Earthquakes indicate plate movement along faults in California. Forces in the Earth (tension, compression, shearing) cause stress at plate boundaries. Movement at plate boundaries produces different types of faults: normal, reverse/thrust, and strike-slip. Exposed rock layers indicate the type of fault. California has a strike-slip fault where constant movement occurs over millions of years (San Andreas) on the transform boundary between the Pacific and North American Plate. Energy is transmitted through the earth in the form of seismic waves, which are classified as body waves and surface waves. Body waves (primary P and secondary S) have different movements. Primary and secondary waves travel through Earth’s layers in different ways. The epicenter of earthquakes can be determined by triangulation using the difference in arrival times of “P” and “S” waves. Observable phenomena are used to determine the intensity of earthquakes using the Mercalli Scale. Seismographs determine the magnitude of an earthquake by measuring its force and duration. This is reported on a Richter Scale that increases by powers of ten. Damage from an earthquake is dependent on local geology, the magnitude of the earthquake, and building construction. Earthquake preparation includes safety and supplies. Earthquakes and volcanoes occur in relationship to each other. Magma reaches the surface through volcanic structures. Volcano eruptions can be of various types: quiet and explosive. Volcanoes are classified by how they are formed (quiet or explosive eruption) and the resulting land formation (shield, cinder cone, or composite/stratovolcano). Earthquakes and volcanic activity form and shape California’s geologic features.

50 minutes

Prompt

1. Duplicate test for each student

1. Tell students they will have an opportunity to share what they understand about earthquakes and volcanoes.
2. Distribute the prompt to each student and ask him/her to do his/her best work.
Grade Six: Earthquakes and Volcanoes
Post Test

Multiple Choice:
Directions: Please circle the best answer.

1. S waves move
   a. push and pull
   b. side to side
   c. rolling like an ocean
   d. straight line

2. What type of earthquake wave can travel through both liquids and solids?
   a. P waves
   b. S waves
   c. focus waves
   d. surface waves

3. The point deep beneath Earth’s surface where rock breaks under stress and triggers an earthquake is called the
   a. syncline.
   b. footwall.
   c. epicenter.
   d. focus.

4. Volcanoes form along
   a. the coast of Antarctica.
   c. the boundaries of Earth’s plates.
   d. islands in the Pacific Ocean.

5. The formation of the Hawaiian Islands is one example of
   a. the Ring of Fire.
   b. volcanoes forming over a hot spot.
   c. continental drift.
   d. volcanoes forming along plate boundaries.

6. What provides the force that causes magma to erupt to the surface?
   a. gravity in the lithosphere
   b. the silica in the magma
   c. the density of the magma
   d. dissolved gases trapped in the magma
7. The risk of earthquakes is high along the Pacific coast of the United States, including California, because
   a. there have been no earthquakes there lately.
   b. serious earthquakes are rare east of the Rockies.
   c. satellites have detected increasing elevation of the ground surface.
   d. that’s where the Pacific and North America plates meet.

8. What does the Richter Scale measure?
   a. Time in seconds
   b. Intensity of earthquake
   c. Distance in feet
   d. Mass in grams

Justified Multiple Choice

Directions: Please circle the best answer and explain why it is the best answer using science terms for questions 9-12.

9. Shear walls and cross-bracing are examples used in buildings to limit damage from
   a. floods.
   b. volcanoes.
   c. earthquakes.
   d. fires.

Science “reason:” ____________________________________________________________

__________________________________________________________

10. Most earthquake-related deaths and injuries result from
    a. tsunamis
    b. damage to buildings
    c. liquefaction
    d. P waves

Science “reason:” ____________________________________________________________

__________________________________________________________

11. Liquid magma flows upward through cracks in rock because it is
    a. more dense than the surrounding solid material
    b. less dense than the surrounding solid material
    c. more magnetic than the surrounding solid material
    d. less magnetic than the surrounding solid material

Science “reason:” ____________________________________________________________

__________________________________________________________
12. Geologists have detected many small earthquakes in the area near the dormant Mammoth Lakes volcano, what might happen in the near future?
   a. A volcano may erupt.
   b. A landslide may occur.
   c. A forest fire will start.
   d. A storm will start.

Science “reason:” ____________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________

Expanded/Justified Multiple Choice:
Directions: Please use the diagram below to answer questions and explain why it is the best answer using science terms for question 13-14

13. “Hi. This is Jo from Southside City Junior High School. Students felt it and did the drop, cover and hold on drill. We only had slight damage to the building, but the teacher’s desk moved.” Using the Mercalli scale above, what level would you assign to the earthquake at Southside City Junior High School?
   a. I
   b. III
   c. VI
   d. X

Science “reason:” ____________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________

6.F Post Assessment Earthquakes and Volcanoes

※Science Matters
14. If Southside City Junior High School was the epicenter of the earthquake, what would you expect the level of the earthquake to be at Blue Lake Resort?
   a. The same as South City Junior High School.
   b. Lower than South City Junior High School.
   c. Higher than South City Junior High School.
   d. They would not feel the earthquake at all.

   Science “reason:”
   ________________________________________________________________
   ________________________________________________________________

Expanded/Justified Multiple Choice:
   Directions: Please use the rock stress diagram below to answer questions and explain why it is the best answer using science terms for question 15-17.

15. The San Andreas fault is represented by which diagram?
   a. Diagram A
   b. Diagram B
   c. Diagram C
   d. Diagram D

   Science “reason:”
   ________________________________________________________________
   ________________________________________________________________

6. F Post Assessment: Earthquakes and Volcanoes
*SCIENCE MATTERS*
16. Which type of stress produced the fault in Diagram B?
   a. shearing
   b. tension
   c. compression
   d. deformation

   Science “reason:” ____________________________________________________________
   ________________________________________________________________________

17. In Diagram D which type of stress is shown?
   a. shearing
   b. tension
   c. compression
   d. deformation

   Science “reason:” ____________________________________________________________
   ________________________________________________________________________
18. Which number represents magma in the diagram?
   a. 2
   b. 4
   c. 9
   d. 10

19. Which number represents the pipe in the diagram?
   a. 1
   b. 3
   c. 4
   d. 5
20. Which number represents the vent in the diagram?
   a. 3
   b. 5
   c. 7
   d. 10

21. What type of volcano has alternating layers of lava and ash?
   a. Shield volcano
   b. Composite volcano
   c. Cinder cone volcano
   d. Lava plateau

Open Response
Directions: Please answer the following questions in the space provided. All answers should be in complete sentences. You may use diagrams to help explain your answers.

22. Compare and contrast diagram C to diagram A.

23. How are volcanoes and earthquakes similar?
Grade Six: Earthquakes and Volcanoes

Post Test Key

Multiple Choice:

Directions: Please circle the best answer.

1. S waves move
   a. push and pull
   b. side to side
   c. rolling like an ocean
   d. straight line

2. What type of earthquake wave can travel through both liquids and solids?
   a. P waves
   b. S waves
   c. focus waves
   d. surface waves

3. The point deep beneath Earth’s surface where rock breaks under stress and triggers an earthquake is called the
   a. syncline.
   b. footwall.
   c. epicenter.
   d. focus.

4. Volcanoes form along
   a. the coast of Antarctica.
   c. the boundaries of Earth’s plates.
   d. islands in the Pacific Ocean.

5. The formation of the Hawaiian Islands is one example of
   a. the Ring of Fire.
   b. volcanoes forming over a hot spot.
   c. continental drift.
   d. volcanoes forming along plate boundaries.

6. What provides the force that causes magma to erupt to the surface?
   a. gravity in the lithosphere
   b. the silica in the magma
   c. the density of the magma
   d. dissolved gases trapped in the magma
7. The risk of earthquakes is high along the Pacific coast of the United States, including California, because
   a. there have been no earthquakes there lately.
   b. serious earthquakes are rare east of the Rockies.
   c. satellites have detected increasing elevation of the ground surface.
   d. that’s where the Pacific and North America plates meet.

8. What does the Richter Scale measure?
   e. Time in seconds
   f. Intensity of earthquake
   g. Distance in feet
   h. Mass in grams

Justified Multiple Choice
Directions: Please circle the best answer and explain why it is the best answer using science terms for questions 19-22.

9. Shear walls and cross-members are examples used in buildings to limit damage from
   e. floods.
   f. volcanoes.
   g. earthquakes.
   h. fires.

   Science “reason:” __Shear walls resist movement and keep buildings from collapsing. Cross –members form triangles which strengthens the building.

10. Most earthquake-related deaths and injuries result from
    e. tsunamis
    f. damage to buildings
    g. liquefaction
    h. P waves

   Science “reason:” __Buildings or objects fall on people.

11. Liquid magma flows upward through cracks in rock because it is
    e. more dense than the surrounding solid material
    f. less dense than the surrounding solid material
    g. more magnetic than the surrounding solid material
    h. less magnetic than the surrounding solid material

   Science “reason:” __Heated liquid rock expands and becomes less dense.

12. Geologists have detected many small earthquakes in the area near the dormant Mammoth Lakes volcano, what might happen in the near future?
e. A volcano may erupt.
f. A landslide may occur.
g. A forest fire will start.
h. A storm will start.

**Science “reason:”** Seismic activity indicates movement of magma. The small earthquakes indicate magma may move under the dormant volcano and cause an eruption.

**Expanded/Justified Multiple Choice:**

*Directions:* Please use the diagram below to answer questions and explain why it is the best answer using science terms for question 13-14.

13 “Hi. This is Jo from Southside City Junior High School. Students felt it and did the drop, cover and hold on drill. We only had slight damage to the building, but the teacher’s desk moved.” Using the Mercalli scale above, what level would you assign to the earthquake at Southside City Junior High School?

a. I
b. III
c. VI
d. X

**Science “reason:”** Everyone felt the earthquake and the movement of the desk indicates a VI.
14 If Southside City Junior High School was the epicenter of the earthquake, what would you expect the level of the earthquake to be at Blue Lake Resort?
   a. The same as South City Junior High School.
   b. **Lower than South City Junior High School.**
   c. Higher than South City Junior High School.
   d. They would not feel the earthquake at all.

   **Science “reason:”** Blue lake is over 300 km away from the epicenter.

Expanded/Justified Multiple Choice:

**Directions:** Please use the diagram below to answer questions and explain why it is the best answer using science terms for question 15-17.

15. The San Andreas fault is represent by which diagram?
   a. Diagram A
   b. Diagram B
   c. Diagram C
   d. **Diagram D**

   **Science “reason:”** D is a strick-slip fault and the San Andreas also is a strike-slip.

16. Which type of stress produced the fault in Diagram B?
   a. shearing
   b. tension
   c. **compression**
   d. deformation

17. In Diagram D which type of stress is shown?
   a. shearing
   b. tension
   c. compression
   d. deformation
18. Which number represents magma in the diagram?
   a. 2
   b. 4
   c. 9
   d. 10

19. Which number represents the pipe in the diagram?
   a. 1
   b. 3
   c. 4
   d. 5
20. Which number represents the vent in the diagram?
   a. 3
   b. 5
   c. 7
   e. 10

21. What type of volcano has alternating layers of lava and ash?
   a. Shield volcano
   b. Composite volcano
   c. Cinder cone volcano
   d. Lava plateau

Open Response
Directions: Please answer the following questions in the space provided. All answers should be in complete sentences. You may use diagrams to help explain your answers.

22. Compare and contrast diagram C to diagram A.

   A has no stress applied to it. The stress occurring in C is tension, pulling apart. They both show rock layers (parts of the crust).

   May or may not include that diagram A is not on a boundary and diagram C is on a divergent boundary.

23. How are volcanoes and earthquakes similar?

   Most occur along plate boundaries. They are a result of stress in Earth’s crust. They both change the surface of the Earth.