Lecture 03 – 20 January 2009

- **SCIENCE TOPICS**:
  Darkness and Light
  Winter and Summer
  Equinoxes and Eclipses
- **READING**
  E2–E4, p.1–22
- **PRACTICE**
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  p.23 Self-Test: 2, 4–8, 11–15
  p.23 Problems: 6–9

Homework 01 is out!

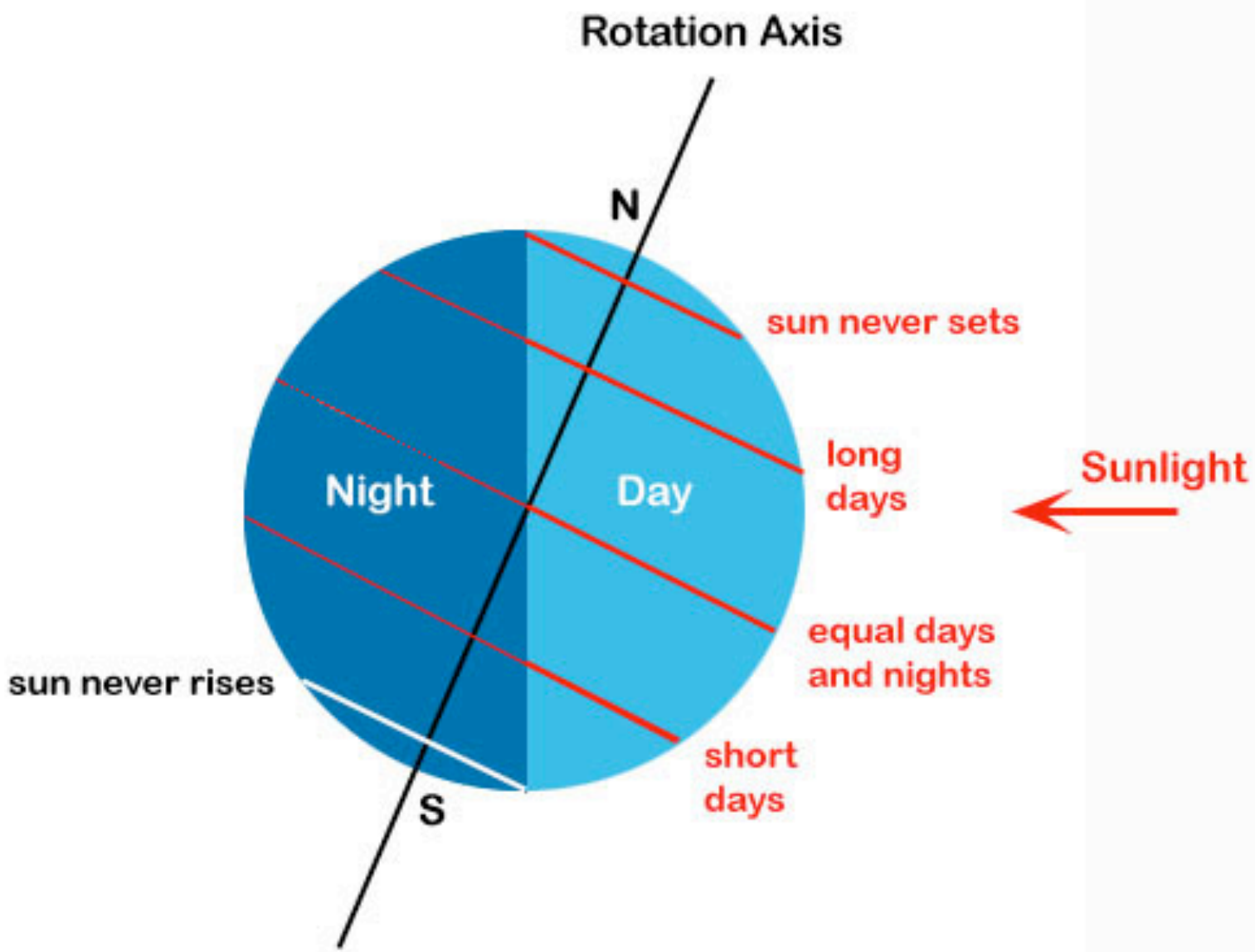
Existential Questions

- Why do we see day and night?
- What causes the seasons? What makes the days longer in the summer than in the winter?
- Why do we see different stars in the summer and in the winter?
- What causes the phases of the moon?
- What causes Solar and Lunar Eclipses?

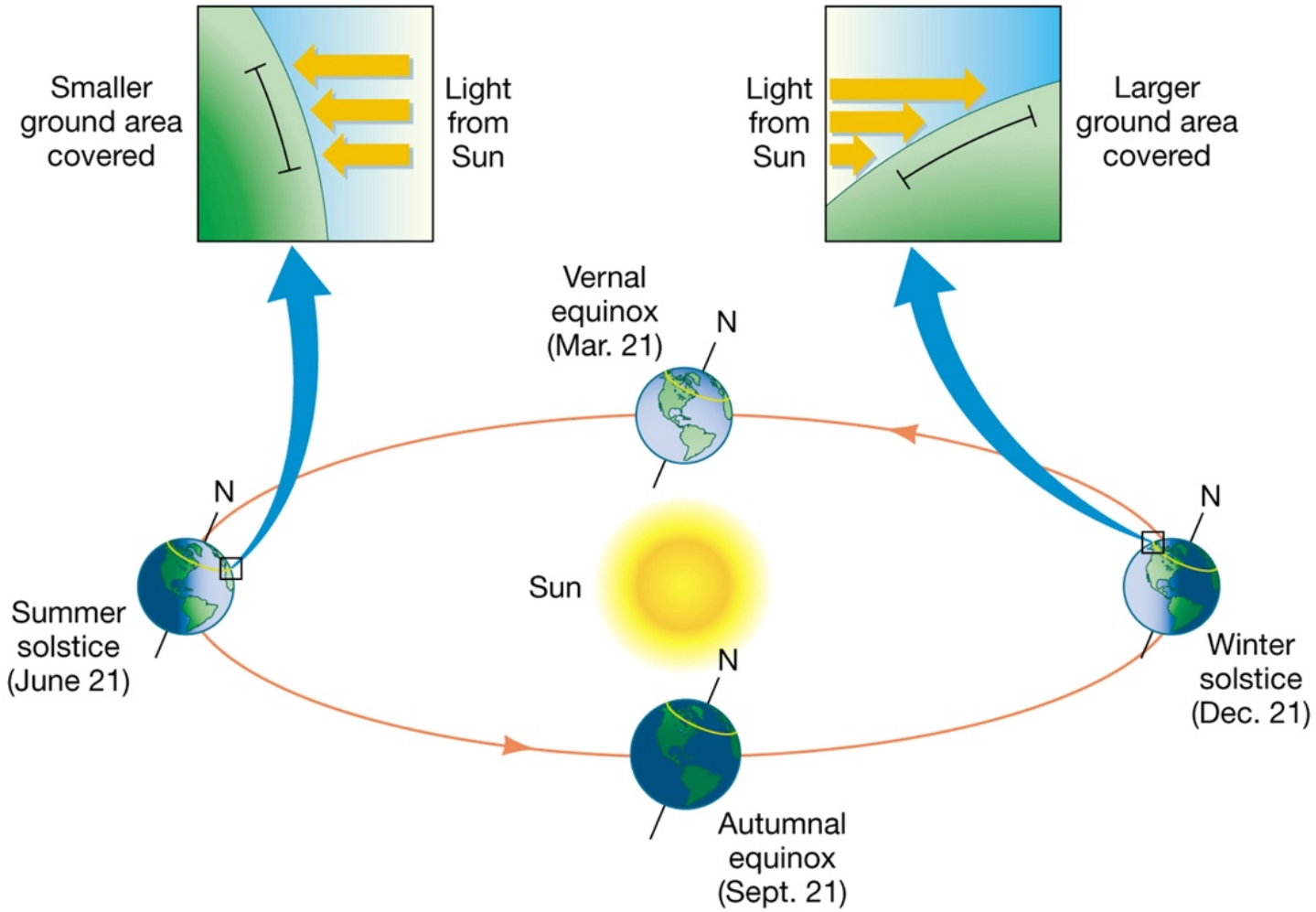
The Earth, the Moon and the Sun

Some basic facts...

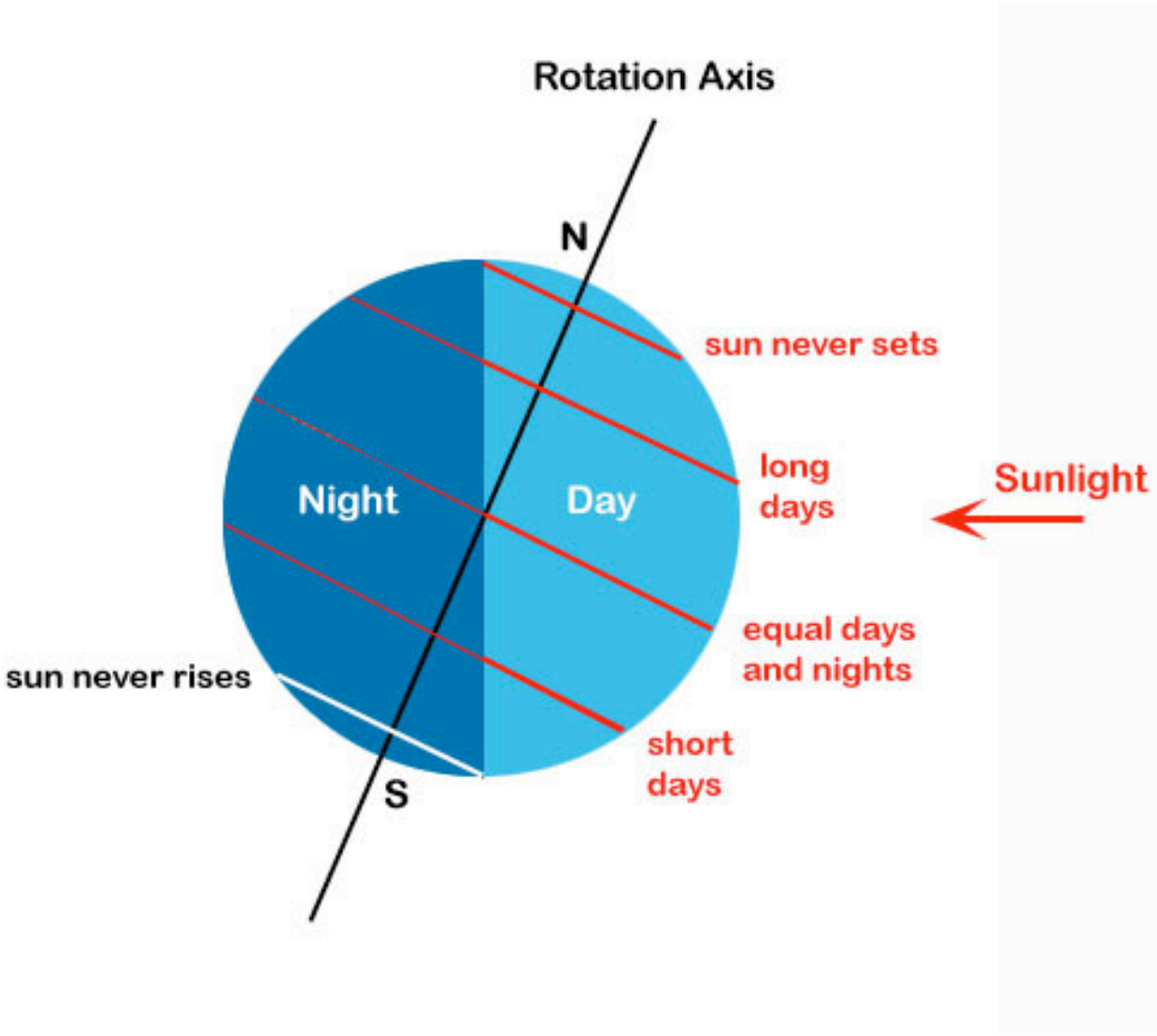
- The Earth orbits (revolves around) the Sun with a period of one year.
- The Earth also rotates on its axis (i.e., around itself) with a period of one day.
- The Earth's rotation axis passes through the north and south poles and points approximately in the direction of Polaris (these days). It is tilted relative to the axis of the Earth's orbit by 23.5°
- The Moon revolves around the Earth in 27 days but not in the same plane as the earth's orbit around the Sun. *It always presents the same face towards the Earth.*


Rotation Axis
N
sun never sets
long
days
Sunlight
Night
Day
equal days
and nights
sun never rises
short
days
S

2. What causes the seasons?


Smaller ground area covered
Light from Sun
Light from Sun
Larger ground area covered
Vernal equinox (Mar. 21)
N
N
Summer solstice (June 21)
Sun
N
N
Winter solstice (Dec. 21)
Autumnal equinox (Sept. 21)

Length of a day

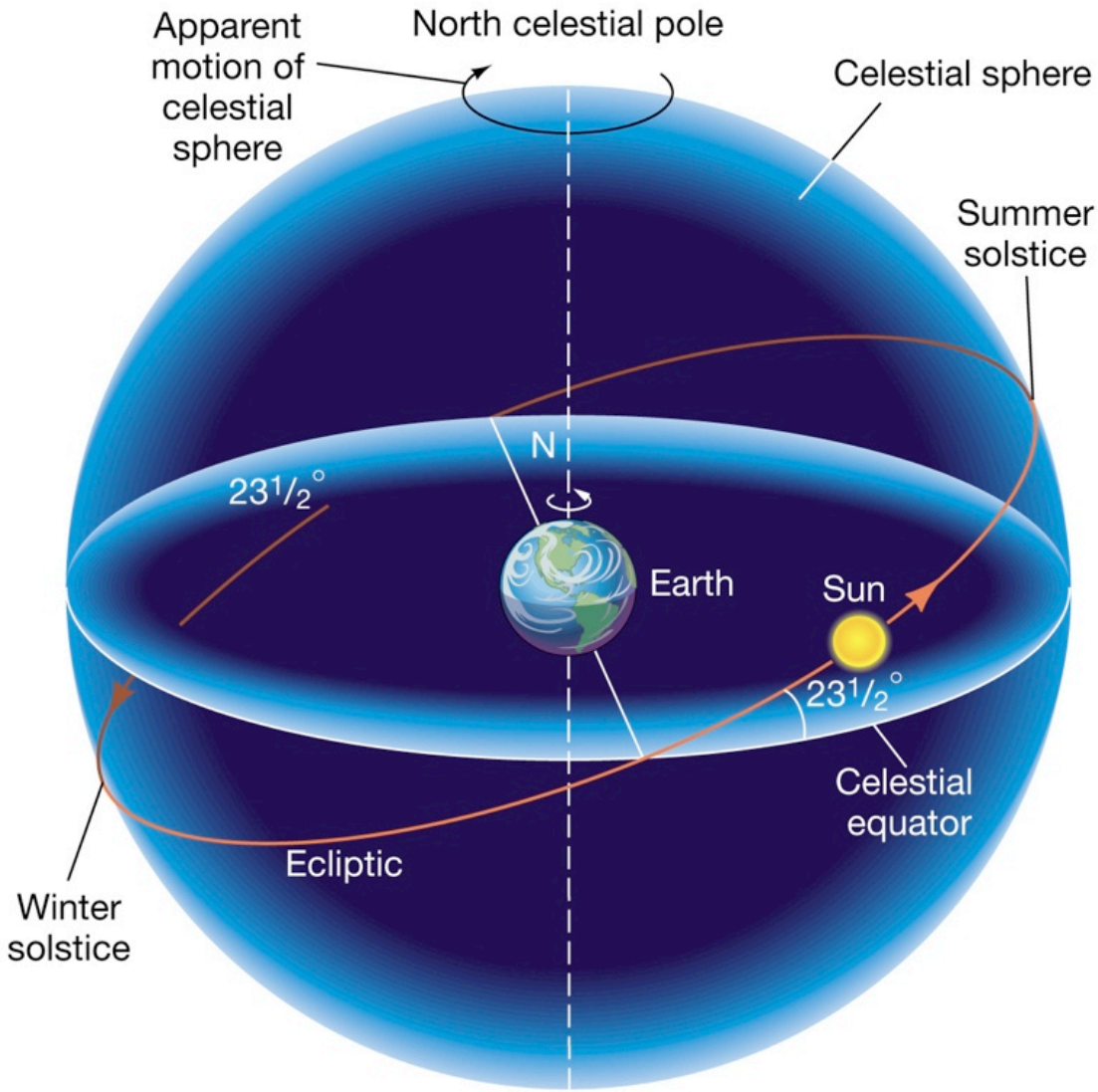


Solstice and Equinox

Winter Solstice	December 21	shortest day of year*
Summer Solstice	June 21	longest day of year*
Autumnal (fall) Equinox	September 22	day and night have equal length
Vernal (spring) Equinox	March 20	

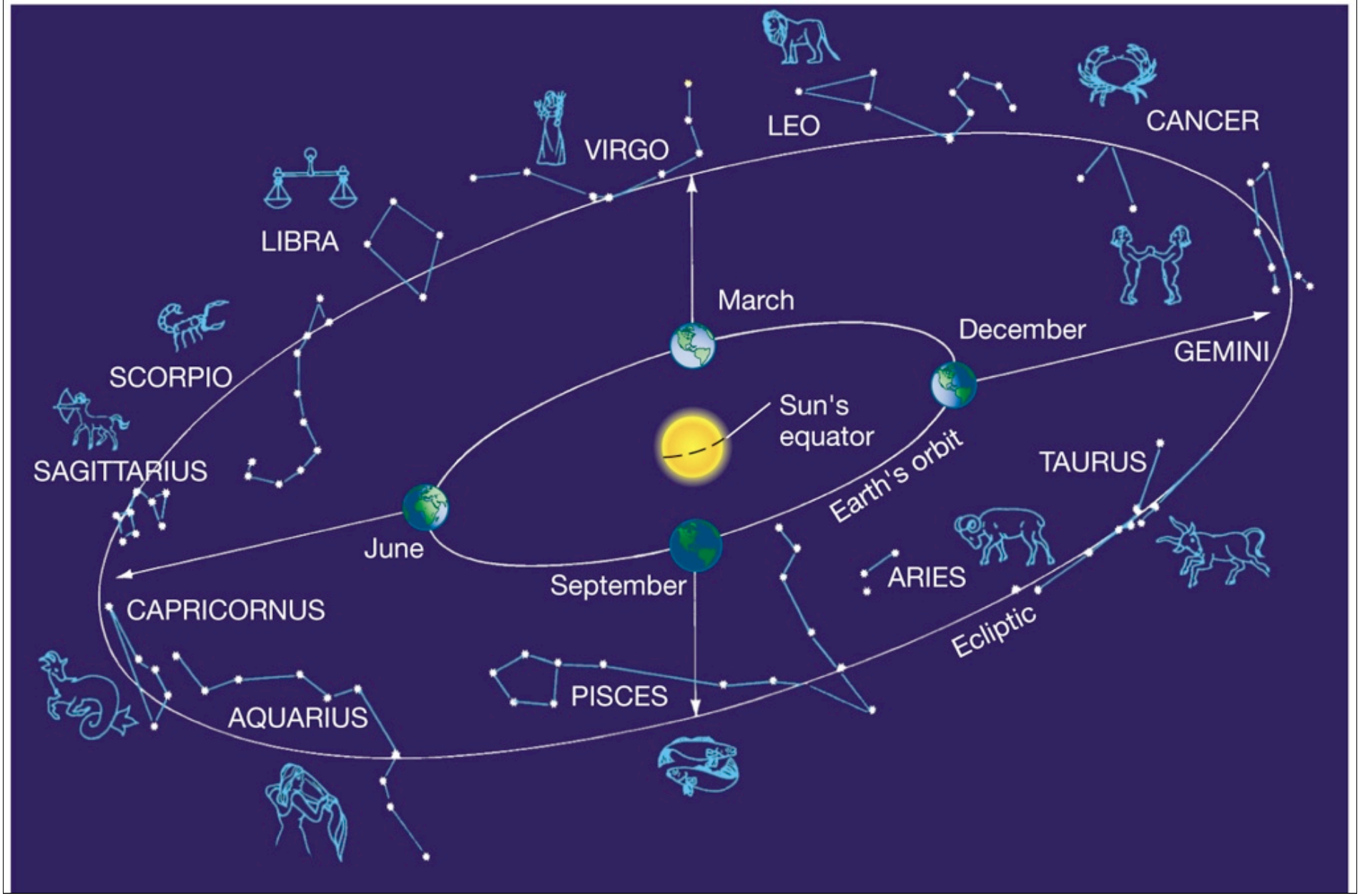
*In the Northern Hemisphere

Location of Sun in the sky over the course of a year

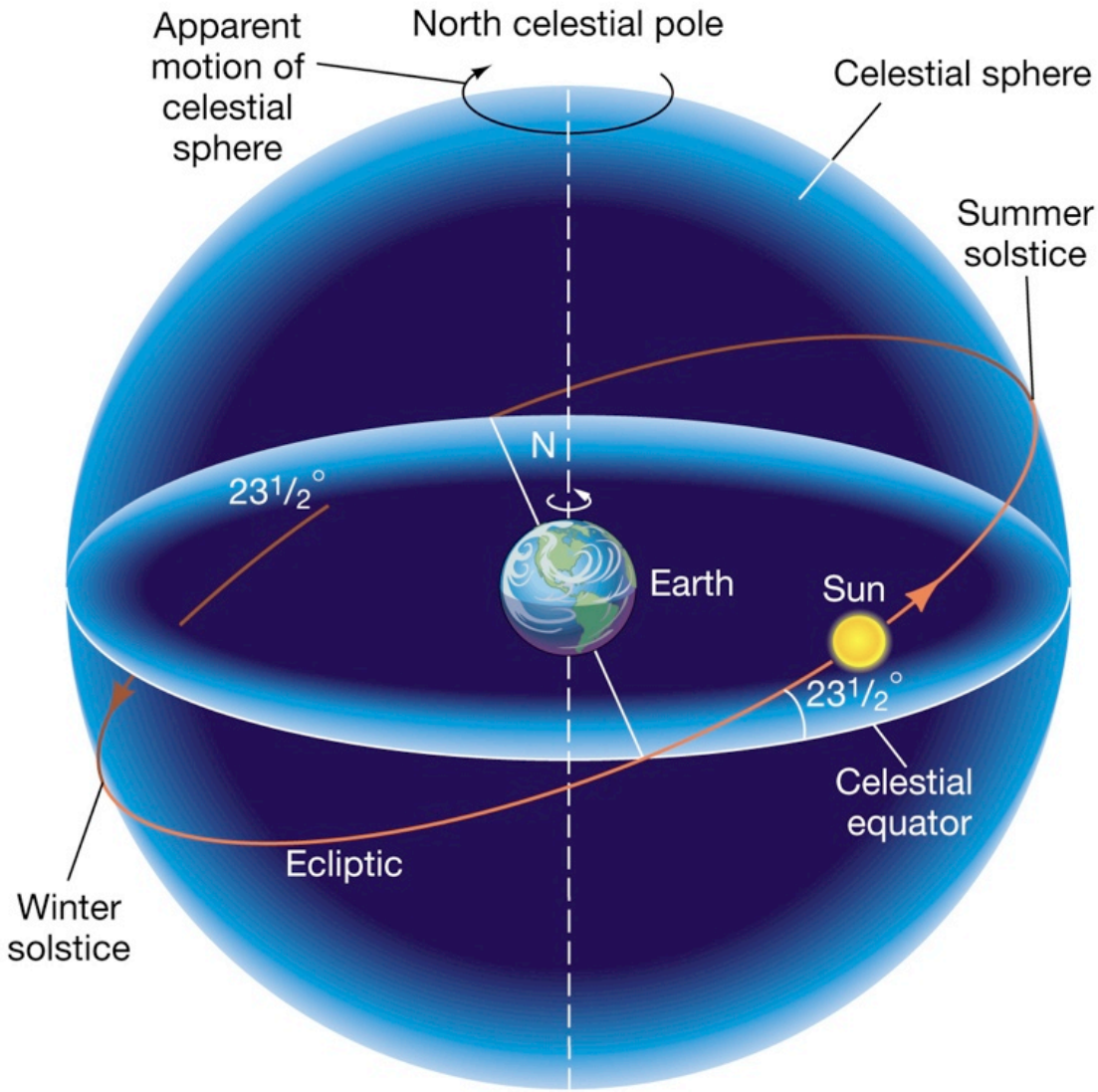


3. Why do we see different stars in the sky in different seasons?

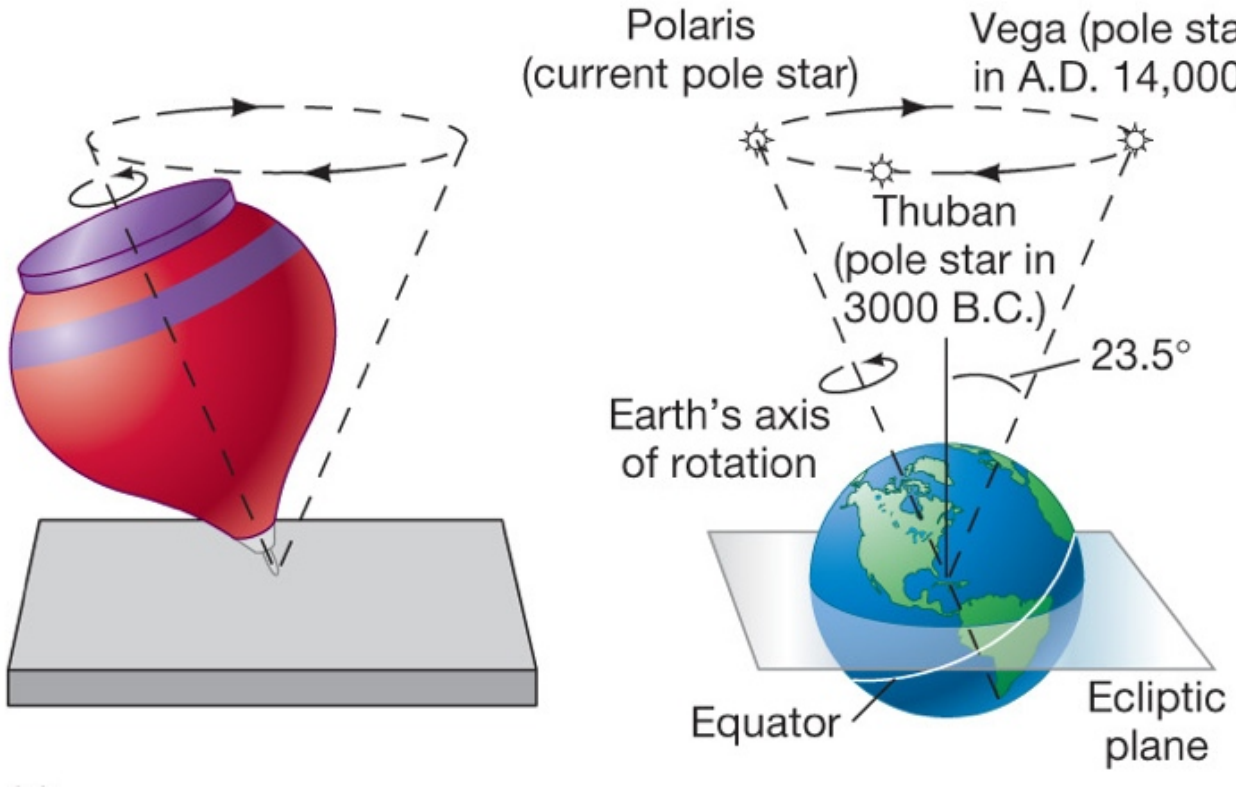
Constellations of the Zodiac



Location of Sun in the sky over the course of a year

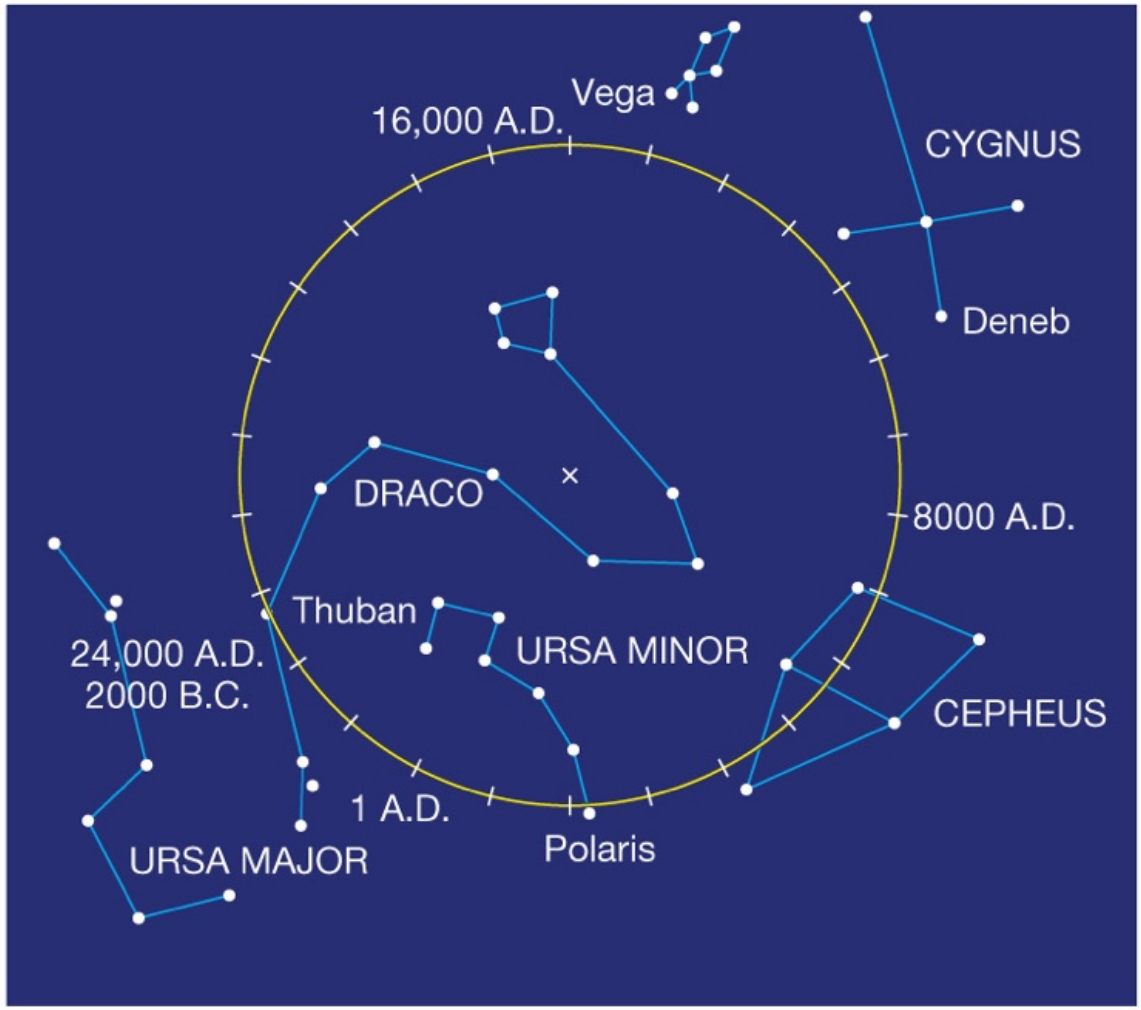


Precession of the equinoxes



The Earth's rotation axis precesses with a period of 26,000 years. At the moment is points close to Polaris.

Polaris not always the North Star

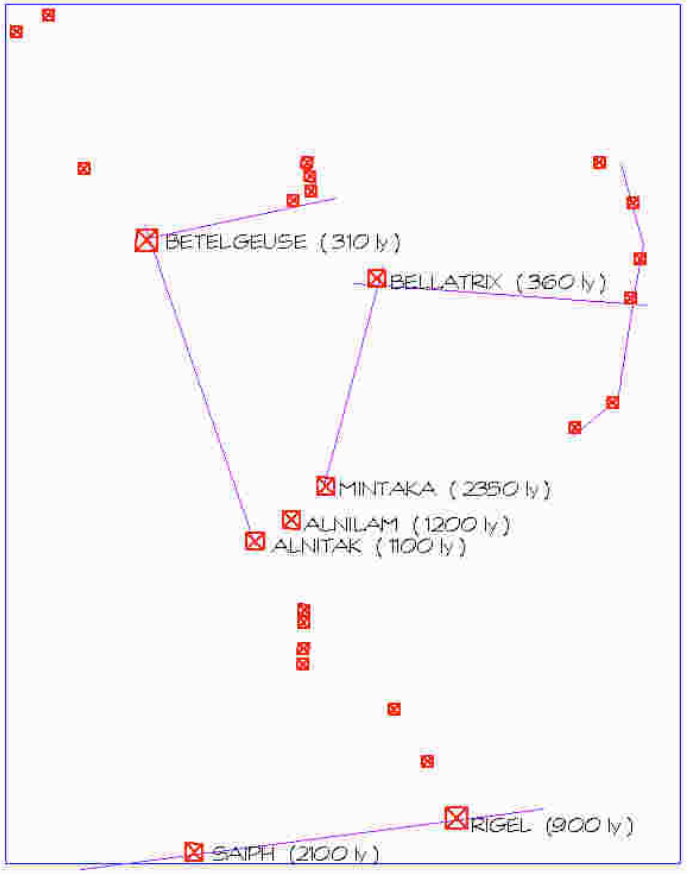


Astrological charts were devised in 131 BC.

What fraction of a precession cycle are they off?

How many constellations does that offset correspond to?

Orion the Hunter



Was in love with Merope (one of the Pleiades), who did not love him back. Stepped on Scorpius...
Placed by the gods next to the river Eridanus with his two dogs (Canis Major, Canis Minor).

Stars in a constellation need not be close to each other. They are only **projected** close to each other