



Climate Change Lesson 1: *The Solve*

Student Guide Live Video Phenomenon

Part 1: The Phenomena

Either on your own, in a small group, or as a class (your teacher will let you know), watch the video clips.

Watch each video. As you watch, write down observations and your reactions to each video.

[Video Clip 1](#): Mendenhall Glacier

[Video Clip 2](#): Polar Bear in Danger

Video 1:	Video 2:
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How do you think these videos are related? Jot down your initial observations.	What do you think could be causing the changes observed in each video?
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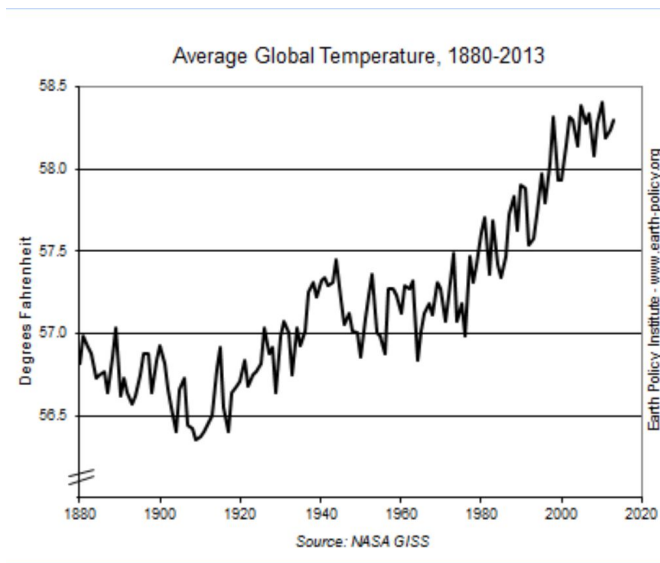
Part 2. Let's Look at the Data

A. Graph analysis

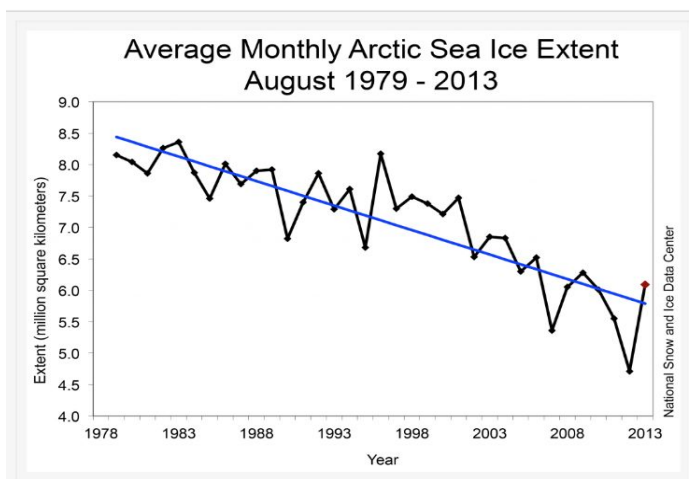
Observe the four graphs below. To the right of each graph, write:

1. What information does this graph present?
2. What trends do you notice?

Graph A



Graph B



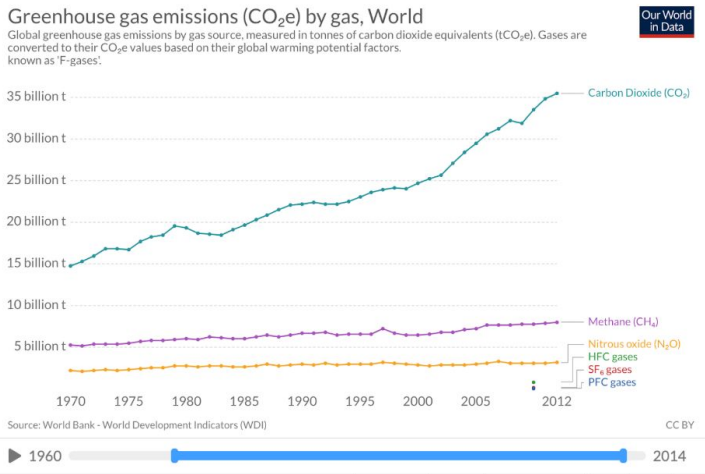
Sea ice extent is a measurement of the area of ocean where there is at least some sea ice.



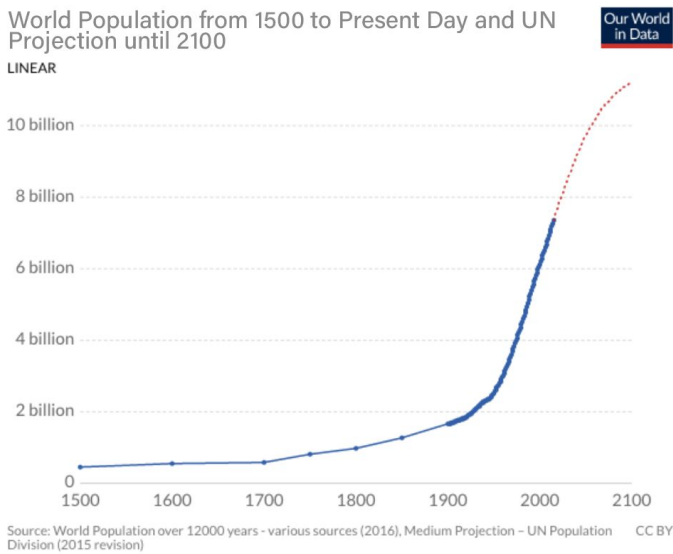
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Graph C



Graph D





B. Questions: Relationships between the Graphs

1. How might the information in graph A and graph B be related?
2. How might the information in graph C and graph D be related?
3. How might the information in graph A and graph C be related?
4. In what other ways might the four graphs be connected? Explain your answer.
5. How can the data presented in the graphs help to explain the footage observed in the videos (Part 1)? Refer to as many graphs as possible in your answer.



Part 4. Putting it All Together: Finding Evidence and Constructing an Explanation

Now that we have some data behind us to help us understand what has been going on, you're going to be working with a partner to put together a presentation that contains three labeled sections:

- Section 1 – #Before&AfterChallenge: Photos showing how various locations have been impacted by climate change.
- Section 2 – Reflection Questions: Using data from the graphs and your evidence from the #Before&AfterChallenge, explain the cause of the original video phenomena and propose an idea about human impact on climate change.
- Section 3 – Putting climate terms in context.

Before We Begin: Set Up Your Presentation

1. Open a digital presentation such as Google Slides or PowerPoint.
2. On **Slide 1**:
 - a. Include the title, "Climate Change: Evidence and Explanations."
 - b. Include your name and your partner's name.
3. On **Slide 2**:
 - a. include the text, "Section 1: The #Before&AfterChallenge." This slide will be a section header.

Section 1

Section 1 of your presentation will focus on the photographic evidence of climate change, which you will find yourself. The #10yearchallenge was started as a hashtag to see how people and places changed over the past 10 years. Today, you're going to do something very similar with the #Before&AfterChallenge. Your task is to find **four** sets of "before and after" photos of locations that have been impacted by climate change. Suggested search terms include:

- Glacier melting
- Arctic sea ice changes
- Sea level rising

You can also refer to "Appendix A: Useful Image Links."



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Slides 3–6: Each slide will include one set of before and after photos. On each slide:

- Title the page by the name of the location you’re highlighting.
- Place the “before” photo on the left side and the “after” photo on the right.
- Below each photo, indicate the year that the photo was taken.
- Optional: Add annotations to the images to highlight your observations.
- In the notes section of the online presentation, explain:
 - what you notice about the change and/or what you find most interesting about these photos; and
 - reflecting on the information you learned from the graphs, suggest a possible reason for the change presented in your images.

Sample slide format

Columbia Glacier, Alaska

2009 2015

This is a before and after photo of Columbia Glacier, Alaska. In 2009, you can see a large sheet of ice. By 2015, this ice had completely melted. Information from the photo: Columbia Glacier, Alaska, has retreated by 6.5km (4 miles) between 2009 and 2015. Photo credit: James Balog and the Extreme Ice Survey

Section 2

Slide 7: Add the text “Section 2: Reflection Questions.” This will be a section header slide.

Slide 8: Write your answer to the following question:

Reflecting on everything you’ve learned in this lesson, explain how Mendenhall Glacier and polar bears may be indicators of climate change. Use all of these terms in your explanation: greenhouse gas, atmosphere, melting, temperature, and climate change.



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Greenhouse Gas: A gas that absorbs the heat from the sun (infrared radiation) in the atmosphere. Examples include carbon dioxide and methane.

Atmosphere: Layer of gas around a planet.

Melting: The process of going from solid to liquid.

Temperature: The degree or intensity of heat; the temperature of something is how hot or cold it is.

Climate Change: A change to the average weather in a place over many years, primarily caused by increasing atmospheric temperatures.

Slide 9: Write your answer to the following question:

How might human activities contribute to climate change?

Section 3

Slide 10: Add the text “Section 3: My Climate Terms.” This will be a section header slide.

Slides 11–15: Find one image that illustrates each vocabulary term below. For example, one image that illustrates greenhouse gas, one image that illustrates atmosphere, and so on. You can use as many terms in the same photo as you’d like. However, you must label and define all terms. In the notes section, explain where in the image the term appears.

- Greenhouse Gas: A gas that absorbs the heat from the sun (infrared radiation) in the atmosphere. Examples include carbon dioxide and methane.
- Atmosphere: Layer of gas around a planet.
- Melting: The process of going from solid to liquid.
- Temperature: The degree or intensity of heat; the temperature of something is how hot or cold it is.
- Climate Change: A change to the average weather in a place over many years, primarily caused by increasing atmospheric temperatures. *Tip: It might be helpful to use a photo that shows evidence of climate change here.*

When you’re done with all 15 slides, click “Share” to share the slideshow with your teacher.



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V. Quiz: Check for Understanding

Complete the exit ticket below or you can take the quiz online!

Name: _____

Date: _____

1. True or False: Global temperatures have remained steady for the past 30 years.
2. Earth's global temperature change is due to which of the following factors?
 - a. The starvation of polar bears
 - b. The retreat of Mendenhall Glacier
 - c. The increase in atmospheric greenhouse gases
 - d. The use of solar energy
3. All of the following statements about greenhouse gases are true except:
 - a. Greenhouse gases are naturally occurring gases in the atmosphere.
 - b. The amount of greenhouse gases in the atmosphere has declined over the past 30 years.
 - c. Methane and carbon dioxide are two of the most abundant greenhouse gases in the atmosphere.
 - d. Greenhouse gases trap heat in the atmosphere, warming the earth.
4. Which of the following are sources of greenhouse emissions? Choose all that apply.
 - a. Industry
 - b. Electricity and heat
 - c. Agriculture
 - d. Transportation
5. Which of the following can result from climate change?
 - a. Loss of arctic sea ice
 - b. Rising global temperatures
 - c. Rising sea levels
 - d. All of the above
6. Too many greenhouse gases in the atmosphere block heat from escaping into space and trap too much heat next to the earth's surface causing:

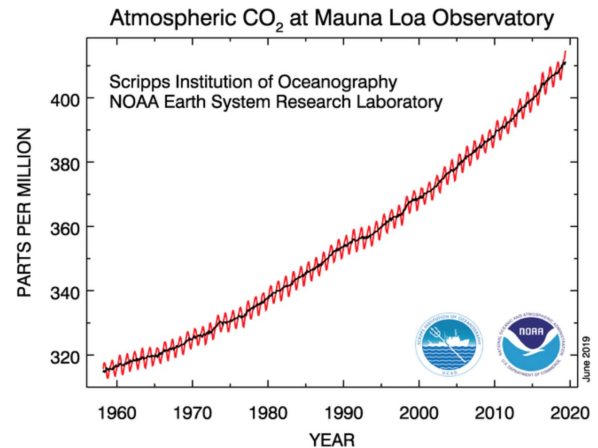
 - a. another ice age
 - b. an increase in average global temperature
 - c. earthquakes
 - d. volcanic eruptions



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7. Which of the following is the best conclusion that can be made from this graph?
- Atmospheric CO₂ levels have been decreasing since 1960
 - Atmospheric CO₂ levels have been increasing steadily since 1960
 - Hawaii has a lot of CO₂
 - Humans have been working hard to decrease CO₂ levels



Appendix A: Useful Image Links

- Nasa Images of Change:
<https://climate.nasa.gov/images-of-change?id=589#589-flooding-on-the-ganges-river-india>
- USGS Repeat Photography:
<https://www.usgs.gov/science-explorer-results?es=repeat+photography&classification=image>
- NSIDC Arctic Sea Ice:
<http://nsidc.org/arcticseaicenews/sea-ice-comparison-tool/>
- UCAR Arctic Sea Ice:
<https://scied.ucar.edu/longcontent/sea-ice-extent-maps-compare-arctic>
- NASA Dramatic Glacier Melt:
https://climate.nasa.gov/climate_resources/4/graphic-dramatic-glacier-melt/
- New Atlas Before and After Glacier Photos:
<https://newatlas.com/before-after-photos-glaciers-climate-change/49143/#gallery>
- NSIDC Retreating Glaciers:
<https://nsidc.org/cryosphere/glaciers/gallery/retreating.html>
- Extreme Ice Survey:
<http://extremeicesurvey.org/>