The Thermos Bottle

Thermos bottles keeps cold drinks cold and hot drinks hot longer than any other container. Fill a Thermos with hot chocolate, and your cocoa will still be steaming hot hours later.

The secret to a Thermos is the glass flask inside it. It's a double-walled container that has had all the air sucked out from the space between its walls, creating a vacuum. The flask walls have a reflective, silvery surface. The combination of the vacuum and the reflective walls greatly reduces the flow of heat into or out of the flask.

Here's why the vacuum flask is such a good insulator:

1. **Conduction** can't occur in a vacuum. It only occurs in matter, and there's no matter in a vacuum.
2. **Convection** can't occur in a vacuum. It only occurs in fluids such as air, and there's no air (or any other fluid) in a vacuum.
3. **Radiation** (electromagnetic waves) can travel through a vacuum. But electromagnetic waves bounce off the flask's reflective walls, greatly reducing heat transfer by radiation.

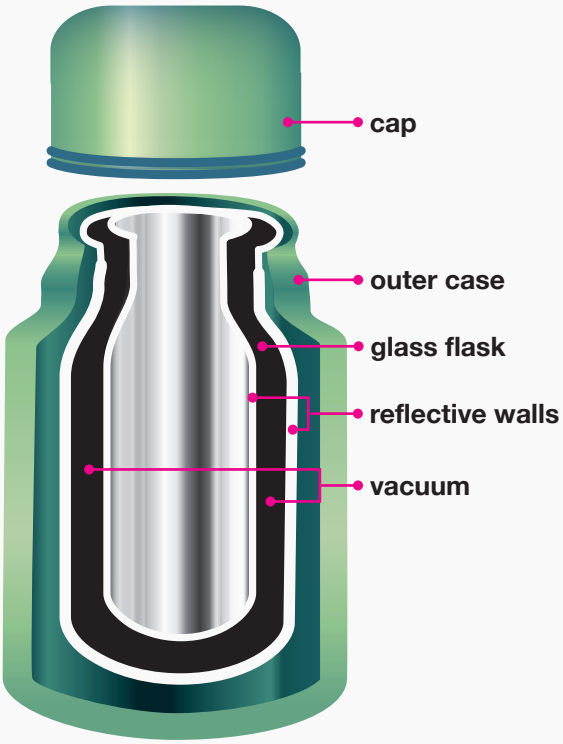


Photo: Andrew Hall

Tip #12 Don't Leave the Refrigerator Door Open!

Want to conserve electricity? Here's an easy way. Don't leave your fridge door open! When you do that, you're wasting energy. The fridge warms up, and then its cooling system has to work even harder to do its job.

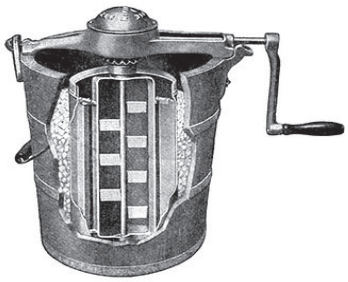
Your fridge has a network of pipes filled with a coolant. When warm air inside the fridge comes in contact with the chilly pipes, heat moves from the air into the coolant. As the air in the fridge cools, the contents of the fridge also get cold.

A refrigerator works on this basic principle: that heat always flows in one direction, from hot to cold. Your fridge doesn't put coldness into a warm drink. No, it's the other way around: the warm drink loses its heat to the cold air of the fridge. As heat flows out of the drink and into the cold air, the drink cools down.

When you stand there with the fridge door open, you're letting the cold air out and warm air in. It'll take a long time for the cooling system to cool the fridge back down. And the longer it takes, the more electricity you use. So don't stand there staring into the fridge! Close the door and save power.

Photo: Eloïse L

Homemade Ice Cream



A 19th-century hand-cranked ice cream maker

There's very little technology from 170 years ago that we still use today. But for people who enjoy making ice cream, the machine they use is pretty much the same as the one invented in 1843 by a woman called Nancy Johnson.

To make ice cream, all you need are a few ingredients and a hand-cranked machine. (You can get electric ones, but doing it yourself is more fun—and better exercise.)

A hand-cranked ice cream maker sold today

The ingredients are milk, sugar, flavorings, ice, and salt. Yes, salt. But it doesn't go in the ice cream mixture—nobody likes salty ice cream. You add the salt to the ice. You'll see why in a minute.

The machine is made up of an outer bucket and an inner metal can. You pour the mixture of milk, sugar, and flavorings into the inner can. Then you fill the space between the can and the outer bucket with ice and salt. There's a rotating paddle in the inner can that you operate by turning the hand crank. The paddle stirs the milky mixture and helps it freeze evenly as it makes contact with the icy walls of the can. It takes about half an hour of steady cranking to turn the mixture into ice cream.

Salt is the key ingredient in the whole process. Why? Because salty water freezes at a lower temperature than plain water. That means the slushy ice-salt combination (or brine) in the bucket is actually colder than regular ice. It's that super-cold ice that makes it possible for the ice cream to harden.

Images of ice cream makers (clockwise from top left): Fannie Merritt Farmer; White Mountain; Randy Mayor

Beat the Heat

When it feels like an oven outside, here are some things you can do to beat the heat:

Wear light, loose-fitting clothes.
Your clothes should be loose and made of natural materials such as cotton. They breathe, allowing your sweat to evaporate. Sweating is key to staying cool. It cools the skin directly: Wet your skin and blow on it—it feels cool, right? More importantly, as sweat evaporates, it lowers your body's core temperature.

Eat small meals.
The larger the meal, the more heat your body creates as it works to break down the food. So eat frequent, small meals. And avoid high-protein foods like meat. Digesting them increases metabolic heat and warms the body. Instead, eat low-protein foods such as fruits and vegetables. Spicy foods are good, too. They make you sweat, and sweat cools you as it evaporates.

Drink lots of water!
Your body needs lots of water to stay cool. If you want something extra-refreshing, put a bottle of water in the freezer overnight. The next day you'll have a bottle of ice that will melt into cold water. But don't fill the bottle all the way. Water expands as it freezes, and an over-full bottle will burst or break. Ten cups of water turn into 11 cups of ice!

Take it slow.
Strenuous activity raises your core temperature. So kick back and relax.

Photo: Timothy J Carroll

Winter Kayaking

Falling into cold water is dangerous. A person loses body heat 25 times faster in cold water than in cold air. This chart shows how long a person can survive in cold water.

Water Temperature (°F)	Expected Time Before Unconsciousness	Expected Survival Time
32.5	15 minutes	45 minutes
32.5–40	15–30 minutes	30–90 minutes
40–50	30–60 minutes	1–3 hours
50–60	1–2 hours	1–6 hours
60–70	2-7 hours	2–40 hours
70–80	3–12 hours	3 hours–indefinite
above 80	indefinite	indefinite

Despite the dangers of cold water, there are people who love kayaking in winter. They know that if they fall in the water, conserving body heat is the key to survival. So winter kayakers wear lots of wool and fleece layers to provide insulation. And as an outer layer they wear a waterproof suit called a dry suit.

If you fall into cold water without protection, your warm body quickly loses its heat to the colder water. That causes your core temperature to drop and can lead to hypothermia, a dangerous condition. But if you're wearing the right gear, heat loss is slowed way down. Layers of wool and fleece clothing trap your body heat, keeping warmth near your skin. And the dry suit, a waterproof garment with tight seals at the neck, wrists, and ankles, keeps you from getting wet.

With a dry suit on, a kayaker who falls into icy water is safe. Without it, her body would lose heat to the water so quickly she'd soon be in big trouble. That's why winter paddlers are so careful about what they wear. According to them, "There's no bad weather, only bad gear."

Photo: ilovegreenland