Normal Stuff in Not-So-Normal Places: Crash Course Kids 46.2

Physical Science
https://youtube.com/watch?v=T7hK6OMpvbE
https://nerdfighteria.info/v/T7hK6OMpvbE

If I had said the word "oobleck" to you a few weeks ago, you might have thought I was a crazy person. But, if you saw our most recent episode, you now know that oobleck is actually a thing, and not just a word I made up.

Oobleck is a goop-like material that can behave like different states of matter, acting like a solid one minute and a liquid the next. We call these kinds of materials that can act like multiple states of matter non-Newtonian fluids, and they're pretty unusual.

But today I want to talk about normal materials in totally non-normal environments. Which, drum-roll please, leads us to our big question: How do everyday materials behave in unusual environments?

Well, materials, as you know by now, are made of matter, and they typically come in the form of a solid, a liquid, or a gas. And all materials have properties, or characteristics that help identify them. Like their color, or weight, or their boiling point, which is the temperature at which a substance can change from a liquid to a gas.

Now, let's take a look at an everyday material and a few of its properties. This ordinary glass of water. This material is a liquid, and its properties include having a color that's, well, clear. And at sea level, its boiling point is 100 degrees Celsius.

This is exactly how you'd expect water to look and act in everyday environments like in your kitchen or in a restaurant or in someone's backyard on a picnic table. But what about in not so normal environments? How would this water and its properties change, say, at the top of a very tall mountain? Or, even in space?

To help us find out what would happen to this liquid in these extreme environments, Little Sabrina is back with an even littler glass of water.

First, check out little me scaling Mt. Everest, and as she climbs, she's taking this water up to a much higher elevation.

Now, if you wanted to boil water at sea level, the temperature required to make it boil would need to be pretty high: 100 degrees Celsius, like I mentioned earlier. But, if Little Sabrina decided to boil her water over a fire at the top of this enormous mountain peak, she'd find that the temperature wouldn't need to be nearly as high to make the water boil.

Up there, it starts boiling at just 71 degrees. That's because higher altitude means lower pressure. Less pressure exerts less force on the water molecules that keeps them bound together as a liquid.

So, without all that pressure packing it together into a liquid, water boils much more quickly at higher elevations. So, an extreme change in pressure can cause a big change in one of water's properties--making its boiling point a lot lower.

That's what can happen to a glass of water in an extreme environment, on Earth. But, what about an extreme environment beyond this planet? Let's say, a vacuum?

I don't mean in a vacuum, like the thing you clean your house with. I mean a vacuum, like a huge vast space where there's no air. A space, like space.

Now, it's hard to think of an environment that's more extreme than the vacuum of space. For one thing, space is extremely cold, so you might think that water would freeze there immediately. But, space also has no pressure, so water should also boil quickly there. Even more quickly than at the top of a very low pressure environment of Mt. Everest, right?

Let's check out Little Sabrina's glass of water now that she's safely made it up to space.

Up there, the pressure is so low that the water's boiling point falls to where it just boils almost instantly. But that's not all. After the water has boiled, you'd end up with isolated water molecules in a gaseous state. But because space is so very super incredibly cold, the tiny water vapor droplets then immediately freeze and become ice crystals.

So, in space, liquid water boils and then it freezes. And astronauts have found that the same thing happens to their pee. When their waste is released into space it first boils and turns into a vapor. Then that pee vapor freezes into a solid and you'd end up with frozen urine crystals.

Watch out for for flying pee!

So, when you put this glass of water in an extreme, low pressure environment, like Mt. Everest, or in space, where there are even colder temperatures and no pressure, its properties, like its boiling point, change dramatically. And now we know that normal, everyday materials behave in unusual ways when placed in unusual environments. That's because an unusual environment can alter a material's properties, potentially changing it from one state of matter to another.

Who knew an ordinary glass of water could do so many different things?