

ROCK AND ROLL

Balancing River Rocks

Target Population:
Students, ages 6–18



Rock and Roll: Balancing River Rocks is part of the STEM²D Student Activity Series. The content and layout were both developed by the Smithsonian Science Education Center as part of Johnson & Johnson's WiSTEM²D initiative (Women in Science, Technology, Engineering, Mathematics, Manufacturing, and Design), using a template provided by FHI 360 and JA Worldwide. This series includes a suite of interactive and fun, hands-on activities for girls (and boys), ages 5-18, globally.

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Rock and Roll:

BALANCING RIVER ROCKS

Challenge: Create a balanced sculpture of two to five rocks kept in place by shape, weight, and friction

Target Population: Students, ages 6–18

ACTIVITY DESCRIPTION

Balancing rocks is a learned skill and a growing Earth art form. Students will first experience the skill of balancing by designing a simple balance using a rock as a fulcrum to balance two river rocks. They will create a unique, temporary balanced sculpture from two to five river rocks of various shapes and sizes. This activity combines the science of gravity with hand-eye coordination and basic engineering to make a piece of art held together by “gravity glue.” Older students may want to try to counterbalance the rocks, making arches and other structures that seem to defy gravity. Students will troubleshoot and practice trial and error to solve this engineering challenge.

Materials

For 100 students:

- 600 River rocks, different shapes and sizes
- 6 Wooden rulers or paint-stirring sticks, 12-inch
- Optional: Computer playing YouTube video *Gravity Glue*, 2014 by Michael Grab
- Purchase River Rocks:
 - Lowes Garden Center*
 - Color Scape River Rocks 0.5 Cu Ft, 30 lbs., \$3.58*
 - Old Castle Lawn & Garden, Inc.*
 - P.O. Box 468567*
 - Atlanta, GA 31146*



Safety

Even small rocks are heavy and hurt if dropped on a person's feet or toes. Watch that all rocks are away from table edges.

Instructions: Open Engineering

1. Provide each student with three river rocks and a ruler or paint-stirring stick. Ask them to make a base and balance two rocks. This gives the student a feel for the fine-tuning of finding the center of gravity needed to balance rocks.
2. Let each student select several river rocks to begin to make a rock sculpture. There should be at least 20 rocks available for them to choose from as they work to balance the rocks.



zmescience.com

3. Have the YouTube video *Gravity Glue*, 2014 by Michael Grab playing on a computer so students can see some of the amazing balanced rock sculptures and how they are engineered.

Younger students will begin by stacking the rocks on top of each other, making a tower. There is a difference between stone stacking and rock balancing. Stacked stones or rocks tend to look flat and are not very dramatic. Balanced rocks catch your attention, making your mind's eye try to find the center of gravity.

Background Information/Resources

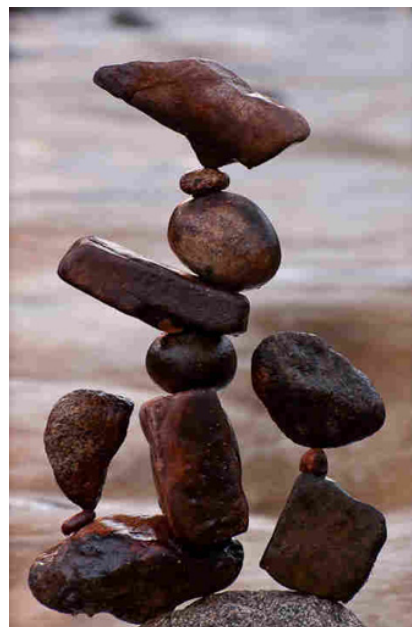
Smithsonian STC Curriculum: Balancing and Weighing

In *Balancing and Weighing*, students explore balance and discover that it is affected by three variables: the mass of an object, the length of the lever arm, and the position of the fulcrum. Using an equal-arm balance to conduct their investigations, students learn to measure mass and are able to arrange objects in serial order according to their mass. Students discover that mass is not directly related to volume as they measure the mass of equal volumes of foods.

YouTube video *Gravity Glue*, 2014 by Michael Grab (*Short version, 7 minutes, 38 seconds*)

Rock Balancing Art by Peter Juhl, author of *Center of Gravity: A Guide to the Practice of Rock Balancing*, 2013

Choose a longish rock with rounded ends and try to balance it on a boulder or other stable base rock. Find a depression, chip, or bubble in the base, not too small—at this point try for something not much smaller than a half-inch wide, and deep enough so that your balancing rock does not “bottom out” in it. Nestle a rounded end into the depression with the rock roughly vertical.



Michael Grab, npr.org

Feel the direction in which it is trying to fall. Turn and twist, “walking” it around in the depression, always gently tilting opposite the direction it wants to fall while trying to keep the end nestled in. You will eventually feel certain positions in which the tendency to fall is less pronounced. Pursue these as you continue finer adjustments. Eventually your fingers will sense a point where the rock attains stability: As you loosen your hold on the rock, it will no longer be trying to fall over, but will almost imperceptibly seek to maintain its vertical orientation. Loosen your hold further, making any necessary final adjustments by feel, until you have let it go altogether. With luck, you can take a step back, shake the ache out of your arms, and admire your first balanced rock.

Stay with one rock until you have mastered it, balancing it again and again, trying

a different contact on the base, the other end of the rock, a different rock. Practice using a contact that is on a slope. Try a smaller contact. Choose a depression contact on the underside of the rock you're balancing coupled with a smooth surface on the base rock.

Adding a second rock complicates things. If you can find a suitable contact on the second rock directly above the first rock's balance point, all you have to worry about is trying not to disturb the first rock as you place the second. If you can't, then you have to adjust the first rock to account for the shift in the center of gravity you caused by adding the second rock. It all gets easier with practice, but it pays to take one step at a time.

<https://curiosity.com/topics/the-beautifully-precarious-art-of-rock-balancing/>

There are a handful of famous rock balancers around the world who seem to be supernaturally in tune with their medium. One such artist, Michael Grab, says that he balances his stone sculptures by feeling for the tiniest of indentations on the rocks that can interact with and counterbalance each other. An annual Rock Stacking World Championship is held in Llano, Texas, where competitors can focus on categories such as height and arches.

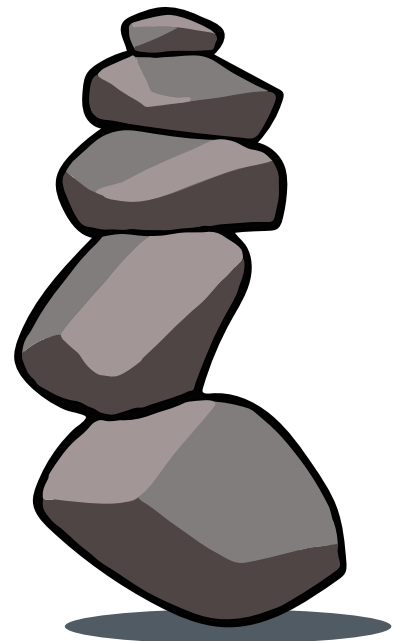
Be aware, stack with care! Be respectful of the environment and animal habitats. [HTTPS://RHYTHMSOFPPLAY.COM/ROCK-BALANCING-STONE-STACKING-ART-STEAM-ACTIVITY/](https://rhythmsofplay.com/rock-balancing-stone-stacking-art-steam-activity/)

Rock balancing or stone stacking is not an activity that should be done in certain locations. It can disturb natural habitats and lead to the extinction of certain species.

On the island of Aruba, the art of balancing rocks and stacking stones is not advised and many are attempting to have the activity banned entirely. In the US, the national parks service forbids disrupting or moving any rocks or other natural structures within the parks.

Questions/Assessment:

1. What did you discover when making a balance and trying to balance two rocks?
2. Which rock made the best fulcrum? Why?
3. To give one side of a rock less weight, did you move it closer or farther away from the fulcrum?
4. Are you stacking or balancing your rocks?
5. Where is the center of gravity for your sculpture?
6. Did you enjoy doing this engineering activity?





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