

# Ice Power



## Objective

Students will investigate how ice expands when freezing and how powerful that expansion can be.

## Materials

- three plastic drinking glasses
- plastic container with a wide mouth
- stiff plastic sheet to cover the mouth of the container
- various objects of known weight
- water
- freezer

## Background

As water freezes, the molecules move from a free-form flowing structure to a static lattice structure. The lattice structure takes up more space, so water expands as it changes from a liquid to a solid. Under laboratory conditions at a temperature of  $-22^{\circ}\text{C}$  ( $-7.6^{\circ}\text{F}$ ), the pressure of freezing and expanding water is about 55 tons per square foot. This is enough pressure to burst the water pipes typically found in many family homes.

## Action

1. Fill the plastic glasses to the rim with water. Ask students to predict what will happen when the water freezes.
2. Freeze the water in the plastic glasses overnight and examine the next day. Did the water expand? Are there differences in the way water froze in the three glasses?
3. Now fill the container to the rim with water. Place the plastic sheet over the mouth of the plastic container. Ask students to predict how much weight will be needed to keep the frozen water from expanding out of the container's mouth. Have students add that weight to the top of the container.
4. Freeze water in the plastic container overnight. Did the students predict the weight on top of the container correctly? If not, try experiment again with students predicting again.

## Deeper Depths

Different liquids have different freezing temperatures. Try freezing a variety of liquids. Use orange juice to make popsicles, or try oil or very salty water. Do these make popsicles too? You might also want to try inedible items such as rubbing alcohol and glycerin. Ask students if they know how antifreeze works in a car radiator.