Lesson Concept: Earthquakes indicate plate movement along faults in California.

Link: Lesson 6.1 introduces the exploration of earthquakes by plotting the many historical earthquakes in California and discussing the earthquakes distance from the Santa Barbara/Carpinteria area. The next lesson 6.2 provides models of how different fault formations are formed.

Time: 60 minutes

Materials:
- Per Group (groups of 4)
  - Half sheet of plain paper
- Individual
  - H1a-b Earthshaking Events
  - 4 Different colored pencils (any color)
  - Ruler

Advance Preparation:
- Duplicate handouts, Make K W L Chart

Procedure:

Engage: (10 minutes) Think about and share own experiences with earthquakes.

1. Ask students to think-pair-share with a partner using the following prompt: What experiences have you had with earthquakes? Chart student responses on a K,W,L chart. Share some teacher experiences.
2. Ask students to think about what they want to learn about earthquakes? Chart student responses on W column of the chart. Save the chart to add information during the series of lessons on earthquakes.

Explore: (20 minutes) Identify locations on the map of California

3. Distribute H1a, b (Earthshaking Events). Ask students to mark the location of Carpinteria with a star using a colored pencil. Ask students to pick another colored pencil and trace the San Andreas Fault. Ask students to pick a third color to trace the other active faults in California.
4. Explain to students to use the map scale to measure the distance from Carpinteria to the nearest fault and record the fault and distance on H1 a, b (Earthshaking Events).
5. Ask students to use a 4th color and plot the epicenter of California’s historic earthquakes. Next to the epicenter, ask students to write the magnitude for each earthquake.

6. Ask students to measure the distance from Carpinteria to the nearest epicenter of a historic earthquake. Record the name of the earthquake and the distance from Carpinteria on H1 a, b (Earthshaking Events).

**Explain (10 minutes)** Earthquakes indicate plate movement along faults in California

7. Ask students to refer to information on Earthshaking Events activity sheet. Lead a class discussion including these questions:
   
   a. What major fault is closest to your city?
   b. What is the distance from your city to the fault?
   c. What historical earthquake was closest to your city?
   d. What is the distance from your city to this earthquake?
   e. What was the magnitude?
   f. Were any of these historical earthquakes during your lifetime?

**Extend (10 minutes)** A map of faults and historical earthquakes can be use to analyze earthquake risk in California

8. Ask partners to discuss how great is the earthquake risk in Carpinteria (high, medium, low)?

9. Ask students to record the risk on H1 a, b (Earthshaking Events) and explain their reasoning including factors such as the role of plate tectonics, active faults and historic earthquakes.

**Evaluate (10 minutes)**

10. Ask students to discuss Carpinteria’s risk level and reasons with table group.

11. Ask table groups to come to a consensus about Carpinteria’s risk level. Ask each student to record on half sheet of paper to be used as an exit slip. Remind students to include factors for their consensus such as role of plate tectonics, active faults and historic earthquakes.

12. Refer students to the L column on the KWL chart and complete ideas for what they learned today.

13. Submit consensus half sheet as an “Exit Slip”
EARTHSHAKING EVENTS!

Problem:
How can you use a map of faults and historic earthquakes to analyze earthquake risk in California?

Materials:
* Map of California  * 4 colored pencils  * ruler

Procedure:
1. On the map of California, mark the location of Carpinteria with a star.
2. With a second color, trace the San Andreas Fault.
3. With a third color, trace the other active faults in California.
4. Use the map scale to measure the distance from Carpinteria to the nearest fault and record the fault and distance in #1 of questions.
5. In a 4th color, plot the epicenters of California’s historic earthquakes, next to the epicenter, write in the magnitude for each one.
6. Measure the distance from Carpinteria to the nearest epicenter of a historic earthquake. Record the name of the quake and the distance in #2.

Analyze and Conclude:
1. What major fault is closest to Carpinteria? _____________________________
   What is the distance from Carpinteria? _____________________________

2. What historic earthquake was closest to Carpinteria? ___________________
   What is the distance from Carpinteria? _____________________________
   What is the magnitude? _____________________________

3. Based on Carpinteria’s distance from an active fault and historic earthquake, how would you rate our earthquake risk (high, medium, low)? Explain why, including factors such as the role of plate tectonics, active faults and historic earthquakes.
### Earth Shaking Events: Earthquakes and Volcanoes

#### Historic Earthquakes

<table>
<thead>
<tr>
<th>Earthquake</th>
<th>Epicenter</th>
<th>Magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fort Tejon, 1857</td>
<td>somewhere along the southern San Andreas fault</td>
<td>7.9</td>
</tr>
<tr>
<td>Owens Valley, 1872</td>
<td>118° W, 37° N</td>
<td>7.4</td>
</tr>
<tr>
<td>San Francisco, 1906</td>
<td>approximately 123° W, 38° N</td>
<td>7.8</td>
</tr>
<tr>
<td>Calaveras fault, 1911</td>
<td>122° W, 37° N</td>
<td>6.5</td>
</tr>
<tr>
<td>Long Beach, 1933</td>
<td>118° W, 34° N</td>
<td>6.4</td>
</tr>
<tr>
<td>Imperial Valley, 1940</td>
<td>116° W, 33° N</td>
<td>7.1</td>
</tr>
<tr>
<td>Concord, 1955</td>
<td>122° W, 38° N</td>
<td>5.4</td>
</tr>
<tr>
<td>San Fernando, 1971</td>
<td>118° W, 34° N</td>
<td>6.7</td>
</tr>
<tr>
<td>Gorda Plate, 1980</td>
<td>125° W, 41° N</td>
<td>7.2</td>
</tr>
<tr>
<td>Loma Prieta, 1989</td>
<td>122° W, 37° N</td>
<td>6.9</td>
</tr>
<tr>
<td>Northridge, 1994</td>
<td>119° W, 34° N</td>
<td>6.7</td>
</tr>
<tr>
<td>Parkfield, 2004</td>
<td>120° W, 36° N</td>
<td>6.0</td>
</tr>
</tbody>
</table>