Name _____ Date _____

Earthquakes and Volcanoes: Reading USGS Data on Magnitude, Plate Boundaries and Hot Spots

Directions: Read the passage and study the data table. In number questions, type only the number; the unit is shown next to the box.

Six Large Earthquakes

Use the passage and the data table to answer these questions.

Earthquake Size, Location and Warnings

Scientists describe the size of an earthquake with a number called its magnitude. Each step up of 1 on the magnitude scale means the waves on instrument recordings are about 10 times as large, once scientists adjust for distance. It also means the earthquake releases about 32 times as much energy. How hard the ground shakes at any one place also depends on how far away it is and on the kind of ground there.

Most earthquakes and volcanoes happen near plate boundaries. These are the edges where Earth's plates pull apart, push together or slide past each other. Where an ocean plate sinks under another plate, chains of volcanoes often form too. But not every earthquake or volcano is near a plate boundary. The Island of Hawaii is in the middle of the Pacific Plate, more than 3,200 kilometers away from any plate boundary. It sits over a hot spot, an unusually hot area deep below the plate. Hot rock rises there, partly melts and feeds the island's volcanoes. Earthquakes happen in Hawaii too. They happen as magma moves underground, as the sides of the volcanoes slide and as the heavy volcanoes press down on the plate.

No one can predict the day an earthquake will strike. Instead, scientists forecast the chances of a strong earthquake in an area over a span of years. Earthquake early warning systems do something different. Their instruments sense an earthquake soon after it begins. Then the system sends alerts ahead of the strong shaking, to places it has not reached yet.

Six large earthquakes. Source: U.S. Geological Survey (USGS) Earthquake Hazards Program, magnitudes as listed in 2026.

Year	Place	Magnitude	Setting
1906	San Francisco, California	7.9	Plate boundary: the Pacific and North American plates slide past each other along the San Andreas Fault
1960	Southern Chile	9.5	Plate boundary: the Nazca Plate, an ocean plate, sinks under South America
1964	Southern Alaska	9.2	Plate boundary: the Pacific Plate, an ocean plate, sinks under North America

Year	Place	Magnitude	Setting
1989	Loma Prieta, California	6.9	Plate boundary: the San Andreas Fault system
2015	Gorkha, Nepal	7.8	Plate boundary: the India and Eurasia plates, both carrying continents, push together
2018	Island of Hawaii	6.9	Hot spot in the middle of the Pacific Plate, far from any plate boundary

1. On the magnitude scale, each step of 1 stands for waves about 10 times as large on adjusted instrument recordings. Use 10 for each step. By this rule, how many times as large were the waves of the 1906 San Francisco earthquake as those of the 1989 Loma Prieta earthquake?

_____ times

2. Each step of 1 in magnitude means about 32 times as much energy released. Use 32 for each step. How many times as much energy does a magnitude 8.0 earthquake release as a magnitude 6.0 earthquake? Type your answer without a comma.

_____ times

3. According to the table, which two earthquakes happened where an ocean plate sinks under another plate?

☐ A. The 1960 earthquake in Southern Chile
☐ B. The 1906 earthquake in San Francisco, California
☐ C. The 1964 earthquake in Southern Alaska
☐ D. The 2015 earthquake in Gorkha, Nepal
☐ E. The 2018 earthquake on the Island of Hawaii

4. In this table, which kind of setting had the two largest earthquakes?

A. Two plates sliding past each other
B. A hot spot in the middle of a plate
C. Two plates carrying continents pushing together
D. An ocean plate sinking under another plate

5. A classmate says, "Earthquakes happen only at plate boundaries." Which statement about the passage and table is true?

A. They support the claim, because every earthquake in the table happened at a plate boundary.
B. They do not support the claim, because the 2018 Hawaii earthquake happened far from any plate boundary, in the middle of a plate.
C. They do not support the claim, because most earthquakes in the table happened far from plate boundaries.
D. They support the claim, because a hot spot is one kind of plate boundary.

6. According to the passage, why does the Island of Hawaii have volcanoes even though it is far from any plate boundary?

A. Two plates are pulling apart under the island, letting magma rise between them.

B. The Pacific Plate is sinking under another plate right next to the island.

C. Hot rock rising from an unusually hot area deep below the middle of the Pacific Plate partly melts and feeds the volcanoes.

D. Two plates are sliding past each other under the island, and the rubbing melts the rock.

7. The 1906 San Francisco and 1989 Loma Prieta earthquakes both struck the San Andreas Fault system, 83 years apart. What can scientists say about when the next large earthquake there will strike?

A. They can use the 83-year gap to predict the exact day.

B. There will be no more large earthquakes there, because the fault already released its energy.

C. It will strike in 2072, exactly 83 years after 1989.

D. They cannot name the day, but they can forecast the chances of a large earthquake there over a span of years.

8. Leo's phone shows an earthquake early warning alert. A few seconds later, the ground where he is starts to shake. Which statement best explains how the alert came before the shaking?

A. Instruments sensed the earthquake soon after it began, and the alert reached Leo before the shaking did.

B. The alert made the shaking reach Leo later than it would have.

C. The alert went out before the earthquake started, because the ground gave a warning sign.

D. Scientists predicted the day before that an earthquake would strike at that moment.