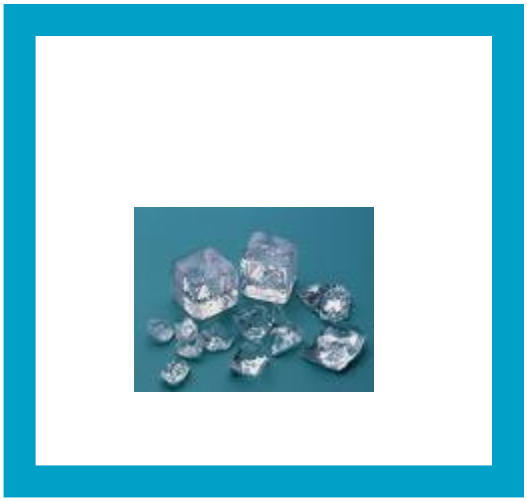

Scientific Method Experiment: Factors Affecting How Ice Melts

This is a nice example of the scientific method for younger kids. You could also tie it into states of matter (solid-liquid-gas), glaciers, or sea level rise.

Lesson prepared by Heather Goss
University of Maine, NSF GK-12 Fellow (2005)

Grades 3-4

Time 1 hour

Teacher Background and Resources
States of matter
http://www.chem4kids.com/files/matter_states.html

Why do we put salt on roads in the winter?
http://chemistry.about.com/cs/howthingswork/a/aa120703a.htm

What is insulation?
http://www.school-for-champions.com/science/thermalinsulation.htm

Ice sheets and glaciers melting due to atmospheric warming and warm ocean waters
http://www.sciencedaily.com/releases/2005/02/050223130619.htm

Materials

6 ice cubes per every group of ~4 students (plus extra ice cubes just in case)
3 paper plates per group (to keep the ice cubes on)
sink (source of hot or cold water)
a few beakers
salt
tin foil
plastic wrap
felt or other thick fabric
hammer, Ziploc bags, and towel for breaking ice safely
sources of heat (candles?)
other supplies you may think of that could be used to either melt or insulate ice
Ice Cube Melting Worksheets
Lab handout (link)

Introduce the activity to students with discussion:
(Leave the ice cubes in the freezer during the discussion part)

- What causes ice to melt?
- Does it always melt at the same speed?
- What factors/forces affect how fast ice melts?
- Brainstorm the many different things we can do to make ice melt FAST.

  Increase temperature (sun, fire, hot water, etc), pressure, decrease size, increase surface area, change chemistry/composition (salt), etc.
- Brainstorm as many as possible different things we can do to make ice melt SLOWLY

  Different types of insulation, put it outside the school building in winter, etc

List all of these on the board. Split up class into groups of ~4. Each group discusses and chooses a different way (or combination of ways) that they will try to melt ice fast and a way to make ice melt slower. Write each group's plan on the board. Remind them that they must stick with their original plan even if they get other ideas later. Each person should make hypotheses on their lab sheet about which group they think will melt ice the fastest and the slowest.

Tell the students that they will get 2 samples to melt fast and 2 samples to melt slowly. Ask why they think they will get 2 samples instead of just one. Discuss the idea of **replication**, which is important in case one result is a fluke, if one of the pieces of ice is bigger/smaller, or they make a mistake, etc.

Tell them they will also get 2 samples that they should leave alone and not touch. Why? How do we know if

we're melting ice slower or faster than normal? **Control samples** will allow us to see whether we melted slower or faster than ice would normally melt.

(Tell the students to discuss what materials they need for their plan while you retrieve the ice cubes)

Experiment
Pass out 3 paper plates to each group. Have them label these with pencil (Q 1, C 1, S 1, etc.)
Have 1 student from each group come to the front of the room to pick up the materials they need. Note the time that they start on the board. As they start, they should draw their experimental setup on the lab sheet. Circulate around the room as they do the experiment, and remind them to note the time when each ice cube melts.

Discussion:

If the "fast" samples didn't all melt (they probably won't in an hour), bring each group's fast samples up to one table and have all gather around to observe which melted fastest. Rank them. Then write these ranks up on the board next to the descriptions of what each group did. Same for the slow samples.

Why did certain samples melt faster or slower?

Did each of the same type of sample melt in exactly the same amount of time? Why did we have replication?

If you were to do this experiment again, how would you change your plan to melt ice cubes faster or slower?

Extensions:
Go outside and take the temperature of snowdrift in different parts of the school yard to illustrate insulation—protection.

Which part of an ice cube melts first?

Observe an ice cube melting in a bath of warm water. See how it flips over when it gets top-heavy, because the bottom melts faster because it is totally surrounded by water, while the top is exposed to cooler air.

Name:_____

Ice cube melting experiment

Questions:

What factors can make ice melt more quickly than normal?
What factors can make ice melt more slowly than normal?

Hypothesis:

I predict that the *fastest* melting in the class will be caused by_____
I predict that the *slowest* melting will be caused by_____

Procedure:

Each group will choose a different way to make ice cubes melt quickly, and a different way to make ice cubes melt slowly. Record the time as soon as each ice cube melts. At the end, we will do a data analysis, where we compare our results to find out which methods caused the fastest and the slowest melting.

Experimental Observations:

You will have 2 ice cubes for each type of treatment; this is called 'replication.' Draw one of your two ice cubes for each type, showing what influences you will put on it.

Quick melting	***Control (don't touch!)***	***Slow melting***

Record how long it takes for each sample to melt <u>completely</u>:

Quick sample 1 time _____	Control sample 1 time _____	Slow sample 1 time_____
Quick sample 2 time _____	Control sample 2 time _____	Slow sample 2 time_____

Data Analysis:

As a class, we will compare all the groups' results.

Conclusion:

The fastest-melting sample in the class melted in _____minutes. It was fast because _____
_____

The slowest-melting sample in the class_____

Prepared by Heather Goss, University of Maine, NSF GK-12 Fellow (2005)

Fill in the blanks in each sentence below with one of the vocabulary words from the scientific method listed below:

data analysis	*question*	*record*	*conclusion*	*controls*
hypothesis	*observations*	*formatting*	*contradiction*	*replication*

You made _____ when you looked carefully at the ice cubes and noticed how they were melting.

You were asking a _____ when you started at the beginning, wondering what would make the ice cubes melt faster and what would make them melt slower.

You made a _____ when you guessed how you could make ice cubes melt faster or slower.

Each group had several ice cubes so that there was more than one example of each type of ice cube for you to look at, instead of just one each. This is called _____.

Some of the ice cubes had special treatments to make them melt faster, and some had special treatments to make them melt slower. Ice cubes that did not have any special treatment are known as _____.

After we did the experiment, we compared all the groups' ice cubes. We were performing a _____.

Our final decision about which procedures can make ice melt fastest and which procedures made ice melt slowest is known as a _____.

Prepared by Heather Goss, University of Maine, NSF GK-12 Fellow (2005)