Ice Balloon Inquiry

Adapted from the Institute for Inquiry www.exploratorium.edu/ifi (search for "ice balloon")

(For good background information on ice ball science, see p. 19-21 of http://www.exploratorium.edu/ifi-archive/docs/Raising_Questions.pdf)

NYS Standards: *Key Idea MST 4.1, Performance Indicator MST 4.1PS4.2, Major Understanding MST 4.1.PS4.2d* . **Next Gen. Sci. Standards:** 2-PS1, MS-PS1, HS-ESS2-5.

Objectives:

- improve questioning and observation skills
- Use student questions to lead productive discussions or create experiments and research projects
- Learn about properties of water

Materials:

- Ice Balls (1 balloon for each group of 2-4 students)
- Cafeteria-type tray or bowl (basin) for each ice balloon (to catch melting water)
- Flashlights, 1 per group
- Hand lens, 1 per student
- Wood and metal objects (like toothpicks and paper clips)
- Salt and sugar (coarse salt is larger and may be easier to see results)
- Food coloring (various colors)
- Plastic tub or sink with water (big enough to place ice balloons in)
- Post-it notes and writing utensils
- Scissors to cut open the balloon (or the instructor can do this)
- Towels (in case of spills)

Making Ice Balloons:

1. **Stretch a 9" balloon over a faucet and slowly fill the balloon to about 5"-6" in diameter**. If possible use a faucet without an aerator, so there will be less air and fewer bubbles in the water balloons. (Often aerators can be unscrewed from faucets)
2. **Remove the balloon from the faucet and squeeze out any excess air before tying balloon close**d.
3. **Put the balloons in a freezer at least 48 hours before the lesson**. To keep a round balloon shape, try to keep space around the balloons in the freezer.
4. **Leave the balloons in the freezer until the last possible minute**.
5. **Peel the balloon away from the ice to reveal a ball of solid ice**. Ice will not likely be completely clear. Cloudiness may be caused by minerals or gases in the water.

Using Guided Inquiry

"Inquiry is an approach to learning that involves a process of exploring the natural or material world, and that leads to asking questions, making discoveries, and testing those discoveries in the search for new understanding." (http://www.exploratorium.edu/education/ifi/inquiry).

The instructor rarely answers questions in guided inquiry, and even poses new questions to the students. By deciding which materials and when to provide those supplies, you can guide the direction of the questions that will be asked. In this way, the students are still coming up with the observations and questions that direct the lesson, but you chose the materials with specific learning objectives in mind.

1. Provide each group with a **basin, ice ball**, **flashlights and a hand lens.** Instruct students to look closely at the ice balls. What do they notice? You may choose to turn off the lights to block out everything but the ice balls.

2. Ask students to **write questions they have about the ice on sticky notes**. Do not answer questions now, just let them observe and wonder. Encourage them to come up with as many questions as they can.

3. **Ask each group to share question(s)** with the class. (Limit questions based on time available).

4. **Explain** that you will hand out supplies to experiment on the ice balls. Have students share with their group what they plan to do with the supplies before they do it, and make a guess as to what will happen. Hand out:
    a. W**ood and metal objects** (toothpicks, craft sticks, paper clips etc.)
    b. **Salt and sugar**
    c. **One food color per group** (multiple colors may cause children to explore mixing colors instead of the reaction between the ice and one color)

    Allow time between handing out supplies to help focus attention.
    Finally, allow students to put their ice ball into a **tub of water.**

5. **Encourage students to continue writing questions.** As the instructor, it is helpful to walk around and listen to the types of questions that are coming up to prepare yourself for later discussion.

6. **Discuss observations and share questions.** Notice the range of questions, even though everyone was observing the same object. As time permits, group

questions together, for example, all the "why" questions, "what if" questions, etc. Discuss how these questions could be answered, such as research (questions relating to identifying or naming) or experiments ("why" and "what if" questions). Some groups may have found answers to another group's questions.

Extending the Activity

- Choose one or more of the investigable questions to experiment and try and find the answer. (This will likely require more materials such as stop watches, thermometers, etc.) It is important for each group to only focus on one question at a time when designing their experiment.
- Choose one or more research questions to read about and try and find the answer. Questions that want something defined or explained make good research questions. "Why" questions may be turned into experiments or used for research.
- After allowing time to explore, you may choose to teach a specific lesson based on student observations. If you had started with the specific lesson, you would limit the questions students ask. If you have limited time, starting with the topic would cause students to only focus on the question you shared with them. Possible topics include:
    - Density/ volume (for a fun math- related lesson plan see http://astro.uchicago.edu/cara/southpole.edu/flaky.html)
    - States of matter
    - Buoyancy
    - Winter weather: what happens to wildlife in frozen lakes; ice fishing safety