HALLOWEEN DRY ICE SECRETS

13 AMAZING SCIENCE EXPERIMENTS USING DRY ICE

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AMAZING SCIENCE EXPERIENCES

DRY ICE SCIENCE

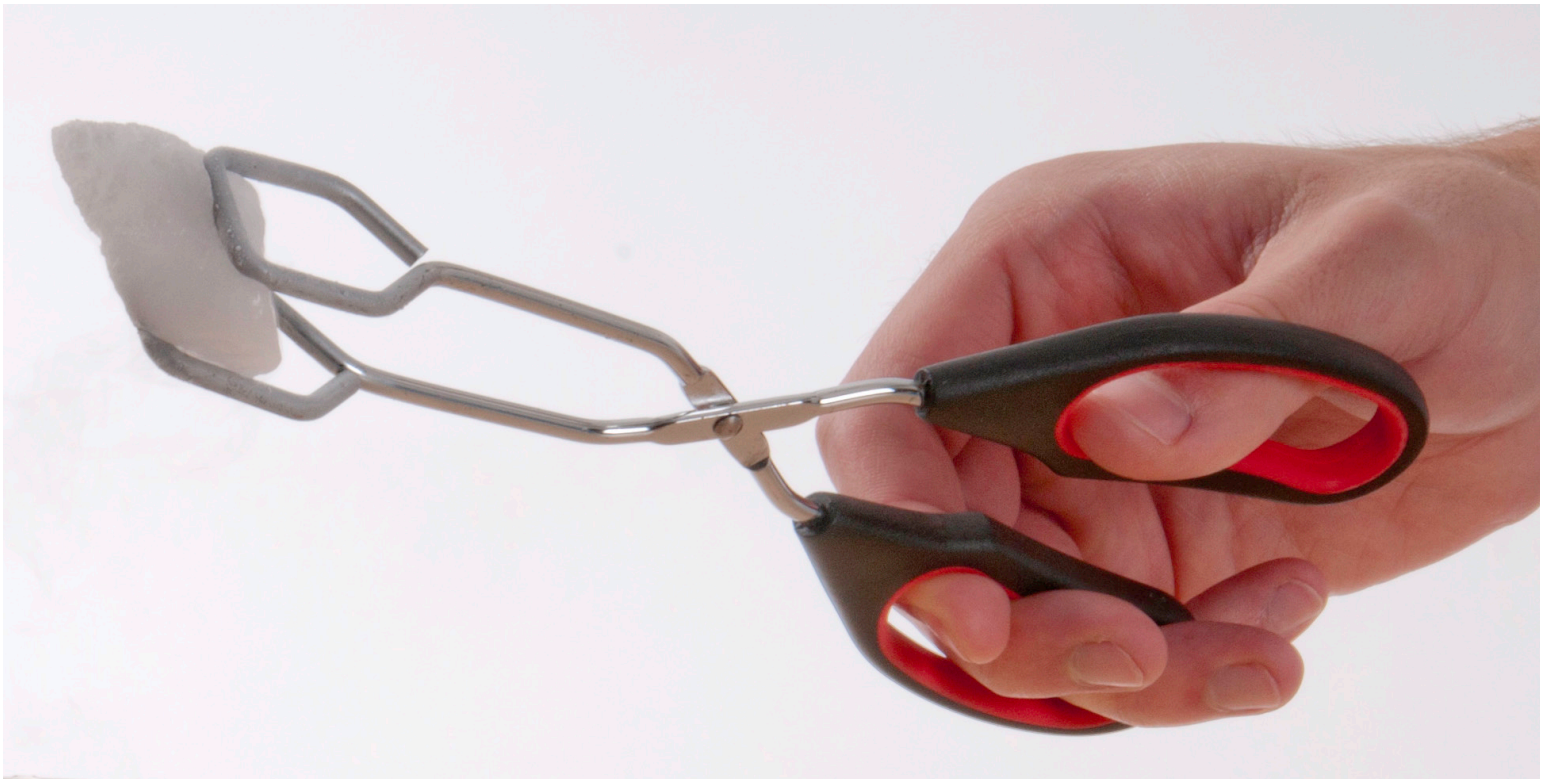
Halloween is the perfect time for oozing, bubbling, eye-catching science! If you love to perform science demonstrations, Halloween is a wonderful excuse to fill the cooler with dry ice and get ready for a day filled with “ooze” and ahhhs!

BUYING DRY ICE

Grocery stores use dry ice to keep food cold during shipping. Some stores and ice cream shops will sell dry ice to the public, especially around Halloween, for about $1 per pound. Dry ice comes as flat square slabs a few inches thick or as cylinders that are about three inches long and about a half of an inch thick. Either size will work fine for your dry ice experiments. Remember, dry ice turns from a solid into a gas in a process called sublimation. In other words, dry ice in a grocery bag will literally vanish in about a day! The experts tell us dry ice will sublimate (turn from a solid to a gas) at a rate of five to ten pounds every 24 hours in a typical ice chest. It’s best to purchase the dry ice as close to the time you need it as possible. Last minute shopping is necessary. If you are planning to perform a number of dry ice demonstrations, plan to purchase 5 to 10 pounds.

DRY ICE SAFETY

First of all, here’s the background information and safety lesson on dry ice. Dry ice is frozen carbon dioxide. Under normal atmospheric conditions, carbon dioxide is a gas. Only about 0.035% of our atmosphere is made up of carbon dioxide. Most of the air we breathe is nitrogen (79%) and oxygen (20%). Instead of melting, dry ice turns directly into carbon dioxide gas but does not melt like real ice. Dry ice must be handled with care as it is -109.3°F (-78.5°C). It must be handled using gloves or tongs, as it will cause severe burns if it comes in contact with your skin. Never put dry ice into your mouth. When you drop a piece of dry ice in a bucket of water, the gas that you see is a combination of carbon dioxide and water vapor. So, the gas that you see is actually a cloud of tiny water droplets.



TRANSPORTING AND STORING DRY ICE

You'll need a good pair of gloves to handle the dry ice and a beverage cooler like a Styrofoam ice chest to carry it. The insulated container will help to slow down the rate of sublimation. Remember the basic science of dry ice… Dry ice turns from a solid into a gas (sublimation) as it heats up. Since the gas takes up more space than the solid, the container you choose to store and transport the dry ice must be vented. **Never place dry ice in a sealed container!** As dry ice turns from a solid into a gas, the volume increases and the container will explode. It is best not to store dry ice in your freezer. Your freezer's thermostat will shut off the freezer due to the extreme temperature of the dry ice. Tricky! It's best just to store the dry ice in a well ventilated, insulated container until you're ready to use it.

DID YOU KNOW…

- Dry ice is extremely useful for freezing and keeping things frozen because of its very cold temperature (-109.3°F or -78.5°C). Dry Ice is widely used because it is simple to freeze and easy to handle using insulated gloves.
- Dry ice gives more than twice the cooling energy per pound of weight and three times the cooling energy per volume than regular water ice. Dry ice is often mixed with regular ice to save shipping weight and extend the cooling energy of water ice.
- Sometimes dry ice is made on the spot from liquid carbon dioxide. The resulting dry ice snow is packed in the top of a shipping container offering extended cooling without electrical refrigeration equipment and connections.

HOW IS DRY ICE MADE?

The first step in making dry ice is to compress carbon dioxide gas until it liquefies, at the same time removing the excess heat. The CO_2 gas will liquefy at a pressure of approximately 870 pounds per square inch at room temperature. Once liquid CO_2 is formed, the CO_2 is sent through an expansion valve and enters a pressure chamber. The pressure change causes the liquid to flash into a solid and causes the temperature to drop quickly. About 46% of the gas will freeze into "dry ice snow." The rest of the CO_2 gas, 54%, is released into the atmosphere or recovered to be used again. The dry ice snow is then collected in a chamber where it is compressed into block, pellet or rice size pieces using hydraulics.

COOL THINGS TO DO WITH DRY ICE

The following science experiments and activities require adult supervision. Dry ice is fun and safe to use if all of the safety precautions are followed. Just a quick search on the Internet will reveal a bunch of stupid things that people do (or used to do when they had all of their fingers!) with dry ice. The best advice we can offer in this guide is to treat dry ice with respect. Always wear gloves when handling dry ice, and never seal dry ice in a container. Dry ice bombs are extremely dangerous and result in many serious injuries every year. Just use common sense and you'll have fun… and learn some cool science at the same time.

DISAPPEARING ICE

Here's a quick experiment to help children better understand why it's called dry ice. Ask the children, "Why do you think they call this dry ice?" Place a regular ice cube on one plate and a similar size piece of dry ice on a second plate. Keep both plates out of the reach of the children. "Let's try to guess what is going to happen to the ice cube and the piece of dry ice if we leave it on the plate for one hour." Of course, the children are likely to tell you that both pieces of ice will melt, turning into a puddle of water. Allow the children to view the plates after one hour and to discover the difference between real ice and dry ice. There should be a puddle of water on the plate where the real ice was, but the dry ice plate will be "dry." Where did the dry ice go? Dry ice is not made from water, it's made from some of the air that we breathe... it's frozen carbon dioxide. The dry ice turned into invisible carbon dioxide gas that disappears into the air. Magic!

BURPING, BUBBLING, SMOKING WATER

Use the tongs or gloves to place a piece of dry ice in a glass of warm water. Immediately, the dry ice will turn into carbon dioxide gas and water vapor, forming a really cool cloud! This cloud is perfectly safe for the children to touch and feel as long as they do not put their fingers far enough down into the water to accidentally touch the dry ice. To create the best effect, be sure to use warm water and add a few drops of food coloring to turn boring water into a bubbling potion. Over time, the dry ice will make the water cold and the "smoking" will slow down. Replace the cold water with warm water and you're back in business!

Remember –
ALWAYS use gloves or tongs when handling and transporting dry ice.

SMOKING PUMPKINS

It's easy to make your favorite carved pumpkin smoke by placing the beaker or glass of bubbling dry ice and water mixture into the pumpkin. Let's face it… dry ice in almost anything "Halloween" works, and who doesn't like a smoking pumpkin?

SMOKING CYLINDERS

Selecting the correct container for the bubbling dry ice and water makes the activity safer for small children to participate. Instead of using a wide mouth container like a beaker or a household jar, use a graduated cylinder. This is a common piece of lab equipment for teachers and scientists, but they are easy to find online. The best advice is to find a good quality, plastic graduated cylinder that holds approximately 1000 mL (about a quart).

Fill the graduated cylinder (assuming that you're using a 1000 mL size) with approximately 250 mL of warm water. Add a few good sized pieces of dry ice to start the bubbling action. Here's the best part… notice how children can hold onto the bubbling container but they can't reach their hands down into the cylinder to touch the dry ice! This is a great way for you to pass around the bubbling concoction without fear of the kids coming in contact with the dry ice.

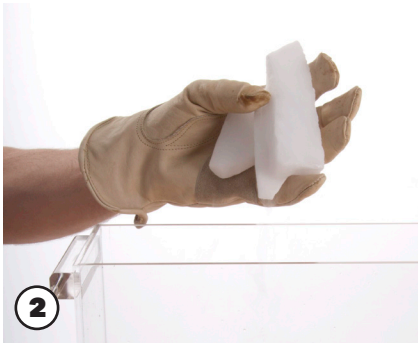
BUBBLING SOAP BUBBLES

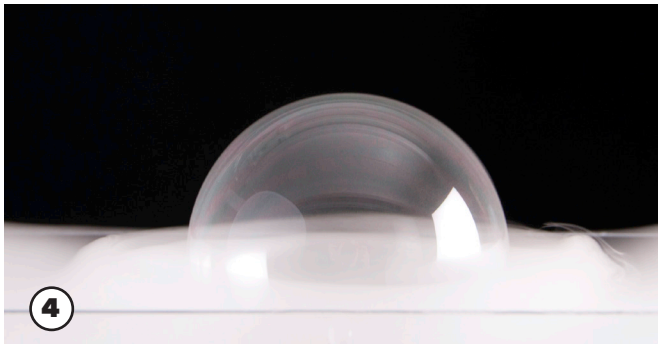
Who would have guessed that you could have this much fun with soapy water and a chunk of dry ice? Fill a tall glass or plastic cylinder with warm water and add a squirt of liquid dish soap like Dawn. Use gloves or tongs to place a piece of dry ice into the soapy water. Get ready for a room full of ooohs & ahhhs! Instead of the dry ice just bubbling in the water to make a cloud, the soap in the water traps the carbon dioxide and water vapor in the form of a bubble. The children will see the bubbles climb out of the cylinder of warm, soapy water and explode with a burst of "smoke" as they crawl over the edge. Add some food coloring to the water to make the demonstration more colorful. You can give the suds an eerie glow, by dropping a glowing lightstick into the water along with the dry ice.

FLOATING BUBBLE

You'll notice that when you add dry ice to water, the cloud of carbon dioxide and water does not go up into the air, but instead falls towards the ground. Why? This cloud-like mixture of carbon dioxide and water is heavier than the surrounding air. You'll use this little piece of science trivia to perform the amazing Floating Bubble trick. A small fish aquarium works well for this activity. Fill the bottom of the aquarium about an inch deep with warm water. Use gloves or the tongs to add a few pieces of dry ice. Of course, the dry ice will begin to smoke turning into carbon dioxide and water vapor.

Using a bubble wand and a bottle of bubble fluid, blow a few bubbles into the aquarium (it's a little difficult, so be patient). To everyone's amazement, a few bubbles will appear to float in mid-air in the aquarium. The bubble is really just floating on a cushion of invisible carbon dioxide gas. Of course, the spooky Halloween story is up to you, but I'm almost certain the aquarium is the home of a ghost known to play with soap bubbles!



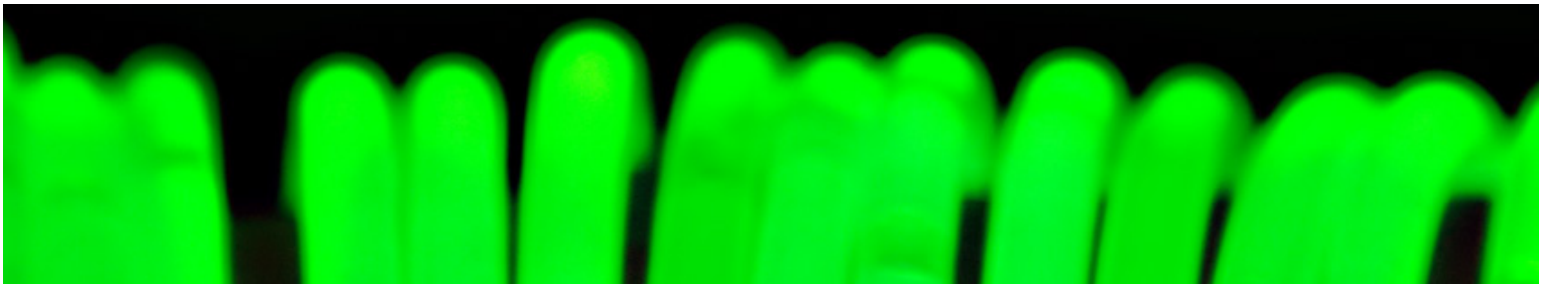


TRY A SPOOKY, BUBBLING BEVERAGE

The next time you have a craving for a sparkling beverage, make your own batch using what you know about dry ice. Fill a bowl or pitcher with apple juice and use gloves or tongs to add a few large pieces of dry ice. While the mixture is bubbling and burping, the apple juice is being carbonated by the dry ice. Carbon dioxide gas is mixing with the juice to make a "sparkling" drink. Wait until the dry ice is completely gone before serving your carbonated drink.

LIGHTSTICKS... THE EEEEEEERIE GLOW!

Make a trip to your local supermarket or Halloween store to find a supply of lightsticks. When you bend the lightstick, a small glass tube breaks and the chemicals in the lightstick mix. The result is an eerie glowing light that is safely contained within the walls of the lightstick. Drop a lightstick into your bubbling, dry ice potion for a great eerie effect.



DRY ICE CRYSTAL BALL BUBBLE

It's the world's coolest crystal ball. Create a soap film on the rim of the bucket and you'll have what appears to be a crystal ball filled with a cloud-like mixture of water vapor and carbon dioxide. When the giant bubble bursts, the cloud of "smoke" falls to the floor followed by an outburst of ooohs & ahhhs from your audience.

You'll need a large bucket with a smooth rim, solution of dish soap and water, piece of cloth 18 inches long, gloves, safety glasses, and a few pieces of dry ice.

Cut a strip of cloth about 1 inch wide and 18 inches long. An old t-shirt works well. Soak the cloth in a solution of Dawn dish soap or use your favorite recipe for making bubble solution. Make sure that the cloth is completely soaked. Fill the bucket half full with water. Have tongs or gloves ready to transfer the dry ice to the bucket.

Place two or three pieces of dry ice into the water so that a good amount of fog is being produced. Remove the strip of cloth from the dish soap and carefully pull the strip across the rim. The goal is to create a soap film that covers the top. It also helps to have the rim wet before you start.

This may take some practice until you get the technique mastered. Remember that a bubble's worst enemies are dirt, oil, and rough edges. Your patience will pay off in the long run. If you accidentally get soap in the bucket of water, you'll notice that zillions of bubbles filled with fog will start to emerge from the bucket. This, too, produces a great effect.

Place a waterproof flashlight in the bucket along with the dry ice so that the light shines up through the fog. Draw the cloth across the rim to create the soap film lid and turn off the room lights. The crystal bubbles will emit an eerie glow and you'll be able to see the fog churning inside the transparent bubble walls. Take your bows as the class erupts in a chorus of ooohs.