

# MIND TREKKERS Dragon's Breath Lesson Plan

**Amount of time Demo takes: 3-5 min Container: enormous bin (mostly full of graham crackers)**

**Materials:** 1. Graham crackers (1 box/hr) 2. Liquid Nitrogen ("LN<sub>2</sub>") 3. Styrofoam bowls (4/day) 4. Wire scoop (2) 5. Tupperware serving container (2) 6. Safety goggles and thick rubber gloves (2)

**Set up instructions:** 1. Safety equipment for handling liquid nitrogen must be worn: goggles and thick rubber gloves. 2. Put holes in the bottom of a Styrofoam bowl and place bite size broken graham cracker pieces in the bowl. 3. Fill an empty bowl with liquid nitrogen. 4. Carefully submerge the first bowl with holes and graham crackers into the liquid nitrogen. Feel free to use the wire scoop to make sure all crackers are submerged in LN<sub>2</sub>. Lift the bowl out and let it drain. 5. Using the wire scoop, take the graham crackers out and put them into the serving container. 4. Wait at least 15-30 seconds before serving to let the remaining liquid nitrogen evaporate off the graham cracker. Serve to people around the table.

**SAFETY!** 1. Put on safety goggles and rubber gloves while handling liquid nitrogen. Liquid nitrogen is -321 °F and can cause frostbite when it touches skin. 2. Do this on a table away from students, or make sure they stay back while working with the liquid nitrogen. 3. Wait a minute or two before handing them out to make sure the excess liquid nitrogen has boiled off the graham crackers. You can also blow warm air on them (see picture at right) to warm them up -- this way, the crackers will not stick to people's tongues as easily.

**Lesson's big idea** This is a great demonstration of condensation. Water vapor condensates due to a change in temperature forming a small cloud, as the person with the graham cracker in their mouth breaths out.

**Instructional Procedure 1.** This is a quick demonstration. Once the graham crackers are prepared from the directions above, hand out the Dragon's Breath graham crackers. **2.** Tell participants to chew right away and breathe out of their mouths/noses to produce "dragon's breath." This is similar to going outside on a cold day and seeing your breath - your warm, moist breath hits the cold air. Cold air can't hold as much moisture as warm air and you get a little cloud from your breath. In a similar fashion, the moisture from your breath condensates when it comes in contact with the cold graham cracker. **3.** Concepts and vocabulary that may be helpful to know when describing this: Condensation - change of a state of matter from gas to a liquid Dew point - temperature at which the air can no longer hold all of its water vapor, and some of its water vapor becomes liquid water. The dew point is always lower than the air temperature. If the air temperature cools to the dew point, or if the dew point rises to equal the air temperature, then dew, fog or clouds begin to form. At this point where the dew point temperature equals the air temperature, the relative humidity is 100%.

**Assessment: 1.** Why do you think you can see your breath?

**Clean Up** Make sure to dump crumbs out of the liquid nitrogen bowls. Always make sure that a dewar or bowl filled with liquid nitrogen is moved out of reach. Excess liquid nitrogen can be disposed of.

## References

[http://www.weatherquestions.com/What\\_is\\_dewpoint\\_temperature.htm](http://www.weatherquestions.com/What_is_dewpoint_temperature.htm)

**National Standards** K-4 Content Standard B: Physical Science, Properties of objects and materials 5-8 Content Standard B: Physical Science, Transfer of energy, Properties and changes of properties in matter 9-12 Content Standard B: Physical Science, Structure and properties of matter, Interactions of energy and matter