Dry Ice in Your Classroom
Jane Snell Copes Science Outside the Box

Dry Ice is solid carbon dioxide. You can buy slabs or pellets of dry ice for less than $1 per pound. Look in your Yellow Pages under **dry ice**. Be sure you

- wear gloves (surface temperature is -109° F),
- open your car windows (you need oxygen to breathe), and
- don't lock your cooler closed (dry ice sublimes rapidly to make large volumes of gas).

wet ice	**Let's compare . . .**	**dry ice**
it floats it makes the water colder it **melts** S→L	What happens when you drop it in water?	it sinks it makes the water colder it makes a lot of FOG it **sublimes** S→G
water H_2O	What's it made of?	carbon dioxide CO_2
32° F or 0° C or colder	How cold is it?	-109° F or -78° C
water puts out flames	How does it affect a flame?	sublimed CO_2 gas puts out flames
you could drown in liquid water, but it isn't poisonous	Could it kill you?	if you breathe only CO_2, you could die, but it isn't poisonous
you can swim in liquid water and skate on wet ice	Is it fun?	For sure!!

Activities
Please wear safety glasses. NO dry ice on bare skin!
NEVER trap dry ice in a glass or plastic bottle with a screw top!

De-Luminators Put some dry ice and water in a cut-off soda bottle. Let it bubble and fog. Pour only the vapor into another cut-off soda bottle. Pour the vapor slowly over a lit candle. Do not let the flame touch the plastic bottle. Would this trick work with helium?

Exploding Pillows You need a **freezer-weight, quart size zipper bag with a single zipper** (not double). Put a small amount of water and a few dry ice pellets in the bag and zip it. Hold the bag firmly by the sides. Do not put your face over the bog. Don't drop or throw the bag when it pops. This one's LOUD! Re-zip the bag to activate the Snooze Alarm!

Bubbling Cauldrons Put dry ice in a container of water. Is it really boiling? Does warm water behave differently from cold water? Can you make colored fog if you add food coloring to the water?

Crystal Ball Put dry ice and water in a container that has a flat top or mouth. Wet a bubble fur (Polar Fleece) strip with bubble solution (1 part dish washing liquid to 15 parts water). Pull the fur strip over the mouth of the container to make a bubble film. Subliming CO_2 gas makes the bubble expand. If you finger is wet with bubble solution, you can poke it through without breaking the bubble.

Floating Bubbles Line the bottom of an aquarium or plastic bin with cardboard. Place dry ice on cardboard. Blow bubbles across the container (not down). Bubbles filled with air float on the layer of denser CO_2 gas.

Shivering George and other noises Push the edge of a warm quarter into a block of dry ice. It will start to vibrate and chatter as the subliming CO_2 gas pushes it back and forth. Grab a piece of dry ice with metal tongs—it squeals! Put dry ice in a metal bowl—it also squeals briefly. Why does it make a noise? Why does it stop?

Color Changers Dry ice makes an acidic solution in water, so dry ice will change any acid-base indicator to its acid color. It happens rapidly, but you can delay the color change by adding washing soda (sodium carbonate, Na_2CO_3) to the water.

Hockey Puck Slide a large slab of dry ice over a smooth table. Subliming CO_2 gas under the slab lowers friction with the table top. Be sure to wear gloves.

Balloon Fun Crush some dry ice using a glass bottle and a plastic container. Put a small amount of the powder into a balloon. Pull the mouth of the balloon sideways to hear the squeal (vibrating objects make sound). Now tie the balloon and warm it with your hands. Subliming CO_2 gas fills the balloon without your effort. A piece of dry ice the size of your fist will fill a 40-gallon trash bag.

For a second experiment, put dry ice pellets in a plastic soda bottle. Fill a balloon part-way with water and attach it to the bottle without spilling water. Lift the balloon to add water to the bottle. Balloon will fill with gas faster than without the water. How come?

Other ways to make carbon dioxide:

- Baking soda or washing soda plus any acid (vinegar, stomach acid HCl, citrus juices)
- Egg shells, sea shells, or chalk plus any acid
- Yeast plus sugar plus warm water
- Alka-seltzer is baking soda plus citric acid plus aspirin
- Shake a bottle of soda, beer, or champagne.

BONUS You can make oxygen gas O_2 from baking yeast and 3% hydrogen peroxide. How is this gas different from carbon dioxide?