What Changed the Climate?

Ask questions that test explanations for global warming

MS-ESS3-5 "Ask questions to clarify evidence of the factors that may have caused a change in global temperatures over the past century. (SEP: 1; DCI: ESS3.D; CCC: Stability/Change)"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline two pieces of evidence about changes over time, circle two possible causes of temperature change, and put a question mark beside one place where you would ask for more evidence.

A Warming World, Several Possible Causes

1. A thermometer outside your school might show a hotter day than one across town. That does not tell us whether Earth is warming. To track global temperature, scientists combine readings from many land stations and ocean measurements. They compare yearly averages over many decades, rather than picking one hot summer. These records show that Earth's average surface temperature has risen by about 1.2°C since the late 1800s. Scientists also check whether changes in measuring sites or tools could affect the records. The trend raises a harder question: what caused it?

2. One possible cause is the buildup of carbon dioxide, CO_2, in the air. Burning coal, oil, and gas releases this gas. Ice cores preserve tiny bubbles of old air, while modern instruments measure today's air. Together, these records show CO_2 rose from about 280 parts per million before widespread fossil fuel use to more than 420 parts per million in recent years. CO_2 absorbs some heat that Earth sends toward space and sends some back toward the surface. Rising gas levels and rising temperatures occur together, but scientists also test other possible causes.

3. Could the Sun or volcanoes explain the rise instead? Satellites have measured the Sun's energy since the late 1970s. It has gone up and down, but it has not risen steadily while global temperatures have continued to rise. Large volcanic eruptions can send particles high into the air that block some sunlight. This can cool Earth for a few years, not produce a century of warming. Comparing the timing and direction of these changes helps scientists test causes. They ask what evidence is missing before deciding how strong an explanation is.

2 ANSWER WITH EVIDENCE

Use the passage

1. What question would you ask to check whether the temperature rise reflects a global, long-term change rather than a hot day in one place?

2. What question would you ask to clarify the evidence that CO_2 may have helped cause warming?

3. What question would you ask to test whether changes in the Sun's energy explain recent warming?

4. What question would you ask to test whether volcanoes explain the century-long temperature rise?

3 YOUR TURN

Your own words

A student says, "Our school parking lot was hotter than the soccer field yesterday, so cars must be the main cause of global warming." Write three different questions to test this claim: one about the local measurements, one about the global temperature trend, and one about a possible cause. After each question, explain what its answer would clarify.

ANSWER KEY

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GRADES 6-8 · MS-ESS3-5

PART 1 · READ AND MARK

Underline two pieces of evidence about changes over time, circle two possible causes of temperature change, and put a question mark beside one place where you would ask for more evidence. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What question would you ask to check whether the temperature rise reflects a global, long-term change rather than a hot day in one place?	**Do yearly temperature averages from many land stations and ocean measurements show a rise over many decades?**
2	What question would you ask to clarify the evidence that CO_2 may have helped cause warming?	**Did CO_2 levels rise during the period of warming, and can CO_2 trap heat?**
3	What question would you ask to test whether changes in the Sun's energy explain recent warming?	**Has the Sun's energy risen steadily while global temperatures have risen since the late 1970s?**
4	What question would you ask to test whether volcanoes explain the century-long temperature rise?	**Do large eruptions warm Earth for many decades, or do they cool it for a few years?**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Were the two thermometers at the same height and in the same amount of shade? That would help check whether the local comparison is fair. Do records from many places show a long-term rise, not just one hot day? That would check whether the parking lot result tells us anything about a global trend. How have CO_2 emissions from cars changed over time? That would help test whether car emissions could contribute to long-term warming.

Accept other specific, testable questions tied to the passage's evidence. For Your Turn, look for three distinct questions and an explanation of what each answer would clarify, without treating one local temperature reading as proof of a global cause.