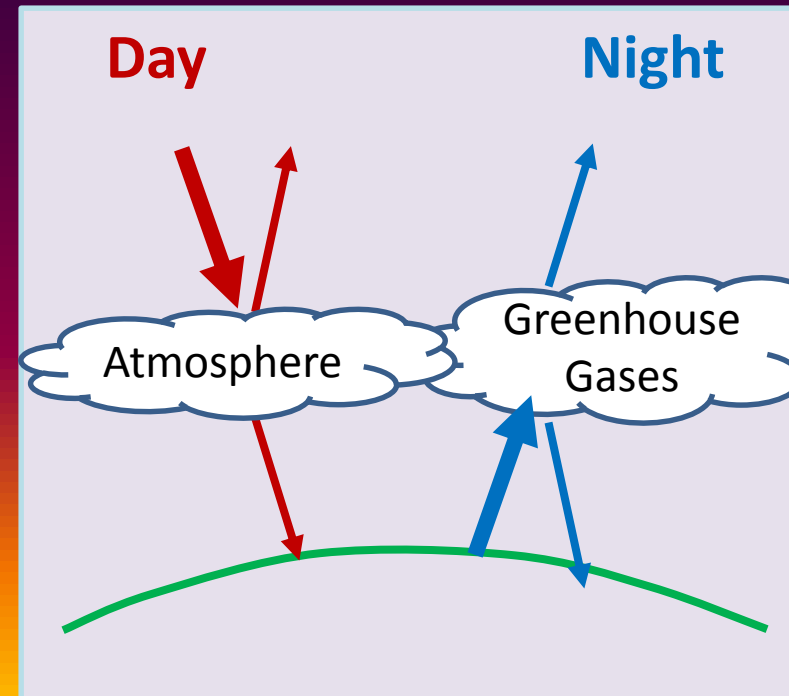


NATURAL CLIMATE CHANGE

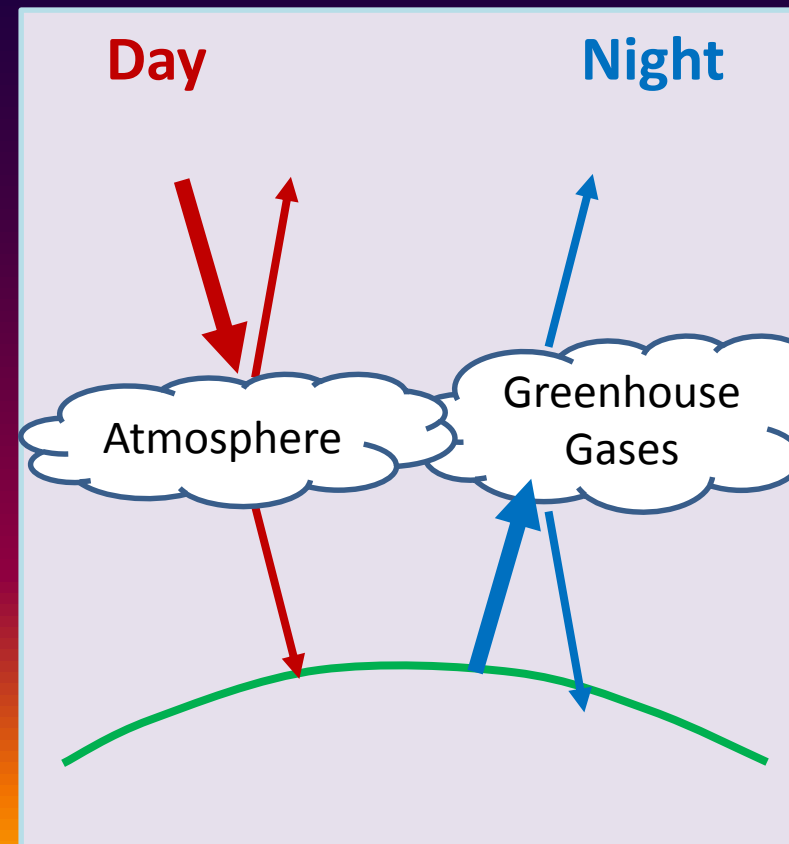
GLOBAL TEMPERATURES: A DELICATE BALANCE

- Earth is the “Goldilocks Planet”—not too hot or too cold.
- There is a balance between ...
 - Incoming heat (Daytime)
 - Atmosphere blocks most solar radiation = warmth without burning



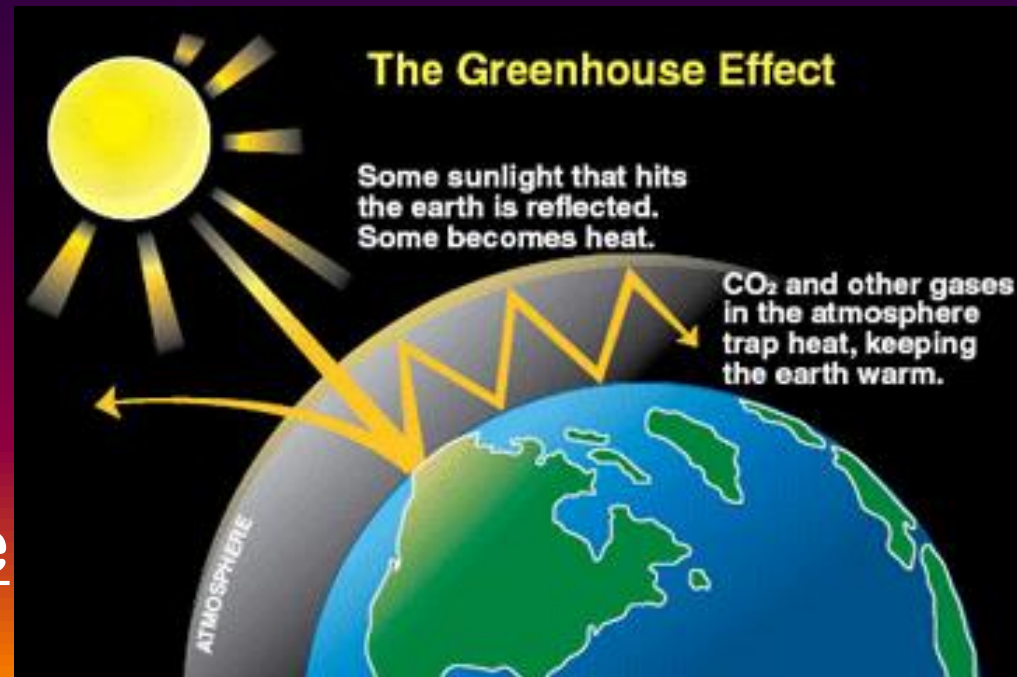
GLOBAL TEMPERATURES: A DELICATE BALANCE

- There is a balance between . . .
 - Outgoing heat (Nighttime)
 - Greenhouse effect
prevents too much
heat loss
= cooling without
freezing



GREENHOUSE EFFECT

- At night, infrared radiation is trapped on the planet by greenhouse gases & other particles:
 - Water vapor
 - Carbon Dioxide
 - Smoke, dust, ash
- This is a natural process and necessary for life on this planet!!!



ATMOSPHERIC GASES

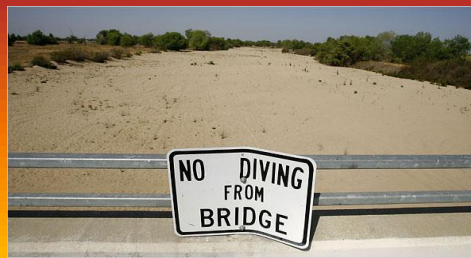
GAS	% Abundance
Nitrogen	75-78%
Oxygen	21-23%
Argon	1%
<u>Water Vapor</u>	<u>0.3%</u>
<u>CO₂</u>	<u>0.06%</u>

Key
Greenhouse
Gases

CLIMATE: VARIATIONS VS. CHANGE

Variations

- Single, abnormal event
- Always short-term (very!)
- Examples:
 - Droughts: period of below-normal rainfall
 - Heat Waves: period of above-normal temperatures
 - Cold Wave: period of below-normal temperatures



Change

- Can be short-term or long-term
- Examples:
 - Seasons (short-term)
 - El Nino (short-term)
 - La Nina (short-term)
 - Ice Age (long-term)



CAUSES OF NATURAL CHANGE

4 Short-Term

(Weeks-Months)

- Volcanic eruptions
- Forest Fires
- Seasons (Earth's tilt)
- El Nino / La Nina

4 Long-term

(Years +)

- Solar radiation
- Continental drift
- Earth's tilt
- Earth's orbit

CAUSE: VOLCANIC ERUPTIONS



WHAT HAPPENS:

- Eruptions increase
greenhouse gases & particles*

EFFECT:

- Increased temperatures (big particles
low in atmosphere trap more heat)

OR

- Decreased temperatures (small
particles high in atmosphere block
incoming solar energy)

*Water vapor, carbon dioxide, ash

CAUSE: FOREST FIRES

WHAT HAPPENS:

- Fires increase greenhouse gases & particles*

EFFECT:

- Increased temperatures (particles trap heat at surface & more heat sent into atmosphere)

*Water vapor, carbon dioxide, ash



CAUSE: SEASONS (1)

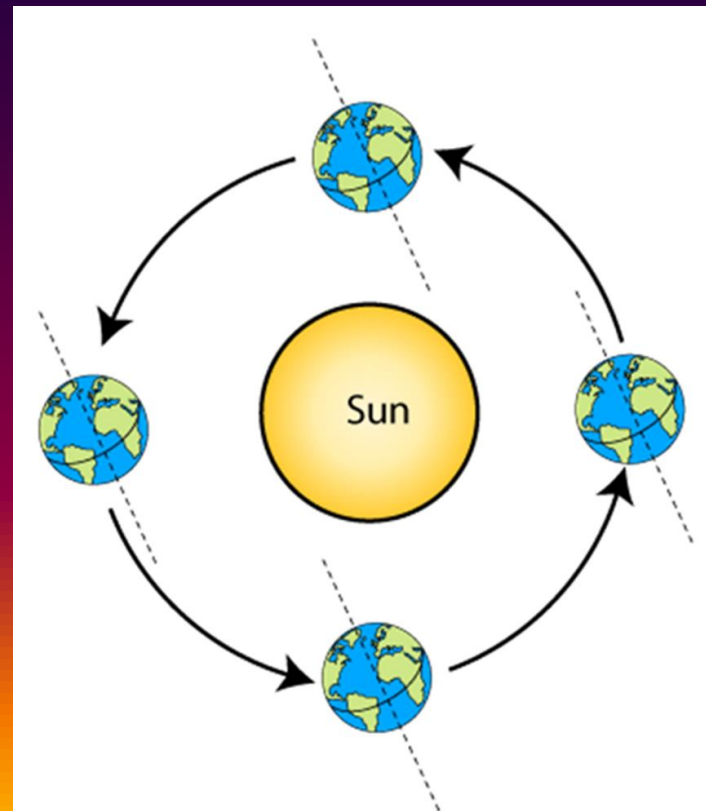
- During its orbit, the Earth's Northern and Southern Hemispheres alternately tilt toward and away from the sun.

WHAT HAPPENS:

- Tilted towards sun = direct solar radiation

EFFECT:

- Increased temperatures



CAUSE: SEASONS (2)

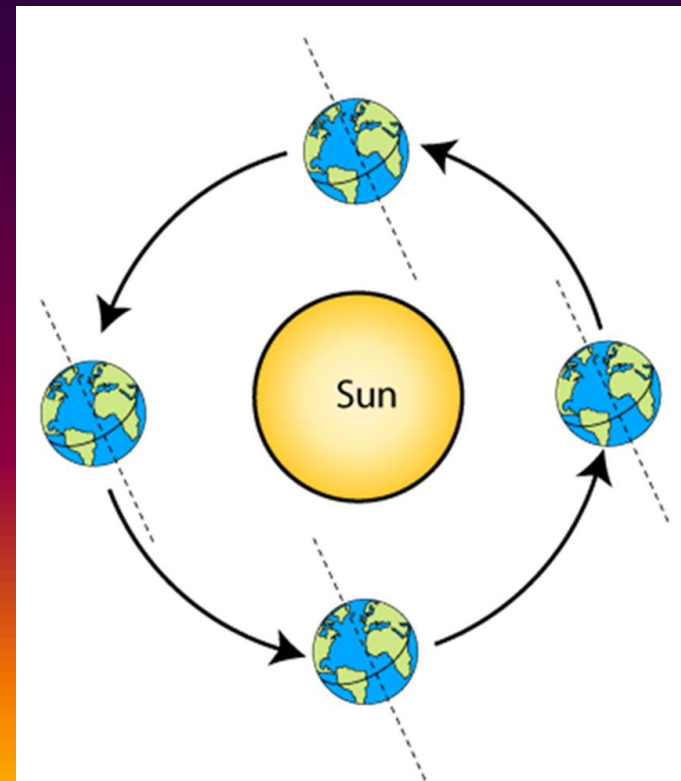
- During its orbit, the Earth's Northern and Southern Hemispheres alternately tilt toward and away from the sun.

WHAT HAPPENS:

- Tilted away from sun = indirect solar radiation

EFFECT

- Decreased temperatures



CAUSE: EL NIÑO & LA NIÑA

- During the video clip, note what happens to the global weather patterns during these phenomena.



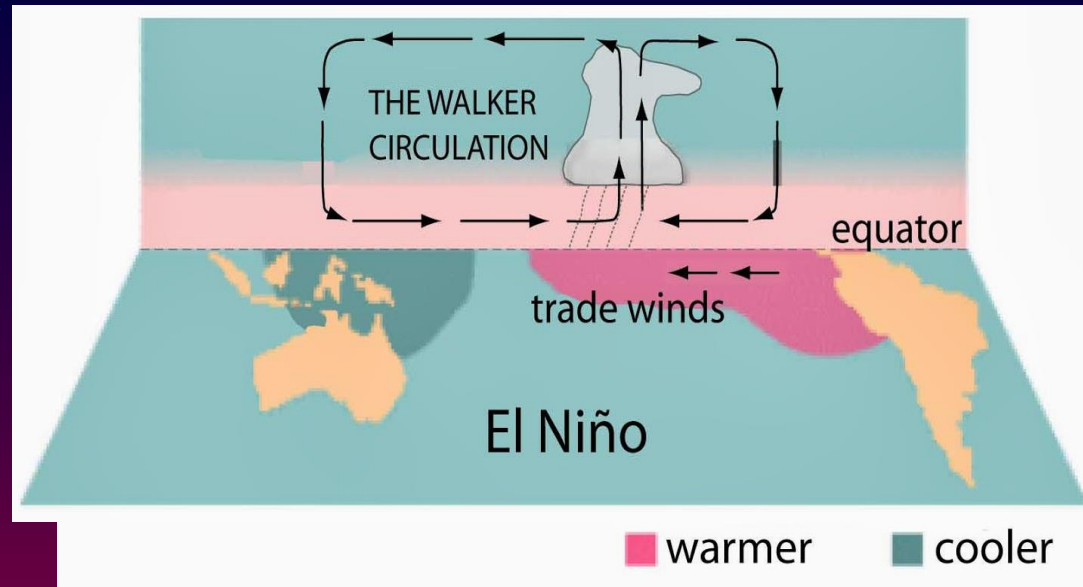
CAUSE: EL NIÑO

WHAT HAPPENS:

- Tradewinds (near equator) weaken

EFFECT:

- Warming of the eastern Pacific Ocean → less upwelling, warmer, wetter winters in northern US



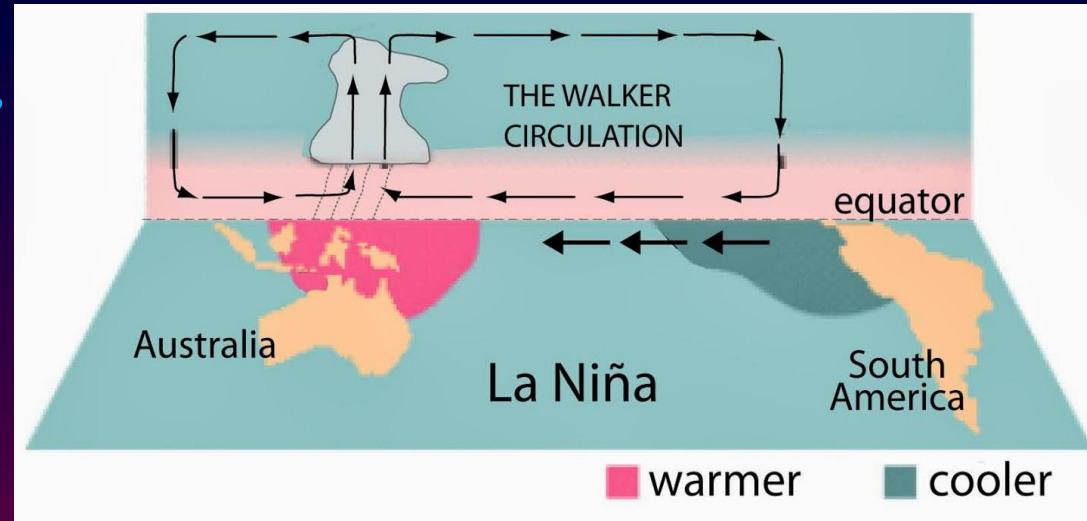
CAUSE: LA NIÑA

WHAT HAPPENS:

- Tradewinds
strengthen

EFFECT:

- Cooling of Pacific Ocean → more upwelling, colder in NW & mid-west US, warmer in rest of US, more hurricanes



CAUSE: SOLAR RADIATION

WHAT HAPPENS:

- Sun's energy production changes year to year
- Periodic solar flares & sun spots release extra solar radiation



EFFECT:

- More heat comes to Earth, is trapped by Greenhouse Effect, and causes warmer global temperatures

CAUSE: LAND VS. OCEAN AREA (1)

WHAT HAPPENS:

- More land area with lower specific heat capacity

EFFECT:

- Small amounts of solar radiation increase temperatures



CAUSE: LAND VS. OCEAN AREA (2)



WHAT HAPPENS:

- More ocean area with higher specific heat capacity

EFFECT:

- More solar energy absorbed without a temperature change → decreased temperatures
- Currently, global land area is decreasing, so the temperatures should be . . .

CAUSE: EARTH'S TILT (1)

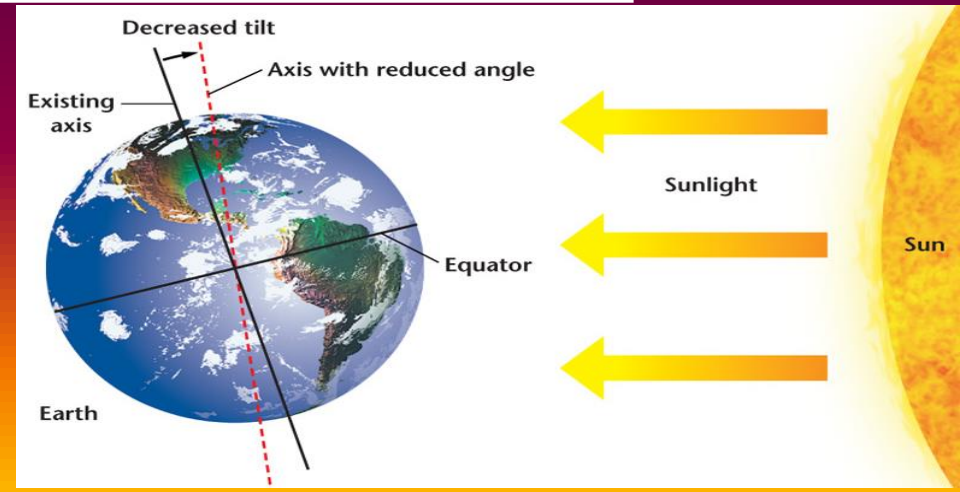
- Tilt of the axis varies from 22.1° to 24.5° every 41,000 years!

WHAT HAPPENS:

- More tilt =
 - Less direct s.r. in winter = colder
 - More direct s.r. in summer = hotter

EFFECT:

- Greater variation in seasons



CAUSE: EARTH'S TILT (1)

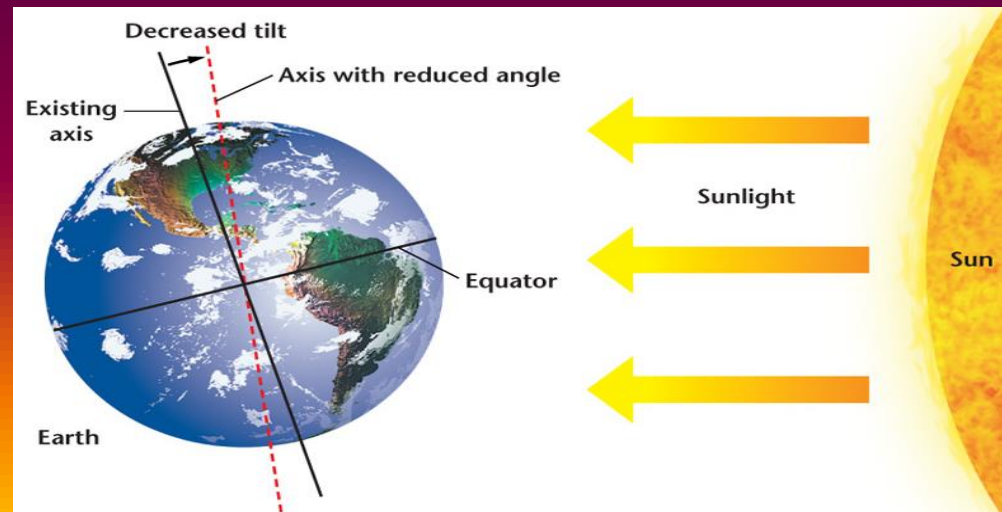
- Tilt of the axis varies from 22.1° to 24.5° every 41,000 years!

WHAT HAPPENS:

- Less tilt = more direct s.r. in winter = hotter
- Less direct s.r. in summer = colder

EFFECT:

- Less variation in seasons



CAUSE: EARTH'S ORBIT (1)

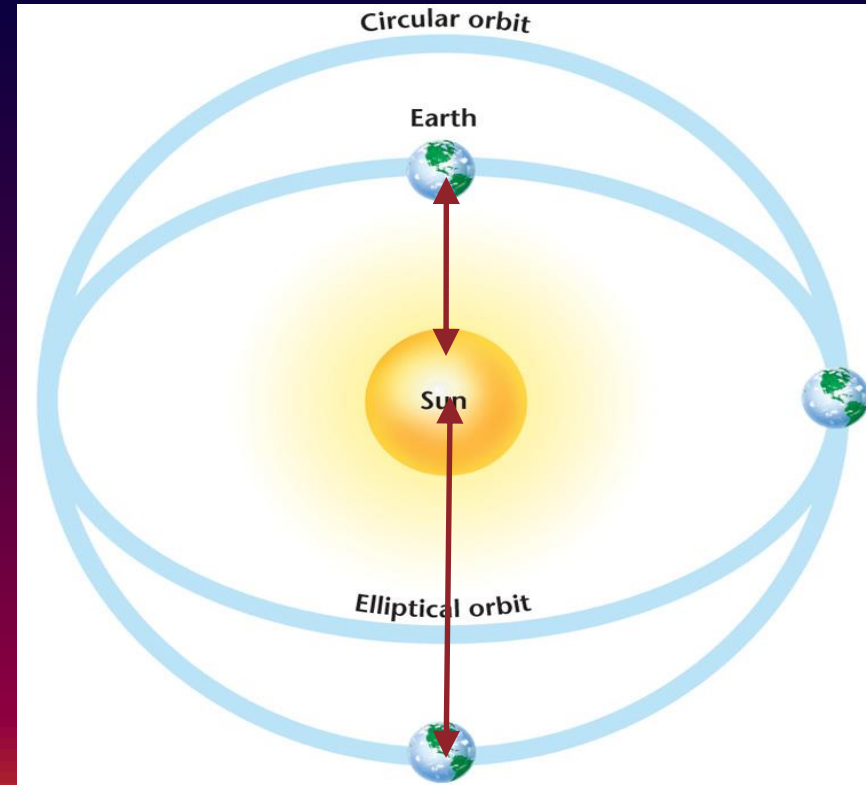
(PATH AROUND THE SUN)

WHAT HAPPENS:

- Elongated/more elliptical orbit = Earth closer to sun

EFFECT:

- More solar radiation = warmer temperatures



CAUSE: EARTH'S ORBIT (2)

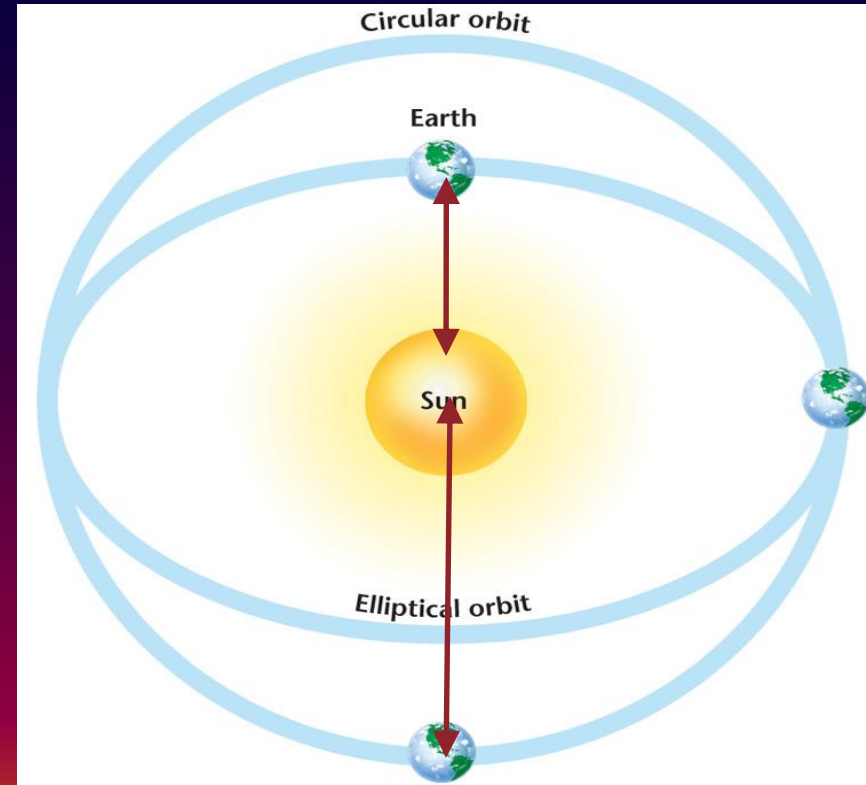
(PATH AROUND THE SUN)

WHAT HAPPENS:

- Circular orbit = Earth further from sun

EFFECT:

- Less solar radiation = colder temperatures



IT'S THE END OF THE WORLD AS WE KNOW IT"

- Reimagine our current planet but with an extreme climate . . .
 - Choose WHAT global climate—very hot or very cold
 - Back: Explain HOW Earth's climate gets to this extreme naturally (include each short-term & long-term cause)
 - Front: Illustrate our revised planet (be sure to include visible causes as well as effects of said climate change)