

Topics: Motion, Forces,
Chemical & Physical
Properties, Earth Science

Materials List

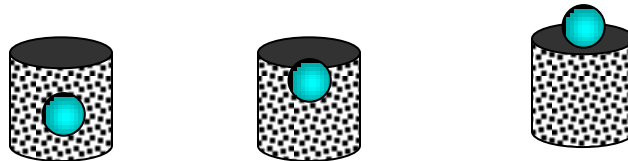
- ✓ 2-liter bottle preform tube
- ✓ Standard shape bottle cap
- ✓ 1 marble
- ✓ Sand

This activity can be used to teach:

- Mixtures (Next Generation Science Standards: Grade 5, Physical Science 1-4)
- Geoscience Processes (Next Generation Science Standards: Middle School, Earth & Space Science 2-2, High School, Earth & Space Science 2-2)

Brazil Nut Effect

The Settling of Packaged Materials



Whenever a can of mixed nuts is opened, the Brazil nuts tend to be on the top. This phenomenon seems counterintuitive, because the Brazil nuts are more massive than the peanuts, cashews and other nuts in the can. How can this be?

Assembly

1. Place the marble into the preform tube.
2. Fill the preform $\frac{3}{4}$ full with sand.
3. Cap the preform securely.

To Do and Notice

1. Shake the container for a few seconds. Notice that the marble will eventually rise to the top and rest on the sand despite the fact that the marble is much heavier than the sand particles.

The Science Behind the Activity

This phenomenon is known as the “Brazil Nut Effect” and illustrates the physical process called kinetic sieving, where an initially homogeneous mixture is sorted by size, with the larger particles overlying the smaller ones. When materials are shaken, voids are continually being created beneath grains. The smaller grains (such as sand or peanuts) are more likely to fall in and fill the available space. This process is primarily a function of particle size (with density also playing a role). Although the difference between the size of the Brazil nuts and the other nuts is not as pronounced as with the marble and the sand, the process and the results are the same; it just takes longer with the nuts.

This type of sorting is of particular interest to geologists and planetary scientists, who use complex mathematical formulas to predict stratification during avalanches, landslides, and underwater silt flows at the ocean bottom. There are also applications for scientists working with very small Nanomaterials

Taking it Further

- Encourage students to investigate this phenomenon further by trying different materials, such as rice and gravel.
- Students can use this activity in a series of investigations on sorting and separating mixed materials (i.e. – salt, pepper, sawdust, iron filings)

Web Resources (Visit www.raft.net/raft-idea?isid=4 for more resources!)

- For a look at how this phenomenon is applied in cutting edge research in geology, visit - nile.physics.ncsu.edu/pub/Publications/papers/Shearer-2007-SSS.pdf