal equinox | c. Vernal equinox  |
| b. Summer solstice  | d. Winter solstice |

20. At the equator, there are \_\_\_\_\_ seasons. *(Enter a number)*

21. When the North Pole has 24 hours of daylight, the South Pole will have 24 hours of darkness.

- |         |          |
|---------|----------|
| a. True | b. False |
|---------|----------|





## Why Darkness Falls

By Galadriel Watson

🌍 *In ancient times, people believed gods controlled night and day. Egyptians, for example, thought the Sun god Ra disappeared at dusk into the underworld, where he had to fight off a demon of darkness before rising each dawn. Today, science has a different idea.*

### Night and Day

The imaginary rod rammed straight through Earth--one end poking out of the North Pole, the other out of the South Pole--is called Earth's axis. Earth spins on this axis [rotation]. When the side of Earth you're on faces the Sun, it's day. When it faces away from the Sun, it's night. It takes 24 hours for Earth to make one complete turn.

### Winter and Summer

The farther you live from the equator, the longer your days are in summer and the shorter they are in winter. This is because while it spins, Earth travels in a second way, too, in a most circular path around the Sun. This path is called an orbit [revolution].

If Earth stood straight up and down, this orbit wouldn't make a difference. But, Earth tilts on its axis in one direction. In June, the northern half of Earth tilts toward the Sun, so the farther north an area is, the longer it faces the Sun during one complete spin of the Earth--and the longer its days. In December, the north tilts away, and the opposite happens.

### Good Night Sun

Because of the way Earth tilts, the Sun disappears completely from view at the North Pole from October 7 through March 4. Countries that surround the polar region receive as little as two hours of Sunlight each winter day. During that same period at the South Pole in Antarctica, the Sun never sets. From March to October, the tilt brings 24-hour Sun to the north and 24-hour darkness to the south.

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🌍 Earth spins on its axis at 1,000 miles per hour. We don't notice the speed because our bodies are used to the constant movement. Gravity keeps us from flying off.

## Why Darkness Falls ~ Worksheet

22. Egyptians believed which god fought the demon of darkness each night?

- a. Anubis
- b. Hathor
- c. Osiris
- d. Ra

23. This is responsible for day and night.

- a. Earth's revolution around the Sun.
- b. Earth's rotation.
- c. The Sun's revolution around Earth.
- d. The Sun's rotation.

24. It takes the Earth \_\_\_\_\_ hours to turn once on its axis. (*Enter a number*)

25. The farther you live from the equator, the \_\_\_\_\_ your days are in the summer and the \_\_\_\_\_ they are in the winter.

- a. longer, shorter
- b. shorter, longer
- c. longer, longer
- d. shorter, shorter

26. At the North Pole, the Sun does not set between October 7<sup>th</sup> through March 4<sup>th</sup>.

- a. True
- b. False

27. At the South Pole, the Sun does not set between October 7<sup>th</sup> through March 4<sup>th</sup>.

- a. True
- b. False

28. The Earth spins on its axis at around \_\_\_\_\_ miles per hour (*enter a number, no comma*)

29. We don't fly off the Earth as it rotates because of gravity.

- a. True
- b. False