Global Temperature Patterns

Recent spike in temperatures
Pp. 86-88

During the Video...

1. Describe the temperature patterns before 1850.
2. List the natural activities that could account for the temperature patterns before 1850.
3. Describe the temperature patterns after 1850.

After the VIDEO...

1. Explain how natural activities (like volcanic eruptions or solar activity) could account for the temperature patterns before 1850.
    a. Read: How Volcanoes Influence Climate (UCAR)
    b. Read: What Is the Sun's Role in Climate Change? (NASA)
2. HYPOTHESIS: Develop a hypothesis that explains why the temperatures spiked after 1850.

GREENHOUSE GASES LAB

OBJECTIVE:

- WHAT: We will determine how greenhouse gases affect the temperatures
- HOW: By calculating the rate of change of a control sample versus one with Carbon Dioxide
- WHY: To determine if greenhouse gases could result in a global temperature increase and affect Greenland

Time	Control (AIR) Temperature	Carbon Dioxide Temperature
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Lab Directions

1. You will use a straw to blow carbon dioxide into the labeled cup. Be sure to quickly seal the cup with the rubber band and plastic bag.
2. The other cup will be a sample of air. Cover the sample of air with the plastic bag and rubber band.
3. Record initial temperatures and record in time 0.
4. When the teacher gives you permission, turn on your light. Record temperature every minute for 10 minutes.
5. When 10 minutes is up, record final temperature (10). Turn off light. Determine the difference between the 0 and 10 minute for both samples. Record data on board.

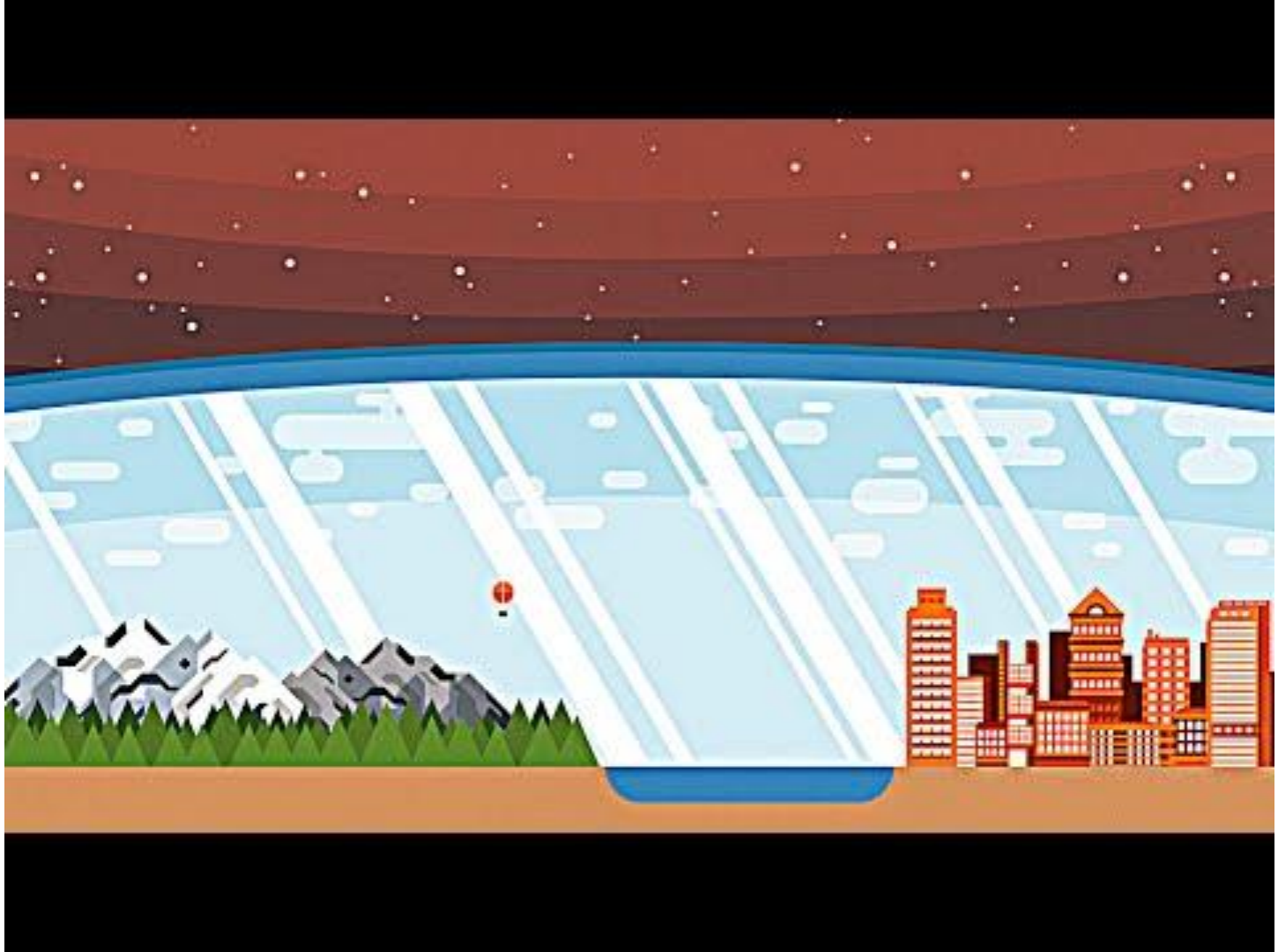
Lab Reflections

Using the Claim, Evidence, and Reasoning format, answer the following prompt:

Use evidence to explain the correlation between greenhouse gases (like carbon dioxide) and temperatures.

During the Video:

1. Compare and contrast the Moon and Earth's temperatures, including the causes of the differences.
2. What is the role of Earth's atmosphere - during the day and night?
3. What does our atmosphere need in order to absorb infrared radiation?
4. Why do particles need to be "lopsided?"
5. Why are carbon dioxide and methane able to absorb energy?
6. Why doesn't 99% of the atmosphere absorb energy?
7. What percentage of outgoing heat do the greenhouse gases absorb?



We see that Greenhouse gases cause increasing temperatures.

Next: develop a hypothesis that predicts what factors are Producing or causing greenhouse gases.

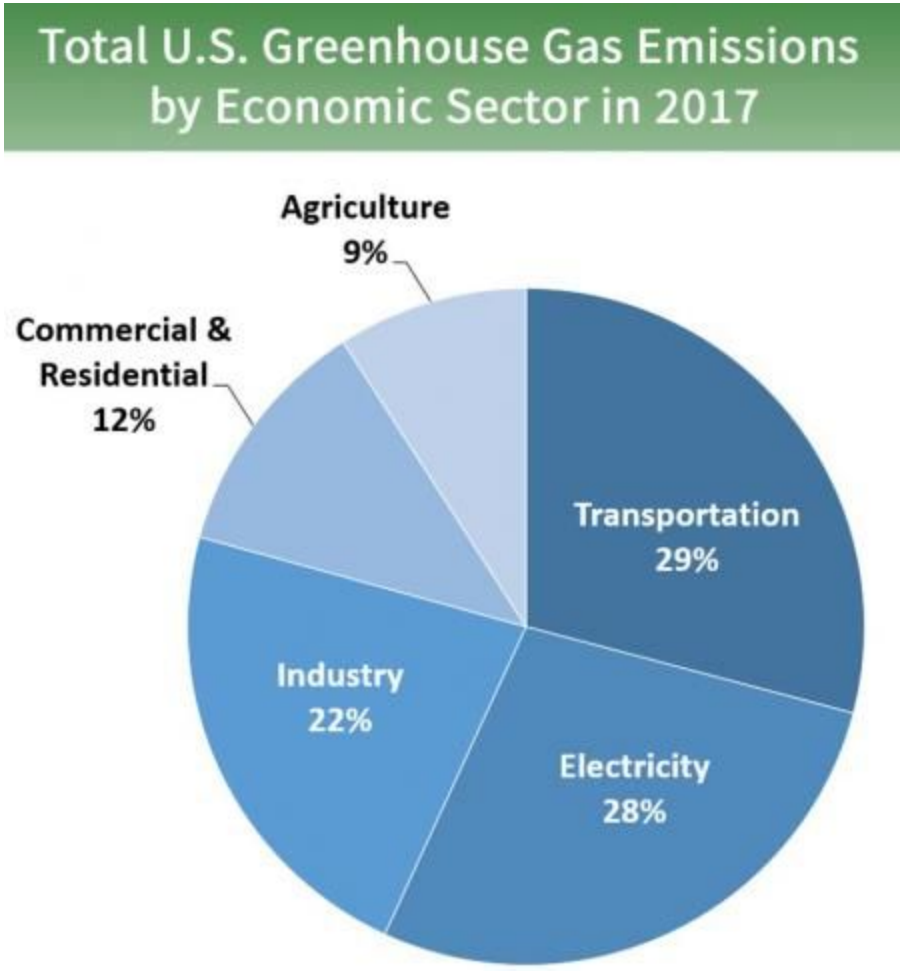
Greenhouse Gas Sources

Use: https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

- Describe the sources (or sectors producing) greenhouse gases
- What activities do all these sectors have in common in terms of sources for greenhouse gas?

Greenhouse gases sources

- Greenhouse gases are emitted primarily by the burning of fossil fuels (coal, gas, oil)
- Fossil fuels are burned to provide energy sources for human activities
- Thus, the majority of greenhouse gases are emitted as a result of human activities.



Describe the patterns you observe in the graphs; describe Similar patterns.

Temperature Graph: https://www.temperaturerecord.org/

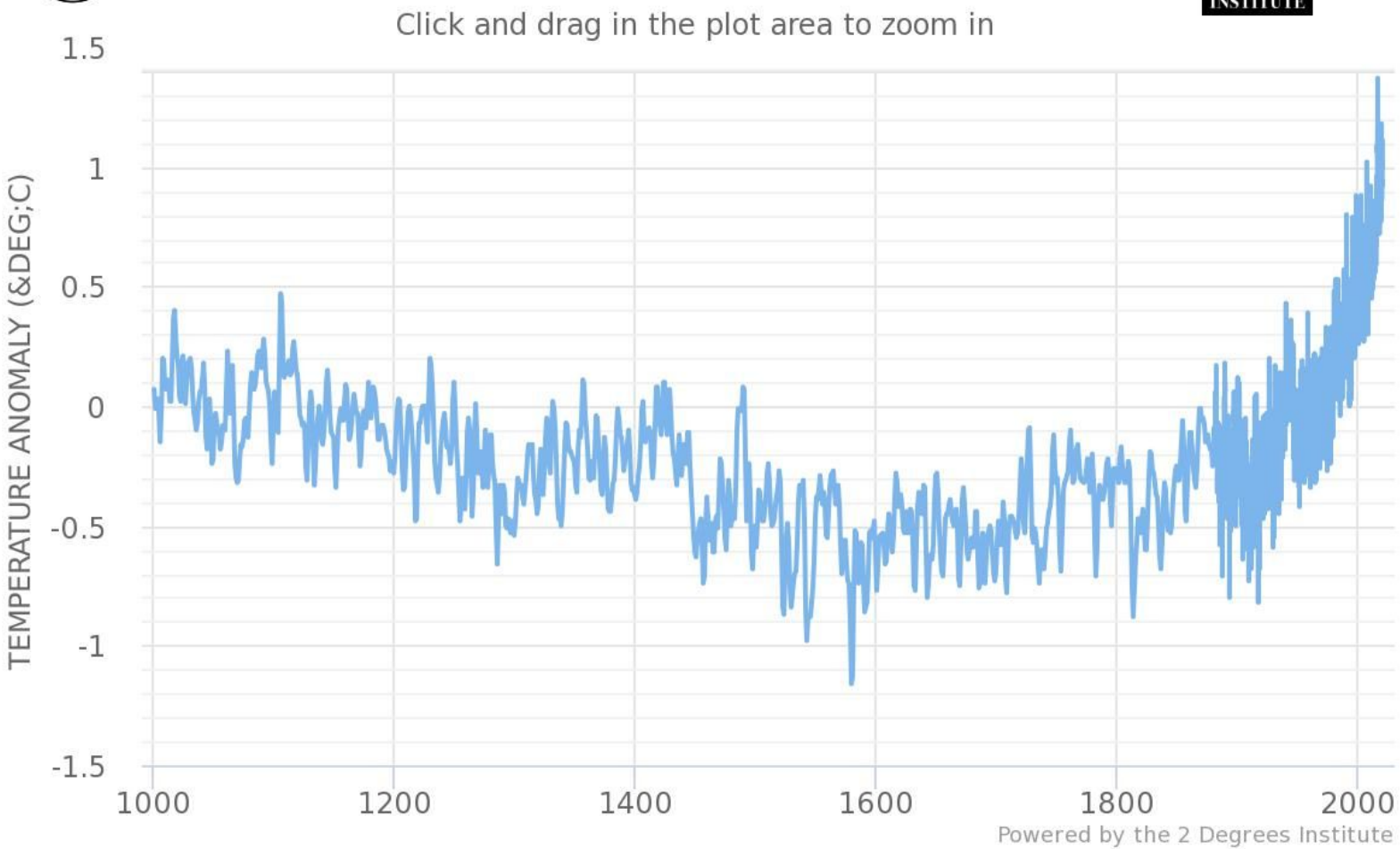
Greenhouse Gas Emissions: https://www.temperaturerecord.org/ (click 3 lines in upper left and change to carbon dioxide, methane, and nitrous oxide; click climate dashboard to see multiple)

Population Graph: https://ourworldindata.org/uploads/2018/11/Annual-World-Population-since-10-thousand-BCE-for-OWID.png

IRE RECORD

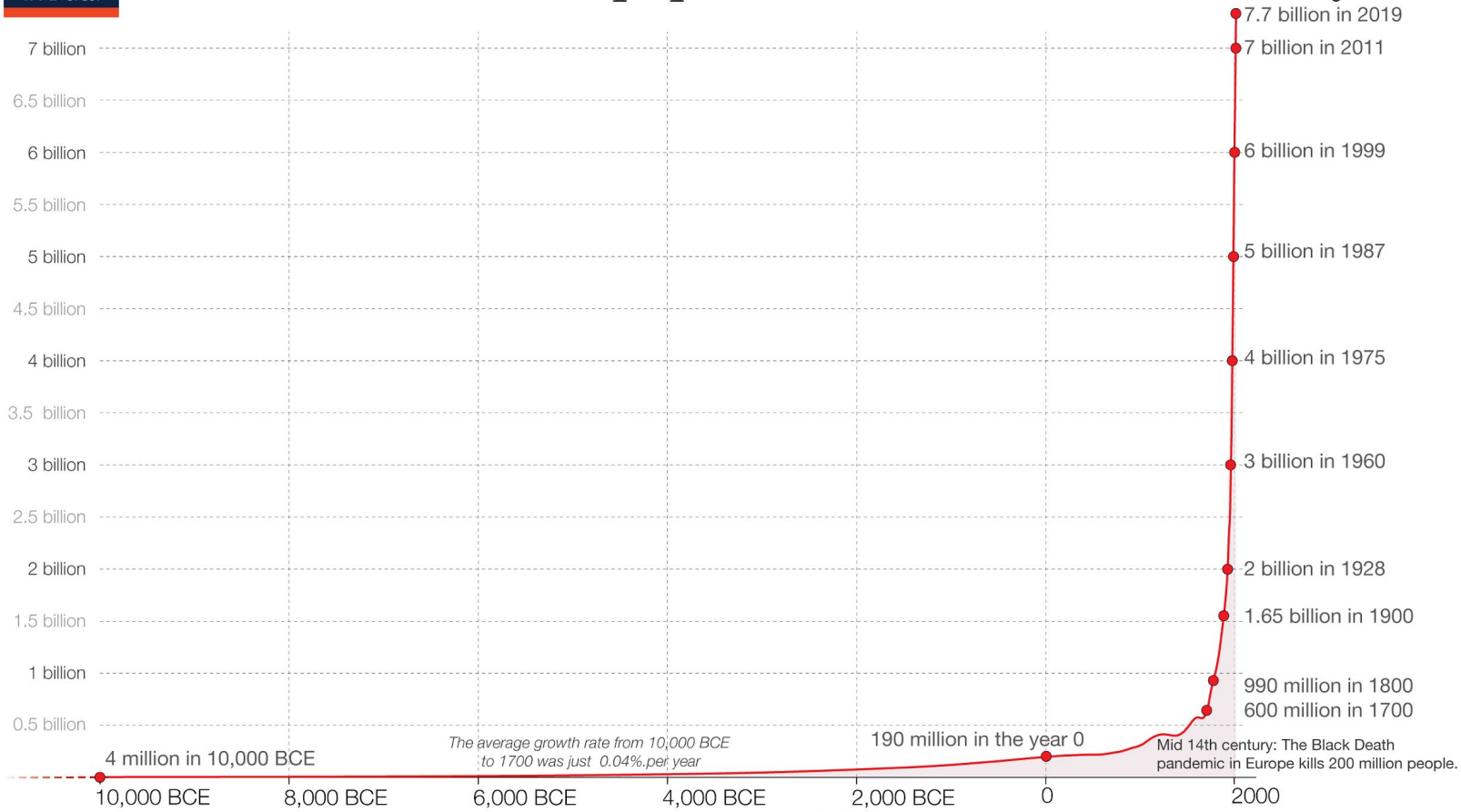
GLOBAL

2° INSTITUTE



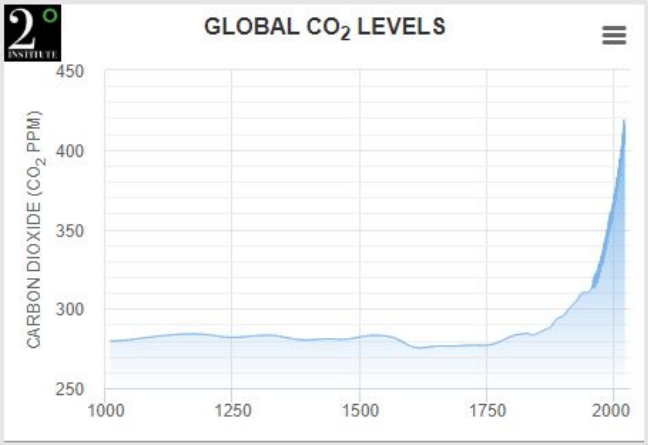
Our World in Data

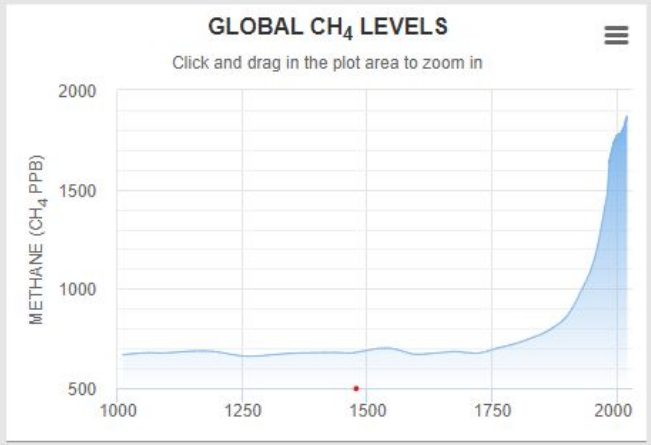
The size of the world population over the last 12.000 years

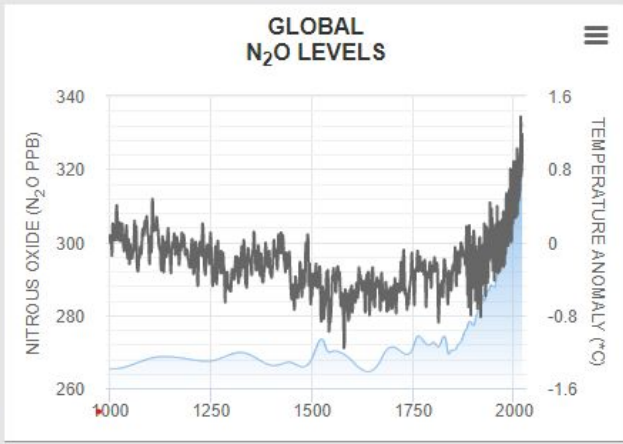


Based on estimates by the *History Database of the Global Environment* (HYDE) and the United Nations. On OurWorldinData.org you can download the annual data.

This is a visualization from OurWorldinData.org, where you find data and research on how the world is changing.

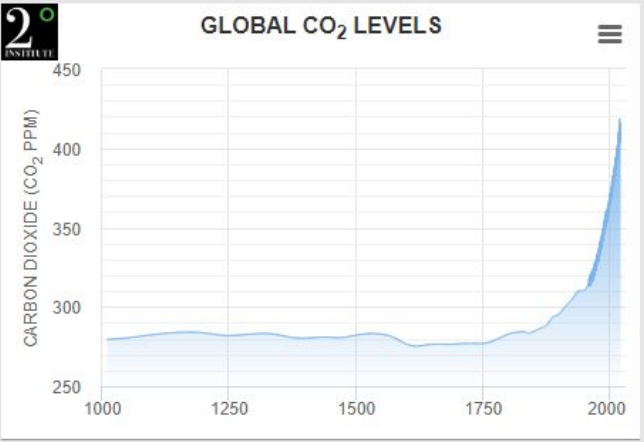

GLOBAL CO_2 LEVELS
CARBON DIOXIDE (CO_2 PPM)
450
400
350
300
250
1000
1250
1500
1750
2000

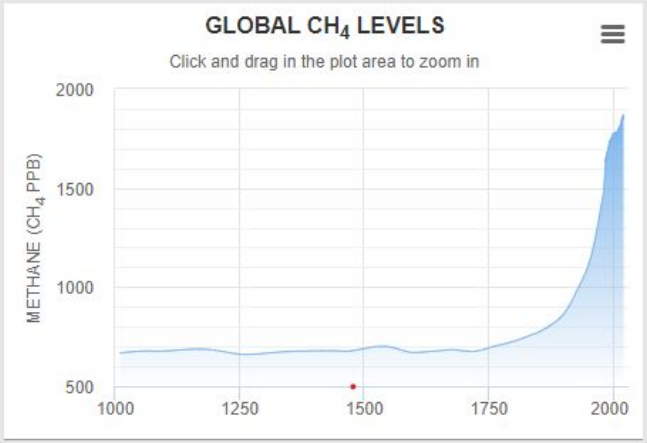

GLOBAL CH_4 LEVELS
Click and drag in the plot area to zoom in
METHANE (CH_4 PPB)
2000
1500
1000
500
1000
1250
1500
1750
2000

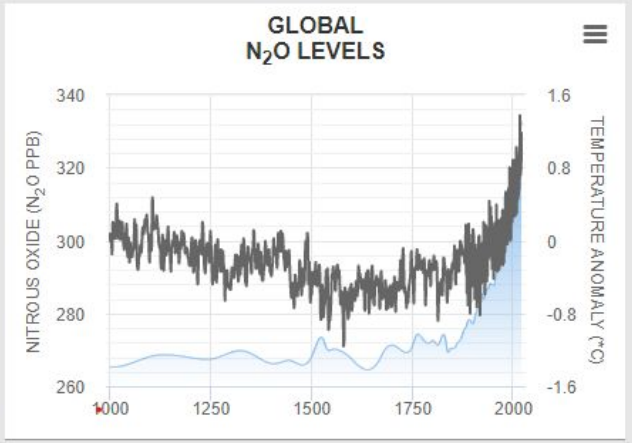

GLOBAL
N_2O LEVELS
NITROUS OXIDE (N_2O PPB)
340
320
300
280
260
TEMPERATURE ANOMALY (°C)
1.6
0.8
0
-0.8
-1.6
1000
1250
1500
1750
2000

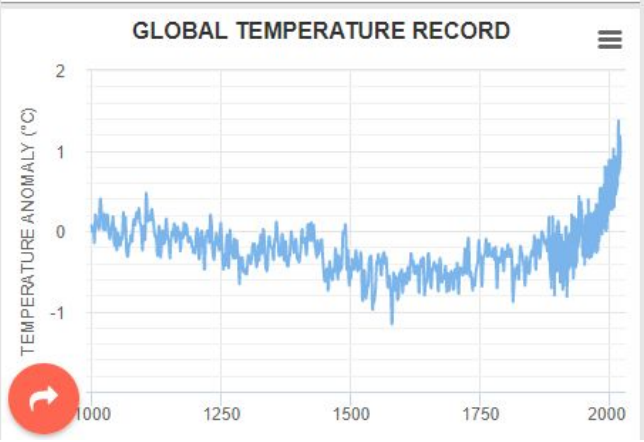
Explaining the Phenomenon

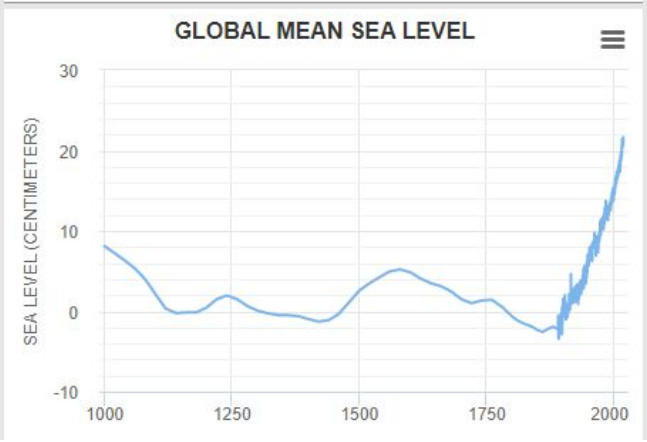
Use evidence to explain how human population, industrialization/human activities, and greenhouse gas emissions support the patterns of global temperature changes.

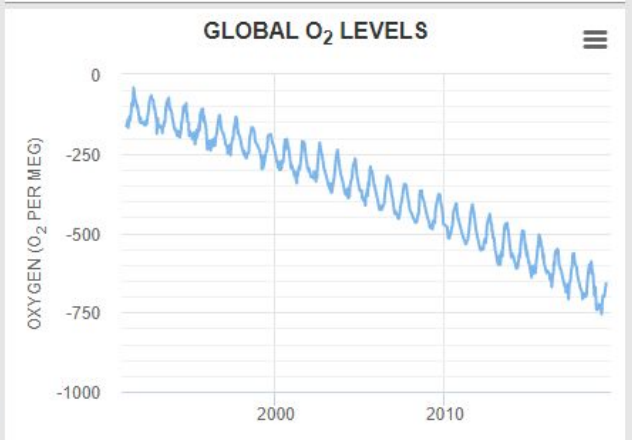

GLOBAL CO_2 LEVELS
CARBON DIOXIDE (CO_2 PPM)
450
400
350
300
250
1000
1250
1500
1750
2000


GLOBAL CH_4 LEVELS
Click and drag in the plot area to zoom in
METHANE (CH_4 PPB)
2000
1500
1000
500
1000
1250
1500
1750
2000


GLOBAL
N_2O LEVELS
NITROUS OXIDE (N_2O PPB)
340
320
300
280
260
TEMPERATURE ANOMALY (°C)
1.6
0.8
0
-0.8
-1.6
1000
1250
1500
1750
2000


GLOBAL TEMPERATURE RECORD
TEMPERATURE ANOMALY (°C)
2
1
0
-1
1000
1250
1500
1750
2000


GLOBAL MEAN SEA LEVEL
SEA LEVEL (CENTIMETERS)
30
20
10
0
-10
1000
1250
1500
1750
2000


GLOBAL O_2 LEVELS
OXYGEN (O_2 PER MEG)
0
-250
-500
-750
-1000
2000
2010

Explaining the Phenomenon

- Simply put: the more people, the more negative human activities/burning of fossil fuels, the more greenhouse gases emitted, and the greater the temperatures.
- Important to note: human activities/industrialization and human population combined increase GHG levels (if we are doing the same activities today, but we had a population like that of 1800, we would not be producing the same levels of greenhouse gases that we are today)

Use evidence to explain why Greenland's ice is melting and sea levels are rising.