

How Volcanoes Erupt

Name _____ Date _____

Words to Know

tectonic plate: one of the huge slabs of rock that make up Earth's outer shell

magma: melted rock underground (called lava once it reaches the surface)

viscosity: how much a liquid resists flowing; thick liquids have high viscosity

pyroclastic flow: a fast-moving avalanche of hot gas, ash and rock from an explosive eruption

1 A volcano is an opening in Earth's crust where melted rock, gases and ash escape to the surface. Most of Earth's active volcanoes sit along the edges of tectonic plates, the huge slabs of rock that fit together like puzzle pieces to form Earth's outer shell. A few, like the volcanoes of Hawaii, form far from any plate edge, over a hot spot, where unusually hot rock rises from deep in the mantle. To understand why a volcano erupts, and why some eruptions are gentle while others are deadly, scientists look at three things: where melted rock comes from, what is dissolved in it, and how easily it flows.



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2 Melted rock underground is called magma; once it reaches the surface, it is called lava. It is easy to imagine a layer of liquid rock under the crust, but most of the mantle is actually solid, even though it is extremely hot. Rock melts only where conditions change. Where two plates pull apart, the pressure on the rock below drops, and some of it melts. Where one plate sinks beneath another, water carried down with the sinking plate lowers the melting point of the rock above it. Over a hot spot, unusually hot rock rises from deep in the mantle and partly melts. Magma at hot spots and spreading plates is usually low in silica, while magma where plates sink often has more. Because magma is less dense than the solid rock around it, it slowly rises and can collect in a magma chamber a few kilometers below the surface.

3 Magma also holds dissolved gases, mostly water vapor, along with carbon dioxide and sulfur dioxide. Deep underground, the high pressure keeps these gases dissolved in the magma, the way the gas in a closed bottle of soda stays in the liquid. As magma rises, the pressure on it drops, and the gases form bubbles, just as bubbles appear the moment a soda bottle is opened. The bubbles expand as they rise, and their push helps drive magma up toward the surface.

4 Whether those bubbles escape quietly or explode depends on viscosity, which is how much a liquid resists flowing. Magma with less silica, a compound of silicon and oxygen found in most rocks, has low viscosity. It is runny, like warm syrup, so gas bubbles can rise through it and escape. Eruptions of this magma are usually gentle, with lava pouring or fountaining out of the ground. Magma with more silica has high viscosity. It is thick and sticky, so it traps the gas bubbles. Pressure builds until the magma bursts apart, blasting it into ash and rock fragments.

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5 Runny lava builds shield volcanoes, which are broad mountains with gentle slopes. Each flow travels a long way before it cools and hardens, so layer after layer spreads out into a wide, low shape. Mauna Loa in Hawaii, a shield volcano, is one of the largest volcanoes on Earth. Lava flows can bury roads and burn down buildings, but they usually move slowly enough for people to walk away from them.

6 Thick, gas-rich magma builds composite volcanoes, also called stratovolcanoes. These steep, cone-shaped mountains are made of layers of hardened lava, ash and rock from many eruptions. When Mount St. Helens in Washington State erupted in 1980, the blast flattened forests for miles and sent ash high into the sky. Explosive eruptions like this can also cause pyroclastic flows, fast-moving avalanches of hot gas, ash and rock that rush down a volcano's sides and destroy everything in their path.

7 Scientists cannot yet say exactly when a volcano will erupt, but they watch for warning signs. As magma moves underground, it can cause swarms of small earthquakes, make the ground swell, and change the gases coming out of the volcano. Instruments that measure these signs help scientists warn people who live nearby, so they have time to leave before an eruption.

According to the text, why does magma rise toward the surface?

Magma rises because ...

What happens to the gases dissolved in magma as the magma rises? Use details from the text.

As magma rises, ...

How Volcanoes Erupt: questions

What evidence does the text give that lava flows from shield volcanoes are usually less dangerous to people than explosive eruptions?

The text says ...

Explain why high-silica magma tends to erupt explosively while low-silica magma erupts gently. Use two details from the text.

High-silica magma ..., but low-silica magma ...

How does the comparison to a bottle of soda help explain what happens inside a volcano?

The soda bottle shows that ...

Why is it still useful for scientists to watch volcanoes, even though they cannot predict the exact time of an eruption?

Watching volcanoes helps because ...

Main idea and details

In the text
Main idea
Detail
Detail
Detail

How Volcanoes Erupt: answer key

Question	Answer
According to the text, why does magma rise toward the surface? (in the text)	It is less dense than the solid rock around it.
What happens to the gases dissolved in magma as the magma rises? Use details from the text. (in the text)	The pressure drops, so the gases form bubbles that expand and help push the magma up.
What evidence does the text give that lava flows from shield volcanoes are usually less dangerous to people than explosive eruptions? (in the text)	Lava flows usually move slowly enough for people to walk away from them.
Explain why high-silica magma tends to erupt explosively while low-silica magma erupts gently. Use two details from the text. (thinking)	High-silica magma is thick and sticky (high viscosity), so it traps gas bubbles and pressure builds until it bursts; low-silica magma is runny, so the gas escapes.
How does the comparison to a bottle of soda help explain what happens inside a volcano? (thinking)	When pressure is released, dissolved gas forms bubbles, just as gas comes out of magma when the pressure drops as it rises.
Why is it still useful for scientists to watch volcanoes, even though they cannot predict the exact time of an eruption? (thinking)	Warning signs like small earthquakes, swelling ground and gas changes can give people time to leave.

How Volcanoes Erupt: answer key

	In the text
Main idea	Where magma forms, the gases dissolved in it and how easily it flows decide how a volcano erupts and what kind of volcano it builds.
Detail	Magma forms where conditions change, and it rises because it is less dense.
Detail	Rising magma lets dissolved gases form bubbles that push it up.
Detail	Runny, low-silica magma erupts gently and builds shield volcanoes; thick, high-silica magma erupts explosively and builds composite volcanoes.

About this reading: an original informational text for grade 8 about volcanoes, 648 words, fact-checked. Questions start with what the text says, then ask students to think.

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