MIND TREKKERS
LN2 Flowers, Fruit and Balloons Lesson Plan

Amount of time Demo takes: variable
Materials:
1. Liquid Nitrogen (LN2) dewar
2. Styrofoam cooler to fill with LN2
3. Roses
4. Fruit
5. Balloons (partially filled)
6. Hammer
7. Tongs
8. Safety goggles
9. Trash bag to keep area clean
10. Drop cloth or other form of protection to hang on wall if throwing fruit against the wall.

Set up instructions:
1. Fruit takes a while to fully freeze, place fruit in cooler with LN2 at beginning of the day and throughout as needed for hourly smashing demos. Cutting fruit in half decreases amount of time it takes to freeze all the way through. (Peeling Bananas also helps reduce freezing time.) Use tongs to retrieve fruit from inside LN2. When fully frozen the fruit will shatter when smashed. The fruit becomes brittle when the water inside it is frozen.
2. Place a single rose into the LN2 until frozen. You can make it more interesting by asking participant to gently pull off a petal and letting them watch it shatter, or make up a story and dramatically smash the flower. Have fun with it. Pay attention to the number of roses you have for the day and evenly spread out how often you smash them.
3. Place the balloon into the LN2, and with tongs make sure it is fully submerged. The partially blown up balloon will shrink and flatten. The air molecules inside the balloon get cold and get closer together. When you take the balloon out with tongs and it starts to warm up, the balloon will go back to the same size as before. The air molecules will warm up and take up more space inside the balloon as the molecules are moving around more quickly. You can do this repeatedly with the same balloon.
4. You can freeze other things and they will shatter, cotton t-shirts, ping pong balls, racket balls etc.

SAFETY!
1. Goggles and protective gloves must be worn at all times while handling the liquid nitrogen, because liquid nitrogen is -321 °F, it can cause frostbite if it touches skin. Use caution when pouring it.
2. Don’t be afraid to ask participants to step back if they are too close to LN2 or to demo when you are planning to smash fruit.
3. When smashing fruit wear goggles and make sure participants are well out of the way so everyone is at a safe distance from flying debris.
Lesson’s big idea
● This demo shows the extreme effect on freezing ordinary materials.
● Freezing the balloon demonstrates the change in volume of gasses as they are cooled and warmed.

Assessment
1. Why does the balloon shrink in the LN2 then expand when pulled out?
2. Why does the fruit smash into many pieces when frozen?

Clean Up
Clean up between demonstrations if needed. When completely finished gather all materials listed for this demonstration and make sure everything is accounted for. If something was used up, broken or damaged. Let someone know so it can get replaced or fixed.

References:
http://phun.physics.virginia.edu/demos/nitrogen.html (pics, video, and explanation)

National Standards:
K-4 Content Standard B: Physical Science, Light, heat, electricity and magnetism
5-8 Content Standard B: Physical Science, Transfer of energy
9-12 Content Standard B: Physical Science, Structure and properties of matter, Interactions of energy and matter