Monday, April 2, 2018

Pick up: ppt notes

Today you will:

- Learn about the telescopes that make learning about space possible
- Motion of the planets and how it affects the constellations, time & seasons
- Ch. 26 WB-Read, highlight key terms, main ideas, answer questions and put # of Questions next to where you found answer.

HOMEWORK:

Ch. 26 WB

Telescopes

- In 1609, an Italian scientist, Galileo, built a device that used two lenses to make distant objects appear closer and turned it toward the sky.
- **telescope** an instrument that collects electromagnetic radiation from the sky and concentrates it for better observation
- Telescopes that collect only visible light are called *optical telescopes.*
- The two types of optical telescopes are refracting telescopes and reflecting telescopes.

Telescopes, *continued*

Refracting Telescopes

- **refracting telescope** a telescope that uses a set of lenses to gather and focus light from distant objects
- The bending of light is called *refraction*.
- Refracting telescopes have an objective lens that bends light that passes through the lens and focuses the light to be magnified by an eyepiece.
- One problem with refracting telescopes is that the lens focuses different colors of light at different distances causing the image to distort.
- Another problem is that it is difficult to make very large lenses of the required strength and clarity.

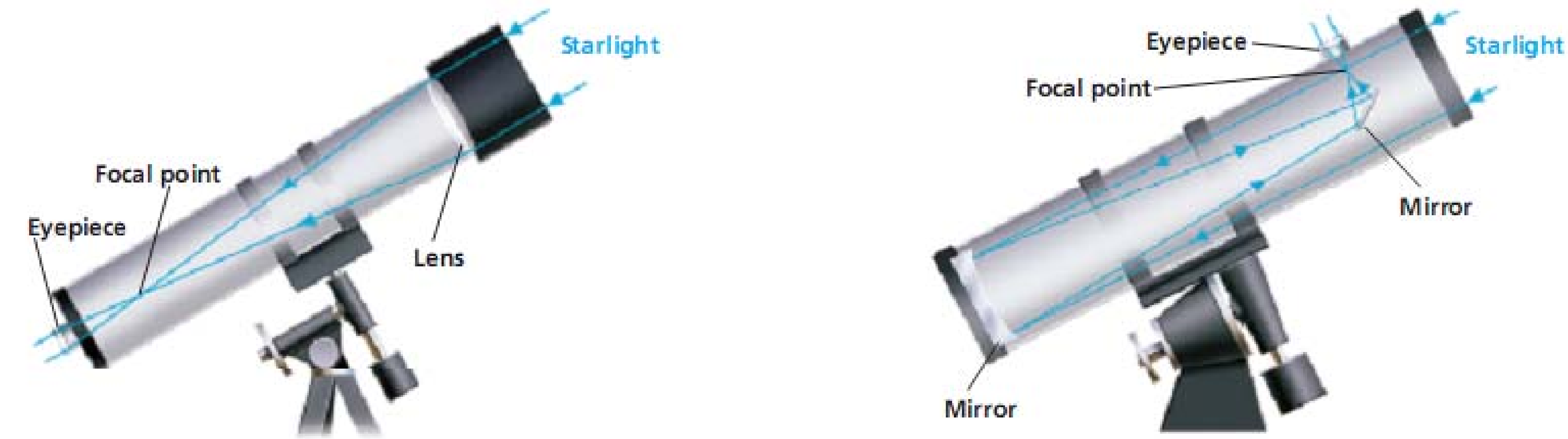
Telescopes, *continued*

Reflecting Telescopes

- **reflecting telescopes** a telescope that uses a curved mirror to gather and focus light from distant objects
- In the mid-1600s Isaac Newton solved the problem of color separation that resulted from the use of lenses.
- When light enters a reflecting telescope, the light is reflected by a large curved mirror to a second mirror. The second mirror reflects the light to the eyepiece, where the image is magnified and focused.
- Unlike refracting telescopes, mirrors in reflecting telescopes can be made very large without affecting the quality of the image.

Telescopes, *continued*

The diagram below shows refracting and reflecting telescopes.



Refracting telescopes use lenses to gather and focus light from distant objects.

Reflecting telescopes use mirrors to gather and focus light from distant objects.

Telescopes, *continued*

Telescopes for Invisible Electromagnetic Radiation

- Scientists have developed telescopes that detect invisible radiation, such as a radio telescope for radio waves.
- One problem with using telescopes to detect invisible electromagnetic radiation is that Earth's atmosphere acts as a shield against many forms of electromagnetic radiation.
- Ground-based telescopes work best at high elevations, where the air is thin and dry.

Space-Based Astronomy, *continued*

Space Telescopes

- The *Hubble Space Telescope* collects electromagnetic radiation from objects in space.
- The *Chandra X-ray Observatory* makes remarkably clear images using X rays from objects in space, such as remnants of exploded stars.
- The *Swift* spacecraft detects gamma rays and X rays from explosions and collisions of objects such as black holes.
- The *James Webb Space Telescope* is scheduled to be launched in 2013 to detect near- and mid-range infrared radiation from objects in space.

- https://www.youtube.com/watch?v=mYhy7eaazlk

Space-Based Astronomy, *continued*

Other Spacecraft

- Since the early 1960s, spacecrafts have been sent out of Earth's orbit to study other planets.
- The space probes *Voyager 1* and *Voyager 2* investigated Jupiter, Saturn, Uranus, and Neptune, and collected images of these planets and their moons.
- The *Galileo* spacecraft orbited Jupiter and its moons from 1995 to 2003.

Space-Based Astronomy, *continued*

Other Spacecraft, *continued*

- The *Cassini* spacecraft began orbiting Saturn in 2004. In December 2004, the *Huygens* probe detached from the *Cassini* orbiter to study the atmosphere and surface of Titan, Saturn's largest moon.
- The twin rovers *Spirit* and *Opportunity* landed on Mars in January 2004. They confirmed that water had once been present on Mars.
- In 2008, the *Phoenix* lander found ice on Mars.

Space-Based Astronomy, *continued*

Human Space Exploration

- Spacecraft that carry only instruments and computers are described as *robotic* and can travel beyond the solar system.
- The first humans went into space in the 1960's. Between 1969 and 1972, NASA landed 12 people on the moon.
- The loss of two space shuttles and their crews, the *Challenger* in 1986 and the *Columbia* in 2003, have focused public attention on the risks of human space exploration.

Space-Based Astronomy, *continued*

Spinoffs of the Space Program

- Satellites in orbit provide information about weather all over Earth.
- Other satellites broadcast television signals from around the world or allow people to navigate cars and airplanes.
- Inventing ways to make objects smaller and lighter so that they can go into space has also led to improved electronics.
- Even medical equipment, like the heart pump, have been improved based on NASA's research on the flow of fluids through rockets.

The Rotating Earth

- **rotation** the spin of a body on its axis
- Each complete rotation of Earth takes about one day.
- As Earth rotates from west to east, the sun appears to rise in the east in the morning. The sun then appears to cross the sky and set in the west.
- At any given moment, the part of Earth that faces the sun experiences daylight. At the same time, the part of Earth that faces away from the sun experiences nighttime.

The Rotating Earth, *continued*

The Foucault Pendulum

- In the 19th century, the scientist Jean-Bernard-Leon Foucault, provided evidence of Earth's rotation by using a pendulum.
- The path of the pendulum appeared to change over time. However, it was the floor that was moving while the pendulum's path stayed constant.
- Because the floor was attached to Earth, one can conclude that Earth rotates.

The Coriolis Effect

- The rotation of Earth causes ocean currents and wind belts to curve to the left or right. This curving is caused by Earth's rotation and is called the *Coriolis effect*.

The Revolving Earth

- As Earth spins on its axis, Earth also revolves around the sun.
- Even though you cannot feel Earth moving, it is traveling around the sun at an average speed of 29.8 km/s.
- **revolution** the motion of a body that travels around another body in space; one complete trip along an orbit
- Each complete revolution of Earth around the sun takes 365 1/4 days, or about one year.

The Revolving Earth, *continued*

Earth's Orbit

- The path that a body follows as it travels around another body is called an *orbit*.
- Earth's orbit around the sun is an *ellipse,* a closed curve whose shape is determined by two points, or *foci*, within the ellipse.
- In planetary orbits, one focus is located within the sun. No object is located at the other focus.

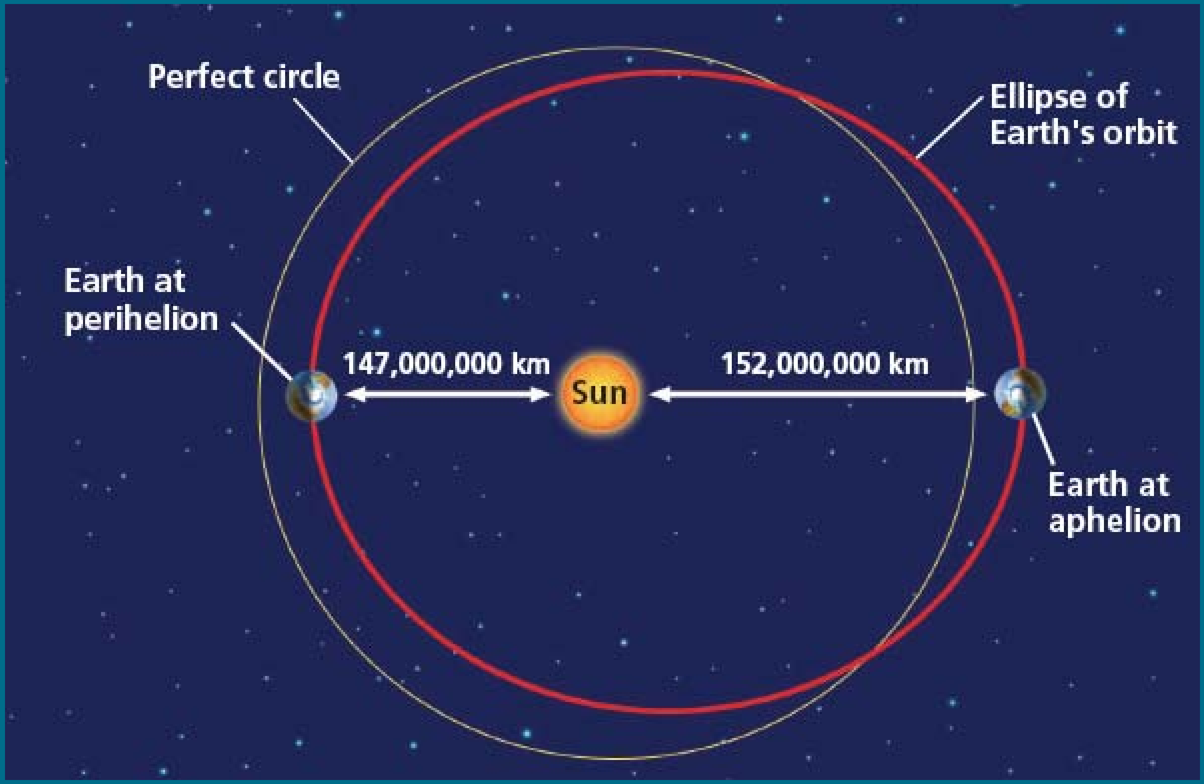
The Revolving Earth, *continued*

Earth's Orbit, *continued*

- Because its orbit is an ellipse, Earth is not always the same distance from the sun.
- **perihelion** in the orbit of a planet or other body in the solar system, the point that is closest to the sun
- **aphelion** in the orbit of a planet or other body in the solar system, the point that is farthest from the sun

The Revolving Earth, *continued*

The diagram below shows the Earth’s orbit.



Constellations and Earth's Motion

- A *constellation* is a group of stars that are organized in a recognizable pattern.

Evidence of Earth's Rotation

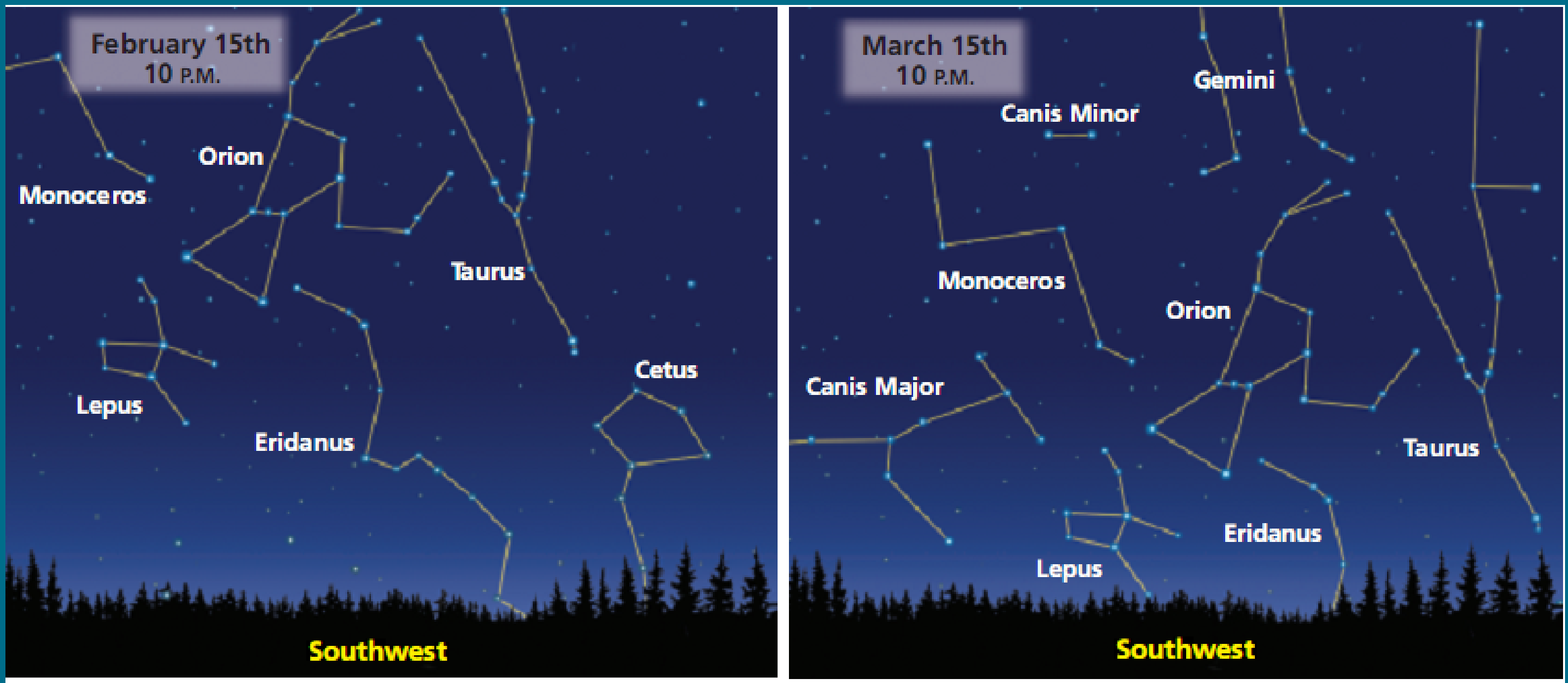
- Over a period of several hours, the constellations appear to have changed its position in the sky. The rotation of Earth on its axis causes the apparent change in position.

Evidence of Earth's Revolution

- As Earth revolves around the sun, the night side of Earth faces in a different direction of the universe. Thus, as Earth moves, different constellations are visible in the night sky from month to month and from season to season.

Constellations and Earth's Motion, *continued*

The diagram below shows how constellations move across the sky.



Measuring Time

- Earth's motion provides the basis for measuring time.
- A day is determined by Earth's rotation on its axis. Each complete rotation of Earth on its axis takes one day, which is then divided into 24 hours.
- The year is determined by Earth's revolution around the sun. Each complete revolution of Earth around the sun takes 365 1/4 days, or one year.
- A month was originally determined by the period between successive full moons, which is 29.5 days. However, the number of full moons in a year is not a whole number. Therefore, a month is now determined as roughly one-twelfth of a year.

Measuring Time, *continued*

Formation of the Calendar

- A *calendar* is a system created for measuring long intervals of time by dividing time into periods of days, weeks, months, and years.
- Because the year is 365 1/4 days long, the extra 1/4 day is usually ignored. Every four years, one day is added to the month of February. Any year that contains an extra day is called a *leap year*.
- More than 2,000 years ago, Julius Caesar, of the Roman Empire, revised the calendar to account for the extra day every four years.

Measuring Time, *continued*

The Modern Calendar

- Because the year is not exactly 365 days long, over centuries, the calendar gradually became misaligned with the seasons.
- In the late 1500s, Pope Gregory XIII formed a committee to create a calendar that would keep the calendar aligned with the seasons. We use this calendar today.
- In this Gregorian calendar, century years, such as 1800 and 1900, are not leap years unless the century years are exactly divisible by 400.

Measuring Time, *continued*

Time Zone

- Using the sun as the basis for measuring time, we define noon as the time when the sun is highest in the sky.
- Earth’s surface has been divided into 24 standard time zones to avoid problems created by different local times.
- The time in each zone is one hour earlier than the time in the zone to the east of each zone.

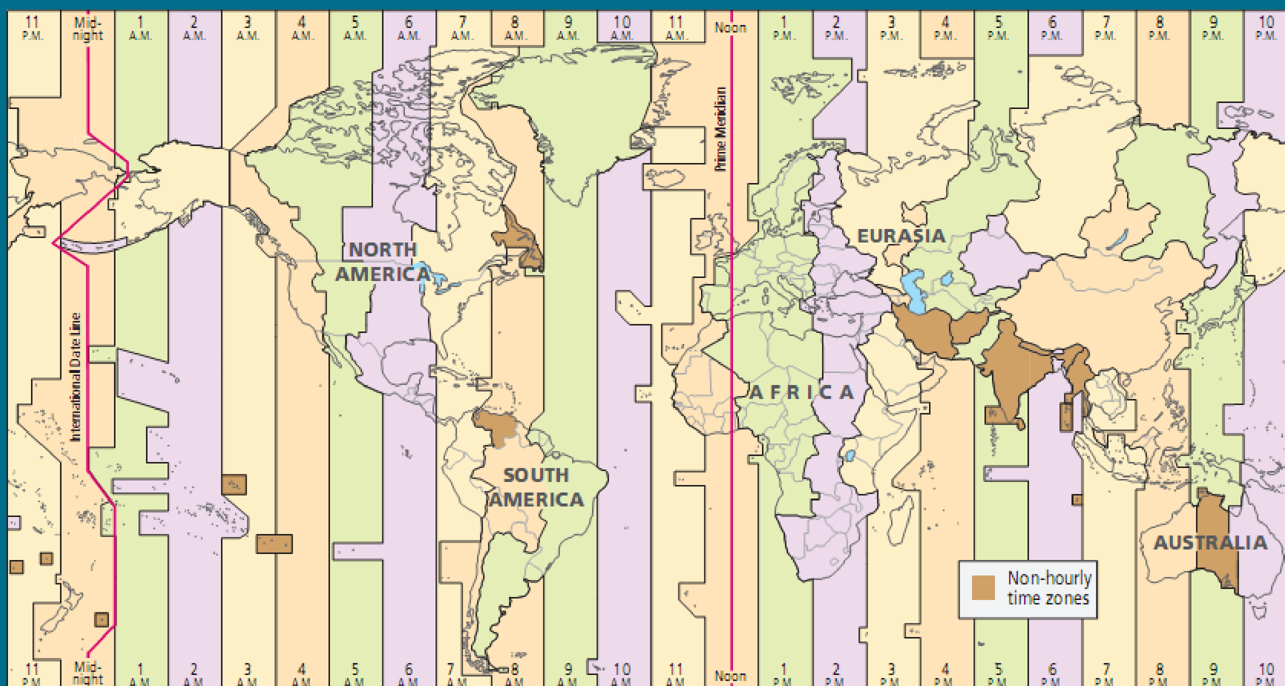
Measuring Time, *continued*

International Date Line

- The *International Date Line* was established to prevent confusion about the point on Earth's surface where the date changes.
- This imaginary line runs from north to south through the Pacific Ocean.
- The line is drawn so that it does not cut through islands or continents. Thus, everyone living within one country has the same date.

Measuring Time, *continued*

The diagram below shows the Earth’s 24 different time zones.



Measuring Time, *continued*

Daylight Savings Time

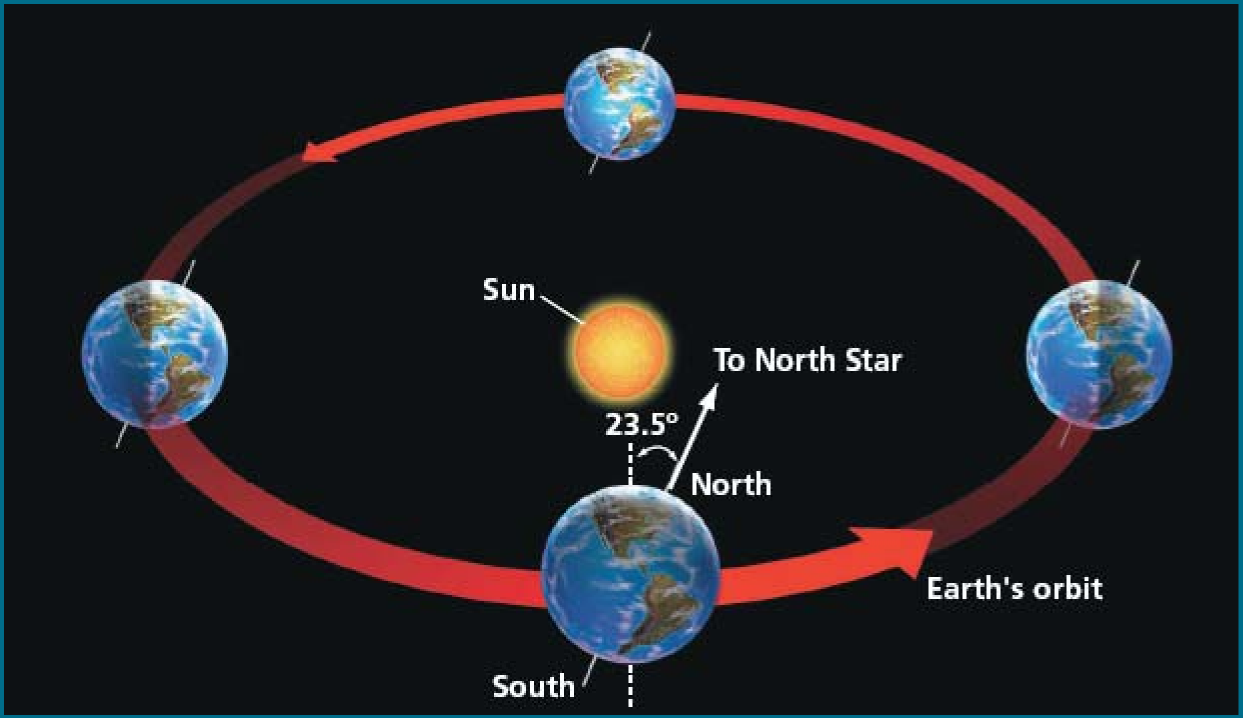
- Because of the tilt of Earth’s axis, daylight time is shorter in the winter months than in the summer months.
- During the summer months, days are longer so that the sun rises earlier in the morning.
- The United States uses *daylight savings time*. Under this system, clocks are set one hour ahead of standard time in March, which provide an additional hour of daylight during the evening.
- In November, clocks are set back one hour to return to standard time.

The Seasons

- Earth's axis is tilted at 23.5˚.
- As Earth revolves around the sun, Earth's axis always points toward the North Star.
- The North Pole sometimes tilts towards the sun and sometimes tilts away from the sun.
- When the North Pole tilts towards the sun, the Northern Hemisphere has longer periods of daylight than the Southern Hemisphere.
- When the North Pole tilts away from the sun, the Southern Hemisphere has longer periods of daylight.

The Seasons, *continued*

The diagram below shows how the seasons change with the Earth's tilt.



The Seasons, *continued*

Seasonal Weather

- Changes in the angle at which the sun's rays strike Earth's surface cause the seasons.
- When the North Pole tilts away from the sun, the angle of the sun's rays falling on the Northern Hemisphere is low.
- This means the Northern Hemisphere experiences fewer daylight hours, less energy, and lower temperatures.
- Meanwhile, the sun's rays hits the Southern Hemisphere at a greater angle. Therefore, the Southern Hemisphere has more daylight hours and experiences a warm summer season.

The Seasons, *continued*

Equinoxes

- **equinox** the moment when the sun appears to cross the celestial equator
- During an equinox, the sun's rays strike the Earth at a 90° angle along the equator. The hours of daylight and darkness are approximately equal everywhere on Earth that day.
- The *autumnal equinox* occurs on September 22 or 23 of each year and marks the beginning of fall in the Northern Hemisphere.
- The *vernal equinox* occurs on March 21 or 22 of each year and marks the beginning of spring in the Northern Hemisphere.

The Seasons, *continued*

Summer Solstices

- **solstice** the point at which the sun is as far north or as far south of the equator as possible
- The sun's rays strike the Earth at a 90° angle along the Tropic of Cancer.
- The *summer solstice* occurs on June 21 or 22 of each year and marks the beginning of summer in the Northern Hemisphere.
- The farther north of the equator you are, the longer the period of daylight you have.

The Seasons, *continued*

Winter Solstices

- The sun's rays strike the Earth at a 90° angle along the Tropic of Capricorn. The sun follows its lowest path across the sky on the winter solstice.
- The *winter solstice* occurs on December 21 or 22 of each year and marks the beginning of winter in the Northern Hemisphere.
- Places that are north of the Arctic Circle then have 24 hours of darkness. However, places that are south of the Antarctic Circle have 24 hours of daylight at that time.

Maps in Action

Light Sources