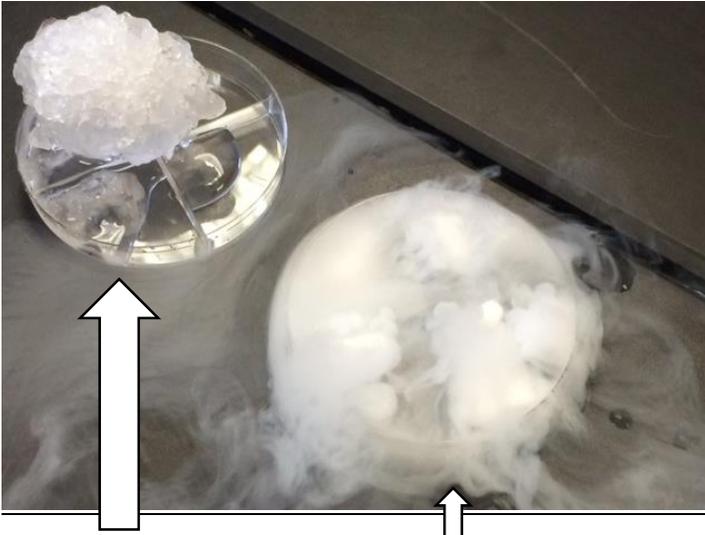


Dry Ice Lab - Comparing Melting to Sublimation



The dish on the left is ice made of water molecules. When the frozen water receives thermal energy from the warmer air (74°F), the ice **melts** into water. (Remember that heat always moves from warm to cool.) The water whether it is solid or liquid has the same chemical makeup (H₂O).

The frozen carbon dioxide (Dry Ice) receives heat from the warm air then **sublimates** into a gas. The chemical makeup of solid carbon dioxide and gaseous carbon dioxide is the same (CO₂).



When dry ice is placed into a beaker of water the dry ice still **sublimates** and the carbon dioxide gas bubbles rise to the surface of the water (carbon dioxide gas is less dense than water). The white carbon dioxide gas then pours over the beaker and sinks in air (carbon dioxide gas is more dense than air).

➤ **Directions:** 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 (-109°F)! 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**.

- When matter changes directly from a solid phase to a gas phase (without changing into a liquid phase).
- Sublimation occurs when the solid receives thermal energy.

2. Define **DEPOSITION**.

- When matter changes directly from a gas phase to a solid phase (without condensing into a liquid first).
- Deposition occurs when thermal energy is removed from the gas.

3. **How can you tell that CO₂ gas is denser than air? Draw a picture that illustrates your explanation.**

- You can tell that the Carbon Dioxide gas is denser than air because the cloudy-white carbon dioxide gas sinks in air. You can see the white gas moving out of the petri dish and out of the beaker and falling down on the desk. The gas seems to be pouring out and over the petri dish and beaker. If the carbon dioxide gas was less dense than air, we would see the white gas flowing up toward the ceiling of the room. We did not see this. See photos above.

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.** See photos and captions above.

5. **Place a "copper" penny on top of the dry ice. Exhale your CO₂ onto the penny. Draw and explain what happened. Use appropriate scientific vocabulary in your explanation.**

- When you place the penny on the dry ice, and blow on it, the penny quickly becomes covered in white, frozen CO₂ and frozen water vapor from your breath. This process where a gas changes directly to a solid is called **deposition**. Heat from the exhaled gas (your breath) is transferred to the penny and the gas freezes on the penny.



6. Explain why the “warm” penny makes a squeaky noise when pressed against the dry ice.
- Watch video below then record your answer
 - <https://www.youtube.com/watch?v=x5cfUHK-s20>
7. Draw a picture and explain what happens when dry ice is placed into a small beaker of water.
- Watch video below then answer this question:
 - <https://www.youtube.com/watch?v=bNOol7Nh07Y>



8. Explain why the dry ice is called dry ice.

 - It changes from a solid to a gas without changing into a “wet” liquid, thus it is a dry process unlike water melting into a wet liquid.
9. Is melting a physical or chemical change? Explain.

 - When something melts it is a physical change because it melts into the same exact substance just a different state of matter; it might look different but it has the same exact chemical composition; no new substance has been created and it can be easily reversed.
10. Is sublimation a physical or chemical change? Explain.

 - When something sublimates it is a physical change not a chemical change; no new substance has been created; just a different phase; compounds can exist in different phases with changes in temperature and pressure.
11. Is Deposition a physical or chemical change? Explain.

 - When something changes directly from a gas to a solid it still has the same exact chemical makeup so it is a physical change; no new substance has been created and the process can be easily reversed as seen in class.
12. Record two other observations you made during this lab or record two other things that you found interesting.

 - Some students found it very interesting that the CO₂ gas that had sublimated sank back onto the penny and other pellets of dry ice and immediately froze again (deposition). You could see small shards of the deposited carbon dioxide on the penny and dry ice pellets.
 - Some students also found it very interesting that it was easy to see the CO₂ gas sink in air showing that carbon dioxide gas is denser than air.
 - Many students mentioned that they were surprised by all the uses of dry ice such as freezing warts to remove them from their skin.
 - Many were surprised at the dangers of dry ice such as explosions and frostbite.



Never place dry ice in a closed container!