# U2D3 – ENERGY IN THE ATMOSPHERE

10/29





#### U2D3 – BELL RINGER – 10/30

Textbooks tell us that Earth's tilt causes the change of seasons. But *how* does the tile cause the seasons to change? Put an X next to any of the statements you think can help to explain how the tilt of the Earth causes it to be warmer in the summer than in the winter.

A As the Earth circles the Sun, the direction of the tilt relative to the plane of Earth's orbit gradually changes.

**B** The direction of Earth's axis always stays the same as we circle the Sun.

<u>C</u> When the Northern Hemisphere tilts toward the sun, we are closer to the sun so its warmer.

\_\_\_\_D When the Northern Hemisphere tilts toward the Sun the days are longer, so there is more time for the Earth to warm up.

E When the Northern Hemisphere tilts toward the Sun then the Sun appears higher in the sky viewed from the USA so sunlight is more concentrated and intense.

**\_\_\_\_F** The Earth's tilt causes the Sun to be directly overhead at noon in the summer when viewed from the USA.

\_\_\_\_G As the Earth circles the Sun it changes the angle of tilt during different seasons of the year, which then changes the amount of direct sunlight the earth receives.

#### OBJECTIVES



Content Objective: I can explain how Earth's tilt creates seasons.



Content Objective: I can explain three types of energy and how they affect the atmosphere.



Language Objective: I can discuss opposing ideas.

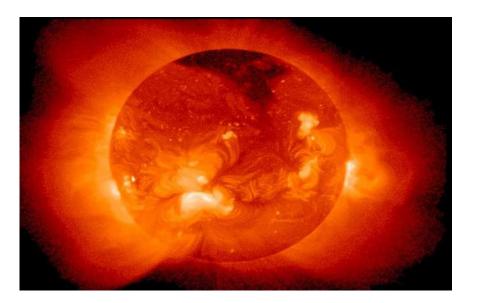


Language Objective: I can cite information from a text.

## THE IONOSPHERE

- <u>The lonosphere</u> is affected by solar events.
- The Sun gives off charged particles called ions. They travel out into space super fast. The cloud or gas of these ions, or charged particles is called a <u>Plasma</u>.
- The stream of plasma coming from the sun is known as <u>solar wind</u>, and the intensity of it depends on storms occurring on the sun, called sunspots.

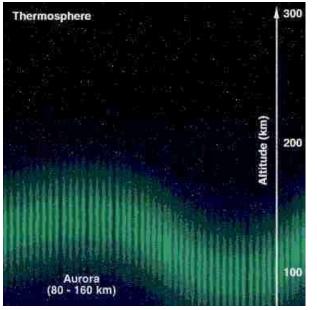




# **The Ionosphere**

- Huge eruptions associated with sunspots send out large amounts of radiation and ionized particles.
- Because the sun's particles are electrically charged, they are deflected by Earth's magnetic field to the North and South poles.
- The ionized particles sometimes interact with air molecules to form <u>auroras</u>, sometimes called "Northern Lights"





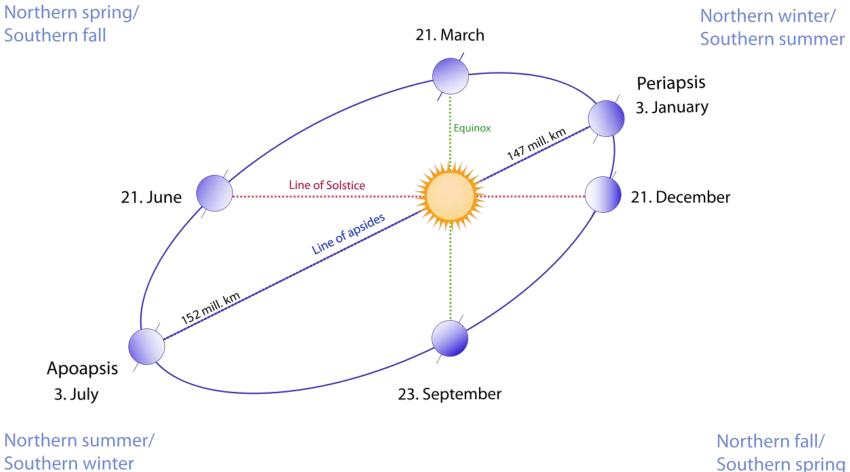
# AURORA BOREALIS "NORTHERN LIGHTS" AURORA AUSTRALIS "SOUTHERN LIGHTS"

As the electrons enter the earth's upper atmosphere, they will encounter atoms of oxygen and nitrogen at altitudes from 20 to 200 miles above the earth's surface. The color of the aurora depends on which atom is struck, and the altitude of the meeting.

- Green oxygen, up to 150 miles in altitude
- Red oxygen, above 150 miles in altitude
- Blue nitrogen, up to 60 miles in altitude
- Purple/violet nitrogen, above 60 miles in altitude

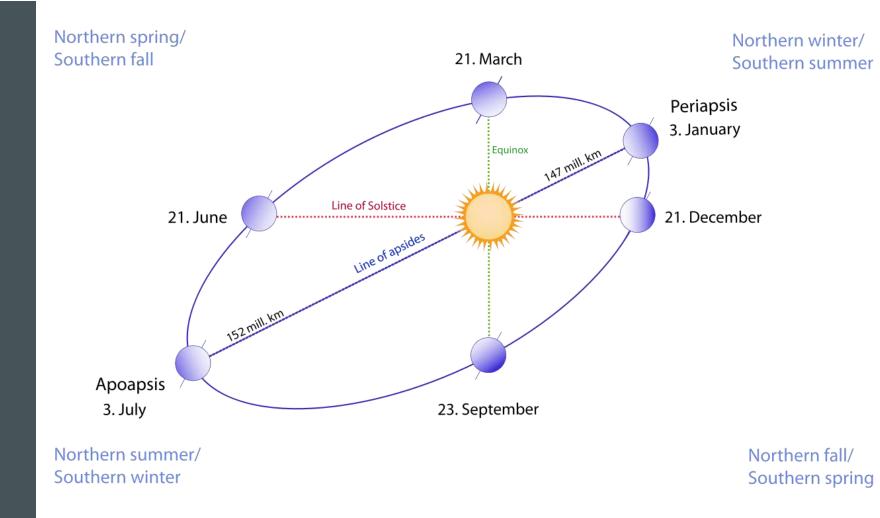
## VOCAB ALERT!

- Perihelion point where Earth is closest to the sun
- Aphelion point where Earth is farthest from the sun.

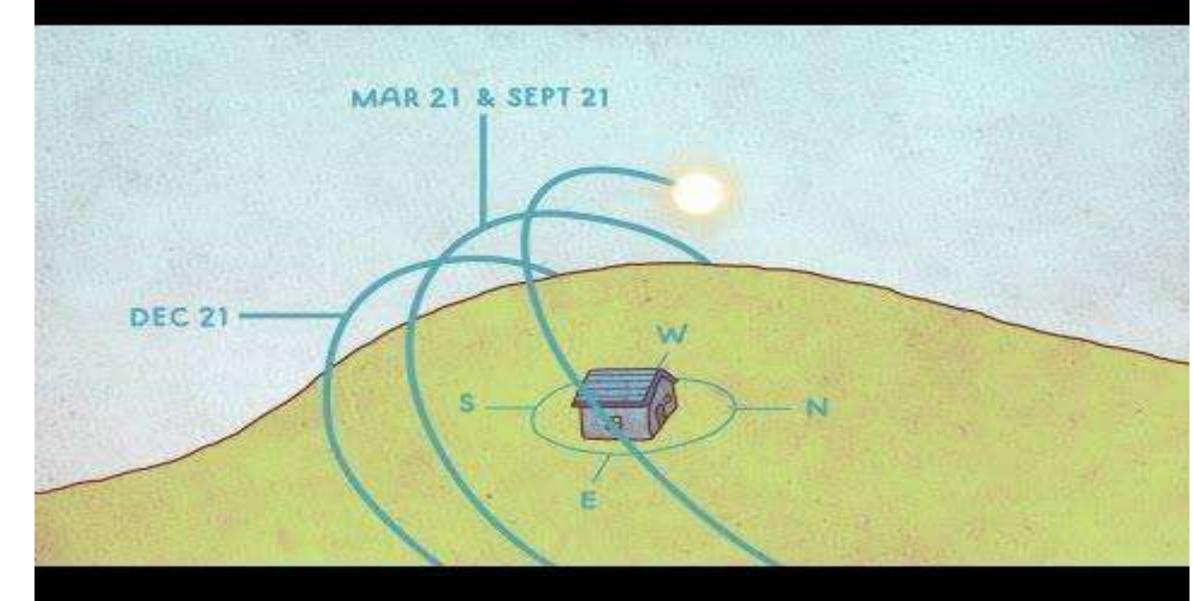


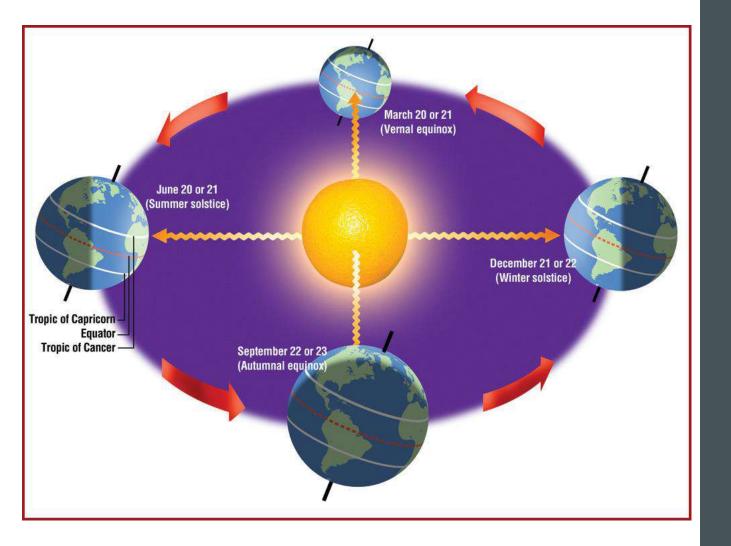
#### TRUE OR FALSE?

 We are closest to the sun in the summer, that's why it's hotter in the summer.



# WHAT MAKES SEASONS?





# QUICK WRITE:

What makes day and night?

- Use the word rotation
- What makes the seasons?
  - Use the words revolve and <u>tilt.</u>

#### QUICK WRITE:

Word Bank: day, night, tilted, rotation, toward, away, direct, indirect, revolves, hours.

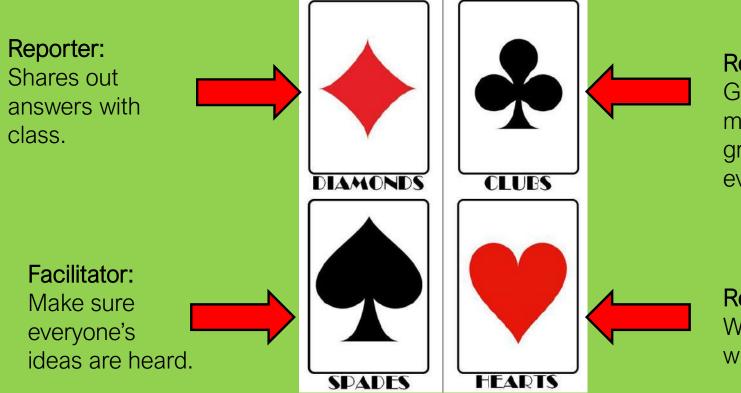
- The Earth experiences day and night because of its \_\_\_\_\_. That means it spins around on its axis. The side of the Earth facing the sun will experience \_\_\_\_\_. The side of the Earth facing away from the sun will experience
- The Earth experiences seasons because it is \_\_\_\_\_ on its axis, and it \_\_\_\_\_around the sun.
- That means that during the summer in the Northern Hemisphere, are tilted\_\_\_\_\_\_ the sun, so we receive more \_\_\_\_\_\_ of sunlight and more \_\_\_\_\_\_ sunlight, making it warmer.
- During the winter in the northern hemisphere, we are tilted \_\_\_\_\_from the sun, so we receive fewer hours of sunlight and more indirect light, making it colder.

#### IN GROUPS, ON SMALL WHITEBOARD, CH 17.2 (7 MINUTES)



- 1) How are heat and temperature related?
- 2) What are the 3 major mechanisms of heat transfer?
- 3) How is the atmosphere affected by each of the heat transfer mechanisms?

#### ENERGY IN THE ATMOSPHERE READING GROUP ROLES



#### **Resource Manager:**

Grab whiteboards and markers. Makes sure group finds specific evidence in the text.

Recorder Writes answers on whiteboards.

# 01

1) How are heat and temperature related? 02

2) What are the 3 major mechanisms of heat transfer?

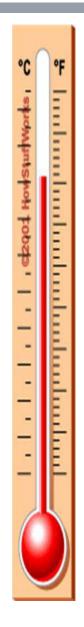
03

3) How is the atmosphere affected by each of the heat transfer mechanisms?

#### SHARE-OUT

#### HEAT AND THE ATMOSPHERE

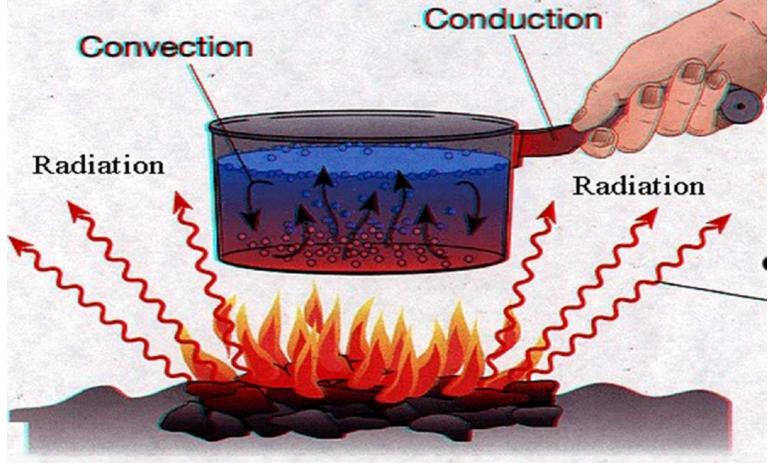
- Heat: measure of how <u>fast</u> the atoms or molecules of a substance are moving.
- Temperature: is the <u>average kinetic energy</u> (Energy of movement)
- The <u>faster</u> the movement the <u>higher</u> the heat energy and the <u>higher</u> the temperature



#### HEAT TRANSFER NOTES

- Radiation the movement of energy through <u>empty space</u>
  - Light travels from a sun across the solar system to the earth
  - Heat from a fire warms your hand without touching the fire.
- Conduction the movement of energy through a substance, on contact. Atoms or molecules <u>collide</u> with others to make them move
  - Heat moves through the handle of a hot pot to burn your hand
- Convection the rising and falling of a substance due to its change in its temperature and density
  - Water in a pot boils, heat in a room rises, cold water sinks

#### HEAT TRANSFER MECHANISMS

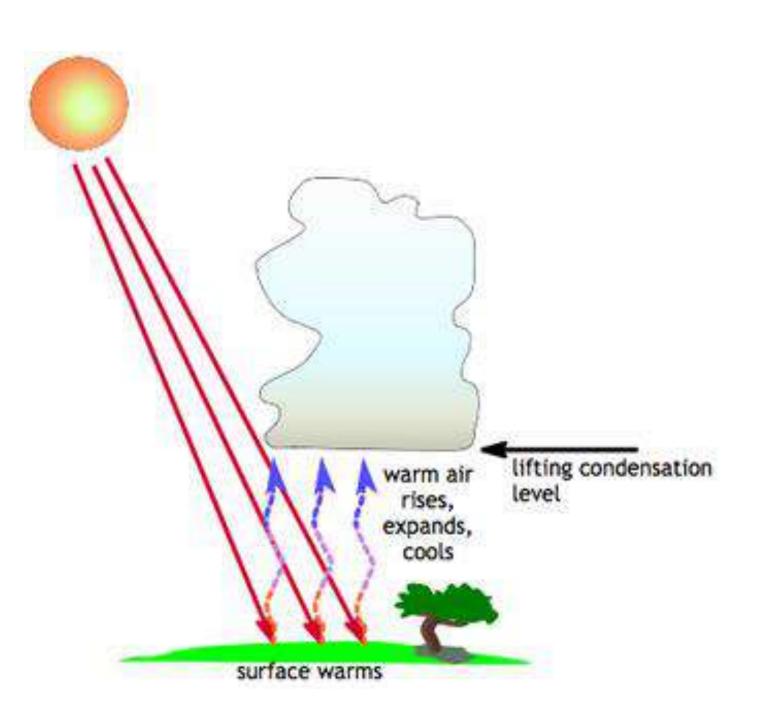


# 3) HOW IS THE ATMOSPHERE AFFECTED BY EACH OF THE HEAT TRANSFER MECHANISMS?

- Radiation is either <u>absorbed</u> or <u>reflected</u> by Earth's surface. Some of it is absorbed by plants for <u>photosynthesis</u>.
- Conduction happens between Earth's <u>surface</u> and the air <u>directly</u> in contact with Earth's surface because air is a <u>poor</u> conductor of heat.
- Convection affects the atmosphere because heat acquired by radiation and conduction is <u>transferred</u> through the atmosphere by convection currents.

#### ATMOSPHERIC HEATING AND ENERGY

- All energy comes from the sun
- About 50% absorbed by land and sea-the rest radiated back to space
- Sun heats ground, ground heats the air
- Warm air rises, expands and cools
  - Clouds!!



#### REVISIT YESTERDAY'S QUICK WRITE:

#### WHY DOES TEMPERATURE DECREASE AS YOU GO HIGHER IN THE TROPOSPHERE?

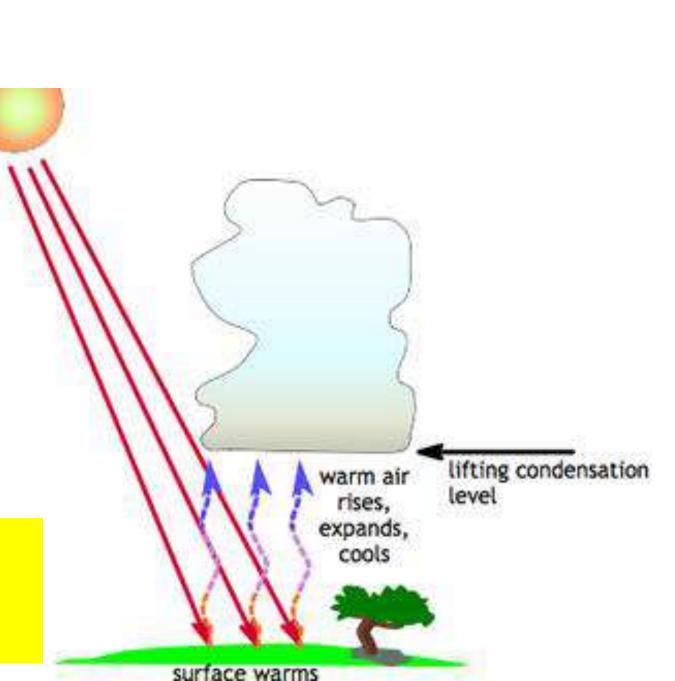
The temperature decreases as you go higher in the troposphere because...

The sun warms the \_\_\_\_\_ by \_\_\_\_\_.

The surface warms the air right above it by \_\_\_\_\_,

And the warm air rises, expands and cools, by \_\_\_\_\_

making the temperature decrease higher in the troposphere.



# SURFACE HEATING AND RADIATION:

WHAT CAN HAPPEN TO RADIATION THAT IS NOT ABSORBED BY THE SURFACE?

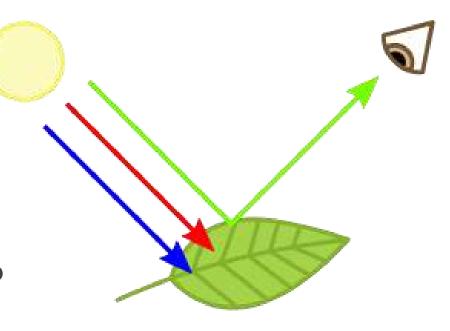
30% lost to space by reflection and scattering Solar radiation 100% 5% backscattered to space by the atmosphere 20% reflected from clouds 20% of radiation absorbed by atmosphere and clouds 5% reflected from 50% of direct and diffused radiation land-sea surface absorbed by land and sea

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#### VOCAB PRACTICE

What does it mean if light is reflected?

What does it mean if light is absorbed?



#### ALBEDO

#### Measure of a surfaces' reflectivity

- Very dark colors have an albedo close to zero (or close to 0%).
- Very light colors have an albedo close to 100%

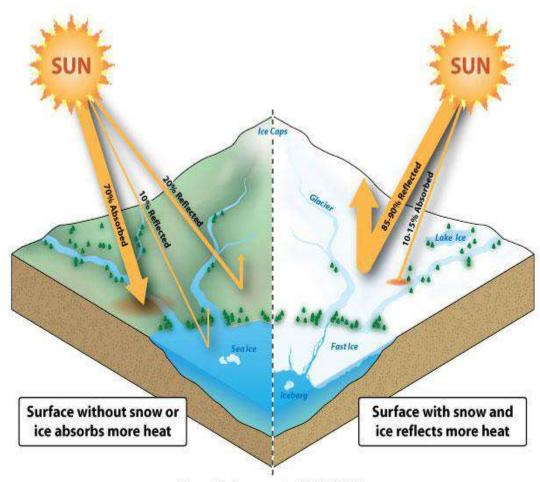


#### GROUND SURFACE HEATING

Albedo vs absorption

Albedo

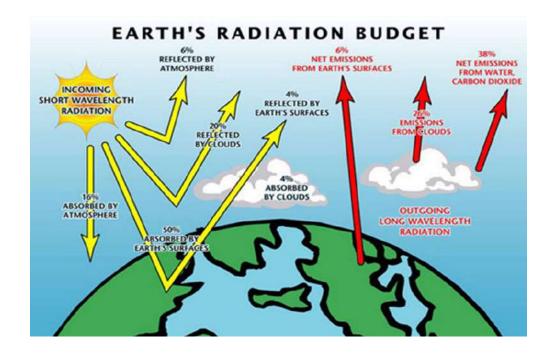
- Solar energy reflected from Earth back into space
- Albedo-cool temps
- Absorption-warm temps



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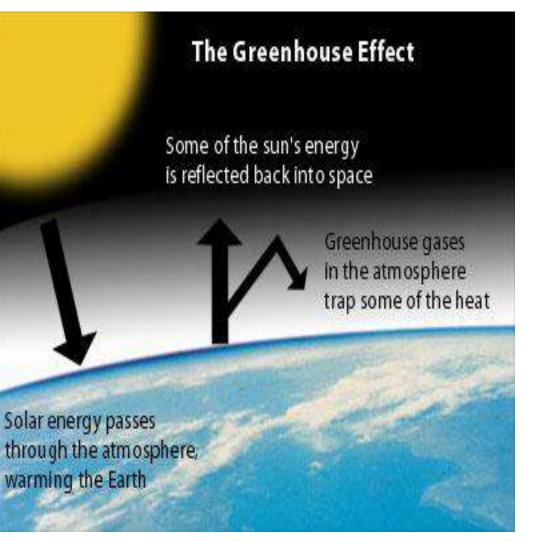
#### ALBEDO VS ABSORPTION CONTINUED

- Two surfaces-Land and Water
  - Dark materials (most land surfaces) absorb more heat
- Trees-low albedo, high absorption
- Snow-high albedo, low absorption
  - temperature feedback
  - Clouds



#### **THE GREENHOUSE EFFECT**

The earth's temperature is naturally regulated by a layer of gases in the atmosphere which act like the glass in a greenhouse. This layer of gases— Greenhouse Gases (GHGs)—such as carbon dioxide  $(CO_2)$ , methane, and nitrous oxide, let in sunlight but tend to trap the heat reflected from the earth's surface. Thus, the earth is naturally warmed by the greenhouse effect.



https://www.youtube.com/watch?v=sTvqlijqvTg

## The Greenhouse Effect

**Radiated Heat** 

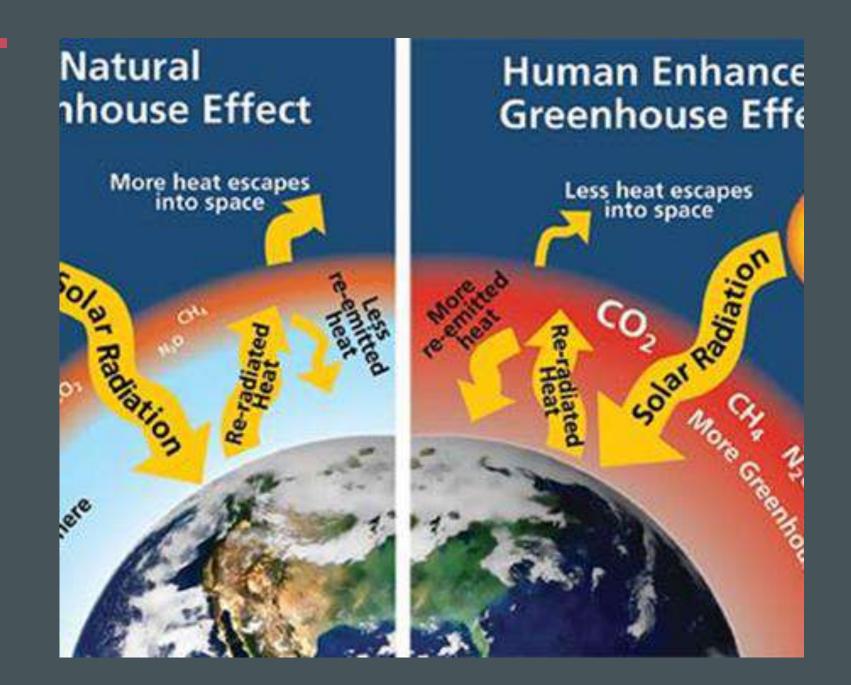
Solar Radiation

EO<sub>2</sub> and other gases in the atmosphere trap the heat, warming the earth

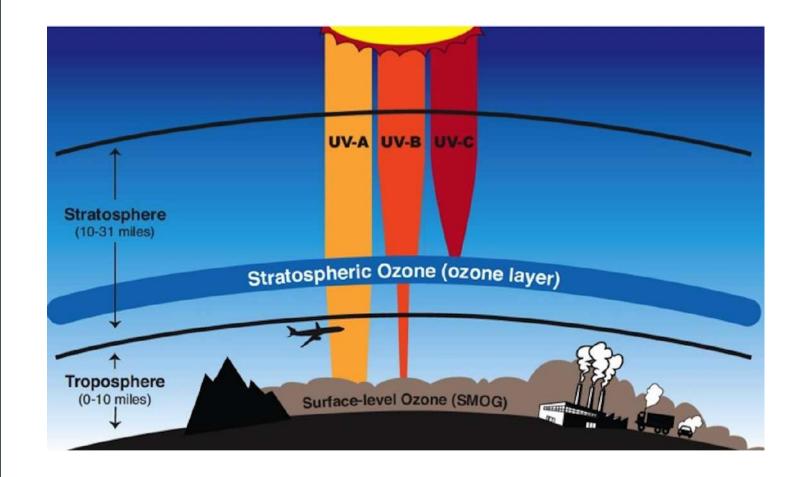
Green House Gasesere

Draw a diagram in your notes!

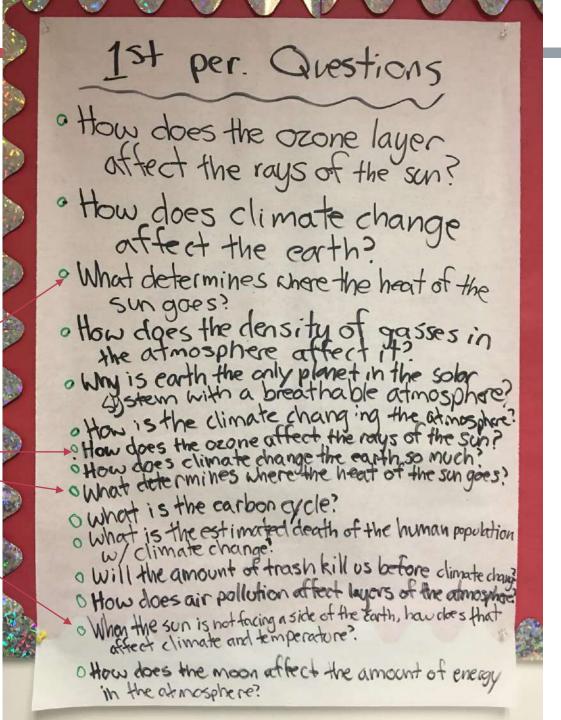
# GREENHOUSE EFFECT ARTICLE



#### HOW DOES THE OZONE PROTECT US?



Choose 1 of the questions from our question list that has to do with energy in the atmosphere and answer it.



Choose 1 of the questions from our question list that has to do with energy in the atmosphere and answer it.

2nd por. Questions How do the layers of the Atmosphere affect climate?
Haw does the ozone layer affect climate?
What are ways climate clata is collected?
What makes carbon more through q cycle? · How are some ways we can control the temperature on Earth? How can we control climate change?
What are ways we can repair the hole in the ozone by:
How can we reduce climate change?
How does climate modeling affect What is the Carbon Cycle?
How do we prevent Climate change?
What can we do to fix the ozone layer?

 Choose 1 of the questions from our question list that has to do with <u>energy</u> in the atmosphere and answer it.

4th per. Questions • How does each layer of the atmosphere work? • How is each layer of the atmosphere different? • How does the sun affect weather? • How does climate modeling work? How does the Greenhouse Effect affect the atmosphere?
How does the Carbon cycle effect the atmosphere?
Why is there an Ozone layer?
Why use there different layers of atmosphere?
How do you model Climate change?
What do the layers of the Earth (atmosphere) do?
Why is Climate change increasing?
How does the carbon cycle affect the Earth? • How can we reduce climate change? • How does dimate affect larger cities? • What is climate? How does electromagnetic tother rags/sattle lites
 What type of energies does the atmosphere produce?
 How much impact does energy have on climate?

Choose 1 of the questions from our question list that has to do with energy in the atmosphere and answer it.

ige? per. Questions How does temperature affect our climate? How does the atmosphere change how the energy comes | works on conth? Whore is the ozone layer? What does it affect? Whore is the ozone layer? What does it affect? Why are there so many layers in the atmosphere? Why does climate change exist? The greenhouse Wind does climate change exist? The greenhouse Wind does climate change exist? How does the sun affect our climate • How does the carbon cycle affect the atmosphere · What causes the Northern Lights + how does it O 16 the Carbon Cycle important to the Earth's at mosphere + why? How no seasons change?
 What are the layers of the atmosphere + why are thay important?
 What do each of the loyers of the atmosphere do?
 What do each of the loyers of the atmosphere do?
 How hoes the oreenhouse effect affect us? . How does the Carbon Cycle work? How do you track climate data? What makes the seasons change? What are some big factors in climate change?

Choose 1 of the questions from our question list that has to do with
 energy in the atmosphere and answer it.

What factors affect the atmosphere? What factors affect climate change. How does the orane layer protect us? How does the greenhouse effect work? How can be prevent climate drage?