

# Cryogenic Theory

By Alec

On the trip to Purdue University, we learned about something amazing, cryogenic theory. Below are some of the fascinating things we learned.

We learned that when dry ice becomes gas it is called sublimation. Sublimation is when something goes from a solid to a vapor. It skips the liquid stage. When this happened in our experiment, the dry ice became less dense than air and it expanded. Our experiment used a balloon attached to a two-liter bottle with dry ice and water. When we did this, the balloon inflated with  $\text{CO}_2$  gas. The density of the dry ice changed because when the dry ice sublimated and became a gas (not a liquid) it expanded. After this happened we detached the balloon and tied it.

To prove it was the temperature that created sublimation, we next tried an experiment with liquid nitrogen. We dipped the balloon into a bowl filled with liquid nitrogen. The balloon shrank. When the temperature inside the bowl decreased because of the liquid nitrogen, the volume of the balloon decreased. This told us it was now denser. We then cut open the balloon to find that the  $\text{CO}_2$  gas had changed back into dry ice.

This experience takes me to my next thought. In the air there is nitrogen. Our air contains about 79% nitrogen. When a balloon containing normal air (and nitrogen) is dipped into liquid nitrogen it shrinks because of the cold temperature. It helped to use the same compound to cool it. When the nitrogen particles are in an environment of -320 degrees Fahrenheit or less they become a solid that is denser than the vapor. Then when the balloon was removed from the nitrogen it expanded back to its original size. This is what I learned during my trip to Purdue University. I hope you've learned more about physics.

