

Name: _____

Volcanoes and Climate Change

Keely sat in the airport terminal waiting for the announcement that their plane could finally take off. Flights had been canceled due to a volcano eruption, for pete's sake! She and her family had been sitting around now for 2 days, sleeping on the floor, washing off in the bathroom sinks, and eating at fast food stands.

They weren't alone, of course. There were many people at the airport—all stuck in the same situation. The volcano wasn't even near the airport! Surely, it would be safe to start flying again soon!

Another family moved to seats near Keely and she started a conversation with a boy that looked to be about her age just to relieve the boredom. They started talking about the volcanic ash that was delaying their trip. Jake said that his father had explained that even though the volcanic eruption had occurred thousands of miles away, it had thrown the ash high into the atmosphere and wind currents were carrying the ash around the world. Flights in the path of the ash had to be canceled or delayed for safety reasons.

Keely had heard the same explanation from her parents so she agreed with Jake until he started to talk about what else his parents had told him. They had also explained that erupting volcanoes had other far-reaching and more serious effects than just delaying air flights. Volcanoes emitted gases, such as carbon dioxide and sulfur dioxide that absorb energy from sunlight and raise Earth's temperatures. Jake said that he learned in school that Earth's temperatures have been rising. His parents had also told him that volcanoes with greenhouse gases are just one of the factors that increase Earth's global temperatures. Jake didn't like cold temperatures so he didn't think that sounded that bad until his parents added that increasing global temperatures are linked to severe weather events, ice cap melting, and sea level rise. Jake took it a lot more seriously after hearing all that.

Keely told Jake that her parents had discussed the volcanic eruption with her as well. But they said that volcanic eruptions *lower* global temperatures! Her parents had explained that active volcanoes emit particles that can block sunlight and therefore lower temperatures.

Both opinions made sense and both were based on the science of volcanoes and eruptions.

Who is correct? Keely or Jake? Do volcanoes increase or decrease temperatures on Earth? Do volcanoes cause climate changes? Give reasoning to support your claim. You should write 4-5 sentences.

Analysis:

1. What is the overall global temperature change that results from major volcanic eruptions? Explain what causes this.
2. What must a volcano usually measure on the VEI scale to impact climate?
3. What gas seems to have the greatest impact on temperature – sulfur gases or carbon dioxide? Explain how you made your choice.
4. What is the time frame in which temperature can be affected by volcanic eruptions?
5. Draw a diagram below of a volcanic eruption, the gases emitted, and what is occurring that results in changes in temperature.

<p>During major explosive eruptions huge amounts of volcanic gas, aerosol droplets, and ash are injected into the stratosphere. Injected ash falls rapidly from the stratosphere -- most of it is removed within several days to weeks.</p>	<p>Sulfur dioxide in the stratosphere converts into to sulfuric acid, which condenses rapidly in the stratosphere to form fine sulfate aerosols. The aerosols increase the reflection of radiation from the Sun back into space and can persist for years.</p>
	<p>The 1980 eruption of Mount St. Helens</p>

<p>The eruption of Mount Pinatubo on June 15, 1991, was one of the largest eruptions of the twentieth century and injected a 20-million ton (metric scale) sulfur dioxide cloud into the stratosphere at an altitude of more than 20 miles. It cooled the Earth's surface for three years following the eruption, by as much as 1.3 degrees F at the height of the impact.</p>	<p>vented approximately 10 million tons of CO₂ into the atmosphere in only 9 hours. However, carbon dioxide released in contemporary volcanic eruptions has never caused detectable global warming of the atmosphere.</p>
<p>In addition, the aerosols absorb energy radiated from the surface of Earth. This process, known as “radiative forcing,” persists for several years and results in surface temperatures that are cooler in the summer and warmer in the winter.</p>	<p>In addition to ash, the eruptive cloud consists primarily of vast quantities of sulfur dioxide (SO₂), hydrogen chloride (HCl), and hydrogen fluoride gases (HF). The gases combine with water in the atmosphere to produce acid rain, destroying crops and killing livestock.</p>
<p>The major Mt. St. Helens eruption lowered global temperatures by about 0.1 degree C. The much smaller eruption of El Chichn, in contrast, had three to five times the global cooling effect worldwide. Despite its smaller ash cloud, El Chichn emitted more than 40 times the volume of sulfur-rich gases produced by Mt. St. Helens</p>	<p>Massive volcanic eruptions capable of changing global climate occur rarely. The Volcanic Eruptive Index (VEI) was developed in the early 1980s to assess the relative size of eruptions. The scale is logarithmic, meaning a 3 is ten times for powerful than a 2. The scale places events from 0 (non explosive) to 8 (most explosive). Single explosions that change global climate generally measure greater than 5 on the VEI scale.</p>