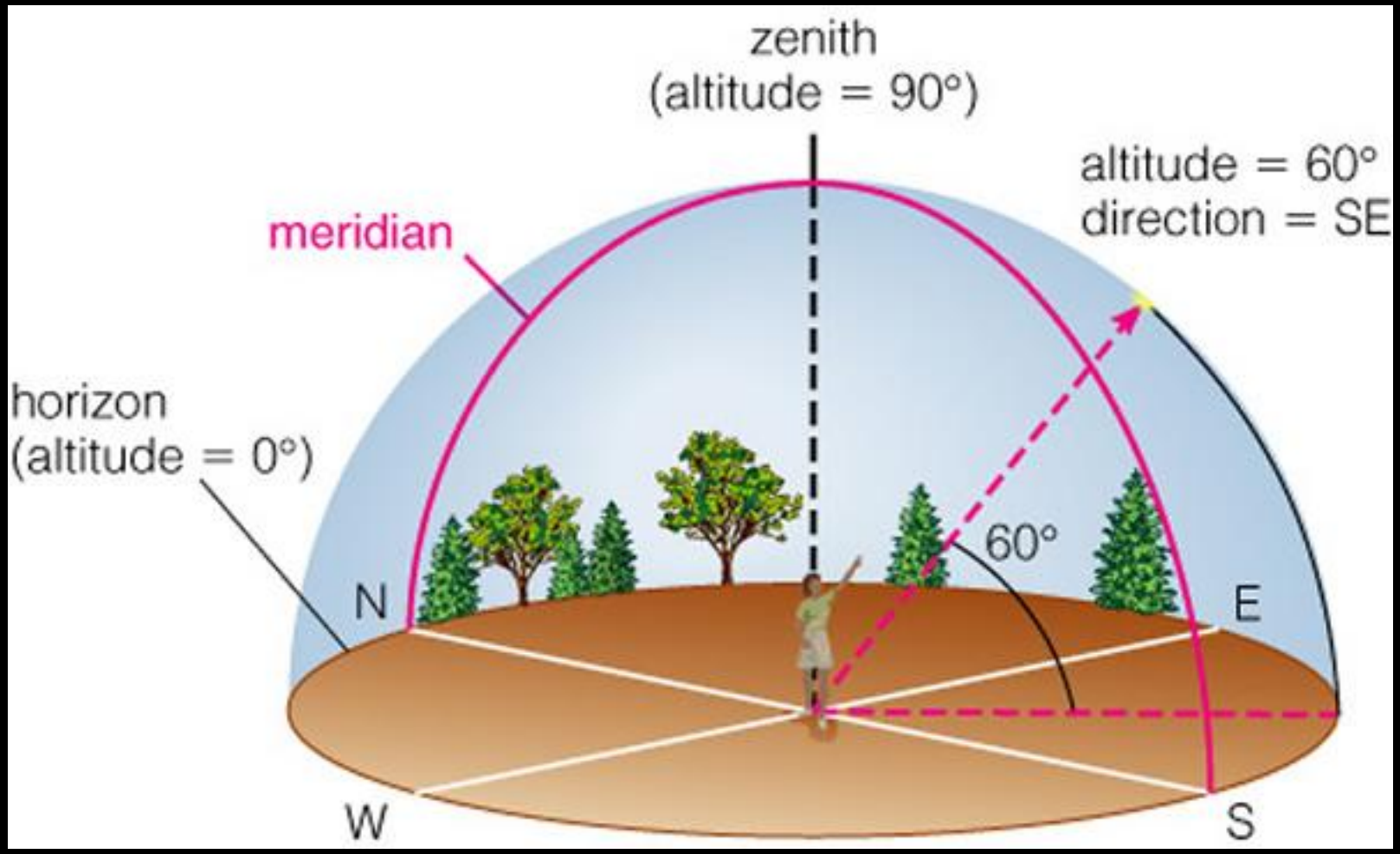
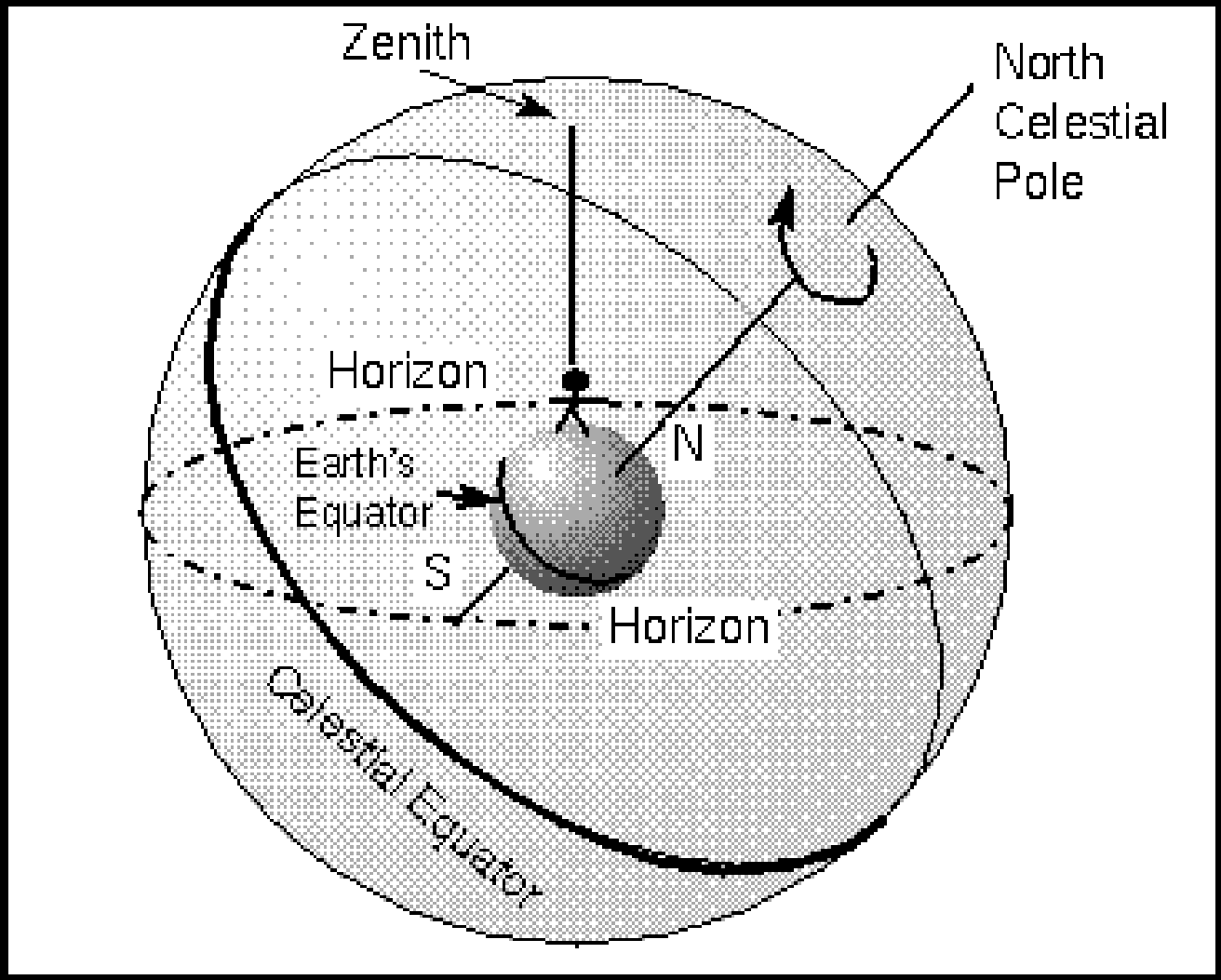
Syllabus, Semester Project, Scales/Scale Models

- Questions?
- One comment…

Patterns in the Sky: Traxoline



PS: Celestial Sphere



Think

Pair

Share!

Standing at the North Pole (brrrr), the star closest to zenith

- A. is always Polaris, the North Star
- B. is always the Sun
- C. changes depending on the time of day
- D. changes depending on the time of year

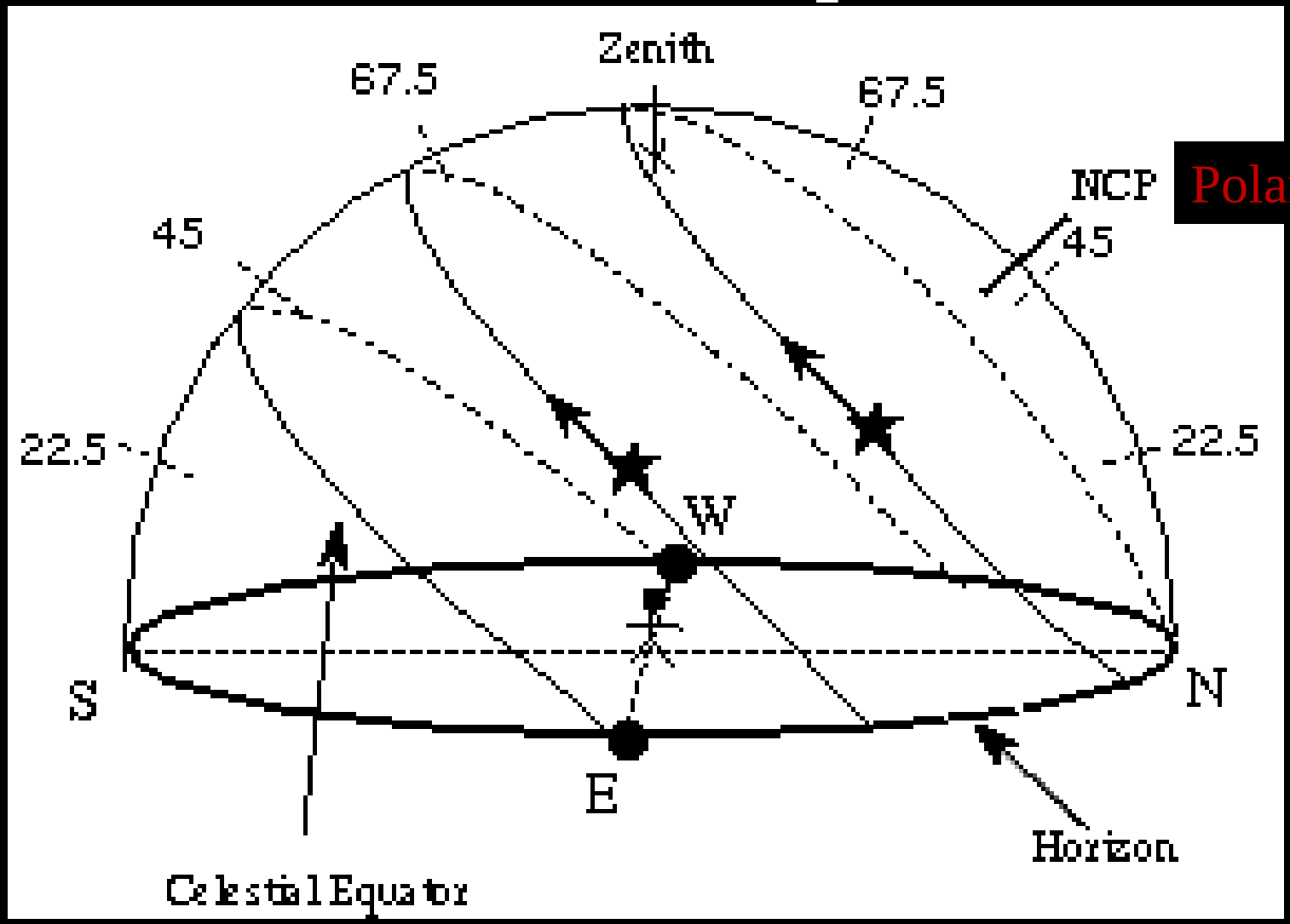
The celestial equator is…

- A. the path of the Sun compared to the stars.
- B. the path of the Moon compared to the stars.
- C. always directly overhead at the Earth's equator.
- D. always along the horizon for people on Earth's equator.

After rising from the eastern horizon, an object transits (crosses the meridian). At that instant, the object

- A. has reached its highest position in the sky.
- B. has reached its lowest position in the sky.
- C. has just risen.
- D. is just about to set.

PS: Celestial Sphere



Lecture Tutorials

- Break up into group of 2-3
  - NO MORE THAN THREE
- In your group, work through the following:
  - Position (pages 1-3)
  - Motion (pages 4-6)
  - Discuss the answers – don't be silent!
- Mark, Dan, (Jacquelyn,) and I will be roaming around if you need help…
- If your group finishes, check you answers with another group.

Did you get the Key Ideas from the Lecture Tutorials?

Think

Pair

Share!

In what direction is the observer facing?

A. toward the South
B. toward the North
C. toward the East
D. toward the West

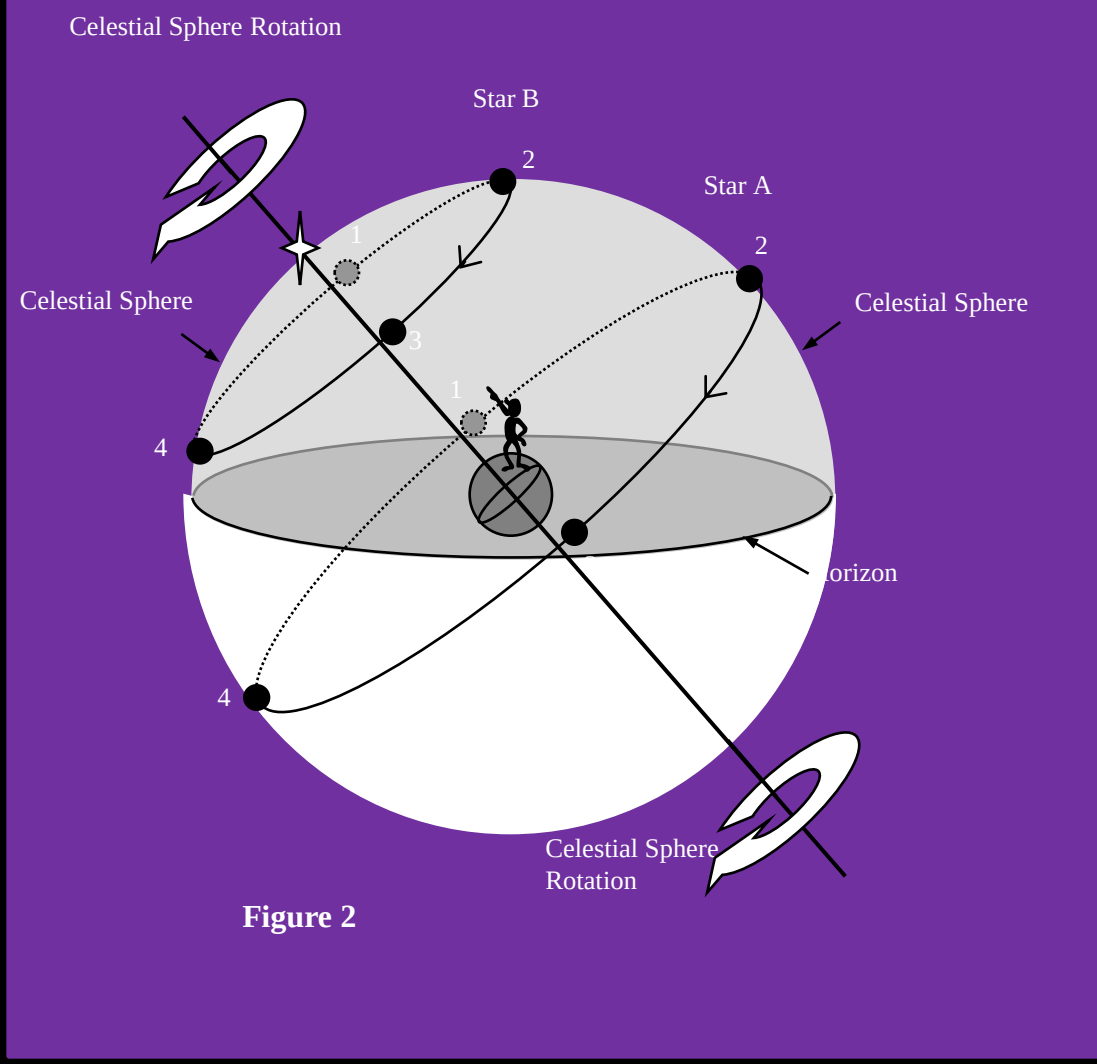


Figure 2

Imagine that from your current location you observe a star rising directly in the east. When this star reaches its highest position above the horizon, where will it be?

A. high in the northern sky
B. high in the southern sky
C. high in the western sky
D. directly overhead

Where would the observer look to see the star indicated by the arrow?

A. High in the Northeast
B. High in the Southeast
C. High in the Northwest
D. High in the Southwest

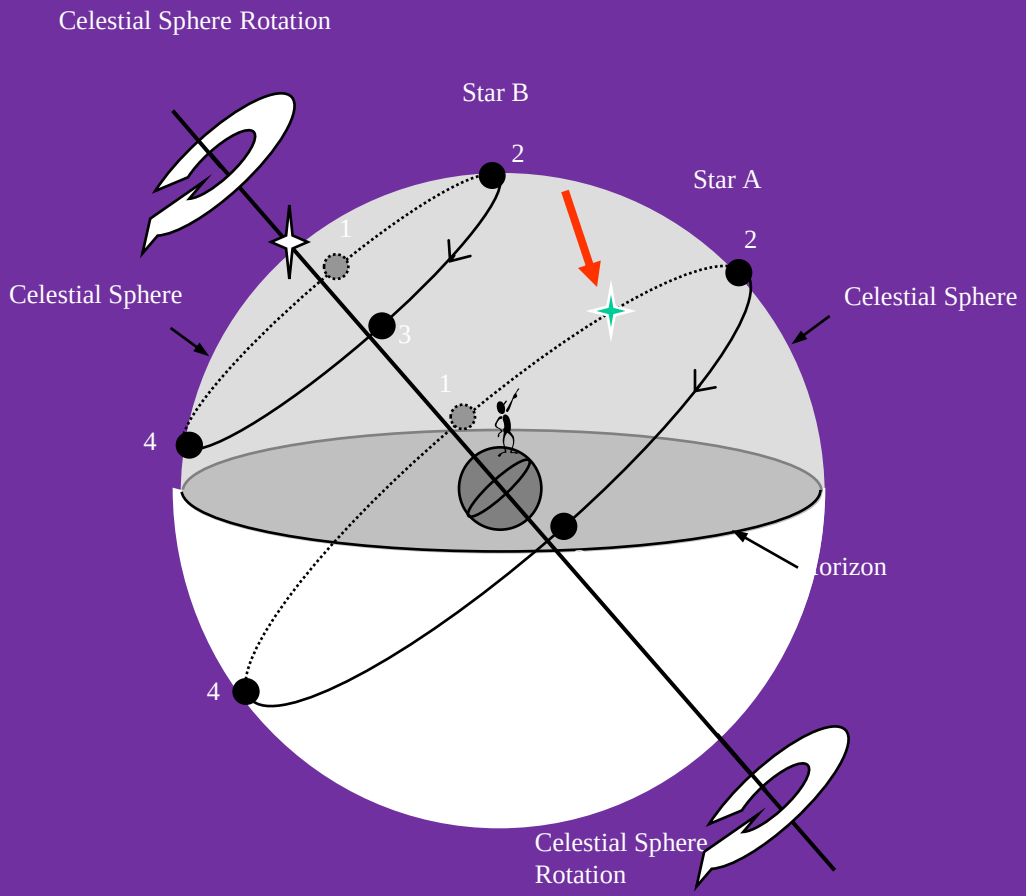


Figure 2

Nightly Motion of the Stars

- Imagine looking toward the East as a star rises above your horizon - what does it do after that?

Nightly Motion of the Stars

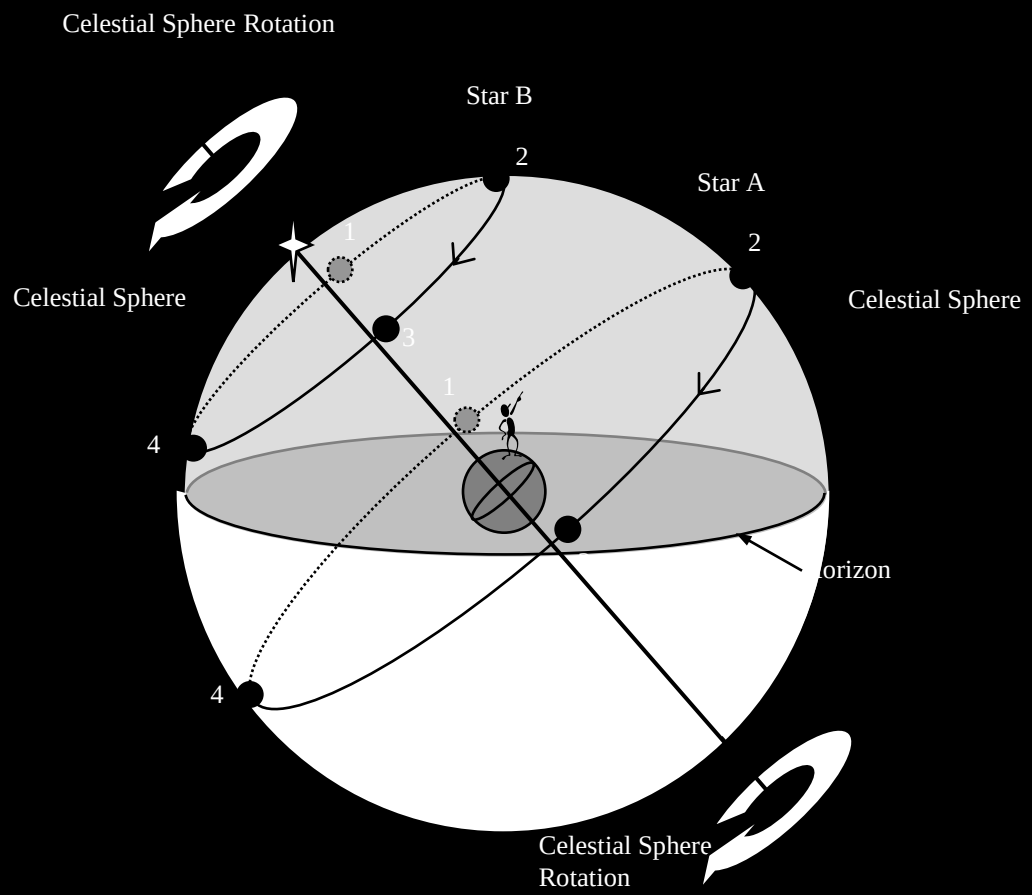
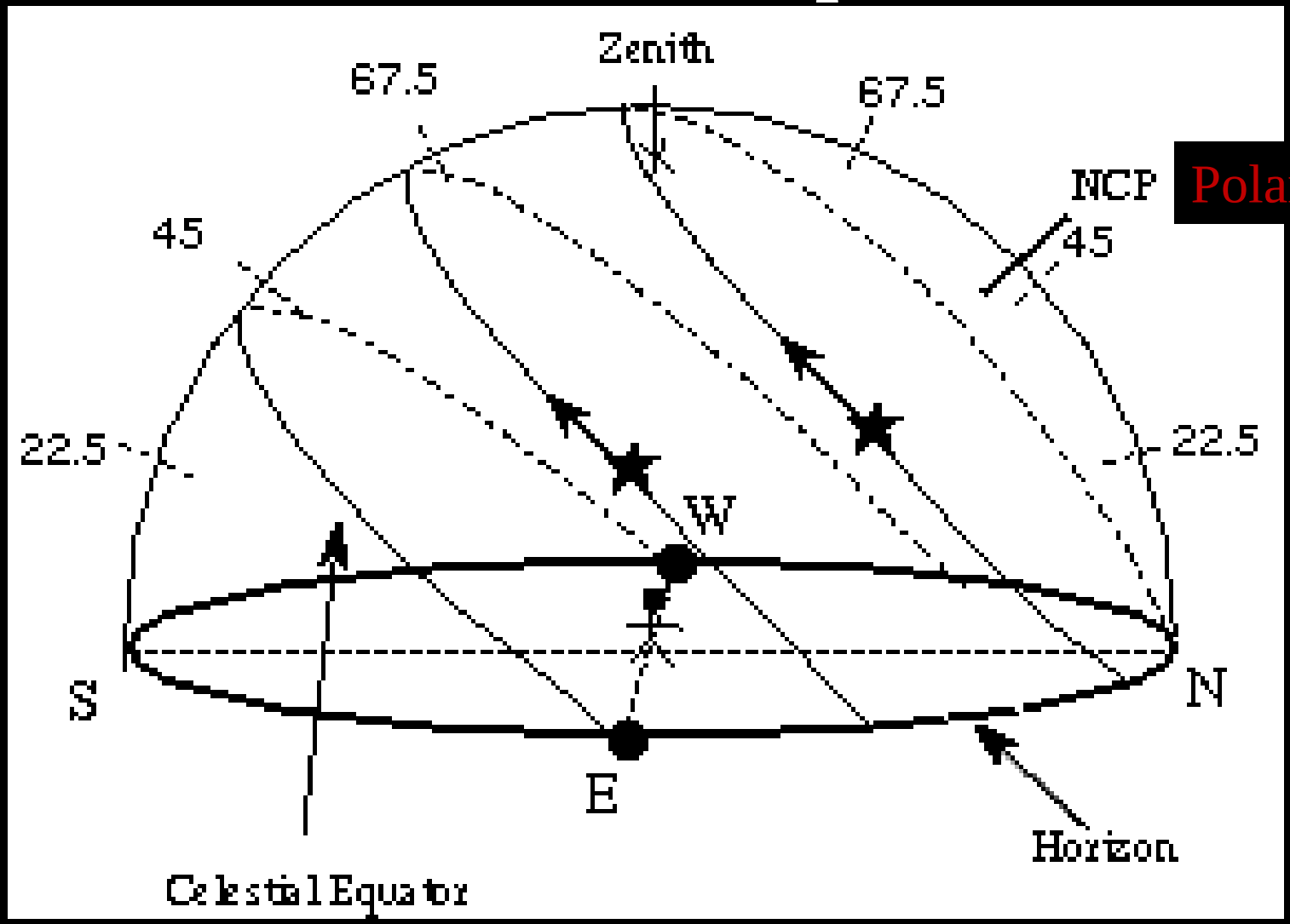


Figure 2

Nightly Motion of the Stars

- **For stars (the Moon and planets) that appear in the southern sky: Stars first rise near the eastern horizon, move upward and toward the south, and then move down and set near the western horizon.**

PS: Celestial Sphere



Facing due East in Laramie at night, you notice three stars that have just risen – Star Alpha in the Northeast, Star Bravo due East, and Star Charlie in the Southeast. Which of the following statements in true?

A. Star Alpha sets first, followed by Star Bravo, then Star Charlie.
B. Star Charlie sets first, followed by Star Bravo, then Star Alpha.
C. All three set at the same time.
D. Star Bravo sets first, followed by Star Alpha, then Star Charlie.

Reiser & Lyons (2008)

Quiz on Monday regarding this picture. (Will be posted on course site under “Quizzes so far”)

What direction is the camera facing in this picture?

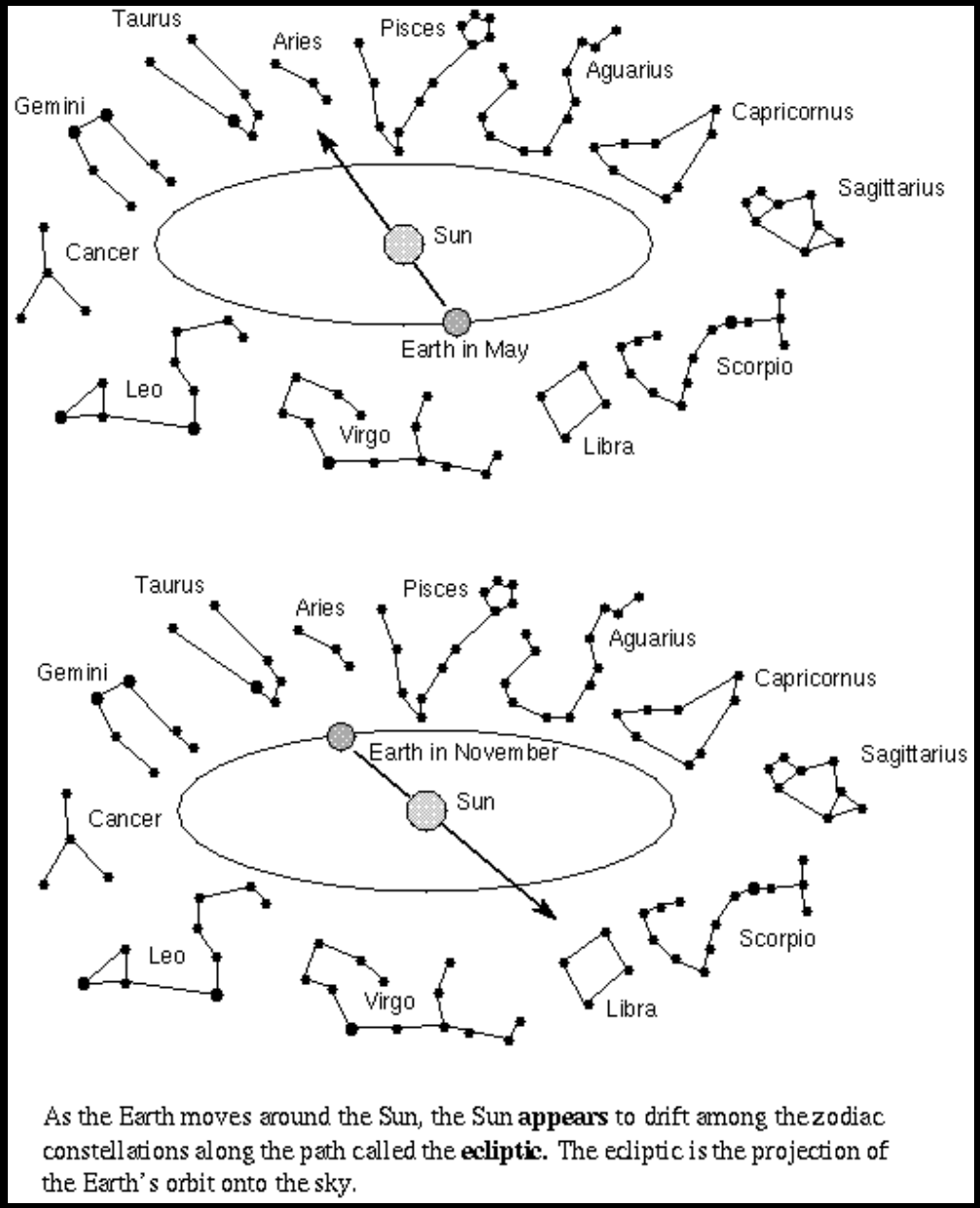
A.North
B.East
C.South
D.West

Change in day-today structure

12:00-12:15	Announcement Mini-lecture to get us on the same page
12:15-12:45	Lecture Tutorials
12:45-12:50	Think-Pair-Share or Quiz

Reminder about think-pair-share procedure

- Earth orbits the Sun
  - Can see this in the apparent motion of the Sun/stars.
  - Consider going out and observing the sky at the same time every night…
- Recall how we define different times of day
  - Noon = when the Sun in on the meridian.
  - Midnight = noon+12 hours
  - Is this the same for stars?
  - Solar day = day according to measuring the Sun
  - Sidereal day = day according to measuring the stars



As the Earth moves around the Sun, the Sun **appears** to drift among the zodiac constellations along the path called the **ecliptic.** The ecliptic is the projection of the Earth's orbit onto the sky.

Lecture Tutorials

- Break up into group of 2-3
  - NO MORE THAN THREE, NO SINGLES
- In your group, work through the following:
  - Seasonal Stars (pages 7-9)
  - Solar vs. Sidereal Day (pages 11-12)
  - Discuss the answers – don't be silent!
- Mark, Dan, (Jacquelyn,) and I will be roaming around if you need help…
- If your group finishes, check your answers with another group.

Today's plan

1. Review of Wednesday's think-pair-share
2. Quick summary of we've done with the last two LTs, and a setup for the next one
3. Ecliptic lecture tutorial
4. Quiz

After seeing Taurus at its highest position in the sky at midnight, in how many months will Virgo appear low in the western sky at midnight?

A. 2 months
B. 4 months
C. 6 months
D. 8 months

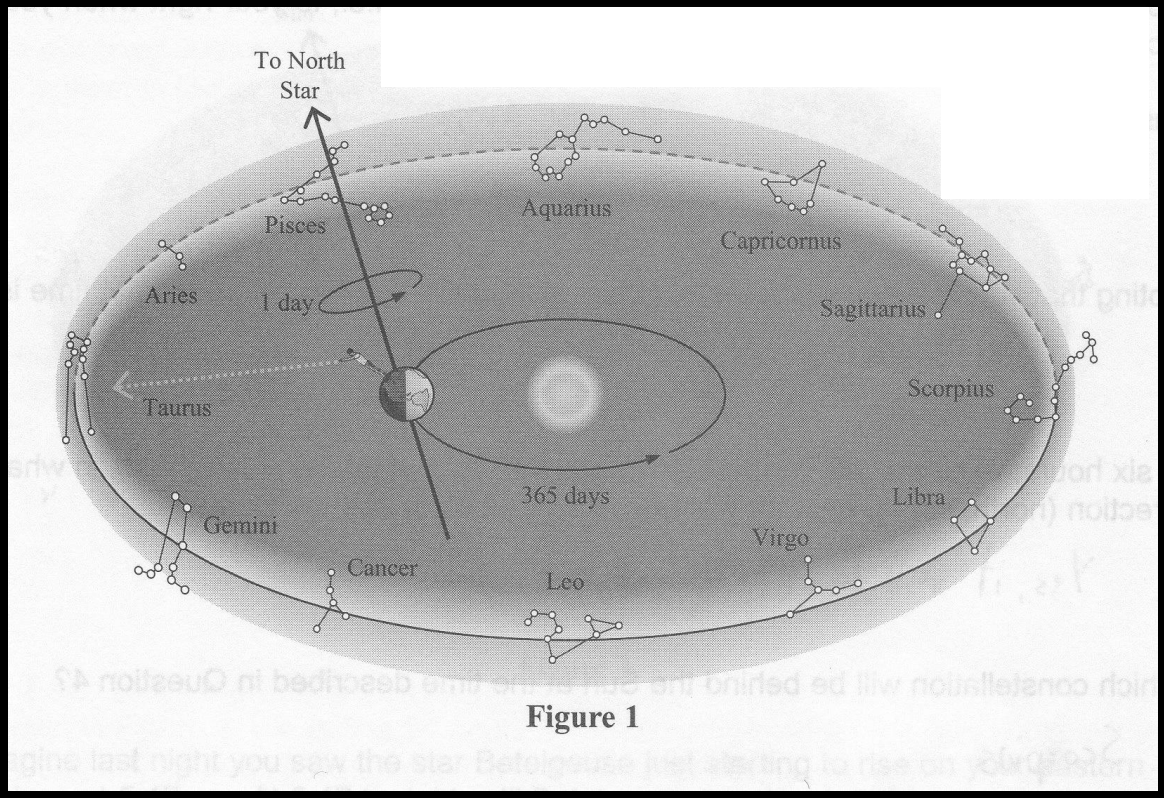


Figure 1

- Seasonal Stars
  - How do the stars appear to move from night to night at a given time of night
- Solar vs. Sidereal Day
  - What is physically happening to cause the night to night change? How might it be different if the Earth's orbit or rotation changed?
- Ecliptic – putting together the last 4 LTs
  - How does the daily motion of the Celestial Sphere (rotation of the Earth!) relate to the daily/monthly changes due to Earth's orbit?

• Two depictions of the same thing, highlighting different features.
• One cautionary note: Both figures fail to accurately represent the relative sizes of Earth, Sun, you, and Earth's orbit.

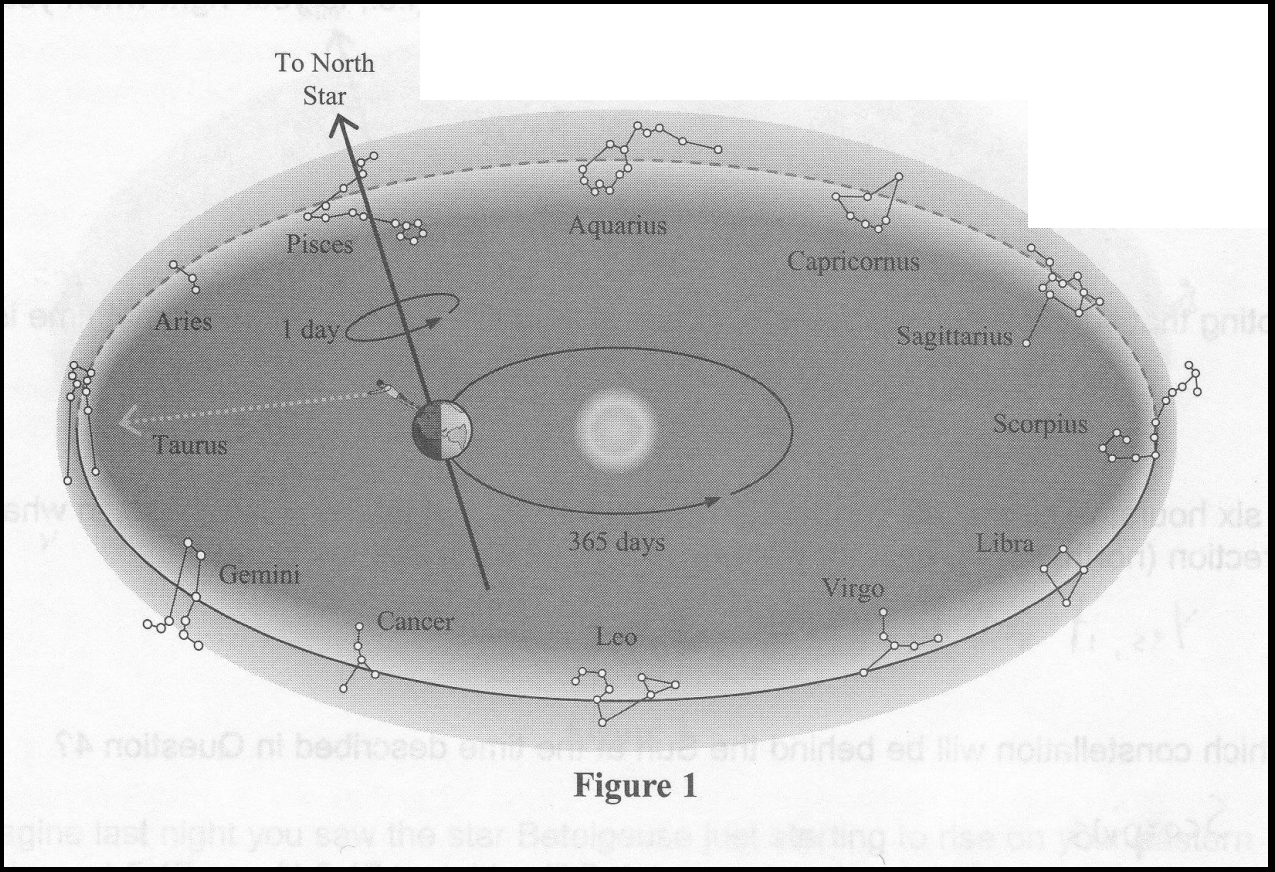
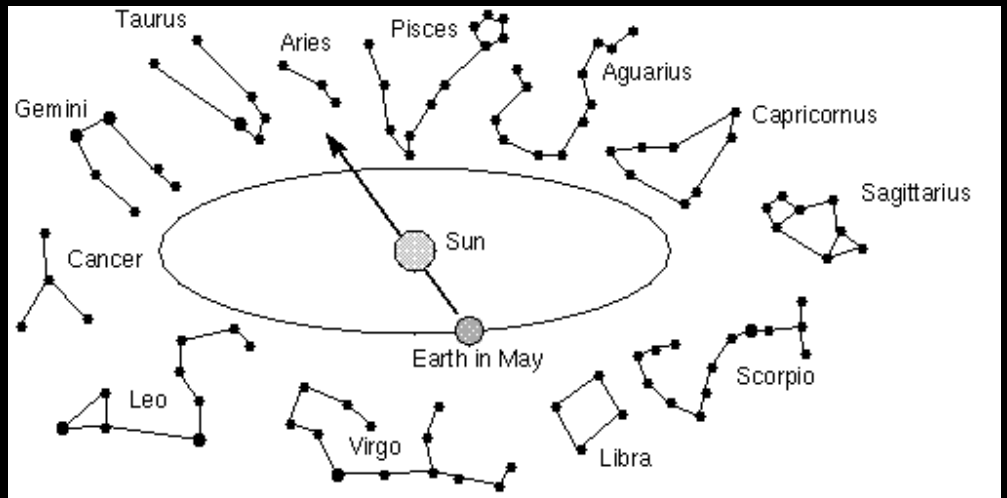


Figure 1

• The constellations shown are only those in which the Sun will move through *over the course of a full year* – the zodiac. The average line though them is the ecliptic.



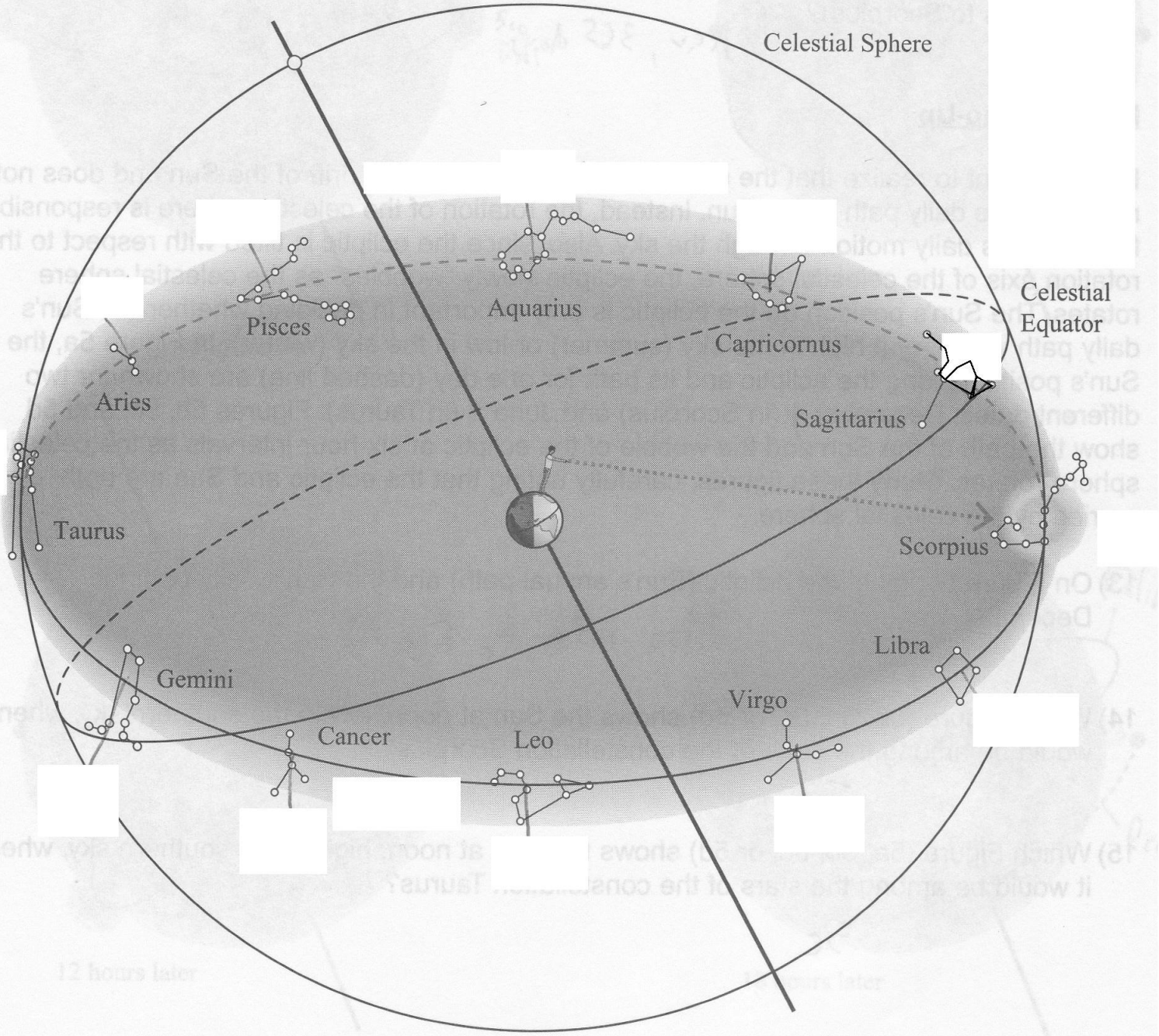

Celestial Sphere
Celestial Equator
Aquarius
Pisces
Capricornus
Aries
Sagittarius
Taurus
Scorpius
Libra
Gemini
Virgo
Cancer
Leo

Figure 4

Lecture Tutorials

- Break up into group of 2-3
  - NO MORE THAN THREE, NO SINGLES
- In your group, work through the following:
  - Ecliptic (pages 13-17)
  - Discuss the answers – don't be silent!
- MarkDan, Jacquelyn, and I will be roaming around if you need help…
- If your group finishes, check your answers with another group.

- Have a great weekend!
- Where to get help?
  - SI sessions on Wednesday
    - 6:30-8:30PM, PS 132
  - Office Hours
  - Each other

Today's plan

1. Quiz
2. Announcements
3. Figure 5 of the Ecliptic LT
4. Phases of the Moon mini-lecture
5. Lecture tutorials (Phases of the Moon, Predicting Moon Phases)

Quiz

1. Write your name on a sheet of loose-leaf paper. (If you do not have loose-leaf paper, kindly ask for one from some one.)
2. In a short paragraph, answer the following question from your text:

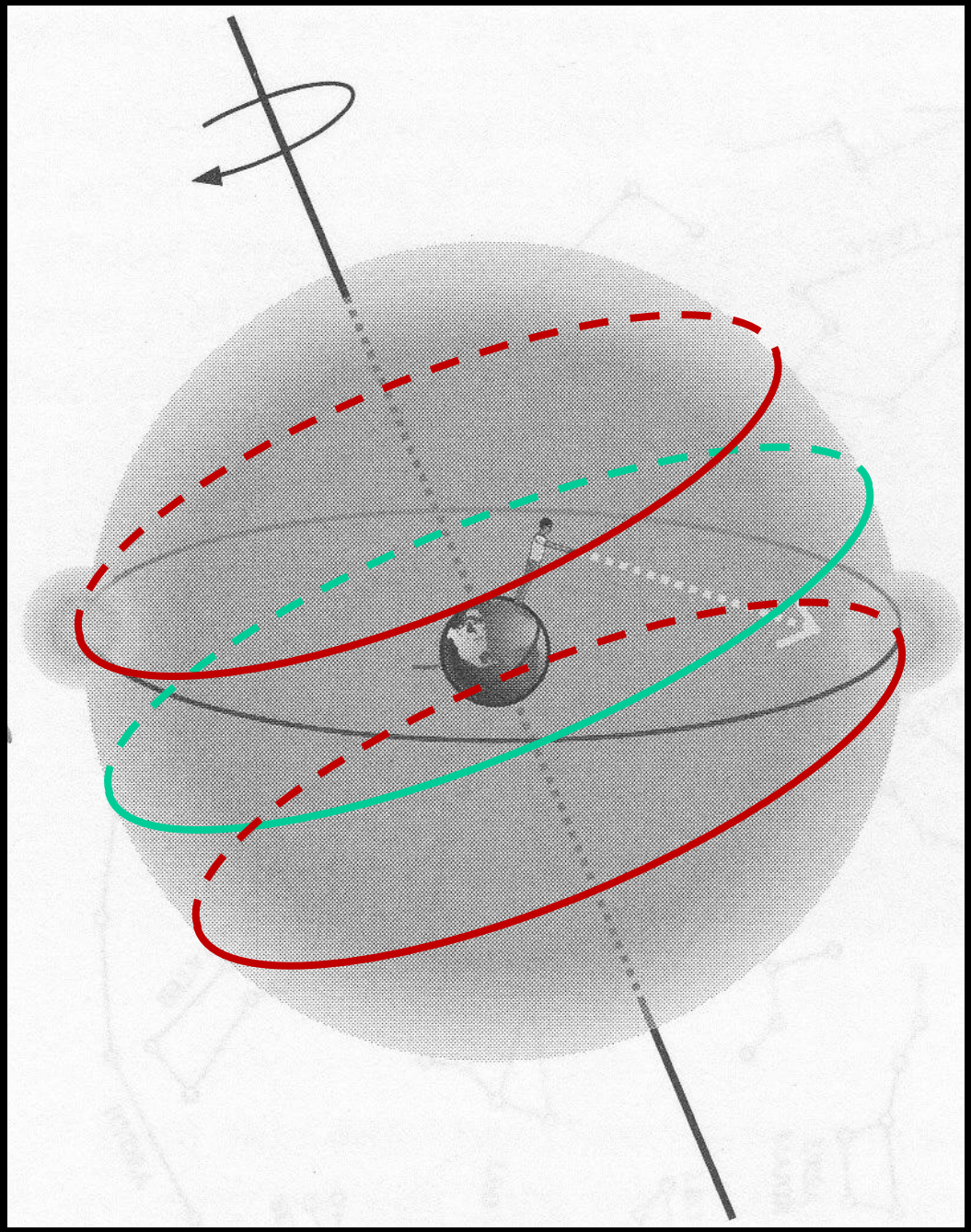
   "If the Earth rotated twice as quickly as it does now, what would be the difference in minutes between the solar and sidereal days? Explain how you got your answer."
3. When you are done, open your lecture tutorial book and review Part IV of the Ecliptic LT (pages 16-17). We will collect the quizzes after 5 minutes by having everyone pass them to the aisle.

- Where to get help?
  - SI sessions on Mondays & Wednesdays
    - 6:30-7:30PM, PS 132
  - Office Hours
    - Tuesdays, 4-5PM
    - Wednesdays, 2-3PM
    - Fridays, 2:30-3:30PM
  - Each other
- Lecture slides and copies of labs available on course web site (need to revise Schedule)
- Free public lecture “Einstein’s General Relativity” by Dr. Kip Thorn, 7:30-9PM, CR222

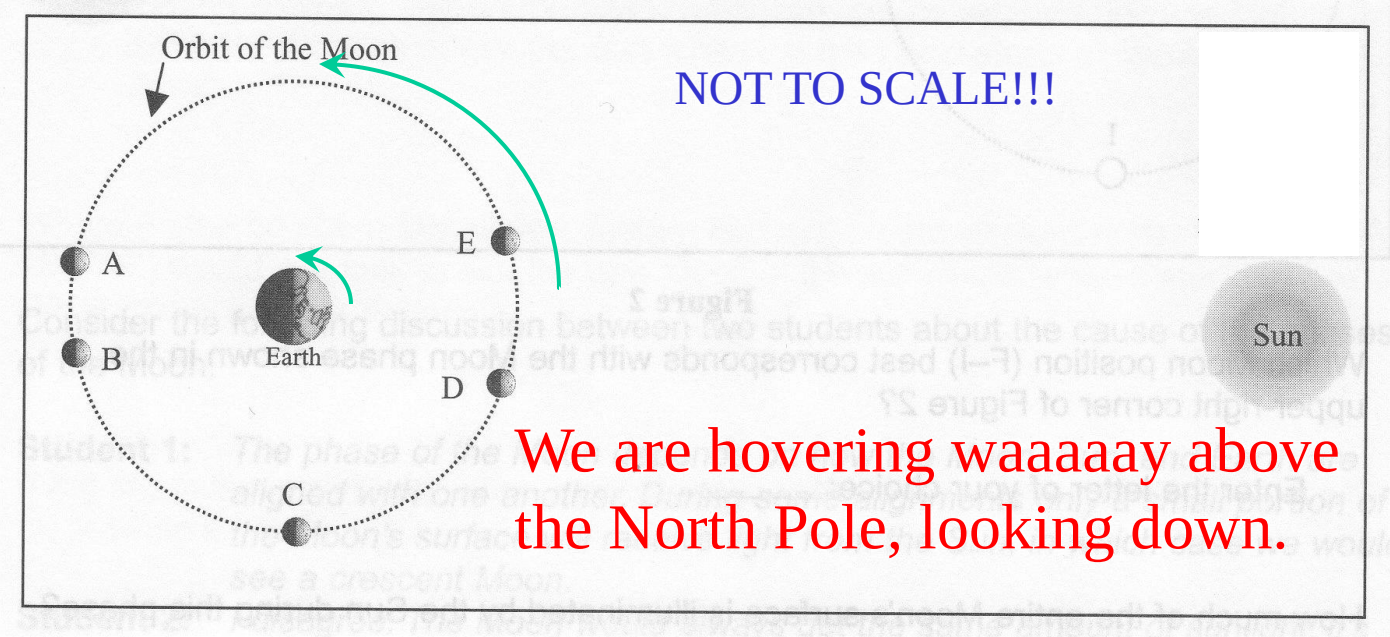
- Celestial equator – defined by Earth's *rotation*
- Ecliptic – defined by Earth's *orbit*

- On a daily basis, *everything* moves with the celestial sphere (i.e., the sky) – cf. "Motion" LT – parallel to the celestial equator.
- In addition to this motion, the Sun slowly creeps along the ecliptic, about a degree a day.

- We'll come back to this when we look at why we have seasons (outside of California). For now, let's take a break from Celestial Spheres and consider the Phases of the Moon…

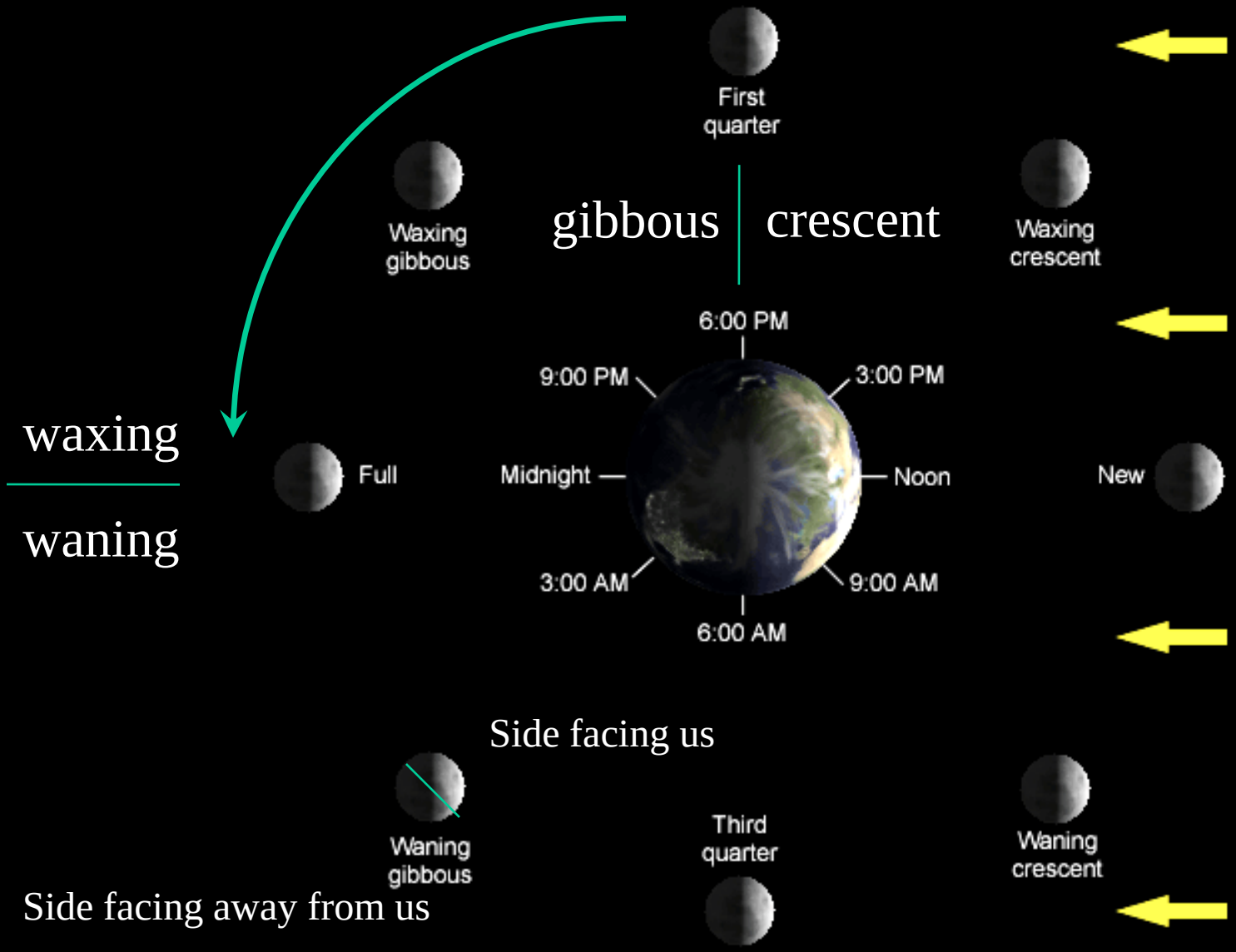


Phases of the Moon



- Phases caused by motion of Moon around the Earth, and the relative alignment of the Sun, Earth, and Moon.
- Phases go through ~1 cycle every moon-th, er, month.
- The Moon also rotates once in exactly the same time, so the same side always faces Earth all the time.
- We see the part that is facing us that is also lit up by the Sun. The “dark” part is NOT a result of Earth’s shadow.

Phases of the Moon: Traxoline



Lecture Tutorials

- Break up into group of 2-3
  - NO MORE THAN THREE, NO SINGLES
- In your group, work through the following:
  - The Cause of Moon Phases (pages 79-81)
  - Predicting Moon Phases (pages 83-85)
  - Discuss the answers – don't be silent!
- MarkDan, Jacquelyn, and I will be roaming around if you need help…
- If your group finishes, check your answers with another group.

Today's plan

1. Mini-lecture
   A. Review of Quiz question
   B. The Path of the Sun
2. Lecture tutorial (The Path of the Sun)
3. Think-pair-share

Quiz Question Review

"If the Earth rotated twice as quickly as it does now, what would be the difference in minutes between the solar and sidereal days? Explain how you got your answer."

- Currently
  - Solar day = 24 hours, ~ 361 degree rotation
  - Sidereal day = 360 degree rotation, x min. shorter
  - x min. needed to rotate extra degree
- Earth rotates twice as fast, orbit around Sun unchanged
  - Solar day = 12 hours, ~361 degree rotation
  - Sidereal day = 360 degree rotation
  - Half as long to rotate extra degree…

• Until now, we have used the fact that the *average* position of the Sun is on the celestial equator

– Half of circle above/below horizon

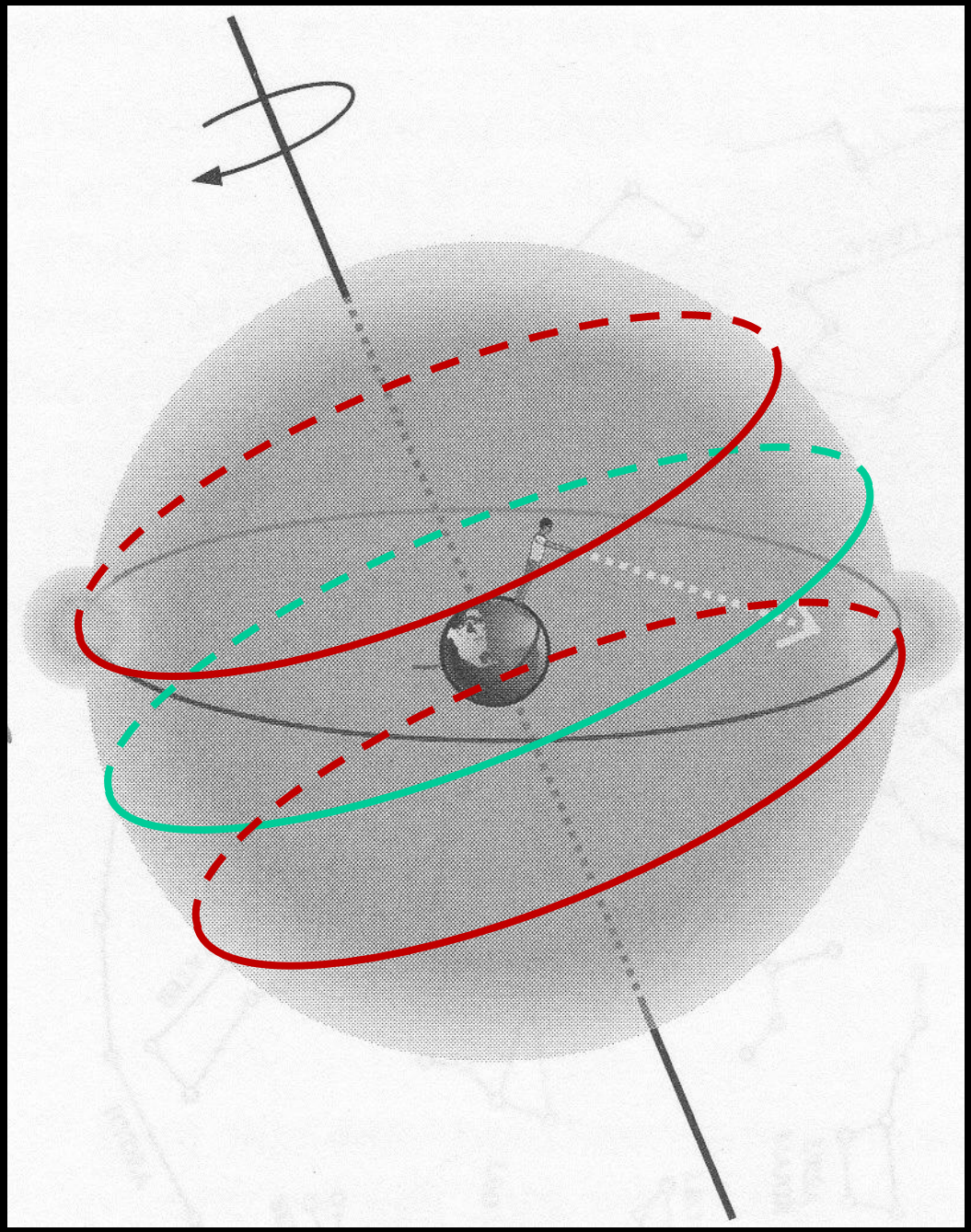
– Rises due east, 6AM

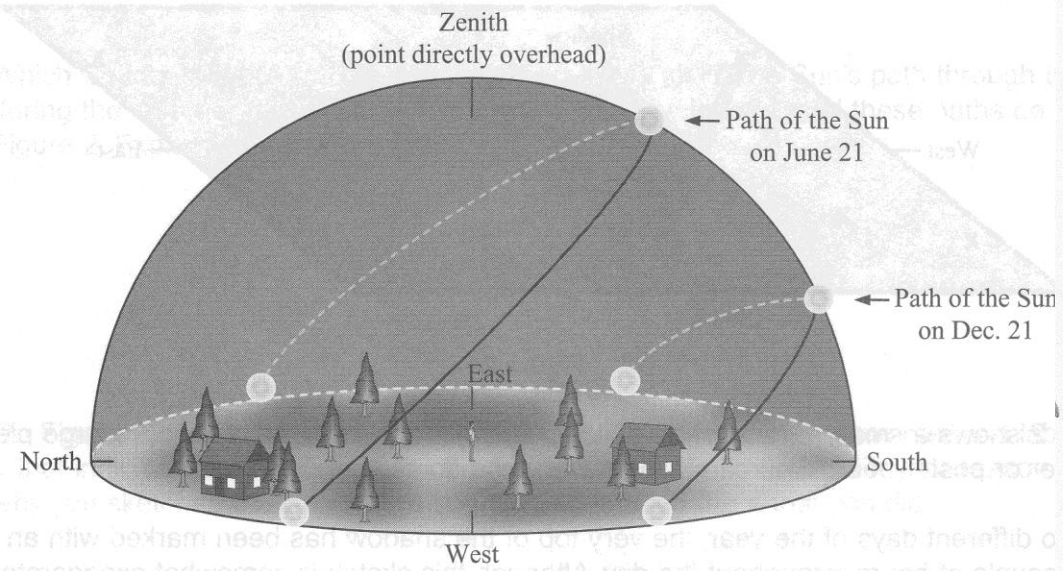
– Sets due west, 6PM

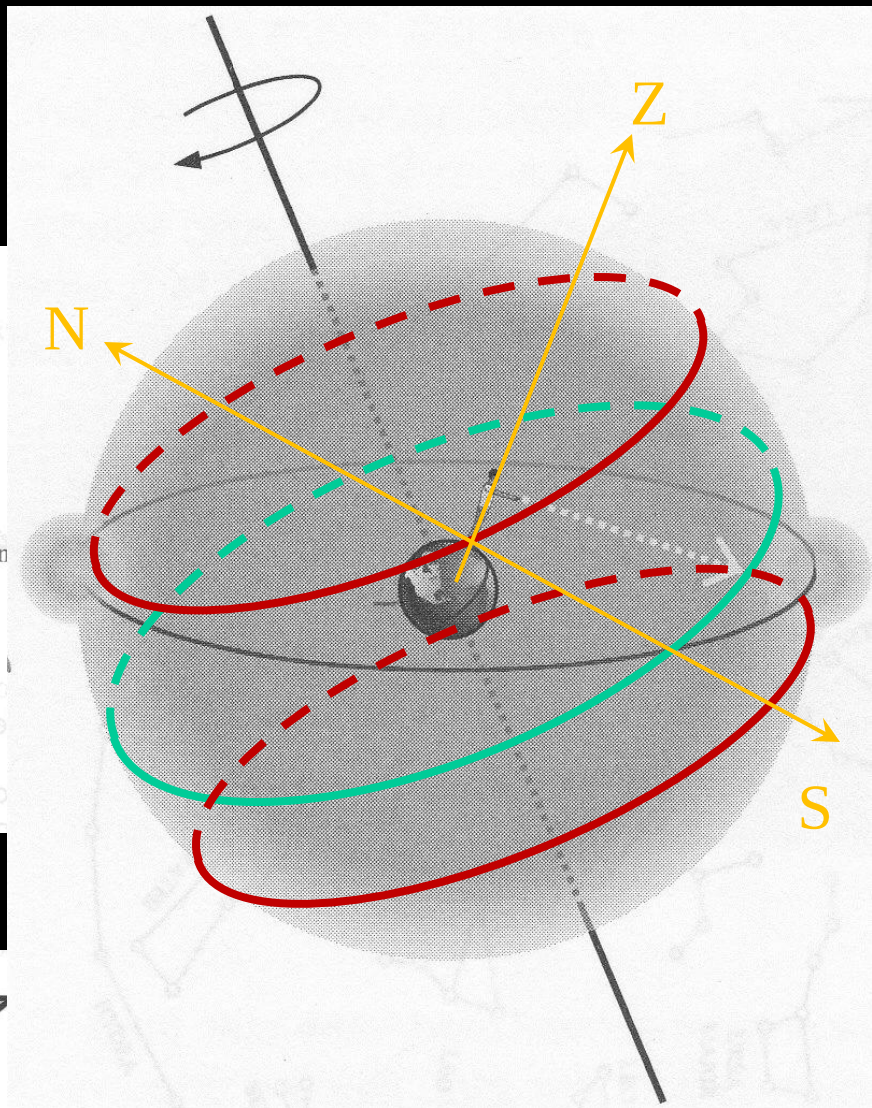
• The Sun actually creeps along the ecliptic…

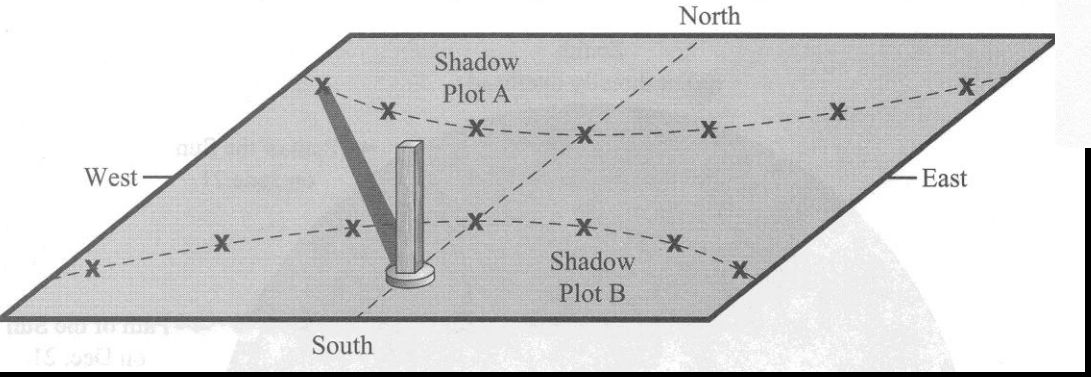
– Equinox: when the Sun is at the intersection of the ecliptic and celestial equator (March 21, September 22)

– Solstice: when the Sun is farthest from the celestial equator (June 21, December 21), 23.5 degrees




Zenith
(point directly overhead)
Path of the Sun
on June 21
Path of the Sun
on Dec. 21
East
North
South
West


Z
N
S


North
Shadow
Plot A
West
East
Shadow
Plot B
South

Lecture Tutorials

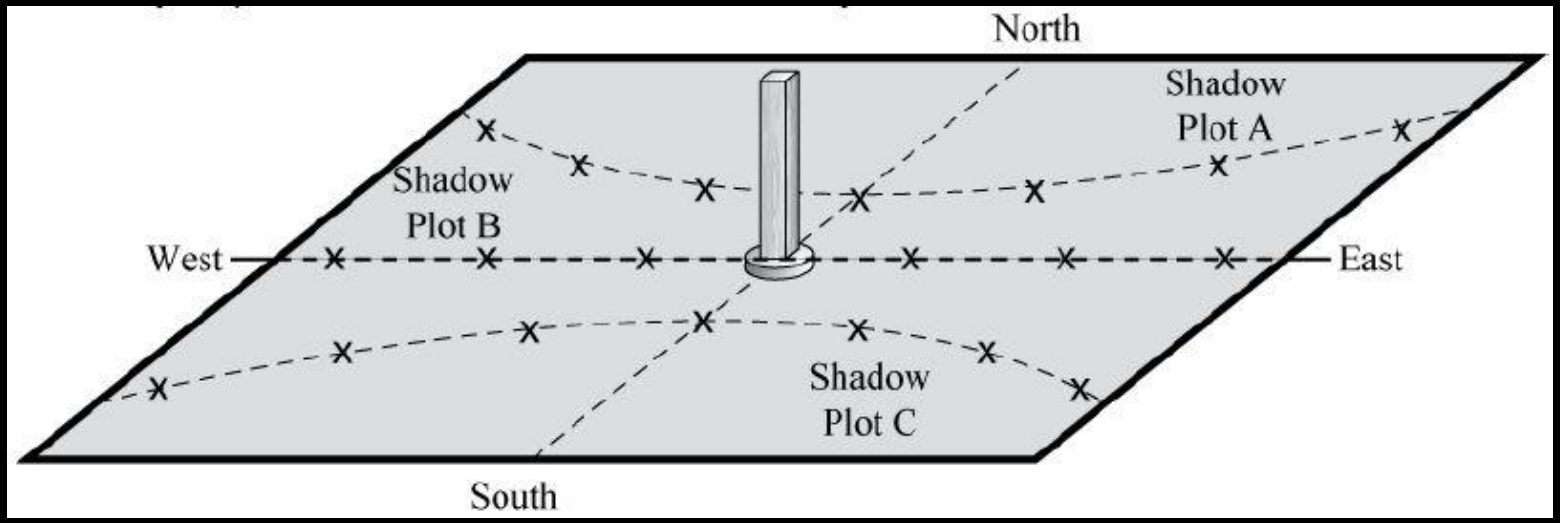
- Break up into group of 2-3
  - NO MORE THAN THREE, NO SINGLES
- In your group, work through the following:
  - The Path of the Sun (pages 87-90)
  - Discuss the answers – don't be silent!
- MarkDan, Jacquelyn, and I will be roaming around if you need help…
- If your group finishes, check your answers with another group.

Think

Pair

Share!

For an observer in the continental U.S., which of the three shadow plots, show below, correctly depicts the Sun's motion for one day?



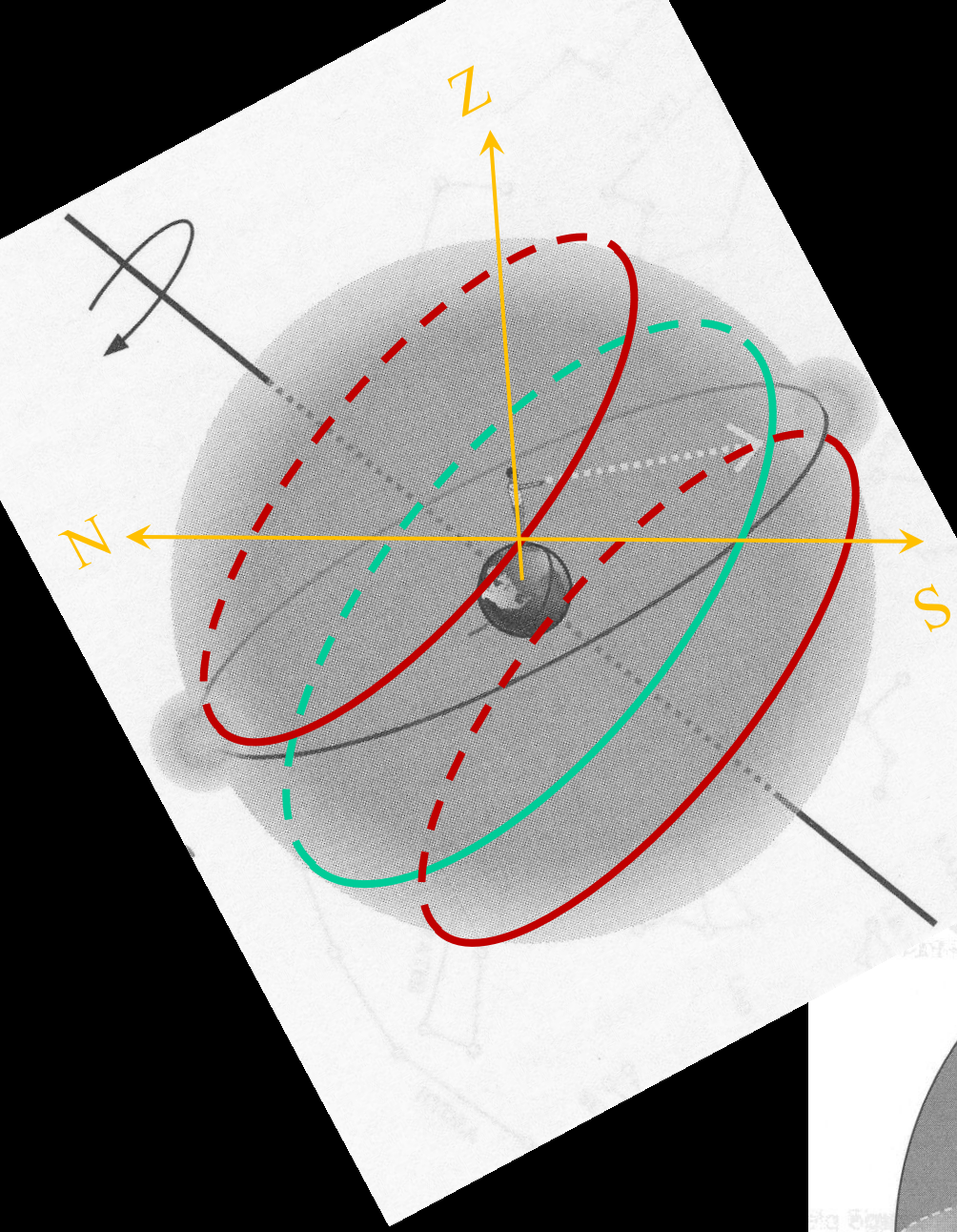
A. Shadow plot A
B. Shadow plot B
C. Shadow plot C
D. All three plots are possible, on different days of the year.

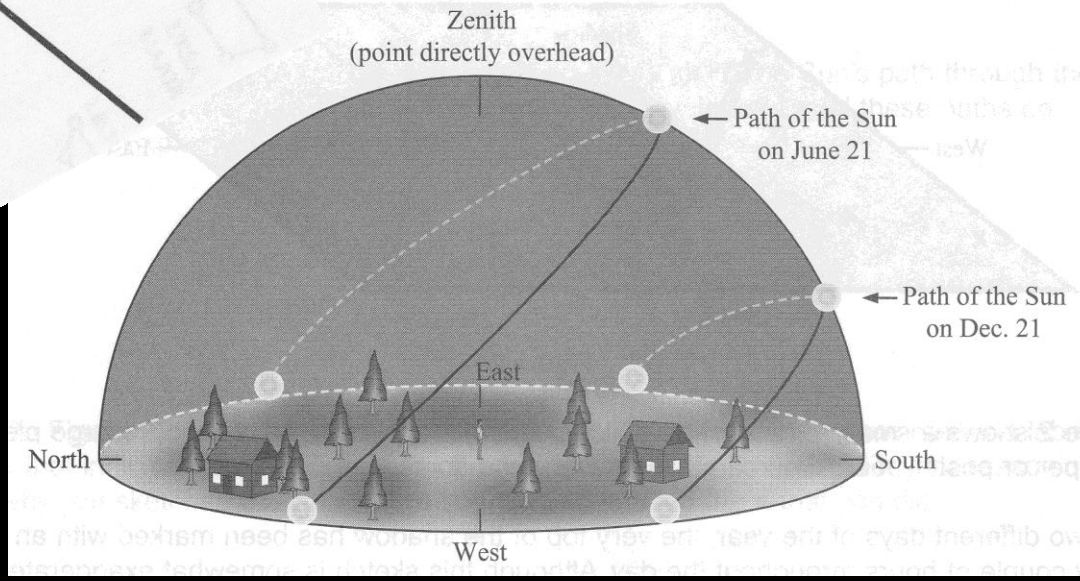
Today's plan

9/18 – Seasons

Next week: Gravity

In two weeks: Midterm Exam 1


Z
N
S

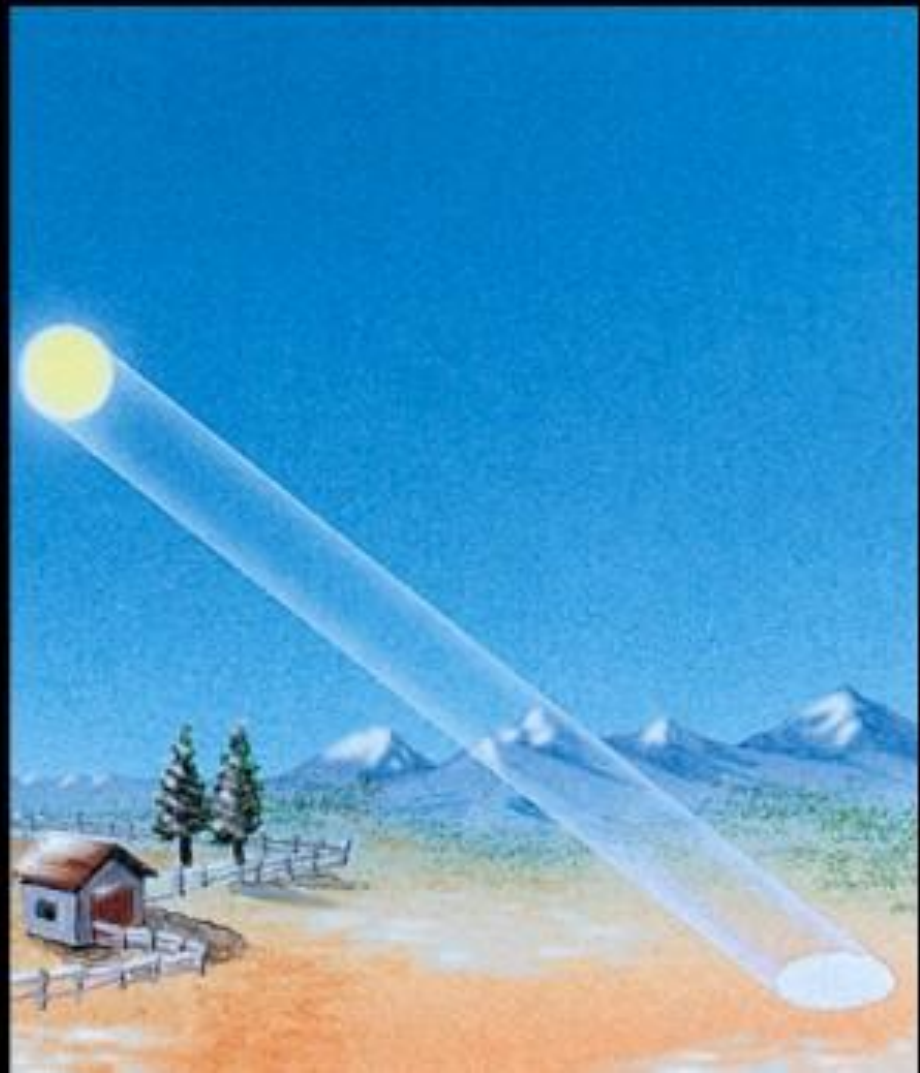

Zenith
(point directly overhead)
Path of the Sun
on June 21
Path of the Sun
on Dec. 21
East
North
South
West

Which of these are true and which are false and what evidence is there to support your answer?

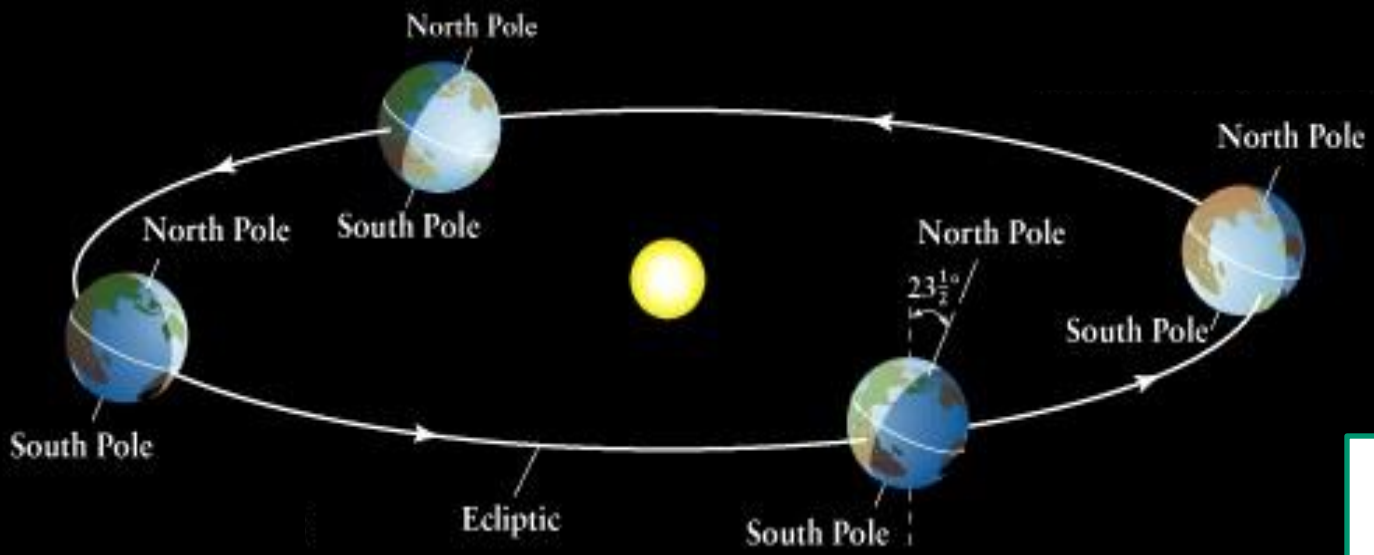
A = true, B = false

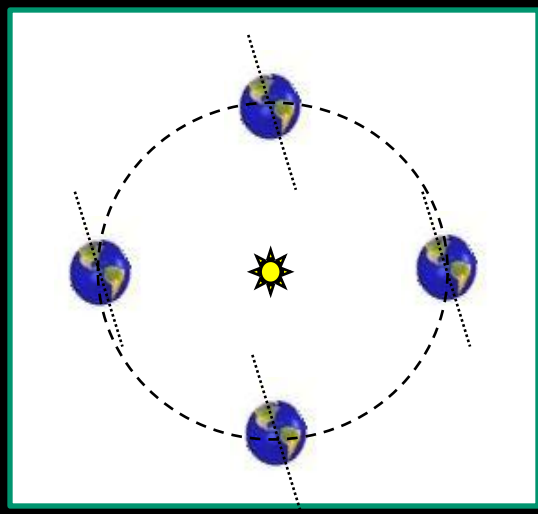
- Earth is closer to the Sun in summer than it is in the winter.
- When it is summer, the Sun is giving off more energy and when it is winter the Sun is giving off less energy.
- When it is summer, more sunlight reaches Earth than it does during the winter.

- How long does the Sun have to warm the ground?
- How effectively can it heat a given patch of ground?



The tilt of Earth's axis of rotation produces longer (or shorter) hours of more (or less) direct sunlight

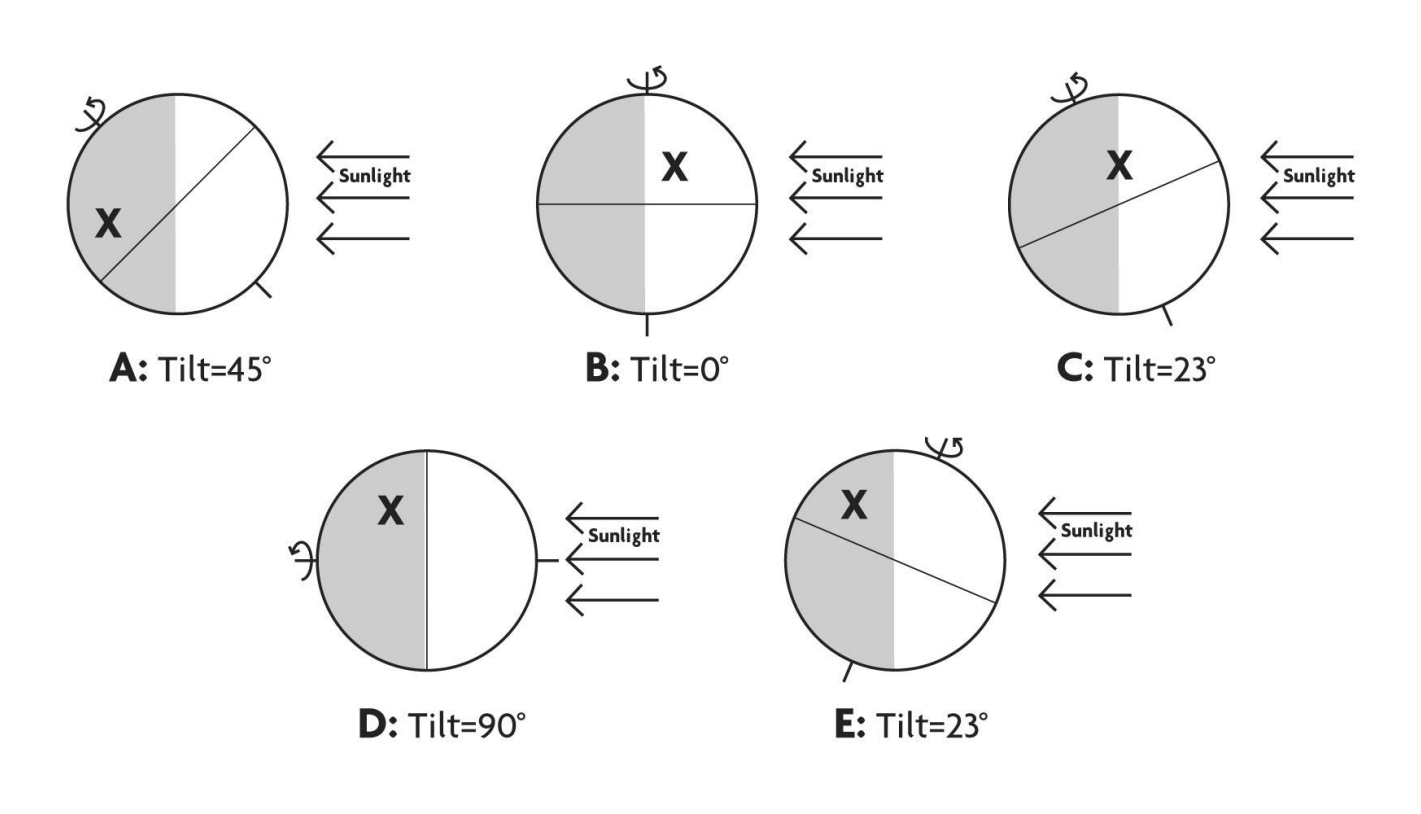




Lecture Tutorials

- Break up into group of 2-3
  - NO MORE THAN THREE, NO SINGLES
- In your group, work through the following:
  - Seasons (pages 91-96)
  - Discuss the answers – don't be silent!
- MarkDan, Jacquelyn, and I will be roaming around if you need help…
- If your group finishes, check your answers with another group.

Quiz



Which of the locations identified with an "x" for each of the situations (A – E) would experience the coolest temperature over the course of one day? Explain your answer.

- Have a great weekend!
- Where to get help?
  - SI sessions on Monday, Wednesday
    - 6:30-7:30PM, PS 132
  - Office Hours
  - Each other