

Part 6 Climate Change

Name: _____

Part 6 Lesson 1

AGW= A _____ G _____ W _____

Climate: The average weather of a particular part of the world at different times of the year.
 – Gathered over longer periods of time

Tell me about the atom below. It is important when it comes to climate change.



Name the Major Greenhouse Gases?

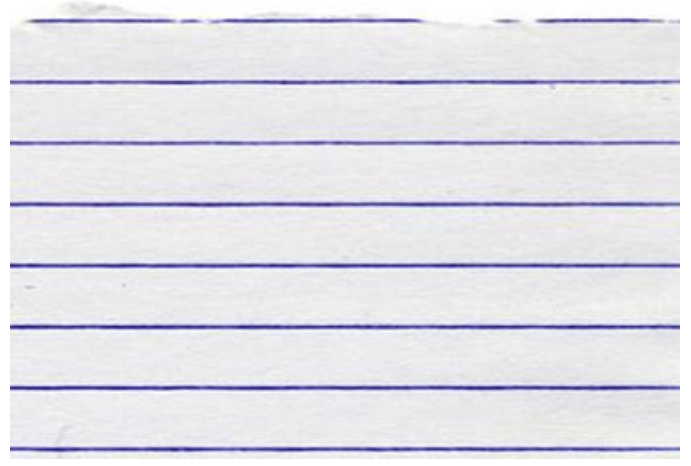
Name this important greenhouse gas that represents around 80% of total greenhouse gas mass, and 90% of the volume. Answer= _____

What are some natural emitters of carbon, and what are some sinks / places carbon is stored on planet earth?

Natural Emitters of Carbon



Natural Sinks of Carbon



Which is not a factor that has caused Earth's climate to change many times?

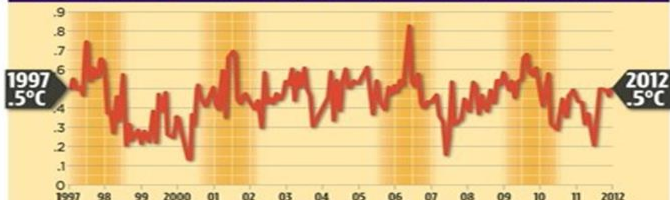
- A.) Changes in the greenhouse effect, which affects the amount of heat retained by Earth's atmosphere.
- B.) Human created climate change.
- C.) Variations in the sun's energy reaching Earth
- D.) Changes in the reflectivity of Earth's atmosphere and surface

Part 6 Lesson 2 Greenhouse Effect

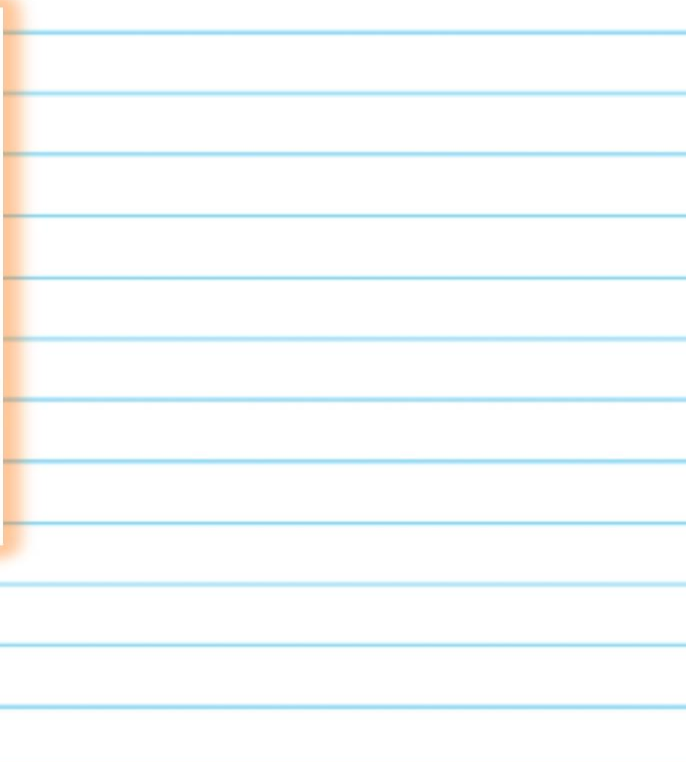
Do sources matter? Explain below.

Global warming stopped 16 years ago, Met Office report reveals

Graph showing tenths of a degree above and below 14C world average



by the Met Office's Hadley Centre and Prof Jones's Climatic Research Unit cuts to carbon-dioxide emissions, predicting a catastrophic increase of up to a further five degrees. Energy Minister, John Hayes, promised that "the high-flown theories of bourgeois Left-wingers

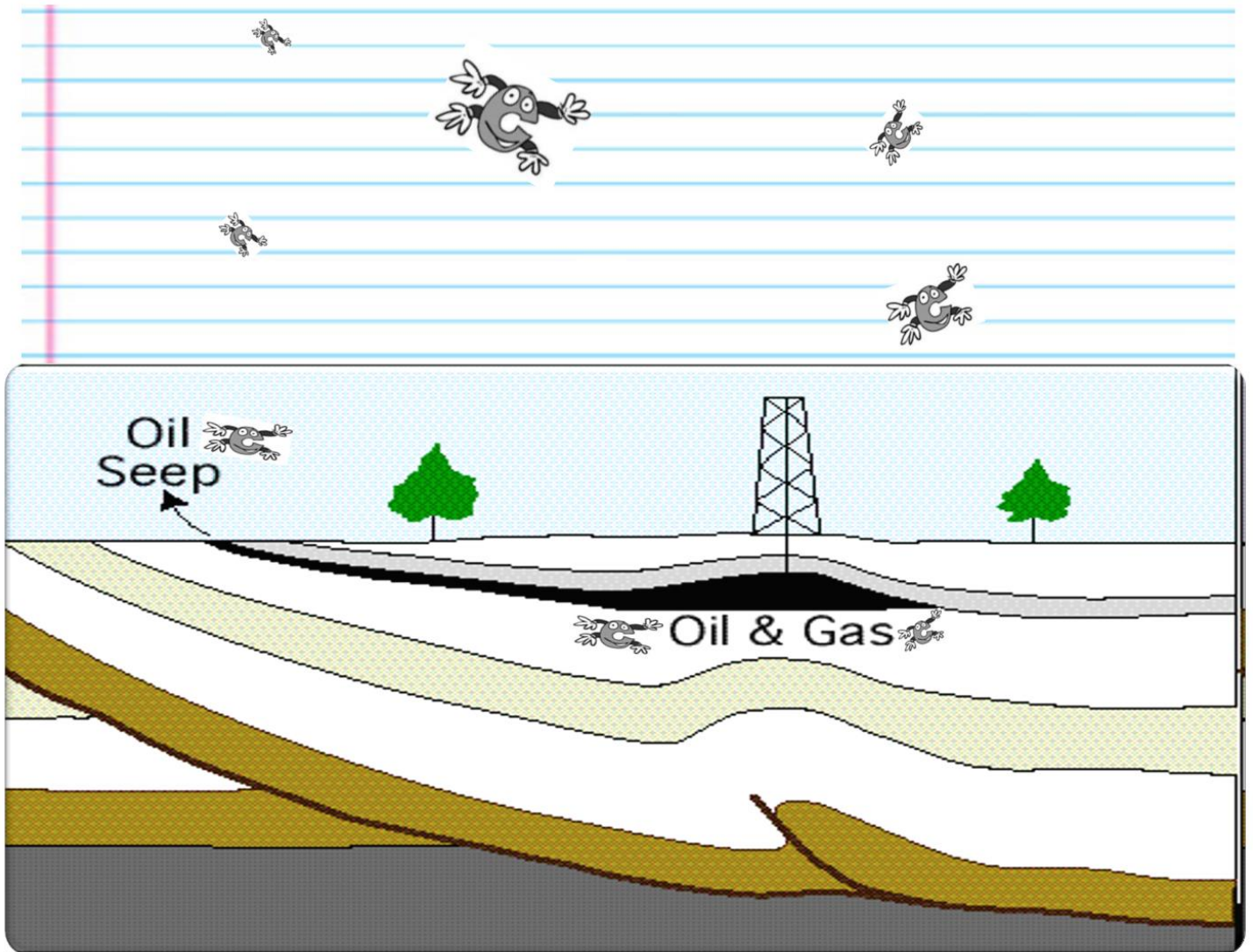


How is this Borrowed Light?

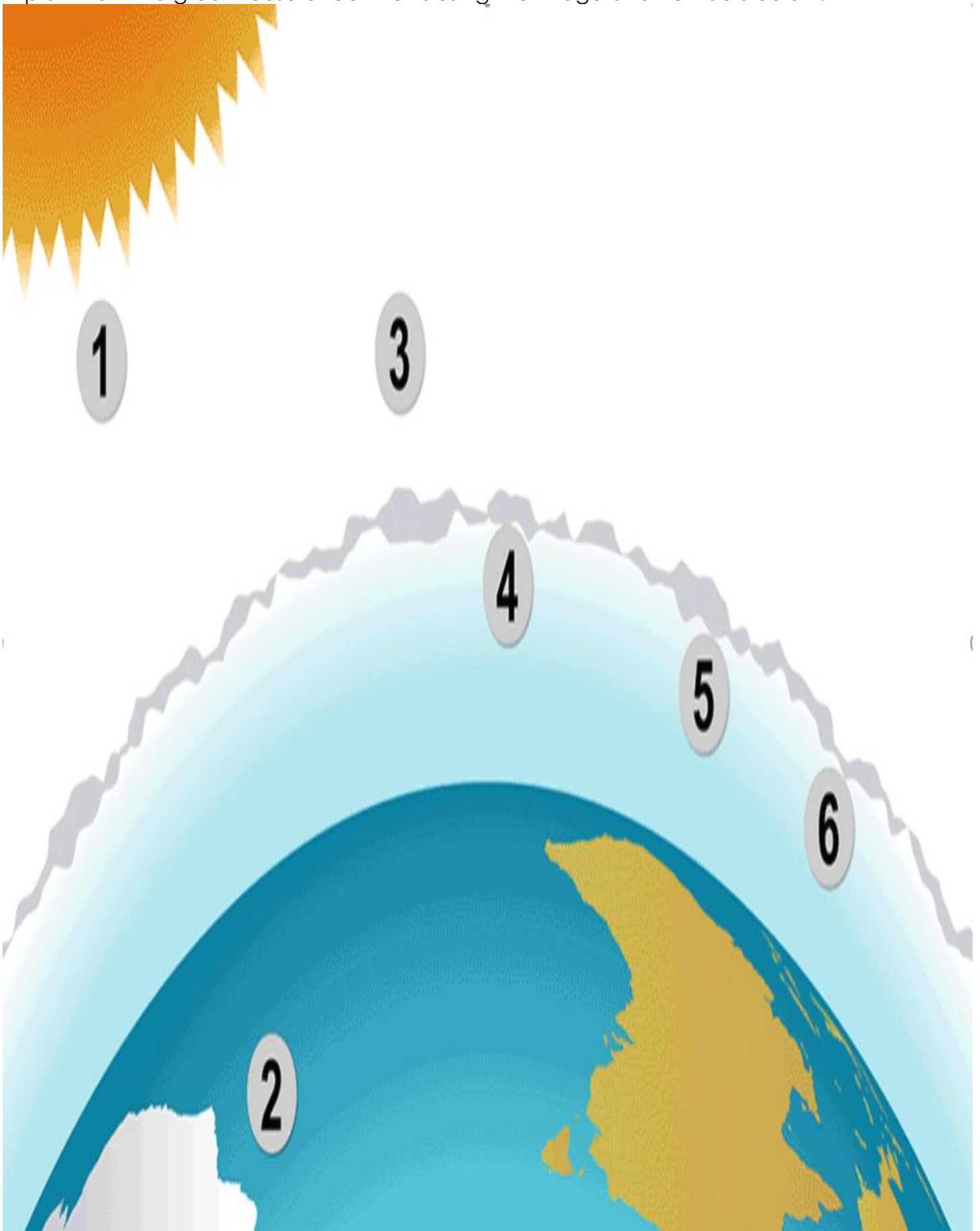


Greenhouse Effect: The Trapping of Earth's _____ at or near the surface

There is a natural carbon dioxide cycle that has been occurring on our planet for millions of years. In the picture below, describe how extra carbon, that has not been in the carbon cycle for the last several million years is getting in.



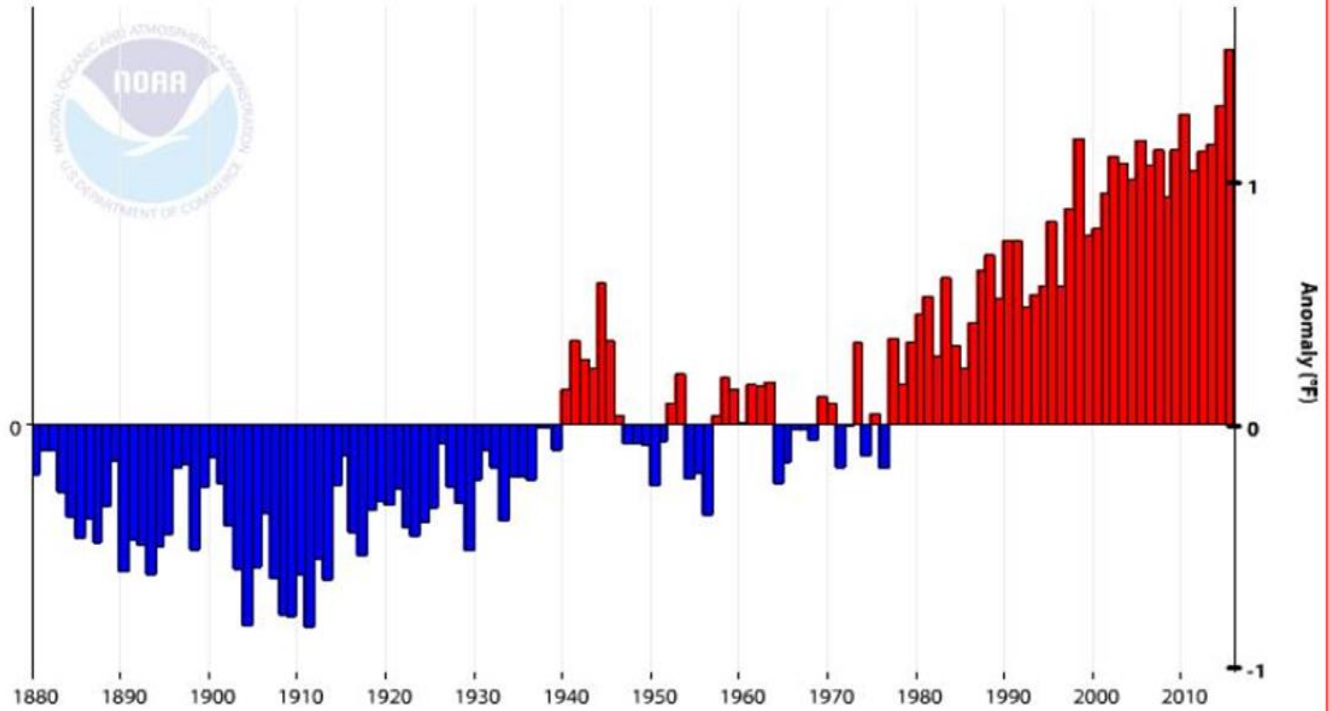
Explain how the greenhouse effect works using the image and numbers below.



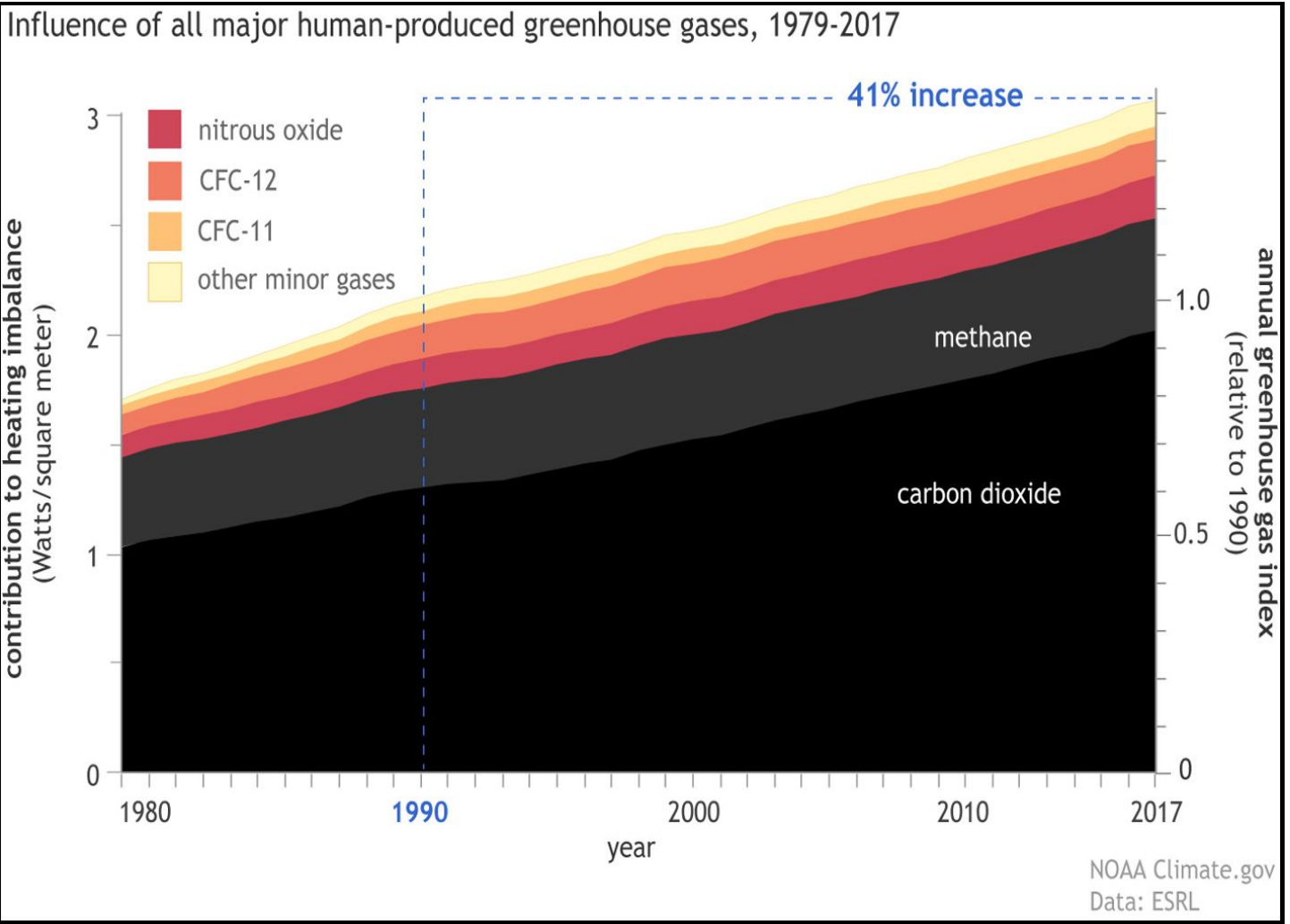
Please describe what each graph shows in a few sentences?

Global Land and Ocean Temperature Departure from 20th Century Average, January-October

Global Land and Ocean Temperature Anomalies, January-October

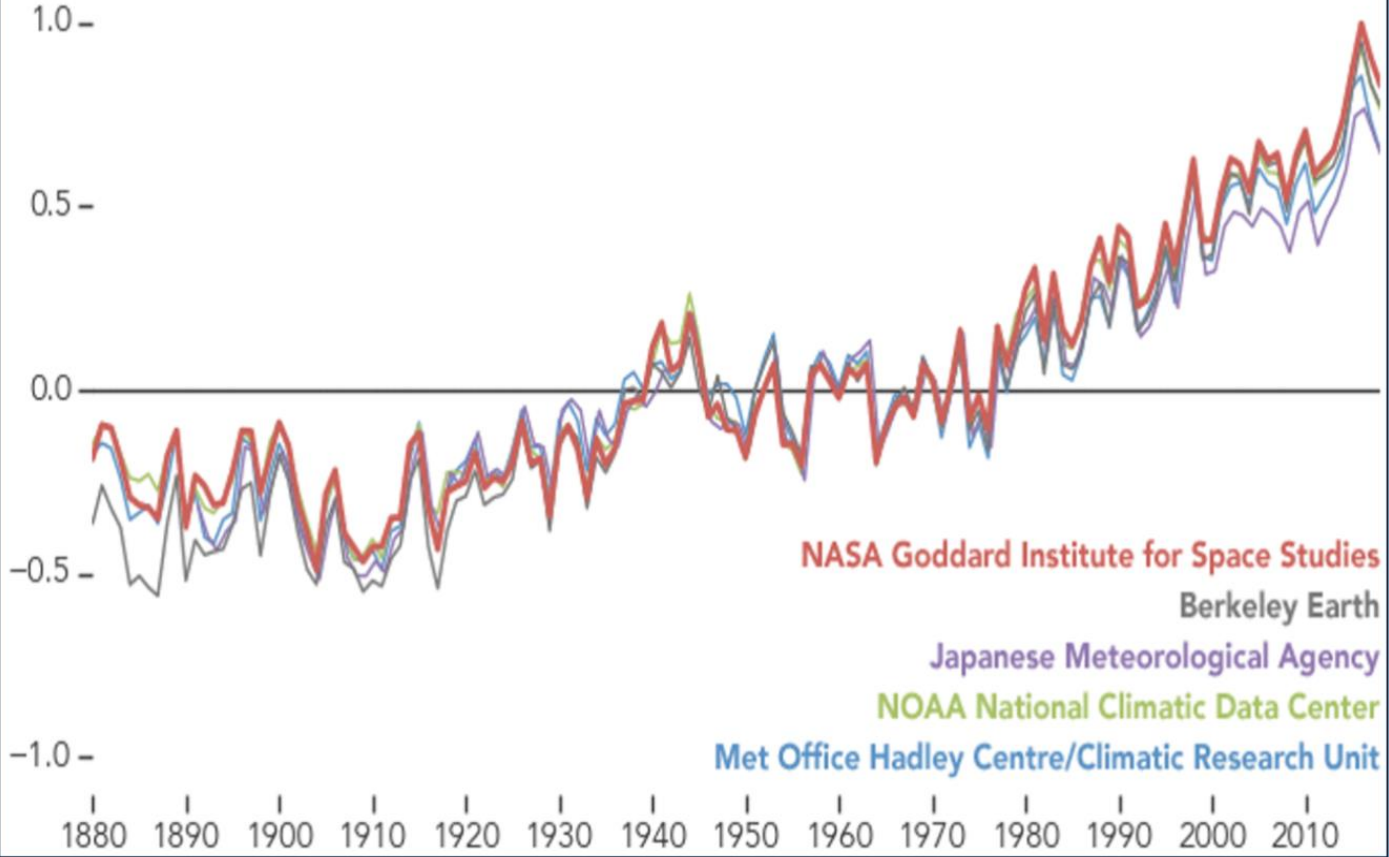


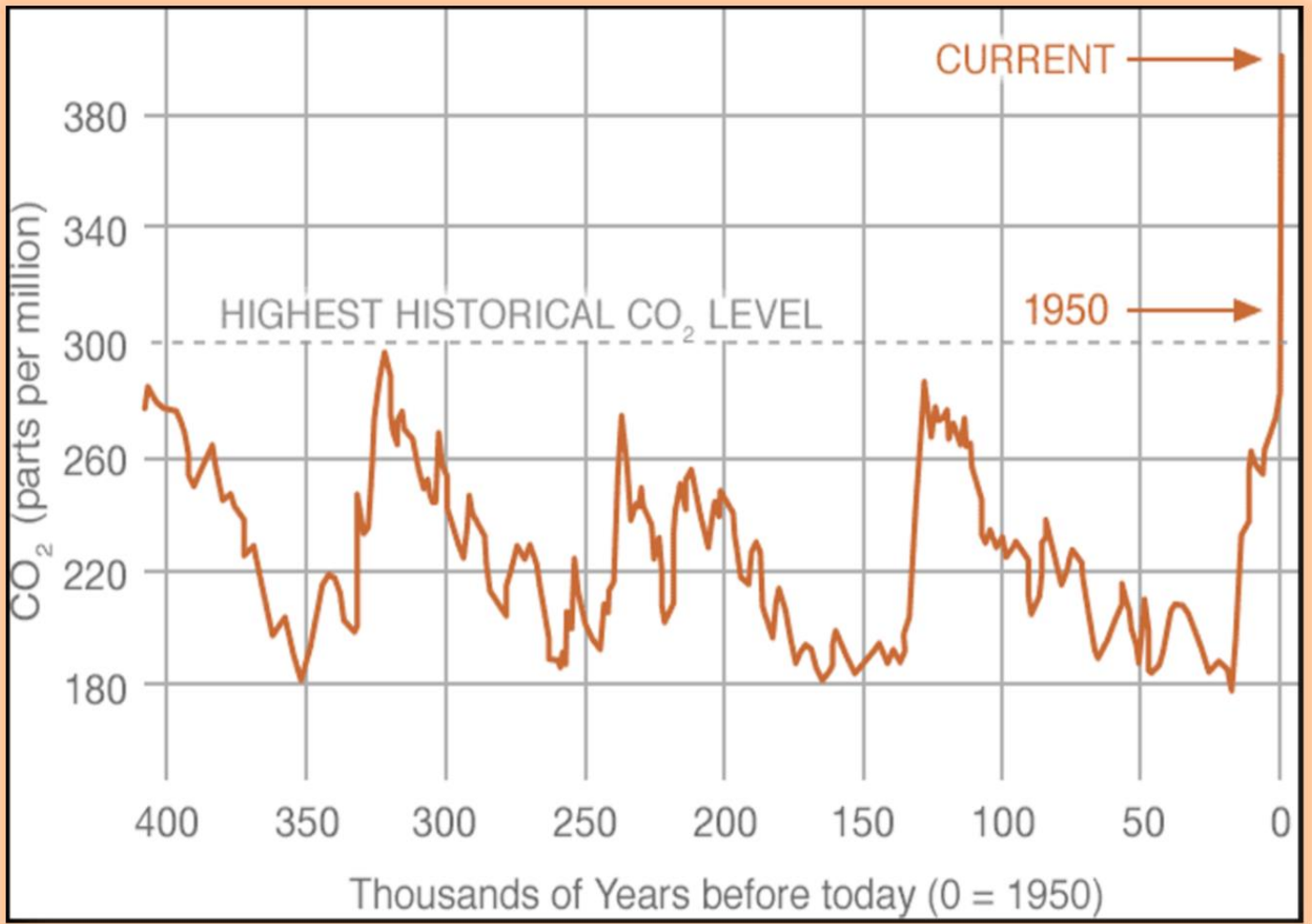
Handwriting practice lines consisting of a vertical pink margin line on the left and horizontal blue lines for writing.



A World of Agreement: Temperatures are Rising

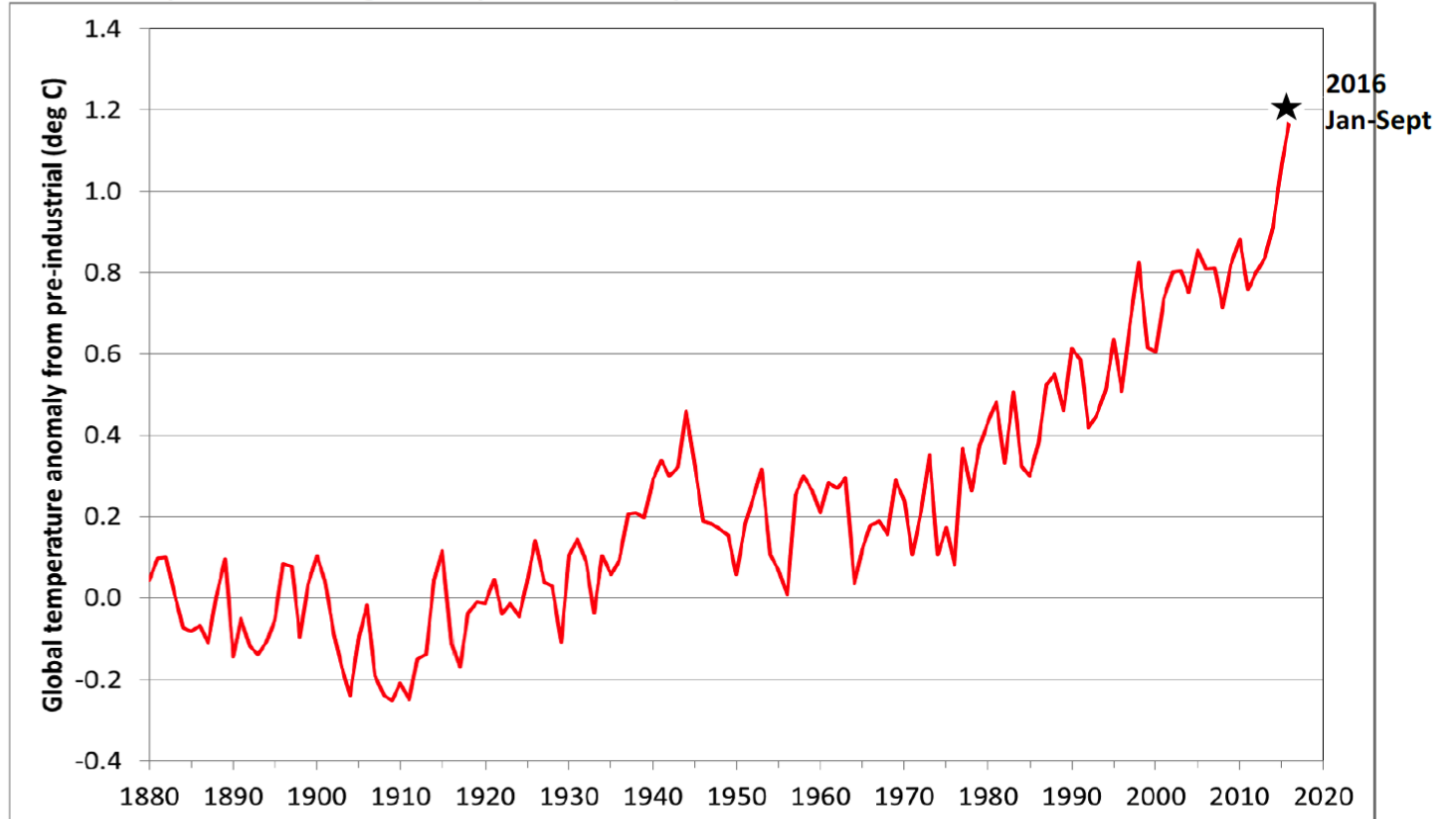
Global Temperature Anomaly (°C)





Use the graph to answer the questions?

Global Temperature change from pre-industrial period



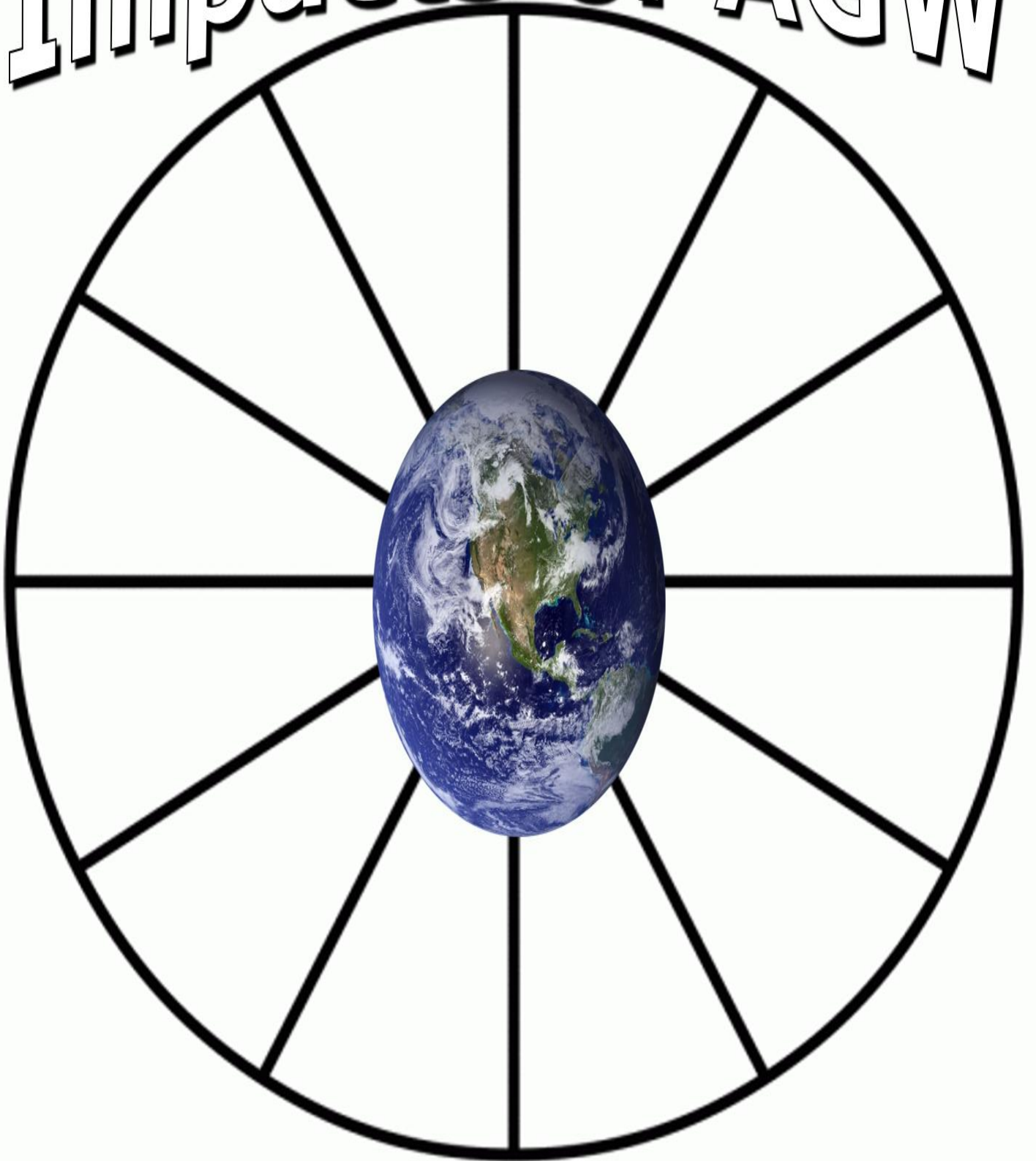
Why does this graph start at the Pre-Industrial Period of 1880? _____

Draw an arrow on the graph to show the overall trend in temperature data from 1880 to present?

What time period was the coldest, and what time period is the warmest from 1880-2016?

Describe the temperature trend from 2010 until present? Is this concerning? _____

Impacts of AGW



Part 6 Lesson 4

Do not forget the difference between weather and climate.

- _____ is what is occurring right now.
- _____ is weather conditions over a long period of time (years).

Use the space below to respond to this climate denier. Use your current understanding of climate change to create an intelligent response.



Cake Activity. Carbon Emissions. Who do we blame?
Was this activity fair?

A set of handwriting practice lines consisting of two vertical red lines on the left and seven horizontal blue lines extending across the page.

How do you feel knowing that our lifestyle in the U.S.A causes the most damage per person in the entire world?

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Should we change our ways?

A set of handwriting practice lines consisting of two vertical red lines on the left and seven horizontal blue lines extending across the page.

Activity! Calculating your carbon footprint.

- How many Earth's would the world need if everyone on the planet lived like you.
- <http://www.footprintnetwork.org/en/index.php/GFN/page/calculators/>

How many Earth's do you require if everyone lived like you? Answer=_____



A series of horizontal blue lines for writing, with a vertical pink margin line on the left side.

ICE ON FIRE

[Ice on Fire](#) | [Documentaries](#) | [HBO](#)

Please watch the movie [Ice on Fire](#) and complete the questions below. If you have any questions than please write them down to be answered at the end of the movie. The movie will run two class periods so plan accordingly.

Who is making this movie, what are their motives, and what are the main messages being said?



What examples are shown in this movie to show that humans are impacting the climate of the planet?

- Images
- Graphs
- Statistics
- Art
- Interviews
- Etc

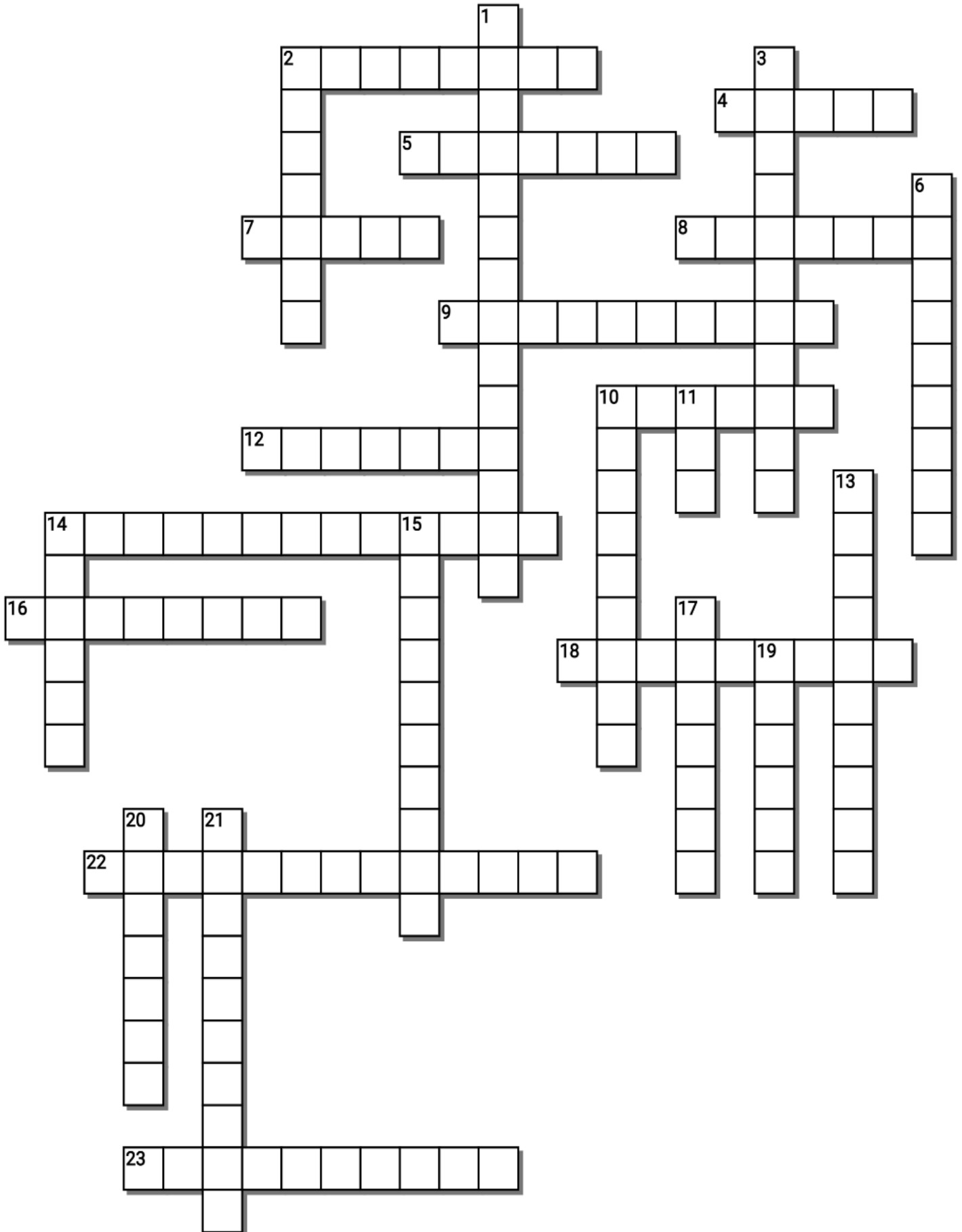
Climate science is a complicated issue. What were some different types of scientists / various branches of science in the video?



What is being done to help reduce and then eventually draw down atmospheric carbon.



One question you have from watching this movie: _____



Across

2. Climate changes causes longer _____ and intense heat waves
4. Example of a Planet with a run away greenhouse effect
5. CH₄
7. _____ vapor is one of the most important elements of the climate system. It's an important greenhouse gas and represents around 80% of total greenhouse gas mass, and 90% of the volume.
8. The average weather of a particular part of the world at different times of the year
9. Since the start of the _____ Revolution, more than 2,000 billion metric tons of carbon dioxide have been added to the atmosphere by human activities.
10. _____ Fuels: Produce large quantities oossil fuelsf carbon dioxide when burned.
12. CO₂ is Carbon _____
14. AGW stands for _____ Global Warming
16. As the planet warms, Heatwaves and drought lead to more intense and more frequent _____ events.
18. As the planet warms, Loss of agricultural land, disease, drought, and sea level rise will have a negative impact on the global _____ markets.
22. Some future options include carbon _____ that collects CO₂ and stores it back in the ground.
23. _____ Effect: the trapping of the sun's warmth in a planet's lower atmosphere, due to the greater transparency of the atmosphere to visible radiation from the sun than to infrared radiation emitted from the planet's surface.

Down

1. During the process of _____, cells use carbon dioxide and energy from the Sun to make sugar molecules and oxygen.
2. As the planet warms, _____ carrying insects migrate north, bringing plague and their diseases with them.
3. During cellular _____, glucose and oxygen are changed into energy and carbon dioxide. Therefore, carbon dioxide is released into the atmosphere during the process of cellular respiration
6. _____ energy is useful energy that is collected from renewable resources, which are naturally replenished on a human timescale, including carbon neutral sources like sunlight, wind, rain, tides, waves, and geothermal heat
10. Carbon _____: the amount of carbon dioxide and other carbon compounds emitted due to the consumption of fossil fuels by a particular person, group, etc.
11. As the planet warms, polar Ice Caps Melt and _____ Level Rise.
13. As the planet warms, the _____ is melting. The carbon (CH₄) locked in the soil is being released into the atmosphere through decay. Methane is 25 times more potent than CO₂
14. As more CO₂ is pumped int oteh air, The oceans also become more _____ with increased carbon dioxide levels
15. As the planet warms, Rapid _____ changes occur
17. Global _____ usually refers to human-induced warming of the Earth system, whereas climate change can refer to natural as well as anthropogenic change. The two terms are often used interchangeably.
19. An atom that likes to bond to a lot of other atoms. It's the atom at the heart of AGW.
20. The state of the atmosphere that is occurring right now
21. As the planet warms, the intensity and frequency of large h_____ has increased.

Part 6 REVIEW GAME

Name: _____

Due: Today

1-20 = 5 pts

Part 6 Lesson 5

*20-*25 * = Bonus + 1 pt,

(Secretly write owl in correct space +1 pt)

Score ____ / 100

Final Question = 5 pt wager

BIG BLUE	MALL LIKE YOU	LET'S DROP	CLOUDED JUDGEMENT	PUFF BALL Bonus round 1pt each
1)	6)	11)	16)	*21)
2)	7)	12)	17)	*22)
3)	8)	13)	18)	*23)
4)	9)	14)	19)	*24)
5)	10)	15)	20)	*25)

Final Question Wager ____ /5 Answer: _____

Part 6 Climate Change

Name:

Due:

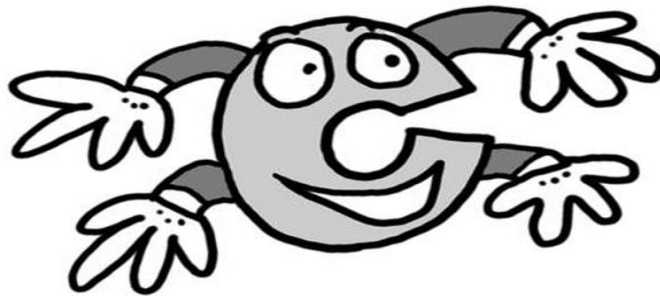
Part 6 Lesson 1

AGW= Anthropogenic Global Warming

Climate: The average weather of a particular part of the world at different times of the year.
– Gathered over longer periods of time

Tell me about the atom below. It is important when it comes to climate change.

As carbon compounds move throughout the Geosphere and Biosphere, they undergo many different chemical changes. When fossil fuels burn, we mostly get three things: heat, water, and CO₂. CO₂ is a greenhouse gas. That means CO₂ in the atmosphere works to trap heat close to Earth. It helps Earth to hold on to some of the energy it gets from the Sun so the energy doesn't all leak back out into space. O₂ and other greenhouse gases are good—up to a point. But CO₂ is so good at holding in heat from the Sun, that even a small increase in CO₂ in the atmosphere can cause Earth to get even warmer which is called climate change



Name the Major Greenhouse Gases?

Water Vapor

Carbon Dioxide

Methane

Nitrous Oxides and Fluorinated Gases

What are some natural emitters of carbon, and what are some sinks / places carbon is stored on planet earth?

Natural Emitters of Carbon	Natural Sinks of Carbon
Oceans Forests Lakes Streams Volcanoes Fires Soil	Oceans Forests Lakes Soil

Which is not a factor that has caused Earth's climate to change many times?

A.) Changes in the greenhouse effect, which affects the amount of heat retained by Earth's atmosphere.

B.) Human created climate change.


C.) Variations in the sun's energy reaching Earth

D.) Changes in the reflectivity of Earth's atmosphere and surface

Part 6 Lesson 2 Greenhouse Effect

Do sources matter? Explain below.

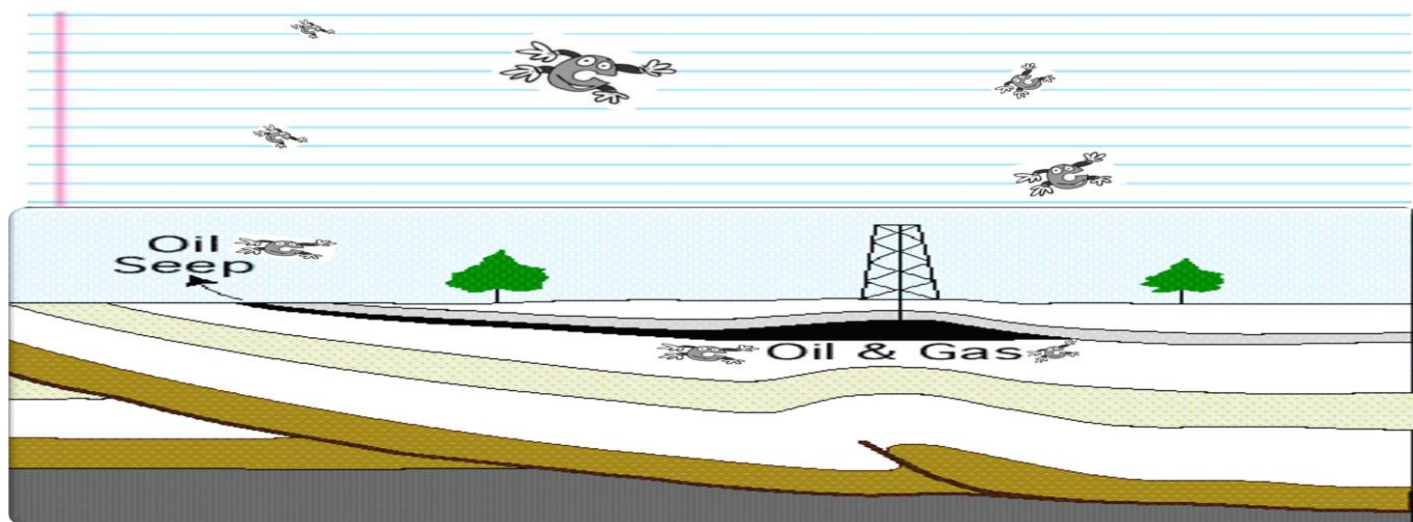
Sources do matter. The sources for correct information should be peer reviewed articles. Peer-reviewed / scholarly articles are written by experts and are reviewed by several other experts in the field before the article is published. This ensure the article's quality and makes the article more likely to be scientifically valid / reach a conclusion.

<p>How is this Borrowed Light?</p> 	<p>Oil, Coal, and Natural Gas (Fossil Fuels) are the remains of plants and animals from hundreds of millions of years ago. We found a way to use light from millions of years ago, thus borrowed light.</p>
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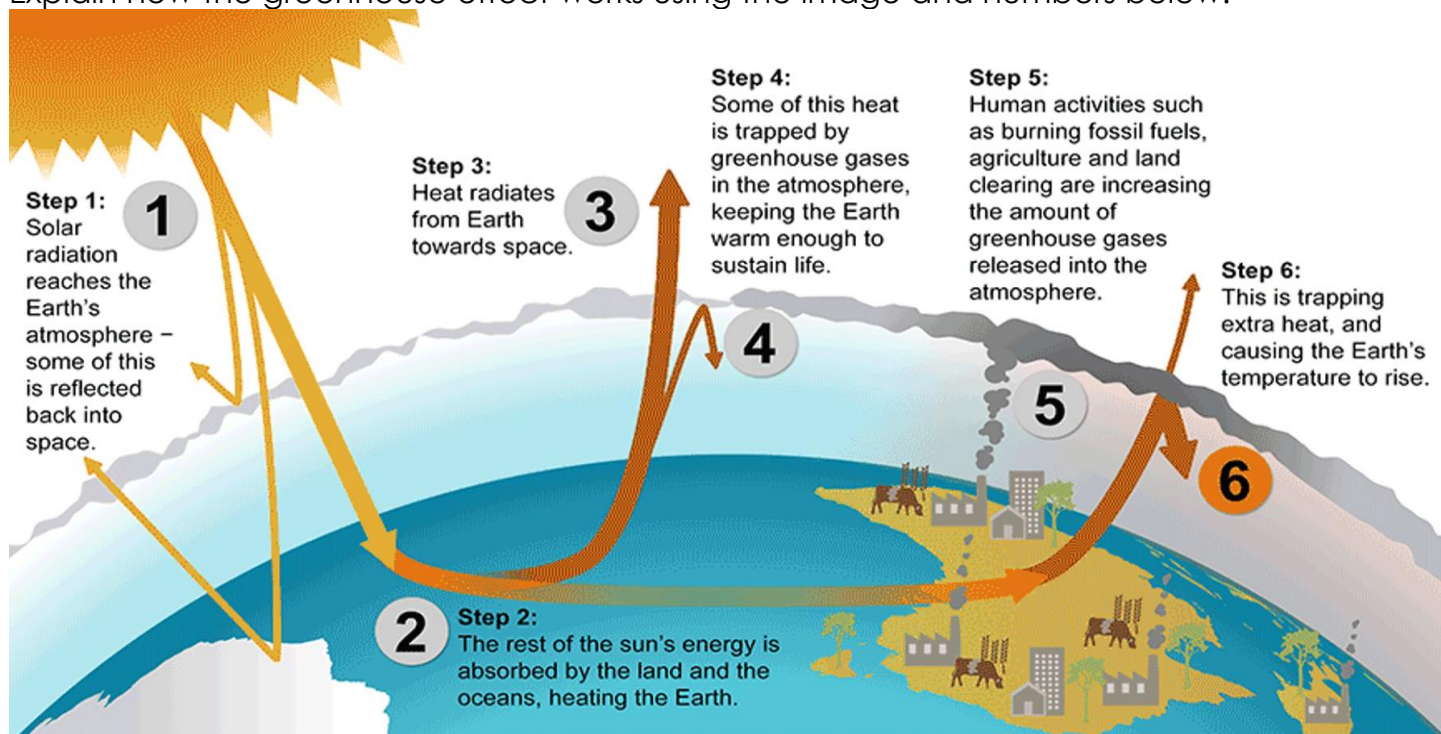
Greenhouse Effect: The Trapping of Earth's heat at or near the surface

There is a natural carbon dioxide cycle that has been occurring on our planet for millions of years. In the picture below, describe how extra carbon, that has not been in the carbon cycle for the last several million years is getting in.

The Carbon in this picture was trapped / locked away and out of the natural Carbon Cycle on Earth. When humans go underground and collect this Carbon (Oil, Gas, Coal), they burn it for energy. That Carbon attaches to Oxygen to become Carbon Dioxide. This new Carbon is now in the atmosphere and can warm the planet. It's extra Carbon being added to the Carbon Cycle, and it is causing the planet to warm.



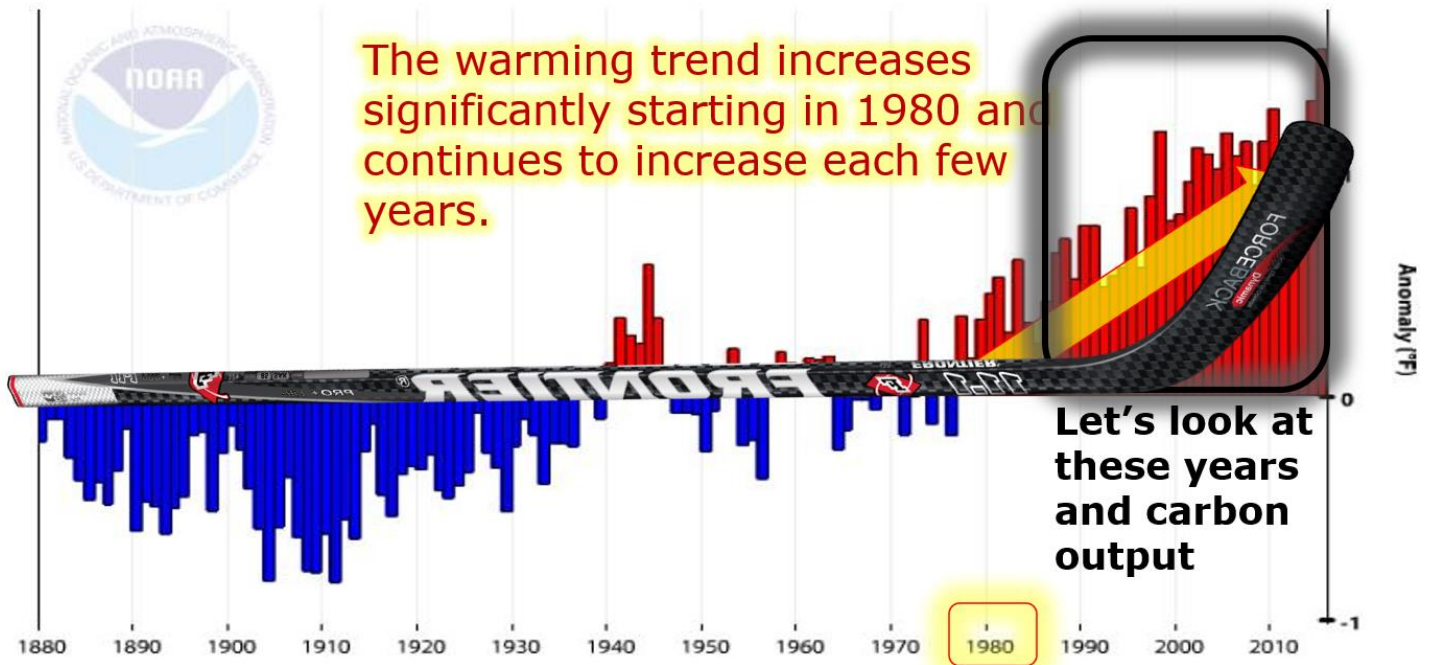
Explain how the greenhouse effect works using the image and numbers below.



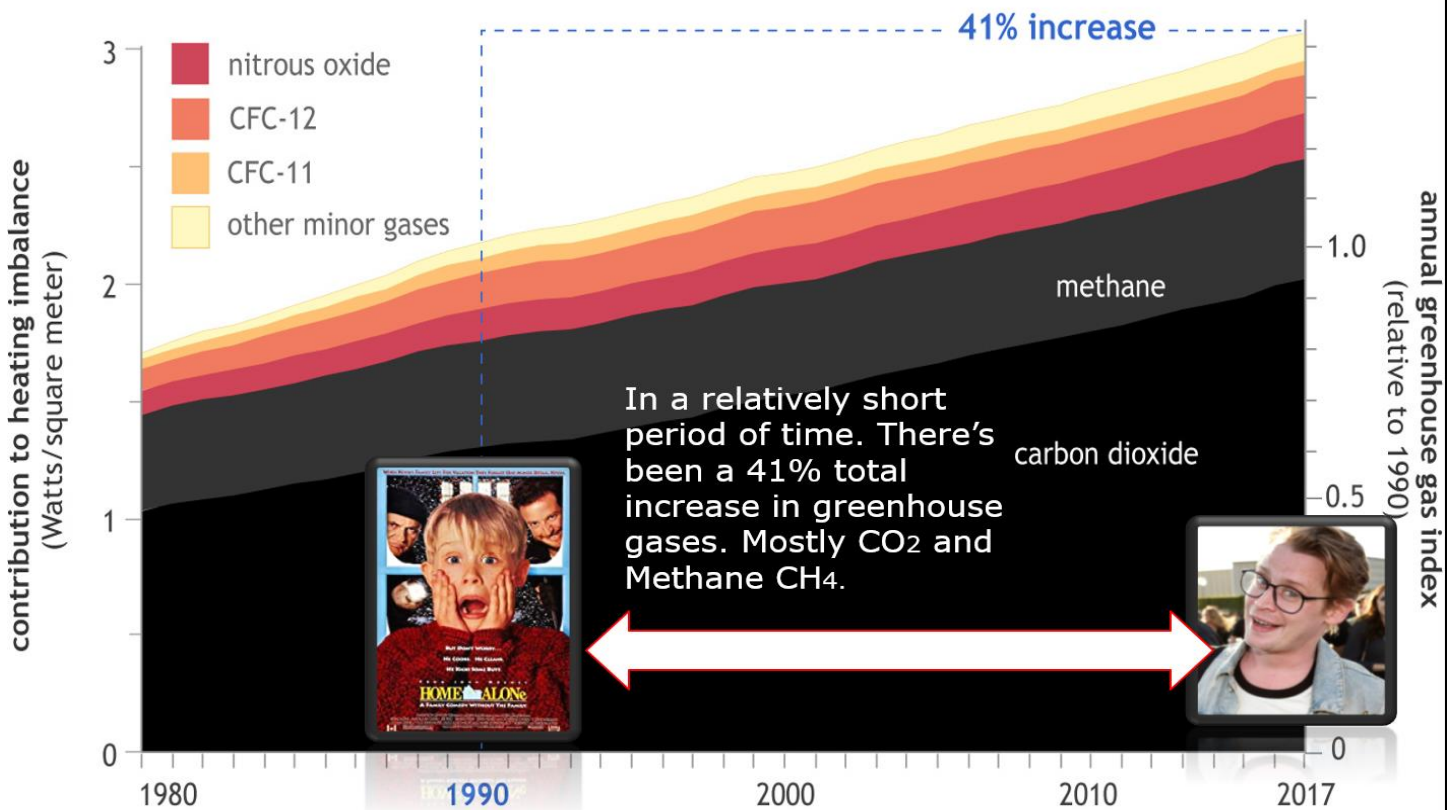
Please describe what each graph shows in a few sentences?

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Global Land and Ocean Temperature Anomalies, January-October

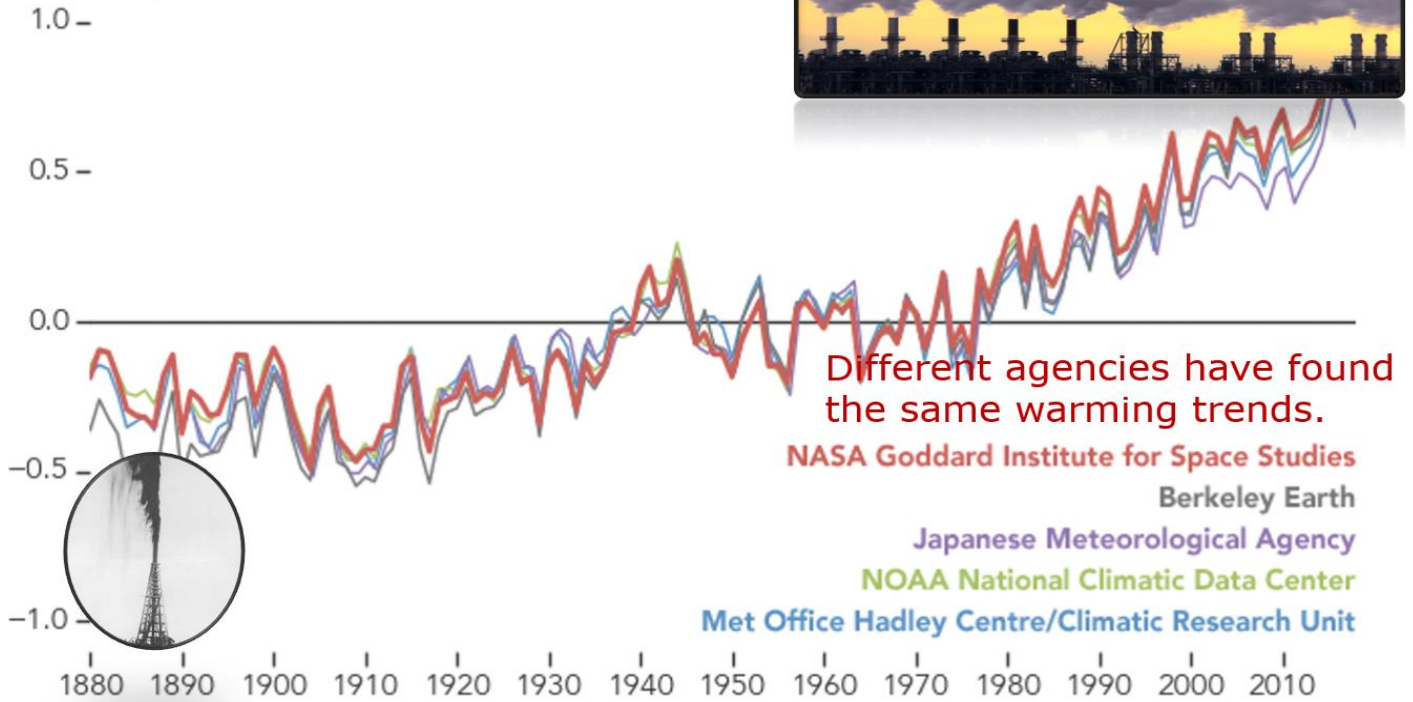


Influence of all major human-produced greenhouse gases, 1979-2017



A World of Agreement: Temperatures are Rising

Global Temperature Anomaly (°C)



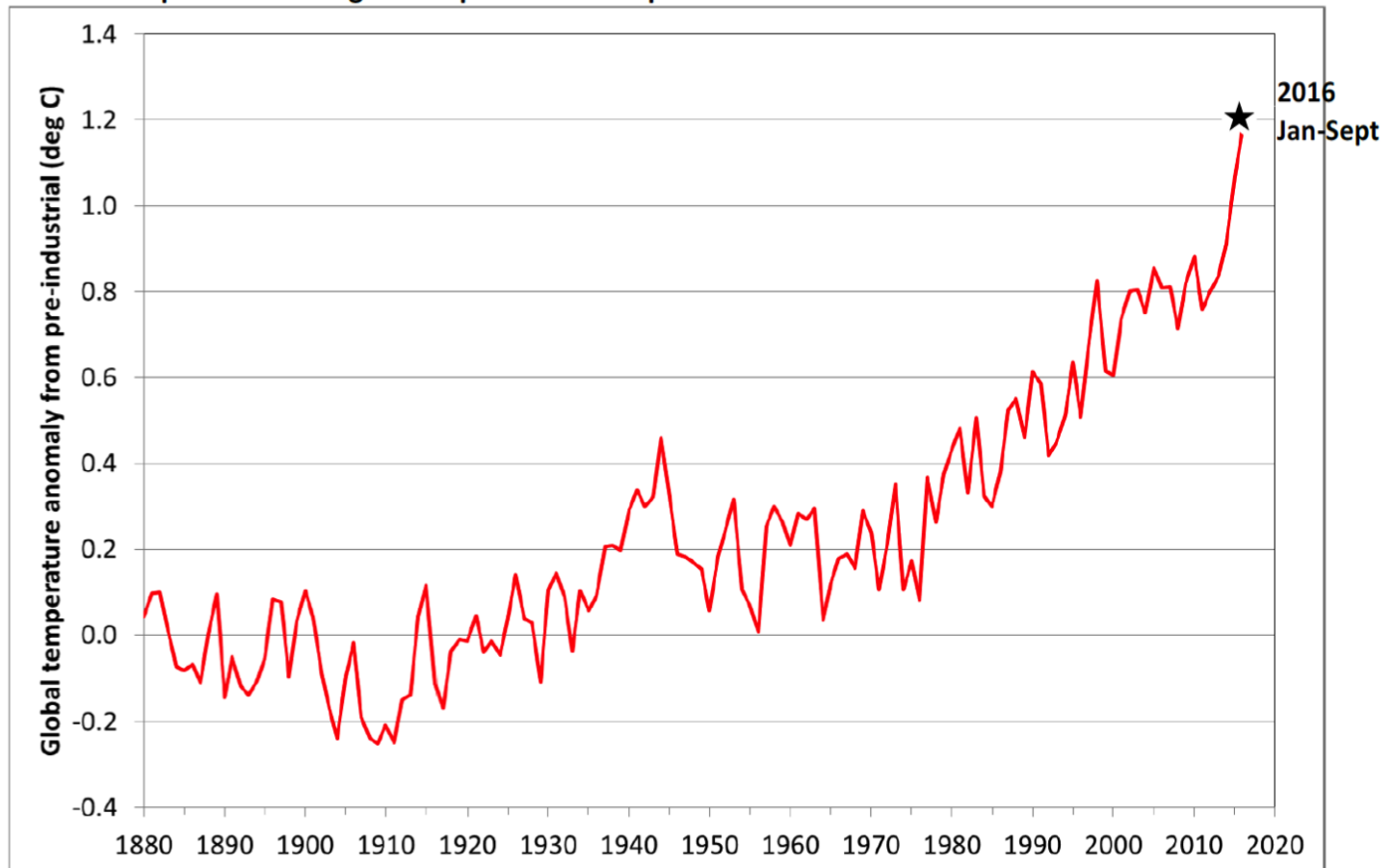
Different agencies have found the same warming trends.

- NASA Goddard Institute for Space Studies
- Berkeley Earth
- Japanese Meteorological Agency
- NOAA National Climatic Data Center
- Met Office Hadley Centre/Climatic Research Unit



Use the graph to answer the questions?

Global Temperature change from pre-industrial period



Why does this graph start at the Pre-Industrial Period of 1880? That's when humans first started using fossil fuels at an industrial level. This is the time when new Carbon that was locked away underground has been burned for energy.

Draw an arrow on the graph to show the overall trend in temperature data from 1880 to present? The Arrow should follow the upward trend starting in the 1970's

What time period was the coldest, and what time period is the warmest from 1880-2016? Warmest 2012-2016, Coldest 1910-1912

Describe the temperature trend from 2010 until present? Is this concerning? The trend from 2010 to present is extremely alarming. The warming trend goes from .8 degrees in 2010 to almost 1.2 degrees in 2016. This follows the hockey model where global climate is rising rapidly.

Part 6 Lesson 3

Impacts of AGW



Part 6 Lesson 4

Do not forget the difference between weather and climate.

- **Weather** is what is occurring right now.
- **Climate** is weather conditions over a long period of time (years).

Use the space below to respond to this climate denier. Use your current understanding of climate change to create an intelligent response.

Scientific evidence for warming of the climate system is unequivocal.

- Intergovernmental Panel on Climate Change

Any information from this website could be used to write a paragraph describing how the planet is getting warmer from human activities.

<https://climate.nasa.gov/evidence/>

Cake Activity. Carbon Emissions. Who do we blame?

Was this activity fair?

In this Activity, The United States gets the largest slice of the Carbon Cake. Asia actually has the largest slice, but they have much more people. For the most carbon use per person on the planet, The United States unfortunately takes the cake.

How do you feel knowing that our lifestyle in the U.S.A causes the most damage per person in the entire world?

This is a self-reflection piece so answers will vary.

Should we change our ways?

The United States and the world will need to change our ways and do it very quickly. The changes that need to be made are everywhere. We cannot continue to emit and use Carbon in the way that we've been doing it. If we do nothing, the impacts to our behavior on our planet and our livelihood will be catastrophic.

Activity! Calculating your carbon footprint.

- How many Earth's would the world need if everyone on the planet lived like you.
- <http://www.footprintnetwork.org/en/index.php/GFN/page/calculators/>

How many Earth's do you require if everyone lived like you? Answer=_____

Part 6 Lesson 4

Solutions

Forego Fossil Fuels—The first challenge is eliminating the burning of coal, oil and, eventually, natural gas.

Infrastructure Upgrade—Buildings worldwide contribute around one third of all greenhouse gas emissions (43 percent in the U.S. alone), even though investing in thicker insulation and other cost-effective, temperature-regulating steps can save money in the long run.

Move Closer to Work: One way to dramatically curtail transportation fuel needs is to move closer to work, use mass transit, or switch to walking, cycling or some other mode of transport that does not require anything other than human energy.

Consume Less—The easiest way to cut back on greenhouse gas emissions is simply to buy less stuff.

Be Efficient—A potentially simpler and even bigger impact can be made by doing more with less. Citizens of many developed countries are profligate wasters of energy, whether by speeding in a gas-guzzling sport-utility vehicle or leaving the lights on when not in a room.

Eat Smart, Go Vegetarian?—Corn grown in the U.S. requires barrels of oil for the fertilizer to grow it and the diesel fuel to harvest and transport it. Some grocery stores stock organic produce that do not require such fertilizers, but it is often shipped from halfway across the globe. And meat, whether beef, chicken or pork, requires pounds of feed to produce a pound of protein.

Stop Cutting Down Trees—Every year, 33 million acres of forests are cut down. Timber harvesting in the tropics alone contributes 1.5 billion metric tons of carbon to the atmosphere. That represents 20 percent of human-made greenhouse gas emissions and a source that could be avoided relatively easily.

Unplug—Believe it or not, U.S. citizens spend more money on electricity to power devices when off than when on. Televisions, stereo equipment, computers, battery chargers and a

host of other gadgets and appliances consume more energy when seemingly switched off, so unplug them instead.

One Child—There are at least 6.6 billion people living today, a number that is predicted by the United Nations to grow to at least nine billion by mid-century. The U.N. Environmental Program estimates that it requires 54 acres to sustain an average human being today—food, clothing and other resources extracted from the planet. Continuing such population growth seems unsustainable.

Future Fuels—Replacing fossil fuels may prove the great challenge of the 21st century. Many contenders exist, ranging from ethanol derived from crops to hydrogen electrolyzed out of water, but all of them have some drawbacks, too, and none are immediately available at the scale needed.

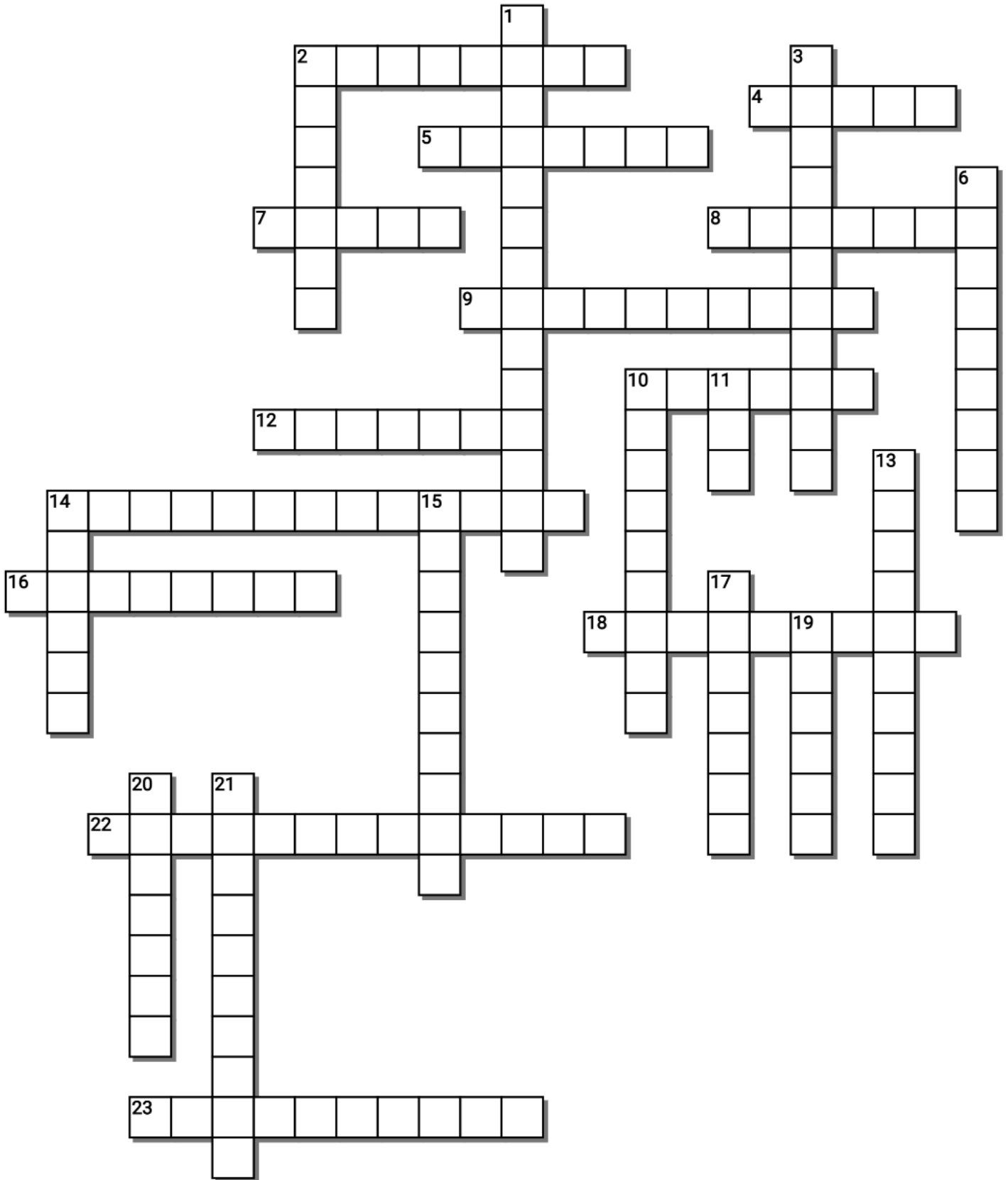
Experiment Earth—Climate change represents humanity's first planetwide experiment. But, if all else fails, it may not be the last. So-called geoengineering, radical interventions to either block sunlight or reduce greenhouse gases, is a potential last resort for addressing the challenge of climate change.

ICE ON FIRE

[Ice on Fire](#) | [Documentaries](#) | [HBO](#)

Please watch the movie [Ice on Fire](#) and complete the questions below. If you have any questions than please write them down to be answered at the end of the movie. The movie will run two class periods so plan accordingly.

<p>Who is making this movie, what are their motives, and what are the main messages being said?</p> <p>About Ice on Fire Documentaries HBO. Produced by Oscar-winner Leonardo DiCaprio, George DiCaprio and Mathew Schmid and directed by Leila Conners, Ice on Fire is an eye-opening documentary that focuses on many never-before-seen solutions designed to slow down our escalating environmental crisis. The main message is that we need to change who we are and how we treat the environment very quickly or we and the biosphere are in trouble.</p>	<p>What examples are shown in this movie to show that humans are impacting the climate of the planet?</p> <ul style="list-style-type: none"> -Images Lots of images are used to provoke emotion and back up messages -Graphs -Graphs are used to show accelerated warming -Statistics – Statistics are shown to back up imagery and messages of a declining planet -Art Is used, with technology to depict a better future -Interviews – World leaders and leading environmental leaders provide testimony -Etc
<p>Climate science is a complicated issue. What were some different types of scientists / various branches of science in the video? In order to understand climate change you need lots of different types of scientists. This is not just about the climate and weather. You also need geo scientists, historians, physics, ocean scientists and all the branches of science and world leaders working together.</p>	<p>What is being done to help reduce and then eventually draw down atmospheric carbon. Lot is being done but so much more still needs to occur. Solutions are presented at the end. The good news, this is not a technological problem. This is a cultural problem and when we want to change the solutions are ready to implement. We just need people to change.</p>



Across

2. Climate changes causes longer _____ and intense heat waves
4. Example of a Planet with a run away greenhouse effect
5. CH₄
7. _____ vapor is one of the most important elements of the climate system. It's an important greenhouse gas and represents around 80% of total greenhouse gas mass, and 90% of the volume.
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19. An atom that likes to bond to a lot of other atoms. It's the atom at the heart of AGW.
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Part 6 REVIEW GAME

1-20 = 5 pts

Part 6 Lesson 5

*20-*25 * = Bonus + 1 pt,

(Secretly write owl in correct space +1 pt)

Final Question = 5 pt wager

Name:

Due: Today

Score ____ / 100

BIG BLUE	MALL LIKE YOU	LET'S DROP	CLOUDED JUDGEMENT	PUFF BALL Bonus round 1pt each
1) Letter C	6) PEER REVIEWED	11) A SIGNIFICANT WARMING TREND	16) SEA LEVEL RISE	*21) BRUCE LEE
2) A= Climate B= Weather	7) FOSSIL FUELS	12) GLACIERS	17) USA, CHINA, INDIA, RUSSIA	*22) THE PHOENIX
3) Carbon Dioxide Water Vapor Methane Nitrous Oxides Fluorinated Gases	8) THE GREENHOUSE EFFECT	13) LETTER D RAPID ECOLOGICAL CHANGE	18) CARBON SEQUESTRATION	*23) THE HUNGER GAMES
4) Positive Feedback Loop	9) TRUE	14) ACIDIC	19) CARBON FOOTPRINT	*24) THE CALGARY FLAMES
5) Natural Sink Forests, Ocean, Lakes and Streams CO2 Natural emitters, Fires, Volcanoes	10) ICE CORE	15) PERMAFROST	20) FALSE	*25) THE MIAMI HEAT

Final Question Wager ____ /5 Answer: **METHANE GAS**

