BENCHMARK ASSESSMENT

Volcano Hunters

Student Name: .....

Date: .....

There are approximately 1,500 active volcanoes around the world. Volcanologists monitor and collect data from some of Earth's most dangerous volcanoes. Studying how the Earth's materials and systems work together allows them to predict when natural hazards, like volcanic eruptions, are most likely to occur. It is impossible to know exactly when a volcano is going to erupt, but analyzing the patterns of specific volcanic indicators lets volcanologists alert communities to help them prepare for the next big eruption.

In this assessment, you will interpret evidence to help a team of volcanologists decide which of two volcanoes poses the biggest threat if they were to erupt. You will use what you have learned in the module to describe how interactions between tectonic plates cause volcanoes to form, and use materials to model the rock cycle process. Finally, you will apply your understanding of how volcanologists predict eruptions by analyzing four datasets from one volcano and assigning appropriate warning levels.

Knowledge and Science Practices Being Assessed

In this assessment, you will demonstrate your ability to:

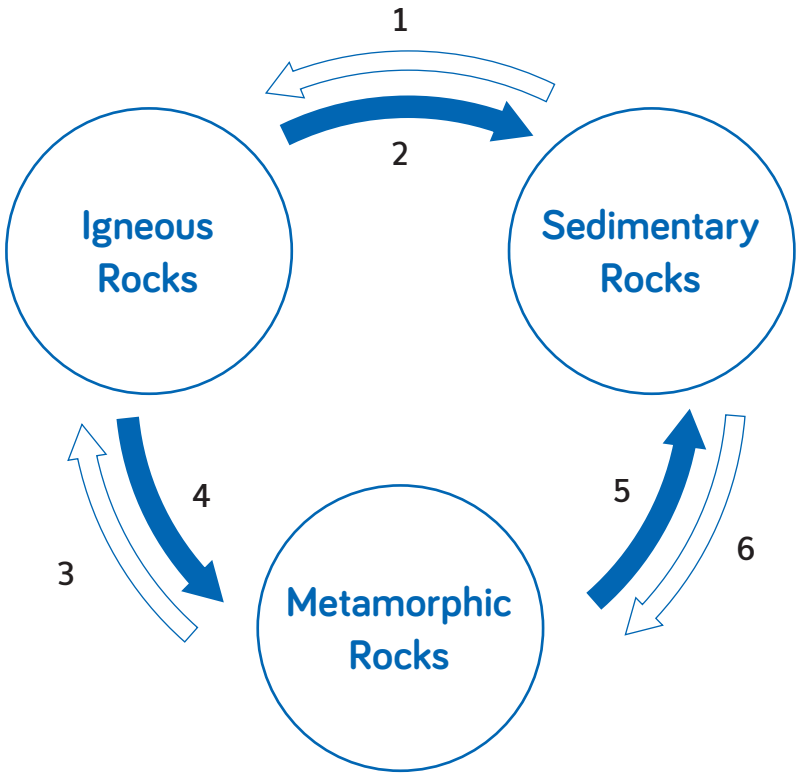
- Model the stages of the rock cycle process
- Explain how volcanoes are formed
- Analyze and interpret data to create a scientific claim to help a team of volcanologists
- Analyze data and identify patterns to assign warning levels to sets of volcanic data.

1. You have been asked to create a model of the rock cycle using crayons. You have been provided with the following additional materials:
   - Heavy book
   - Aluminum foil
   - Rolling pin
   - Cheese grater
   - Heat source

a. **Complete the table to explain how you would create your model. For each stage, identify the materials you would use, the steps you would take, and the processes being modeled. The first example has been done for you.**

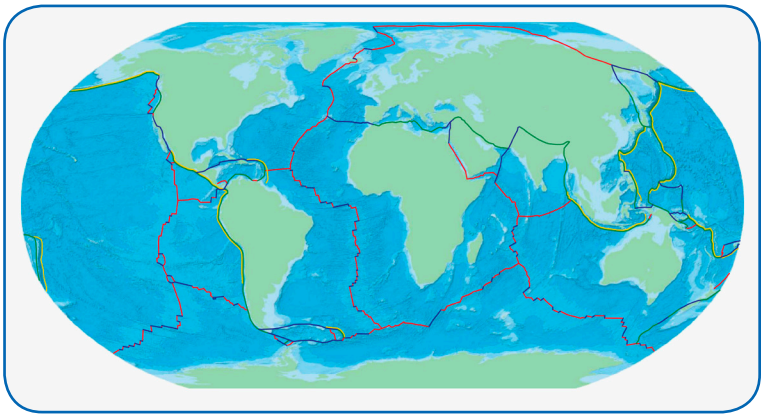
Materials	Step	Process Modeled
Cheese grater	Grate the crayons into small pieces.	Weathering, erosion
		Compaction, cementation
Heavy book, aluminum foil, heat source		
	Use a heat source to melt the crayons.	
		Cooling, crystallization

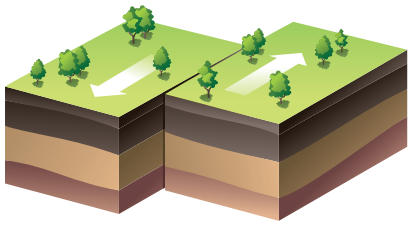
b. **Think about how the processes you modeled fit into the rock cycle. Write all processes that occur between each stage of the rock cycle.**



Number	Processes
1	
2	
3	
4	
5	
6	

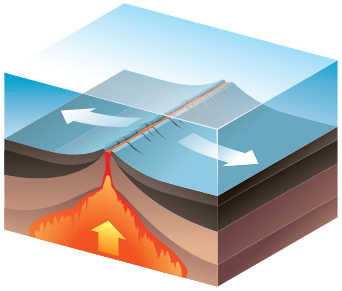
2. Tectonic plates are large pieces of the Earth's crust that move slowly and powerfully along the Earth's mantle. The manner in which the two plates interact determines the types of features that will form.

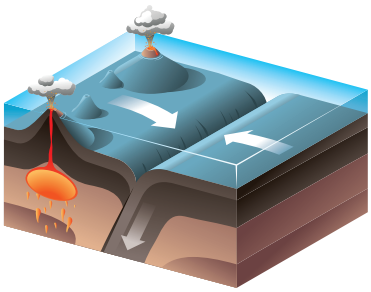




When two plates slide past each other, this is known as a transform boundary. Friction between the plates can cause earthquakes.

When two plates move away from each other, this is known as a divergent boundary. Mountains and volcanoes can form as magma flows up to fill the gap between plates.



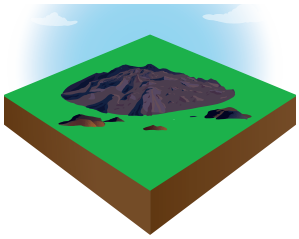


When two plates collide, this is known as a convergent boundary. Volcanoes often form at oceanic-continental or oceanic-oceanic convergent boundaries, while mountains can be created at continental-continental convergent boundaries.

Explain how a volcano might form at an oceanic-continental convergent boundary. Use the term *subduct* in your answer.

3. A team of volcanologists have been investigating two volcanoes. They are only able to monitor one, and need your help in deciding which to monitor. They have provided some information to help you with your recommendation.

a. **Analyze the evidence. For each type of evidence, write which volcano poses the greater threat. The first example has been done for you.**

Volcano A	Volcano B	Analysis and Reasoning
Shield volcano 	Stratovolcano 	Volcano B. Stratovolcanoes tend to erupt explosively.
20-degree slope	45-degree slope	
Magma believed to have low viscosity	Magma believed to have high viscosity	
Low gas content	Large gas content	
Last major eruption was 200 years ago	Last major eruption was 800 years ago	

b. **Construct a claim about which volcano poses the greater threat. Include your evidence and reasoning.**

4. The U.S. Geological Survey (USGS) uses a nationwide volcano alert-level system to categorize volcanoes into four warning levels: **Normal**, **Advisory**, **Watch**, and **Warning**. These are used when notifying the public about the likelihood of an eruption.

Volcanologists monitor different types of volcanic activity to help predict eruptions. Generally, the higher the readings, the greater the activity. When different types of data peak at the same time, this can also indicate significant volcanic activity.

During periods of inactivity, Volcano C is known to have temperatures of 24–30°C, fewer than 10 earthquakes per day, ground movement of 0–2 mm, and gas emissions of up to 120 tons per day. Just before a large eruption, it is known to have temperatures of 38–47°C, up to 50 earthquakes per day, ground movement of up to 8 mm, and gas emissions of 700–1,000 tons per day.

This table shows data collected at Volcano C on four different days.

Scenario	Temperature (°C)	Number of Earthquakes	Ground Movement (mm)	Gas Levels (tons)	Frequency of Overlapping Peaks
A	29–32	8	3	241	Medium
B	39–43	38	6	712	High
C	30–36	22	5	282	High
D	26–28	9	1	67	Low

Based on this information, which warning level would you assign to each scenario? Why?

Scenario	Warning Level	Reasoning
A		
B		
C		
D		