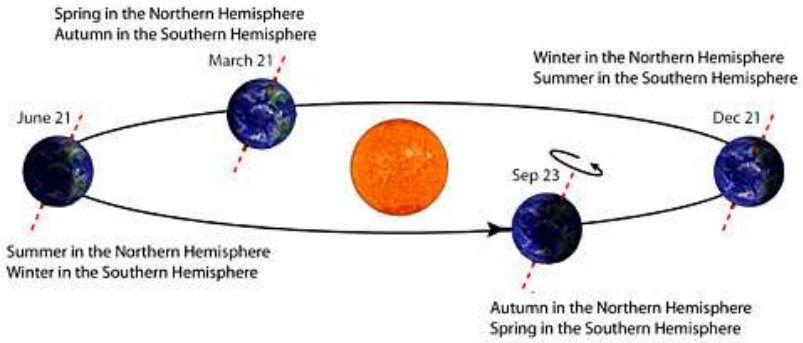
Reason for the Seasons Facts

Revolution

The Earth ***revolves*** around the Sun (***revolution, revolve*** - *The circling of one object around another object in space. A planet revolves around the sun. A moon revolves around a planet*). Here's a diagram of the Earth ***revolving*** around the Sun.



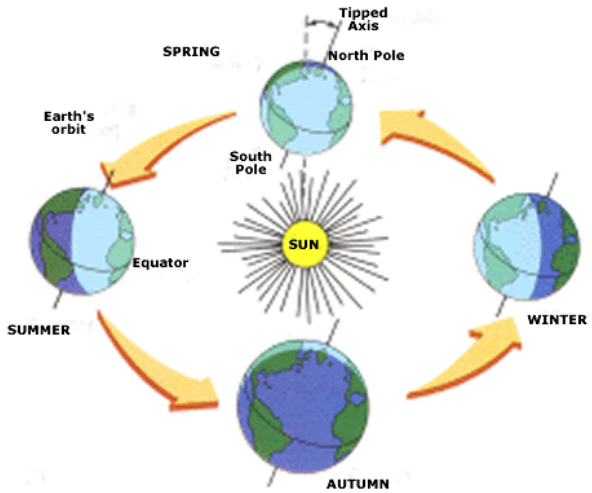
(Alder Planetarium, http://www.adlerplanetarium.org/education/resources/sunearth/section06i.shtml, accessed November 1, 2008)

The Earth is ***revolving*** around the Sun counter-clockwise.

Tilt

The Earth ***tilts*** 23.5° from the perpendicular (***tilt*** - *The earth's axis is not straight up and down, instead it leans at a 23.5-degree angle*). Say what? This means that instead of the Earth being straight up-and-down, it ***tilts*** 23.5°. Here's the ***tilt*** of the Earth.

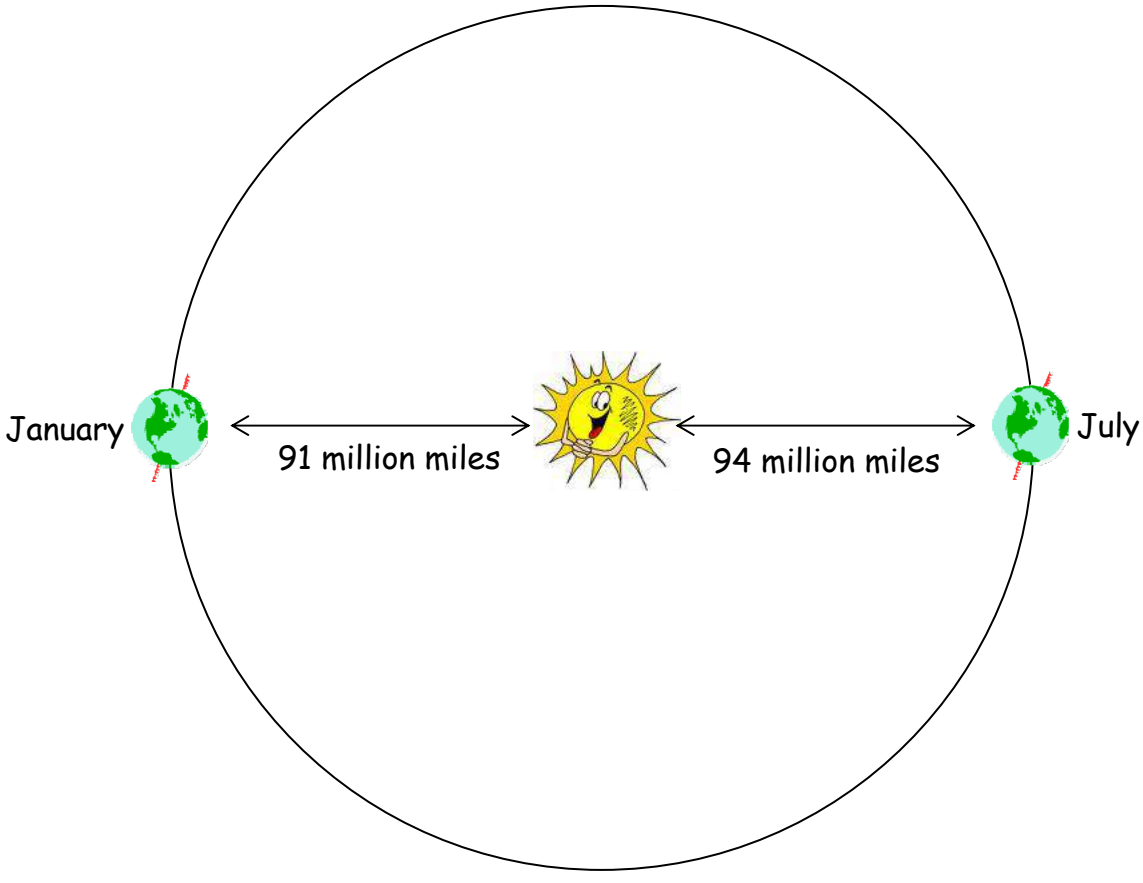
The Earth is ***tilted***. Sometimes the Northern Hemisphere is ***tilted*** towards the Sun. Sometimes it's ***tilted*** away from the Sun. Look at this diagram.



The ***tilt*** of the Earth affects the amount of heat energy we receive from the Sun. Look at the Earth when it is winter. The Northern Hemisphere is ***tilted away*** from the Sun.

Distance from the Sun

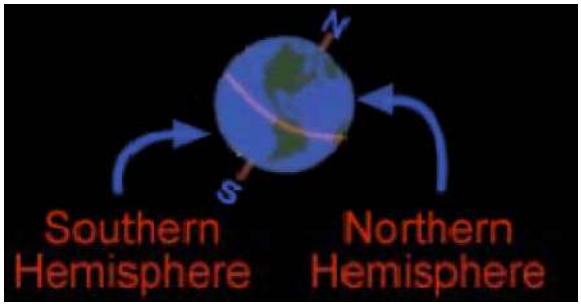
As the Earth ***revolves*** around the Sun, it is not always the same distance from the Sun. During January, Earth is closest to the Sun. During July, the Earth is farthest from the Sun. The Earth's orbit ***is not*** a perfect circle. It is an ellipse. Even though it's not a perfect circle, it's very, very close. This diagram shows you the distances to the Sun.



Many people think it's warm in summer because the Earth is closer to the Sun in the summer. In the winter, Earth is farther away from the Sun. Is this correct? ***The answer is no, uh-uh, wrong, incorrect, mistaken, untrue, false, bogus, made-up, fiction …*** Well, you get the point. The distance between the Earth and the Sun has ***absolutely nothing*** to do with why we have seasons. Tattoo this on your forehead! (Just kidding! Do not tattoo this on your forehead. Simply remember it!)

Look at the picture. Is Earth closest to the Sun in ***January!*** We're well into ***winter*** when we are closest to the Sun.

You know that seasons are reversed in the Northern and Southern Hemisphere. Look at this chart.



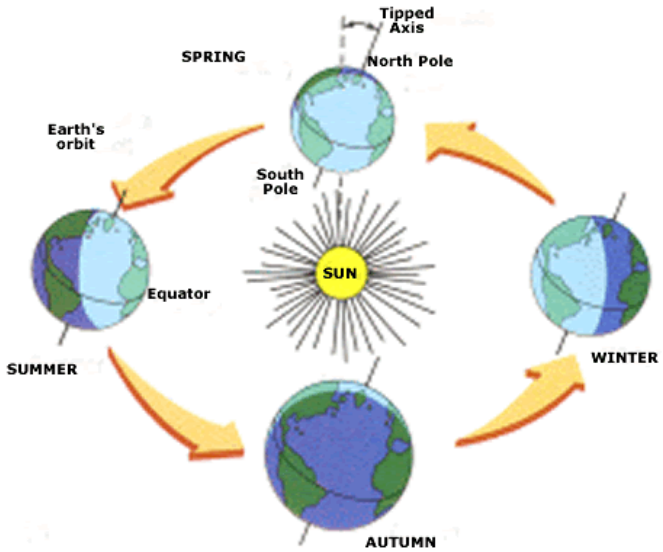
Summer	Winter
Autumn	Spring
Winter	Summer
Spring	Autumn

Answer this question. ***If we have summer when we are closest to the Sun, why is it winter in Australia? Why don't they have summer?*** Come on. Give me an answer. I'm waiting. Ha! I didn't think you could give me an answer!

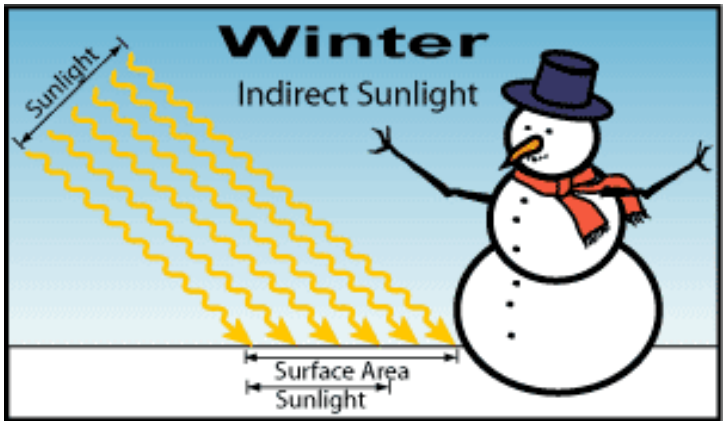
Reason for the Seasons Facts

Tilt and Direct/Indirect Heat Energy

The Earth is ***tilted***. Sometimes the Northern Hemisphere is ***tilted*** towards the Sun. Sometimes it's ***tilted*** away from the Sun. Look at this diagram.

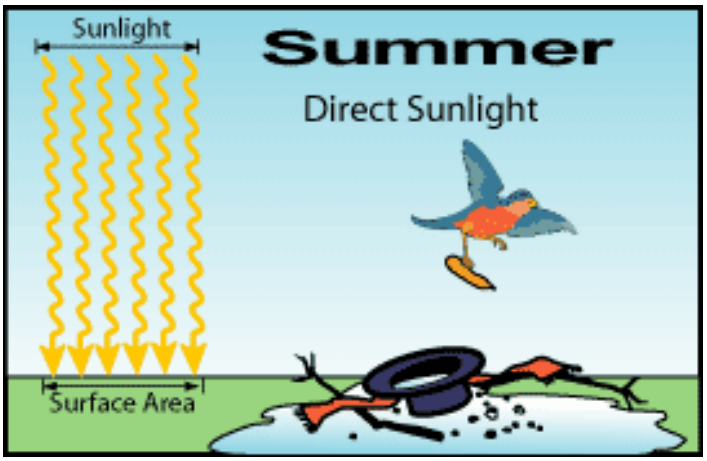


The ***tilt*** of the Earth affects the amount of heat energy we receive from the Sun. Look at the Earth when it is winter. The Northern Hemisphere is ***tilted away*** from the Sun. We receive the same amount of heat energy from the Sun, but it has to heat a larger area. To see how this works, we need to look at some diagrams.



Indirect heat energy strikes the ground at an angle. The light and its heat are spread out over a larger surface area than if it had struck the ground directly. The picture shows that the same amount of heat energy hits the surface. However, this energy heats a ***larger*** surface area. This means winter temperatures are cooler.

What happens in the summer? Look at this diagram.

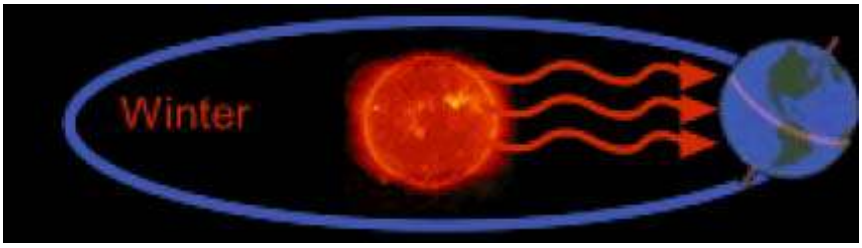


Direct heat energy is energy at or near right angles to the ground. The picture shows that, during the summer, the heat energy heats a ***smaller*** surface area. This means that summer temperatures are warmer.

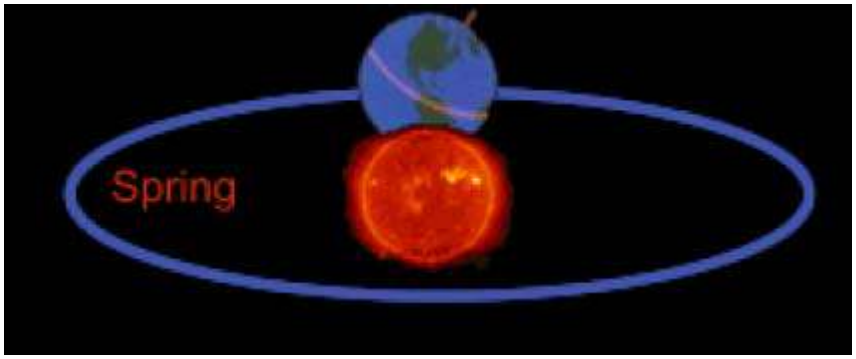
There are two times when the heat energy is between direct and indirect. That is when it is spring and autumn. At that time, the Earth gets an equal amount of heat energy. This is why it is warming up in spring. It is why it is getting cooler in autumn.

There are four important dates as the Earth revolves around the Sun.

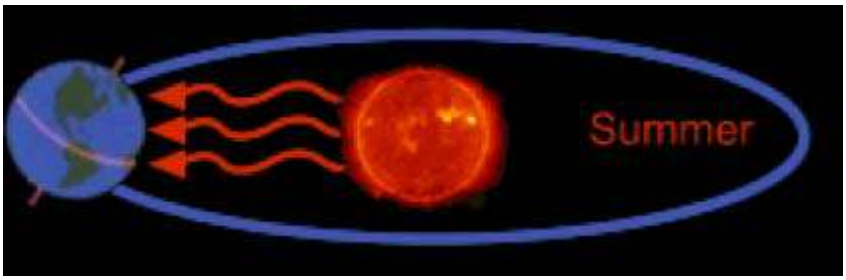
- ☑ December 21st – Winter Solstice. Solstice means "Sun standing still." On the Winter Solstice, the Sun appears at its most southern position along the horizon at sunrise and sunset and reaches its lowest midday altitude for the year. The South Pole is tilted most toward the Sun.



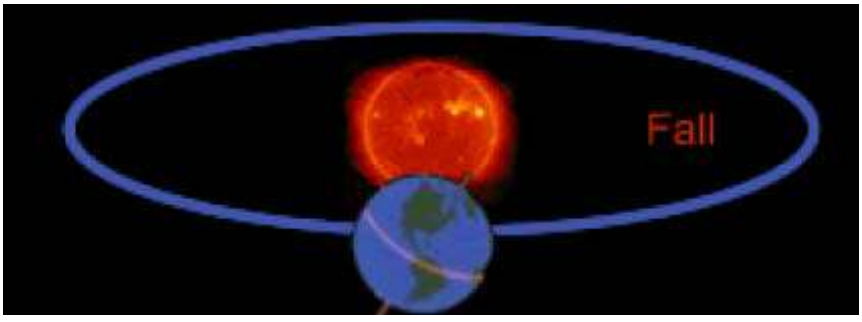
☑ March 21st - Vernal Equinox - Midway between the Winter and Summer Solstices, the date when the ecliptic crosses the celestial equator.



☑ June 21st - Summer Solstice - On the Summer Solstice, the Sun appears at its most northern position along the horizon at sunrise and sunset and reaches its highest midday altitude for the year. The North Pole is tilted most toward the Sun.



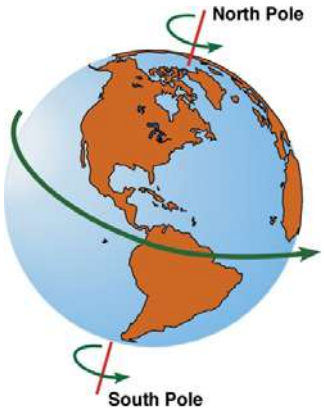
☑ September 22nd - Autumnal Equinox - Midway between the Summer and Winter Solstices, the date when the ecliptic crosses the celestial equator.



Reason for the Seasons Facts

Rotation

Fact: The Earth ***rotates*** on its axis (***axis*** - *An imaginary line going from the North Pole to the South Pole. The earth spins on this line*). Look at this picture:



The Earth ***rotates*** once every 24 hours (or once a day!).

Why do things ***appear*** to move in the sky? Why does the Sun and Moon move across our sky? Why do we see different stars at 10:00 p.m. and at 4:00 a.m.? The Earth ***rotates***. As the Earth rotates, objects in the sky ***appear*** to move. They really don't, you know!

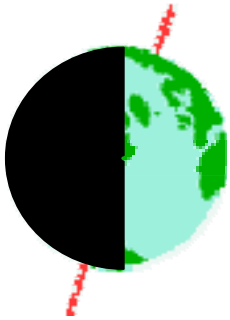
As you watch objects throughout the day and night, you will see ***everything*** rises in the ***east*** and sets in the ***west***. This is because the Earth rotates counter-clockwise.

Changes in Daylight Hours Thru the Year

How does the length of daylight change throughout the year? Look at this diagram.

When it's winter, the Northern Hemisphere is tilted away from the Sun. The North Pole is in darkness 24 hours a day. Daylight hours increase as you move south. In Utah, our daylight hours are around eight hours a day. Shorter daylight hours and indirect heat energy from the Sun make for a cold season.

After the Winter Solstice, the daylight hours start ***increasing***. By the Vernal Equinox, daylight hours are about twelve hours long. Daylight hours continue to increase until the Summer Solstice. Look at this diagram.



The Northern Hemisphere is now tilted towards the Sun. The North Pole is getting 24 hours of daylight. Daylight hours decrease as you move south. In Utah, our daylight hours are around 16 hours a day. Longer daylight hours and direct heat energy make for a warm season.

After the Summer Solstice, daylight hours start ***decreasing***. By the Autumnal Equinox, daylight hours are about twelve hours long. Daylight hours continue decreasing until the Winter Solstice.

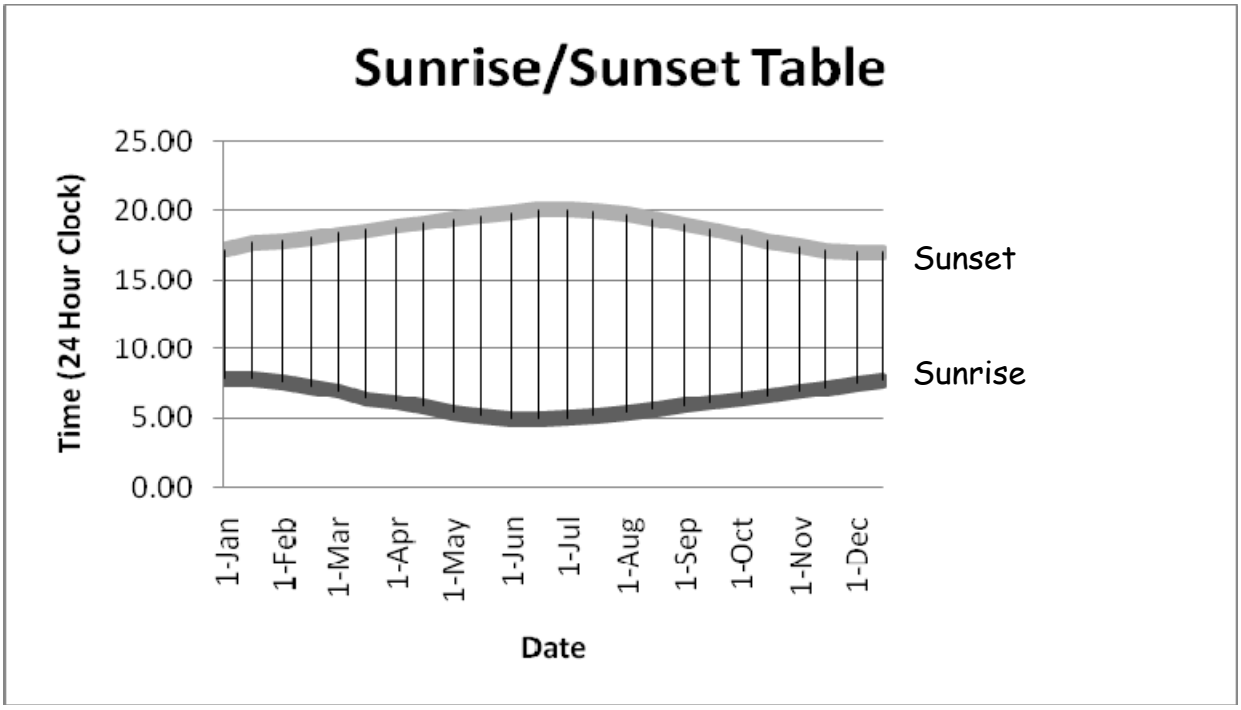
How do the daylight hours change? Look at this table that shows daylight hours throughout the year.

Latitude 40°N						
Date	Jan 1	Jan 16	Feb 1	Feb 16	Mar 1	Mar 16
Hours light	9.21	9.46	9.92	10.48	11.02	11.68
Date	Apr 1	Apr 16	May 1	May 16	Jun 1	Jun 16
Hours light	12.41	13.07	13.68	14.21	14.63	14.82
Date	Jul 1	Jul 16	Aug 1	Aug 16	Sep 1	Sep 16
Hours light	14.81	14.58	14.13	13.59	12.92	12.25

Date	Oct 1	Oct 16	Nov 1	Nov 16	Dec 1	Dec 16
Hours light	11.58	10.92	10.27	9.75	9.37	9.17

(Source: http://www.orchidculture.com/COD/daylength.html; accessed November 11, 2008)

This graph shows how the daylight hours change throughout the year.



The area between sunrise and sunset are the daylight hours. As the year goes along, you see that the hours of daylight increase until the middle of June. They begin to decrease until the middle of December. Then, the process repeats itself.