Investigation Project

Title: Keep it Cool

- **Testable Question:** Which is the best insulator for keeping ice cold?
- **What I changed (Independent variable):** The insulators (aluminum foil, Styrofoam, commercial plastic insulator, and no treatment)
- **What stayed the same (Controlled Variables):** initial amount of ice, containers, time, location of the containers
- **What I measured: (Dependent variables):** how much water melted from the ice over time

---

Research:
I started by looking up insulators in a book at my house. The book was called *How Science Works* by Judith Hann published by Reader's Digest 1991. The book said that materials that trap air like polystyrene and wool are good insulators. Metals like aluminum are good at conducting heat. A thermos is good at keeping things cold because it cuts down on the passage of heat in all possible ways. Inside a thermos is a flask with a double wall of glass or plastic with a vacuum in between. The vacuum is good for stopping heat from passing through it.

I wasn't sure if a book published in 1991 had the latest information about my topic, so I searched the internet to see if other current scientists still agree. After searching the internet, I found that polystyrene or Styrofoam is still good at keeping things cold.
http://www.nationalgeographic.com/ngkids/trythis/rocket_scientist/

Finally, I asked the manager at the local convenience store. He said that Styrofoam coolers are one of his most popular products.

Hypothesis:
Styrofoam is the best insulator for preventing ice from melting.
Why I think so: I think this because my research says that polystyrene traps air and Styrofoam coolers are a very popular cooler to purchase.

Testable Question	What is tested (independent variable)	What says the same (controlled variables)	Data Collected (dependent variable)
Which is the best insulator for keeping ice cold?	The insulators (aluminum foil, Styrofoam, commercial plastic insulator, and no treatment)	initial amount of ice, containers, time	how much water melted from the ice over time

Materials:

- Styrofoam
- Aluminum foil
- Plastic commercial product (drink cozy)
- Ice 300g
- Clock/timer
- 4 transparent plastic cups with lids
- Clay
- Scale for determining mass
- Measuring tool for mL

Time: 1 day

Procedure:

1. Place 75 grams of ice into each of 4 identical transparent plastic cups. Cover with lid. Cover the opening where the straw hole is with clay to make it airtight.
2. Insulate 3 of the cups with either aluminum foil, Styrofoam, or a plastic commercial insulator. Do not put any insulation on one of the cups.
3. Wait one hour. Remove the clay and pour the water from the cup. Measure the amount of water in each cup. Compare the amounts of water.
4. Measure and compare again every hour for 5 hours. Observe the ice and make qualitative observations as well.

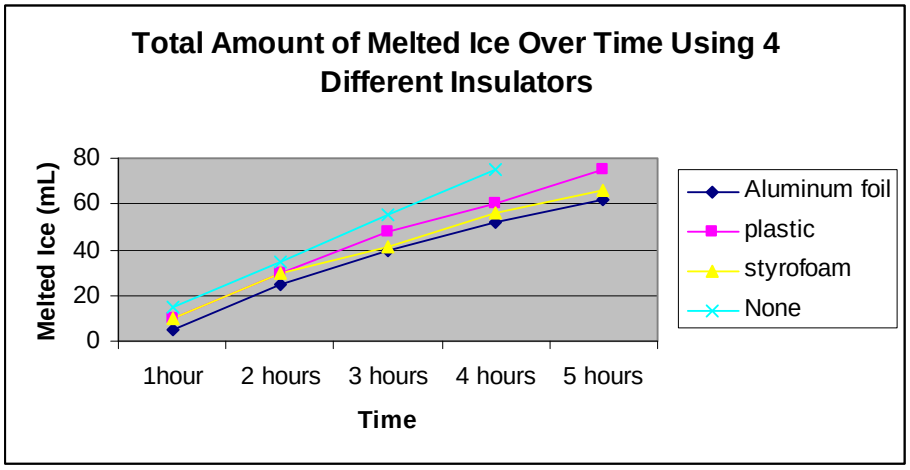
Data:

The chart below shows how much water I collected after each hour.

Amount of Melted Water Collected Over Time in mL					
Type of insulator	After 1 hour	After 2 hours	After 3 hours	After 4 hours	After 5 hours
Aluminum foil	5mL	20mL	15 mL	12mL	10mL
Plastic	10mL	20mL	18mL	12mL	15mL
styrofoam	10mL	20mL	11mL	15mL	10mL
none	15mL	20mL	20mL	20mL	--

Qualitative notes: As the ice cubes began to melt they stuck together. At the end of the 5 hours, there clearly was a bigger piece of ice left in the aluminum foil covered cup than in any of the other cups.

Results and Conclusion



The results did not confirm my original hypothesis. I thought that the Styrofoam would be the clear winner. Instead the container with the aluminum foil had the most ice left at the end of the test. The Styrofoam came in second place, followed by the plastic and the container with no insulation.

I wonder if my results had something to do with the procedure I used. The loose Styrofoam that I placed around one of the cups may have let in more air than the aluminum foil that covered the other container completely. If I had to do the experiment again, I would use a Styrofoam cup instead of the smaller pieces of Styrofoam.

Also, since the difference between the Styrofoam and the aluminum foil was not that much, there could have been a slight error in how much ice I measured at the beginning of the experiment. Maybe the styrofoam cup had slightly less grams of ice at the beginning of the

investigation because some of the ice could have been accidentally dropped when moving it from the scale to inside the cup. Maybe the ice in one of the containers began melting together when I was measuring it at the beginning of the investigation and this affected the rate of melting more than if the ice cubes were still cold and separate at the beginning of the experiment. My best guess for the different results is that it might have taken me too long to measure the melted ice resulting in more air getting inside the Styrofoam container than in the aluminum foil container.

While the results of my investigation show that aluminum foil is best for keeping things cold, I am not confident that my original hypothesis is totally wrong. The small differences at the end of the investigation make me think that repeating the investigation would help draw a more firm conclusion.

.