How to Create

SUPERCOOLING SLUSHIES

YOU WILL NEED

access to a freezer • 2 plastic bottles of pop (any size) • 1 metal or glass container (optional) • timer or clock

THE EXPERIMENT

Step 1: Place your first pop bottle in the freezer for about 2.5 - 4 hours. Make sure to keep track of how long it takes for your pop to freeze completely. This may require you to check in periodically on your pop bottle. Do not use glass bottles or aluminum cans, as they may shatter or explode in the freezer!

Step 2: Once you know how long it takes for your pop to freeze fully, subtract 15 minutes from the time it takes to freeze your pop fully. This calculated time will approximately be how long it takes to supercool your pop. Example: 3 hours to freeze a pop means supercooling time is about 2 hours and 45 minutes. **WARNING**: Do not drink your supercooled liquid when it comes out of the freezer, as the liquid might expand between your teeth and injure you. Wait until it is in slush form before drinking (see next steps).

Step 3: Now that you have your calculated supercooling time, shake up your second pop bottle and place in the freezer for that amount of calculated time. You will not need your first bottle anymore. Supercooling may take a few attempts to get right.

Step 4:
Method 1: Once your second pop bottle is done supercooling (not completely frozen!), take it out of the freezer. Open the cap gently to release the pressure and reseal the cap. Then, give the bottle a good shake. The liquid pop should freeze into slush right before your eyes!

Method 2: Chill a container by leaving a glass or metal bowl/cup in the freezer for about a half hour. Take the supercooled liquid pop out of the freezer. Gently open the cap to release the pressure and then reseal. Do not shake the bottle. Open and pour the contents of the supercooled bottle into your chilled bowl/cup and you should see slush forming in your container!

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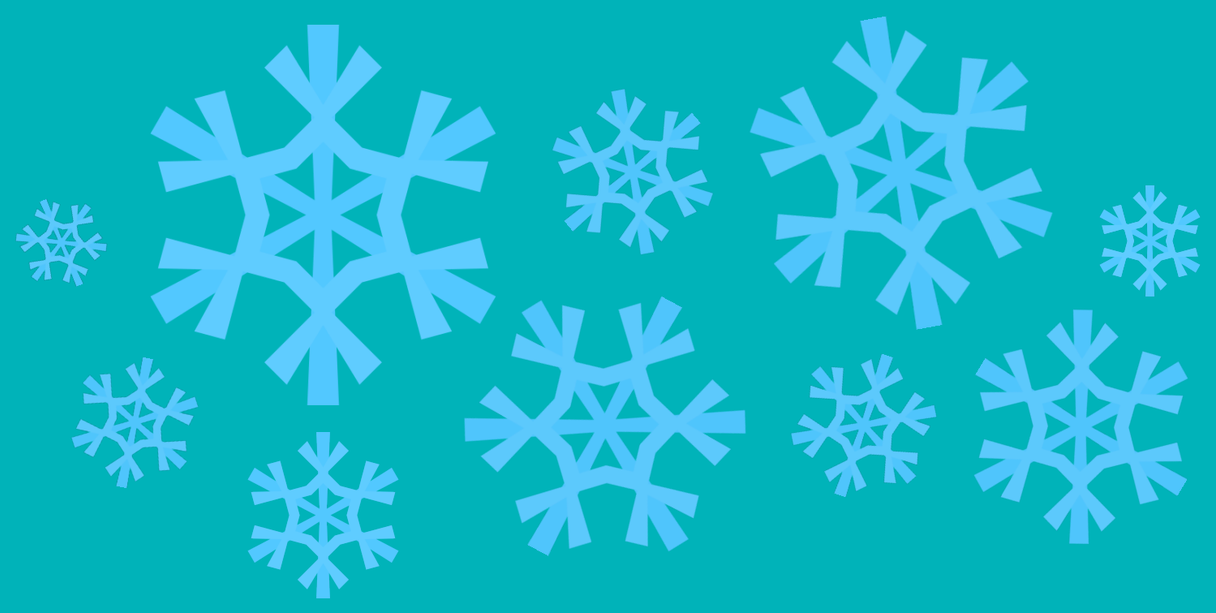
THE SCIENCE BEHIND THE SLUSHY



Supercooling is the process of lowering the temperature of a liquid or gas below its freezing point without it becoming a solid. In other words, the liquid is actually colder than the point at which the solution transforms into ice—but not frozen!

When we shake the pop before placing it in the freezer, we are moving the carbon dioxide gas in the liquid into the air space of the bottle. We want to avoid having ice crystals form, so shaking the liquid removes large bubbles from the liquid. Large bubbles may be prime places that these ice crystals could form, hence it makes sense to remove these spots by shaking. This makes sure that tiny ice crystals don't form in our pop and freeze our entire liquid.

By shaking the bottle, we are also increasing the pressure inside the bottle. This causes the natural freezing point of our liquid in the bottle to drop as well. The longer the bottle is left in the freezer, the more energy is removed and the temperature begins to drop. After a few hours, enough energy is removed, causing the liquid's temperature to drop below its natural freezing point.

Then, when we open the bottle, our pressure drops inside the bottle. The reason we shake the bottle again or pour the supercooled liquid into a chilled, frosty container is so we can create something for the ice crystals to form on. Once the crystals find something to form on, our supercooled liquid transforms into a delicious slushy. This is also known as nucleation.

TERMS

Freezing Point: the temperature at which liquid turns into a solid

Nucleation: the process that occurs in the formation of a crystal from a liquid in which a small number of molecules become arranged in a pattern characteristic of a crystalline solid, such as ice, through self assembly

Pressure: in this experiment, pressure is the force the carbon dioxide gas exerts on the walls of the container

Supercooling: the process of lowering the temperature of a liquid below its freezing point without it freezing into a solid

References: The Sci Guys, Wonder How To, Smithsonian, Popular Science, Brittanica