SUPERCOOL H_2O SCIENCE

Water freezes at 32°F, right? Well, not always…

Happy winter, scientists! In our part of the world, things will soon be covered in a layer of frozen water. Join us in honoring the cold temps with a demo that's sure to topple everything you thought you knew about ice.

Supplies:

- A few unopened (*plastic) bottles of purified water
- Bottle of tap water
- Ice cubes
- A bowl
- Freezer
- Patience and fortitude—this one can take a couple tries to get right!

*Never put a glass container of liquid in the freezer

Instructions:

Put the bottles of purified water and the bottle of tap water in the freezer for approximately 2–2.5 hours. Do something really fun and important (and preferably scientific!) while you wait.

What do you predict will happen when you take the bottles out? Why?

After about 2.5 hours, open the freezer gently. Pick up the bottle of *tap* water. If that's frozen, CAREFULLY pick up one bottle of *purified* water. Now's the fun part, so get ready to look closely: Either smack the bottle with your hand, or whack it on a hard surface like a table. What happened to the liquid water inside the bottle?

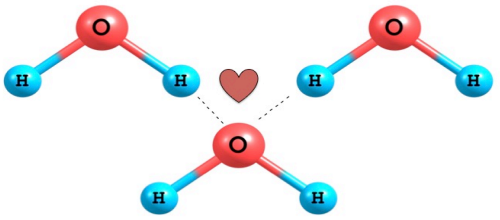
Now, grab your bowl and place an ice cube in it. Take another bottle of purified water CAREFULLY out of the freezer; try not to bump it. Open the bottle, and SLOWLY pour a thin stream of water from the bottle onto the top of the ice cube.

What's happening to the water? Why?

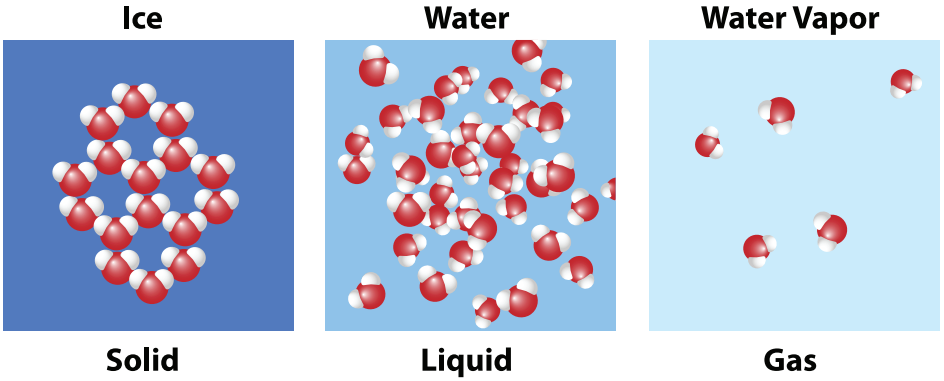
Water is Weird

Most of what's happening can be explained by the fact that water is *sticky*!

Not sticky like a lollipop, but at a molecular level, which means that water molecules (two hydrogens and an oxygen atom) are always trying to form bonds with each other. Kinda sweet, no?



At room temperature and standard pressure, water molecules flow past each other sort of slowly. Some of the molecules form temporary bonds, but they're not very stable. Add heat up to 212° F, and the molecules gain energy and zip around each other in the form of a gas, when no bonds are formed. Take away that heat, and the molecules lose energy, stop moving, and form bonds with others next to them, becoming solid. We call this "freezing."



Freezing usually happens at 32°F or 0°C. BUT in order to freeze, the molecules need something to build crystals around. This is called "nucleation." Most water found on Earth has plenty of impurities or minerals to form around, but not so for water that's been purified and put into sealed bottles.

That lack of something to nucleate around allows the water to stay liquid well below the normal freezing point. We call this water "supercooled." It will stay liquid until you smack it on the table, sending a shock wave that pushes the first few molecules into alignment, creating a nucleation site. Similarly, the ice cube serves as a nucleus, setting off a chain reaction of molecules telling each other to "get in line!"

Water might be weird, but it's definitely *super cool.*