

Reminder: no food or  
drinks in the planetarium!

Thanks for making the  
longest day of the year  
longer by explaining  
why it's the longest  
day of the year.



som<sup>ee</sup>cards

# The Seasons

True/False: The Earth is closer to the Sun in the Summer and further away in the Winter

- A) True
- B) False

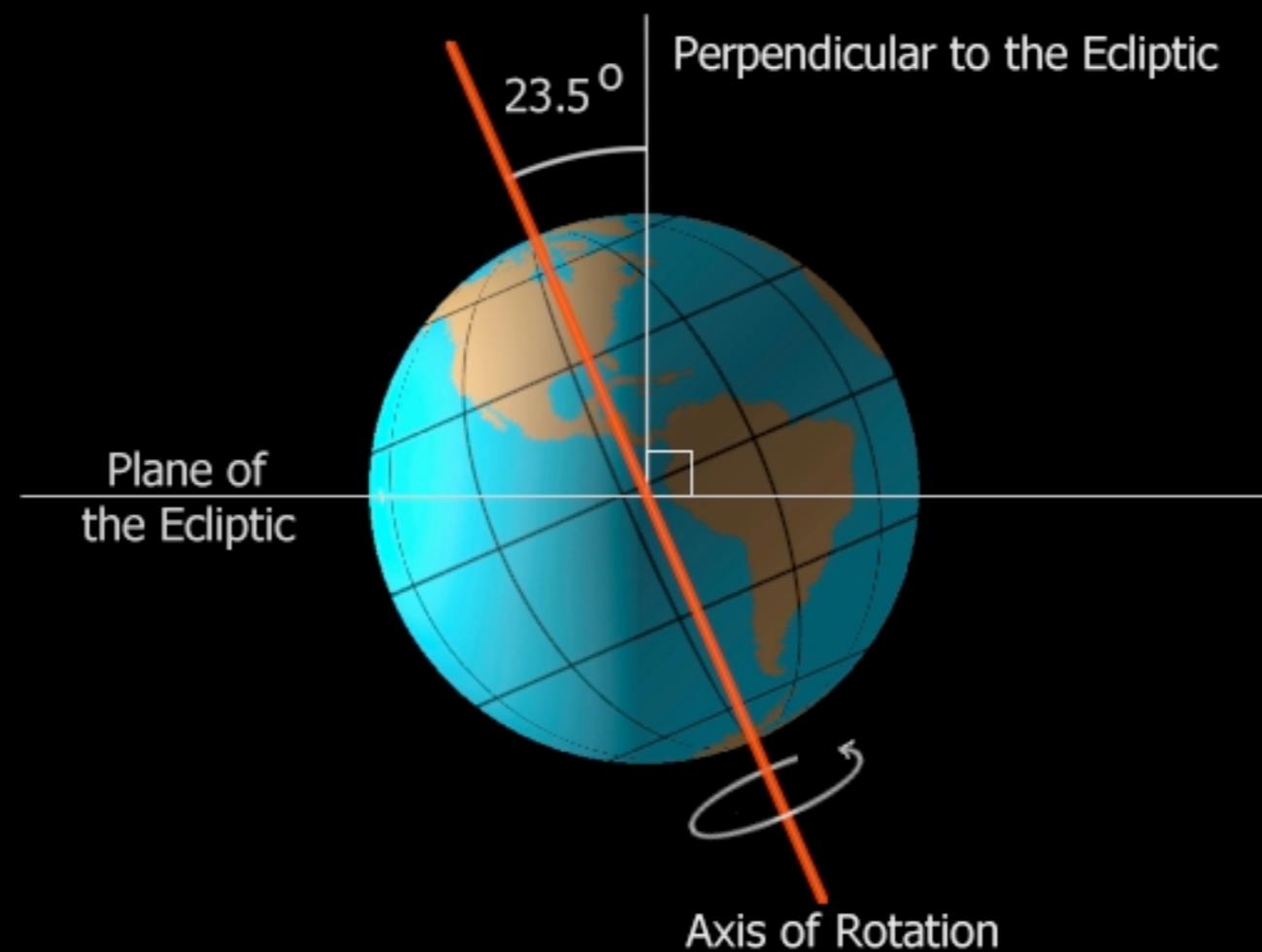
# The Seasons

True/False: The Earth is closer to the Sun in the Summer and further away in the Winter

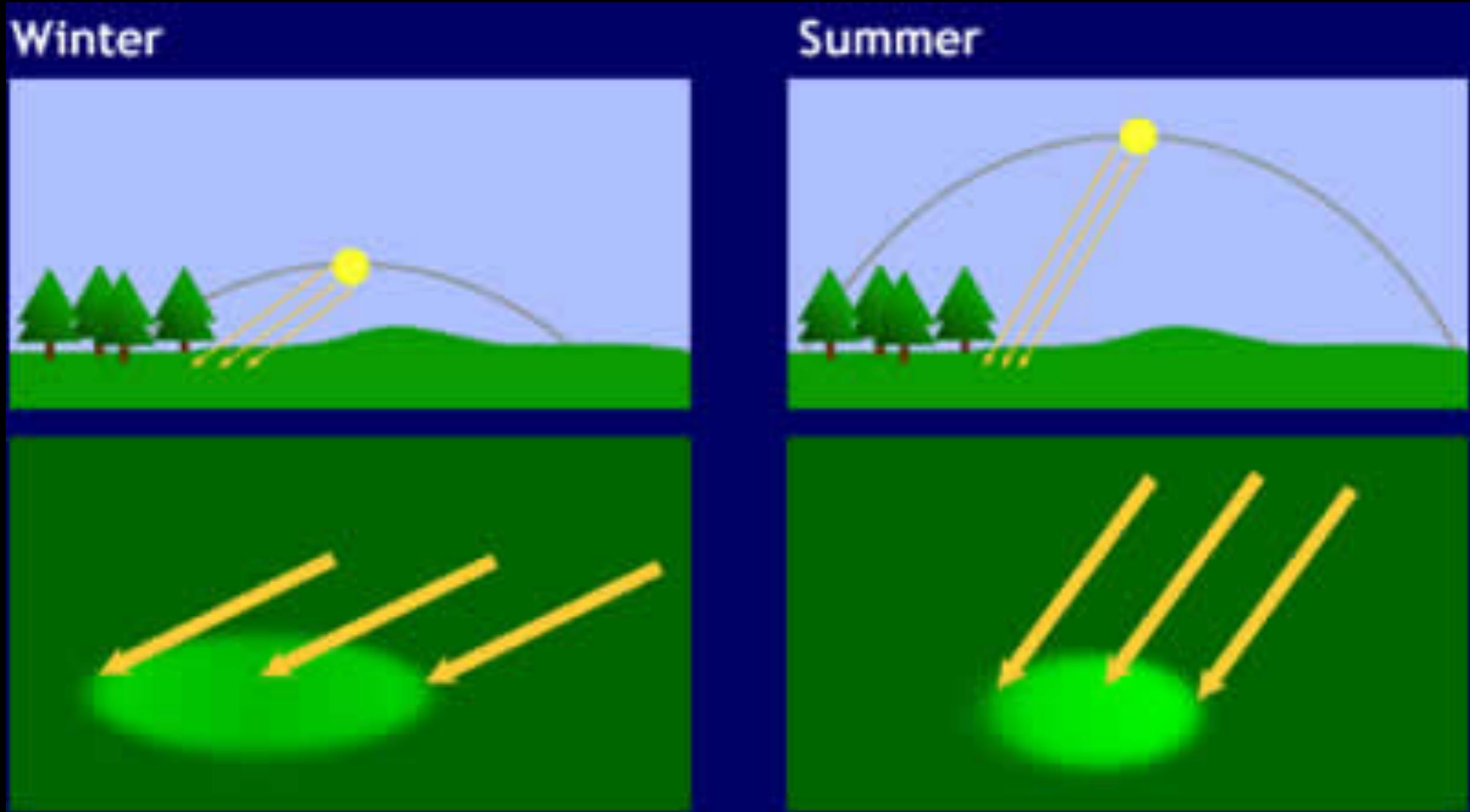
- A) True
- B) **False** – on July 4<sup>th</sup> the Earth is 152.1 million km and on Jan 4<sup>th</sup> its 147.1 million km away

# The Seasons

- Earth's equator is tipped  $23.5^\circ$  relative to its orbit.
- The combination of our motion around the Sun AND the **TILT** in the Earth's axis is responsible for the seasons



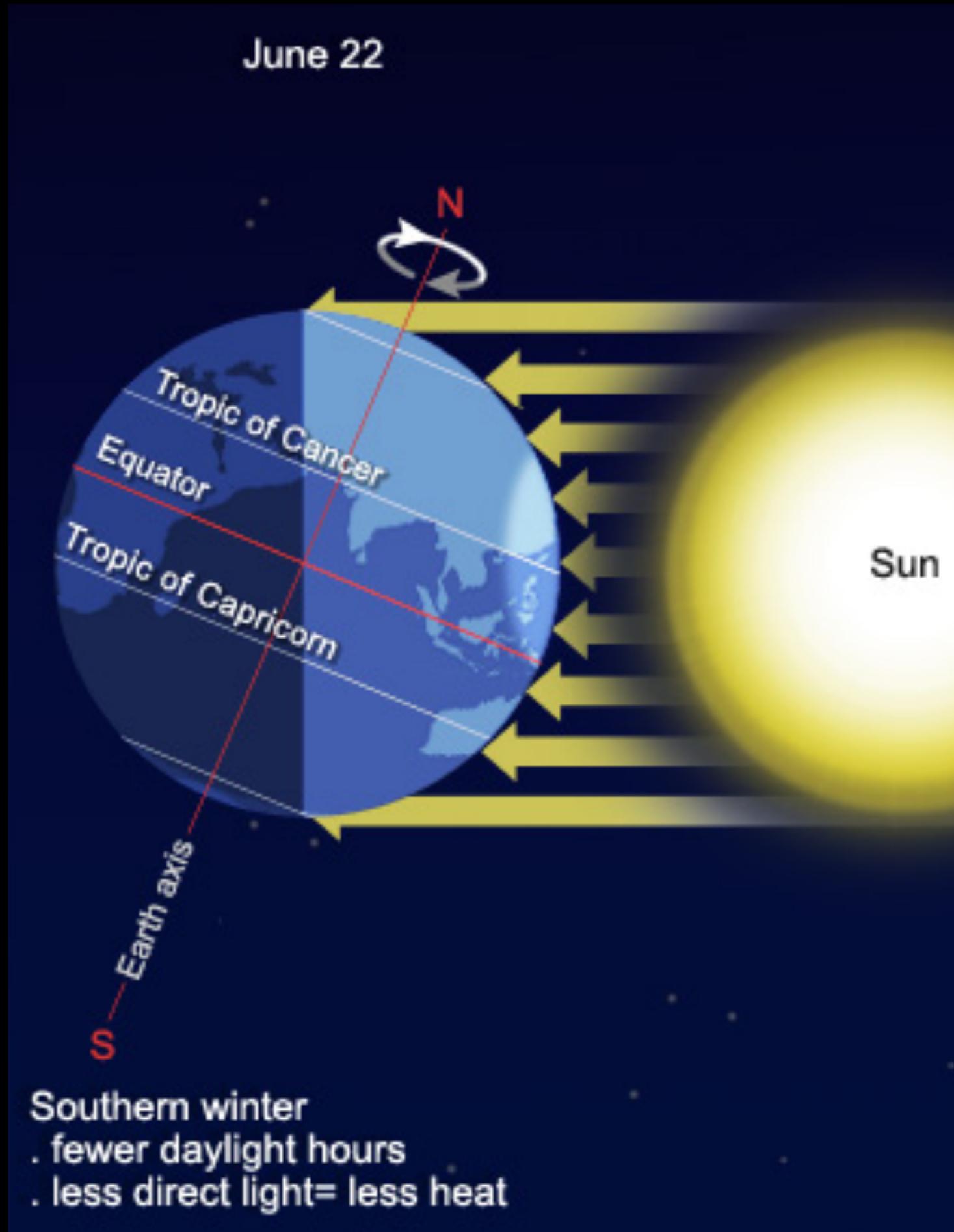
The lower the angle of the Sun the less energy absorbed per square foot and vice versa



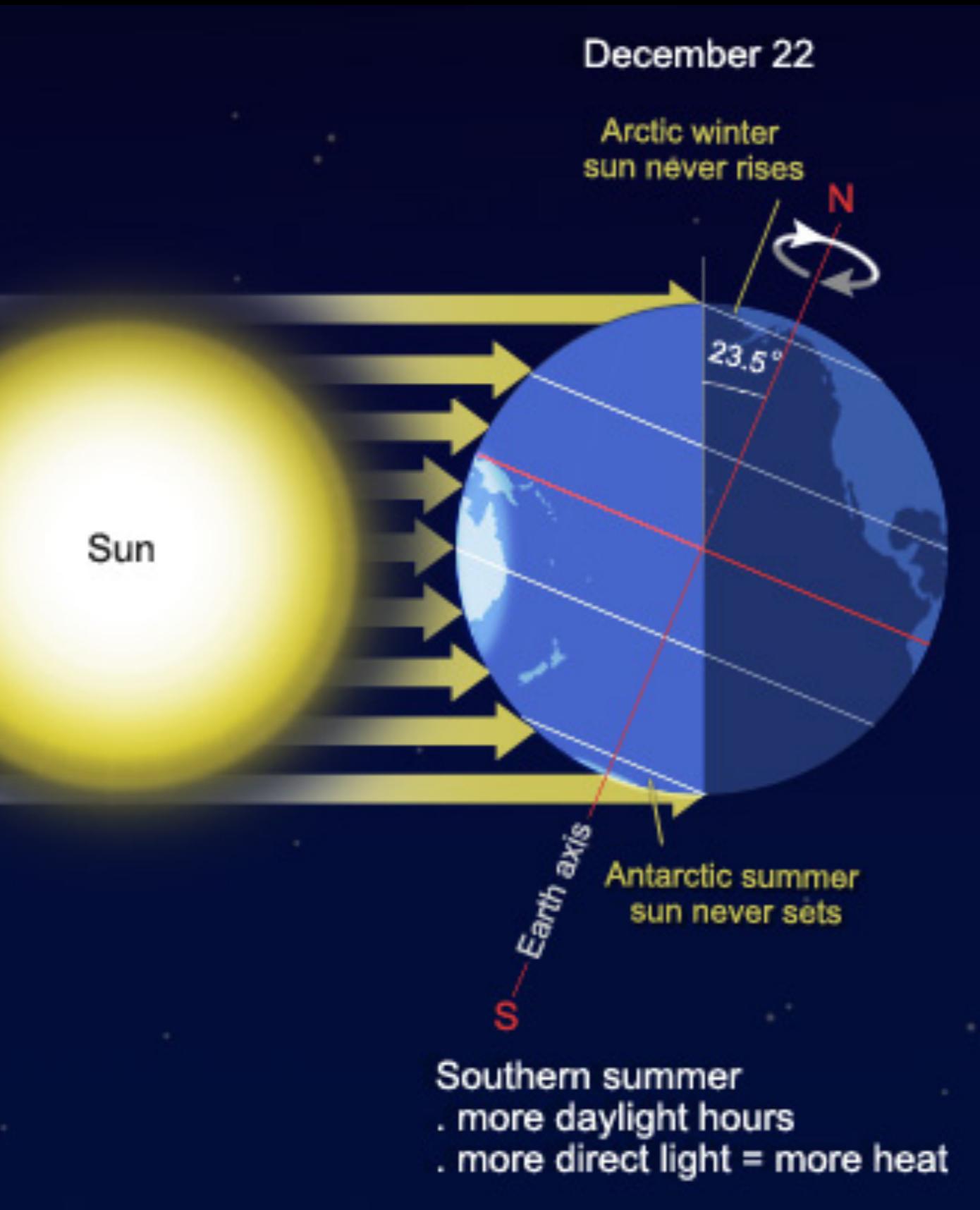
# During OUR Summer

The Northern Hemisphere is pointed toward the Sun

- The more direct the sunlight, the hotter it gets
- The longer the Sun is up, the hotter it gets



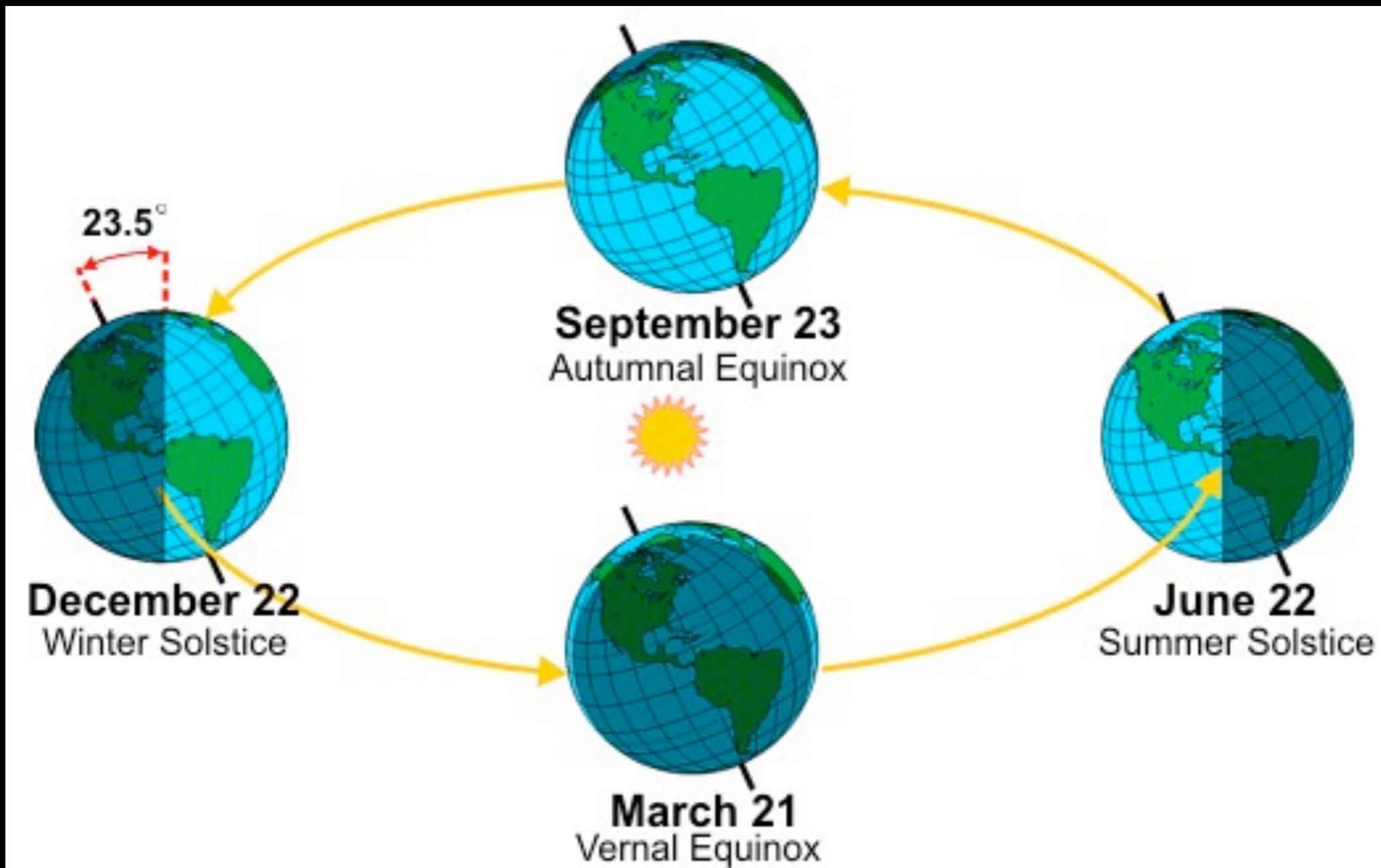
# During OUR Winter



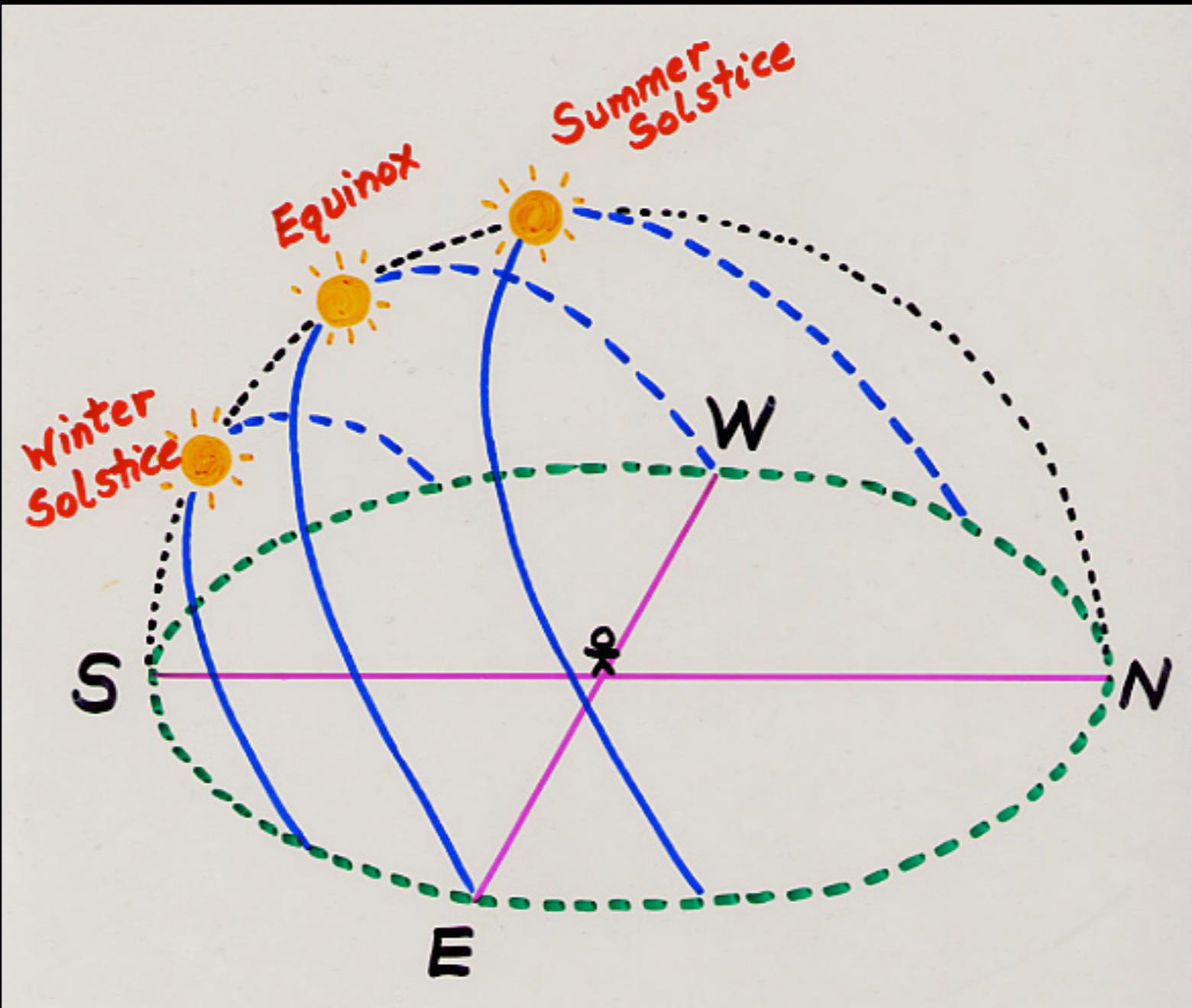
The Northern Hemisphere is pointed away from the Sun

- The more indirect the sunlight, the cooler it gets
- The less the Sun is up, the colder it gets

- **Equinox** - midpoint between summer and winter - equal day and night
- **Solstice** - extreme of the seasons - winter solstice = shortest day, summer solstice = longest day

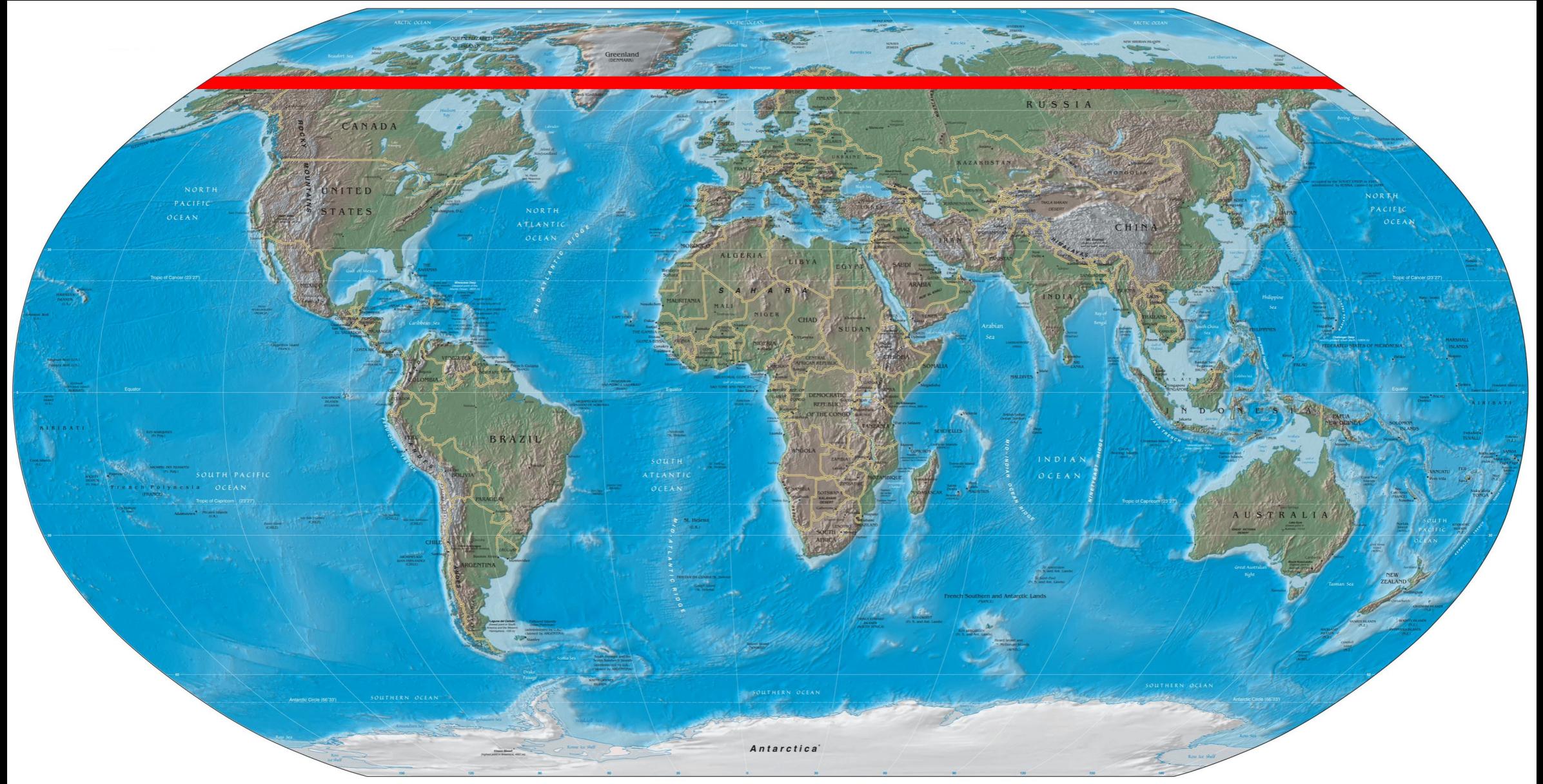


# Diagram of the path of the Sun travels on the DAYS of the Solstices and the Equinoxes



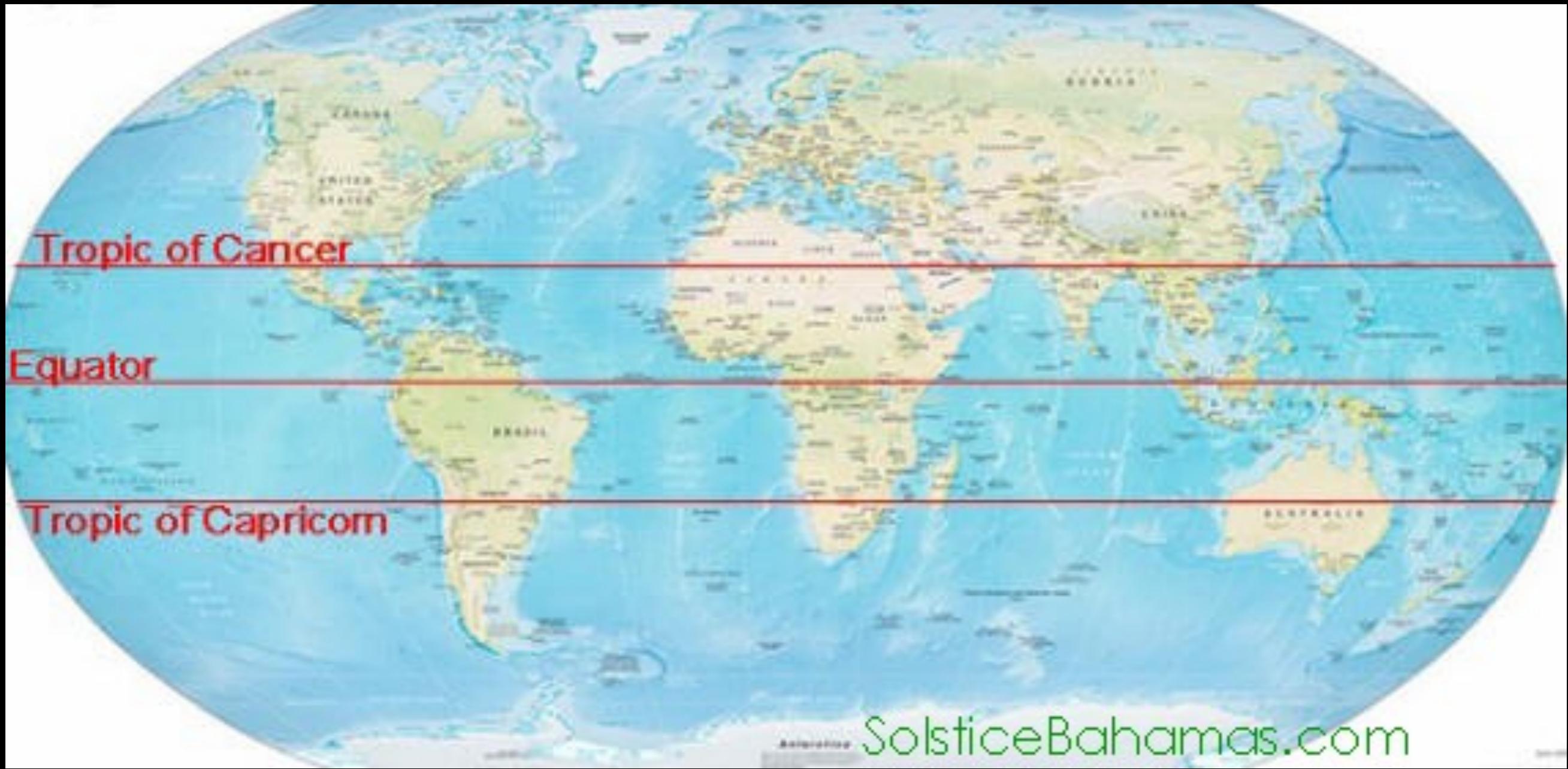
The Sun rises/sets DUE east/west only on the equinoxes!

# Unique places on the Earth - the Circles



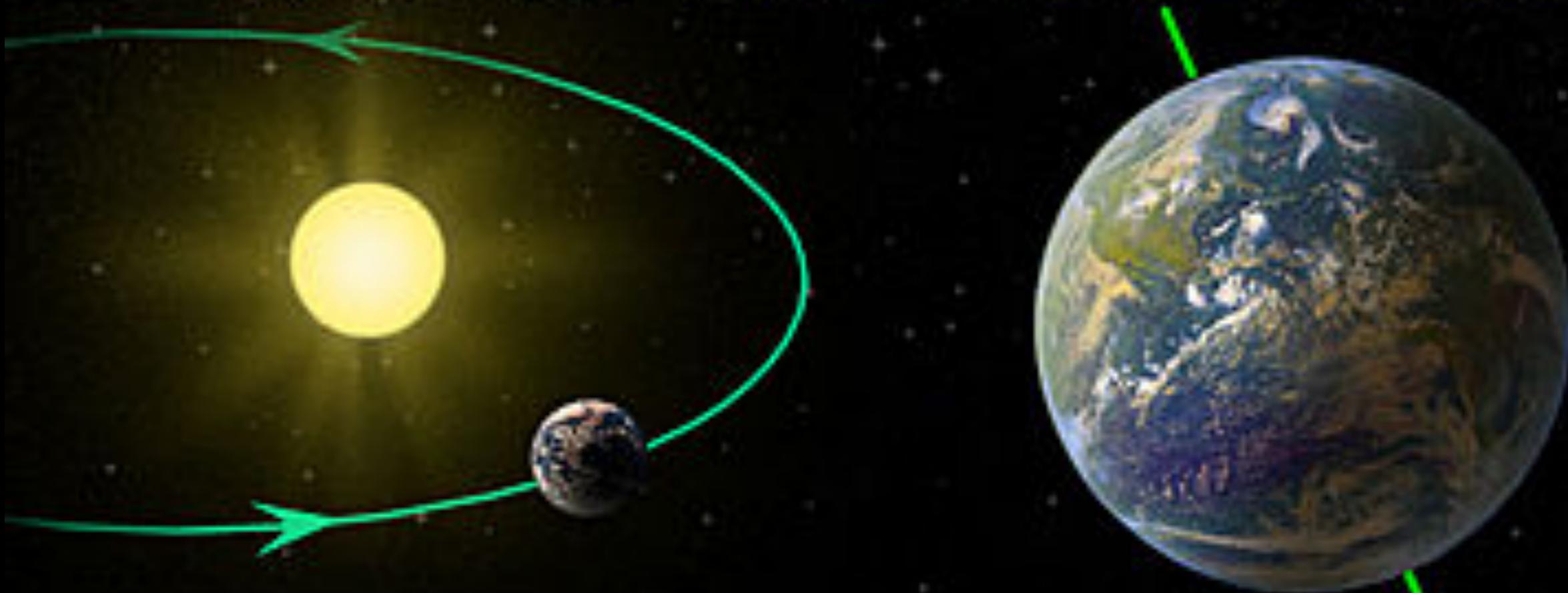
- The latitudes of 66.5 degrees N and S are called the **Arctic and Antarctic circles**
- They are unique because above this latitude the Sun is either visible or not visible for AT LEAST 24 hours straight

# Unique places on the Earth - the Tropics



- The latitudes of 23.5 degrees N and S are called the **Tropics of Cancer and Capricorn**
- They are unique because between these two latitudes the Sun may pass through the zenith at least once a year (on the summer solstice)

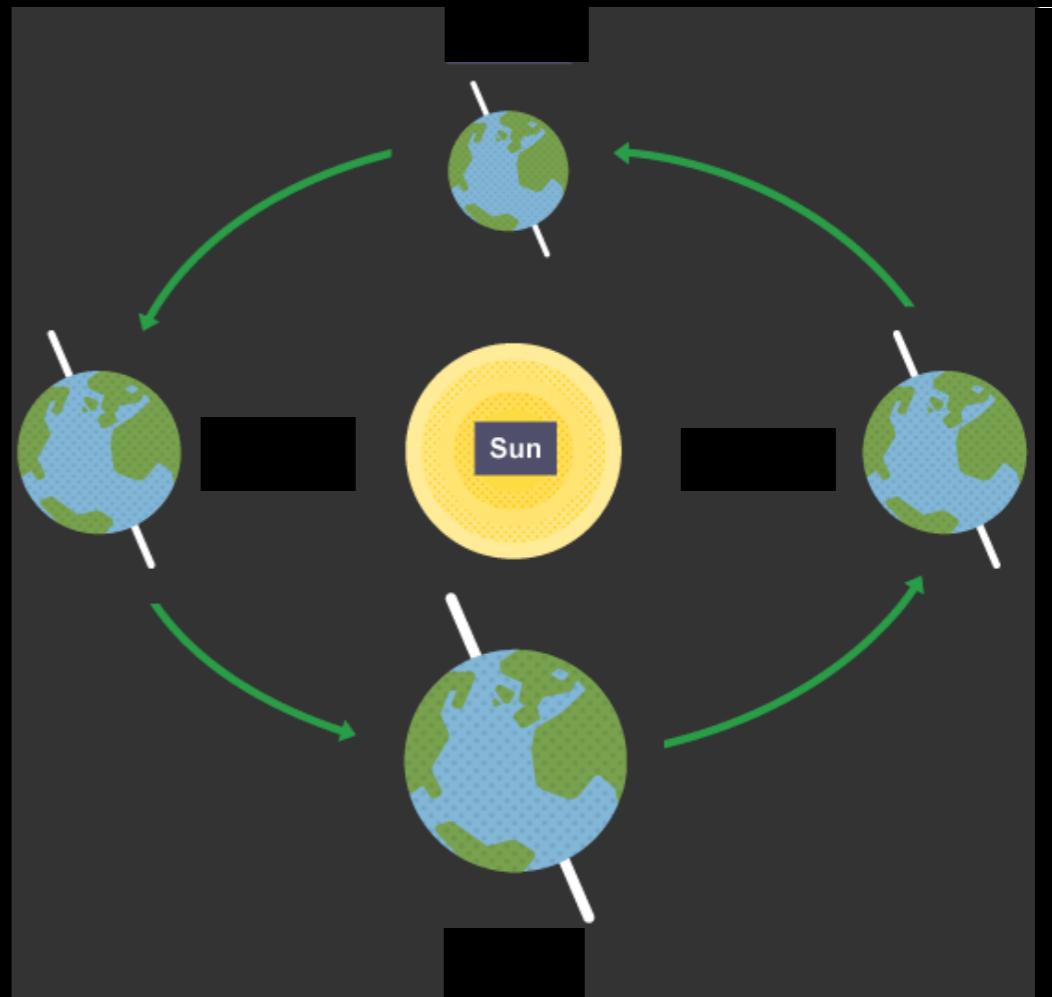
# SEASONS ARE CAUSED BY...

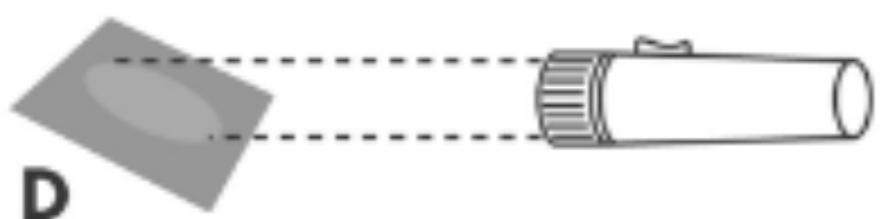
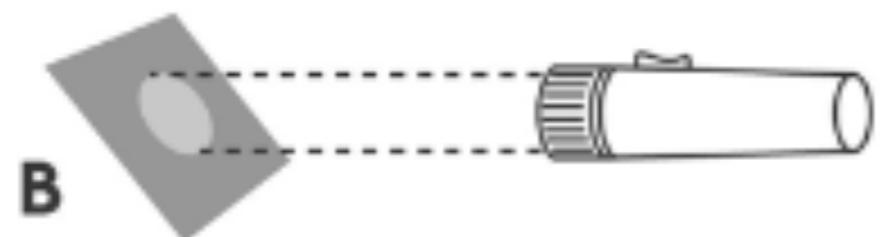
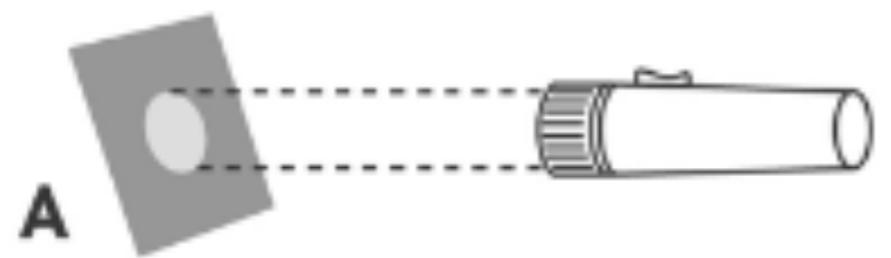


EARTH'S ORBIT  
AROUND THE SUN + EARTH'S  
AXIAL TILT

And now for some exercises...

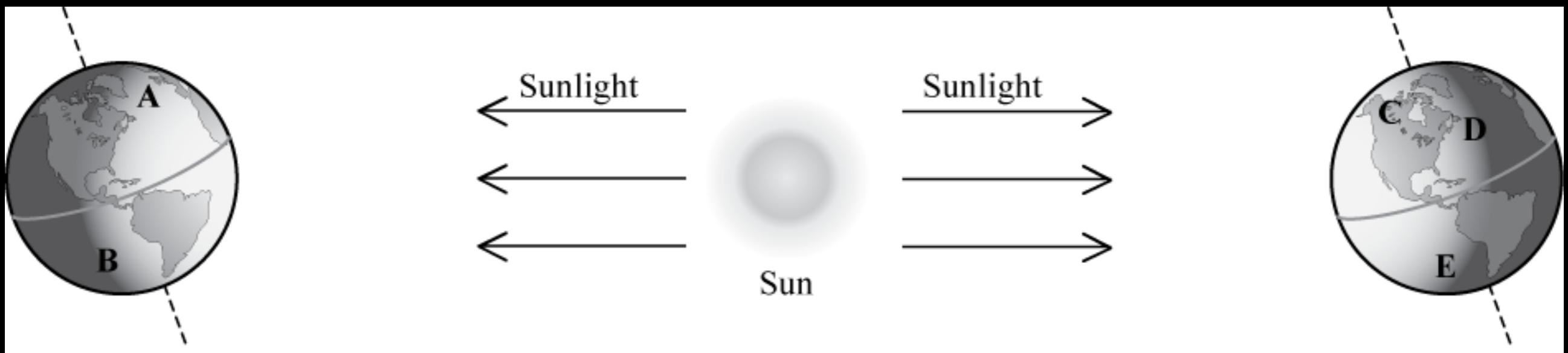
1. Is the direction of the Earth's axis tilted changing as Earth orbits the sun?
2. Are the seasons the same in the Northern and Southern hemispheres at the same time? What do the temperatures do in the Northern vs. Southern hemisphere?





1. Which of the illuminated areas is brightest?
2. Which of lightest areas is smallest?
3. Which of the areas receives the most direct light?
4. If a thermometer were placed in each lighted areas, which one would show the highest temperature?

Which lettered position (a-e), in the image below, best represents the location on Earth that is experiencing winter in the Northern hemisphere? What about winter in the Southern hemisphere?



Note: this drawing is not to scale. In fact you could fit more than 11,000 Earths between the Sun and Earth.

During which season (summer or winter) is the number of daylight hours the greatest?

During which season (summer or winter) is the Sun highest in the sky at noon?

How are your answers to the previous two questions related to the time of year that your location experiences the highest average temperature?

If Earth were tilted more ( $60^{\circ}$  rather than  $23.5^{\circ}$ ), then during winter at your location you would:

- A) experience cooler temperatures.
- B) experience warmer temperatures.
- C) not experience any significant change in temperature.

If Earth were upright with no tilt, would the temperature at your location in July be colder, warmer or the same as it is in December?

- A) cooler
- B) warmer
- C) the same