EQUATION

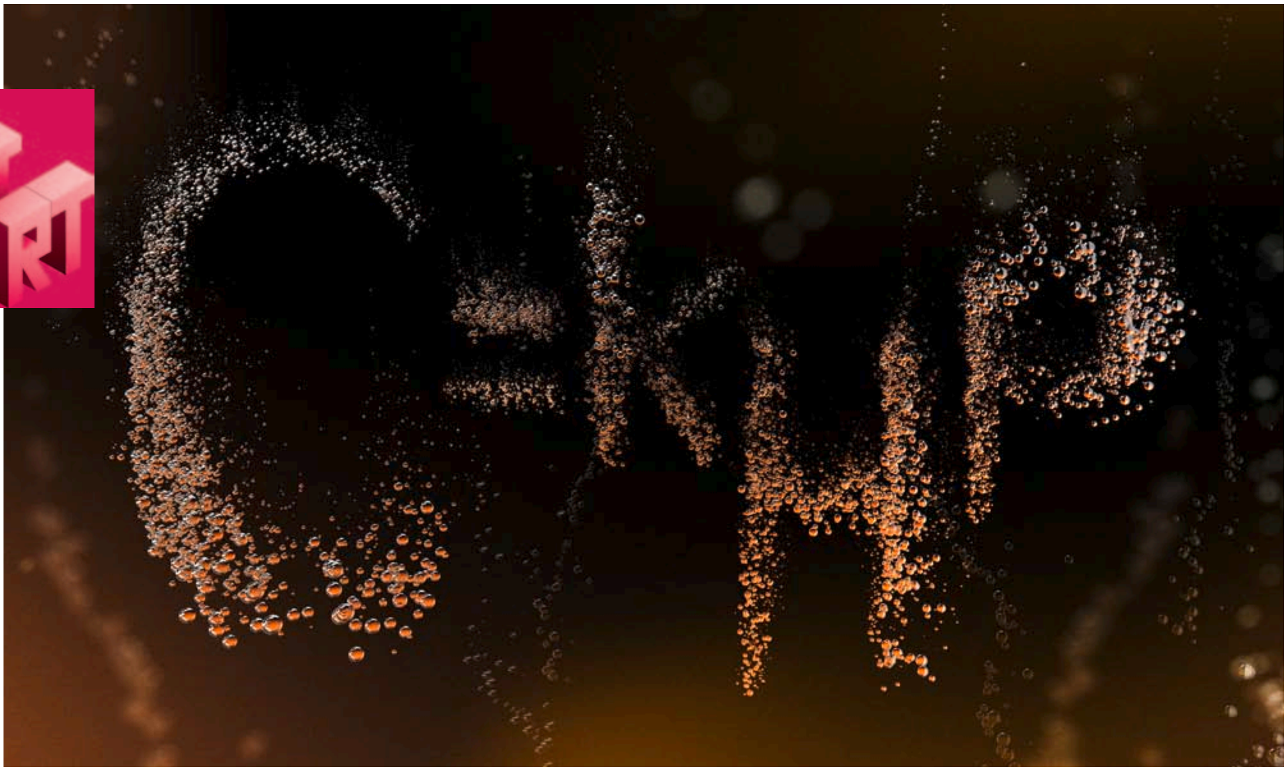
Why Soda Goes Pop

Fssst! That sound you hear when you open a can of soda? It's carbon dioxide making a run for it.

During manufacturing, the CO_2 gets pumped into the soda at pressures of around 60 pounds per square inch. This forces the carbon dioxide to dissolve into the liquid, creating carbonic acid—H_2CO_3—and giving pop its tang. (That's why flat soda tastes strange—no carbonic acid.) Open the can and some of the carbon dioxide molecules break out of their carbonic chain gang and bubble up to freedom—giving soda its fizz. (Or, if you're a human body surfacing from a deep dive underwater, gasses like nitrogen try to do the same thing in your bloodstream. It's ... unpleasant. And dangerous.)

The whole dance is orchestrated by the simple equation here, known as Henry's law. Lower the pressure *p* by opening the can, and the concentration *c* of carbon dioxide in the liquid goes down, too. The soda keeps bubbling for a while because the liquid's surface tension makes it hard for the carbon dioxide bubbles to form and expand—the CO_2 molecules have to find one another and join up in mobs to have enough strength for the job.

Of course, you can always speed things up the process by shaking the can a bit. That incorporates more air into the liquid, giving the carbon dioxide molecules a perfect meeting place. Shake enough, and Henry's law will put on a foamy show. —JULIE REHMEYER



c Concentration of the gas in the solution (measured in moles per liter)

k_H A constant, which depends on the ability of the liquid to dissolve a gas. For carbon dioxide and soda, the value will be around 0.034 mol/(L * atm)

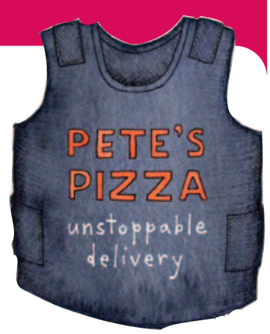
p Partial pressure of the gas (in this case, just the pressure of the CO_2—adding in the other ambient gasses would yield "total pressure") in the airspace in the can, above the liquid (measured in atmospheres)

3 Smart Things About Bullet-Resistant Vests

1. Kevlar, the material in many vests, was created in 1965 as a component for automobile tires. It is synthesized by dissolving a polymer in a highly concentrated bath of sulfuric acid, then spinning it into fibers.

2. A standard Kevlar vest won't stop a knife—the tip can push the fibers aside. The National Institute of Justice, which rates ballistic vests, has separate standards for stab-resistant body armor.

3. Vests stop bullets by distributing the force of their impact. A .45-caliber slug traveling at 600 mph will end up feeling like a baseball going 90 mph. Translation: Lots of pain, but no perforation. —*Aaron Rowe*



LEGO: DAVID CLUGSTON

ILLUSTRATION BY Toby And Pete

EQUATION

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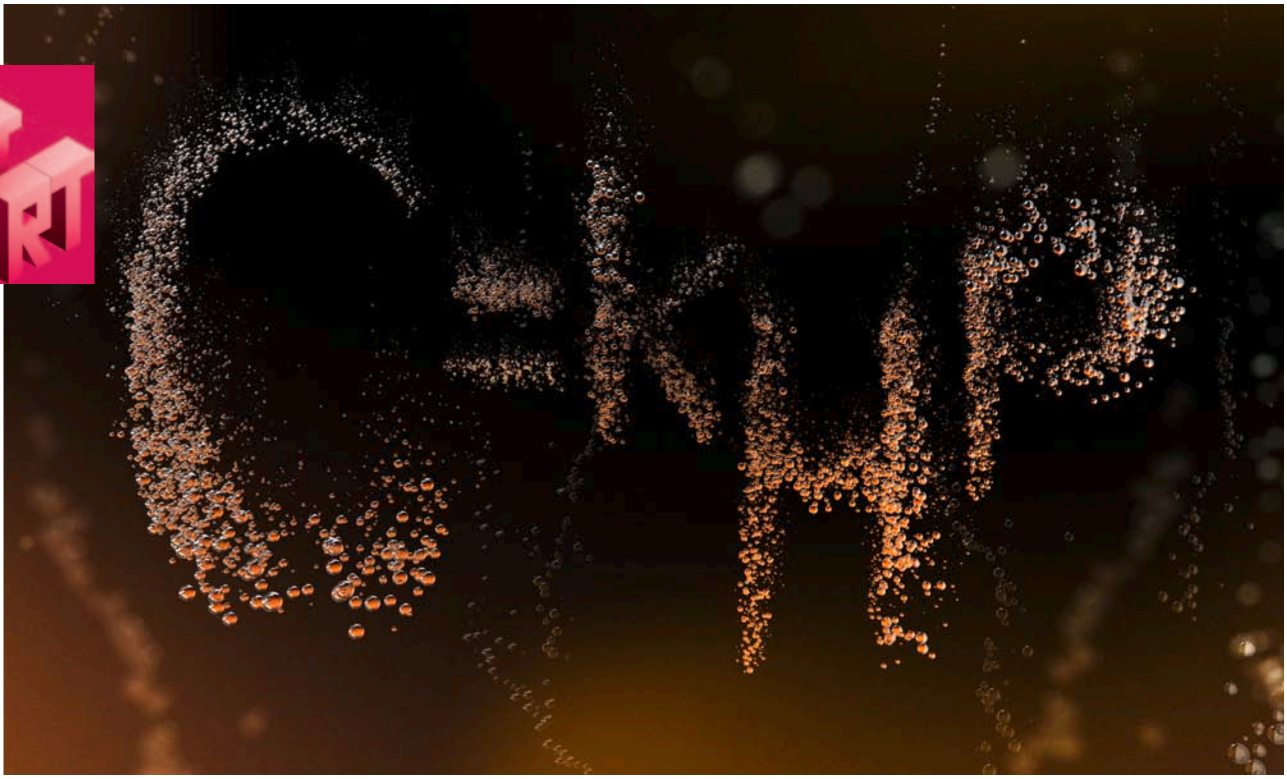
The whole dance is orchestrated by a simple equation known as Henry's law. Lower the pressure p by opening the can, and the concentration c of carbon dioxide in the liquid goes down too. The soda keeps bubbling for a while because surface tension of the liquid makes it hard for the carbon dioxide bubbles to form and expand—the CO_2 molecules have to find one another and join up in gangs to have enough strength for the job.

Of course, you can always speed up the process by giving the can a bit of a shake. That incorporates more air into the liquid, giving the carbon dioxide molecules a meeting place to find one another. Shake enough, and Henry's law will put on a foamy show. —JULIE REHMEYER



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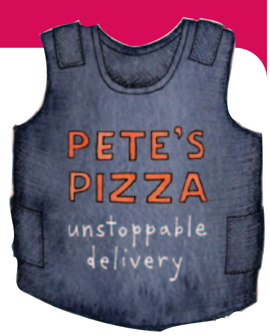
3 Smart Things About **Bullet-Proof Vests**

1. Kevlar, the material in many vests, was created in 1971 as a component for automobile tires. It is synthesized by combining several monomers—simple molecules—in a highly concentrated bath of sulfuric acid.

2. Vests don't stop bullets, they distribute impact. They can make a 9mm slug traveling at 950 mph feel like an 8 pound sledgehammer going 40 mph. Translation: Lots of pain, but no perforation.— Aaron Rowe

3. A standard Kevlar vest won't stop knives—the tip can push the fibers aside. The National Institute of Justice, which rates different grades of vests, has separate standards for stab-resistant body armor.



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