World Climate Patterns

Unit 2

Distinguish between the terms revolution & rotation.

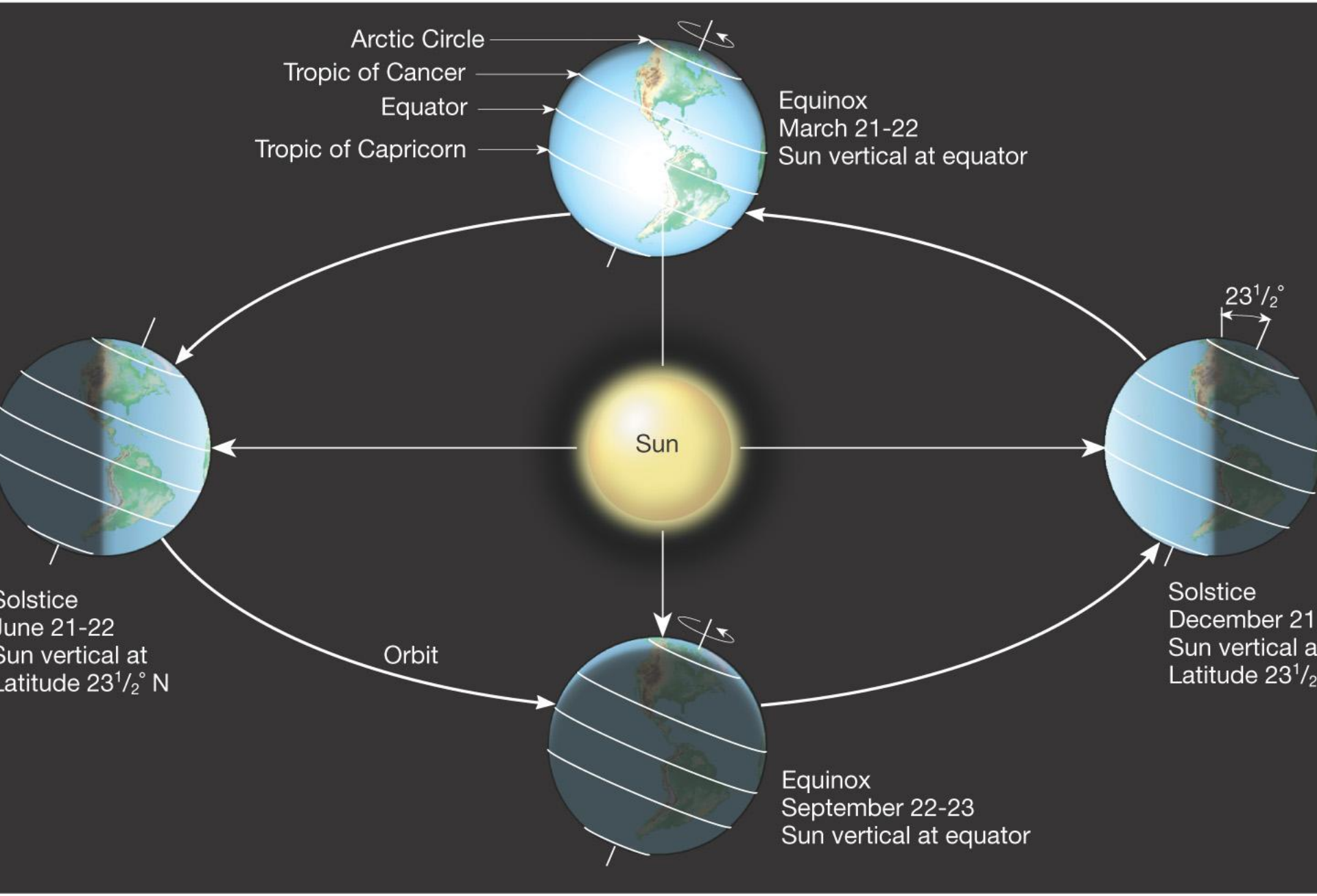
- The earth **rotates (spins)** on its axis
- One rotation takes **24 hours** and results in **day and night**.
- The earth **revolves (orbits) around** the sun
- One revolution takes **365 days** and results in **seasons**.

Day – Exposed to the sun

Night – Away from the sun

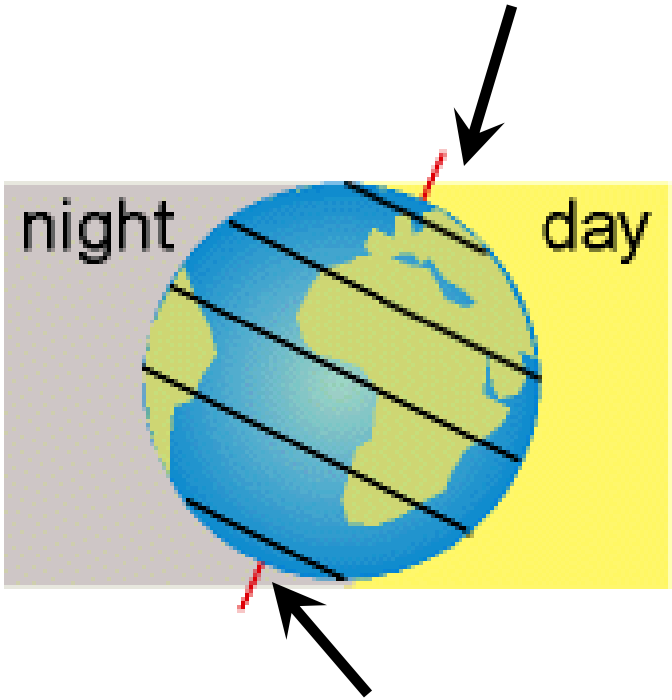
Tilt of the Earth

- The earth is tilted on its axis @ 23.5°
- At different times of the year, one *hemisphere* is pointed towards the sun, while the other one is pointed away from the sun.
- Causes days to be longer or shorter.
- This helps the seasons happen as well.

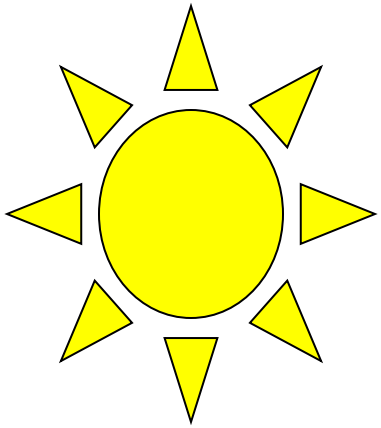

Arctic Circle
Tropic of Cancer
Equator
Tropic of Capricorn
Equinox
March 21-22
Sun vertical at equator
23 1/2°
Sun
Solstice
June 21-22
Sun vertical at
Latitude 23 1/2° N
Orbit
Solstice
December 21
Sun vertical a
Latitude 23 1/2
Equinox
September 22-23
Sun vertical at equator

Tilt of the Earth…
Example 1: Northern Hemisphere – June

North pole experiences 24 hours of daylight



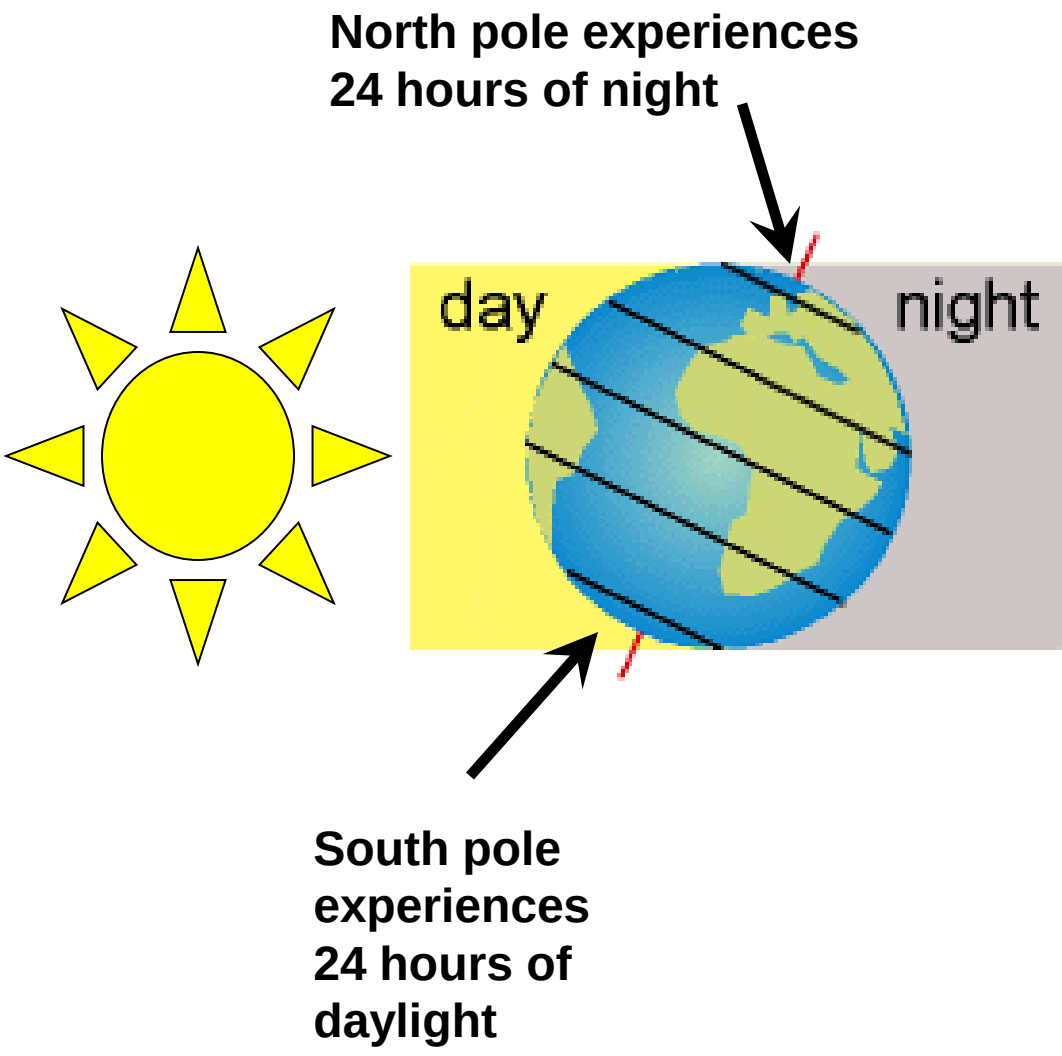
South pole experiences 24 hours of night



- Because of the tilt on the earth's axis, the north pole points towards the sun.
- It now receives more hours of exposure to the sun, hence giving it longer days.
- In NL: Light until 9:30 PM sunrise at 5:30 AM

Tilt of the Earth…
Northern Hemisphere- December

- Because of the tilt on the earth's axis, the north pole points away from the sun.
- It now receives fewer hours of exposure to the sun hence giving it shorter days.
- Here the northern hem. Rotates out of the sun for long periods.
- Dark at 5:30 PM, sunrise at 8:00 AM

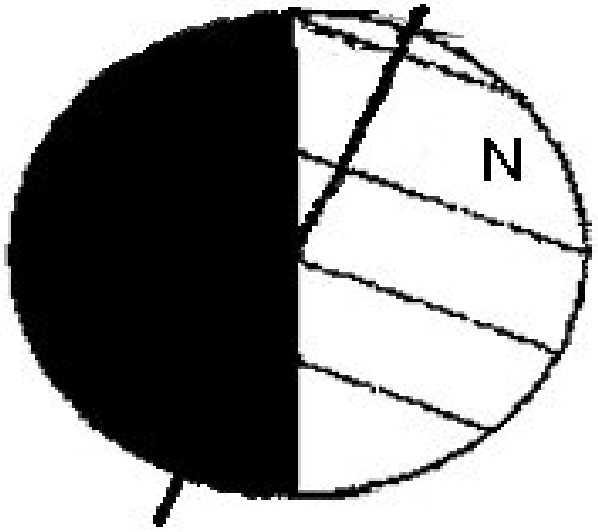


Day vs Night & Length of day

- Rotation on the axis causes day and night
- Tilt on axis causes length of day to be longer or shorter.
- When hemisphere is pointed towards the sun
- More hours of exposure to the sun
- Giving that hemisphere longer days.

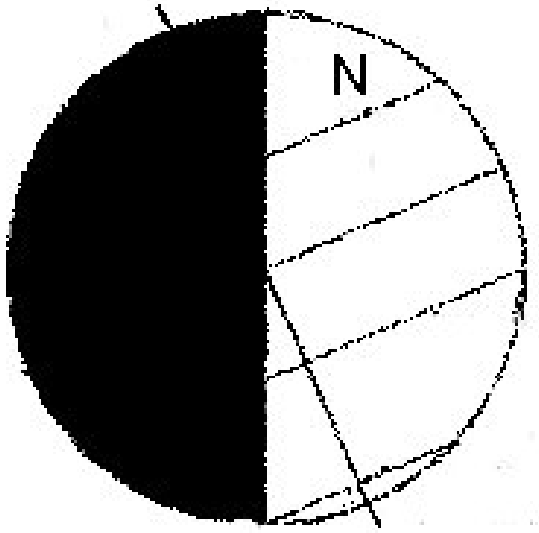
Differences in Day Length

Our Summer



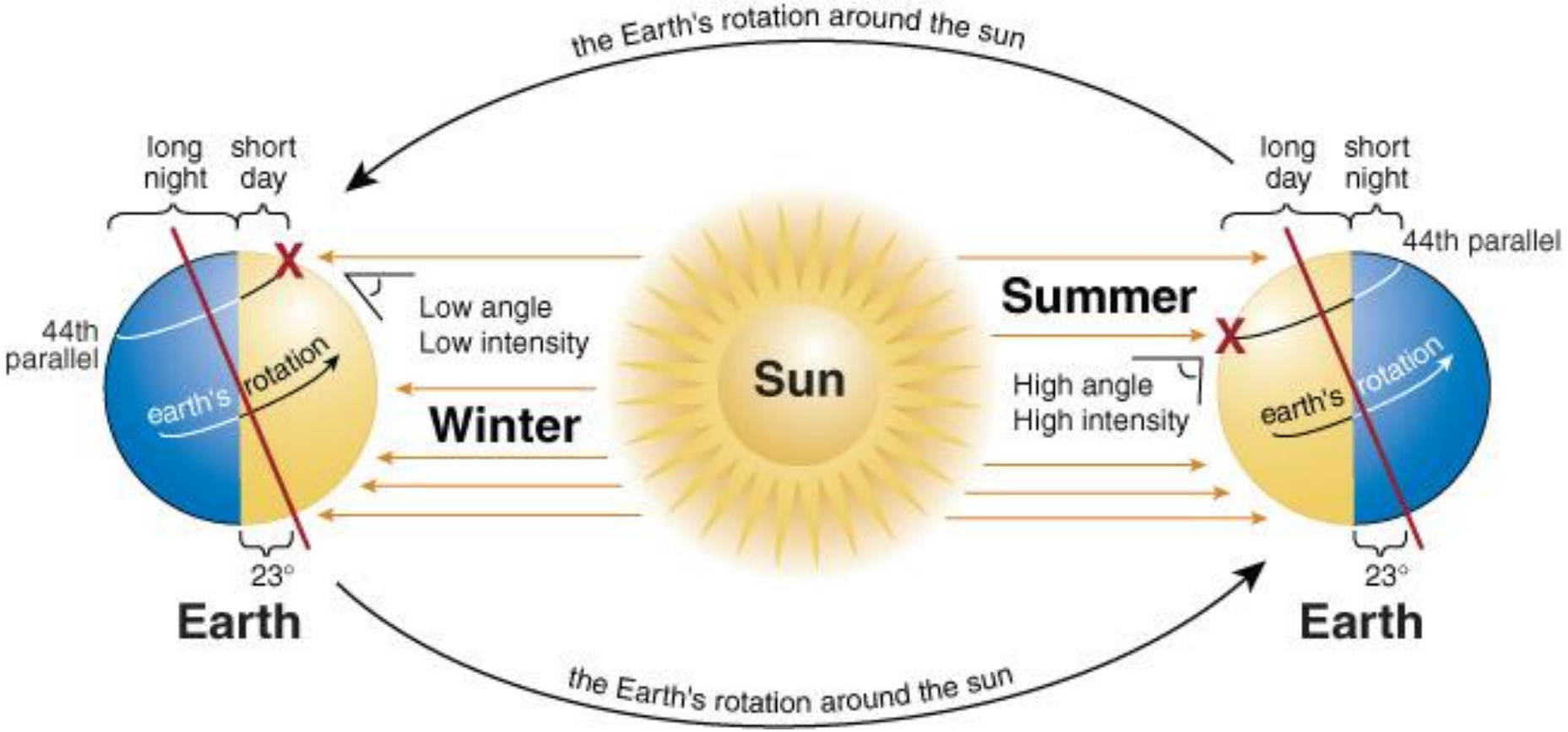
June

Our winter



<-----SUN

December


the Earth's rotation around the sun
long night
short day
long day
short night
44th parallel
44th parallel
Low angle
Low intensity
Summer
Sun
High angle
High intensity
Winter
earth's rotation
earth's rotation
23°
23°
Earth
Earth
the Earth's rotation around the sun

Cloud cover and daily temperature ranges

- **Temperature range** is the difference between the highest and lowest temperatures.
- If you have a cloudy day, the clouds will act like a blanket and keep more heat in the Earth's atmosphere at night. ***The temperature range will be lower***.
- If you have a hot sunny day and a clear night, more heat will escape into space. ***The temperature range will be higher***.

What are the temperature ranges?

Forecast

Sun	Mon	Tue	Wed	Thu	Fri	Sat
27 Oct	28 Oct	29 Oct	30 Oct	31 Oct	1 Nov	2 Nov
						
60%	60%				60%	
	8°C	6°C	5°C	3°C	5°C	10°C
7°C	2°C	0°C	1°C	-3°C	5°C	

2.1- Seasons

- In this lesson you will learn to…
  - 2.1.3 Define the terms equinox and solstice. (k)
  - 2.1.4 Explain how changes in the seasons, in the northern hemisphere and southern hemisphere, relate to the earth's revolution around the sun. (k)
  - 2.1.6 Describe the factors that account for differences in temperature as seasons change. (k)

What is the speed of the Earth's rotation? (Not test material)

- At the equator, the circumference of the Earth is 40,070 kilometers, and the day is 24 hours long so the speed is 1670 kilometers/hour (1070 miles/hr).
- This decreases by the cosine of your latitude so that at a latitude of 45 degrees, cos(45) = .707 and the speed is .707 x 1670 = 1180 kilometers/hr.
- You can use this formula to find the speed of rotation at any latitude.

Orbits (Not test material)

- The Earth travels at an orbital speed of 108,000 km (67,000 miles) an hour around the Sun.
- The Earth has only one satellite, the Moon. The Moon is the second brightest object in the sky.
- The Moon orbits around the Earth at about 1 km/s or about 3700 km/h. The Moon takes about 27.3 days to orbit the Earth.

Explaining Why Seasons Occur

- There are 2 main reasons why we get seasons outside the **tropics** (the latitudes between 23.5˚ North and South):

  1. the tilt on the earth's axis

  2. the revolution of the earth around the sun

Explaining Why Seasons Occur

- Because of tilt and revolution, different places on Earth get different amounts of sunlight at the same time of the year.
- The places that get more direct sunlight get summer instead of winter.

Video resource…

- Equinox and Solstice Explained

Equinox & Solstice

SOLSTICE

- From Latin for "sun stand still".
- Sun is directly overhead at *12 noon on 23.5° North or South*.
- Happens twice a year:

- Dec 21 (Winter)…the shortest day of the year
  - The northern hemisphere pointed AWAY from the sun

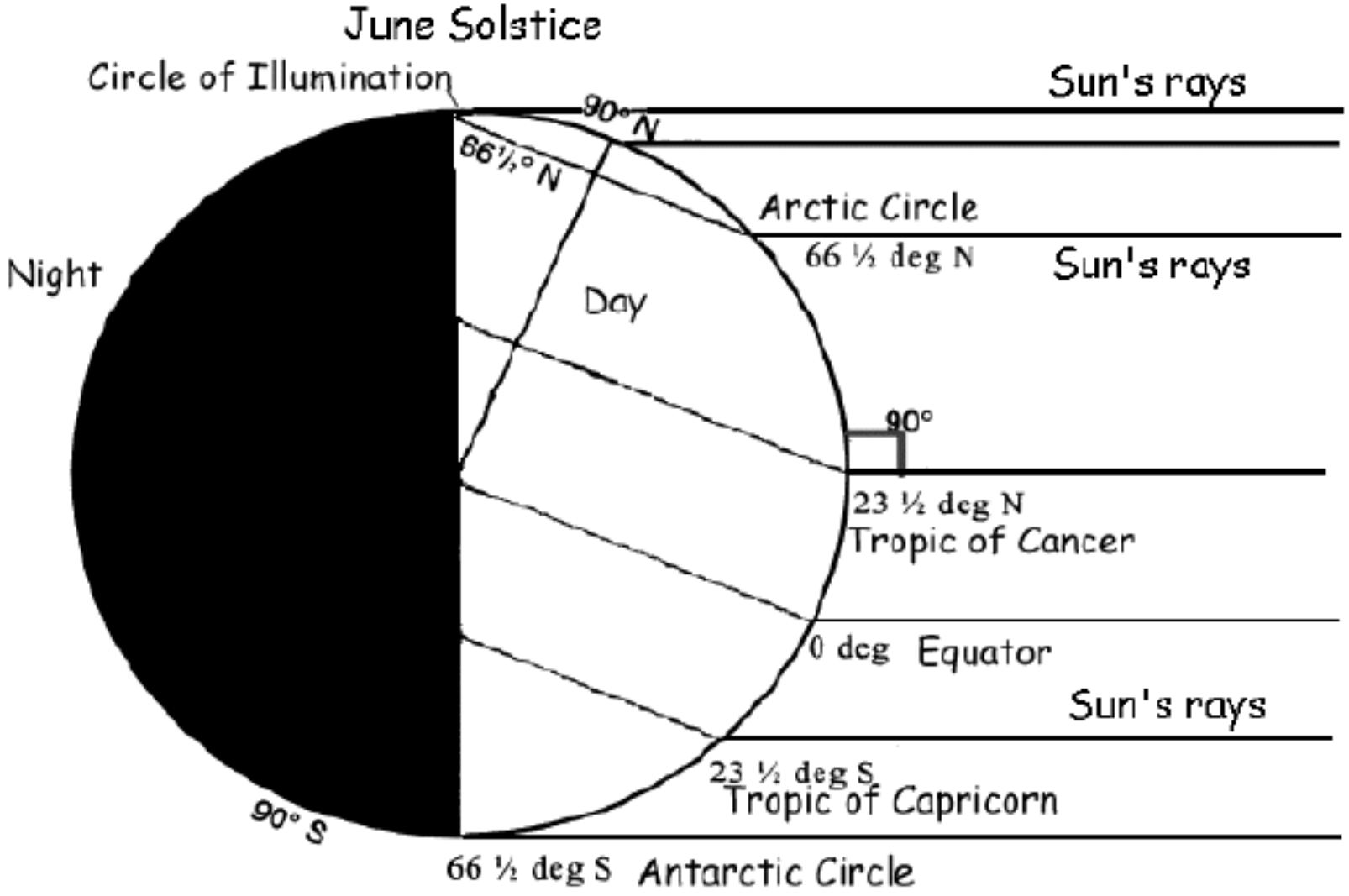
- June 21 (Summer)…the longest day of the year.
  - The northern hemisphere pointed TOWARDS the sun

Equinox & Solstice

EQUINOX

1. From Latin for "equal day & night".
2. Sun is directly overhead at ***12 noon on the equator***.
3. Happens twice a year:

- Sept. 21 (Fall Equinox)
- March 21(Spring Equinox)
- 12 hours of daylight, 12 hours of night.


June Solstice
Circle of Illumination
Sun's rays
90° N
66½° N
Arctic Circle
66 ½ deg N
Sun's rays
Night
Day
90°
23 ½ deg N
Tropic of Cancer
0 deg Equator
Sun's rays
23 ½ deg S
Tropic of Capricorn
90° S
66 ½ deg S Antarctic Circle

Reversal of Seasons by Hemisphere

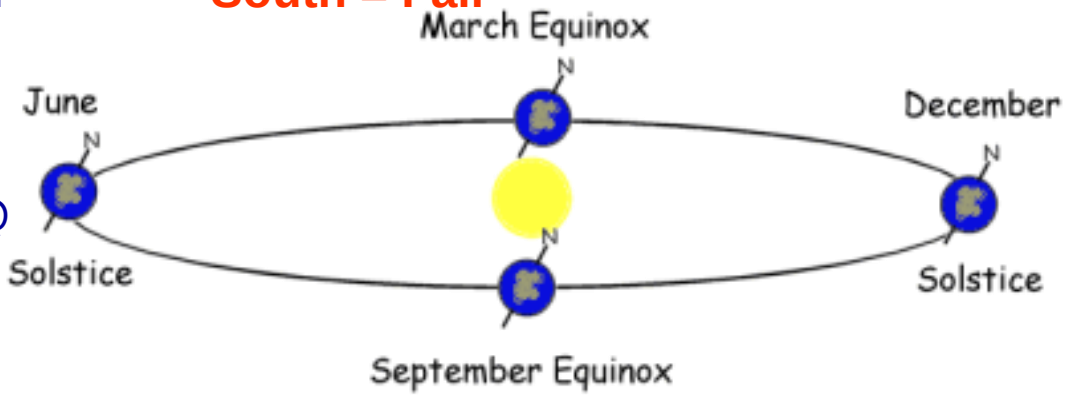
- The Northern Hemisphere and the Southern Hemisphere have opposite seasons.

- Canada's winter = Australia's Summer
- Canada's summer = Australia's Winter
- Canada's Fall = Australia's Spring
- Canada's Spring = Australia's Fall

Seasons Summary

- June 21st
- North = Summer
- More sun hours
- More direct sun
- Noon Sun 90^0 @ Tropic of Cancer
- South = Winter
- Less sun hours
- Less direct sun

- North = Spring
- 12 hrs day & 12 hrs night
- Noon Sun 90^0 @ Equator
- South = Fall



- September 21st
- North = Fall
- 12 hrs day & 12 hrs night
- Noon Sun 90^0 @ Equator
- South = Spring

- Dec 21st
- North = Winter
- Less sun hours
- Less direct sun
- South = Summer
- More sun hours
- More direct sun
- Noon Sun 90^0 @ Tropic of Capricorn

Tropics and Poles- Heat Intensity

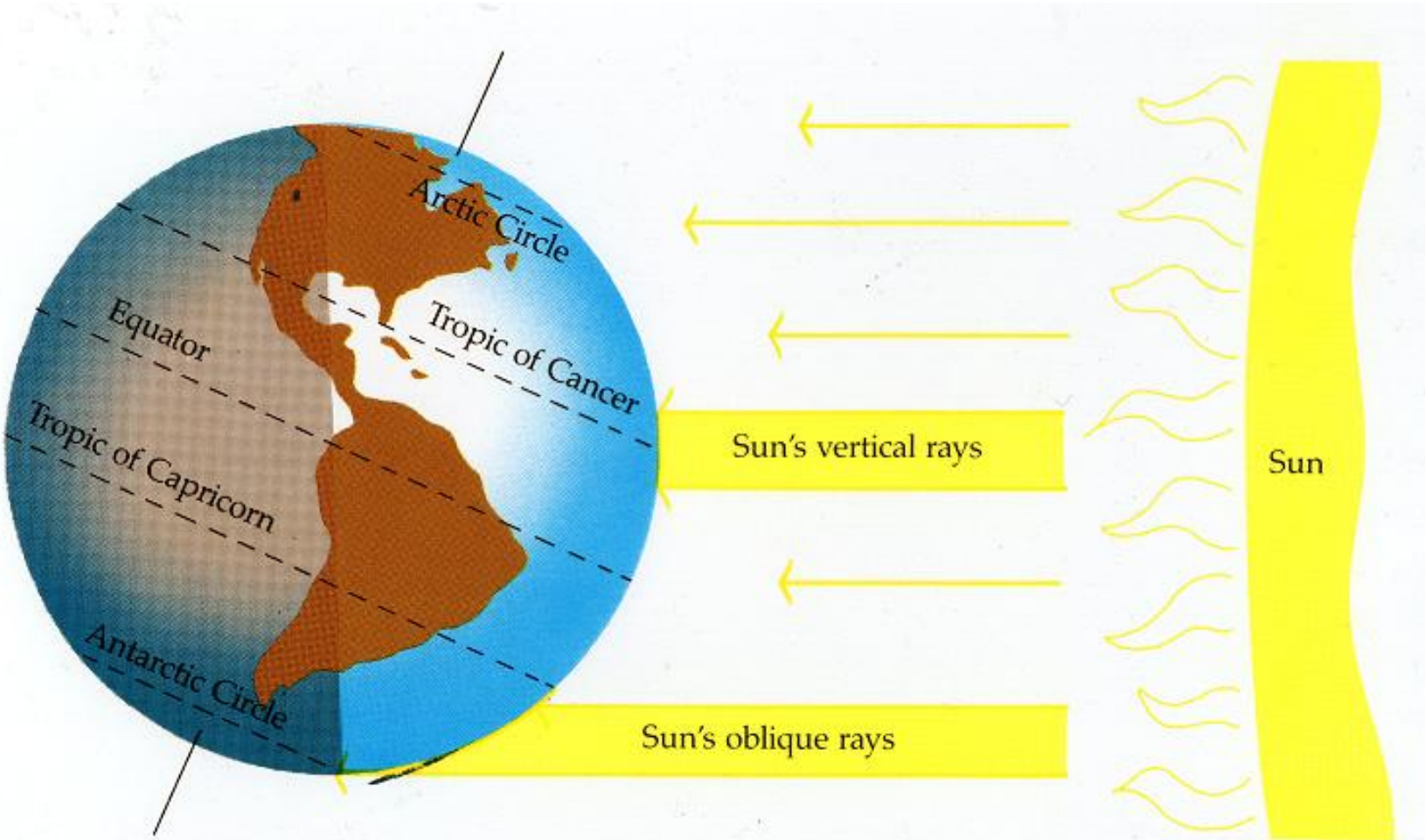
•The **tropics** are located between 23.5˚north (Tropic of Cancer) and 23.5 ˚south (Tropic of Capricorn).

•These areas get the most direct sunlight during the year and don't see much change in the seasons.

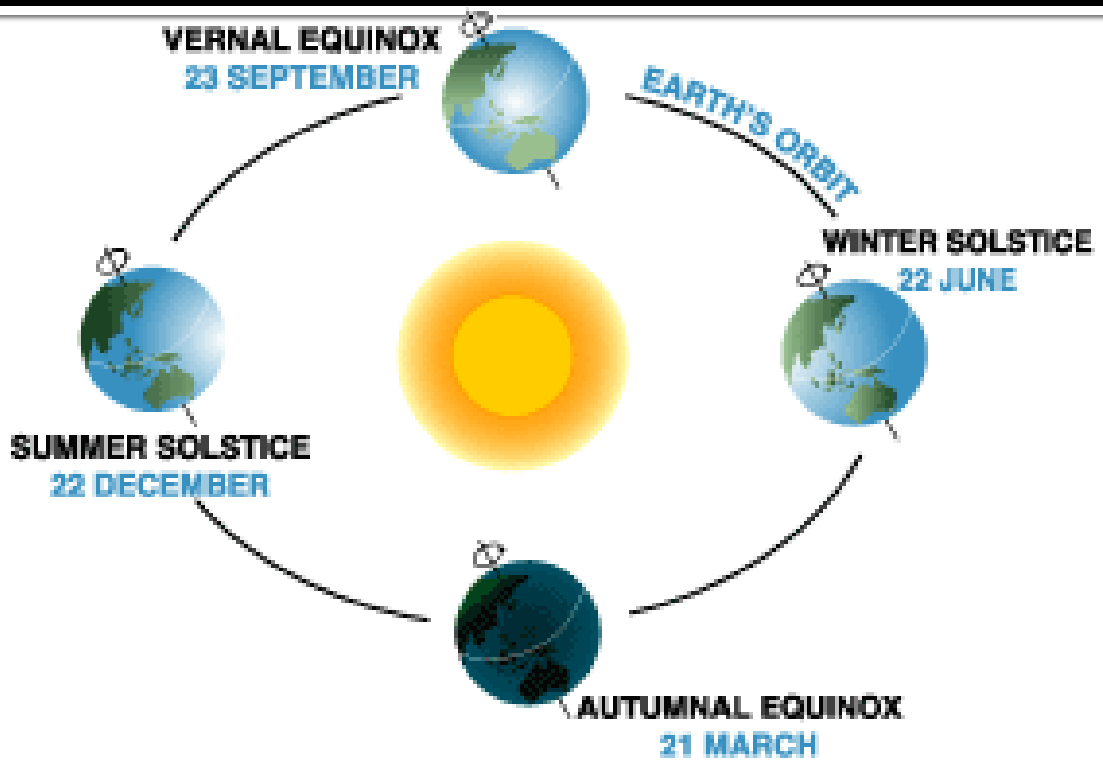
•But as you move away from the tropics, the strength of the sun becomes weaker.

•The rays have to travel further and hit the earth at a different angle than at the equator. The closer to the poles you live, the more you are affected.

Intensity and Duration!!



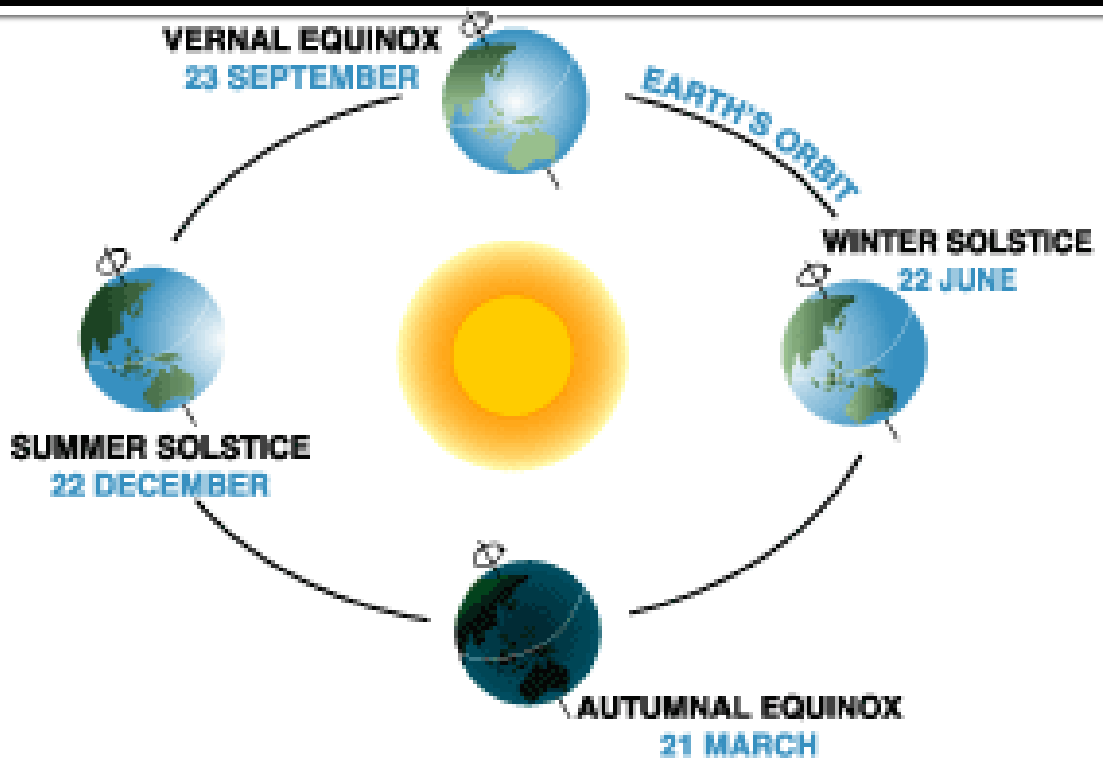
Where are these seasons experienced?



Northern Hemisphere or Southern Hemisphere?

How do you know?

Where are these seasons experienced?



S o u t h e r n

Northern Hemisphere or Southern Hemisphere?

How do you know?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STOP
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Temperature Patterns on Earth

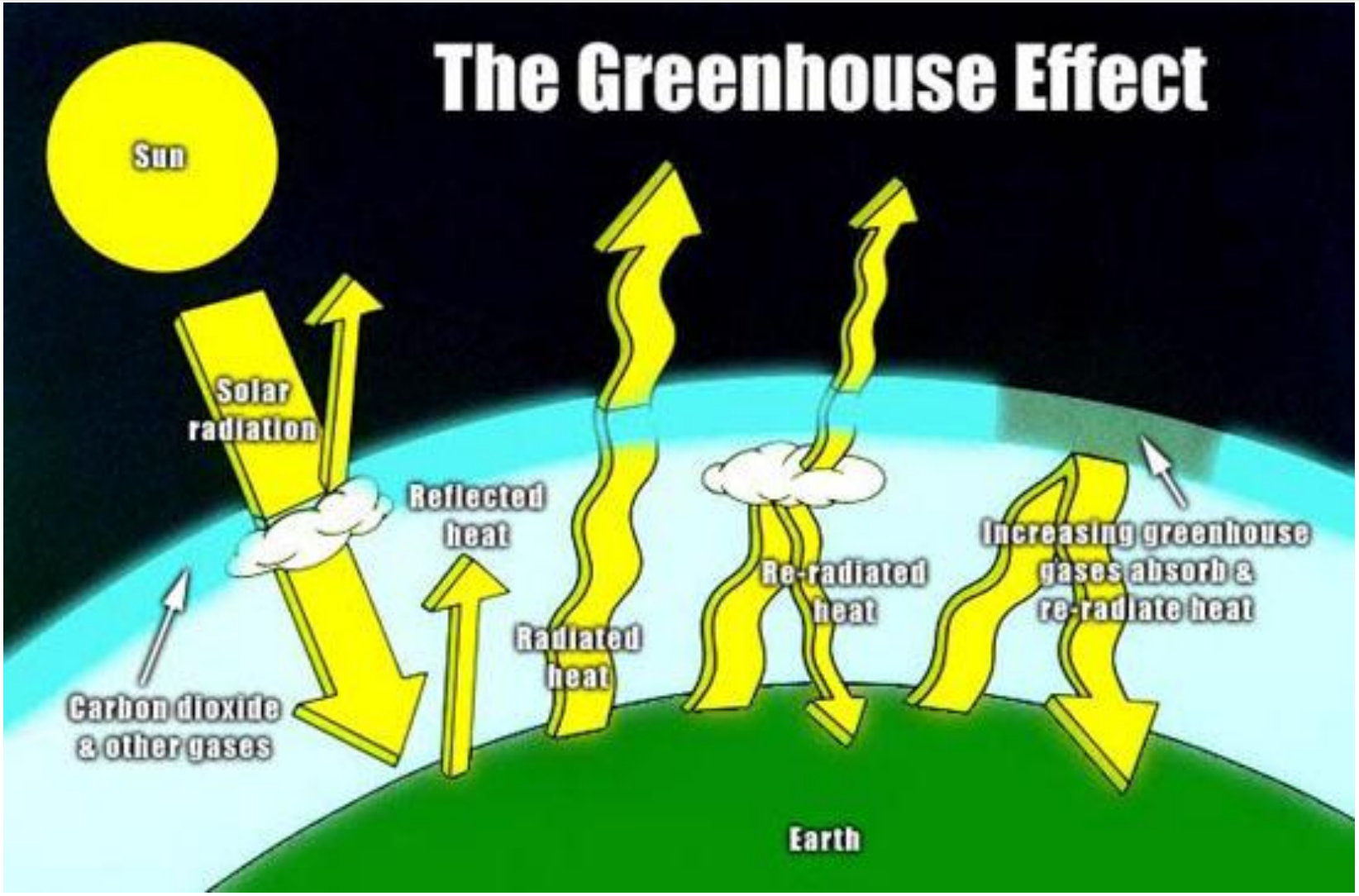
- In this lesson you will learn to…
  - 2.2.1 Explain how the greenhouse effect moderates climate. (k)
  - 2.2.2 Generalize that temperatures tend to decrease from low to high latitudes. (a)
  - 2.2.4 Given selected data, assess the accuracy of temperature descriptions. (i)

Explaining Temperature Patterns

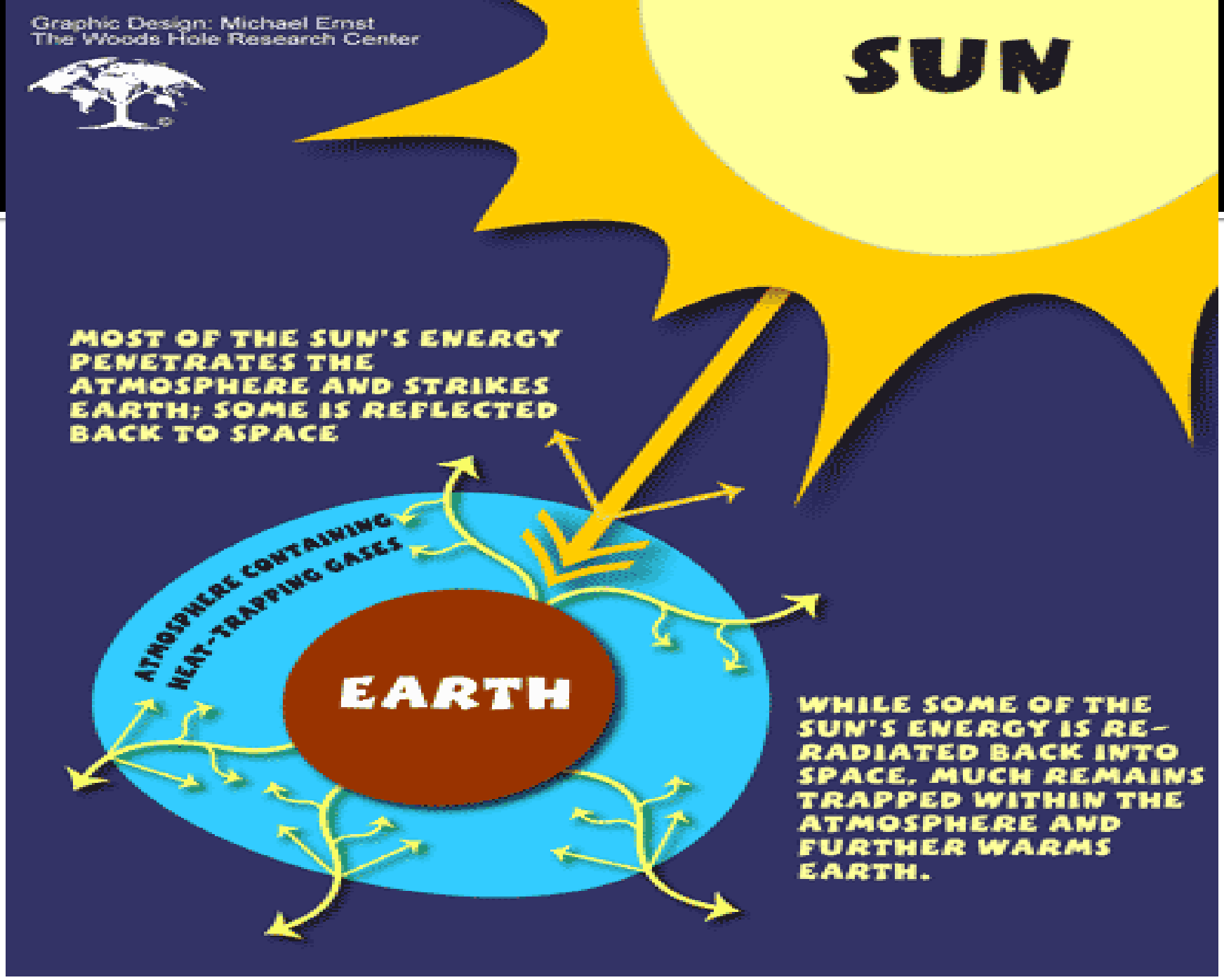
- The **greenhouse effect** is a good thing. It moderates our temperature. (It is not "Global Warming".)
- Planets without atmospheres (gases above the surface) have large differences between day and night temperatures.
- During the day, planets without an atmosphere get the full power of the sun making it very hot.
- At night planets without atmospheres have nothing to hold heat in, so it gets very cold.

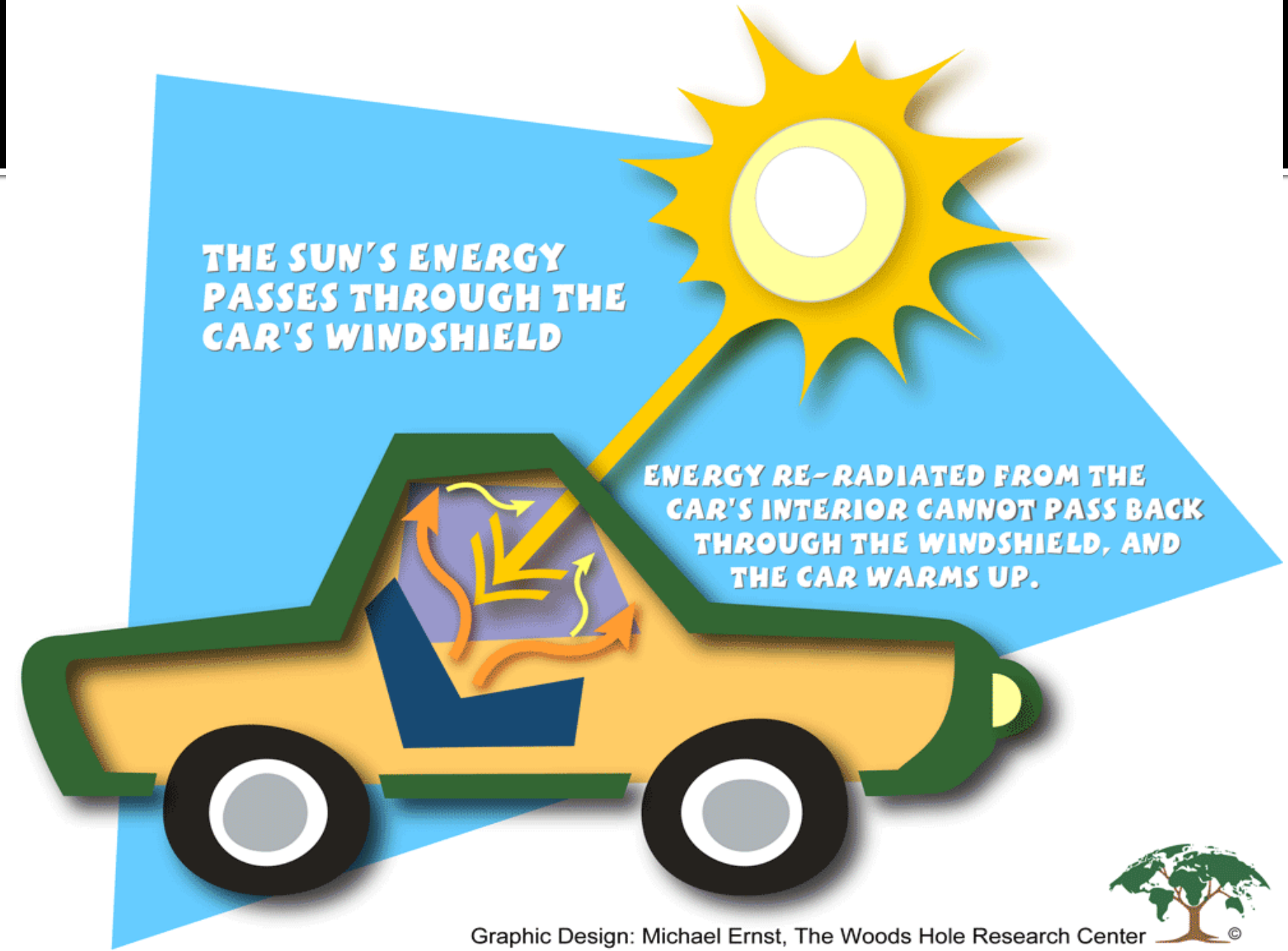
Greenhouse Effect

- Here on earth the atmosphere reflects and absorbs almost 50% of radiant energy.
- The atmosphere acts like the glass on a greenhouse keeping in much of the heat. So here on earth the nights are not as cold.


The Greenhouse Effect
Sun
Solar radiation
Reflected heat
Radiated heat
Re-radiated heat
Increasing greenhouse gases absorb & re-radiate heat
Carbon dioxide & other gases
Earth

- Earth has an average surface temperature of **13 degrees C**.
- The planet would be much colder without greenhouse gasses, such as carbon dioxide and water vapor, to trap outgoing thermal radiation.
- The greenhouse effect raises the planet's temperature **35 degrees C**.


Graphic Design: Michael Ernst
The Woods Hole Research Center
SUN
MOST OF THE SUN'S ENERGY PENETRATES THE ATMOSPHERE AND STRIKES EARTH; SOME IS REFLECTED BACK TO SPACE
ATMOSPHERE CONTAINING HEAT-TRAPPING GASES
EARTH
WHILE SOME OF THE SUN'S ENERGY IS RE-RADIATED BACK INTO SPACE, MUCH REMAINS TRAPPED WITHIN THE ATMOSPHERE AND FURTHER WARMS EARTH.


THE SUN'S ENERGY PASSES THROUGH THE CAR'S WINDSHIELD
ENERGY RE-RADIATED FROM THE CAR'S INTERIOR CANNOT PASS BACK THROUGH THE WINDSHIELD, AND THE CAR WARMS UP.
Graphic Design: Michael Ernst, The Woods Hole Research Center ©

Altitude/Latitude & Temperature

- Living in the North we realize that the closer we get to the equator the warmer it gets.
- As **latitude** increases, temperature decreases.
- Increased latitude exhibits decreased temperature.
- As **altitude** increases, temperature decreases.
- Increased altitude exhibits decreased temperature.

- See Figure 4.7 on page 60