

Teacher Survey

Instructions: Please complete the following evaluation.

1. Did you make any adjustments to the learning module? If so, what did you change or omit?

2. From your observations, are the students more interested in atmospheric science?

3. What part of the lesson was most effective or interesting to them?

4. What concept did the students have most trouble understanding or applying?

Student Survey

Please distribute this survey to the students before and after completing the module.

Instructions: Circle the answer that best describes your feelings about science.

1. I like science.
 - a. I strongly disagree.
 - b. I disagree.
 - c. I am indifferent or unsure.
 - d. I agree.
 - e. I strongly agree.

2. How often do you talk to your *family* about what you do in science class?
 - a. Never
 - b. Rarely (less than once a week)
 - c. Once a week
 - d. A few times a week
 - e. Every day

3. How often do you talk to your *friends* about what you do in science class?
 - a. Never
 - b. Rarely (less than once a week)
 - c. Once a week
 - d. A few times a week
 - e. Every day

4. I think science will be useful when I am older.
 - a. I strongly disagree.
 - b. I disagree.
 - c. I am indifferent or unsure.
 - d. I agree.
 - e. I strongly agree.

5. I would like to be a scientist when I am older.
 - a. I strongly disagree.
 - b. I disagree.
 - c. I am indifferent or unsure.
 - d. I agree.
 - e. I strongly agree.

Effectiveness Assessment

Part 1: Pre- and Post-Assessment (Student Evaluation)

Instructions: Please distribute and score the **Student Evaluation** for each student before and after completing the module. Each question is worth 1 point.

Student Evaluation

Instructions: After completing the lesson on climate, please have the students answer the following questions.

1. Which of the following is not a mechanism to change the global average temperature?
 - a. Changing seasons
 - b. Changing solar energy output
 - c. Changing Earth's albedo
 - d. Changing the composition of the atmosphere

2. Earth has warmed by _____ since 1750.
 - a. 0°C
 - b. 1°C
 - c. 5°C
 - d. 20°C

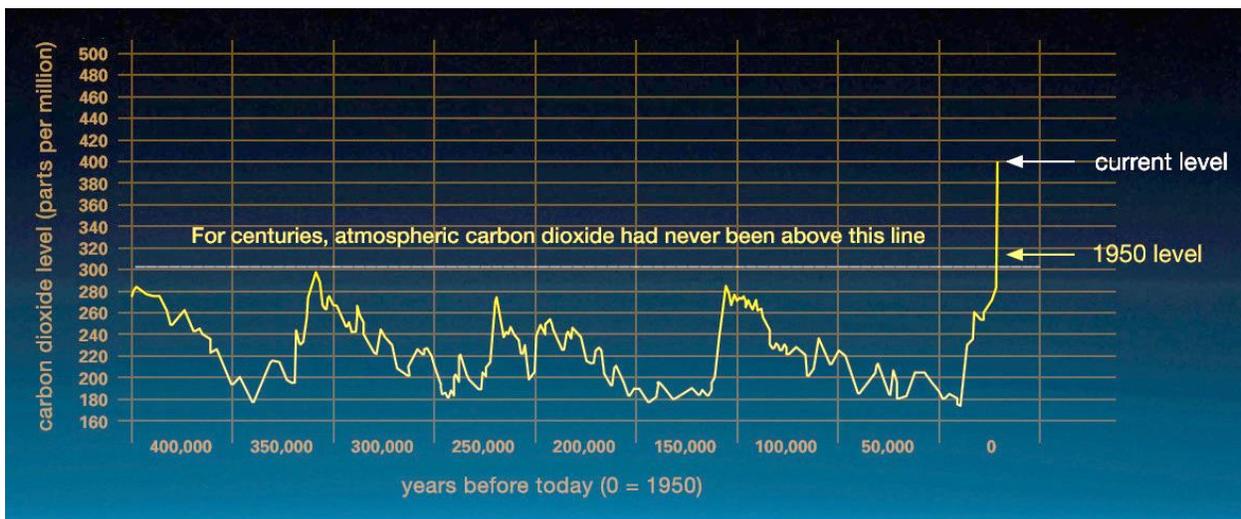
3. Current carbon dioxide levels have exceeded _____ parts per million.
 - a. 100
 - b. 200
 - c. 300
 - d. 400

4. Objects with a high albedo _____ solar radiation.
 - a. absorb
 - b. reflect
 - c. reemit
 - d. refract

5. Which greenhouse gas is most abundant in Earth's atmosphere?
 - a. Carbon dioxide
 - b. Methane
 - c. Water vapor
 - d. Ozone

6. Change in the solar energy output is responsible for global warming. T F
7. Volcanoes have a temporary cooling effect on the global climate. T F
8. Understanding the carbon cycle in the atmosphere and ocean is essential for estimating the effects that carbon dioxide has on our climate system. T F
9. Briefly explain the difference between weather and climate.

10. The graph below from 2015 shows the level of carbon dioxide over the past 400,000 years in parts per million. What is the rate of change of the carbon dioxide level since 1950? Units should be parts per million per year.



Rate of Change = $(\text{Carbon Dioxide Level}_{2015} - \text{Carbon Dioxide Level}_{1950}) / \text{Number of Years}$

- 1.38 parts per million / year
- 1.53 parts per million / year
- 1.8 parts per million / year
- 6.15 parts per million / year
- None of the above

Part 2: Math & Science Proficiency (Take Home Assignment: Part 3)

Please score **Take Home Assignment: Part 3** for each student using the rubric below. This problem is aligned with the following academic standards:

NGSS.MS-ESS3-5
MS-ESS3-5. Weather and Climate: Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

NGSS.MS-ESS3-3
MS-ESS3-3. Human Impacts: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

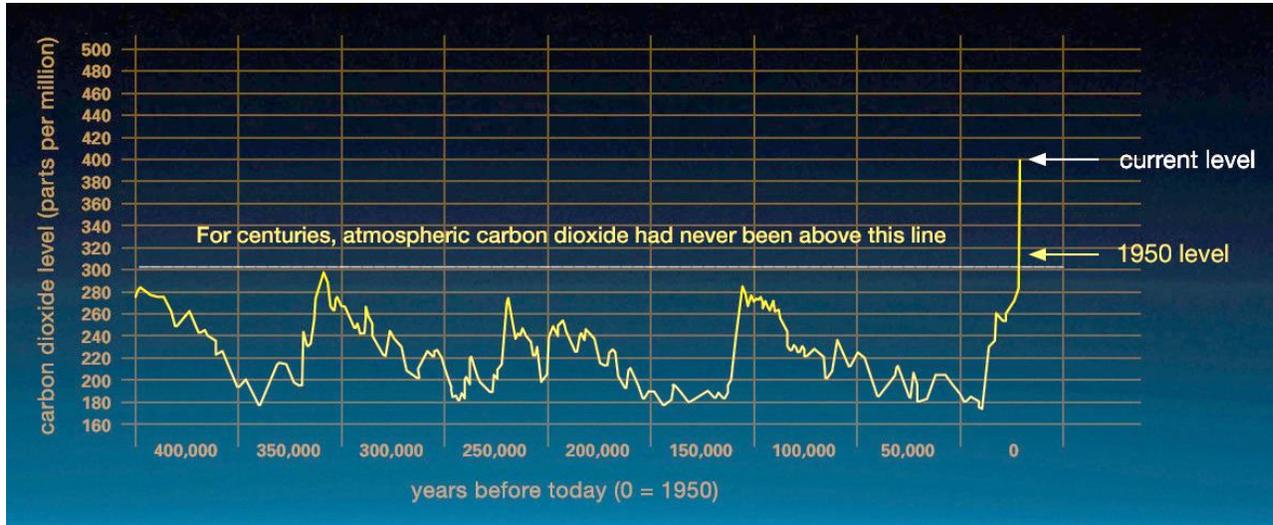
Scoring Rubric

Questions	Score (0 – 3)
Did the student correctly identify the current carbon dioxide concentration (Q1)?	
Did the student demonstrate knowledge of relating the warming effects of carbon dioxide to global climate change (Q2 & Q3)?	
Did the student clearly identify sources of carbon dioxide emissions and how to reduce them (Q4 & Q6)?	
Did the student demonstrate understanding of how climate change affects each of Earth’s systems (Q5)?	

- 0 – Incomplete*
- 1 – Completed with incorrect answer*
- 2 – Complete with small errors*
- 3 – Complete with correct answer*

Part 3. Greenhouse Gas Concentrations 4, 5

Instructions: Using the plot below, which shows the concentration of carbon dioxide, answer the following questions.



[Source](#)

1. What is the current concentration of carbon dioxide in parts per million?
2. Looking at the plot and using your knowledge about greenhouse gases, what can you infer about how the global average temperature has changed since 1950?
3. How do greenhouse gases such as CO₂ cause climate change?
4. What has caused this disruption in carbon cycle?

5. What are potential effects of enhanced carbon dioxide levels in each of Earth's systems?

Atmosphere:

Hydrosphere:

Cryosphere:

Biosphere:

6. List three things that humans can do to reduce their carbon footprint.

1. _____

2. _____

3. _____