

Class Experiment

Making a Rock Glacier in your Refrigerator *The Dynamics of Frost Heave*

Description:

In this experiment, we will see the power of frost heave by creating a rock glacier right in your refrigerator! In nature, rock glaciers are created in very cold and cyclical melting and freezing environments. Frost heave pushes rock and other sediment that might be in ice to the surface while allowing for water to seep into the ground and freeze during nighttime or prolonged cold temperatures. We can recreate this environment with simple elements in our yard and kitchen. We will see through this experiment frost heave in action and create a mini version of a rock glacier right in our kitchen!

Elements needed:

- A bag of small rocks (enough to fill a dinner-sized Tupper ware container)
- Tupper ware container (approximately about 5X7 and 2.5-3 inches deep)
- Water (enough to fill the Tupper ware container about ½ way)
- A refrigerator
- A marker pen OR masking tape
- Attention to instructions and about a 3 or 4 days of time



Step 1:

Place enough rocks in the Tupper ware to fill the container about ½ way with rocks. Make sure you *do not* put too many rocks in the container.

Step 2:

Pour water over the rocks and fill the Tupper ware container with water, to about ¾ full, or just enough to cover the rocks. You may put a lid on the container, but it is not necessary. Mark the water level on the outside of the container with a marker pen or with masking tape. Next place the container (now with rocks and water) in the freezer.

Questions before you go on:

- Q1: Guess at what might happen to the rocks and to the water when it freezes?
- The rocks and the ice will be evenly intermingled (THIS IS THE FIRST TIME)
 - The rocks will rise to the surface and the ice will be at the bottom
 - The rocks will lie on the bottom and the ice will be on the top

Q2: Guess at what will happen with the water level after everything freezes?

- The new frozen water/ice level will be above the marked line (because water expands in ice form)
- The new frozen water/ice level will be below the marked line
- The frozen water/ice level will not change

Step 3:

Allow the mix to fully freeze either over night or for at least for several hours until the ice inside is very solidly frozen. You should see rocks and ice mixed up, with some rocks on the top mixed up with ice. The mix of rocks and ice should be pretty evenly distributed throughout the container. We are at the first freezing stage of the frost heave process!

Step 4:

Now remove the container from the freezer and let it sit on the kitchen counter top about 1 hour, or until about 1/3 to 1/2 of the ice has melted. Depending on the room temperature this may be less than an hour or more. Do not let the ice completely thaw out, or you will have to start all over!

Question before you go on:

Q: Guess what might happen to the water and the rocks during the short thawing phase while the Tupper ware is put in a warm climate.

- The rocks will begin to sink into the Tupper ware
- The block of ice and rocks will break up into many floating pieces
- The melting water will seep down to the bottom while the block of ice/rock stays together.

This phase is what also happens in Mother Nature as rock glaciers are made. The warm phase can be a warm daytime phase when the sun is out, or a sudden change in weather with warmer temperatures.

Step 5:

Once about 1/3 to 1/2 of the ice has melted return the container to the freezer and let it freeze completely. Caution: Do not let too much of the ice melt.

Step 6:

Repeat steps 3 and 4 about 5 or 6 times. This may take you several days to complete. You may try to do this in a single day, but you'll have to be keeping tabs on the ice all day! Each time you freeze and then thaw the container, you should find that when you take the completely frozen container out of the freezer, there should be more rocks on the surface than the previous time, and more ice beneath.

This is frost heave in action! Eventually, all (or most) of the rocks will be on the top and all of the ice on the bottom.

If this has not occurred, you may have left the container outside of the refrigerator too much time. Try reducing the time you leave it out to thaw.

Questions and Observations:

- 1) How many cycles of freezing and thawing did it take for you to notice that more rocks were appearing on the surface and that ice was forming below the rocks. **About 5 or 6.**
- 2) How would you explain the fact that the rocks appear on the top and not at the bottom? **Ice is pushing rocks upward, while water seeping down refreezes at bottom, forming an ice base.**
- 3) What is the force called that is pushing the rocks to the surface and depositing the ice downward? **Frost Heave.**