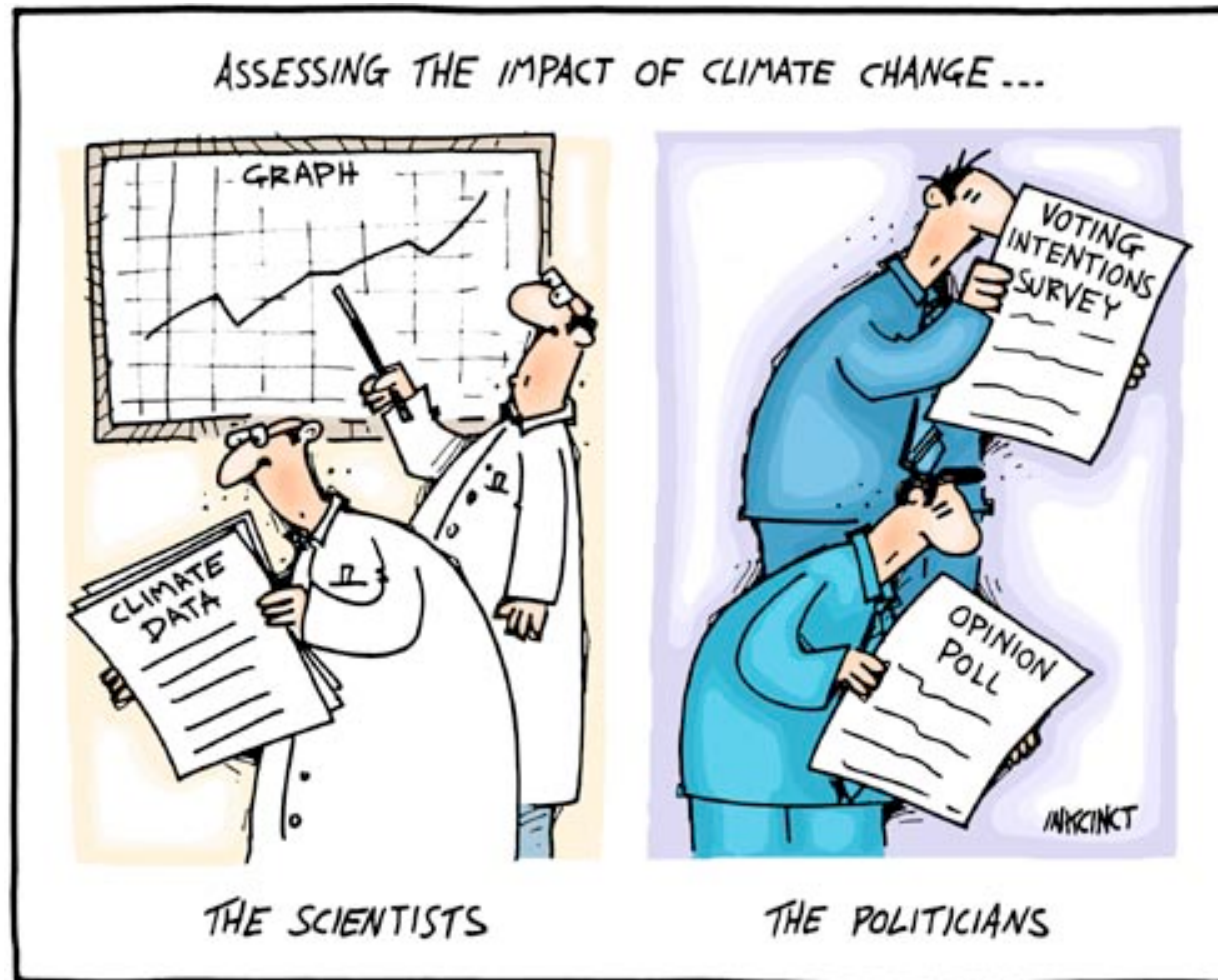


Climate Box Activity

Effect of Albedo and Greenhouse Gases



Climate Box - Materials

Materials

Plastic Bin

Thermometer (°F)

Lamp

Light Bulb (100 W)

Ruler

Plastic Cup

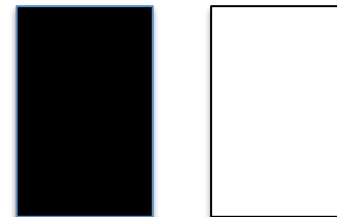
Measuring spoon

Black Foam

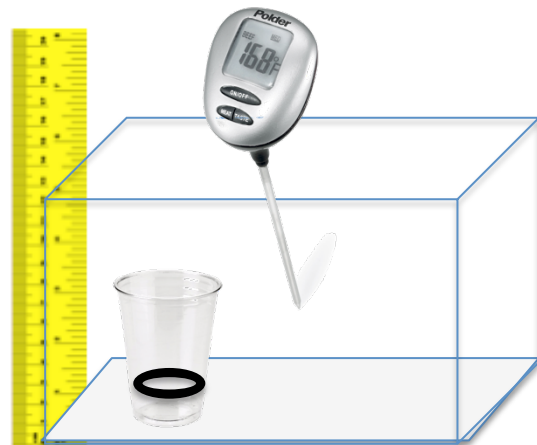
White Foam

Vinegar (50 ml)

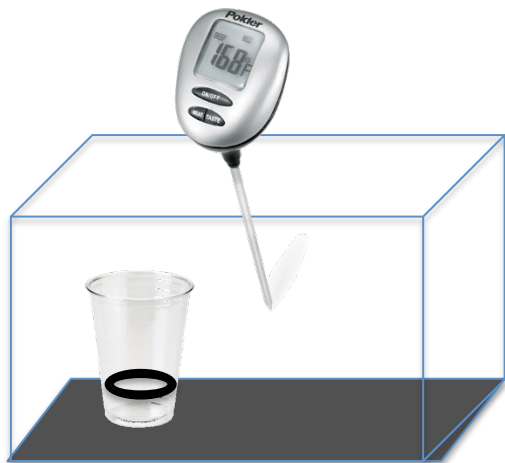
Baking Soda (1 tsp)



Climate Box - Procedure



Place white foam in plastic bin
 Fill cup to line with vinegar
 Place vented top on the bin
 Place thermometer in vent in the bin top
 Position light above bin, 12 inches off the floor
 Take initial temperature reading and record on sheet
 Turn on lamp and record every minute for 7 minutes
 Turn off lamp and let box cool down for 3 minutes



Replace white foam w/ black foam and repeat process

Add 1 tsp baking soda to the vinegar
 Replace lid and wait 1 minute before initial reading
 Turn on lamp and record every minute for 7 minutes
 Turn off lamp and let box cool down for 3 minutes

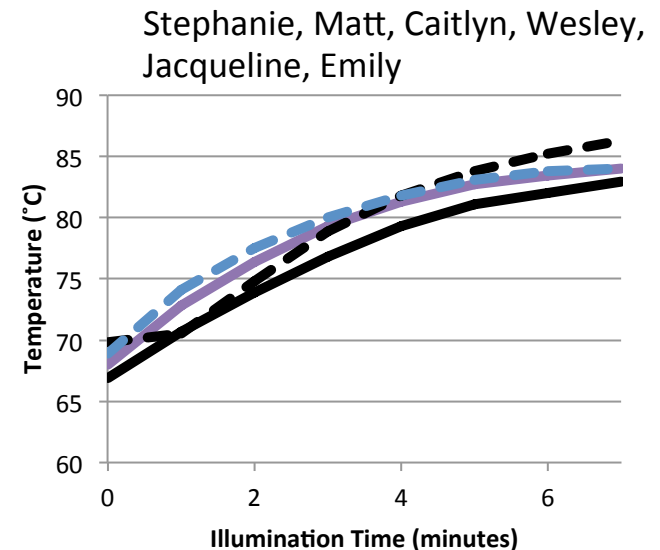
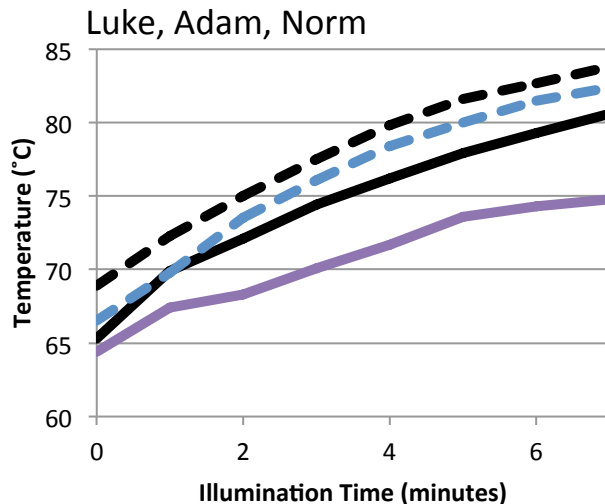
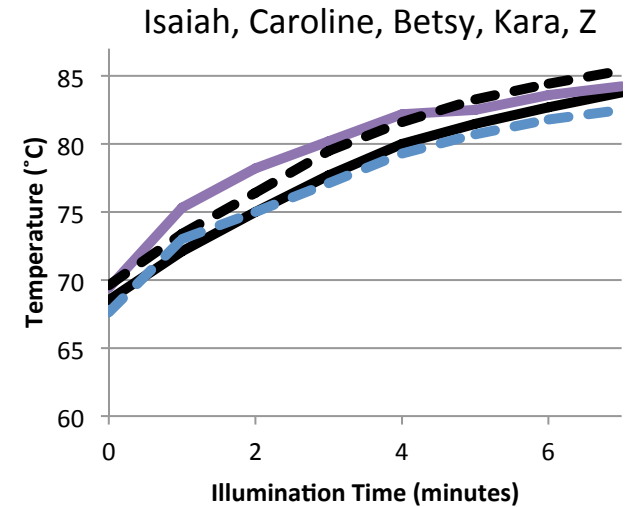
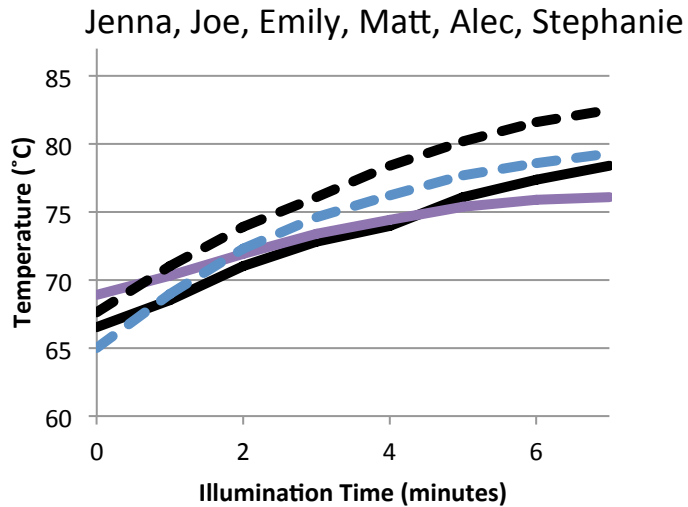
Replace black foam with white foam
 Refill/replace vinegar
 Add 1 tsp baking soda to the vinegar
 Repeat steps above

Team Members_____

Time (min.)	White Bottom No mixing	Black Bottom No mixing	White Bottom Add powder	Black Bottom Add powder
0				
1				
2				
3				
4				
5				
6				
7				

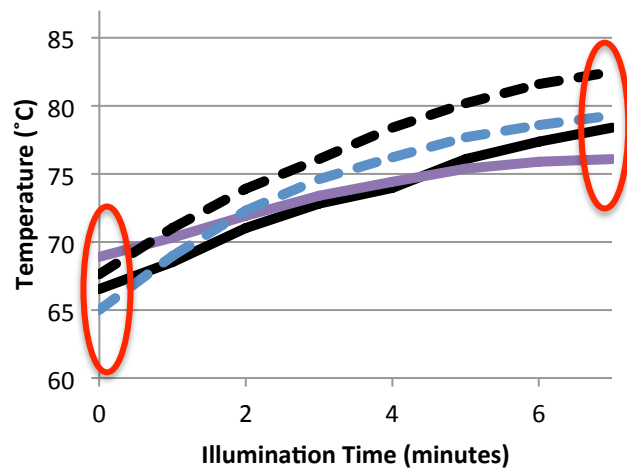
Climate Box Review – Overview

Results



Climate Box Review – Black & White

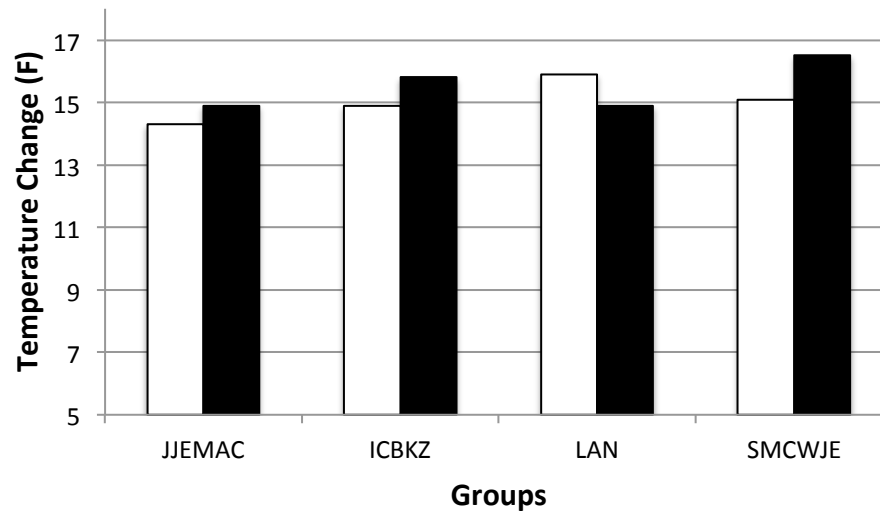
Results



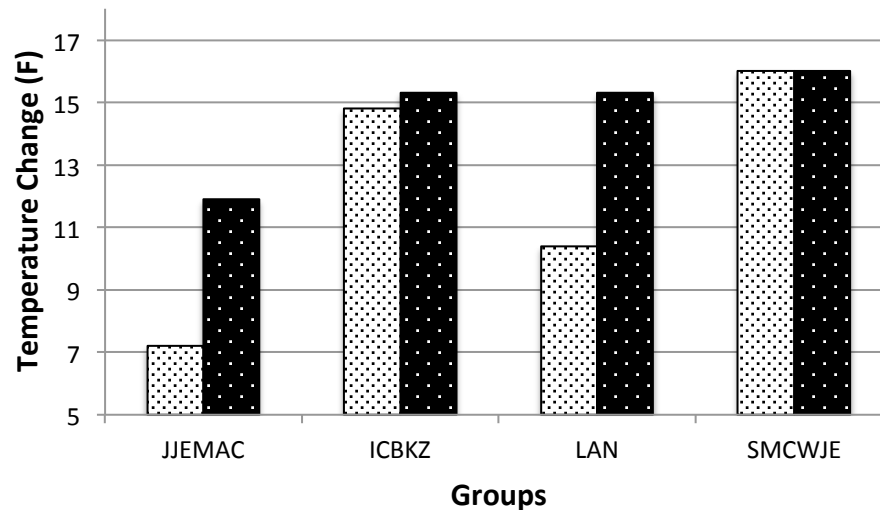
What patterns do you see?

Think-Pair-Share

Separate



Mixed

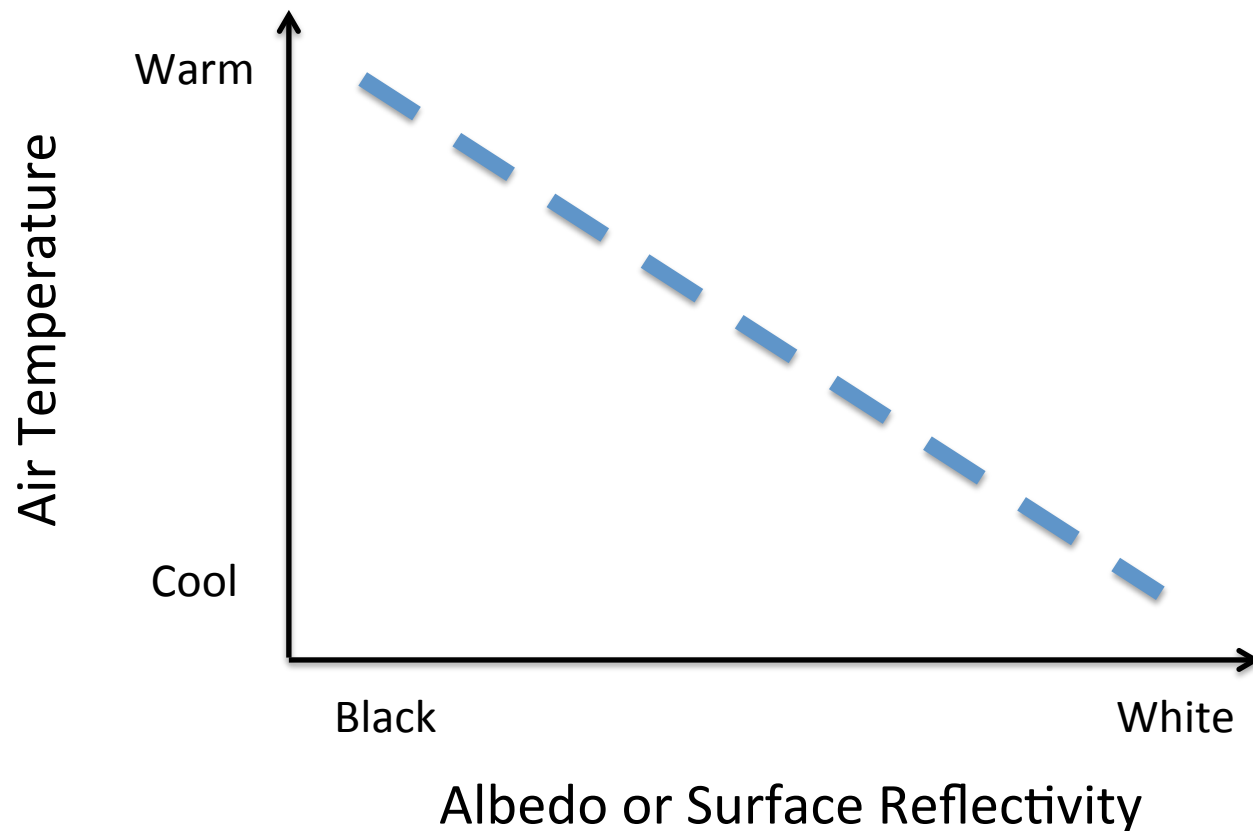


Climate Box Review

Key Relationship

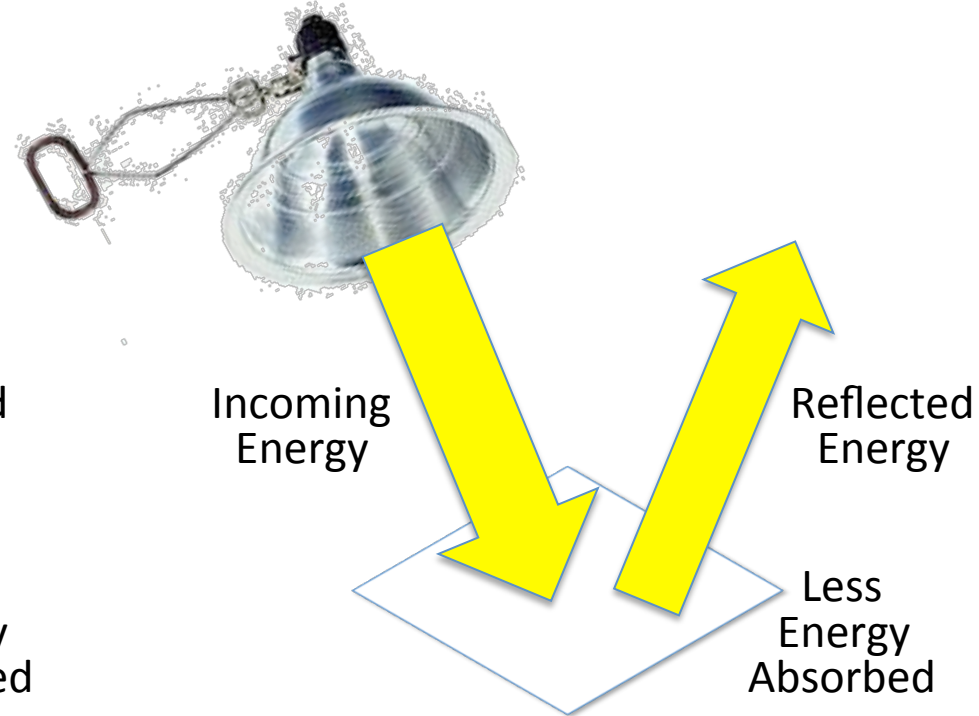
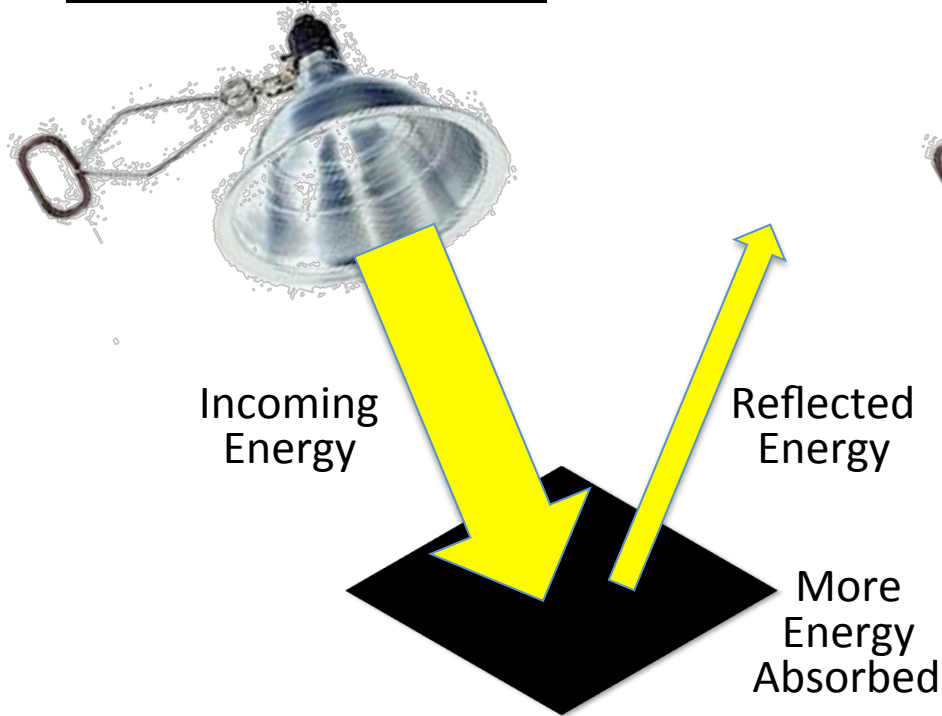
Temperature & Reflectivity

- darker background => increase air temperature

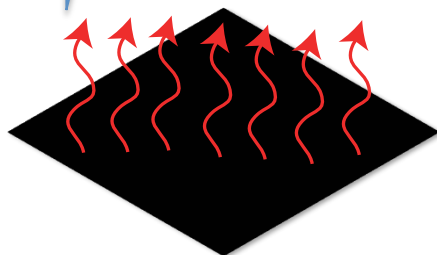


Climate Box Review – Black & White

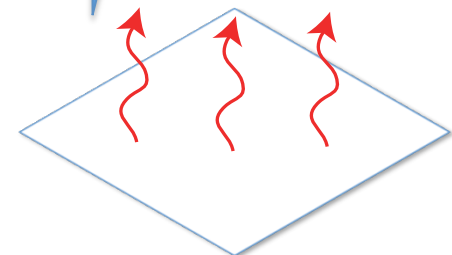
What's Happening



More Energy Absorbed → Plastic Warms Faster → Adjacent Air Warmed Faster & More

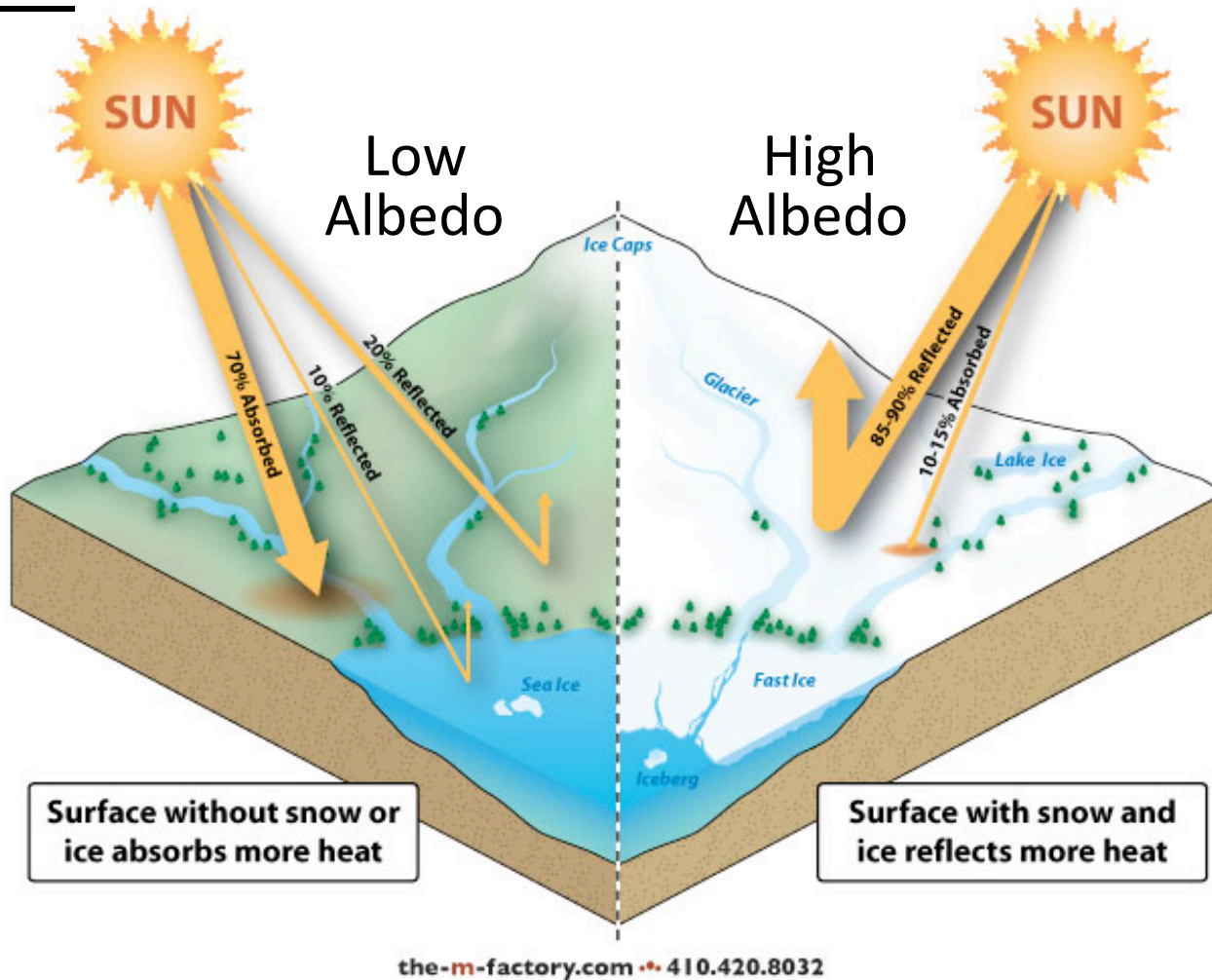


Less Energy Absorbed → Plastic Warms Slower → Adjacent Air Warmed Slower & Less



Climate Box Review – Black & White

Implications

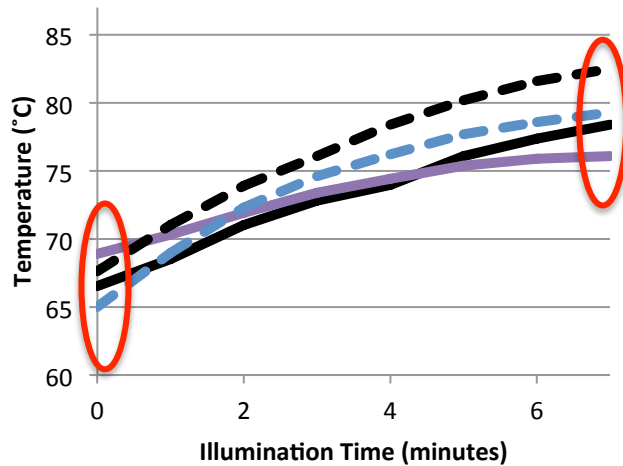


Asphalt => Black => Low Albedo

Snow => White => High Albedo

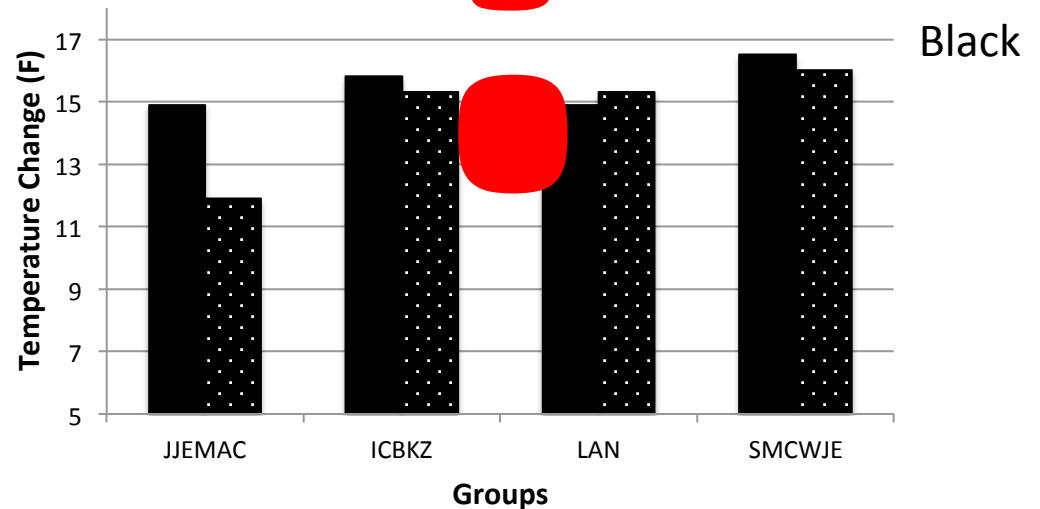
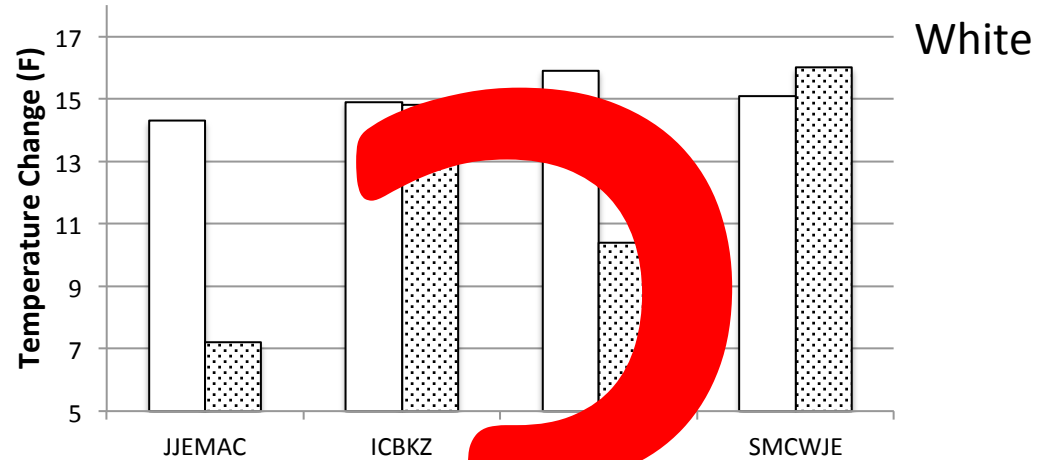
Climate Box Review – Pre & Post Fizz

Results



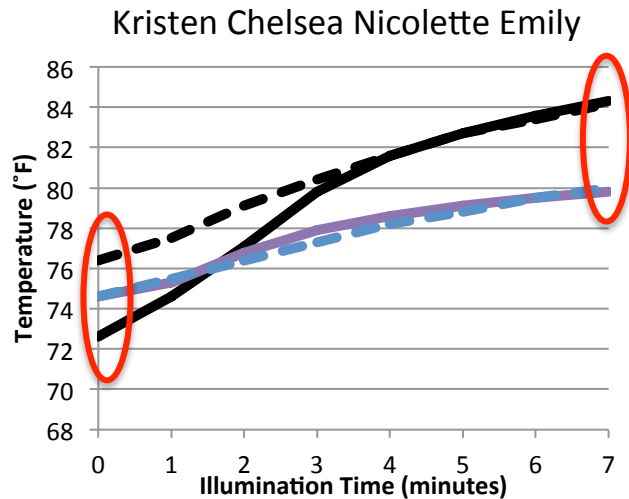
What patterns do you see?

Think-Pair-Share



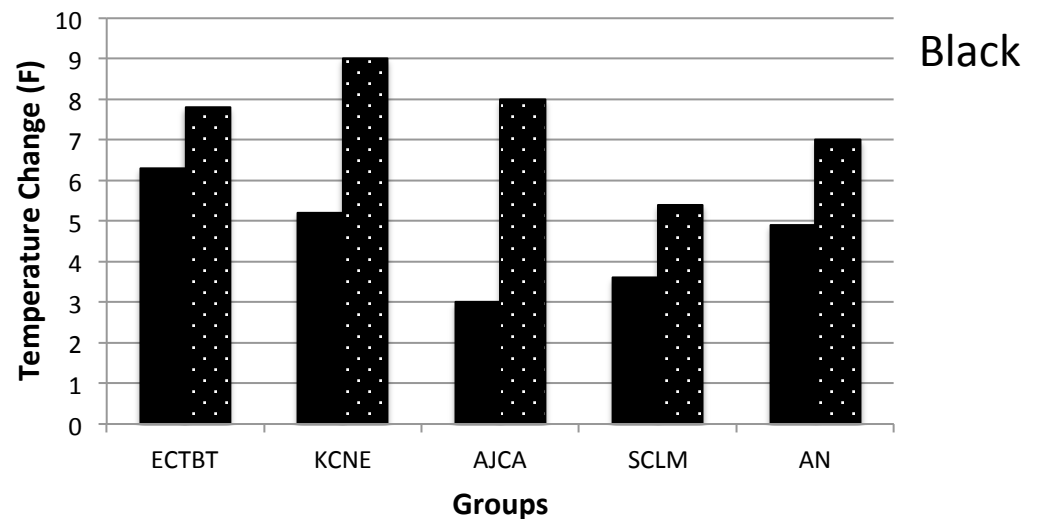
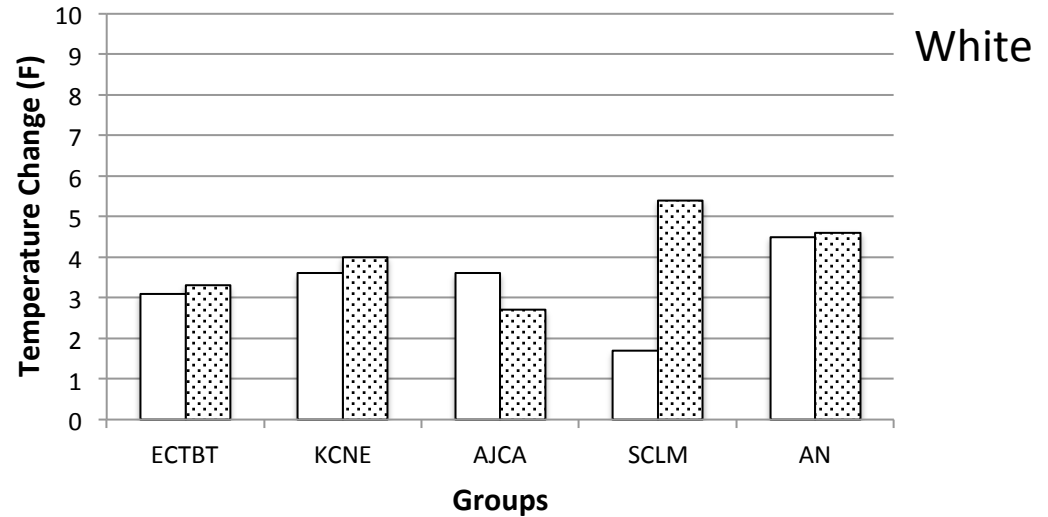
Climate Box Review – Pre & Post Fizz

Results



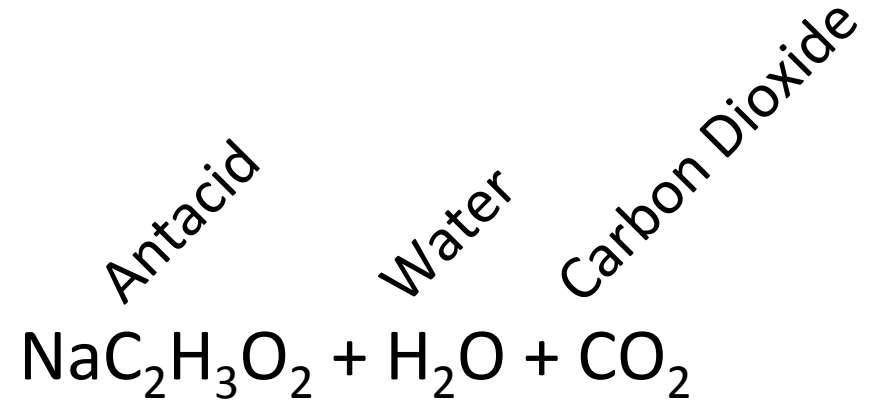
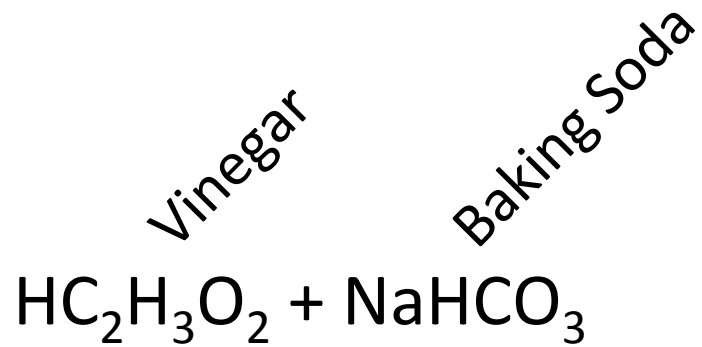
What patterns do you see?

Think-Pair-Share



Climate Box Review

What's Happening ?

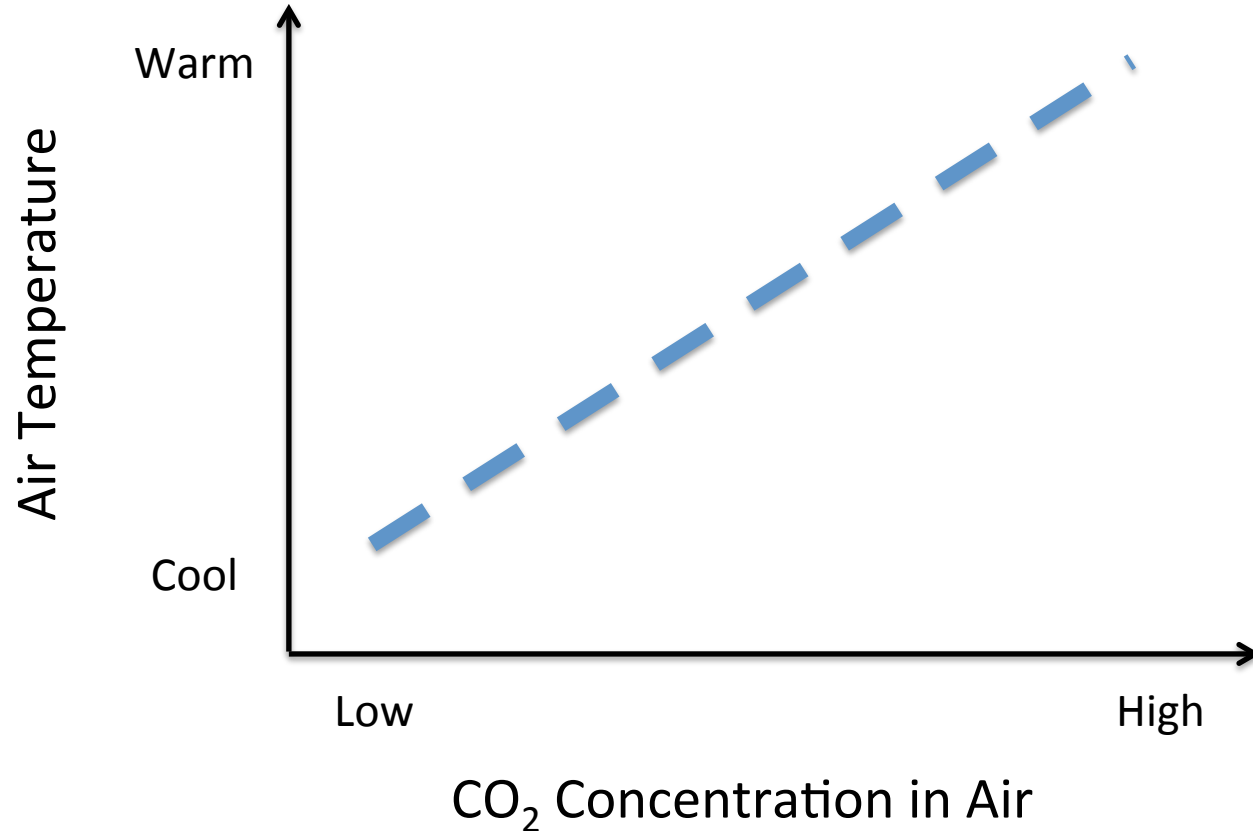


Climate Box Review

Key Relationship

Temperature & CO₂ Correlation

- increase in atmospheric CO₂ => increase air temperature

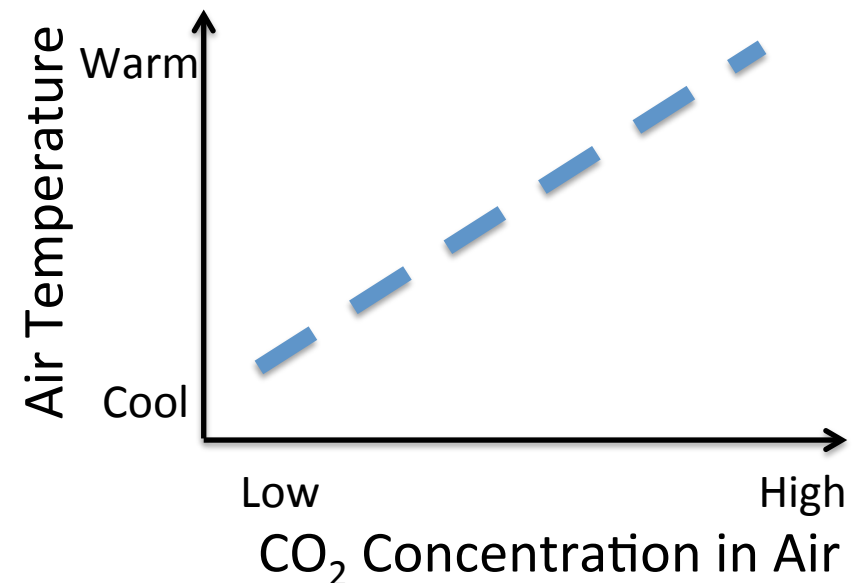
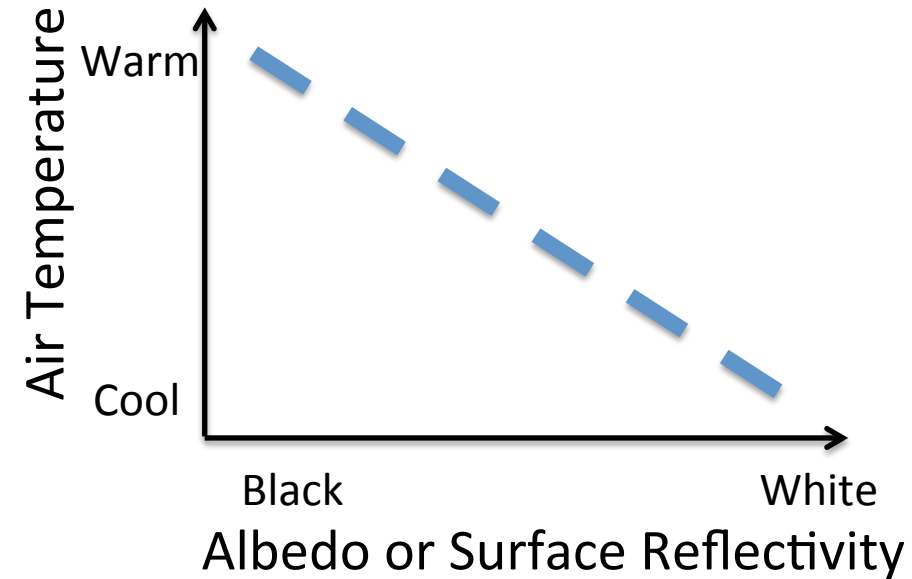
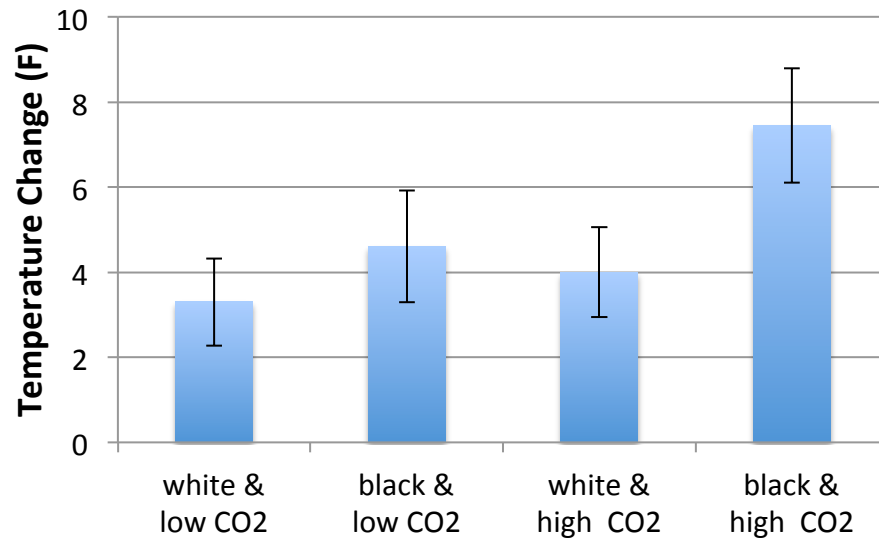


Climate Box Review – Multiple Factors

Implications

Factor 1 → Albedo

Factor 2 → Carbon Dioxide (CO₂)



Climate Box Review – Summary

Key Points

Surface Reflectivity (Albedo) is an important factor in the Earth's temperature

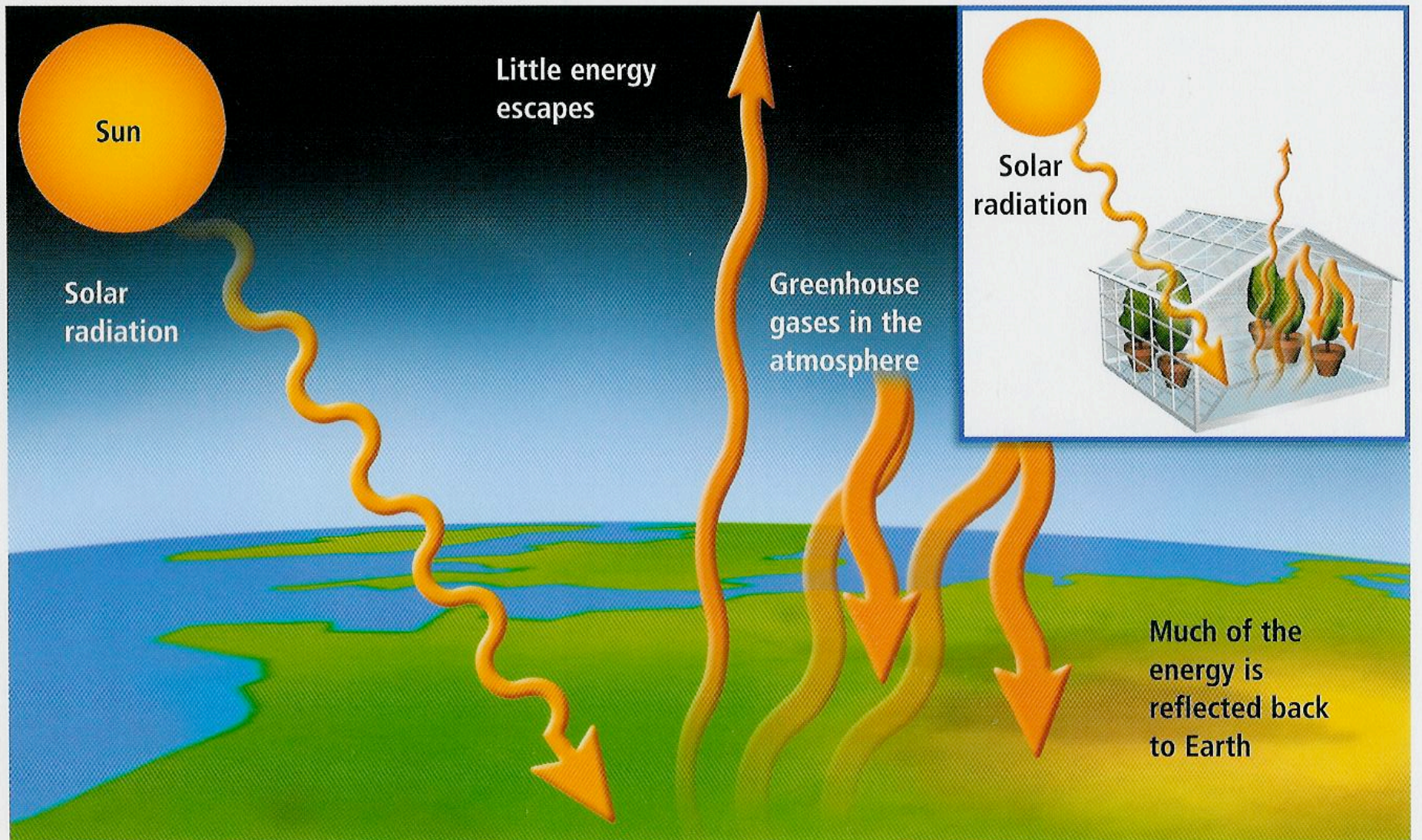
Carbon Dioxide (CO₂) and other greenhouse gases are also important factor in the Earth's temperature

High reflectivity and Low CO₂ => cooler temperatures

Low reflectivity and High CO₂ => warmer temperatures

Greenhouse Effect

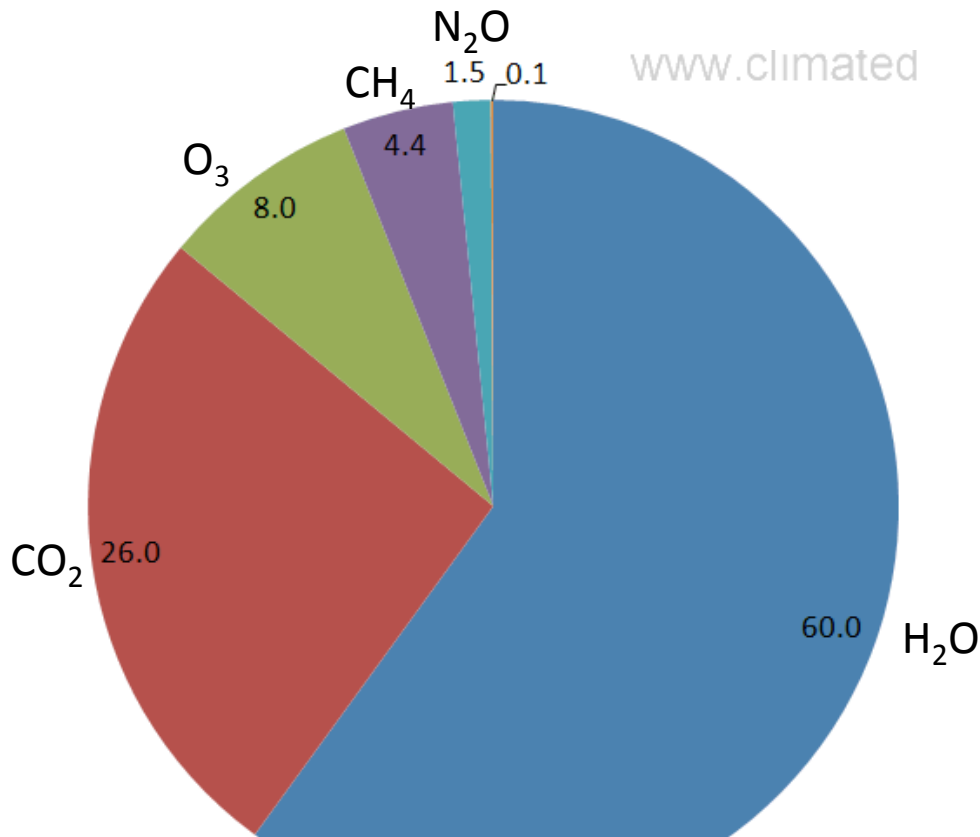
What is the greenhouse effect?



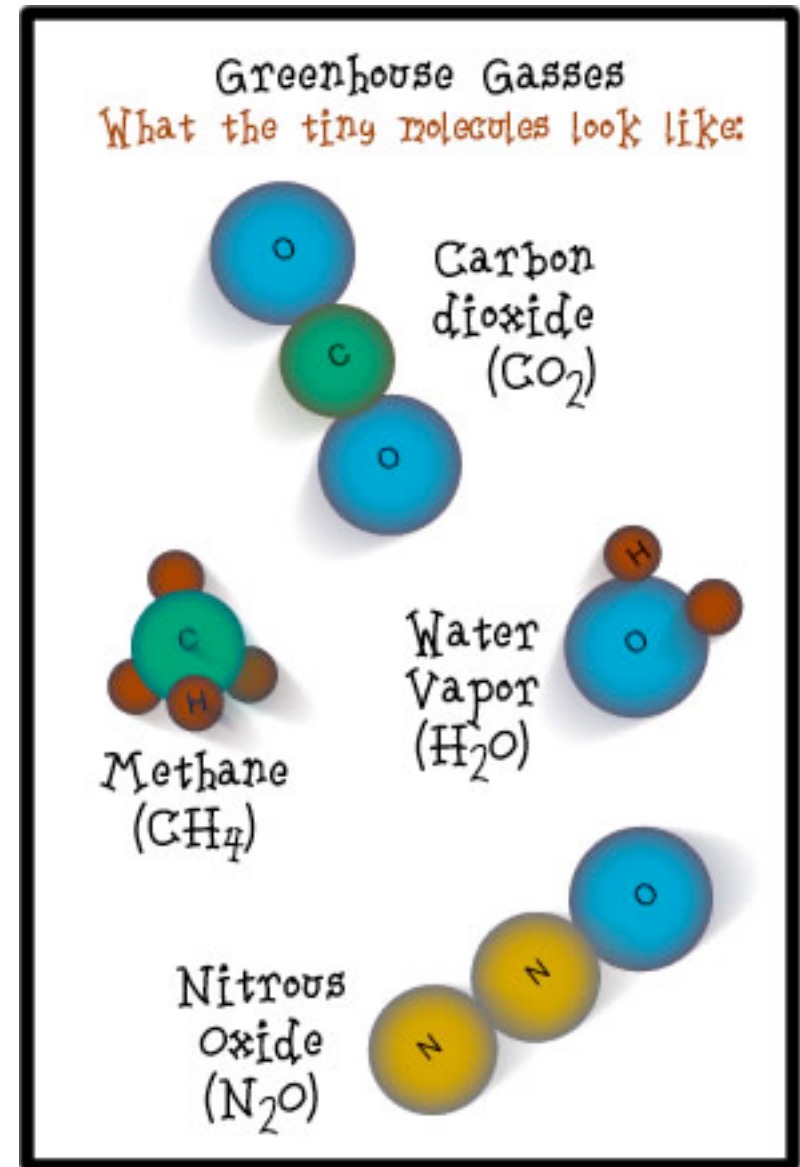
Greenhouse Effect

Greenhouse Gases (GHG)

Water Vapor (H_2O)
Carbon Dioxide (CO_2)
Nitrous Oxide (N_2O)
Methane (CH_4)
Ozone (O_3)

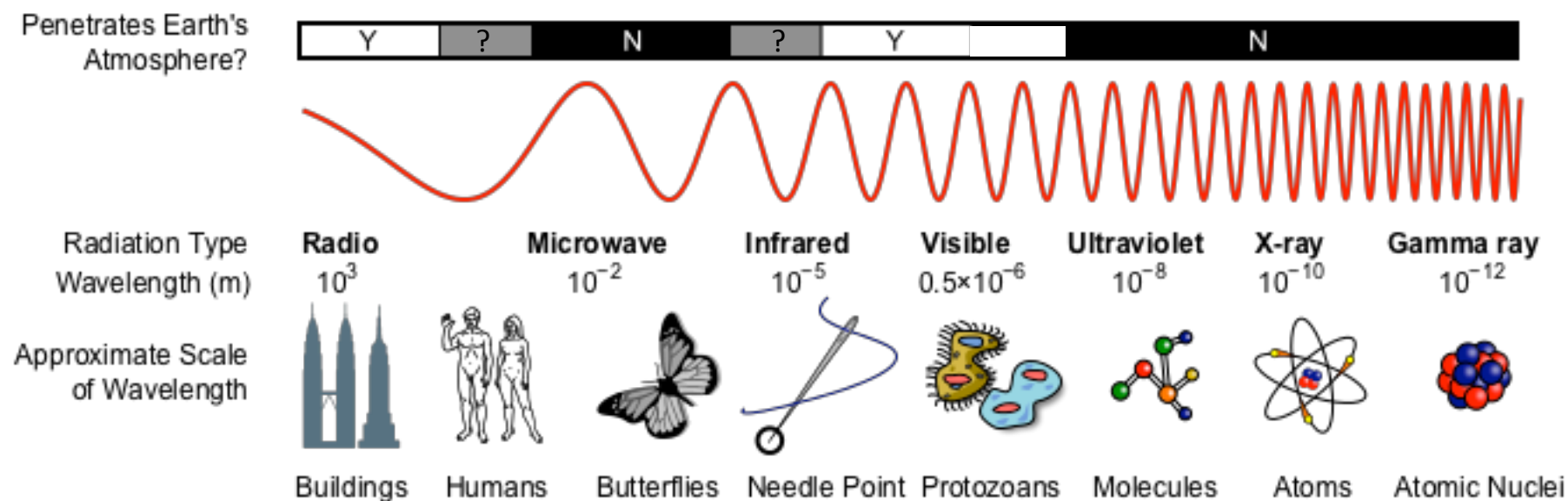


Contribution to Greenhouse Effect



Greenhouse Effect – How does it work?

Electromagnetic Radiation Spectrum



Radio Waves

Infrared

Visible Light

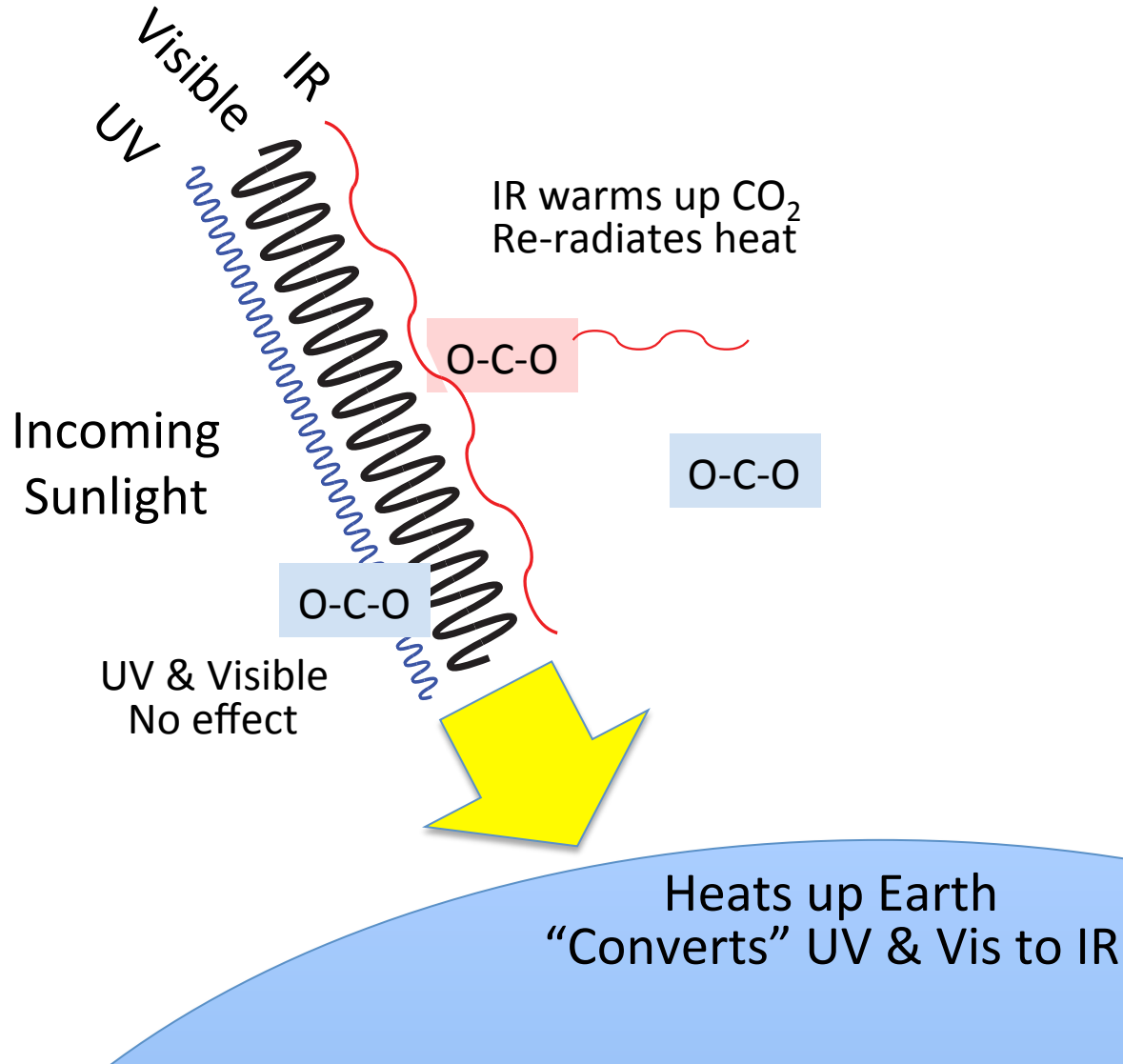
Ultraviolet



Penetrate Earth's Atmosphere

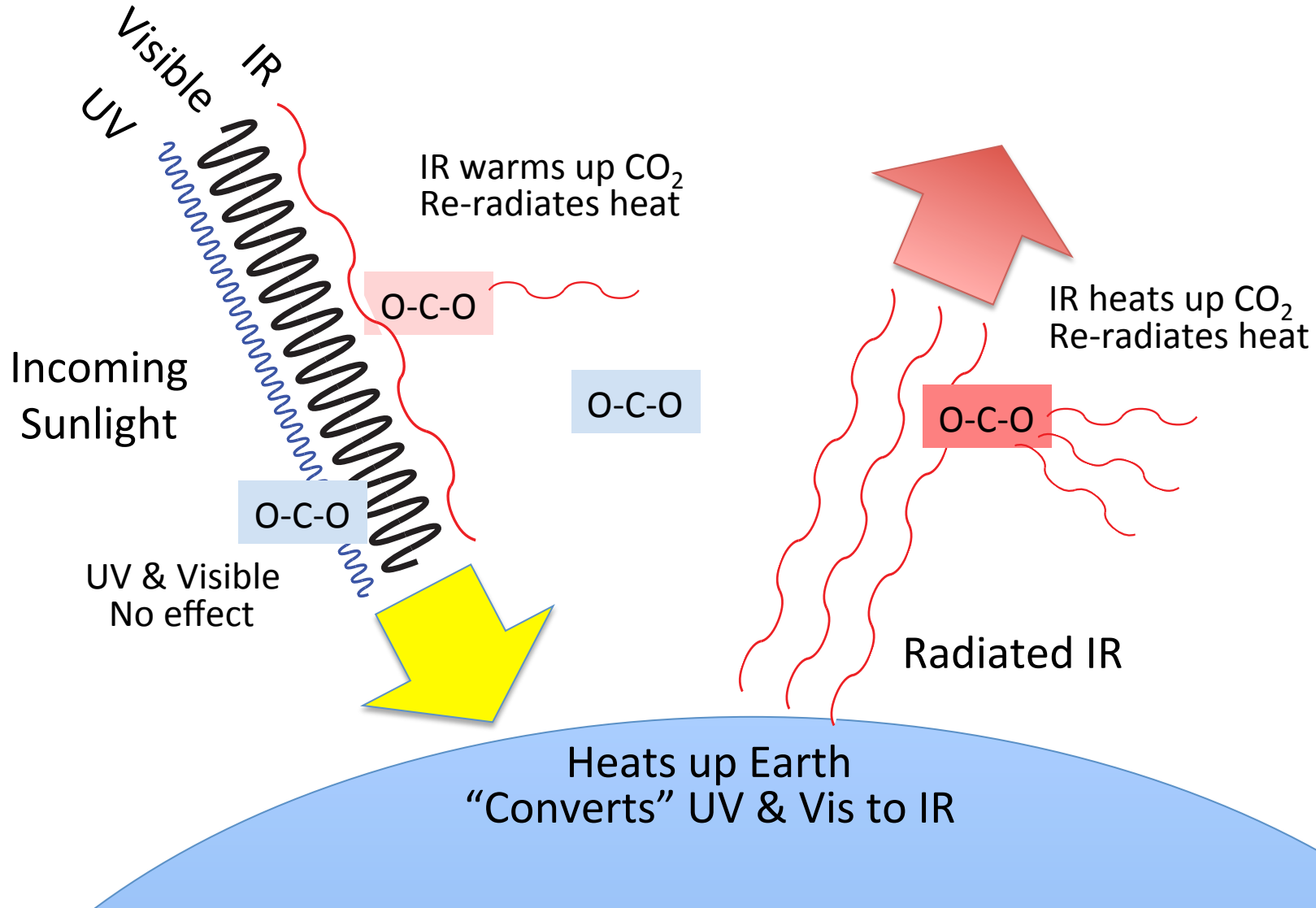
Greenhouse Effect

Greenhouse Gases



Greenhouse Effect

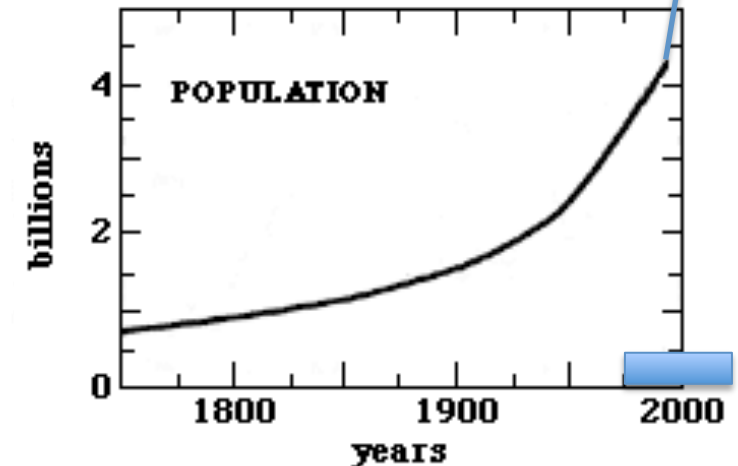
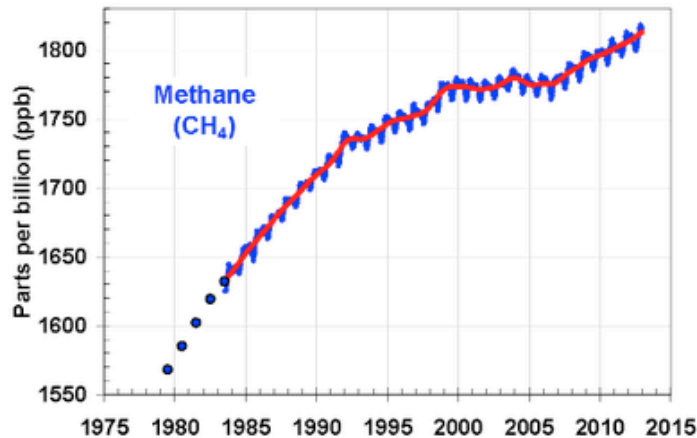
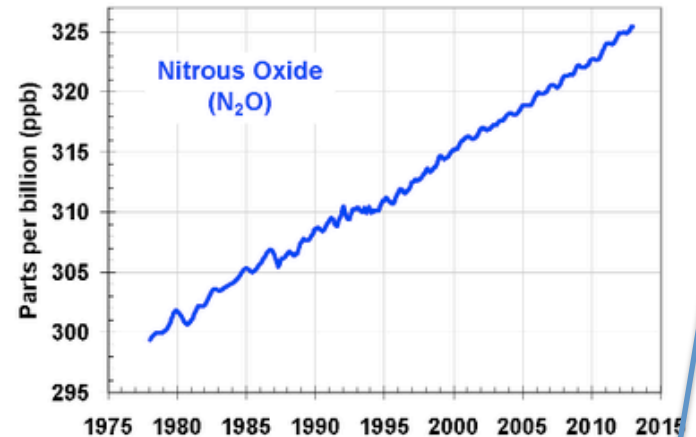
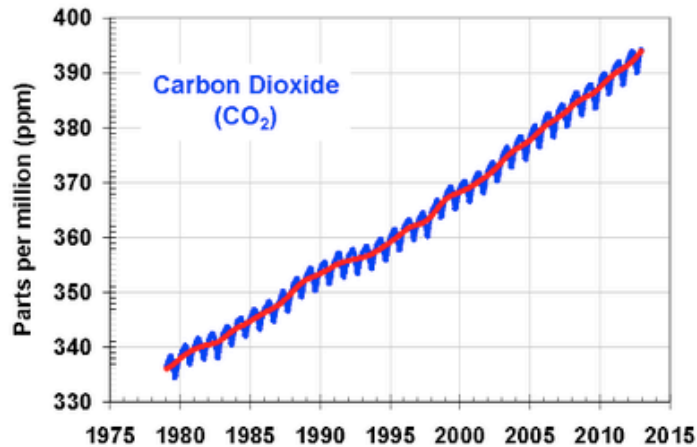
Greenhouse Gases



Greenhouse Effect - Trends

Greenhouse Gases (GHG)

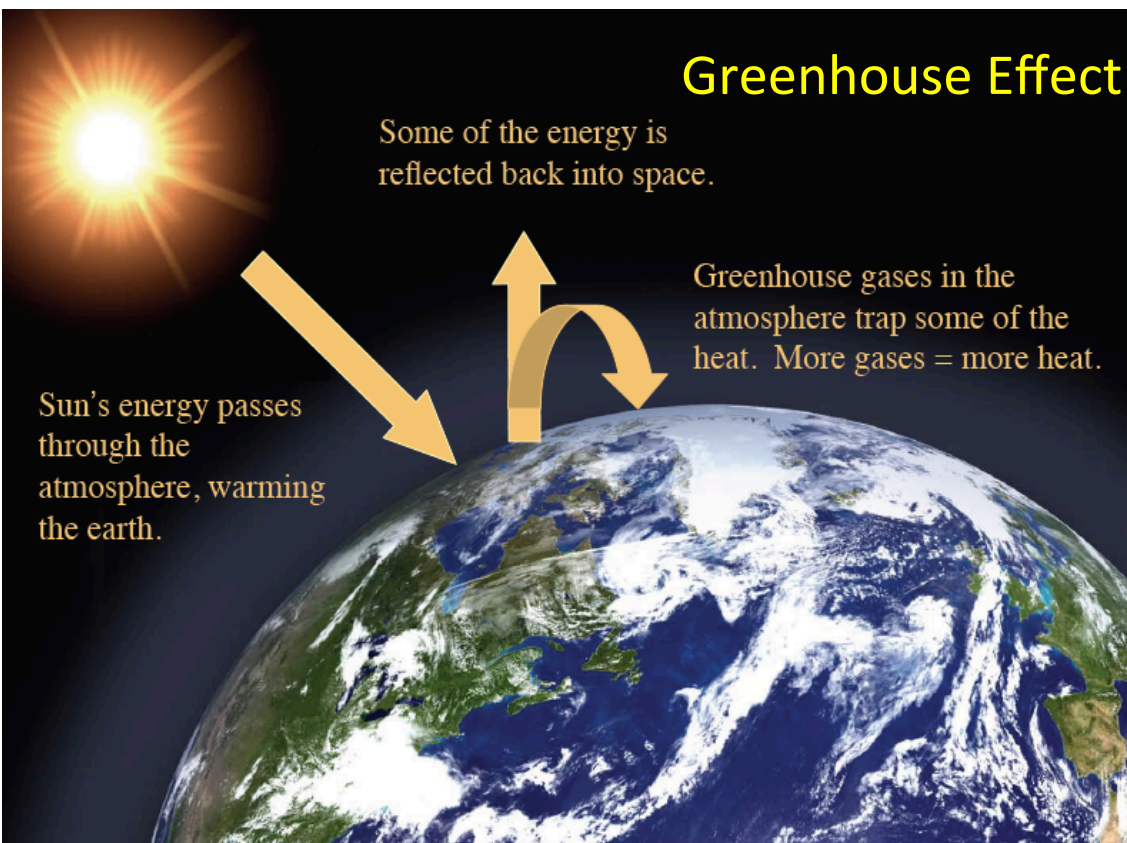
Water Vapor (H_2O)
Carbon Dioxide (CO_2)
Nitrous Oxide (N_2O)
Methane (CH_4)
Ozone (O_3)



Greenhouse Effect

Greenhouse Gases (GHG)

Water Vapor (H_2O)
Carbon Dioxide (CO_2)
Nitrous Oxide (N_2O)
Methane (CH_4)
Ozone (O_3)



No Atmosphere
Sun In =>Sun Out

Atmosphere w/ some GHG
Sun In =>warm air =>Sun Out

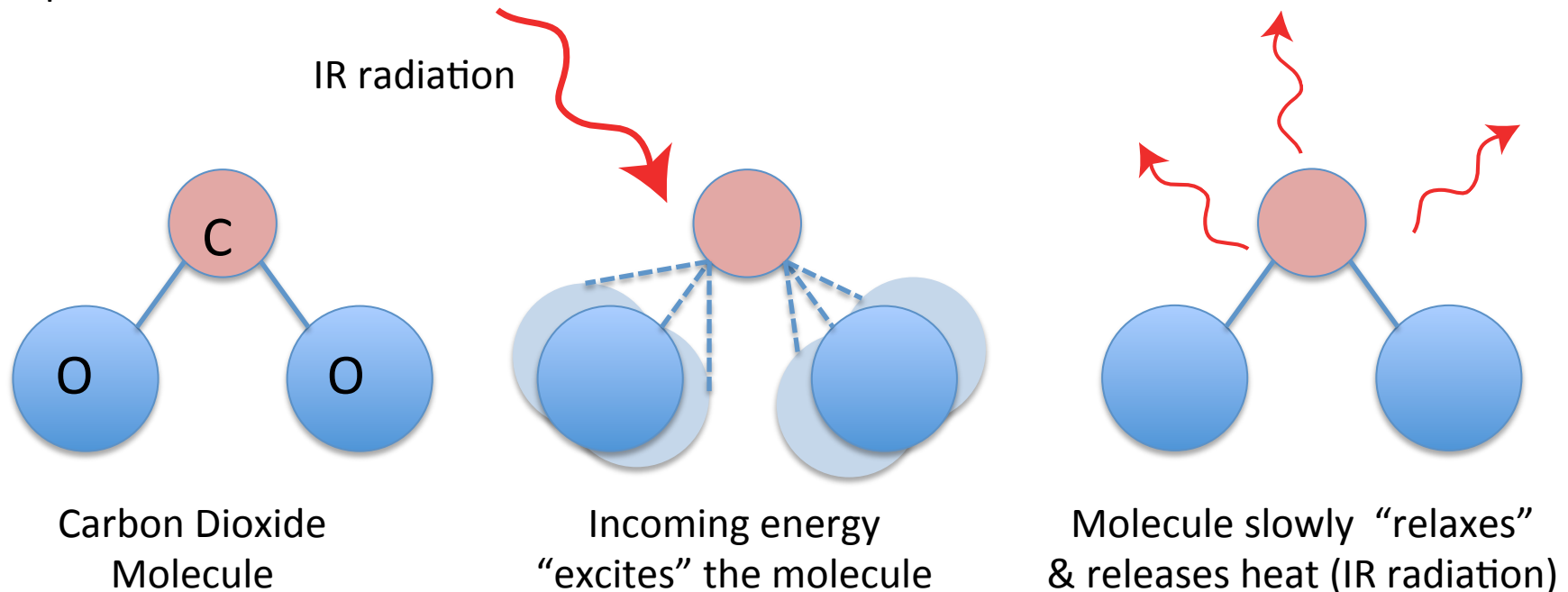
Atmosphere w/ more GHG
Sun In =>**warmer air** =>Sun Out

Video – Questions

I still do not understand how CO_2 can create such a temperature change.

One thing that I still don't understand from the greenhouse gas video is how exactly greenhouse gases trap heat.

If our planet's atmosphere is 99% nitrogen, which said it doesn't absorb heat well, how does the carbon dioxide and water vapor contain enough heat to keep the planet warm?



Video – Questions

Why do the radiation wavelengths change from short to long?

Electrical
Current



Electrical heater “converts” electric waves to heat (IR radiation)

Greenhouse Effect - Trends

Greenhouse Gases (GHG)

Water Vapor (H_2O)
Carbon Dioxide (CO_2)
Nitrous Oxide (N_2O)
Methane (CH_4)
Ozone (O_3)

