

Earth Day Science Symposium

Carbon and the Arctic

Instructions for Pre/Post Question Sets

Introduction

Pre/Post Questions are tools for guiding inquiry and assessing student learning. Students answer the questions before they prepare their EDSS data sets for presentation and again after the activities are completed.

Students are not expected to score high points the first time they answer the questions. As they work with their data sets, they will be practicing the skills needed to improve their answers in the second round.

Contents

Question sets are presented on two-page reproducible handouts (double-sided copies will help save paper). The answer key on pages 2–4 includes rubrics for grading the constructed answer questions. Use one or both of the question sets—the more time you invest, the more students learn and the more opportunities you have for assessment.

Answer Key	2
Question Set 1	5
Question Set 2	7

Scheduling, Time, Materials

Schedule the first round (Pre) a few days in advance of starting the EDSS activity. Plan on 30–40 minutes for each question set. The only materials you'll need are two copies of each question set and a pencil for each student.

New Mexico Science Benchmarks, Grades K–4

Scientific Thinking and Practice, **Standard I, Benchmark I** – Use scientific methods to observe, collect, record, analyze, predict, interpret, and determine reasonableness of data; **Benchmark III** – Use mathematical skills and vocabulary to analyze data, understand patterns and relationships, and communicate findings.

Earth and Space Science, **Standard III, Benchmark II** – Know the structure and formation of Earth and its atmosphere and the processes that shape them.

New Mexico Science Benchmarks, Grades 5–8

Scientific Thinking and Practice, **Standard I, Benchmark I** – Use scientific methods to develop questions, design and conduct experiments using appropriate technologies, analyze and evaluate results, make predictions, and communicate findings; **Benchmark III** – Use mathematical ideas, tools, and techniques to understand scientific knowledge.

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Earth and Space Science, **Standard III, Benchmark II** – Describe the structure of Earth and its atmosphere and explain how energy, matter, and forces shape Earth's systems.

New Mexico Math Benchmarks, Grades K–8

Algebra: **Benchmark A.1** – Understand patterns, relations, and functions; **Benchmark A.3** – Use mathematical models to represent and understand quantitative relationships; **Benchmark A.4** – Analyze change in various contexts.

Data Analysis and Probability: **Benchmark D.1** – Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them; **Benchmark D.2** – Select and use appropriate statistical methods to analyze data; **Benchmark D.3** – Develop and evaluate inferences and predictions that are based on data.

For More Information: www.earthsbirthday.org/nm

Answer Key

Question Set 1

The total possible score for all three questions is 6. Grade according to your usual scale (convert to a percentage by multiplying the student's total score by 16.67).

- The maximum score is 1 point. Following are some **examples of different ways to state** the correct answer.
 - The temperatures on the graph are going up and down, but they are going up more than they are going down. They will probably keep going up.
 - The temperatures have been mostly going up for 79 years. That's a long time, so they will probably keep going up.
 - In 79 years the temperature never went down as low as it was in 1910, so it probably won't now.
 - Something must be making the temperature go up. If it doesn't change, then the temperature will probably keep going up.
- The maximum possible score is 3 points, one for listing decades correctly and two for listing degrees correctly. **Students will estimate the air temperatures. Amounts between the ranges shown should be counted as correct.**

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Decade	Average Global Air Temperature (°Celsius)
1910–1919	13.75 – 13.80
1920–1929	13.80 – 13.95
1930–1939	14.00 – 14.10
1940–1949	14.01 – 14.15
1950–1959	13.95 – 14.00
1960–1969	13.80 – 13.99
1970–1979	14.00 – 14.10
1980–1989	14.25 – 14.29

3. The maximum possible score is 2, **one each for any two of the following:**
- Proof that carbon dioxide makes the air warmer
 - Proof that there is more carbon dioxide in the atmosphere now than in 1910
 - The amount of carbon dioxide in the atmosphere in each of the decades
 - The total amount of carbon dioxide released into the atmosphere since 1910
 - The total amount of carbon dioxide released into the atmosphere in each decade
 - The amount of carbon dioxide released into the atmosphere from major sources (like burning plants)

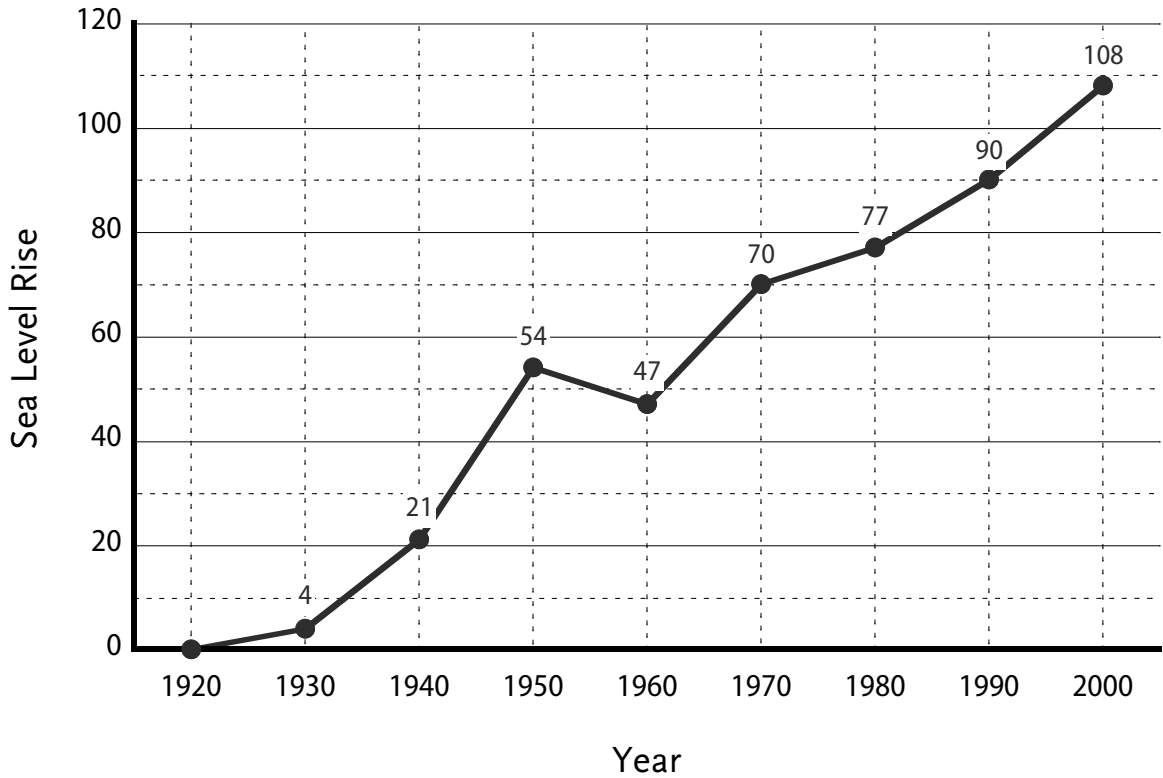
Question Set 2

The total possible score for all three questions is 6. Grade according to your usual scale (convert to a percentage by multiplying the student's total score by 16.67).

1. The maximum possible score is 3 points, one each for **a) 4 mm b) 54 mm**, and **c) 61 mm**.
2. The maximum possible score is 3 points, one for correctly labeling the axes, one for correctly plotting the data points, and one for a line that connects the data points. **Simplify grading** by laying the student's work on the graph below. Data points should line up approximately correctly.

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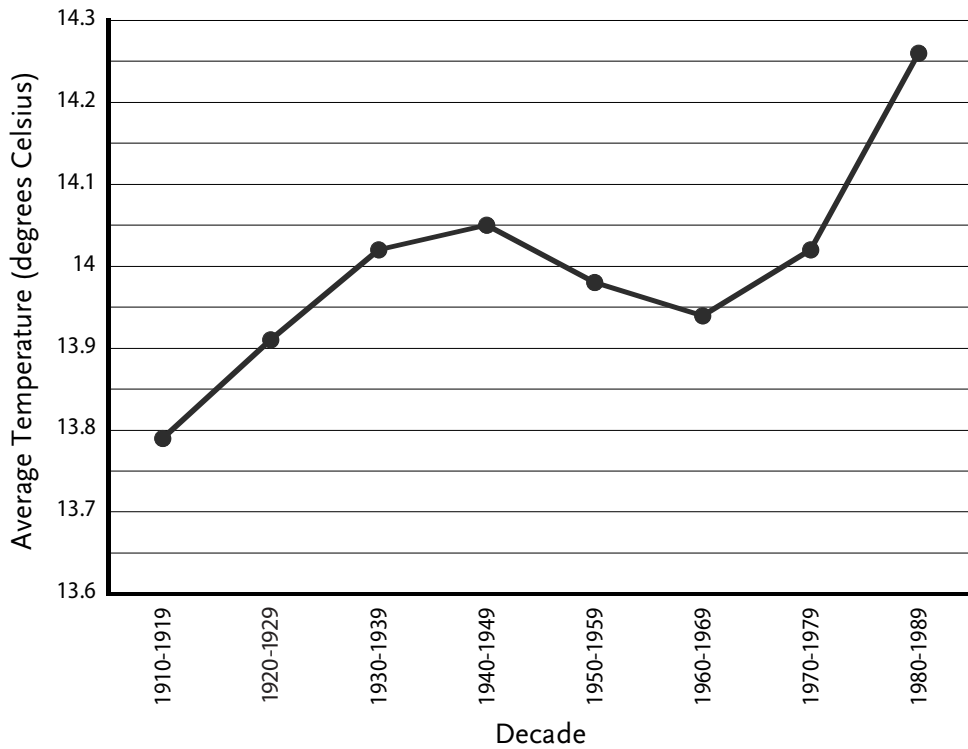
3. The maximum possible score is 2. The correct answer should include all of the following information: **The cumulative sea level off the coast of Honolulu is increasing.** Subtract a point if the information is not written as a complete sentence.
4. The maximum possible score is 2, **one each for any two of the following.**
 - Sea levels at other places in the world
 - Global air temperatures in the decades since 1920
 - The changes in the global air temperature since 1911
 - How much ice in glaciers and ice caps melted in the decades since 1920
 - Whether water from melting ice is going into the oceans
 - How much water from melting ice is going into the oceans

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Jack and Maria are writing a report on climate change. Maria found the following graph comparing average global air temperature over 125 years.

Average Global Air Temperature, 1910–1989



1. Jack said that the average global air temperature would probably continue to rise in the future. Based on the graph, explain why this might be true.



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2. Record the data shown on the graph in the data table below. Read the graph carefully and estimate the numbers for temperature.

Decade	Average Global Air Temperature (°Celsius)

3. Maria said air temperature around the world has been rising because of carbon dioxide in the atmosphere. List two other kinds of data that Maria and Jack could use to show that this is true.

a) _____

b) _____



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Pete and Sarah are doing research on recent changes in Earth's atmosphere and oceans. They found the following table at a website:

Cumulative Sea Level Rise off the Coast of Honolulu, HI

Year	Cumulative Sea Level Rise (mm)	Year	Cumulative Sea Level Rise (mm)
1920	0	1970	70
1930	4	1980	77
1940	21	1990	90
1950	54	2000	108
1960	47		

- Each year on the table stands for a decade (for example, 1920 stands for the years 1911–1920). “Cumulative Sea Level Rise” is the amount the sea level rose in that decade plus the amount it rose in the preceding decades.
 - How many millimeters did the sea level rise in the decade 1921–1930?
_____ mm
 - How many millimeters did it rise between 1911 and 1950? _____ mm
 - How many millimeters did it rise between 1961 and 2000? _____ mm
- Plot the data on a line graph (see next page). Make the graph as complete as possible.
- A trend is a change that has been happening over a long time, and appears likely to continue. The sea level data shows a trend. What is the trend? Answer with a complete sentence.



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4. Pete and Sarah learned in their science class that glaciers and ice caps melt as the global temperature increases. They also learned that melting ice may cause sea levels to rise.

Based on the sea level data, Pete and Sarah thought that global temperatures must have increased from 1911 to 2008. List two other kinds of data they needed to help prove this.

a)

b)

