

## ACTIVITY: Pasta Quake Magnitude Grades K - 2

Purpose: Students learn about the relative sizes of earthquakes by breaking different size bundles of uncooked spaghetti noodles and that the magnitude scale is not linear, but increases approximately 30-fold for each step.

Time: 50 minutes of class time to complete the activity and discussion. 60 to 90 minutes of preparation time for the teacher.

Educational Standards: 3PS2-1, 3PS2-2, R1.2.1, W.2.8, VPA1.1

See Additional Resources for Teachers – California Educational Standards for Kamome – under the Resource Menu for standard definitions.

### Materials:

Computer with display screen

1-pound package of thin spaghetti or a two-pound package of regular spaghetti

32 large rubber bands

One fat drawing pencil, one tennis ball, one beach ball

You will need a single strand of pasta to represent a magnitude 5 earthquake, bundles of 30 strands to represent a magnitude 6, and bundles of 900 strands to represent a magnitude 7.

*Teacher preparation: Prepare pasta bundles ahead of time (1 strand and 1 bundle per student in your class)*

*(a) Set aside 30 single strands of spaghetti*

*(b) Make a minimum of 30 bundles of 30 strands of spaghetti, holding each together with a rubber band. In addition, make one bundle of 900 strands. This will allow you to demonstrate the energy in an M5 (1 strand), an M6 (30 strands) and an M7 (900 strands) earthquake.*

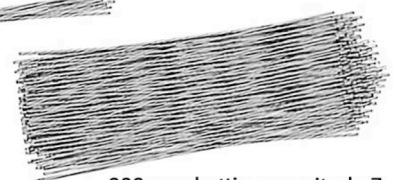
1 spaghetti = magnitude 5



30 spaghetti = magnitude 6



900 spaghetti = magnitude 7



*(c) To demonstrate the energy of an M8 earthquake, you would need 900 bundles of 30 strands each (27,000 strands). Rather than making this impossibly large bundle, preview the video:*

[https://www.iris.edu/hq/inclass/video/pasta\\_quake\\_modeling\\_magnitude\\_scale\\_using\\_spaghetti](https://www.iris.edu/hq/inclass/video/pasta_quake_modeling_magnitude_scale_using_spaghetti)

*The video will give you a visual demonstration of an M5, M6, M7, M8 and an M9 earthquake. You can show this video to students (although the dialogue might not engage them) and/or skip to step# 3 below. This video is also useful to watch before the lesson for an explanation of how to model the difference between a magnitude 6 and a magnitude 9 earthquake.*

*In the moment-magnitude scale a magnitude increase of one unit corresponds roughly to a factor of 30 increase in the energy released by the breaking of the fault in an earthquake. That's why we increased the number of spaghetti noodles from 1 to 30 to 900 ( $900 = 30 \times 30$ ). In order to release the energy of one M 7 earthquake you would have to have 30 M 6 quakes or 900 magnitude 5's.*

## Procedure:

### 1. Magnitude 5 earthquake

(a) Hand out one piece of spaghetti to each student. Tell the students the spaghetti represents a little bit of the earth's crust.

- Hold up one piece of spaghetti.
- Tell the students to bend the piece with their hands until it breaks. Ask them how hard it was to break the strand and how long it takes them to break the piece. Listen to the sound the spaghetti makes when it breaks. Is the sound short or long? The sound is just like the seismic waves that travel through the earth when rocks break during an earthquake.
- Tell students you are going to give this single piece of spaghetti activity a name of M5 (5 on the Pasta Magnitude scale). Write M5 on the board.
- Ask for students' observations on how hard it was to break the piece of spaghetti and what they observed using their senses of sight and sound.
- Record student responses on the board under the M5.

### 2. Magnitude 6 earthquake

Hand out a bundle of 30 pieces of spaghetti to each student. Tell the students the spaghetti bundles are like stronger rocks in the earth's crust.

- Hold up a bundle of spaghetti.
- Tell the students to bend their bundle until it breaks. Notice the work it takes to break the bundle. Tell them to listen to the sound and feel the vibrations in their hands when the bundle breaks.
- Tell students you are going to give this bundle of spaghetti activity a name of M6 (6 on the Pasta Magnitude scale). Write M6 on the board.
- Ask for students' observations on how hard it was to break the bundle of spaghetti and what they observed using their senses of sight, sound and feel. Encourage them to compare this activity with the breaking of 1 piece of spaghetti.
- Record student responses on the board under the M6 (If the pasta magnitude scale were like the earthquake magnitude scale this would be a Pasta Magnitude 6 break.)

### 3. Magnitude 7 earthquake

Hold up a bundle of 900 pieces of pasta. Tell the students the spaghetti bundle is like an even stronger part of the earth's crust.

- Ask for a student volunteer (or volunteers) to help you bend the bundle until it breaks. Notice how hard it is to break the bundle. What does it sound like?
- Tell students you are going to give this bundle of 900 pieces of spaghetti activity a name of M7 (7 on the Pasta Magnitude scale). Write M7 on the board.

- Ask for students' observations on how hard it was to break the bundle of spaghetti and what they observed using their senses of sight and sound. Encourage them to compare this activity with breaking the bundle of 30 pieces.
- Record student responses on the board under the M7.

Discussion: Talk with students about the similarities and differences in their observations between breaking 1 piece of spaghetti, a bundle of 30 pieces and the larger bundle of 900 pieces. Tell them this illustrates the increase in energy released as you step up the earthquake magnitude scale. Ask them if the M6 pasta quake is twice as big as the M5? (No – it is 30 times bigger). How they might represent an even bigger earthquake such as M8? How many pieces of pasta might it take? (900 x 30 or 27,000 pieces)

Optional: Show the video

[https://www.iris.edu/hq/inclass/video/pasta\\_quake\\_modeling\\_magnitude\\_scale\\_using\\_spaghetti](https://www.iris.edu/hq/inclass/video/pasta_quake_modeling_magnitude_scale_using_spaghetti)

Another way to illustrate the difference in size between M6, M7, M8 and an M9 earthquake is to use physical objects:

A fat drawing pencil (represents an M6)

A tennis ball (represents an M7)

A beach ball (represents an M8)

A circle (an imaginary circle) with a diameter slightly larger than the height of a door (represents an M9)

4. Ask for student participation in these questions and/or review this information with your students.

(a) In this activity we did with the spaghetti, what does the spaghetti represent? (The earth, rocks, faults)

(b) What do your hands represent? (forces, stress)

(c) What does the breaking spaghetti represent? (an earthquake)

(d) Do you think a real earthquake releases the same amount of energy as breaking a piece of pasta? (no of course not – that's a silly question! Earthquakes release much, much, much, more energy)

Extension Activities:

1. Hands-on Activity: Magnitude Scale

[https://www.teachengineering.org/activities/view/cub\\_natdis\\_lesson03\\_activity4](https://www.teachengineering.org/activities/view/cub_natdis_lesson03_activity4)

2. Hands-on Activity: Testing Model Structures: Jell-O Earthquake in the Classroom

[https://www.teachengineering.org/activities/view/cub\\_natdis\\_lesson03\\_activity1](https://www.teachengineering.org/activities/view/cub_natdis_lesson03_activity1)

3. For the teacher: Seismic Wave Energy in Earthquakes Energy Equivalents graphic

<https://earthquake.usgs.gov/learn/topics/mag-intensity/images/Mag-Energy-Freq-lg.gif>

4. For the teacher: For an online - Try It Yourself Calculator - to compare earthquake magnitudes

[https://earthquake.usgs.gov/learn/topics/how\\_much\\_bigger.php](https://earthquake.usgs.gov/learn/topics/how_much_bigger.php)

This activity adapted from the Cascadia Earthscope Earthquake Tsunami Education Project (CEETEP)

<https://ceetep.oregonstate.edu>

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