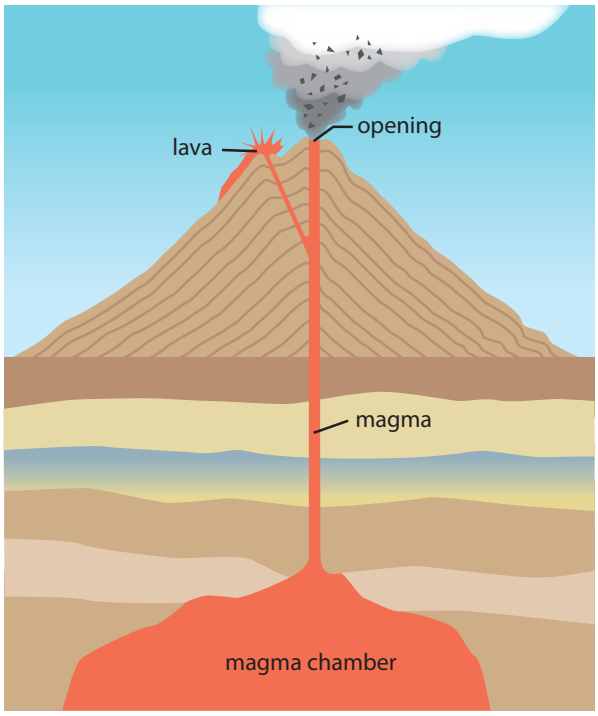
5 Modeling Volcanic Eruptions

MODELING

DURING A VOLCANIC eruption, magma from underground is released onto Earth's surface. Prior to eruption, magma is located in the magma chamber of a volcano beneath the volcano's opening in Earth's surface. When magma flows over Earth's surface, it is called **lava**. **Igneous rock** forms when magma or lava cools and solidifies. The mountain of the volcano is made of this cooled and solidified lava. Not all volcanic eruptions are the same, though. Some are more explosive than others. Different types of igneous rock are formed during different eruptions. One factor that affects the type of igneous rock formed by the amount of gas in the magma in the magma chamber. That gas also affects the force of the volcanic eruption. In this activity, you will use a model to investigate what happens during different volcanic eruptions.

GUIDING QUESTION

How can models help us understand what happens during a volcanic eruption?



A diagram of the inside of a volcano.

MATERIALS

For each group of four students

- 1 sample of basalt rock
- 1 sample of pumice rock
- 1 vial of baking soda
- 1 bottle of less-gassy "magma" (60-mL; red)
- 1 bottle of more-gassy "magma" (60-mL; colorless)
- 1 cup of water
- 1 plastic volcano model with base
- 1 clear, colorless plastic tube
- 1 rubber stopper
- 1 white plastic scoop
- 1 graduated cup (30-mL)
- paper towels and/or a sponge

For each pair of students

- 1 magnifying lens

For each student

- 1 pair of chemical splash goggles

SAFETY

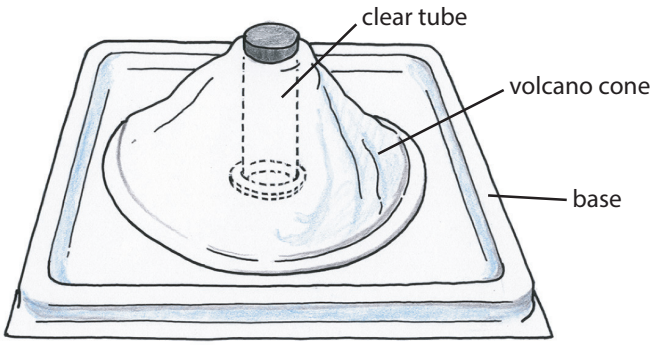
Both types of "magma" contain dilute acid. Wear chemical splash goggles, and avoid touching skin and eyes while working with the magma. Wash your hands after completing the activity.

PROCEDURE

Part A: Eruption of Less-Gassy Magma

1. Examine the samples of two types of rock that formed when lava cooled during a volcanic eruption using the magnifying lens. These rocks are called basalt (ba-SALT) and pumice (PUM-is). Compare the two rocks. In your science notebook, make a prediction of which rock you think likely formed from a volcanic eruption with (a) less-gassy magma or (b) more-gassy magma. Explain your reasoning.
2. In your science notebook, make a data table to record your observations of the eruptions with less-gassy magma and more-gassy magma. Be sure to include room in your table to record data for two trials of each eruption.

3. Work with your group to set up your volcano model as shown below by following these steps:
   a. Gently push the clear tube into the mouth of the white volcano cone.
   b. Set the base of the clear tube into the hole of the square plastic tray.



4. Place 1 scoopful of baking soda into the bottom of the volcano tube.
5. Use the graduated cup to measure and pour 5 mL of less-gassy magma into the tube.
6. Without disturbing the model, observe it carefully for 2 min.
7. Record your observations in your science notebook.
8. Rinse your volcano model.
9. Repeat Steps 4–8. Be sure to switch roles among your group members.

Part B: Eruption of More-Gassy Magma

10. Use the graduated cup to measure and pour 2.5 mL of more-gassy magma into the volcano tube.
11. Dip your finger into water, and use it to moisten the bottom of the rubber stopper.
12. Dip the bottom of the stopper into the baking soda so that a thin layer of baking soda sticks to it.
13. Gently cap the volcano tube with the stopper. Trying not to spill any baking soda, insert the stopper snugly into the tube.

14. Quickly turn the entire volcano model upside-down, and then put it back on the table right-side up.

    Hint: Balance the volcano model on the palm of one hand. Use the other hand to hold the stopper and tube in place. Turn the model upside-down and right-side up, as shown below. Quickly set the model on the table right-side up.

15. Without disturbing the model, observe it carefully for 2 min.
16. Describe what you observe in your science notebook.
17. Rinse your volcano model.
18. Repeat Steps 10–17. Be sure to switch roles among your group members.

19. Examine the basalt and pumice rock samples again. Look back at the prediction you wrote down in Step 1. With your group of four students, discuss any new ideas you have about which rock more likely formed from a volcanic eruption with (a) less-gassy magma and (b) more-gassy magma. In your science notebook, write down which rock you think formed from less-gassy and which from more-gassy magma. Use evidence from the activity to support your ideas.

ANALYSIS

1. Use your observations of the volcano model to answer the following:
   a. Describe the similarities and differences between the eruptions of volcanoes with less-gassy and more-gassy magma.
   b. Which type of magma produced a more explosive eruption?
2. Imagine a volcano erupting many times over a period of many years. Which of the following landforms is most likely a result of volcanic eruptions: flat plains, a hole or depression, or a mountain? Explain.
3. What were the strengths and weaknesses of the volcano model?

   Hint: Think about ways in which the model did or did not represent real volcanoes or volcanic eruptions.
4. In this activity, you modeled a system. A **system** is a group of interacting objects or processes. Every system includes
   - components: the substances, materials, and processes that make up the system.
   - interactions: the relationships between the substances, materials, and processes in the system.
   - boundaries: the extent of the system, separating those components and processes that are part of the system from those that are not.

   a. In a volcano system, how does the geological process of a volcanic eruption result in the formation of igneous rock?
   b. In a volcano system, how can different volcanic eruptions result in the formation of different kinds of igneous rock?