



■ **Figure 10.6** A geyser is a type of hot spring from which very hot water and vapor erupt at the surface.

Identify the origin of a geyser.

Temperature of springs People usually think of spring water as being cool and refreshing. But the temperature of groundwater that is discharged through a spring is generally the average annual temperature of the region in which it is located. Thus, springs in New England have year-round temperatures of about 10°C, while further south, springs in the Gulf states have temperatures of about 20°C.

Compared to air temperatures, groundwater is generally colder in the summer and warmer in the winter. However, in some regions around the world, springs discharge water that is much warmer than the average annual temperature. These springs are called warm springs or **hot springs**, depending on their temperatures. Hot springs are springs that have a temperature higher than that of the human body, which is 37°C.

There are thousands of hot springs in the United States. Most of them are located in the western United States in areas where the subsurface is still hot from nearby igneous activity. A number of hot springs also occur in some eastern states. These hot springs emerge from aquifers that descend to tremendous depths in Earth's crust and through which deep, hot water rises. The water is hot because temperatures in Earth's upper crust increase by an average of 25°C for every km of depth.

Among the most spectacular features produced by Earth's underground thermal energy in volcanic regions are geysers, shown in **Figure 10.6**. **Geysers** are explosive hot springs. In a geyser, water is heated past its boiling point, causing it to vaporize. The resulting water vapor builds up tremendous pressure. This pressure is what fuels the eruptions. One of the world's most famous geysers, Old Faithful, is located in Yellowstone National Park, Wyoming.

Section 10.1 Assessment

Section Summary

- Some precipitation infiltrates the ground to become groundwater.
- Groundwater is stored below the water table in pore spaces of rocks and sediment.
- Groundwater moves through permeable layers called aquifers and is trapped by impermeable layers called aquicludes.
- Groundwater emerges from the ground where the water table intersects Earth's surface.

Understand Main Ideas

1. **MAIN Idea** Explain how the movement of groundwater is related to the water cycle.
2. **Illustrate** how the relative positions of an aquifer and aquiclude can result in the presence of a spring.
3. **Describe** how the water in hot springs gets hot.
4. **Analyze** the factors that determine flow velocity.

Think Critically

5. **Differentiate** between porosity and permeability in subsurface materials.
6. **Infer** why it is beneficial for a community to have an aquiclude located beneath the aquifer from which it draw its water supply.

WRITING in Earth Science

7. Develop a set of guidelines in which you describe where you would be most likely to find groundwater.