



DRY ICE BUBBLE DOME EXPERIMENT

MATERIALS:

Dry Ice	Hammer	Safety Goggles
Thick Gloves	Dish Soap	Large Metal Bowl
Small Bowl	Water	Long Strip of Thick Fabric

VOCABULARY:

Dry Ice	Carbon Dioxide	Bubble
Surface Tension	Solid	Liquid
Gas	Sublimate	

DIRECTIONS:

**** This experiment should only be done with adult supervision due to the use of dry ice.**

1. With adult supervision, put your safety goggles and gloves on.
2. Lay the dry ice, still in the bag, on the ground. Use the hammer to break up the dry ice into smaller chunks.
3. Rip open the bag and remove a chunk of dry ice with a gloved hand.
4. Place a chunk of dry ice in the large metal bowl.
5. Add a small amount of warm water to the bowl.
6. Add some dish soap and water to the small bowl.
7. Dip the strip of fabric into the soapy water.
8. Run the fabric around the edge of the bowl.
9. Stretch the fabric out into a straight line.
10. Drag the fabric over the top of the bowl, leaving behind a thin film of soap across the top of the bowl.
11. Gas rising under the film should make it expand and form a bubble dome.



THE STEAM BEHIND THE EXPERIMENT:

Dry ice is solid carbon dioxide. At its surface temperature of -109.3 degrees Fahrenheit (-78.5 degrees Celsius), a frozen block of dry ice transforms directly into a gas, skipping the liquid phase entirely. Because it doesn't melt, and because it can be formed in solid blocks or pellets, it's already a popular choice for shipping certain foods and medicines.

Despite its many benefits as a refrigerant, dry ice must be handled properly or it poses health risks. Because it's so cold, insulated clothing and gloves should be worn when handling it, and it should never be touched directly, as it can "burn the skin similar to frostbite. It should also never be placed in closed containers as the rapidly expanding gas can cause the container to explode. When dry ice is placed in water, it sublimates rapidly since the water is so much warmer than the dry ice. The solution appears to boil. As the dry ice sublimates to gaseous CO₂, some of the gas bubbles away quickly and some dissolves in the water. A heavy white cloud of condensed water vapor forms above the liquid (due to the coldness of the escaping CO₂ gas). As the CO₂ gas dissolves in the water, the solution becomes more acidic from the production of carbonic acid (H₂CO₃), a weak acid, according to the following equation: $H_2O + CO_2 \leftrightarrow H_2CO_3$.

When you drop a piece of dry ice in the bowl 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. The thin layer of soap film stretched across the rim of the bowl traps the expanding cloud to create a giant bubble. When the water gets colder than 50°F, the dry ice stops making fog, but continues to sublimate and bubble. Just replace the cold water with warm water and you're back in business.

NOTE: Whenever you use dry ice, *always* be aware of the rules for handling it safely.

- This is not a toy. It's for demonstration purposes only.
- Use dry ice only with adult supervision.

- Dry ice **must** be handled using heavy gloves or tongs. It will cause severe burns if it comes in contact with bare or unprotected skin.
- Always wear safety goggles when handling dry ice. The debris and shards are extremely dangerous to your eyes. When tapping dry ice with a hammer, first cover it with a towel to keep the pieces in one place.
- **Never** put dry ice in your mouth.
- Never store dry ice in an airtight container. As the dry ice sublimates, gas pressure will build and the container will explode. Make sure your container is ventilated or has a loose-fitting lid.
- Do not store dry ice in your freezer. It will cause your freezer to become too cold and the freezer may shut off. On the other hand, if you lose power for an extended period, dry ice is a good way to keep things cold if you can get it.
- In the unlikely event of a dry ice burn, treat it the same as you would a heat burn. See a doctor if the skin blisters or comes off. Apply antibiotic ointment to prevent infection and bandage mild burns.

MAKE IT AWESOME:

Try the experiment again, but try using different sized bowls.

EXTENSIONS:

1. What happens when you change the temperature of the water?
2. What happens when you pop the bubble dome?
3. What other changes can you come up with for this experiment?

WEBSITES AND VIDEOS:

1. Video of Making a Bubble Dome: <https://youtu.be/hiSbzTEoEIE>
2. Steve Spangler Bubble Dome Experiment: <https://stevespangler.com/experiments/dry-ice-crystal-ball-bubble/>

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