Shake It!

Suggested Age: 5-7
Time: 15 minutes

If you've every opened up a can of mixed nuts, you may have noticed that the larger nuts tend to be on the top, and as you eat the nuts, the smaller ones are on the bottom (unless you dig through the can to find the kind that you want). This phenomenon is known as the Brazil Nut Effect. The Brazil Nut Effect occurs when a container of smaller objects with a larger object mixed in is shaken and the larger object rises to the top due to convection forces. Convection forces occur when the objects flow in a circular motion. The larger object moves toward the top, but is too large to move back down through the flow to the bottom again, thus ending at the top of the container.

In this activity we will:

- Examine how large objects move when placed in a container of sand and shaken.
- You will investigate the Brazil Nut Effect and create an example using objects that can be found in the home.

Materials

- Funnel with a small aperture
- Container of sand (colored art sand or play sand)
- Small marble
- Small clear plastic container (i.e. salt shaker or soda/water bottle)
- Clear tape
- Empty clear plastic container (i.e. peanut butter jar or soda/water bottle)
- Various sized dried foods (i.e. rice, sugar (colored sugars work well), popcorn kernels, small pasta shells, marshmallows, etc)
- Chopstick

Safety

Be sure to work in an area which can be easily swept. Sand is very difficult to get out of carpet, thus, a room with a smooth floor surface is an ideal location. Sand is an irritant if it gets into your eyes. Do not touch around or near your eyes while doing this activity and be sure to wash your hands thoroughly at the conclusion.

Preparation

To prepare for this activity, depending on the colors of your dried foods, you may need to use food coloring to dye them:

1. Place a small amount (about ¼ cup) of one of the dried foods (white or light in color) in an empty disposable container.
2. Place a few drops of food coloring into the container.
3. Place the lid on the container. Holding the lid on, shake the container, checking every now and then to see if all items have been dyed.
4. Repeat with different colors if there are other food items that are similar in color.

Pre-Activity

Discuss with the children what they think would happen if a marble was placed in the bottom of a container of sand and the container was shaken. Would the marble stay at the bottom? Would it move to one side? Would it rise to the top? Ask them for their justification to their answer.

Activity

When you open a new box of cereal that contains marshmallows, what do you observe as you eat more and more of the cereal? More of the marshmallows (depending on whether the marshmallows are either larger or smaller than the cereal) either ends up at the top half or the bottom. What causes this?

- Open the small clear container and place the marble in the bottom of it.

- Carefully funnel sand into the container until it is about ½“ from the top of the container.
- Place the lid back on the container as tightly as possible. Seal off the edge between the lid and the container using clear tape.
- Shake the container vertically several times. Observe what happens. Where did the marble go? Is it still at the bottom? What do you think would happen if objects of many different sizes were placed into a container and mixed up and then shaken?
- Place approximately ½ cup of each dried food into the other larger container.

- Using a spoon, stir it until there are no layers of each food type.
- Place the lid securely back onto the container and seal with clear tape.
- Shake this container vertically with quick jerking motions. What do you observe happening? Is this what you had expected? Why?

Extension Activity

1. Count the number of shakes that it takes to move the marble from one end of the container to the other. Flip it over and repeat. Is the number consistent? What variables could be affecting any differences you may be seeing?
2. Instead of shaking the container of dried foods by hand, set the container on the dryer when a load of clothes is being run through. See if the vibrations from the dryer are enough to cause the layers to separate out.

References

http://www.seed.slb.com/en/scictr/lab/brazilnut/res.htm
http://jfi.uchicago.edu/~jaeger/group/brazilnut.html