

# Example Answers

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Class: \_\_\_\_\_

## Geology and Earthquakes in Japan Worksheet

**Objective:** Investigate the geologic conditions that make Japan a frequent location for large-magnitude earthquakes.

**Materials:** Work in pairs sharing one computer with Internet access.

**Engage:** Take a moment to think about what you already know about Japan.

1. Where is it located?

*Example answers:* Japan is an island off the coast of the Asian continent. Japan is located in the Pacific Ocean/

2. What do you know about the geology of Japan?

*Students might not know much about the geology, but expect them to know that Japan is an island. Japan also has volcanic activity and an active fault.*

3. Have you heard of earthquakes in the Japan area?

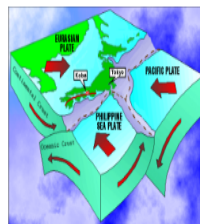
*Possible answers:* The 2011 Fukushima earthquake, which caused a tsunami, resulted in a nuclear disaster. Japan has had several other historic earthquakes, including one in 1995.

**Explore:** Navigate to the Earthquakes Living Lab at <http://www.teachengineering.org/livinglabs/earthquakes/>.

4. Notice the four main focus regions in the Earthquakes Living Lab, each based on one of four historic earthquakes. For this activity, select the third option, the “Japan” box. Then follow the link on the right side of the page: “Why did the earthquake happen at Kobe? What were the short- and long-term effects of the earthquake?”



Effects and consequences of earthquakes



Why did the earthquake happen at Kobe? What were the short- and long-term effects of the earthquake?

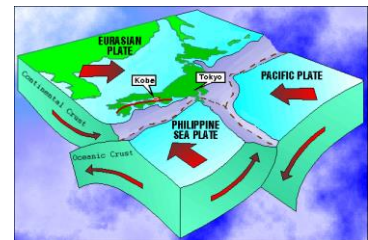
Click to learn!

5. Read the screen information about “Why did the earthquake happen here?”

**Explain:** Record the following information in your journal:

6. Draw a labeled sketch of the plate tectonics present in the Kobe region. Include the name of the fault, crusts and plates. Make the sketch large enough to add additional information to it later in the activity.

*On the sketches, make sure students identify the Philippine Plate, Pacific Plate and Eurasian Plate, as well as the continental and oceanic crusts and Nojima Fault. →*



7. Describe the motion of each tectonic plate relative to the other plates. (Hint: Look at the arrows.)

*Answer:* The arrows indicate the plates are pushing towards one another in a clockwise fashion, with the Pacific Plate going under the Philippine Plate. The Philippine Plate is then being pushed on the Eurasian Plate.

8. Plot the epicenter of the Kobe earthquake on your sketch. (Hint: Look for the red line.)

*Answer:* Awaji Island is the epicenter, where the red line is on the graph. It should be located right above where “Kobe” is labeled.

**Elaborate:** Read through the given information provide answers to the following items.

9. Identify which two plates likely caused the 1995 Kobe earthquake.

*Answer:* The Kobe region and earthquake epicenter occurred where the Philippine Plate is being pushed beneath the Eurasian Plate. The text states, “The denser oceanic Philippine Plate is being subducted beneath the lighter continental Eurasian Plate at a rate of about 10 centimeters per year.” This is relatively quick movement, and probably caused the earthquake.

10. Consider the movement of all three plates in the region. Identify two other potential locations that similar earthquakes might occur (or may have occurred in the past).

*Answer:* The two other locations are where the Eurasian Plate meets the Pacific Plate and where the Pacific Plate meets the Philippine Plate.

11. Describe the short-term and long-term effects of the earthquake.

*Answer:* The collapse of buildings, bridges and roads. Massive damage to transport facilities including railway lines resulted. Fire triggered by broken gas pipes caused serious damage, destroying thousands of homes. ~300,000 people were left homeless.

**Evaluate:** Another significant earthquake occurred in this same region in 2011. Complete some quick research to find out the location of the epicenter of the 2011 Sendai earthquake near Japan. Start with this link [http://en.wikipedia.org/wiki/2011\\_T%C5%8Dhoku\\_earthquake\\_and\\_tsunami](http://en.wikipedia.org/wiki/2011_T%C5%8Dhoku_earthquake_and_tsunami) or do your own search.

12. Was the epicenter associated with any tectonic plates?

*Yes, the Pacific Plate.*

13. Was this earthquake associated with a fault or trench?

*Yes, the Japan Trench.*

14. Were the “experts” surprised by the location of the Sendai earthquake, the size of the Sendai earthquake or both? Answer the question using specific information from this article written by Devin Powell, originally published in *Science News* on March 17, 2011 at: <http://www.wired.com/wiredscience/2011/03/japan-earthquake-surprise/>



*Experts were surprised by this earthquake’s location. Though the area is active, it has never had an earthquake more than magnitude 8.0.*

15. How does predicting where earthquakes might occur relate to engineering? For what instances in the 1995 earthquake could the engineering have been improved?

*Expect students to suggest building and bridge safety, pipe and water lines, etc. They might mention fire protection, road/building/bridge construction and stairways relating to the 1995 earthquake.*

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**Extra Exploration:**

16. Let's see how many earthquakes occurred this week near Japan and what magnitudes they were. Make a sketch of the locations and magnitudes of earthquakes for the last seven days in the Japan region. Use the following link to get current earthquake data near Japan and anywhere in the world (you may have to zoom in on the Japan area to get details):

<http://earthquake.usgs.gov/earthquakes/map/>

Answers will vary. Example sketch and answer:



*Congratulations—you have completed this activity!* This is only a small part of all there is to know about earthquakes, and researchers are learning new things all the time. Feel free to come back to this resource to keep learning as often as you like.