The Zodiacal Constellations that our Sun covers-up (blocks) in the course of one year (only 12 are shown here)

Figure 1

Which constellation is the Sun in front of for the situation shown?

Lecture-Tutorial: Seasonal Stars (p. 7-9)

- Work with a partner!
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Review: Coordinates on the Earth

- **Latitude**: position north or south of equator
- **Longitude**: position east or west of prime meridian (runs through Greenwich, England)

The sky varies with latitude but not longitude.

Altitude of the celestial pole = your latitude
Where is the Sun throughout the year?

- Mar 21 (Vernal) and Sept 21 (Autumnal) Equinox
- Dec 21 Winter Solstice
- June 21 Summer Solstice

The Reason for the Seasons

Hypothesis: Seasons are caused by the Earth moving closer to or farther from the Sun.

1. Data: When things are closer to the a light source (like the Sun) they get hotter.
2. Data: Northern hemisphere has summer in June, July and August; Southern hemisphere has summer in December, January and February
3. Data: Earth’s distance from the Sun hardly changes in the course of a year. (about 1%) – Earth is closest to the Sun on January 4

Can #2 be true if our hypothesis is correct?

No!

- Then everyone should have summer at the same time

Something else must be going on

Reason for the Seasons

- The seasons are caused by the tilt of the Earth’s axis
- In Summer, the Sun’s rays are more direct and the days are longer
- In Winter, the Sun’s rays are less direct and the days are shorter

The Seasons do NOT occur because the Earth gets closer or farther from the Sun
Reason #1: More or Less Intense Sunlight

- A *direct* beam of light shines on a smaller area than a *glancing* beam.
- So a *direct* beam is more intense

Reason #2: Longer or Shorter Days

Lecture-Tutorial: Seasons (p. 93-98)

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Altitude of the Sun Animation:

As we watch the animation, pay attention to

- Where the sun rises and sets
- Altitude of the sun at mid-day

Also, watch how the shadow changes during a day and over the course of the year.

Phases of the Moon

- The Moon goes through a set of phases about once every month
  - “Month” comes from the word “moon”
  - Time period of the phases (from Full Moon to Full Moon) is 29.5 days.

The different phases have different names:
- Getting larger = *waxing*
- Getting smaller = *waning*
- Less than 1/2 visible = *crescent*
- More than 1/2 visible = *gibbous*
- 1/2 visible, getting larger = *1st quarter*
- 1/2 visible, getting smaller = *3rd quarter*
- Entire Moon visible = *Full Moon*
- None of the Moon visible = *New Moon*
Two perspectives: On Earth, or outside the Moon’s orbit

• At any time (except during lunar eclipses), 1/2 the moon is lit up
• Phases happen because the amount of lit up moon we can see from Earth changes

Lecture Tutorial: The Cause of Moon Phases (pg. 81-83)

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Moon Rise & Set Times

• Moon’s orbit position determines its phase
• Also determines what time the Moon is up in the sky

Moon Rise & Set Times: Examples

• New Moon: Same side as the Sun
  – Rises at sunrise, sets at sunset

• Full Moon: Opposite the Sun
  – Rises at sunset, sets at sunrise

Eclipses

• “The cutting off of all or part of the light of one body by another”
• Rare events when light from the Sun or Moon is blocked for a short time
• Eclipses occur when the Sun, Moon, and Earth are lined up just right
• There is the potential for an eclipse twice a month!
Lunar Eclipses

• The Moon gets darker as it passes into Earth’s shadow
• Sometimes glows with a slightly reddish color at the middle of the eclipse
• The Moon is always in the Full phase during a lunar eclipse

A Lunar Eclipse

• Several pictures of a total lunar eclipse
• The moon gets “eaten up” by Earth’s shadow
• Sometimes glows with light bent through Earth’s atmosphere

What’s going on during a lunar eclipse

Solar Eclipses

• The Sun disappears behind the Moon
• The Moon is always in the New phase during a solar eclipse
• Can only be seen from certain places on Earth
• These events are even more rare than lunar eclipses
  – Next one visible from the USA is in August 2017 (total)

Partial, Total, and Annular

• Partial: Takes out a bite

• Total: Covers the Sun
  – Moon slightly closer

• Annular: Leaves a ring
  – Moon slightly farther away
Total Solar Eclipse on March 29, 2006 (viewed from Turkey)

Diamond Ring Effect

This occurs when sunlight shines through a dip (usually a crater or valley) on the edge of the Moon’s disk.