

Soy Activities and Experiments

Sounds of Soyence

What produces the sounds that you hear from a rainstick?

(You may want to leave this activity until last so that your instruments can remain intact.)

What You Need (per rainstick)

- cardboard tube from paper towels or wrapping paper
- push pin
- round toothpicks
- glue
- masking tape
- two pieces of paper, each 4 inches square
- adult scissors or wire cutters
- soybeans (approximately 2 tablespoons)
- safety goggles

What To Do

1. Use the push pin to punch holes through the wall of the tube.
2. Directly opposite each hole, punch another hole.
3. Push the toothpicks through the holes and place a dab of glue where the toothpicks meet the outside of the tube. Set it aside to dry.
4. Wearing the safety goggles, cut off the extended parts of the toothpicks.
5. Cover one end of the tube with a piece of paper and secure it with masking tape.
6. Pour the soybeans into the tube. Cover the open end of the tube with your hand and tip the tube several times. How does it sound? What is causing the sound?
7. After adjusting the number of beans to get a sound that you like, cover the open end with a piece of paper and tape it to the tube. How does the sound of your rain stick compare with others in your class?

What's Going On?

Sounds are made when something vibrates back and forth very rapidly. To produce a sound, the energy from the vibration must be transferred from one thing to another. As the beans fall through the tube, they collide with one another, the toothpicks and the inside wall of the tube. With each collision, sound is produced. The multiple sound waves travel through the air in the tube, creating a rain-like sound. The sound is amplified because the closed shape concentrates the sound waves in a small area rather than allowing them to disperse in all directions.

Open Exploration

Make rainsticks using a variety of materials or different tube lengths and widths. Compare the sounds made by rice, pebbles, beads or various types of beans. Try making other percussion instruments such as Maracas. You may also like to read [The Rainstick, A Fable](#) by Sandra Chisholm Robinson which examines the origins, variations and science of the rainstick.

Smashing Soybeans

What's in a soybean?

What You Need (per group)

- 1/2 cup of soybeans
- 1 gallon resealable bag
- newspaper
- hammer
- large glass jar
- hot water
- measuring spoons
- brown paper sack
- rubber gloves
- safety goggles
- vinegar
- liquid drain cleaner
- clear plastic cup
- small clear tube with cap

What To Do

Put the soybeans in the resealable bag, remove as much air as possible and seal. Place the bag between the sheets of newspaper, on a hard surface. Use the hammer to break up all of the soybeans (it takes about 5 minutes). Place the pulverized beans into the glass jar and cover with 3 inches of hot water. Stir for 3 minutes. What does the mixture look like? What does it feel like? Let the mixture sit overnight. How has its appearance changed? How many layers can you see? What do you think is in each layer? Touch the top layer with your finger, rub it on your palm or a piece of brown paper. What do you think it is? Why?

What's Going On?

When you crush, stir and soak the soybeans, you release the oil from the soybeans and the oil collects on the top of the mixture because it is less dense than the other substances. The soybean meal settles to the bottom of the container, while the middle layer is a solution of water and protein. Soybeans are an important source of both oil and protein.

Further Exploration

Separating the protein

Place 2 tablespoons of the protein/water solution into a clear plastic cup. Add 1 tablespoon of vinegar and stir. Let the mixture sit for about 10 minutes. What do you see? The two layers form as a result of the acid in the vinegar denaturing (unravelling) the protein. When the protein is unravelled, it is no longer soluble and it precipitates out and settles in the bottom of the cup.

Hydrolyzing oil

While wearing gloves and goggles, skim off half a teaspoon of oil (or use a vegetable oil that contains soybean oil). Pour the oil into a small tube and add 1/2 teaspoon of hot water and 1/2 teaspoon of liquid drain cleaner (Sodium Hydroxide, NaOH). Cap and shake to mix. What do you notice? The foam indicates that the NaOH has hydrolyzed (broken-up) the fatty acids in the oil and soap has formed. This is the process that was used to make the first soaps from animal fat.

BUMBLE BEANS

What happens when you put soybeans inside an inflated balloon?

What You Need (per student)

- three or four soybeans
- 11 inch clear balloon (found in party stores)

What To Do

Place the soybeans into the balloon. Blow up the balloon 2/3 full and tie it. Grip the balloon near the knotted end and twirl it to get the beans moving inside the balloon. What do you observe? What do you see, hear and feel? What creates the noises you hear? How would you explain what's going on?

What's Going On?

Many forces are acting on the soybeans as they move in the balloon. Frictional forces slow the movement of the beans. The force due to gravity slows the bean on its ascent to the top of the balloon, and speeds the bean on its descent to the bottom of the balloon. Centripetal force is supplied by the surface of the balloon pushing the beans toward the center and it keeps the beans moving in a circular motion around the inside of the balloon. The buzzing noise is produced as the beans roll along the inside surface of the balloon, causing the balloon to vibrate. The pitch of the buzzing is determined by the speed of the beans. As the beans move faster, they vibrate more quickly which our ears distinguish as a rise in pitch. The clicking noises are the beans running into each other.

Further Exploration

Rub the balloon against your pant leg or hair for 20 seconds. Let the beans settle in the balloon. What do you observe? Do they come close together or push apart? Rubbing the balloon generates static electricity. As positive and negative charges build up on the beans, similarly charged beans repel each other and oppositely charged beans attract.

MIGHTY SEEDS

How strong are soybeans?

What You Need (per student or pair of students)

- clear plastic cup
- 5 tablespoons of plaster of Paris
- 2 or more tablespoons of water
- plastic spoon for mixing
- dropper
- 3 soybeans

What To Do

Put the plaster of Paris in the plastic cup, add 2 tablespoons of water and mix. Continue to add drops of water until the mixture has the consistency of a very thick milkshake. Push the soybeans into the plaster until they are covered and then smooth the surface. What do you think will happen to the soybeans? Make regular observations. What happens? Why? The next day add a tablespoon of water to the cup and continue to make observations. What happens? Why?

What's Going On?

Seeds require moisture and warmth to germinate. In this case the seed absorbs moisture from the plaster mixture. As the seed absorbs water it increases in size and applies pressure to the surrounding plaster. This force, combined with the strength of the germinating sprout, causes the plaster to crack and allows the shoot to grow up through the plaster. This strength and ability to grow in adverse conditions allows plants to survive in a wide range of environments. You may also notice that when water is mixed with plaster the cup becomes warm. A chemical reaction which gives off heat like this is known as an exothermic reaction.

SUBMABEANS

What makes your soybeans float?

What You Need (per student or group)

- clear drinking glass
- fresh ginger ale or other light colored soda
- several soybeans
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What To Do

Fill the glass 3/4 full with ginger ale. Drop a few soybeans into the soda, one at a time. Observe them for a few minutes. What happens?

What's Going On?

When the soybeans are dropped in the soda, they initially sink, until the bubbles attach to the beans making them more buoyant (able to float). Buoyancy is the lifting force that causes objects to float in both air and water. Carbon dioxide gas is dissolved in the soda. This gives the soda its fizz. The carbon dioxide bubbles that stick to the beans act like tiny balloons, lifting the beans to the surface. Once there, the bubbles expand and eventually pop, releasing carbon dioxide into the air. If enough bubbles pop, the beans sink to start all over again.

Open Exploration

There are many variables you can try. Compare soybeans that have been soaked overnight, rice, raisins, corn kernels and other objects. What results do you get when you use other liquids? How might you explain your observations?

These experiments are from the Ohio Soybean Council.
You can visit their website at www.soyohio.org .