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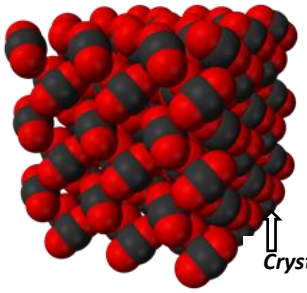

Crystal structure of dry ice

Dry Ice – Frozen Carbon Dioxide

Small pellets of dry ice subliming in air

SAFETY NOTE!

NEVER PLACE dry ice into a **closed container** such as a soda bottle. The bottle can **EXPLODE** with a loud bang, damaging your eardrums. Loose plastic, such as the bottle cap, may fly off, damaging someone's eyes. THIS HAS HAPPENED! DON'T DO IT!

What's Dry Ice?

Dry ice is frozen Carbon Dioxide, or CO_2, a normal part of our earth's atmosphere. Dry Ice is a gas under standard temperature and pressure conditions. Carbon Dioxide gas is what animals exhale during breathing and the gas that plants use in photosynthesis. It is also the same gas commonly added to water to make soda water and is added to soft drinks to make them fizzy. The atmosphere contains about .035% of this gas. CO_2 is a greenhouse gas, which means it absorbs light at infrared wavelengths. An increase in the concentration of this gas would, some scientists believe, cause an increase in the atmosphere's average temperature. The high concentration of CO_2 in the atmosphere of the planet Venus is said to contribute to that planet's high average temperature. This gas is often captured during industrial processes and recycled to make Dry Ice.

At normal atmospheric pressure on *this* planet, frozen CO_2 (Dry Ice) doesn't melt into a liquid, but rather evaporates directly into its gaseous form. Hence the name ***dry* ice**. This process is called ***sublimation***. All of the experiments below rely on this property of dry ice. 1 pound of dry ice, when it sublimates (turns to gas) will produce 250 liters of gas at atmospheric pressure, enough to fill 125 2-liter bottles. That's a lot of gas!

Getting Dry Ice

Dry ice is commonly available from ice dealers in two forms: flat square slabs a few inches thick and about eight inches on a side; or cylinders about half an inch in diameter and from a half to 2 ½ inches long. The price for ten pounds is around six dollars. If you buy less than this you will pay about a dollar per pound.

Storing and Transporting Dry Ice

Dry ice continuously sublimates as heat enters it from its surroundings. The CO_2 gas that evolves must be vented from the container. Do not seal dry ice into a container except as detailed below, because an explosive bursting of the container can result. A Styrofoam (polystyrene foam) ice chest with a loose fitting lid makes a good container for transporting dry ice.

Handling Dry Ice

Due to its **extremely cold temperature** (-78.5°C, or -109.3°F), dry ice can cause **damage to the skin if handled**. Use tongs or insulating gloves when handling dry ice. It is also important when crushing or grinding the solid **not to get any of the dust into your eyes**. ***Wear protective goggles!***

Dry ice can be used for the following applications:

CARBONATE LIQUIDS – When dry ice is added to liquids, the dry ice will sublime and become a gaseous CO_2 vapor. During this process, the liquid will absorb the CO_2 gas and become a carbonated liquid, AKA Soda pop, Sparkling water, etc. CO_2 is extensively used around the world in the beverage and soda industry

FOG VISUAL EFFECT – Dry ice when combined with hot tap water will produce and awe-inspiring display of bubbling water and thick voluminous fog. Use a pound of dry ice for every 4L of hot water for 5-10 minutes of maximum effect. Since dry ice retains a temperature of -78°C, the water will cool rapidly. Replace with hot water to maintain desired effect. Used on stages. Carbon Dioxide falls off of stage since it is denser than air.

ACCELERATED PLANT GROWTH – A small quantity of CO_2 will increase the growth rate of plants. Allow the dry ice to sublimate in close proximity to the plants for 10-15 minutes daily.

LURES MOSQUITOS AWAY – Mosquitos love dry ice! Mosquitos are attracted to both animals and humans because when exhaling, we produce small amounts of CO_2 (Carbon Dioxide). When CO_2 is detected by a mosquito, is registers the location of its next meal of blood. As dry ice sublimes to CO_2 gas, it is equivalent to over 1,000 people breathing at the same time in a close proximity. Therefore the mosquito will zoom in on the dry ice because of the high concentration of 100% pure CO_2 gas that dry ice expels. Place 5-10 pounds pieces of dry ice away from areas where people are gathered. Works amazing!

BED BUG REMOVAL – Infestation of bed bugs has become a serious problem because most of the chemicals used to control them are now banned or restricted. Removal of small infestations or testing whether you have them is possible by building a trap using dry ice.

BROKEN FREEZER – Use dry ice to keep freezer contents frozen during breakdown.

BROKEN REFRIGERATOR – Use dry ice to keep refrigerator contents cool during breakdowns.

CAMPING – Dry ice provides the most effective and inexpensive means to keep perishables chilled or frozen.

CHEMOTHERAPY – Many cancer patients undergoing chemotherapy treatments have found the use of super cooled "cold caps" to be an effective way to reduce or prevent hair loss
DE-FLASHING MOLDED PLASTICS AND RUBBER – Dry ice causes molecules to band closer together and "shrink".
DRY ICE BLASTING – Dry ice blasting has become the fastest growing application of CO_2 in the entire industry. Similar to sand blasting, dry ice blasting uses a jet nozzle and compressed air to shoot small pellets of dry ice (blasting rice) with superior results. The extreme cold causes targeted material to shrink, allowing for easier removal. The used blasting rice will sublimate into gaseous CO_2 after use which makes cleanup a breeze.
FISHING / HUNTING – Enthusiasts wait entire lifetimes for the one chance to bag the elusive trophy animal or catch the perfect wall decoration. Don't let it spoil, use dry ice! Keeping your animal or fish chilled with dry ice will ensure minimal spoilage during transportation.
FLASH FREEZING SUSHI / FISH – Dry ice can be used to flash freeze fish, ensuring freshness and prolonging preservation time by up to ten days longer than regular ice. This method also acts as a biocide and is FDA required before sushi can be sold for consumption.
FREEZING FRESH FRUITS – Place dry ice in the bottom of your cooler and the fruit directly on top. Close cooler and let fruits freeze for 20-30 minutes. Remove fruit and place in freezer safe plastic bags as needed.
FRESH MEAT PROCESSING – Dry ice will keep the temperature cold and reduce spoilage while processing meat. This is used in industrial processing of ground meats and sausages.
GREEN BURIALS – Dry ice can be used to preserve the human body until the funeral. This method has been proven more environmentally friendly than the use of toxic, embalming chemicals, and MUCH less expensive.
KILLS CLOTHES MOTHS – Dry ice, when combined with heavy plastic bags can kill moths, larvae, and eggs through fumigation. Place clothes for fumigation in a plastic bag (at least 3mm thick). Wrap 5 pounds of dry ice in a towel/rag and place inside the bag. Seal the bag but ensure there is enough space for the sublimation to escape rather than building pressure. 20-30 minutes should be adequate time to finish the job.
MEDICAL USES – There are a number of applications in the medical field. Doctors will often use dry ice to freeze and remove warts or other skin imperfections. Temperature sensitive medical supplies, samples, and equipment are also commonly transported with dry ice as a cooling agent.
PLUMBING – Dry ice can be used to freeze pipes, essentially stopping the flow of water at point of contact. This method is very useful if you are unable to access the main shutoff valve. Once the pipes are frozen, proceed with repairs.
PRESERVE SEEDS AND GRAINS – Dry ice can be used to protect post-harvested seeds and grains from bacteria, fungi, and insects. Place what you desire to store into a storage container with a small vent on top. Add dry ice to container (amount varies depending on container size). The dry ice will sublimate into gaseous CO_2 and displace oxygen and keep contents at low temperatures to kill fungi and bacteria
REMOVE CAR DENTS – Dry ice can be used to remove car dents and dings as long as there is no crease on the bottom and the sheet metal is not bent. Allow the dent to sit in the sun to warm up (or use a blow dryer). Take a 10 pound slab of dry ice and place directly over the dent. The rapid cooling of the metal will pop the dent back to normal. There is a very small risk of paint scratching with this method however it is quite rare (use at your own risk)
REMOVE SKIN IMPERFECTIONS – Dry ice is sometimes used either with or as a substitute to liquid nitrogen to remove small skin imperfections, warts, and moles. This method should not to be used at home.
SCHOOL SCIENCE & EXPERIMENTS – There are a multitude of fun, creative science projects and experiments to be used in schools. Volcanoes, cloud chambers, comets, making baking soda, observing sublimation, and gaseous expansion are some common school science projects.
SHRINK METAL FITTING – Dry ice works wonders for metal shrinking and fitting.

Comparing Ice to Dry Ice Lab Summary Questions

- Mrs. Earls will give you a petri dish with ice and a petri dish with dry ice. ***Do not touch the dry ice with your fingers (-109F)***! ***Do not touch anything that has been sitting in dry ice! Objects sitting in dry ice will reach dangerously cold temperatures as well! Skin and tissue exposed to very cold temperatures will cause permanent damage.*** Watch both dishes for 10 minutes. Answer the following questions as you observe both dishes.

1. Define **SUBLIMATION.**
2. Define **DEPOSITION.**
3. Watch the demonstration that Mrs. Earls performs with the flask filled with green water and dried ice. How can you tell that CO_2 gas is denser than air? Draw and color a picture that goes with your explanation.
4. **Observe your dry ice dish and your real ice dish. Draw a picture** which shows what is happening in both dishes and provide a caption under each drawing which explains your observations.
5. Place a "**copper" penny** on top of the dry ice. Exhale your CO_2 in your breath onto the penny. Draw and explain what happened. Use appropriate scientific vocabulary in your explanation.
6. Use your pencil to press the penny slightly against the dry ice. Explain why the penny makes a squeaky noise when pressed against the dry ice.
7. **Mrs. Earls will place some dry ice into a beaker of water for your lab group. Draw a picture** and **explain** what happens when dry ice is placed into a **small beaker of water.**
8. **Explain** why the dry ice is called dry ice.
9. Is **melting** a **physical** or **chemical change**? **Explain.**
10. Is **sublimation** a **physical** or **chemical change**? **Explain**.
11. Is **Deposition** a **physical** or **chemical** change? Explain.
12. Record two other observations you made during this lab or record two other things that you found interesting.