Rubric 1: Use Rubric 1 for student responses for Question 1.

Emerging	Developing	Proficient	Advanced
Student creates a model that **partially or inaccurately** identifies the stages of the rock cycle process, but does not provide an explanation of the processes involved, nor the rock types created. OR **Student response is missing.**	Student creates a model that **accurately** identifies the stages of the rock cycle process, but does not name the rock types created and gives little or no explanation of the processes involved.	Student creates a model that **accurately** identifies the stages of the rock cycle process, **partially or inaccurately** names the rock types created, and provides a **general** explanation of the processes involved.	Student creates a model that **accurately** identifies the stages of the rock cycle process, **correctly** names the rock types created, and provides a **detailed** explanation of the processes involved.
	Look Fors: • Student models the rock cycle process correctly. For example, "Use the cheese grater to shred the crayons. Apply pressure using the rolling pin to create a crayon "rock". Put this rock in aluminum foil, under a heavy book, and place on a heat source, to allow the rock to flatten. Then place either the flat crayon rock or more shredded crayons in the aluminum foil and heat until the crayons melt, then let them cool to form a new type of rock."	**Look Fors:** • Student models the rock cycle process correctly, partially names the rock types created and provides a general explanation of the processes. For example "Use the cheese grater to shred the crayons. Apply pressure using the rolling pin to create sedimentary rock. Place this newly formed sedimentary rock in aluminum foil under the heavy book, and place on a heat source. Apply pressure to flatten and create metamorphic rock. Place either shredded crayons (sediment) or metamorphic rock in the aluminum foil and heat until melted. Once this has cooled it becomes igneous rock.	**Look Fors:** • Student models the rock cycle process correctly, accurately names the rock types created and provides a detailed explanation of the processes. For example "Use the cheese grater to shred the crayons, this creates sediment. Apply pressure using the rolling pin to create sedimentary rock, this process is called compaction. Place this newly formed sedimentary rock in aluminum foil under the heavy book, and place on a heat source. Apply pressure to flatten and cause the "crystals" to elongate, this creates metamorphic rock. Place either shredded crayons (sediment) or metamorphic rock in the aluminum foil and heat until melted, causing magma. Once the magma has cooled it becomes igneous rock. Igneous rocks formed inside the Earth's crust are called intrusive and those formed outside the Earth's crust are called extrusive.

PE	SEP	DCI	CCC	DoK
MS-ESS2-1 Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process	**SEP-2** Developing and Using Models	**ESS2.A** Earth's Materials and Systems	**CCC-7** Stability and Change	3

Rubric 2: Use Rubric 2 for student responses for Question 2.

Emerging	Developing	Proficient	Advanced
Student **inaccurately** identifies the name of the plate boundary and **incompletely or inaccurately** explains the process of how volcanoes form. OR **Student response is missing.**	Student **accurately** identifies the name of the plate boundary and **incompletely or inaccurately** explains the process of how volcanoes form.	Student **accurately** identifies the name of the plate boundary and **generally** explains the process of how volcanoes form.	Student **accurately** identifies the name of the plate boundary and **accurately and specifically** explains the process of how volcanoes form.
	Look Fors: • Student identifications are correct but does not explain what happens at these boundaries. For example, "Volcanoes are most likely to form along the convergent plate, either where a continental plate and an oceanic plate converge or where two oceanic plates converge." • Student may also identify either an oceanic–continental boundary or oceanic–oceanic boundary but does not explain what happens at these boundaries.	**Look Fors:** • Student identifications are correct. For example, "Volcanoes are most likely to form along the convergent plate, either where a continental plate and an oceanic plate converge or where two oceanic plates converge." • Student explanation of the process of how volcanoes form is accurate but general. For example, "The oceanic plate subducts under the continental plate. As the plate subducts, it heats up and melts. The rock becomes magma" or "An older, more dense oceanic plate subducts under a younger, less dense oceanic plate. As the plate subducts, it heats up and melts. The rock becomes magma."	**Look Fors:** • Student identifications are correct. For example, "Volcanoes are most likely to form along the convergent plate, either where a continental plate and an oceanic plate converge or where two oceanic plates converge." • Student explanation of the process of how volcanoes form is accurate and explains the process in detail. For example, "The oceanic plate subducts under the continental plate. As the plate subducts, it heats up and melts. The rock becomes magma, which forms a magma chamber. Overtime the magma comes out of the vent and forms layers of hardened lava, which forms the volcano." or "An older, more dense oceanic plate subducts under a younger, less dense oceanic plate. As the plate subducts, it heats up and melts. The rock becomes magma, which forms a magma chamber. Overtime the magma comes out of the vent and cools, forming layers of hardened lava, which forms the volcano."

PE	SEP	DCI	CCC	DoK
MS-ESS2-1 Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process	**SEP-2** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process	**ESS2.A** Earth's Materials and Systems	**CCC-7** Stability and Change	2

Rubric 3: Use Rubric 3 for student responses for Question 3.

Emerging	Developing	Proficient	Advanced
Student **inaccurately** identifies the volcano posing the greatest threat and in need of monitoring. OR Student **accurately** identifies the volcano posing the greatest threat and in need of monitoring, but does not provide reasoning. OR **Student response is missing.**	Student **accurately** identifies the volcano posing the greatest threat and in need of monitoring, and provides **general** knowledge and reasoning in their recommendation.	Student **accurately** identifies the volcano posing the greatest threat and in need of monitoring, and provides **partial** knowledge and reasoning in their recommendation.	Student **accurately** identifies the volcano posing the greatest threat and in need of monitoring, and provides **detailed** knowledge and reasoning in their recommendation.
	Look Fors: • Student identification of the volcano causing the biggest threat is accurate, for example, "Volcanologists should monitor Volcano B." • Student includes general reasoning to support their recommendation, which includes **one or two** of the following reasons: ◦ The more viscous the magma, the greater the pressure required for an explosion. ◦ Large gas content makes the volcano more explosive. ◦ A high gas content with viscous magma makes for a more explosive and dangerous volcano. ◦ A higher viscosity indicates that the magma can accumulate more debris as it slowly runs down the side of the volcano, which makes it more dangerous. ◦ A steeper slope increases the speed the magma travels at as it erupts. ◦ Last eruption 1,500 years ago could indicate a greater build-up of magma.	**Look Fors:** • Student identification of the volcano causing the biggest threat is accurate, for example, "Volcanologists should monitor Volcano B." • Student includes general reasoning to support their recommendation, which includes at least three of the following reasons: ◦ The more viscous the magma, the greater the pressure required for an explosion. ◦ Large gas content makes the volcano more explosive. ◦ A high gas content with viscous magma makes for a more explosive and dangerous volcano. ◦ A higher viscosity indicates that the magma can accumulate more debris as it slowly runs down the side of the volcano, which makes it more dangerous. ◦ A steeper slope increases the speed the magma travels at as it erupts. ◦ Last eruption 1,500 years ago could indicate a greater build-up of magma.	**Look Fors:** • Student identification of the volcano causing the biggest threat is accurate, for example, "Volcanologists should monitor Volcano B." • Student includes general reasoning to support their recommendation, which includes all of the following reasons: ◦ The more viscous the magma, the greater the pressure required for an explosion. ◦ Large gas content makes the volcano more explosive. ◦ A high gas content with viscous magma makes for a more explosive and dangerous volcano. ◦ A higher viscosity indicates that the magma can accumulate more debris as it slowly runs down the side of the volcano, which makes it more dangerous. ◦ A steeper slope increases the speed the magma travels at as it erupts. ◦ Last eruption 1,500 years ago could indicate a greater build-up of magma.

PE	SEP	DCI	CCC	DoK
MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects	**SEP-4** Analyzing and Interpreting Data	**ESS3.B** Natural Hazards	**CCC-1** Patterns	2

Rubric 4: Use Rubric 4 for student responses for Question 4.

Emerging	Developing	Proficient	Advanced
Student **incompletely and/ or inaccurately** identifies the types of data collected and the data-collection devices used by volcanologists to predict volcanic eruptions. Student does not provide reasoning for how volcanologists know when to increase or decrease the warning level. **Student response is missing.**	Student **accurately and incompletely** identifies the types of data collected and the data-collection devices used by volcanologists to predict volcanic eruptions. Student provides **limited to no** reasoning for how volcanologists know when to increase or decrease the warning level.	Student **accurately and incompletely** identifies the types of data collected and the data-collection devices used by volcanologists to predict volcanic eruptions. Student provides **partial and accurate** reasoning for how volcanologists know when to increase or decrease the warning level.	Student **accurately** identifies the types of data collected and describes the data-collection devices used by volcanologists to predict volcanic eruptions. Student provides **thorough** cause-and-effect reasoning for how volcanologists know when to increase or decrease the warning level.
	Look Fors: • Students accurately list two or three of the types of data collected and data-collection devices/ techniques used by volcanologists to predict volcanic eruptions. o Temperature—Thermometer o Gas Sampling—COSPEC o Earthquake Activity—Seismometer o Land Movement—GPS o 3-D Mapping—Drone o Rock Core Samples—Cylindrical-shaped tubes and dril • Little or no reasoning is provided	**Look Fors:** • Students accurately list four or five of the types of data collected and data-collection devices/techniques used by volcanologists to predict volcanic eruptions o Temperature—Thermometer o Gas Sampling—COSPEC o Earthquake Activity—Seismometer o Land Movement—GPS o 3-D Mapping—Drone o Rock Core Samples—Cylindrical-shaped tubes and drill • Student provides general reasoning. For example, “volcanologists know when to increase the warning level when the data peaks, this means an eruption is imminent. When the recorded data drops it means an eruption is unlikely and the warning level is decreased.”	**Look Fors:** • Students accurately list four or five of the types of data collected and data-collection devices/ techniques used by volcanologists to predict volcanic eruptions o Temperature—Thermometer o Gas Sampling—COSPEC o Earthquake Activity—Seismometer o Land Movement—GPS o 3-D Mapping—Drone o Rock Core Samples—Cylindrical-shaped tubes and drill • Student provides thorough cause-and-effect reasoning For example, “volcanologists know when to increase the warning level when the volcanic activity starts to increase. The is evident when multiple types of data start to peak at the same time. When larger values and a greater number of overlapping peaks start to happen, this may indicate that an eruption is imminent. When the frequency of peaks and data values begin to decrease, volcanologists will often decrease the warning level. Volcanologists study the patterns in historical data to help them identify the risk of a potential volcanic eruption.

PE	SEP	DCI	CCC	DoK
MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects	**SEP-4** Analyzing and Interpreting Data	**ESS3.B** Natural Hazards	**CCC-1** Patterns	2