



## **Rice Handle**

**Primary Audience: 3<sup>rd</sup> – 5<sup>th</sup>**

**Description:** Explore the affects density, gravity and resisting forces have on an object.

**Keywords:** Density, Gravity, Friction

### **Materials:**

- Plastic spoons
- Uncooked, dry rice - enough to fill bottles
- 10-15 vitamin or spice bottles
- 10-15 trays to catch spilled rice

### **Teacher Preparation:**

- Practice poking the handle of the spoon into a bottle of rice so the rice holds the handle tightly and you are able to lift the entire bottle of rice with the spoon handle. For best results, tap the bottle on a counter to settle the rice.
- Then, keep the bottle of rice as still as possible and poke the spoon handle in the rice gently and firmly, allowing the spoon handle to “pack” down the kernels of rice with each poke.
- After repeated tries, you will feel the spoon being held tightly in the rice. You will be able to lift the bottle with the spoon. If it doesn't work, you may need to add more rice to fill the bottle. Note: When lifting the bottle of rice, be sure to have your other hand under the bottle in case it slips off the spoon.

### **Instructions:**

1. Before your students come in, prepare a bottle of rice so that the rice is packed and ready to be lifted with a spoon. Introduce the investigation by demonstrating one final poke of the spoon handle in the rice, and then lift the bottle. Pour out the rice to show students the contents of the bottle – just dry rice. Ask questions, such as “How did this happen?” Help the students uncover what they know. (Do NOT explain concepts, provide answers, or state any conclusions.)
2. Divide the class into teams of 2-3 students. Give each team one spoon, one plastic bottle filled with rice, and one tray. Encourage students to work together to

figure out how to get the spoon handle to “stick” in the rice so that it can lift the bottle. Suggest students look closely at the shape, position, and texture of the rice kernels. Observe and listen to students’ ideas for getting the handle to stick. (Do not provide answers or lead students in a step-by-step solution.)

### **Further Exploration:**

The air space in the bottle of rice can be measured. Place the rice in the bottle. Using a measuring cup full of water, slowly pour water into the bottle until it is full. Wait until the water seeps to the bottom of the bottle. Repeat until the bottle is full. Look at the measuring cup to see how much water was used. This equals the volume of air space between the rice. Empty the bottle, dry the rice and do the experiment. After the rice is compacted, add water once again. What happens?

Color a small amount of rice (about 1 tablespoon) using food coloring or a wide tipped colored marker. Let rice dry thoroughly. Fill a small, clear bottle with rice, top it off with the colored rice. Now do the experiment again. What happens to the colored rice?

### **What’s going on?**

Have each group give possible explanations of how the spoon is held in the bottle of rice to the entire class. Use students’ ideas to formally explain that all matter takes up space. When rice is first placed in the bottle, it fills the bottle; but there is still space between the rice kernels, leaving space for the rice to move. The rice kernels can be reoriented and compacted. (Density refers to how compact, or crowded, a substance is.) Also, have students think about the forces involved. Gravity pulls down on the bottle of rice, and the resisting force of the rice gripping the spoon handle is caused by friction. In order for the bottle to be lifted, the rice kernels must be so tightly packed around the spoon handle that the gravitational force can be overcome.

### **Elaborate:**

Have students work in small groups and investigate some of the explanations given. Ask students "How do you know that the rice is being compacted?" "What's the best way to pack the rice tightly enough that it can hold onto the spoon handle?" Allow students to try out various ways of packing the rice and determine which method works best.

### **Evaluate:**

Observe students in their small groups as they apply new concepts and skills, demonstrating an understanding of density and forces. Allow students to assess their own learning and group-process skills. Ask open-ended questions, such as

Topic: Matter

"What evidence do you have of the rice being compacted?" Have students generate questions for further investigation, such as "What other materials might work in place of rice?" Experiment with other materials, such as popcorn, brown sugar, snow, etc. in the bottle. Ask students to think about real-world situations in which an understanding of material compaction and forces might be applicable.

**Relevant Ohio Science Content Standards:**

**Physical Sciences:** 3.3, 3.4