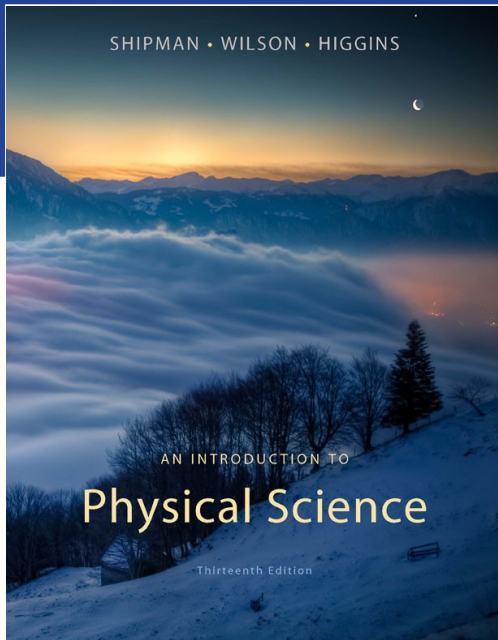


SHIPMAN • WILSON • HIGGINS



AN INTRODUCTION TO
Physical Science

Thirteenth Edition

 **BROOKS/COLE**
CENGAGE Learning™

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Chapter 15

Place and Time

Place & Time



Read sections 15.5 and 15.6, but ignore the math.
Concentrate on those sections that help explain the slides.

[Audio Link](#)

Seasons



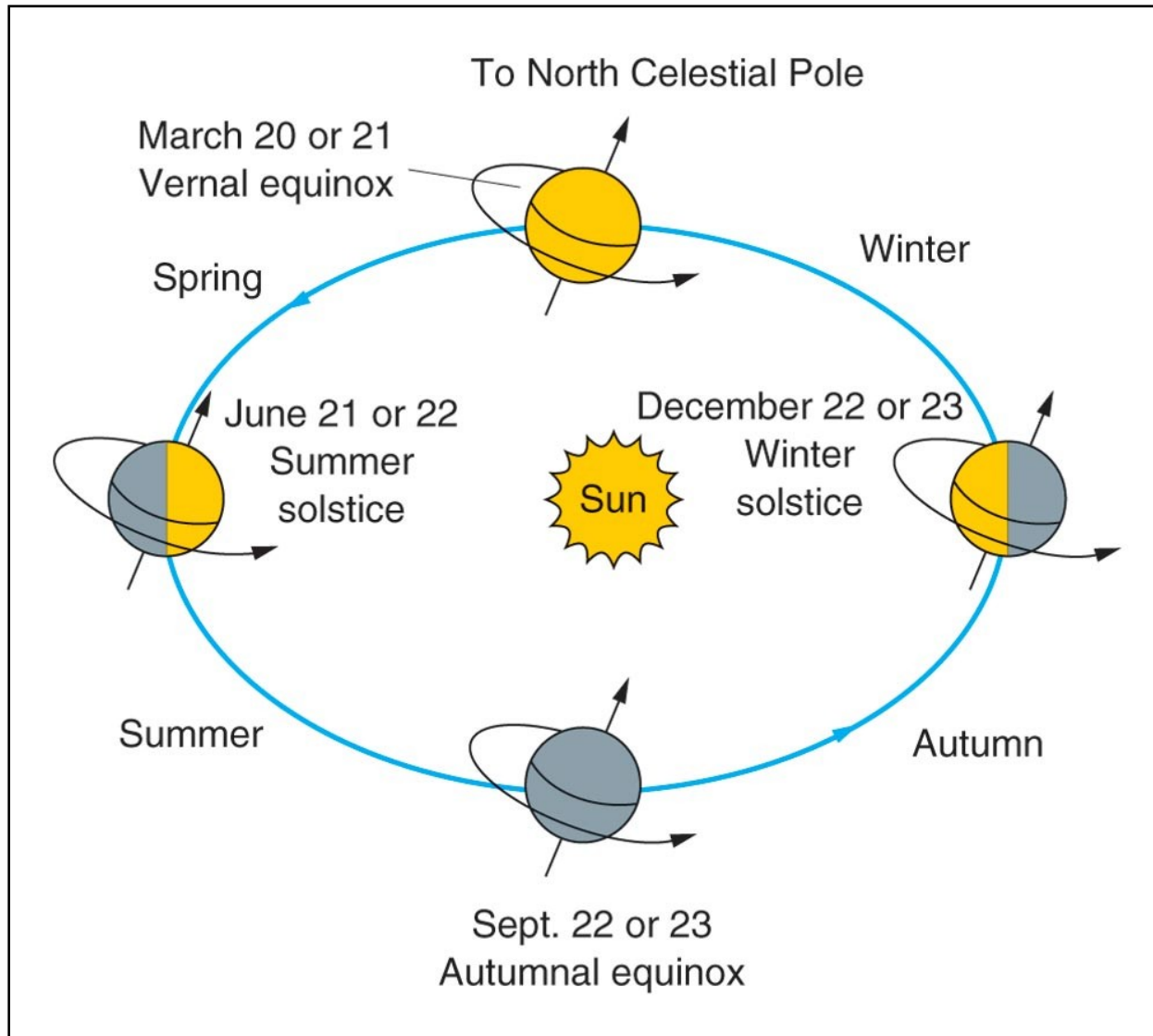
- Seasons affect almost everyone.
- Many of our holidays were originally celebrated as a commemoration of a certain season of the year.
 - Easter – coming of spring
 - Thanksgiving – harvest
 - Christmas – Sun beginning its “journey” north
- Original dates more-or-less set by the movement of the Earth around the Sun.

The Seasons



- As the Earth revolves around the Sun, its axis remains tilted 23.5° from the vertical.
- This constant tilt of the Earth with respect to the Sun causes the Earth's seasons.
- As the Earth revolves around the Sun we also designate 4 particular days – Winter solstice, Vernal equinox, Summer solstice, and Autumnal equinox .
- Light/dark hours are always the same at the equator.

Earth's Positions, Relative to the Sun and the Four Seasons



Vertical Noon Position of the Sun



- Winter Solstice – 23.5°S = Tropic of Capricorn
 - Sun lower in N. Hemisphere, fewer hours of daylight, & less intense sunlight
- Vernal Equinox – 0° = Equator
- Summer Solstice – 23.5°N = Tropic of Cancer
 - Sun higher in N. Hemisphere, more hours of daylight, & more intense sunlight
- Autumnal Equinox – 0° = Equator

The Sun's Overhead Position



- Never greater than 23.5° latitude
- The Sun's position is always due south at 12 noon local solar time, for an observer in the conterminous U.S.
- Solstice – farthest point of the Sun from the equator (“the Sun stands still”)
- Summer Solstice – most northern position
 - Vertical noon Sun at 23.5° N
- Winter Solstice – most southern position
 - Vertical noon Sun at 23.5° S

The Sun's Overhead Position



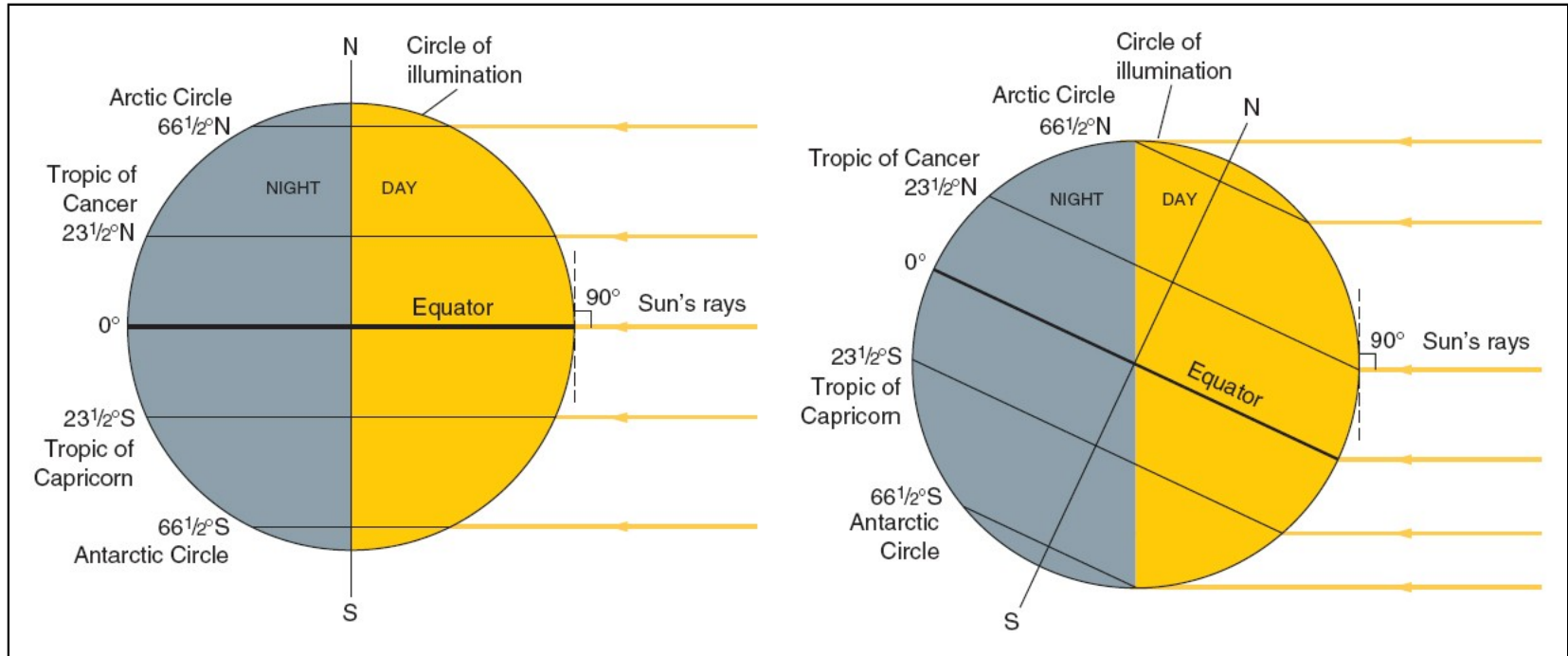
- Therefore the sun's position overhead varies from 23.5° north to 23.5° south of the equator
- When it is directly over the equator, both the days and nights have 12 hours all over the world (except N & S poles)
- Equinox – sun is directly over the equator
- Vernal Equinox – March 21
- Autumnal Equinox – September 22

Daylight



- Due to the great distance from the Sun, the light rays incident on Earth's surface are parallel.
- Therefore, one half of the Earth's surface will be illuminated (daylight) all the time and one half will be in darkness all the time.
- But the number of daylight hours at any place on Earth depends on the latitude and the day of the year.

Circle of Illumination



The Year



- When the Earth makes one complete orbit around the Sun, we call the elapsed time one year.
- More precisely, we can actually define two different years.
- The Tropical Year & the Sidereal Year.

Two Different Years



- Tropical Year – the time interval from one vernal equinox to the next vernal equinox – 365.2422 mean solar days
 - The elapsed time between 1 northward crossing of the sun above the equator to the next northward crossing.
- Sidereal year – the time interval for earth to make one complete revolution around the sun with respect to any particular star other than the sun – 365.2536 mean solar days
 - 20 minutes longer than the tropical year

The Calendar



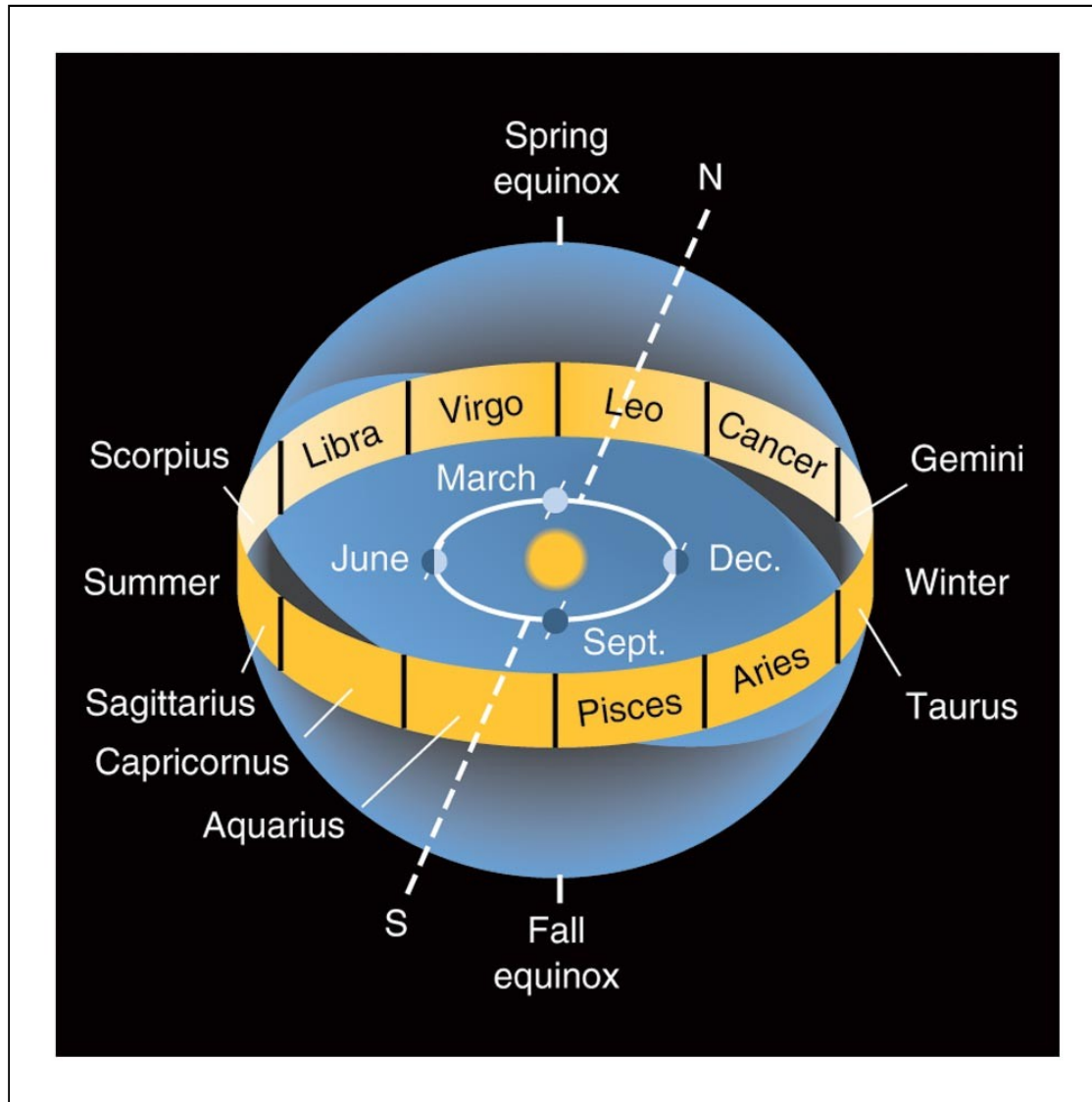
- The measurement of time requires the periodic movement of some object as a reference.
- Probably the first unit of measurement was the “day.”
- The periodic movement of the moon (29.5 solar days) was likely the next time reference.
- Today’s month is based on the moon.
- The Sumerians (3000 B.C.) divided the year into 12 lunar months of 30 days each.

The Zodiac



- Zodiac – the central, circular section of the celestial sphere that is divided into 12 sections
- Each section of the zodiac is identified by a prominent group of stars called a constellation.
 - Ancient civilizations name constellations for the figure the stars seemed to form.
- Due to the Earth's annual revolution around the sun, the appearance of the 12 constellations change during the course of a year.
 - A particular time of the year is marked by the appearance of a particular constellation.

Signs of the Zodiac



Precession of Earth's Axis



- When we spin a toy top, it starts to wobble after a few seconds
- Physicists call this wobble precession.
- Earth slowly precesses in a clockwise direction.
- The period of precession is 25,800 years. In other words, it takes 25,800 years for the axis to precess through 360° .

Precession of Earth's Axis



- As the Earth precesses, Polaris will no longer be the “north star.” It will be Vega.
- Precession of Earth's axis has little influence on the seasons, because the inclination of the Earth (with respect to the Sun) will remain constant.
- However the Earth's precession will slowly change the stars that can be seen in each hemisphere and season.

Precession of a Top & Earth

