



Q & A: melting points of water and drinks

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Q:

I am in 2nd grade and I did a science experiment called "Which Ice Melts Fastest?". I froze equal amounts of cranberry juice, milk, tap water, and filtered water. I put them in bowls on the counter and I watched them melt. The cranberry juice melted first, then the milk, then the filtered water, then the tap water. I think the cranberry juice and milk melted first because they have sugar and other things in them. I want to know why the filtered water melted before the tap water. I did the experiment again and got the same results. So I did another experiment with my parents. I froze distilled water, filtered water, and tap water and then watched them melt. The distilled water melted first, then the filtered water, then tap water. Can you help me understand why this happened? Doesn't the tap water have more chemicals in it and that would make it melt faster?

- Audrey (age 8)
Kingwood, Texas, U.S.A.

A:

Audrey- That's a great question. It sounds like you've done the experiment carefully. You've given us a very clear description of the results, and you've put your finger on the most puzzling part of the results.

That's the good news. The bad news is that we're just about as puzzled as you.

(but see below for possible idea)

As you say, it makes sense that the cranberry juice melted first. There's a lot of sugar in it so that lowers the melting point. Even though the sugar is not really part of the ice, it's sitting in little pockets throughout the ice, helping melt it. The same applies to the milk, which I guess doesn't have quite as many molecules dissolved in it.

What would make filtered water melt before tap water? Maybe as the water is filtered it gets more air dissolved in it. If some of that air is trapped in the ice as it freezes, that could help promote melting. That's just a guess, because I can't think of any better reasons.

Distilled water also can have gas dissolved in it. CO₂ is a particular suspect, because it partially ionizes in water, making a weak acid. That could help keep it trapped as the ice forms. If you have some way of measuring the pH of the waters, you might check to see if the tap water, filtered water, and distilled water are different. (Off-topic: As we increase CO₂ in the atmosphere it acidifies the oceans, killing off corals and other animals with shells.)

Mike W.

Aha- I forgot one of our old answers! (<http://van.physics.illinois.edu/qa/listing.php?id=1662>) Under some circumstances dissolved salt etc. can actually slow the melting. It still lowers the melting point, but it leaves the ice floating in cold melted water on top of warmer saltier water. I'm not sure why the melting point effect is more important in some cases and this other effect is (possibly) more important in others. You've got the interesting finding that lots of solute does speed melting but (apparently) small amounts slow it down.

(published on 01/23/2011)

Follow-Up #1: Why does filtered water melt faster?

Q:

Thank you for answering my question! We tested the water with an aquarium test kit and the distilled water had a low pH. The filtered water and the tap water had a high pH. My mom wants to know if some of the carbon from our water filter might get in the filtered water and if that's why the filtered water melted faster than the tap water?

- Audrey (age 8)
Kingwood, Texas, U.S.A.

A:

Interesting question. Since the distilled water was the one with low pH (acidic) it's the one most likely to have a lot of dissolved CO₂. Since it's distilled, other acids should be pretty well removed. (I'm assuming that low pH here means less than 7.0.) There's no special reason to think then that the carbon from the water filter came off into the water, at least in such a simple form. So I'm a little more puzzled about why the filtered water melted noticeably faster than plain tap water, now that it sounds like they have about the same pH.

Have you tried letting each of the types of water sit for a long time at room temperature before freezing them? Maybe some other dissolved gases are involved, and if they sit long enough those will reach equilibrium. Just scrambling here.

Mike W.

(published on 01/30/2011)

Follow-Up #2: melting times of different types of water: results**Q:**

Guess what...IT WORKED! I left the cups of water on the counter for 24 hours and then froze them. This time they melted in the exact opposite order. The tap water melted first, and then the filtered and then the distilled. Thank you for helping me with my experiment. This is a really interesting experiment.

- Audrey (age 8)
Kingwood, TX USA

A:

Wow! This violates my first law of experimental science, which is that "**things usually don't actually work**". Congratulations on a careful, thorough experiment.

Mike W.

(published on 02/14/2011)

[Follow-up on this answer.](#)

